ALL INDIA COORDINATED RESEARCH PROJECT ON SUGARCANE AGRONOMY

ANNUAL REPORT

2014-15

DEPARTMENT OF AGRONOMY

G. B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY PANTNAGAR – 263145 (U.S. NAGAR) UTTARAKHAND

STAFF ASSOCIATED WITH THE PROJECT

1. **Dr. Dheer Singh**
   Professor
   Department of Agronomy

2. **Shri Vijendra Singh**
   Junior Scientist
   Department of Agronomy

3. **Shri R.D. Yadav**
   Field Assistant
   Department of Agronomy

TECHNICAL REPORT

The following experiment related to Sugarcane Agronomy were allotted to the Pantnagar Centre during 2014-15

S. No.	Experiment	Title
1.	AS-42 (a)	Agronomic evaluation of promising sugarcane genotypes planted in spring season
2.	AS-42 (b)	Agronomic evaluation of promising sugarcane genotypes planted in spring season (Ratoon)
3.	AS-64	Response of sugarcane crop to different plant nutrients in varied agro-ecological situations
4.	AS-65	Enhancing sugarcane productivity and profitability under wheat-sugarcane cropping system
5.	AS-66	Priming of cane nodes for accelerating germination in sugarcane
6.	AS-68	Impact of integrated application of organics and inorganics in improving soil health and sugarcane productivity

As per technical programme, all above experiments were conducted at the Norman E. Borlaug Crop Research Centre of G.B. Pant University of Agriculture & Technology, Pantnagar during 2014-15. Pantnagar is situated at 29^{o} N latitude and 79^{o} E longitude and at an altitude of 243.8 m above the mean sea level in the foot hills of Himalayas (Shivalik Range) in *Tarai* region. The *Tarai* belt enjoys sub-humid tropical climate with hot summers and cold winter with minimum temperature in the range of 7.6 ^{o}C during 2014 in December (**Appendix-I**)**.** Total rainfall received 1016.5 mm from January, 2014 to February, 2015. Maximum relative humidity ranges from 74.0 % in April, 2014 to 94% in January, 2015. Sunshine period was 3.4 hrs/day in July, 2014 and 9.8 hrs/day in April, 2014 (**Appendix-I**)**.** The physio-chemical properties of the experimental soil are given in (**Appendix-II**). The experimental soil was silty loam in texture, rich in organic carbon (1.05 - 1.11 %), medium in available phosphorus (48.5 - 49.0 kg P_2O_5/ha) and potassium (238 - 242 kg K_2O/ha) with soil pH 7.4 to 7.6. The cultural details of different experiments are given in **(Appendix-III).** Other details of the experiment are given experiment wise separately.

PROJECT NO. AS-42 (a)

Title : Performance of Sugarcane genotypes under different fertility levels in spring planted season

Year of Experimentation : 2014-15

Experimental Site : N. E. Borlaug Crop Research Centre of G.B. Pant University of Agriculture & Technology, Pantnagar

Experimental details

Treatments:

1. **Genotypes (4)**
   (i) Co Pant 5224
   (ii) Co Pant 3220
   (iii) Co Pant 97222
   (iv) Co Pant 99214
2. **Fertility levels (3)***
   (i) 75 % of the recommended NPK
   (ii) 100 % of the recommended NPK
   (iii) 125 % of the recommended NPK

*Recommended dose of NPK was 120: 60:40 kg/ha

Design	**:**	Randomized Block Design (R.B.D.) factorial
Replication	**:**	3
Plot Size	**:**	3.75 x 8.0 = 30 m^2
Net plot size	**:**	18 m^2 (8 m X 2.25 m)
Date of Planting	**:**	19.03.2014
Date of harvesting	**:**	23.03.2015

Setts of sugarcane varieties *i.e.* Co Pant 5224, Co Pant 3220, Co Pant 97222 and Co Pant 99214 were planted on March 19, 2014 at 75 cm apart in 10 cm deep furrow using 4 setts per meter row length. Setts were treated with 0.25 % solution of carbendazim to prevent from fungal infection if any. N, P and K were applied as per treatments. Half dose of N along with full dose of P_2O_5 and K_2O were given as basal and remaining N was top dressed in two splits within 90 days after planting. Cultural operations were performed as per recommendations and need of the crop. The

experimental soil was silty loam in texture, rich in organic carbon (1.05 %) and medium in available P_2O_5 (49.0 kg/ha) and K_2O (240.7 kg/ha). Soil was neutral in pH (7.4). The crop was harvested on 23.03.2015.

Results:- Data given in Table-1(a) revealed that higher germination % was recorded in variety Co Pant 5224 which was significantly higher over Co Pant 3220 and Co Pant 97222 in planted cane. Higher net millable canes were recorded in variety Co Pant 5224 which were found significantly higher over rest of the varieties. Cane length and cane weight were also recorded higher in variety Co Pant 5224 as compared to rest of the varieties. Cane yield was higher in variety Co Pant 5224 which was found significantly higher over rest of the varieties *i.e.* Co Pant 3220 and Co Pant 97222 and was at par to Co Pant 99214. Sucrose % was higher in variety Co Pant 3220 which was significantly higher over Co Pant 99214. CCS yield (t/ha) was highest in variety Co Pant 5224 which was significantly higher over Co Pant 3220.

Germination % at 45 DAP could not influence due to fertility treatments. Cane yield was recorded higher in 125 % of the recommended dose of NPK which was significantly higher over 75 and 100 % of the recommended dose of N, P and K. Net millable canes/ha were significantly higher in 125 % of the recommended NPK over 75 % of the recommended dose of NPK. Plant height was also recorded significantly higher in 125 % of the recommended NPK over either 75 % or 100 %. However, cane girth could not influenced significantly due to fertility level. Average cane weight was higher significantly in 125 % of the recommended dose of N, P and K which was found significantly higher over 75 or 100 % of the recommended dose of NPK. Cane yield was influenced in 125 % of the recommended dose of NPK due to higher shoot population, average cane weight, cane length over 75 or 100 % of the recommended. CCS yield (ton/ha) was also higher in 125 % of the recommended NPK over rest of the fertility levels. (Table -1)

Summary:- Among all the sugarcane varieties Co Pant 5224 performed better for higher, NMC, cane yield, cane girth and cane length over rest of the varieties. However, cane yield was at par with variety Co Pant 99214. Cane yield, NMC, cane girth, CCS yield (t/ha) were higher in 125 % of the recommended dose of NPK over 75 or 100 % of the recommended dose.

Table1 1 (a):- Effects of genotypes and fertility levels on growth and yield of spring planted sugarcane at Pantnagar

Treatments	Germination (%) 45 DAP	Shoot population (000/ha)			Average cane weight (g)	Plant height at harvest (cm)	Cane girth (cm)	NMC (000/ ha)	Cane yield (t/ha)	Sucrose (%)	CCS (t/ha)
		60 DAP	90 DAP	120 DAP							
Genotypes											
Co Pant 5224	55.3	115.1	126.6	120.6	1033.3	388.0	8.4	104.1	88.2	14.3	7.0
Co Pant 3220	50.4	125.0	149.5	133.9	896.6	382.8	7.9	94.9	82.2	14.4	6.7
Co Pant 97222	45.7	108.0	141.7	130.2	956.7	385.0	8.4	79.3	83.5	14.3	6.8
Co Pant 99214	51.3	120.5	170.7	151.9	977.8	375.0	8.3	76.9	88.1	14.0	6.8
SEm ±	1.4	7.2	7.2	7.2	26.9	1.1	0.1	1.3	0.3	0.06	0.06
CD at 5%	4.2	21.2	21.2	21.2	78.9	3.4	NS	4.0	0.9	0.19	0.19
Fertility levels (% of Recommended N, P and K)											
75	48.0	112.5	136.9	120.2	855.8	370.0	7.5	82.6	82.5	15.2	6.4
* 100	49.3	112.0	146.3	135.7	938.3	385.0	7.9	90.9	86.1	13.8	6.7
125	49.8	127.1	158.3	141.3	1104.2	393.2	9.3	93.0	87.8	13.6	7.8
SEm ±	1.2	6.2	6.3	6.2	23.3	1.0	0.1	1.2	0.2	0.06	0.1
CD at 5 %	NS	NS	18.4	18.3	68.3	3.0	NS	3.6	0.7	0.18	0.4

***(Recommended dose of N, P and K were 120: 60: 40 kg N, P_2O_5 and K_2O/ha)**

Pooled analysis :- On the basis of two years pooled analysis it was observed that Co Pant 5224 performed better then rest of the genotypes (Table 1-b) which was significantly higher over rest of the treatments. Significantly higher NMC were also recorded in Co Pant 5224 over rest of the genotypes. However, CCS yield was higher significant higher over Co Pant 6224. NMC, cane yield and CCS yield were higher in 125 % of the recommended dose of N as compared to either 100 % or 75 % of the recommended N.

Summary :- Among all the genotype Co Pant 5224 performed better for cane yield and NMC, CCS yield was recorded highest in Co Pant 4222 which was significantly higher over Co Pant 6224. NMC, cane yield and CCS yield were higher in 125 % of the recommended dose of N as compared to either 100 % or 75 % of the recommended N.

Table 1(b) :- NMC (000/ha), cane yield (t/ha) and CCS yield (t/ha) influenced by various genotypes and fertility levels (Pooled)

Treatments	NMC (000/ha)			Cane yield (t/ha)			CCS (t/ha)		
	2012-13	2013-14	Pooled	2012-13	2013-14	Pooled	2012-13	2013-14	Pooled
Genotypes									
Co Pant 5224	87.2	88.0	87.6	85.9	87.7	86.8	8.5	6.9	7.7
Co Pant 6224	86.6	86.4	86.5	84.8	84.5	84.7	7.8	7.3	7.5
Co Pant 4222	87.0	80.4	83.7	85.0	82.2	83.6	8.8	7.5	8.2
Co Pant 2218	80.2	87.7	83.9	81.0	85.5	83.3	8.3	7.8	8.1
SEm ±	0.3	0.2	0.2	0.4	0.2	0.3	0.2	0.2	0.2
CD at 5%	0.9	0.6	0.6	1.6	0.6	1.1	0.8	0.6	0.6
Fertility levels (Nitrogen level % of the recommended)									
75	82.9	84.4	83.7	81.4	82.9	82.2	8.1	6.9	7.5
100	82.6	85.9	84.2	81.4	85.1	83.3	8.2	7.3	7.8
125	90.1	86.6	88.4	88.0	86.8	87.4	8.9	8.0	8.5
SEm ±	0.3	0.1	0.2	0.5	0.2	0.4	0.2	0.2	0.2
CD at 5 %	1.1	0.5	0.8	1.6	0.6	1.2	0.6	0.6	0.6

PROJECT NO. AS-42 (b)

Title : Performance of Sugarcane genotypes (ratoon) under different fertility levels

Year of Experimentation : 2014-15

Experimental Site : N. E. Borlaug Crop Research Centre of G. B. Pant University of Agriculture & Technology, Pantnagar

Experimental details

Treatments:

1. **Genotypes (4)**
   - (i) Co Pant 5224
   - (ii) Co Pant 6224
   - (iii) Co Pant 4222
   - (iv) Co Pant 2218
2. **Fertility levels (3) (Nitrogen levels)**
   - (i) 75 % of the recommended N
   - (ii) 100 % of the recommended N
   - (iii) 125 % of the recommended N

*Recommended dose of N was 150 kg/ha
*Uniform dose of P_2O_5 (60 kg/ha) and K_2O (40 kg/ha) were given as basal

Design	**:**	Randomized Block Design (R.B.D.) factorial
Replication	**:**	3 (Three)
Plot Size	**:**	3.75 x 8.0 = 30 m^2
Net plot size	**:**	18 m^2
Date of ratoon initiation	**:**	18.03.2014
Date of harvesting (ratoon)	**:**	17.02.2015

Sugarcane genotype *i.e.* Co Pant 5224, Co Pant 6224, Co Pant 4222 and Co Pant 2218 were raised as plant crop during 2013-14 with the 75 %, 100 % and 125 % of the recommended dose of N/ha. Uniform dose of P_2O_5 (60 kg/ha) and K_2O (40 kg/ha) was given along with different doses of N in plant cane and ratoon. Recommended dose of N was 150 kg N/ha. Half dose of N was given as basal (at ratoon initiation) and remaining half N was splitted in two parts was applied

up to June last. Cultural practices (irrigation, weeding, hoeing, earthing, tying etc.) were adopted as per recommendations. The ratoon was harvested on 17.02.2015.

Results:- Highest cane yield was recorded from sugarcane variety Co Pant 5224 which was significantly higher over rest of the genotypes *i.e.* Co Pant 6224, Co Pant 4222 and Co Pant 2218. The higher cane yield in the variety Co Pant 5224 was the result of higher millable cane, cane girth, length of cane. Number of clumps (000/ha) were also higher in variety Co Pant 5224 as compared to Co Pant 4222 and Co Pant 2218. Sucrose % in the canes of variety Co Pant 5224 was recorded higher as compared to rest of the genotypes. However CCS yield was not influenced in any of the variety/genotype significantly.

Significantly higher shoot population at different stages of crop growth *i.e.* 60, 90, 120 and 150 DAP was recorded in 125 % of the recommended N (150 kg N/ha) over 75 or 100 % of the recommended dose of N (150 kg N/ha). Cane yield was significantly higher in the treatment of 125 % of the recommended N over 75 % or 100 % of the recommended N/ha. The higher yield in 125 % of the recommended was the result of higher cane length, cane girth, millable cane. Sucrose % was recorded significantly higher in 75 % of the recommended N over either 100 % or 125 % of the recommended N. CCS yield was significantly higher in 125 % of the recommended N over 75 % of the recommended N. (Table - 2)

Summary:- Sugarcane variety Co Pant 5224 performed better over rest of the genotypes *i.e.* Co Pant 6224, Co Pant 4222 and Co Pant 2218 as the ratoon cane yield was significantly higher in Co Pant 5224. Sucrose % was also recorded higher in the variety Co Pant 5224. 125 % of the recommended N (150 kg N/ha) was found good over 75 or 100 % of the recommended N. Cane length, cane weight, millable cane, CCS yield were also significantly higher in 125 % of the recommended N/ha over recommended or sub optimal dose (75 % of the recommended).

Table 2:- Growth, cane yield and juice quality in ratoon affected by various genotypes and fertility levels

Treatments	Clumps (000/ha)	Shoot population (000/ha)				Plant height (cm)	Cane girth (cm)	Per cane wt. (g)	Millable cane (000/ha)	Yield (t/ha)	Sucrose % at harvest	CCS (t/ha)
		60 DAP	90 DAP	120 DAP	150 DAP							
Genotypes												
Co Pant 5224	22.9	71.1	79.0	88.6	97.8	327.4	2.5	812.0	60.4	57.1	14.0	6.7
Co Pant 6224	22.4	96.1	113.5	118.8	99.9	313.4	1.9	677.0	58.7	53.9	12.6	6.4
Co Pant 4222	19.1	74.7	102.0	116.3	91.9	320.4	1.8	833.0	56.6	53.1	13.0	6.4
Co Pant 2218	18.8	84.9	101.1	121.1	98.9	316.9	2.1	844.0	55.9	53.4	13.5	6.5
SEm ±	0.6	3.6	4.4	3.5	1.3	6.3	0.02	16.6	0.7	0.5	0.03	0.09
CD at 5%	1.9	10.6	12.9	10.3	3.9	NS	0.09	49.0	2.1	1.6	0.1	NS
Fertility levels (% of Recommended N)												
75	20.8	72.8	94.9	104.6	88.4	303.0	1.8	708.0	54.7	51.4	14.4	6.3
100	20.4	74.4	94.7	109.8	98.2	318.0	2.1	780.0	57.4	53.6	13.0	6.5
125	21.4	95.0	106.6	120.4	104.7	337.7	2.4	887.0	61.5	58.2	12.4	6.7
SEm ±	0.6	3.1	3.8	3.0	1.2	5.4	0.02	14.4	0.6	0.5	0.03	0.08
CD at 5 %	NS	9.2	11.2	9.1	3.6	16.0	0.07	43.2	1.8	1.5	0.09	0.24

*** Recommended N was 150 kg/ha + uniform dose of P_2O_5 (60 kg/ha) + K_2O (40 kg/ha)**

PROJECT NO. AS-64

Title : Response of sugarcane crop to different plant nutrients in varied agro ecological situations

Objective : To study differential response of sugarcane crop to different nutrients

Year of start : 2012-2013

Year of completion : 2014-2015

Experimental details

Treatments :

1. Control (no fertilizer)
2. N (120 kg/ha.)
3. NP (120+60kg/ha.)
4. NPK (120+60+40kg/ha.)
5. NPK+S (120+60+40+40 kg/ha.)
6. NPK+Zn (120+60+40+25 kg/ha.)
7. NPK+Fe (120+60+40 kg/ha + 1% spray thrice in weekly interval at vegetative stage)
8. NPK + Mn (120+60+40+50 kg/ha.)
9. NPK+S+Zn (120+60+40+40+25 kg/ha.)
10. NPK+S+Zn+Fe (120+60+40+40+25 kg/ha+1% spray thrice in weekly interval at vegetative stage)
11. NPK+S+Zn+Mn+Fe (120+60+40+40+25+50 kg/ha+1% spray thrice in weekly interval at vegetative stage)
12. FYM @ 20 t/ha.
13. Soil test based fertilizer application (150 kg N + 60 kg P_2O_5+ 40 kg K_2O)

Note:

S : 40/60 kg/ha elemental sulphur (Subtropical / Tropical)

Zn : 25/50 $ZnSO_4$ kg /ha (Subtropical / Tropical)

Fe : 1% spray thrice in weekly interval at vegetative stage)

Mn : 50/100 $MnSO_4$ kg/ha (Subtropical / Tropical)

NPK : as per recommendations

Date of planting	**:**	22.03.2014
Variety	**:**	Co Pant 99214
Experimental Design	**:**	RBD
Number of Replications	**:**	3
Number of treatments	**:**	13
Date of harvesting	**:**	23.03.2015
Gross plot size	**:**	8.0 m x 3.75 m = 30 m^2
Net plot size	**:**	18 m^2

Three budded sugarcane setts of variety Co Pant 99214 were planted on March 22, 2014 in 10 cm deep furrows after treatment with carbendazim @ 0.25 % for 10 minutes to prevent the setts from fungal infection, if any. Fertilizer was applied as per treatment. Full dose of phosphorus, potassium, sulphor, zinc and manganese were applied along with half dose of N as basal. Remaining N (half) was applied within 90 days of sowing (before monsoon). Iron (Fe) was applied @ 1.0 % spray in weekly interval at vegetative stage (tillering). Total 5 (five) irrigations were given. Cultural operations were performed as per recommendation and need of the crop. Crop was harvested on March 23, 2015.

Results:- Data given in table - 3 revealed that higher germination was recorded in the treatment T_6 - (NPK + Zn ; 120:60:40:25 kg/ha) which was significantly higher over T_1- (control), T_2 - (N; 120 kg/ha), T_3 - (NP ; 120 : 60 kg/ha), T_{12} - (FYM @ 20 t/ha) and T_{13} - (soil test based fertilizer application ; 150:60:60 kg N, P_2O_5 and K_2O/ha). Cane yield was recorded highest in T_9 (NPK+S+Zn) which was found significantly higher over rest of the treatments except T_{10} - (NPK+S+Zn+Fe) and T_{11} - (NPK+S+Zn+Mn+Fe). Higher cane yield in these treatments was the cumulative effect of higher shoot population at 150 DAP, cane girth, cane length, cane weight and NMC. Sucrose % was also recorded higher in these treatments which was reflected in CCS (ton/ha) because CCS yield was also recorded highest in T_9 - (NPK+S+Zn) which was significantly higher over rest of the treatments except T_{10} and T_{11}.

Summary:- Germination % at 45 DAP recorded highest in T_9 - (NPK+Zn+S) which was significantly higher over T_1, T_2, T_3, T_8, T_{12} and T_{13}. Cane yield was also recorded highest in T_9

which was significantly higher over rest of the treatments except T_{10} and T_{11}. Sucrose % and CCS yield were also higher in T_9, T_{10} and T_{11}. However sucrose % and CCS yield NMC and cane yield were improved in different treatments over control. FYM alone @ 20 ton/ha could not performed better. Higher cane yield in T_9, T_{10} and T_{11} was the result of higher NMC, cane length and cane girth. Higher net returns were also calculated in T_9 followed by T_{10} and T_{11} (Table - 4).

Table 3: Categories of available nutrients in soil (kg/ha)

Nutrients	Low	Medium	High
Nitrogen (kg/ha)	<280	280-560	>560
Phosphorous (kg/ha)	< 10	10-22.5	>22.5
Potassium (kg/ha)	<117	117-280	>280

Table 4: Economics of different nutrient management in sugarcane

Treatment	Common cost (₹ ha^{-1})	Fertilizer cost (₹ ha^{-1})	Harvesting cost (₹ ha^{-1})	Transportation cost (₹ ha^{-1})	Total Cost of cultivation (₹ ha^{-1})	Gross return (₹ ha^{-1})	Net return (₹ ha^{-1})
T_1	63700	0	23200	5800	92700	162400	69700
T_2	63700	1500	25600	6450	100750	180600	79850
T_3	63700	4550	26000	6500	100770	182000	81230
T_4	63700	5700	27600	6900	103900	193200	89300
T_5	63700	11900	30280	7570	113450	211960	98510
T_6	63700	7550	31800	7950	111000	222600	111600
T_7	63700	7150	31560	7890	110300	220920	110620
T_8	63700	6005	26480	6620	102805	185360	82555
T_9	63700	13700	36600	9150	123150	256200	133050
T_{10}	63700	15130	36400	9100	124330	254800	130470
T_{11}	63700	15300	36200	9050	124250	253400	129150
T_{12}	63700	15150	36200	6080	121130	170240	49110
T_{13}	63700	6134	24320	7070	101224	197960	96736

Table 5:- Response of sugarcane to different plant nutrients

Treatments	Germination % at 45 DAP	Shoot population (000/ha)			Cane girth (cm)	Cane length (cm)	Cane weight (g)	NMC (000/ ha)	Cane yield (t/ha)	Sucrose % at harvest	CCS (t/ha)
		90 DAP	120 DAP	150 DAP							
T_1- Control (no fertilizer)	21.8	83.5	88.4	91.1	7.1	280.0	800.0	62.5	58.0	15.2	5.6
T_2- N (120 kg/ha.)	25.6	105.2	109.8	114.5	7.8	291.7	850.0	66.2	64.5	15.5	6.9
T_3- NP (120+60kg/ha.)	26.7	108.7	110.7	113.5	8.3	301.7	900.0	67.7	65.0	16.0	6.8
T_4-NPK (120+60+40kg/ha.)	33.7	110.4	118.6	120.7	8.5	335.7	966.7	71.0	69.0	16.1	6.9
T_5-NPK+S (120+60+40+40 kg/ha.)	32.7	117.3	118.1	126.5	8.1	340.7	933.3	76.4	75.7	16.5	8.5
T_6-NPK+Zn (120+60+40+25 kg/ha.)	36.8	119.6	121.7	131.6	9.0	351.7	1133.3	80.7	79.5	16.8	9.7
T_7-NPK+Fe (120+60+40 kg/ha + 1% spray thrice in weekly interval at vegetative stage)	33.8	118.1	119.5	128.9	8.0	355.3	1100.0	79.7	78.9	17.0	8.8
T_8-NPK+Mn (120+60+40+50 kg/ha.)	27.3	110.6	115.8	118.7	8.0	300.7	816.7	67.6	66.2	16.7	7.8
T_9-NPK+S+Zn (120+60+40+40+25kg/ha.)	37.3	132.6	133.4	136.1	10.0	341.7	1200.0	94.5	91.5	17.7	11.6
T_{10}-NPK+S+Zn+Fe (120+60+40+40+25 kg/ha+1% spray thrice in Weekly interval at vegetative stage)	36.1	121.5	124.4	127.0	9.0	335.3	1266.7	93.0	91.0	17.2	10.7
T_{11}-NPK+S+Zn+Mn+Fe (120+60+40+40+25+50 kg/ha+1% spray thrice in weekly interval at vegetative stage)	34.8	119.8	122.2	124.0	8.8	331.7	1166.7	92.2	90.5	17.6	10.8
T_{12}-FYM @ 20 t/ha.	29.7	94.9	98.4	119.6	7.6	286.7	883.3	61.2	60.8	15.7	6.7
T_{13}-Soil test based fertilizer application (150 kg N + 60 kg P_2O_5+ 60 kg K_2O)	28.2	110.9	117.6	119.6	8.3	307.0	916.7	71.1	70.7	16.7	8.2
SEm±	1.4	1.9	2.1	5.3	0.20	1.6	32.12	0.84	0.81	0.08	0.3
CD at 5 %	4.2	5.6	6.1	15.3	0.60	4.7	93.8	2.45	2.39	0.25	0.9

Pooled analysis :- The experiment was conducted in Randomized block design in three replications having thirteen (13) treatments during 2012-13, 2013-14 and 2014-15. Pooled analysis shows that sugarcane yield was significantly higher in the treatment T_9 - (NPK+S+Zn ; 120+60+40+40+25 kg/ha) over rest of the treatments except T_{10} - (NPK+S+Zn+Fe ; 120+60+40+40+25 kg/ha + 1% spray of Fe thrice in weekly interval at vegetative stage). However, all the treatments increased cane yield in various treatments over control (no fertilizer). FYM @ 20 ton/ha alone could not produced higher yield as compared to various nutritional combinations. FYM @ 20 ton/ha produced cane yield almost equivalent to 120 kg N/ha. Role of S, Zn and Fe application was also seen positive in combination with NPK (at recommended dose) which produced higher cane yield over soil test based fertilizer application (150 kg N + 60 kg P_2O_5 + 60 kg K_2O/ha). Higher cane yield was the result of higher NMC in different treatments and CCS yield was also affected by higher cane yield and quality of juice (Table- 6).

Summary: - On the basis of pooled analysis of the experiment conducted three years in randomized block design it may be concluded that-

(i) Along with recommended dose of NPK (120: 60: 40 kg/ha), S (40 kg/ha) and Zn (25 kg/ha) application increased cane yield.

(ii) Beneficial effects of the 1 % Fe spray (thrice weekly interval) at vegetative stage were recorded for the better cane yield and juice quality.

(iii)FYM (20 ton/ha) alone produced cane yield similar to 120 kg N/ha application.

Table 6 :- Sugarcane productivity influenced by different nutritional treatments over the year (Pooled)

Treatments	NMC (000/ha)				Cane yield (t/ha)				CCS (t/ha)			
	2012 -13	2013 -14	2014 -15	Pooled	2012 -13	2013 -14	2014 -15	Pooled	2012 -13	2013 -14	2014 -15	Pooled
T_1- Control (no fertilizer)	91.2	64.6	62.5	72.8	67.0	60.4	58.0	61.8	7.2	7.8	5.6	6.9
T_2- N (120 kg/ha.)	99.3	67.5	66.2	77.7	84.4	67.5	64.5	72.1	9.6	7.4	6.9	7.8
T_3- NP (120+60kg/ha.)	102.4	68.2	67.6	79.4	88.5	67.9	65.0	73.9	11.0	9.2	6.8	9.0
T_4-NPK (120+60+40kg/ha.)	103.0	69.5	70.9	81.2	90.6	68.4	69.0	76.0	12.1	9.5	6.9	9.5
T_5-NPK+S (120+60+40+40 kg/ha.)	108.4	73.8	76.4	86.2	98.6	70.1	75.7	81.4	12.4	9.6	8.5	10.2
T_6-NPK+Zn (120+60+40+25 kg/ha.)	110.8	77.5	80.6	89.4	101.0	72.1	79.5	84.2	13.3	8.9	9.7	10.7
T_7-NPK+Fe (120+60+40 kg/ha + 1% spray thrice in weekly interval at vegetative stage)	110.2	76.1	79.6	88.7	100.3	71.7	78.9	83.6	13.0	9.5	8.8	10.4
T_8-NPK+Mn (120+60+40+50 kg/ha.)	104.1	72.0	67.6	81.2	90.8	67.2	66.1	75.1	12.1	9.6	7.8	9.8
T_9-NPK+S+Zn (120+60+40+40+25kg/ha.)	121.5	93.4	94.4	103.1	109.4	84.3	91.5	95.1	15.2	10.6	11.6	12.5
T_{10}-NPK+S+Zn+Fe (120+60+40+40+25 kg/ha+1% spray thrice in Weekly interval at vegetative stage)	116.4	81.6	93.1	97.0	106.5	84.2	91.0	93.9	14.9	9.6	10.7	11.7
T_{11}-NPK+S+Zn+Mn+Fe (120+60+40+40+25+50 kg/ha+1% spray thrice in weekly interval at vegetative stage)	115.9	78.8	92.4	95.6	102.0	75.4	90.5	89.2	13.6	10.3	10.9	11.6
T_{12}-FYM @ 20 t/ha.	96.6	65.4	61.2	74.4	80.0	73.4	60.8	71.4	8.4	11.1	6.7	8.7
T_{13}-Soil test based fertilizer application (150 kg N + 60 kg P_2O_5+ 60 kg K_2O)	99.8	70.8	71.1	80.6	92.3	67.9	71.8	77.4	11.1	9.2	8.2	9.5
SEm±	1.2	0.8	1.9	2.3	0.6	1.6	1.3	0.9	0.2	0.6	0.4	0.3
CD at 5 %	3.5	2.4	5.4	6.5	1.8	4.7	3.8	2.6	0.5	1.7	1.0	0.9

PROJECT NO. AS-65

Title : Enhancing sugarcane productivity and profitability under wheat-sugarcane cropping system

Year of start : 2012-13

Under report : 2014-15

Experimental details

Treatments :

T_1 - Autumn planted sugarcane

T_2 - T_1 + Wheat (1:2)

T_3 - T_1 + Wheat (1:3)

T_4 - Wheat sown on 15th November - late sugarcane

T_5 - Wheat sown on 15th December - late sugarcane

T_6 - FIRB sowing of wheat 15th November (75 cm with 3 row of wheat) + Sugarcane in furrow in 3rd week of February

T_7 - FIRB sowing of wheat 15th November (75 cm with 3 row of wheat) + Sugarcane in furrow in 3rd week of March

T_8- FIRB sowing of wheat 15th December (75 cm with 3 row of wheat) + Sugarcane in furrow in 3rd week of February

T_9 - FIRB sowing of wheat 15th December (75 cm with 3 row of wheat) + Sugarcane in furrow in 3rd week of March

Design : Randomized Block Design

Replication : 3

Treatment : 9

Wheat variety : UP 2565

Sugarcane Variety : Co Pant 90223

Plot size : 8.0 x 5.4 = 43.2 m^2

Net plot : 28.8 m^2

Sowing of sugarcane	**Harvesting of sugarcane**	**Sowing of wheat**
T_1, T_2 & T_3 - 20.10. 2013	T_1, T_2 & T_3 - 10.01. 2015	as per treatment
T_4 & T_5 - 16.04.2014	T_4 & T_5 - 06.04.2015	
T_6 &T_8 - 14.02.2014	T_6 &T_8 - 16.02.2015	
T_7 & T_9 - 22.03.2014	T_7 & T_9 - 24.03.2015	

Wheat variety UP 2565 and sugarcane variety Co Pant 90223 were planted as per technical programme (details are given). Wheat and sugarcane crops were raised as per recommended practices and as per need of the crop. The soil of experimental plots was silty loam in texture having organic carbon (1.05 %) and available P_2O_5 (49.0 kg/ha) and K_2O (240.0 kg/ha) and soil was neutral in (pH 6.9).

Results:

(i) Wheat:- Data given in Table - 7 revealed that highest grain yield was recorded from the treatment T_4 and T_5 (November, 15 sown) followed by FIRBS sowing (3 rows of wheat on 75 cm) in treatment T_6 and T_7. Reduction in grain yield due to late planting was recorded in (15^{th} December sown wheat).

(ii) Sugarcane:- Highest cane yield was recorded in the treatment T_1 - (Autumn planted cane) without (wheat inter crop). Reduction in cane yield by 14 % and 15 % in the treatment T_2 and T_3 (2 rows of wheat and 3 rows of wheat planted in between two rows of sugarcane, respectively. Cane yield was reduced in T_4 and T_5 (in late planted sugarcane after wheat harvest irrespective of wheat sowing either in 15^{th} November or 15^{th} December). Reduction in cane yield was recorded 36 % due to late planting of sugarcane. Sugarcane yield was improved in T_8 and T_9 in which sugarcane was planted in furrows in standing crop of wheat (planted on FIRBS) either on Feb. or March. NMC, sugarcane girth, cane weight were also affected badly in late planted sugarcane and these parameters were improved when sugarcane was planted in furrows in Feb/March in standing crop of wheat. However, reduction in cane yield was compensated with wheat intercropping with wheat 2 or 3 rows in between two rows of sugarcane over autumn planted alone. Even sugarcane equivalent yield was higher in T_6 - (FIRBS sowing wheat 3 rows and sugarcane planted in furrows in 3^{rd} week of February). Highest CCS yield 9.5 ton/ha was recorded in autumn planted sugarcane which was significantly higher over rest of the treatments (Table-8).

(iii) Summary: Sugarcane yield, NMC, cane girth, cane length, cane weight, CCS yield and sucrose % at harvesting were higher in autumn planted sugarcane as compared to rest of the

treatments. Though, reduction in cane yield (14 % and 15 %) was recorded in wheat planting as intercrop 2 or 3 rows in between of two rows of sugarcane as compared to autumn planted cane without wheat intercropping. However, this reduction in cane yield was compensated by intercrop wheat and thus equivalent yield was higher in 2 rows wheat planted in between two rows of autumn planted sugarcane. Reduction in cane yield was highest in late planted cane after wheat harvest (36 %). The reduction in cane yield was minimized in T_6 - (18 %), T_7 - (24 %) or T_8 and T_9 - (25 %) by planting of sugarcane in furrows in standing crop of wheat either in the month of February or March.

Table 7:- Enhancing sugarcane productivity and profitability under sugarcane - wheat cropping system 2014-15

Treatments	Wheat population/m^2 (30 DAS)	Wheat tillers		Wheat straw yield (q/ha)	Wheat grain yield (q/ha)
		60 DAS	90 DAS		
T_1 -Autumn planted sugarcane	0.0	0.0	0.0	0.0	0.0
T_2-T_1 + wheat (1:2)	180.0	191.3	297.3	36.8	33.4
T_3-T_1 + wheat (1:3)	206.0	246.7	315.3	30.2	32.9
T_4-Wheat sown on 15th November – late sugarcane	320.3	337.0	341.0	47.2	43.8
T_5-Wheat sown on 15th December – late sugarcane	174.0	186.0	271.7	29.3	27.3
T_6-FIRB sowing of wheat 15th November (75 cm with 3 row of wheat) + sugarcane in furrow in 3rd week of February	260.7	186.0	281.7	34.1	35.6
T_7-FIRB sowing of wheat 15th November (75 cm with 3 row of wheat) + sugarcane in furrow in 3rd week of March	176.7	187.0	76.7	29.7	30.9
T_8-T_6 with 15th Dec. Sowing of wheat +Sugarcane III$_{rd}$ week of February	172.3	183.7	268.0	27.3	26.3
T_9-T_7 with 15th Dec. Sowing of wheat + Sugarcane III$_{rd}$ week of March	170.0	182.7	263.3	26.3	25.5
SEm±	5.4	6.9	5.8	2.3	2.7
CD at 5 %	16.1	20.9	17.5	6.9	8.1

Table 8:- Enhancing sugarcane productivity and profitability under wheat-sugarcane cropping system

Treatments	Sugarcane germination (%) 45 DAS	Shoot population (000/ha)			Plant height (cm)	Plant girth (cm)	NMC 000/ha	Cane weigh t (g)	Yield (t/ha)	Sucrose % at Nov.	Sucrose % at harvest	CCS (t/ha)	Equivalent yield of sugarcane (q/ha)
		90 DAS	120 DAS	180 DAP									
T_1 -Autumn planted sugarcane	22.2	51.3	57.3	164.6	313.3	9.7	102.3	1050.0	95.9	14.3	15.2	9.5	959.0
T_2-T_1 + wheat (1:2)	23.5	38.6	56.5	149.5	310.0	10.0	91.4	950.0	82.1	14.4	14.8	7.6	982.0
T_3-T_1 + wheat (1:3)	25.2	36.3	55.0	143.9	301.7	10.0	85.0	966.7	81.3	14.2	14.3	7.1	971.6
T_4-Wheat sown on 15th November – late sugarcane	27.4	30.2	38.2	141.0	270.0	7.5	63.1	816.6	61.3	13.4	14.2	5.4	824.2
T_5-Wheat sown on 15th December – late sugarcane	27.1	30.4	37.5	138.7	283.3	7.1	61.6	783.3	60.1	13.7	13.8	5.1	738.6
T_6-FIRB sowing of wheat 15th November (75 cm with 3 row of wheat) + sugarcane in furrow in 3rd week of February	29.9	31.8	42.7	52.9	290.0	8.3	67.7	733.3	79.0	14.2	14.2	6.3	961.6
T_7-FIRB sowing of wheat 15th November (75 cm with 3 row of wheat) + sugarcane in furrow in 3rd week of March	31.7	31.9	43.9	57.9	266.7	9.0	76.8	883.3	72.0	14.4	14.4	6.1	869.0
T_8-T_6 with 15th Dec. Sowing of wheat +Sugarcane III$_{rd}$ week of February	29.8	36.5	44.1	47.4	280.0	8.7	73.8	850.0	71.7	14.0	14.5	5.1	843.8
T_9-T_7 with 15th Dec. Sowing of wheat + Sugarcane III$_{rd}$ week of March	32.7	29.3	35.7	47.5	280.0	8.0	73.3	833.3	71.1	14.0	14.5	6.2	833.9
SEm±	1.4	0.6	1.8	1.5	13.6	0.4	2.8	52.7	0.1	0.16	0.10	0.3	-
CD at 5 %	4.2	1.7	5.4	4.6	41.0	1.1	8.4	158.2	0.3	0.48	0.30	0.9	-

Pooled analysis :- Experiment was conducted during three consecutive years *i.e.* 2012-13, 2013-14 and 2014-15 in Randomized block design in three replications. Both the crops wheat and sugarcane were grown as per recommended package and practices. On the basis of pooled analysis data given in table - 9 revealed that highest cane yield was recorded in autumn planted crop which was significantly higher over rest of the treatments. Cane yield was affected in 3 rows planted wheat significantly as compared to 2 rows of wheat planted in between two rows of sugarcane. Reduction in cane yield was recorded higher 26.1 % in late planted sugarcane (sown after wheat harvesting) Sugarcane yield could not affect due to planting of wheat on FIRB and sugarcane planted either in 3rd week of March or 3rd week of February when sugarcane was planted in furrows in between FIRB. Lowest cane yield was recorded when wheat was planted on December 15th (late) and sugarcane was planted after wheat harvesting. The cane yield was directly related to NMC in different treatments. As indicated in (table - 9) that higher cane yield in different treatments was due to higher NMC in all the three years and pooled analysis also shown the similar results. Lowest NMC/ha were recorded in late planted sugarcane (sown after wheat harvest). NMC were also affected due to wheat intercropping (1: 3 ratio). Ultimately CCS yield was also recorded highest in autumn planted cane which was significantly higher were over rest of the treatments except intercropping of wheat (1: 2). Equivalent yield was recorded highest in the treatment of wheat sown on FIRB on 15th November and sugarcane was planted in blank furrows in 3rd week of March. Late planted sugarcane after wheat harvest was not good and lowest cane yield was recorded.

Summary :- On the basis of pooled analysis of three years of the data it may be concluded that-

(i) Autumn planted sugarcane without intercropping of wheat was not economical inspite of highest cane yield over the year.

(ii) In between two rows of sugarcane wheat sown (1: 2) was found economical in terms of higher equivalent yield of sugarcane.

(iii) Sugarcane yield was reduced in the treatment of 1: 3 sown of wheat in between two rows of sugarcane

(iv) Cane yield can be increased if wheat planted on FIRB (timely sown or late sown) and sugarcane planted in blank furrows either in the month of February or March in standing crop of wheat.

(v) Sugarcane planting after wheat harvesting should be restricted as the yield reduction was reduced upto 26 % in sugarcane-wheat cropping system.

Table 9 :- Effect of various treatments on the productivity of sugarcane over the years (Pooled)

Treatments	NMC (000/ha)				Cane yield (t/ha)				CCS (t/ha)			
	2012 -13	2013 -14	2014 -15	Pooled	2012 -13	2013 -14	2014 -15	Pooled	2012-13	2013-14	2014 -15	Pooled
T_1 -Autumn planted sugarcane	88.8	90.4	102.3	93.8	74.7	76.5	95.9	82.4	8.0	8.2	9.5	8.6
T_2-T_1 + wheat (1:2)	79.2	76.0	91.4	83.8	70.3	69.1	82.1	73.8	7.1	7.4	7.6	7.4
T_3-T_1 + wheat (1:3)	69.2	70.4	85.0	74.9	62.7	63.2	81.3	69.0	6.6	6.5	7.1	6.7
T_4-Wheat sown on 15th November – late sugarcane	63.3	62.5	63.2	63.0	60.7	60.8	61.3	60.9	5.3	5.8	5.5	5.5
T_5-Wheat sown on 15th December – late sugarcane	53.4	54.7	61.6	56.3	51.3	51.9	60.1	54.4	4.6	4.9	5.1	5.0
T_6-FIRB sowing of wheat 15th November (75 cm with 3 row of wheat) + sugarcane in furrow in 3rd week of February	73.1	74.0	67.7	71.6	67.3	67.8	79.0	71.3	6.0	6.8	6.3	6.4
T_7-FIRB sowing of wheat 15th November (75 cm with 3 row of wheat) + sugarcane in furrow in 3rd week of March	73.2	74.4	76.8	74.8	69.8	70.4	72.0	70.5	6.1	7.6	6.1	6.6
T_8-T_6 with 15th Dec. Sowing of wheat +Sugarcane III$_{rd}$ week of February	71.8	70.9	73.8	72.2	68.8	69.3	71.7	70.0	6.0	6.7	5.1	6.0
T_9-T_7 with 15th Dec. Sowing of wheat + Sugarcane III$_{rd}$ week of March	71.5	71.3	73.3	72.1	68.8	69.1	71.1	70.0	6.3	6.9	6.2	6.2
SEm±	2.7	1.7	2.8	1.6	1.7	1.0	2.2	1.0	0.9	0.1	0.3	0.4
CD at 5 %	8.0	5.0	8.0	4.8	5.1	3.1	6.2	2.9	NS	0.4	0.9	1.3

PROJECT NO. AS-66

Title : Priming of cane node for accelerating germination in Sugarcane

Observation : (i) To find out suitable cane node priming technique

(ii) To assess the effect of cane node on acceleration of germination and productivity of sugarcane

Year of start : 2012-13

Treatments (6)

T1 : Un-primed cane node.

T2 : Treating cane node in hot water at 50 ^{o}C for 2 hours.

T3 : Treating cane node in hot water at (50 ^{o}C) + urea solution (3 %) for 2 hours.

T4 : Priming cane node with cattle dung, cattle urine and water in 1:2:5 ratio.

T5 : Conventional 3 bud sett planting.

*T6 : Primed and sprouted cane node (Incubated for 4 days after priming).

(*) Put the single cane node in the slurry of cattle dung, cattle urine and water for 15 minutes. Take out the buds and put in decomposed FYM and cover it with sugarcane trash for 4-5 days for sprouting.

Date of planting : 27.3.2014

Variety : Co Pant 99214

Design : Randomized Block Design (R.B.D.)

Treatments : 6

Replication : 4

Date of harvesting : 30.3.2014

Plot size : 3.75 x 8.0 =30.0 m^2

Three budded setts of variety Co pant 99214 were sown in furrows at 75 cm distance on 27 March, 2014. Experiment was conducted in Randomized block design with four replications. Before sowing setts were treated with carbendazim solution (0.2 %) to avoid fungal infection if any. Setts

were treated as per technical programme and sown. Other cultural practices were adopted as per need of the crop. Sugarcane crop was harvested on 30.3.2015

Results: - To see the effect of different treatments on germination observation were recorded from 20 DAP onward (30 and 40 DAP). Germination % however was found non-significant at 20 DAP but there was variation in different treatments and was recorded highest in conventional (3 bud setts planting) followed by seed treatment of cane node in hot water 50 ^{0}C + urea @ 3% for 2 hours and in T_4 - (Priming cane node with cattle dung, cattle urine and water (1: 2: 5) ratio. Lowest germination % was recorded in unprimed cane node at 20 DAP (Table - 10).

At 40 DAP stage the germination % was highest in T_5 - (conventional 3 bud setts) which was significantly higher over unprimed cane node (T_1) and T_6 - (Primed and sprouted cane node (incubated for 4 days after priming). Highest shoot population at 150 DAP was recorded in T_2. Cane node treated in hot water at (50 ^{0}C) for 2 hours which produced significantly higher shoot population over T_1- (unprimed), T_3 - (cane node treated in hot water (50 ^{0}C) + urea (3 % for 2 hours) and T_6 - (Primed and sprouted cane node (incubated foe 4 days after priming). Cane yield was recorded highest in T_5 - (conventional 3 budded setts) which was significantly higher over rest of the treatments except T_2 - (cane node treated in hot water (50 ^{0}C). NMC, cane weight, cane length and cane girth were also higher in T_5 - (conventional 3 bud setts) as compare to rest of the treatments. CCS yield was also higher in T_5 - (conventional 3 bud setts) which was found significantly higher over rest of the treatments.

Summary:- Germination %, shoot population, NMC, cane yield, CCS yield, cane length, cane girth were highest in T_5 – (conventional 3 bud setts). Cane yield was also higher in T_2 - (cane node treated in hot water at 50 ^{0}C for 2 hours). CCS yield, Sucrose % was higher in conventional 3 bud setts (T_5).

Table 10:- Priming of cane node for accelerating germination

Treatments	Germination %			Shoot population (000/ha)				NMC (000/ha)	Average cane weight (g)	Plant height (cm)	Cane girth (cm)	Cane yield (t/ha)	Sucrose % at Nov.	Sucrose % at harvest	CCS (t/ha)
	20 DAP	30 DAP	40 DAP	60 DAP	90 DAP	120 DAP	150 DAP								
T_1-Un-primed cane node	4.3	18.3	24.9	24.3	33.4	39.1	102.8	68.3	1012.5	375.8	8.0	65.5	15.5	17.3	7.6
T_2-Treating cane node in hot water at 50^{o}C for 2 hours	10.0	35.7	42.3	39.8	82.7	92.5	130.7	100.5	1250.0	380.8	10.1	98.5	14.9	17.4	11.4
T_3-Treating cane node in hot water at (50^{o}C) + urea solution (3 %) for 2 hours	14.0	37.4	44.0	50.1	84.0	95.7	107.3	71.8	1062.5	352.5	8.0	69.5	15.9	17.5	8.2
T_4-Priming cane node with cattle dung, cattle urine and water in 1:2:5 ratio	13.6	37.4	44.7	48.3	56.4	66.9	122.5	74.7	1125.0	384.5	8.3	72.6	15.6	16.9	7.9
T_5-Conventional 3 bud setts planting	15.0	47.1	48.3	57.1	91.5	96.7	124.7	105.3	1300.0	400.5	10.1	90.1	15.4	17.3	11.8
*T_6-Primed and sprouted cane node (Incubated for 4 days after priming)	3.3	17.6	23.3	21.3	29.7	34.3	86.8	82.5	1200.0	389.5	9.0	81.2	14.9	16.5	8.7
SEm±	3.6	5.1	5.1	1.8	5.3	4.4	0.7	0.6	18.8	9.9	0.09	0.3	0.3	0.03	0.07
CD at 5 %	NS	15.2	15.5	5.4	16.1	13.3	2.0	1.7	57.7	29.8	0.27	0.9	0.8	0.08	0.22

Pooled analysis :-The pooled analysis of 3 years experiments revealed that germination of sugarcane at 40 days stage was recorded highest in T_3 - (Cane node treated in hot water (50 ^oC) + urea solution (3 %) for 2 hours which was significantly higher over rest of the treatments. Germination % was recorded lowest in unprimed cane node which was significantly lower than rest of the treatments. Significantly higher NMC were recorded in T_5 - (Conventional 3 bud setts) over rest of the treatments. However, NMC were improved in all the priming treatments except in un-primed cane node. Cane yield was recorded highest in conventional 3 bud setts planting which produced significantly higher cane yield over rest of the treatments exceptane node treated in hot water (50 ^0C) for 2 hours. CCS yield was also recorded highest in both the treatments (Table - 11).

Summary:- On the basis of three years pooled analysis of data it may be concluded that to enhance the germination in sugarcane cane node should be treated with hot water (50 ^oC) + urea solution 3 % for 2 hours. However, the cane yield was recorded highest in conventional 3 bud setts planting followed by cane node treated in hot water (50 ^OC) for 2 hours. CCS yield was also higher in both the treatments. However, highest CCS yield was recorded in conventional 3 bud setts planted sugarcane.

Table 11:- Germination %, NMC (000/ha), cane yield (t/ha) and CCS yield (t/ha) as influenced by various treatments (Pooled analysis)

Treatments	Germination % at 40 DAP				NMC (000/ha)				Cane yield (t/ha)				CCS (t/ha)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T_1-Un-primed cane node	45.0	44.7	24.9	38.1	68.7	71.3	68.2	69.4	64.8	69.1	65.3	66.4	7.0	9.0	7.6	7.8
T_2-Treating cane node in hot water at 50^{o}C for 2 hours.	69.3	60.3	42.4	57.3	82.1	82.7	100.6	88.4	96.6	86.1	98.5	93.7	11.4	10.0	11.4	10.9
T_3-Treating cane node in hot water at (50^{o}C) + urea solution (3 %) for 2 hours	73.6	65.6	44.0	61.0	89.3	88.6	71.9	83.3	67.4	72.6	69.4	69.8	7.5	9.4	8.2	8.4
T_4-Priming cane node with cattle dung, cattle urine and water in 1:2:5 ratio	52.5	57.8	44.8	51.7	73.6	78.6	74.6	75.6	70.4	73.7	72.7	72.3	8.0	9.7	7.9	8.5
T_5-Conventional 3 bud setts planting	56.0	59.0	48.4	54.3	148.5	136.0	105.4	129.9	101.3	101.7	90.1	97.7	11.6	12.9	11.7	12.1
*T_6-Primed and sprouted cane node (Incubated for 4 days after priming)	50.5	55.7	23.4	43.1	85.9	82.1	82.5	83.7	78.4	79.3	81.2	79.6	8.9	10.0	8.6	9.2
SEm±	1.5	1.4	1.5	1.0	4.8	4.5	0.5	3.2	3.4	2.7	0.4	2.1	0.2	0.6	0.06	0.3
CD at 5 %	4.4	4.3	4.5	3.0	14.5	13.5	1.5	9.5	10.3	8.3	1.3	6.3	0.6	1.7	0.18	0.9

Project No. AS-68

Title : Impact of integrated application of organics and inorganics in improving soil health and sugarcane productivity

Objective : To develop nutrient management strategy for sustaining soil health and sugarcane production

Year of start : 2014-2015

Location : All the participating centers

Cropping system : Sugarcane – Ratoon-I, Ratoon-II

Treatments & Methodology

Treatments	Sugarcane (plant crop)	Ratoon-I	Ratoon-II
T_1	No organic + 50% RDF	Application of trash at 10 tonnes/ha + 50 % RDF	Application of trash at 10 tonnes/ha + 50 % RDF
T_2	No organic + 100% RDF	Application of trash at 10 tonnes/ha + 100 % RDF	Application of trash at 10 tonnes/ha + 100 % RDF
T_3	No organic + soil test based recommendation	Application of trash at 10 tonnes/ha + soil test basis (NPK application)	Application of trash at 10 tonnes/ha + soil test basis (NPK application)
T_4	Application of FYM/Compost @ 20 tonnes/ha + 50 % RDF (inorganic source)	Application of FYM/Compost @ 20 tonnes/ha + 50 % RDF (inorganic source)	Application of FYM/Compost @ 20 tonnes/ha + 50 % RDF (inorganic source)
T_5	Application of FYM/Compost @ 20 tonnes/ha + 100 % RDF (inorganic source)	Application of FYM/Compost @ 20 tonnes/ha + 100 % RDF (inorganic source)	Application of FYM/Compost @ 20 tonnes/ha + 100 % RDF (inorganic source)
T_6	Application of FYM/Compost @ 20 tonnes/ha + in organic nutrient application based on soil test (rating chart)	Application of FYM/Compost @ 20 tonnes/ha + in organic nutrient application based on soil test (NPK application)	Application of FYM/Compost @ 20 tonnes/ha + in organic nutrient application based on soil test (NPK application)
T_7	Application of FYM/compost @ 10 tonnes/ha + biofertilizer (*Azotobacter/Acetobactor + PSB*) + 50 % RDF	Application of FYM/Compost @ 10 tonnes/ha + biofertilizer (*Azotobacter/Acetobactor + PSB*) + 50 % RDF	Application of FYM/Compost @ 10 tonnes/ha + biofertilizer (*Azotobacter/Acetobactor + PSB*) + 50 % RDF
T_8	Application of FYM/Compost @ 10 tonnes/ha + biofertilizer (*Azotobacter/Acetobactor* + PSB) + 100 % RDF	Application of FYM/Compost @ 10 tonnes/ha + biofertilizer (*Azotobacter/Acetobactor* + PSB) + 100 % RDF	Application of FYM/compost @ 10 tonnes/ha + biofertilizer (*Azotobacter/Acetobactor* + PSB) + 100 % RDF
T_9	Application of FYM/Compost @ 10 tonnes/ha + biofertilizer (*Azotobacter/Acetobactor* + PSB) + soil test basis	Application of FYM/Compost @ 10 tonnes/ha + biofertilizer (*Azotobacter/Acetobactor* + PSB) + soil test basis (NPK application)	Application of FYM/Compost @ 10 tonnes/ha + biofertilizer (*Azotobacter/Acetobactor* + PSB) + soil test basis (NPK application)

Details of experiment:

Design	**:**	Randomized Block Design (R.B.D.)
Sugarcane variety	**:**	Co Pant 5224
Treatments	**:**	9
Replication	**:**	3
Date of planting	**:**	March 25, 2014
Date of harvesting	**:**	30.3.2015
Plot size	**:**	8.0 x 3.75 =30.0 m^2

Setts of sugarcane variety Co Pant 5224 were planted at 75 cm apart row to row by flat method planting on March 25, 2014. Sugarcane setts were treated with carbendazim (0.2 % for 10 minutes to prevent the setts from fungal infection if any). Treatments were given as per technical programme. Crop was raised with recommended package and practices and as per need of the crop. Soil of the experiment was silty loam in texture, rich in organic matter (1.05 %) and medium in available P_2O_5 (79.0 kg/ha) and K_2O (240.7 kg/ha). Soil was neutral pH (7.5) crop was harvested on 30.3.2015

Results :- Highest germination at 45 DAP recorded in the treatment T_5 - (FYM/compost @ 20 tonnes/ha + 100 % RDF, inorganic source (120: 60: 40 NPK/ha) and T_6 - (FYM/compost @ 20 tonnes/ha + in organic nutrient based on soil test) which were significantly higher over rest of the treatments. Higher cane yield was also recorded from the treatment T_5 and T_6 which were significantly higher over rest of the treatments. Higher cane yield in these treatments was due to higher shoot population, NMC, cane girth and heavier cane recorded in these treatments. Sucrose % was also significantly higher in these treatments over T_1, T_2 and T_3. Thus CCS yield was recorded highest in T_6 which was found significantly higher over T_1, T_2, T_3 and T_9 (Table - 12.)

Summary :- Highest cane yield was recorded from T_5 - (FYM @ 20 ton/ha + 100 % RDF (120: 60: 40) followed by T6 - (FYM 20 ton/ha + inorganic nutrients based on soil test). The higher cane yield in these treatments was due to higher NMC, cane girth, cane length and weight of individual cane. Sucrose % and CCS yield were also higher in these treatments.

Table 12:- Impact of integrated application of organics and inorganics in improving soil health and sugarcane productivity

Treatments	Germination (%)		Shoot population (000/ha)			Cane yield (t/ha)	Millable cane (000/ha)	Cane girth at harvest (cm)	Cane length (cm)	Per cane weight (g)	Sucrose % at harvest	CCS (t/ha)
	35 DAP	45 DAP	60 DAP	90 DAP	120 DAP							
T1-No organic + 50% RDF	27.2	31.2	111.5	126.8	128.6	65.9	73.2	8.0	348.3	800.0	14.3	7.0
T2- No organic + 100% RDF	29.4	31.7	119.2	134.8	137.3	66.8	73.2	8.7	358.7	833.3	14.0	7.2
T3- No organic + Soil test based recommendation (150:60:60)	29.4	31.7	125.7	132.6	145.6	68.8	75.7	8.7	358.3	833.3	15.5	7.3
T4- Appication of FYM/compost @ 20 t/ha + 50 % RDF (inorganic source)	33.0	34.4	138.8	130.4	135.6	70.6	78.6	9.0	418.3	916.7	15.6	7.9
T5-Application of FYM/compost @ 20 t/ha +100 % RDF (inorganic source) (120 : 60: 40)	33.2	36.0	139.1	150.4	151.2	77.9	83.0	9.3	429.0	1216.7	16.6	7.9
T6- Application of FYM/compost @ 20 t/ha + in organic nutrient application based on soil test (rating chart)	33.5	35.8	135.9	144.8	150.2	77.9	82.9	9.2	440.0	1250.0	16.7	8.3
T7- Application of FYM/compost @ 10 t/ha + bio fertilizer (*Azotobacter /Acetobacter* + PSB) + 50 % RDF	31.4	32.1	141.5	156.8	134.9	69.3	75.7	8.5	366.7	1066.7	16.4	7.4
T8- Application of FYM/compost @ 10 t/ha +bio fertilizer (*Azotobacter /Acetobacter* + PSB) + 100 % RDF	31.7	33.7	136.1	142.8	146.3	71.7	79.1	9.0	372.0	1033.3	16.4	7.8
T9- Application of FYM/compost @ 10 t/ha +bio fertilizer (*Azotobacter /Acetobacter* + PSB) + soil test basis	31.5	32.3	137.8	160.4	154.0	69.8	76.1	9.0	382.0	1083.3	16.6	7.5
SEm±	0.3	0.3	5.5	5.1	7.0	0.5	1.0	0.2	2.2	19.7	0.07	0.2
CD at 5 %	1.1	0.9	16.6	15.5	20.8	1.5	3.1	0.6	6.5	59.2	0.24	0.7

Appendix I : Metrological observations recorded during experimental period (February, 2014 to April, 2015) at Pantnagar

Month	Temperature (^{0}C)		Rel. Humidity (%)		Rainfall (mm)	No. of rainy/ days	Wind speed Km/h	Sunshine hrs./day	Evap. (mm)
	Max.	Min.	0712	1412					
February, 2014	21.1	9.2	93	58	120.4	3	5.2	05.5	2.0
March, 2014	27.4	13.0	86	42	69.0	5	5.2	07.7	3.3
April, 2014	34.0	15.9	74	25	013.0	4	6.4	09.8	6.9
May, 2014	37.3	21.9	63	28	17.8	2	9.5	09.9	9.4
June, 2014	37.8	26.1	73.6	45.5	113.8	4	7.7	8.1	7.7
July, 2014	32.4	25.9	89	71	428.0	18	6.2	03.4	4.6
August , 2014	33.4	25.9	89	67	89.0	8	5.7	06.7	5.1
September, 2014	32.8	23.5	88	62	38.2	8	5.3	07.5	4.9
October, 2014	30.4	17.8	88	54	45.4	5	2.8	06.3	3.0
November , 2014	27.5	10.2	92	40	0.0	0	2.3	07.6	2.5
December , 2014	20.5	7.6	94	59	40.1	2	3.6	04.9	1.6
January , 2015	17.1	8.8	94	74	32.8	4	4.5	02.9	1.1
February , 2015	23.9	10.5	90	53	8.2	2	4.2	05.7	2.1

Appendix - II : Physico-chemical properties of the experimental soil

Attributes	AS-42 (a)	AS-42 (b)	AS-63	AS-64	AS-65	AS-66	AS - 68
Texture	Silty loam	Silty loam	Silty loam	Silty loam	Silty loam	Silty loam	Silty loam
Organic carbon %	1.05	1.03	1.04	1.04	1.05	1.08	1.04
Available P_2O_5 (kg/ha)	49.0	48.6	47.6	47.0	49.0	48.6	47.8
Available K_2O (kg/ha)	240.7	239.3	240.7	240.5	240.7	240.7	237.5
Soil pH	7.4	7.2	7.4	7.2	7.5	7.4	7.3

Appendix III : Details of different experiments

Experiment	Varieties	Planting date	Date of harvesting	Fertilizer dose (kg/ha)
AS – 42 (a)	Co Pant 5224 Co Pant 3220 Co Pant 97222 Co Pant 99214	19.03.2014	23.03.2015	NPK as per treatment (Recommended dose N 120 kg/ha P 60 kg/ha and K 40 kg/ha)
AS – 42 (b)	Co Pant 5224 Co Pant 6224 Co Pant 2218 Co Pant 4222	18.03.2014	19.03.2015	N as per treatment (Recommended dose N 120 kg/ha P 60 kg/ha and K 40 kg/ha)
AS-64	Co Pant 99214	22.03.2014	23.03.2015	NPK and micro nutrients as per recommended dose
AS-65	Co Pant 90223	As per treatment	As per treatment	NPK as per recommended dose
AS-66	Co Pant 99214	27.03.2014	30.03.2015	NPK as per recommended dose
AS-68	Co Pant 5224	25.03.2014	30.3.2015	NPK as per treatments and FYM as per treatments, bio-fertilizer as per treatments.

Appendix IV : Price, cost and man power used in the experiment

Name of operation	No. of operation	Price (₹)
1. Land preparation		
Pre-sowing irrigation	01	1000 ₹/irrigation/ha
Labour for pre-sowing irrigation	02	
Harrowing	05	225 ₹/labour
Planking	02	
2. Fertilization application		1000 ₹/harrowing/ha
Nitrogen (Urea)	120 kg/ha	500 ₹/planking/ha
Phosphorus (DAP)	60 kg/ha	
Potassium (MOP)	40 kg/ha	5.7 (₹/kg)
Sulphur (Elemental sulphur)	40 kg/ha	17.0 (₹/kg)
Iron (Iron sulphate)	25 kg/ha	24.16 (₹/kg)
Zinc (Zinc sulphate)	25 kg/ha	155 (₹/kg)
Manganese (Manganese sulphate)	50 kg/ha	55 (₹/kg)
FYM	20 t/ha	72 (₹/kg)
Labour	05	50 (₹/kg)
3. Sowing		75 (₹/kg)
Furrow opening	01	225 ₹/labour
Seed cost	60q	
Labour (planting + covering)	30	2500 ₹/ha
4. Irrigation		300 ₹/q
		225 ₹/labour
Irrigation	05	
Labour	10	
5. Weeding		1000 ₹/irrigation/ha
I	25 (labour)	225 ₹/labour
II	25 (labour)	
III	25 (labour)	225 ₹`/labour
6. Chemical treatments		225 ₹/labour
Seed treatment	500gm/ha (Emissan)	225 ₹/labour
Pest control	30kg/ha (Furadan)	
Labour	03	520 ₹`/kg
		70 ₹/kg
	25 (labour)	225 ₹/labour
	25 (labour)	
7. Tying		225 ₹/labour
8. Earthing up		225 ₹/labour
9. Miscellaneous		2500 ₹
10. Harvesting		40 ₹/q
11. Transportation		10 ₹/q