

D.B.Phonde. Sr.Scientist & Head, Soil Science.

VSI/CP/Agro // /2014-15

May 28, 2014

To,

Dr. O. K. Sinha,
Project Co-coordinator,
AICRP on Sugarcane,
Indian Institute of Sugarcane Research,
Rae Bareli Road, Post- Dilkusha,
Lucknow - 226 002 (Uttar Pradesh)

Sub.: Submission of annual research report of AICRP on sugarcane Crop Production and Audit Utilization certificate 2013-14.

Sir,

The research work in Sugarcane Crop Production under AICRP program was conducted as per the technical programme during 2013-14. A report on research work done has been enclosed herewith for inclusion in the proceedings. A copy of the same has also been sent through E-mail. Audit utilization certificate of the contingency grant for the year 2013-14 is also enclosed herewith. No front Line demonstrations and Breeder seed production program was allotted to this centre.

This is submitted for compilation and further need full please.

Thanking you,

Yours faithfully,

Encl.: 1) One hard copy of research work 2013-14
2) Audit Utilization Certificate. 2013-14

(D.B.Phonde)

Copy to:

Dr. T.K.Srivastava.
Principle Investigator (Crop production AICRP on sugarcane)
Head, Division of Crop Production
Indian Institute of Sugarcane Research,
Lucknow 226 002.
Uttar Pradesh

**RESEARCH RESULTS OF WORK DONE IN SUGARCANE
CROP PRODUCTION UNDER AICRP'S PROGRAM
2013-2014**

Submitted to
**Project Co-ordinator, AICRP on Sugarcane.
Indian Institute of Sugarcane Research,
Lucknow.**

Submitted by
Division of Crop Production

**Compiled & Reported
By**

Mr. D. B. Phonde. Senior Scientist & Head, Soil Science Section
Mr. A. S. Deshmukh. Senior scientist & Head, Water management
Mr. P. V. Ghodke, Scientific Officer, Agronomy.



**VASANTDADA SUGAR INSTITUTE,
Manjari (Bk.), Tal. Haveli, Dist. Pune, Pin: 412 307
Maharashtra, India**

HIGHLIGHTS OF RESEARCH WORK CONDUCTED DURING 2013-2014

1. AS-42: Agronomic evaluation of promising sugarcane genotypes (1st plant crop.)

An experiment was conducted on agronomic evaluation of promising sugarcane genotypes viz., Co8001, PI07131 and Co7015 along with CoC 671 and Co 86032 as standard checks. These genotypes were tested for their response to fertilizer levels viz., 75, 100 and 125% of recommended dose of NPK. The results of first plant crop showed that, the cane yield of genotype PI07131 was significantly higher (114.16 t/ha) over other genotypes but at par with CoC 671 and Co86032. The levels of RDF did not show any significant difference. Maximum Brix % (22.80) and Sucrose % (19.58) was noticed in genotype PI07131 compared to other genotypes. Maximum B:C ratio (1:2.26) was also obtained with genotype PI07131. Final conclusion could be drawn after having ratoon and second plant crop studies.

2. AS - 63: Plant geometry in relation to mechanization in sugarcane. (Pooled results)

An experiment on plant geometry in relation to mechanization in sugarcane was conducted for two plant cane crops and one ratoon crop during 2011-12 to 2013-14 at VSI experimental farm. The pooled results of the two plant cane and one ratoon crop revealed that, mechanized farming at 150 cm row spacing was found superior in terms of sugarcane yield (132.75 t/ha), sugar yield (20.33 t/ha), net monetary returns (Rs. 201390/ha) and B: C ratio (1: 2.94). The performance of CoM0265 and CoVSI03102 was found superior in sugarcane yield (148.90 and 128.82 t/ha), sugar yield (21.73 and 20.88 t/ha), net monetary returns (Rs. 235234 and Rs. 189050/ha) and B: C ratio (1:3.20 and 1:2.77) as compared to Co86032 (110.66 t/ha sugarcane yield, 17.76 t/ha sugar yield, Rs. 161639/ha net monetary returns and 1:2.51 B:C ratio) and CoVSI9805 (118.22 t/ha sugarcane yield, 18.18 t/ha sugar yield, Rs. 164736/ha net monetary returns and 1:2.54 B:C ratio).

3. AS 64: Response of sugarcane crop to different plant nutrients in varied ecological situations (1st plant and ratoon crop)

The effect of differential response of sugarcane crop to different nutrients on yield and quality of Preseasonal sugarcane was studied in medium black soil. The results indicated that there was no individual response to S, Zn and Fe nutrients, however, RDF along with S+Zn+Fe combination gave maximum cane yield of 137.29 t ha⁻¹ followed by 136.47 t ha⁻¹ in RDF with S+Zn+Fe+Mn combination and 136.00 t ha⁻¹ in RDF with S+Zn which were found on par and significant over only RDF (124.41 t ha⁻¹). It reveals that application of RDF (400:170:170) along with sulphur @ 60kg ha⁻¹ and ZnSO₄ @ 20 kg ha⁻¹ increased cane yield by 9.31%. Similarly, response of ratoon crop to different nutrients was studied and the results showed similar insignificant results to individual sulphur, Zn, Fe and Mn nutrients. However, cane yield responses to RDF with S+Zn+Fe combination gave maximum cane yield of 118.48 t ha⁻¹ which was significant over RDF (104.92 t ha⁻¹).

Project No. : AS-42 (AICRP'S)

Title of the experiment : Agronomic evaluation of promising sugarcane genotypes (I plant crop)

Objective : To work out agronomy of promising sugarcane genotypes.

Location : Vasantdada R & D farm

Time Frame : Three crop seasons (2 plants + 1 ratoon)

Year of commencement : 20012-13

Year of completion : 2014-15

Date of planting : 11/01/2013

Date of harvesting : 12/02/2014

Treatment details

(1) Varieties : Genotypes- VI. Co8001
V2. PI07131
V3. Co7015
Checks V4. CoC671
V5. Co86032

(2) Fertilizer Levels : i. 75% of the recommended dose of NPK
: ii. 100% of the recommended dose of NPK
: iii. 125% of the recommended dose of NPK
(RDF for suru sugarcane 250:115:115 kg NPK/ha)

Replication : Three

Design : Factorial R.B.D

Plot size : Gross-10 m X 6.00 m = 60.00 sqm
: Net - 9 m X 3.60 m = 32.40 sqm
: Width of furrow 1.20 mt.

Soil type & soil status : Medium black soil.

pH	EC dsm ¹ /cm	Organic carbon%	Av. N Kg/ha	Av.P205 Kg/ha	Av.K20 Kg/ha
8.23	0.55	0.51	280.98	17.04	332.08

Results

The field experiment was conducted to develop the Agronomy for new promising sugarcane genotypes. Data regarding growth, yield and quality contributing characters at harvest of 1st plant crop are presented in Table 1.

Cane and sugar yield (t/ha)

The data regarding cane yield t/ha presented in Table 1, revealed that the genotype PI07131 gave maximum cane yield of 114.16 t/ha which was significantly superior over the rest of the genotypes but at par with CoC 671 (104.70 t/ha). The cane yield differences due to fertilizer levels were found insignificant. The cane yield increased with increased levels of fertilizers Maximum cane yield was 102.29 t/ha due to application of 125 % recommended dose of NPK followed by 75 % RDF (99.16 t/ha) and 100 % RDF (98.31 t/ha).

The differences in CCS t/ha due to different genotypes did not influence significantly. The maximum CCS t/ha (15.38 t/ha) was recorded in genotype PI07131 which was followed by check variety CoC 671 (13.94 t/ha). The CCS t/ha was increased with increased levels of NPK being maximum of 14.02 t/ha due to application of 125 % RDF of NPK. The interaction due to genotypes and fertilizer levels was not significant.

Single cane weight (kg)

The weight per cane was maximum in PI07131 (1.75 Kg) than the check variety CoC 671 (1.55 kg) and rest of genotypes. In case of fertilizer levels the single cane weight did not differ significantly due to levels of fertilizers. Interaction was also not significant.

Number of millable canes.

The data on number of millable cane (NMC) at harvest was significantly affected due to various genotypes. The genotype PI07131 produced maximum number of millable canes (0.81 Lac/ha) at harvest followed by check variety Co 86032 (0.78 lac/ha) The number of millable canes at harvest recorded significantly higher (0.72 lac/ha) at 100 % and 125% of NPK of recommended dose of fertilizers, than application of 75 % RDF (0.68 Lac/ha) The interaction due to genotypes and fertilizer levels was significant (Table 1).

Germination % and Tillering (Lac/ha)

The differences in germination percentage at 45 days after planting among the genotypes under study were significant (Table 1). The genotype Co 8001(74.04%) recorded maximum germination as compared to other genotypes. In case of fertilizer levels the germination did not differ significantly due to levels of fertilizers. Interaction was also not significant.

The differences in tillering at 90 and 120 days were significant among the genotypes under study. The genotype PI07131 produced maximum (1.16 and 1.49 Lac /ha) number of tillers at 90 and 120 days respectively which was significantly higher than the rest of the genotypes and standard checks. The differences due to levels of fertilizers were non significant. Maximum tillers at 90days (1.03 Lac /ha) and 120 days (1.35 Lac /ha) after planting were obtained due to application of 125 % recommended dose of NPK. The interaction between the factors under study was not significant.

Number of internodes, cane girth and cane height.

The differences in number of internodes at harvest were no significant among the genotypes under study. The genotype PI07131 produced maximum (18.1) number of internodes per cane, but it was less than the check varieties CoC 671 (19.1) and Co 86032 (.18.2) In case of fertilizer levels the number of internodes did not differ significantly due to levels of fertilizers. Interaction was also not significant.

The differences in cane girth among the genotypes under study were no significant. The genotype PI07131 showed maximum (3.30 cm) cane girth at harvest than the check variety CoC 671 (3.25cm) and rest of genotypes. The girth of cane increased significantly with increase in the level of fertilizer being maximum (3.28 cm) due to application of 125 % recommended dose of fertilizer followed by application of 100 % RDF (3.11cm) The girth of cane was no significant due to interaction between genotypes and fertilizer levels.

The genotype PI07131 showed maximum total height (284 cm) and millable height (238 cm) at harvest which was significantly higher than the other genotypes Co 8001 (total height 256 cm and millable height 238 cm) and check varieties. The differences in total and millable height of cane at harvest did not influence significantly due to levels of NPK. The interaction was also not significant.

Juice Quality Parameter

The juice quality parameter measured in terms of Brix %, Sucrose % and CCS % was differed significantly due to different genotypes. However, differences in Purity % due to different genotypes were not significant. Maximum Brix % (24.14), CCS % (15.01) and Sucrose % (21.06) was noticed in check variety Coc671 followed by genotype PI07131 i.e. (22.80), (13.77) and (19.58) respectively.

B: C ratio

The B: C ratio differed significantly due to different genotypes. The maximum (1:2.26) B:C ratio was obtained in genotype PI07131 followed by check variety CoC 671 (1:2.07). The B:C ratio was found maximum 1:2.02 due to application of 125 % RDF of NPK which was followed by application of 75 % RDF (1:1.99) and 100 % RDF (1:1.91). The interaction effect due to factors under study was not significant.

Conclusion

Among the various genotypes evaluated, the cane yield of genotype PI07131 was significantly higher (114.16 t/ha) over the genotypes Co 8001 and Co 7015 but at par with CoC 671 and Co86032. Maximum cane yield 102.29 t/ha was recorded due to application of 125 % RDF. Maximum Brix % (22.80) and Sucrose % (19.58) was noticed in genotype PI07131 than the other genotypes under study. Maximum B: C ratio (1:2.26) was also obtained with genotype PI07131. Final conclusion could be drawn after having ratoon and second plant crop studies.

Table 1: Yield and growth attributes of sugarcane genotypes with varying NPK levels

Treatments	Cane yield (t/ha)	B:C Ratio	CCS (t/ha)	Wt.per cane Kg. at harvest	NMC (lac/ha) at harvest	Germination % 45 DAP	Tillering 90 DAP (lac/ha)	Tillering 120 DAP (lac/ha)
A. Genotype								
1.Co8001	96.50	1.97	13.37	1.43	0.70	74.04	1.08	1.47
2.PI07131	114.16	2.26	15.38	1.75	0.81	66.14	1.16	1.49
3. Co7015	83.09	1.64	13.79	1.38	0.66	73.88	1.00	1.09
4. CoC671	104.70	2.07	13.94	1.55	0.57	70.42	0.70	1.10
5. Co86032	101.15	1.93	12.70	1.44	0.78	65.55	0.97	1.41
SE±	5.75	0.10	0.82	0.07	0.02	2.12	0.68	0.04
CD at 5%	18.74	0.36	NS	NS	0.08	6.14	0.22	0.16
B. Fertilizer level								
1.75%RDF	99.16	1.99	13.53	1.50	0.68	68.55	0.98	1.31
2.100%RDF	98.31	1.91	13.95	1.47	0.72	69.35	0.94	1.27
3.125%RDF	102.29	2.02	14.02	1.56	0.72	72.09	1.03	1.35
SE±	3.68	0.07	0.80	0.04	0.03	1.64	0.02	0.03
CD at 5%	NS	NS	NS	NS	0.02	NS	NS	NS
A x B Interaction (Genotype x fertilizer levels)								
SE±	8.86	0.17	1.68	0.11	0.02	3.68	0.07	0.07
CD at 5%	NS	NS	NS	NS	0.09	NS	NS	NS
CV%	17.26	16.90	17.86	16.60	11.60	9.75	20.79	11.55

Contd...Table 1. Growth and quality attributes of sugarcane genotypes with varying NPK levels at harvest

Treatments	No of internodes per cane	Girth of cane at harvest (cm)	Total cane ht. (cm) at harvest	Millable cane ht. (cm) at harvest	Brix %	Sucrose %	CCS %	Purity %
A. Genotype								
1.Co8001	17.7	3.10	256	213	22.01	19.09	13.50	89.75
2.PI07131	18.1	3.30	284	238	22.80	19.58	13.77	89.81
3. Co7015	16.7	3.01	254	217	22.31	19.18	13.49	88.90
4. CoC671	19.1	3.25	251	209	24.14	21.06	15.01	91.62
5. Co86032	18.2	3.09	236	204	20.80	19.39	13.75	90.56
SE±	0.61	0.07	6.61	7.18	0.36	0.36	0.30	0.75
CD at 5%	NS	NS	21.52	23.36	1.20	1.19	1.00	NS
B. Fertilizer level								
1.75%RDF	17.7	3.06	247	210	22.74	19.54	13.97	90.02
2.100%RDF	18.1	3.11	247	216	21.81	19.79	13.82	89.96
3.125%RDF	18.1	3.28	265	222	22.68	19.65	13.93	90.43
SE±	0.28	0.04	5.46	4.78	0.21	0.29	0.26	0.66
CD at 5%	NS	0.14	NS	NS	0.63	NS	NS	NS
A x B Interaction (Genotype x fertilizer levels)								
SE±	0.82	0.11	11.97	0.11	0.58	0.65	0.56	1.43
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS
CV%	10.38	0.73	7.71	9.93	4.94	5.58	6.67	2.51

Project No. : AS 63
Title of the Experiment : Plant geometry in relation to mechanization in sugarcane.
(Pooled results over two plant and one ratoon crops)

Location : Vasantdada R& D Farm.
Objectives : 1) To work out optimum plant geometry for use of farm machinery.
2) To study varietal response to different planting geometry.

Time frame : Three crop seasons (Two plant + One ratoon crops)

Year of commencement : 2011-12

Year of completion : 2013-14

Date of planting/ ratooning: 25-02-2011 10-03-2012 14-12-2012

Date of harvesting : 10-03-2012 04-03-2013 25-12-2013

Soil Type : Medium deep black with pH = 8.15, EC= 0.30 mmhos / cm,
Organic Carbon - 0.59%, Available N – 246.87 Kg/ha, Available
P- 28.52 Kg/ha, Available K – 560.44 kg/ha.

Treatment Details

A. Plant Geometry

T1: 120 cm row distance
T2: 150 cm row distance
T3: 30 - 150 cm row distance
T4: 100 cm row distance

B. Genotypes

V1: CoVSI 9805 V3: CoM 0265
V2: C0 86032 V4: CoVSI 03102

Design : Split plot design

Replications : Four

Plot Size : Gross –12 m X 15 m, Net plot – 9 m X 13 m

Results and Discussion- Pooled data of two plant crops and one ratoon crop

Cane yield

The significant variation in cane yield was observed among the treatments of different furrow spacing. The highest cane yield of 135.21 t/ha was observed under the mechanized farming at 30-150 cm row spacing (T3) followed by 132.75 t/ha under furrow spacing of 150 cm irrigation(T2). The lowest yield of 119.31 t/ha was observed in conventional farming at 100 cm

row spacing (T4). The yield obtained in treatments T3 and T2 was statistically significant as compared to control i.e. treatment T4. The increase in cane yield in treatments of 30-150 cm row spacing (T3) and 150 cm row spacing (T2) were 13.33 and 11.26 % respectively as compared to conventional planting at 100 cm row spacing (T4). The yield obtained in 120 cm row spacing was 119.33 t/ha and which was on par with control.(Table1).

Among the different genotypes the significant differences in cane yield were observed. The highest cane yield of 148.90 t/ha was observed with CoM0265 followed by 128.82 t/ha of CoVSI03102. The yield obtained with CoM0265 and CoVSI03102 were statistically significant as compared to yields of CoVSI9805 (118.22 t/ha) and Co86032 (110.66 t/ha). (Table1).

The interaction of different furrow spacing and genotypes did not show significant differences in cane yield.

C.C.S

The data on C.C.S. % and sugar yield t/ha recorded at harvest is presented in table 1. The highest C.C.S. % of 16.20% was recorded in variety CoVSI03102, which was significant to all other varieties. The C.C.S. % in CoVSI9805 (15.42%) and Co86032 (15.21%) were significantly superior to variety COM0265 (14.59%).

The sugar yield in 30 - 150 cm row spacing was highest (20.44 t/ha) followed by 20.33 t/ha in row spacing of 150 cm and these were statistically significant to row spacing of 100 and 120 cm. In sub-treatments, the highest sugar yield of 21.73 t/ha was observed in variety CoM0265 and 20.88 t/ha in CoVSI03102 and they were significantly superior to sugar yields in CoVSI9805 (18.18 t/ha) and Co86032 (17.76 t/ha).

The interaction of different row spacing and genotypes did not show significant differences in sugar yield

Millable cane population

The significant variation in millable cane population at harvest was observed in main and sub-treatments. The highest millable cane population of 90799 per ha was observed under furrow spacing of 30-150 cm, followed by 89172 per ha under furrow spacing of 100 cm and 85603 per ha under furrow spacing of 150 cm and were statistically significant to millable cane population in 120 cm row spacing (83457).

As regards the genotypes, there was significant difference in millable cane population. The highest cane population of 100850 per ha was observed in CoM0265 followed by 88183 in

Co86032, 84203 in CoVSI03102 and 75797 in CoVSI9805. The millable cane population in CoM0265 was significantly higher than all other genotypes. (Table1).

The interaction of different row spacing and genotypes did not show significant differences in plant population at harvest.

Growth observations at harvest

The growth observations like millable cane height; cane girth and number of internodes were recorded at the time of harvest. As regards to main treatments, the highest millable cane height (257.26 cm) and cane girth (10.36 cm) were observed in furrow spacing of 150 cm, while highest number of internodes (24.06) were recorded in 30-150 cm row spacing.

As regards the genotypes, the highest millable cane height of 275.36 cm was recorded in CoM0265 followed by 252.50 cm in CoVSI03102, 244.45 cm in Co86032 and 244.20 cm in CoVSI9805. The millable cane height in CoM0265 and CoVSI03102 were significantly superior to CoVSI9805 and Co86032. The highest numbers of internodes (25.12) were observed in CoM0265 followed by 24.50 in CoVSI03102 and were significantly superior as compared to Co86032 (23.31) and CoVSI9805 (22.06). The cane girth in CoM0265, CoVSI03102 and CoVSI9805 was 10.65 cm, 10.68 cm and 10.69 cm respectively and was significantly superior to Co86032 (8.77 cm).

The interaction of different row spacing and genotypes did not show significant differences in growth observations at harvest.

Economics

The highest monetary returns of Rs. 310975 were obtained in furrow spacing of 30-150 cm followed by Rs. 305325 in furrow spacing of 150 cm and they were statistically significant to furrow spacing of 120 cm (Rs. 288930) and 100 cm (Rs. 274418). The highest net monetary returns of Rs. 201390 were obtained in furrow spacing of 150 cm, while lowest net monetary returns of Rs. 175484 were obtained in conventional planting at 100 cm row spacing. The highest B: C ratio of 1: 2.94 was observed in furrow spacing of 150 cm and it was significant as compared to all remaining main treatments (Table 2).

As regards to different varieties, the highest monetary returns of Rs. 342481 were obtained in CoM0265 followed by Rs. 296297 in CoVSI03102. The highest B: C ratio of 1:3.20 was observed in CoM0265 followed by 1: 2.77 in CoVSI03102 (Table 2).

The data on net monetary returns and B: C ratio with different furrow spacing and genotypes was not significant.

Conclusions

- i. Mechanized farming at 150 cm row spacing was found superior in terms of sugarcane yield (132.75 t/ha), sugar yield (20.33 t/ha), net monetary returns (Rs. 305325 per ha) and B: C ratio (1:2.94).
- ii. The performance of CoM0265 and CoVSI03102 was found superior in sugarcane yield, sugar yield, net monetary returns and B: C ratio as compared to Co86032 and CoVSI9805.
- iii. The use of mechanical sugarcane planter and earthing up equipment is found beneficial in sugarcane cultivation in plant cane.

Table- 1: Cane and sugar yield contributing characters (Pooled data of two plant cane and one ratoon crop)

Treatments	Cane Yield t/ha	Sugar Yield t/ha	NMC/ ha	Millable height cm	No. of Internodes	Girth cm	C.C.S. % at harvest
Furrow Spacing							
T1: 120 cm row spacing	119.33	19.32	83457	255.95*	24.50*	10.33*	15.41*
T2: 150 cm row spacing	132.75*	20.33*	85603*	257.26*	23.87*	10.36*	15.35*
T3: 30 x 150 cm row spacing	135.21*	20.44*	90799*	255.40*	24.06*	10.22*	15.12
T4: 100 cm row spacing	119.31	18.46	89172	247.91	22.56	9.87	15.54*
S. E ±	3.83	0.37	736.72	1.72	0.28	0.07	0.05
C.D. at 5%	12.22	1.16	2350	5.49	0.89	0.23	0.15
Genotypes							
V1: CoVSI9805	118.22	18.18	75797	244.20	22.06	10.69*	15.42*
V2: Co86032	110.66	17.76	88183*	244.45	23.31	8.77	15.21*
V3: CoM0265	148.90*	21.73*	100850*	275.36*	25.12*	10.65*	14.59
V4: CoVSI03102	128.82*	20.88*	84203*	252.50*	24.50*	10.68*	16.20*
S. E ±	3.56	0.31	917.41	1.66	0.27	0.06	0.05
C.D. at 5%	1019	0.87	2624	4.76	0.77	0.17	0.15
Interaction	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
S. E ±	7.26	0.64	1752	3.36	0.55	0.13	0.11
C.D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Table- 2: Economics of Mechanized farming and varieties (Pooled data of two plant cane and one ratoon crop)

Treatments	Cost of cultivation (Rs./ha)	Cane Yield (t/ha)	Monitory returns (Rs./ha) @ Rs. 2300/ t	Net Monitory returns (Rs./ha)	B: C Ratio
Furrow Spacing					
T1: 120 cm row spacing	107590	119.33	288930	181340	2.68
T2: 150 cm row spacing	103935	132.75*	305325*	201390*	2.94*
T3: 30 x 150 cm row spacing	118530	135.21*	310975*	192446	2.62
T4: 100 cm row spacing	98935	119.31	274418	175484	2.77
S. E ± C.D. at 5%	-----	3.83 12.22	5408.51 17251.42	5124.82 17251.37	0.05 0.16
Genotypes					
V1: CoVSI9805	107247	118.22	271983	164736	2.54
V2: Co86032	107247	110.66	268887	161639	2.51
V3: CoM0265	107247	148.90*	342481*	235234*	3.20*
V4: CoVSI03102	107247	128.82*	296297*	189050*	2.77*
S. E ± C.D. at 5%	-----	3.56 1019	4107.80 11747	4107.42 11746.96	0.04 0.11
Interaction	-----	N.S.	N.S.	N.S.	N.S.
S. E ± C.D.at 5%	-----	7.26 N.S.	8937 N.S.	8936 N.S.	0.08 N.S.

Project No. : AS 64
 Title of the Experiment : Response of sugarcane crop to different plant nutrients in varied ecological situations (II Plant cane)
 Objectives : To study differential response of sugarcane crop to different nutrients.
 Location : Vasantdada R & D Farm
 Date of Planting : 01.12.2013
 Date of Harvesting : 11.02.2014
 Planting season : Preseason
 Sugarcane variety : Co86032
 Design : RBD
 Replication : Three
 Plot Size : Gross : 8.0 m X 7.20 m Net : 7.0m X 4.80 m
 Soil type
 Treatments : T 1- Control
 T 2 - N
 T 3 - NP
 T 4 - NPK
 T 5 - NPK + S
 T 6 - NPK + Zn
 T 7 - NPK + Fe
 T 8 - NPK + Mn
 T 9 - NPK + S + Zn
 T 10 - NPK + S + Zn + Fe
 T 11 - NPK + S + Zn + Fe + Mn
 T12 – Soil test based fertilizer application
 T13 - FYM @ 20 t/ha

Results

The field experiment was conducted to study the Response of sugarcane crop to different plant nutrients in varied ecological situations on yield and quality of sugarcane. The data regarding cane yield, sugar yield, growth and biometric parameters are reported in Table 1 to 4 and soil properties in Table 5

Cane yield

The effect of differential response with respect to sugarcane yield to different nutrients reported in Table 2. All the treatments of application nutrients individually or in combination (N,P,K, S, Zn, Fe, Mn) and soil test based fertilizer application was found significantly superior over absolute control. The maximum cane yield of 137.29 t ha⁻¹ was obtained due to the combine application of Sulphur, Zn, and Fe along with recommended NPK followed by 136.47 t ha⁻¹ due combine application of Sulphur, Zn, Fe and Mn with RDF and 136.00 t ha⁻¹ due combine application of Sulphur and Zn

with RDF which were found on par. Therefore, the results revealed that sugar cane responded to the recommended dose of NPK (400 :170: 170), Sulphur @ 60 kg /ha and ZnSO₄ @ 20 kg/ha

CCS Yield

The Commercial Cane Sugar yield was found highest 19.84 t ha⁻¹ in treatment of NPK + S followed by 19.73 t ha⁻¹ in the treatment of NPK + S + Zn , 19.60 t ha⁻¹ in treatment of NPK + S + Zn + Fe and 19.43 t ha⁻¹ in treatment of NPK + S + Zn + Fe + Mn was found significantly superior over RDF (17.47 t ha⁻¹) . All the treatments of individual nutrients and in combination were found at par with each other except the treatment of soil test based fertilizer application.

Plant population

The plant population presented in Table 2 showed that maximum significant plant population 106.55 thousand ha⁻¹ was recorded in treatment T9 of recommended NPK + S+ Zn was found significantly superior over RDF (100.64 t ha⁻¹).

Growth observation

The growth parameters viz. milliable cane height and girth of cane were numerically increased in all treatments but not significantly differed. The maximum milliable cane height (242.0 cm) was found in treatment T8 of NPK + Mn. Cane girth and numbers of internodes were remained more or less same in all the treatments.

Biometric observation

The germination at 45 days after planting varied from 67.67 – 70.33 %. The data of germination percentage was found to be statistically non significant. The tillering ratio varied from 2.10 – 2.32 showed insignificant difference.

Juice quality

The juice quality parameters with respect to Brix, Pol, Purity and CCS percent are presented in Table. 4 indicated that the juice quality was not affected

Economic evaluation

All the treatment combination of macronutrient and micronutrient was found significantly superior over absolute RDF except in treatment NPK + Mn and treatment of FYM. The maximum cost benefit ratio 3.36 in treatment of NPK + S + Zn + Fe followed by 3.34 in treatment soil test based fertilizer application.

Conclusion

The effect of differential response of sugarcane crop to different nutrients on yield and quality of preseasonal sugarcane was studied in medium black soil. There was no individual response observed to S, Zn and Fe nutrients, however, RDF along with S+Zn+Fe combination gave maximum cane yield of 137.29 t ha⁻¹ followed by 136.47 t ha⁻¹ in RDF with S+Zn+Fe+Mn combination and 136.00 t ha⁻¹ RDF with S+Zn which were found at par and significant over only RDF (124.41 t ha⁻¹). It reveals that application of RDF (400:170:170) along with sulphur @ 60 kg/ha and ZnSO₄@ 20 kg/ha increased cane yield by 9.31% cane yield.

Table 1: Response of sugarcane crop to different nutrients on Cane yield, CCS yield and No. Milliable canes

Treatments	Cane yield (t ha ⁻¹)	CCS yield (t ha ⁻¹)	No. of Milliable canes ('000 ha ⁻¹)
T1	98.13	14.24	88.70
T2	112.86	15.46	93.54
T3	118.33	17.64	98.35
T4	124.41	17.47	100.64
T5	132.57	19.84	102.00
T6	132.23	18.69	100.46
T7	131.79	18.30	98.32
T8	122.39	17.31	97.96
T9	136.00	19.73	106.55
T10	137.29	19.60	104.75
T11	136.47	19.43	103.38
T12	130.14	18.61	100.63
T13	124.14	17.86	97.32
SE +- CD at 5%	1.55 4.54	0.63 1.85	1.47 4.31

Table 2: Response of sugarcane crop to different nutrients on Biometric and growth observation

Treatments	Milliable cane height (cm)	Cane Girth (cm)	Internodes/ cane	Germination (%)	Tillering Ratio
T1	228.0	9.1	20	67.6	2.10
T2	226.6	9.2	20	69.0	2.16
T3	248.3	10.0	20	68.67	2.25
T4	242.6	9.6	20	69.0	2.31
T5	233.3	9.7	21	70.0	2.32
T6	233.3	10.2	20	70.0	2.30
T7	231.0	9.6	20	70.0	2.27
T8	242.0	9.7	21	69.0	2.25
T9	231.3	9.6	21	68.3	2.28
T10	238.3	9.7	21	70.0	2.23
T11	224.6	9.8	21	70.3	2.32
T12	222.6	9.7	20	69.3	2.25
T13	239.3	10.2	21	69.6	2.22
SE +- CD at 5%	8.18 NS	0.28 NS	0.63 NS	0.55 NS	0.07 NS

Table 3: Response of sugarcane crop to different nutrients on Cane juice quality

Treatments	Brix (%)	Pol (%)	Purity (%)	Commercial Cane Sugar (%)
T1	21.20	20.08	94.71	14.52
T2	20.73	19.30	93.07	13.70
T3	21.51	20.55	95.48	14.91
T4	21.39	19.65	91.77	14.02
T5	21.69	20.65	95.23	14.97
T6	20.94	19.63	93.73	14.13
T7	20.57	19.28	93.73	13.88
T8	19.37	18.46	95.37	13.39
T9	20.33	19.35	95.16	14.02
T10	21.75	20.46	94.05	14.75
T11	20.97	19.65	93.53	14.12
T12	21.30	20.10	94.38	14.52
T13	21.32	20.10	94.26	14.51
SE +- CD at 5%	0.43 NS	0.48 NS	1.02 NS	0.40 NS

Table 4 : Response of sugarcane crop to different nutrients on economic evaluation

Treatments	Cane yield (t/ha)	Gross monetary return	Cost of cultivation	Net profit	BC ratio
T1	98.13	225699.0	74020	151679.0	3.05
T2	112.86	259578.0	78794	180784.0	3.29
T3	118.33	272151.3	86865	185286.3	3.13
T4	124.41	286150.7	91659.2	194491.5	3.12
T5	132.57	304903.3	93159.2	211744.1	3.27
T6	132.23	304129.0	92213.2	211915.8	3.30
T7	131.79	303117.0	91884.2	211232.8	3.30
T8	122.39	281489.3	92069.2	189420.1	3.06
T9	136.00	312800.0	93713.2	219086.8	3.34
T10	137.29	315767.0	93938.2	221828.8	3.36
T11	136.47	313881.0	94348.2	219532.8	3.32
T12	130.14	299329.7	91659.2	207670.5	3.27
T13	124.14	285529.7	109020.0	176509.7	2.62
SE +- CD at 5%	1.55 4.54	7178.0 14814.7		266707.8 NS	0.05 0.12

Table 5: Soil analysis at earthing up

Treatment	pH	Electrical conductivity (dSm ⁻¹)	Organic carbon (%)	Available Nitrogen (kg ha ⁻¹)	Available Phosphate (kg ha ⁻¹)	Available Potash (kg ha ⁻¹)	DTPA extractable Micronutrient (mg kg ⁻¹)			
							Cu	Fe	Mn	Zn
Initial soil analysis	8.35	0.65	0.53	370	35.6	470	11.7	6.35	22.17	3.18
Treatment	pH	Electrical conductivity (dSm ⁻¹)	Organic carbon (%)	Available Nitrogen (kg ha ⁻¹)	Available Phosphate (kg ha ⁻¹)	Available Potash (kg ha ⁻¹)	DTPA extractable Micronutrient (mg kg ⁻¹)			
							Cu	Fe	Mn	Zn
T1	8.29	0.43	0.77	301	34	509	8.8	14.2	18.2	1.6
T2	8.27	0.51	0.77	297	37	590	11.2	15.7	17.6	1.9
T3	8.23	0.44	0.79	296	36	546	9.5	16.7	17.5	1.7
T4	8.29	0.47	0.81	303	38	464	6.8	12.3	20.1	2.11
T5	8.27	0.47	0.82	319	37	512	7.2	16.2	20.2	2.05
T6	8.24	0.43	0.79	296	39	582	7.5	18.3	18.7	1.4
T7	8.25	0.47	0.74	307	41	567	8.2	18.5	17.6	1.8
T8	8.25	0.44	0.79	299	37	622	8.6	16.9	18.8	1.9
T9	8.26	8.26	0.80	298	44	546	7.5	17.8	18.2	2.2
T10	8.23	0.44	0.76	310	39	490	7.4	16.5	18.0	2.6
T11	8.22	0.42	0.78	309	40	505	6.9	14.3	19.6	1.3
T12	8.26	0.39	0.77	321	38	487	8.2	15.2	17.8	2.6
T13	8.30	0.48	0.80	300	34	538	8.0	12.7	16.2	1.2

Project No. : AS 64
 Title of the Experiment : Response of sugarcane crop to different plant nutrients in varied ecological situations (Ratoon crop)
 Objectives : To study differential response of sugarcane crop to different nutrients.
 Location : Vasantdada R & D Farm
 Date of Ratooning : 18.01.2013
 Date of Harvesting : 19.01.2014
 Planting season : Preseason
 Sugarcane variety : Co86032
 Design : RBD
 Replication : Three
 Plot Size : Gross: 8.0 m X 7.20 m Net : 7.0m X 4.80 m.
 Soil type : Medium black soil
 Treatments : T 1- Control
 T 2 - N
 T 3 - NP
 T 4 - NPK
 T 5 - NPK + S
 T 6 - NPK + Zn
 T 7 - NPK + Fe
 T 8 - NPK + Mn
 T 9 - NPK + S + Zn
 T 10 - NPK + S + Zn + Fe
 T 11 - NPK + S + Zn + Fe + Mn
 T12 – Soil test based fertilizer application

Results

The field experiment was conducted to study the Response of sugarcane crop to different plant nutrients in varied ecological situations on yield and quality of sugarcane. The data regarding cane yield, sugar yield, growth and biometric parameters are reported in Table 1 to 4 and soil properties in Table 5 and 6

Cane yield

The effect of differential response with respect to sugarcane yield to different nutrients reported in Table 2. All the treatments of application nutrients (N,P,K, S, Zn, Fe, Mn) and soil test based fertilizer application was found significantly superior over absolute control. The maximum cane yield of was obtained due to the combine application of Sulphur, Zn, and Fe along with recommended NPK (118.48 t ha⁻¹) followed by combine application of Sulphur, Zn, Fe and Mn along with RDF (117.90 t ha⁻¹), combine application of Sulphur, Zn along with RDF (115.18 t ha⁻¹) and

application of soil test based fertilizer application (114.33 t ha^{-1}) which was significantly superior over only RDF (104.92 t ha^{-1}). Therefore, the results revealed that sugar cane responded to RDF with S+Zn+Fe combination.

CCS Yield

All the treatments of application individual nutrient with RDF, combination of nutrients with RDF (N,P,K, S, Zn, Fe, Mn) and soil test based fertilizer application was found significantly superior over Control The Commercial Cane Sugar yield was found highest 17.33 t ha^{-1} in treatment of NPK + S + Zn + Fe followed by 17.17 t ha^{-1} in the treatment of NPK + S + Zn + Fe + Mn, 16.88 t ha^{-1} in the treatment of NPK + S + Zn and application of soil test based fertilizer application (15.72 t ha^{-1}) was found significantly superior over RDF and at par with each other.

Plant population

The plant population presented in Table 2 showed that maximum significant plant population 94.41 thousand ha^{-1} was recorded in treatment T11 of recommended NPK + S+ Zn + Fe +Mn. All the treatments are at par with each other except treatment T2 and T3.

Growth observation

The growth parameters viz. milliable cane height and girth of cane were numerically increased in all treatments but not significantly differed. The maximum milliable cane height (244.7 cm) was found in treatment T8 of NPK + Mn. Cane girth and numbers of internodes were remained more or less same in all the treatments.

Juice quality

The juice quality parameters with respect to Brix, Pol, and Purity and CCS percent are presented in Table. 4 indicated that the juice quality was not affected

Economic Evaluation

The maximum benefit cost ratio was obtained due to application of soil test based fertilizer application (5.10) followed by combine application of Sulphur, Zn, and Fe along with recommended NPK (5.06) followed by combine application of Sulphur, Zn, Fe and Mn along with RDF (5.00) which was significantly superior over only RDF (4.68) and at par with each other.

Conclusion

The effect of differential response of sugarcane crop to different nutrients on yield and quality of sugarcane ratoon crop was studied the results showed similar insignificant results to individual sulphur, Zn, Fe and Mn nutrients. However, cane yield responses to RDF with S+Zn+Fe combination gave maximum cane yield of 118.48 t ha⁻¹ which was significant over RDF (104.92 t ha⁻¹).

Table 1: Response of sugarcane crop to different nutrients on Cane yield, CCS yield and No. Milliable canes (Ratoon)

Treatments	Cane yield (t ha ⁻¹)	CCS yield (t ha ⁻¹)	No. of Milliable canes (^{'000} ha ⁻¹)
T1	84.23	11.31	77.14
T2	94.29	13.33	84.26
T3	98.09	13.82	81.74
T4	104.92	15.34	90.31
T5	106.99	15.44	94.12
T6	109.34	15.45	90.85
T7	110.77	16.29	92.85
T8	110.48	15.87	88.89
T9	115.18	16.88	94.18
T10	118.48	17.33	93.78
T11	117.90	17.17	94.41
T12	114.33	15.72	91.77
SE +- CD at 5%	3.22 6.68	0.60 1.24	3.00 6.22

Table 2: Response of sugarcane crop to different nutrients on Biometric and growth observation (Ratoon)

Treatments	Milliable cane height (cm)	Cane Girth (cm)	Internodes/ cane
T1	220.3	9.0	19.3
T2	225.7	9.4	18.3
T3	226.3	9.2	18.7
T4	219.0	9.3	18.7
T5	239.0	9.3	19.8
T6	234.7	9.4	20.0
T7	243.7	9.3	20.3
T8	244.7	9.2	21.0
T9	231.0	9.2	20.0
T10	235.0	9.3	20.3
T11	238.7	9.3	20.7
T12	241.0	9.3	19.0
SE +- CD at 5%	10.28 NS	0.16 NS	1.30 NS

Table 3: Response of sugarcane crop to different nutrients on Cane juice quality (Ratoon)

Treatments	Brix (%)	Pol (%)	Purity (%)	Commercial Cane Sugar (%)
T1	20.3	18.8	92.6	13.4
T2	21.1	19.7	93.3	14.2
T3	21.4	19.7	92.1	14.1
T4	21.6	20.3	93.9	14.6
T5	21.1	20.0	94.4	14.4
T6	21.1	20.0	94.8	14.1
T7	21.1	20.2	95.8	14.7
T8	21.1	19.9	94.3	14.4
T9	21.2	20.3	94.9	14.7
T10	21.4	20.2	94.6	14.6
T11	21.5	20.3	94.6	14.7
T12	20.4	19.1	93.2	13.8
SE +- CD at 5%	0.51 NS	0.56 NS	1.08 NS	0.44 NS

Table 4: Response of sugarcane crop to different nutrients on economic evaluation (Ratoon)

Treatments	Cane yield (t/ha)	Gross monetary return	Cost of cultivation	Net profit	BC ratio
T1	84.23	193736.7	36265.2	157471.5	5.34
T2	94.29	216859.3	39845.7	177013.6	5.44
T3	98.09	225607.0	46751.2	178855.8	4.83
T4	104.92	241323.7	51549.4	189774.3	4.68
T5	106.99	246069.3	53049.4	193020	4.64
T6	109.34	251474.3	52103.4	199371	4.83
T7	110.77	254771.0	51774.4	202996.7	4.92
T8	110.48	254111.7	51959.4	202152.3	4.89
T9	115.18	265906.3	53603.4	211303.9	4.94
T10	118.48	272511.7	53828.4	218683.3	5.06
T11	117.90	271162.3	54238.4	216924	4.99
T12	114.33	262966.7	51549.4	211417.3	5.10
SE +- CD at 5%	3.22 6.68	81650.9 NS		7412.5 NS	0.15 0.30

Table 5 : Initial Soil characteristics under experimental plot

Soil characteristics	Analytical Value Initial
pH	8.15
Electrical Conductivity (dSm ⁻¹)	0.23
Organic carbon (%)	0.52
Available Nitrogen (kg ha ⁻¹)	320
Available Phosphate(kg ha ⁻¹)	34.5
Available Potash (kg ha ⁻¹)	485
Soil Texture	Clay
DTPA extractable Cu (ppm)	12.5
DTPA extractable Fe (ppm)	13.0
DTPA extractable Mn (ppm)	23.5
DTPA extractable Zn (ppm)	2.17

Table 6: Soil analysis at earthing up

Treatment	pH	EC (dSm ¹)	Organic carbon %	Available Nitrogen (kg ha ⁻¹)	Available Phosphate (kg ha ⁻¹)	Available Potash (kg ha ⁻¹)	DTPA extractable Micronutrient (ppm)			
							Cu	Fe	Mn	Zn
T1	8.17	0.22	0.47	341	33.33	344	8.12	13.20	21.30	2.17
T2	8.15	0.24	0.49	343	32.33	340	7.13	11.17	20.12	2.65
T3	8.15	0.25	0.42	347	34.33	338	8.25	13.16	23.60	2.20
T4	8.22	0.24	0.50	347	32.00	352	6.27	14.29	22.65	2.10
T5	8.11	0.24	0.52	349	33.33	351	5.11	13.20	23.20	2.19
T6	8.13	0.24	0.40	351	33.33	345	6.35	13.19	22.55	2.63
T7	8.18	0.25	0.45	341	33.00	344	8.13	13.27	22.00	2.70
T8	8.12	0.25	0.49	337	31.33	343	11.20	14.20	21.69	2.11
T9	8.14	0.22	0.48	343	32.33	334	9.27	14.11	23.10	2.19
T10	8.20	0.27	0.49	347	32.67	353	12.20	13.65	20.66	3.12
T11	8.13	0.24	0.45	345	31.67	342	10.26	13.20	20.10	2.85
T12	8.15	0.24	0.50	345	33.00	340	10.75	12.07	19.11	2.05

**To,
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