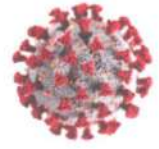




एक कदम स्वच्छता की ओर



**ALL INDIA COORDINATED RESEARCH
PROJECT ON SUGARCANE**

**TECHNICAL REPORT
2019-2020**

**Crop Production
(Agronomy & Soil Science)**

Compiled by

**Dr. T.K. Srivastava,
Principal Scientist
&
Principal Investigator**



भाकृअनुप
ICAR



भारतीय गन्ना अनुसंधान संस्थान, लखनऊ
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**ICAR-Indian Institute of Sugarcane Research,
Lucknow 226002 (U.P.)**

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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
 Locations : All the participating centres
 Cropping system : Sugarcane – Ratoon-I – Ratoon-II

Treatment & Methodology:

Treatments	Sugarcane (plant crop)	Ratoon-I	Ratoon- II
T1	No organic + 50% RDF	Application of trash at 10 tonnes/ ha + 50% RDF	Application of trash at 10 tonnes/ ha + 50% RDF
T2	No organic + 100% RDF	Application of trash at 10 tonnes/ ha + 100% RDF	Application of trash at 10 tonnes/ ha + 100% RDF
T3	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)
T4	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)
T5	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)
T6	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)
T7	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + <i>PSB</i>) + 50% RDF	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + <i>PSB</i>) + 50% RDF	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + <i>PSB</i>) + 50% RDF
T8	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + <i>PSB</i>) + 100% RDF	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + <i>PSB</i>) + 100% RDF	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + <i>PSB</i>) + 100% RDF
T9	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + <i>PSB</i>) + soil test basis	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + <i>PSB</i>) + soil test basis (NPK application)	Application of FYM/Compost @ 10 tonnes / ha + biofertilizer (<i>Azotobacter/ Acetobacter</i> + <i>PSB</i>) + soil test basis (NPK application)

Note:

1. The application rate of biofertilizer (*Azotobacter/ Acetobacter* + *PSB*) will be 5 kg/acre (solid based fertilizer 10^{7-8} cfu).
2. $ZnSO_4$ @ 25 kg/ha will be applied at the start of the cycle.

3. Trash will be inoculated with cellulolytic organism such as *Trichoderma viride* @ 500 g/tonne.
4. The experiment will be conducted in permanent field lay out.
Design : RBD
Replications : Three
Plot size : 6 rows of 6 m length
Planting season: February – March / Main season

Observations to be recorded:

1. Germination count/ plant population at 30 and 45 DAP / DAR
2. Tiller population at 120 and 150 DAP/DAR
3. Millable canes, length, girth and cane weight at harvest
4. Cane and sugar yield
5. Juice quality parameters (Brix, pol, purity) at 10 and 12 months age
6. Soil analysis initial and after harvest of each crop (bulk density, infiltration rate, organic carbon, soil pH, EC, available N, P₂O₅, K₂O in kg/ha)
7. Economics
8. Nutrient uptake (N, P, K) at harvest (optional)
9. Soil microbial parameters (optional)

SUMMARY REPORT FOR THE LAST YEAR (2018-19)

The trial initiated during the year 2010-15 with allotment to all the centres. However, during the year 2018-19 only 08 centres carried out the trial.

NORTH WEST ZONE

1. FARIDKOT

Ratoon cane yield (91.5 t/ha) was the highest with application of FYM/Compost @ 20 tonnes / ha + inorganic nutrient based on soil test (T6) which was significantly higher than all treatments except no organic + soil test based recommendation T3 (83.3 t/ha) and T5 (88.1 t/ha). These treatments also have the residual effect of FYM applied to plant crop. Same trend was there for CCS t/ha.

2. LUCKNOW

In the first ratoon crop the highest rate of sprouting (93.4%) was observed under the treatment of only organic matter application along with FYM. Highest number of tillers (180.2 thousand/ha at 120 days after planting), shoot count (175.6 thousand/ha at 180 DAP), number of millable canes (120.5 thousand/ha), cane yield (84.20 t/ha) and sugar yield (10.55 t/ha) were recorded under the treatment where application of FYM @ 20t/ha was done along with soil test (rating chart) based inorganic fertilizer recommendations.

3. SHAHJAHANPUR

Sugarcane ratoon with application of FYM @ 10 tonnes/ ha + bio-fertilizers (Azotobacter + PSB) + inorganic nutrients on soil test basis (NPK) produced significantly higher cane yield (99.20 t/ha) than that of other treatments.

4. UCHANI

FYM 20 t/ ha + 100% RDF through inorganic source (T6) and FYM @ 10 t/ ha + biofertilizer (Azotobacter/ Acetobacter + PSB) + soil test basis (T9) were found best and at par treatments in terms of number of tillers (18.4, 142.9 thousands/ha), millable canes (119.1, 116.5 thousands/ha) and ratoon cane yield (96.6, 94.0 t/ha) and sugar yield as compared to rest of the treatments.

PENINSULAR ZONE

5. SANKESHWAR

The yield and yield attributes recorded in first ratoon cane indicated significant differences among the treatments. Application of trash at 10 tonnes/ha along with soil test based nutrients application recorded highest cane yield (100.41 t/ha), number of millable canes (80680/ha) and CCS yield (13.65 t/ha).

EAST COAST ZONE

6. NAYAGARH

Results obtained from first ratoon crop indicated that application of FYM/Compost @ 10t/ha + (Azotobacter + PSB) +100% RDF (T8) and Application of FYM/Compost @ 10 t/ha + Azotobacter + PSB + Soil test based (NPK) fertilizer application (T9) recorded higher percentage of germination at 45 DAR i.e. 43.70 and 46.89%, respectively. These treatments subsequently performed better than other treatment combinations leading to higher yield parameters and cane yield.

NORTH CENTRAL ZONE

7. SEORAH I

Sugarcane ratoon with application of FYM @ 10 t/ha + bio-fertilizers (Azotobacter + PSB) + soil test basis NPK application treatment produced significantly higher clump population (34.92 thousand/ha), NMC (107.54 thousand/ha) and cane yield (83.99 t/ha) as compared to other treatments except the treatment T8.

8. PUSA

Integrated application of nutrients was found effective in improving soil fertility and cane yield. The application of fertilizers on soil test basis along with organics @ 20 t/ha was found suitable for boosting cane yield and maintaining soil fertility in calcareous soils of Bihar.

CURRENT YEAR (2019-20) REPORT

NORTH WESTERN ZONE

1. FARIDKOT

The second ratoon (CoJ 88) crop was initiated on 11.02.2019 and the ratoon cane yield (75.6 t/ha) was the highest (Table AS 68.1.1) with application of FYM/Compost @ 20 tonnes/ha + inorganic nutrient based on soil test (T6) which was significantly higher than all treatments except, T2 (67.8 t/ha), T3 (70.7 t/ha), T5 (71.5 t/ha), T6 (75.6 t/ha), T8 (69.3 t/ha) and T9 (71.5 t/ha). These treatments also have the residual effect of FYM applied to plant crop. Same trend was there for CCS t/ha.

Table AS 68.1.1: Performance of second ratoon (second cycle) crop as influenced due to nutrient management in plant-ratoon system at Faridkot

Treat.	No. of Shoots 000/ha	NMC 000/ha	Cane length (cm)	Cane diameter (cm)	Single cane wt. (g)	Cane yield (t/ha)	Sucrose (%)	CCS (%)	CCS (t/ha)
T ₁	167.2	115.2	174.0	2.36	689	55.2	19.5	13.77	7.63
T ₂	176.8	127.8	183.4	2.54	731	67.8	19.6	14.00	9.48
T ₃	178.9	137.6	182.0	2.35	732	70.7	19.7	14.03	9.93
T ₄	172.4	126.3	177.0	2.41	686	58.9	19.8	14.10	8.30
T ₅	179.8	144.1	178.4	2.49	742	71.5	19.1	13.37	9.56
T ₆	188.7	148.3	178.4	2.49	767	75.6	19.4	13.70	10.33
T ₇	172.2	132.8	168.9	2.31	652	61.5	19.5	13.73	8.4
T ₈	178.5	136.5	172.9	2.34	657	69.3	19.7	14.00	9.67
T ₉	186.1	145.2	174.3	2.37	710	71.5	19.6	13.90	9.93
CD (5%)	NS	15.9	NS	NS	NS	9.4	NS	0.37	1.33

2. LUCKNOW

The data of second ratoon sugarcane growth, yield and quality (Table AS 68.2.1) indicates significant variations among the treatments. Highest number of tillers (132.4 thousand /ha at 120 days after ratooning), shoot count (135.6 thousand/ha at 150 DAR) and (136.9 thousand/ha at 180 DAR), higher number of millable cane (NMC- 122.8 thousand/ha), sugarcane yield (66.17 t/ha) and sugar yield (7.91 t/ha) were recorded under the treatment, where application of FYM @ 20 t/ha was done along with soil test (rating chart) based inorganic fertilizer recommendations. However, it was found comparable to the treatment of FYM @ 10 t/ha along with biofertilizer and soil test basis inorganic fertilizers application. The yield attributing characters, such as higher cane length (176.7 cm), cane diameter (2.35 cm) and individual cane weight (0.83 kg) were recorded with application of FYM, bio-fertilizers and along with inorganic fertilizers. The juice quality parameters were non-significant. The soil sample for bulk density (1.27 M/m³), infiltration rate (4.64 mm/hr) and soil organic carbon (0.47%) showed positive responses with application of organic manure in the system.

Table AS 68.2.1: Performance of second ratoon crop as influenced due to nutrient management in plant- ratoon system at Lucknow

Treatment	Tillers / shoot population (‘000/ha)		NMC (‘000/ha)	Cane Yield (t/ha)	CCS (%)
	July	Oct			
	(120 DAR)	(210 DAR)			
50 % RDF	96.8	103.9	80.27	44.47	12.41
100 % RDF	112.6	109.5	96.54	60.25	11.68
STBR	106.5	101.7	88.39	63.70	11.84
FYM 20 t + 50 %	115.3	121.2	111.23	61.17	10.70
FYM 20 + 100 %	121.2	128.3	121.11	66.36	11.87
FYM 20 + STRC	132.4	127.0	122.84	66.17	11.94
FYM 10+ B +50%	119.3	121.6	116.79	62.16	12.33
FYM 10+B+100%	102.1	130.0	123.70	66.36	11.86
FYM 10+ B +STBR	115.7	128.0	121.36	64.81	10.92
Organic only	110.7	118.0	109.63	58.95	12.61
SEM +-	13.98	4.64	3.09	1.99	0.52
CD (P = 0.05)	NS	13.79	9.17	5.92	1.54
CV %	21.37	6.76	4.90	5.61	7.60

3. SHAHJAHANPUR

The soil of experimental field at initial before plant cane was low in organic carbon (0.44%), phosphorus (7.8 kg/ha) and medium in potash (134 kg/ha) with pH 7.5. Experimental sugarcane crop of second ratoon with variety Cos 08279 was initiated on 28.02.2019 and harvested on 15.01.2020.

Experimental mean data of two crop cycle (Table 1b) indicated that application of FYM @ 10 tonnes/ ha + bio – fertilizers (Azotobacter + PSB) + inorganic nutrients on soil test basis produced significantly higher cane yield of 113.60 t/ha, 99.02 and 88.96 in plant, 1st ratoon and second ratoon cane, respectively than those of other treatments. CCS% in cane was not affected significantly with different treatments in plant cane, first ratoon and second ratoon cane (Table AS 68.3.1).

Table AS 68.3.1: Performance of second ratoon as influenced due to nutrient management in plant-ratoon system at Shahjahanpur

Treatment	Stubbles (000/ha)	Mother Shoots (000/ha)		Shoots (000/ha)		NMC (000/ha)	Cane yield (t/ha)	CCS (%)
		30 DAR	45 DAR	120DAR	150 DAR			
T ₁	24768	37963	64467	113888	143749	100694	69.9	13.13
T ₂	25463	39004	69212	117360	147916	105323	77.8	13.47
T ₃	26967	42476	72916	127083	152547	109027	79.4	13.78
T ₄	23727	39930	71759	121956	149536	104860	73.8	13.87
T ₅	25926	43286	77198	127777	164119	112731	75.1	13.20
T ₆	27546	42939	79745	129629	161920	116897	90.0	13.53
T ₇	26273	40625	71794	124536	159490	111342	77.4	13.77
T ₈	27083	43865	80092	128240	164351	114930	83.8	13.67
T ₉	28588	44676	81481	140971	117545	123032	94.6	13.47
SE±	879.98	847.67	2.18	3.98	5.89	3.94	2.74	0.44
CD at 5%	1865.55	1797.06	4.63	8.45	11.85	8.34	5.81	NS

Table AS 68.3.2: Cane yield and CCS (%) of various components of plant –ratoon system

Treatment	Cane yield (t/ha)			CCS %		
	Plant cane	Ratoon I	Ratoon II	Plant	Ratoon I	Ratoon II
T ₁	79.27	74.35	67.65	11.20	11.81	12.64
T ₂	82.82	82.98	75.71	11.06	11.68	13.01
T ₃	84.42	83.26	75.81	11.46	11.76	12.86
T ₄	81.03	79.12	72.09	11.16	11.50	13.27
T ₅	93.08	78.86	71.93	11.35	11.84	12.83
T ₆	96.85	86.96	84.76	11.42	11.67	12.93
T ₇	87.74	81.97	74.64	11.21	11.92	13.15
T ₈	104.74	88.59	79.98	11.06	11.92	12.97
T ₉	113.6	99.02	88.96	11.43	11.57	12.85
SE±	3.11	3.03	2.39	0.15	0.16	0.28
CD at 5%	6.60	6.42	5.06	NS	NS	NS

4. UCHANI

The experiment was conducted on early maturing and good ratooning variety (CoH 160) with nine treatments in randomized block design with three replications. The second ratoon was initiated on March 12, 2019 during spring season. Recommended dose of NPK for sugarcane plant crop in Haryana is 150-50-50 kg/ha whereas for ratoon crop is 225-50-50 NPK kg/ha. Doses of phosphorus, potash as per treatments were applied at the time of ratoon initiation whereas dose of nitrogen was applied in three equal splits as top dressing (April, May & June). The crop was irrigated at 8-10 days intervals during pre-monsoon period and 20 days interval during post monsoon period. The plant crop was harvested on December 19, 2019.

The treatments with 100 % RDF and soil test based fertilizer with and without FYM application being at par produced significantly higher number of tillers, millable canes and ratoon cane yield as compared to the treatments of 50 % RDF with and without FYM (Table AS 68.4.1). Application of 20 t/ha FYM with 50 % RDF or 100% RDF or soil test based

fertilizers application produced similar number of tillers, millable canes, cane yield in comparison to the treatments of 10 t/ha FYM + biofertilizers application with 50 % RDF or 100% RDF or soil test based fertilizers application. FYM 20 t/ ha + 100% RDF through inorganic source (T6), FYM 20 t/ ha + Soil test based fertilizers and FYM 10 t/ ha + biofertilizer (Azotobacter/ Acetobacter + PSB) + soil test basis (T9) and FYM 10 t/ ha + biofertilizer (Azotobacter/ Acetobacter + PSB) + 100 % RDF or soil test based NPK application were found best and at par treatments in terms of number of tillers, millable canes and ratoon cane yield as compared to rest of the treatments. So FYM 10 t /ha can be saved with application of biofertilizer in sugarcane crop in addition in increasing the population of soil microorganism.

Summary: FYM 20 t/ ha + 100% RDF through inorganic source (T6) and FYM @ 20 t/ ha + soil test basis fertilizer (T5) were found best treatments in terms of number of tillers (141.7, 140.3 thousands/ha), millable canes (114.7, 113.3 thousands/ha) and ratoon cane yield (91.9, 90.5 t/ha) as compared to rest of the treatments. These treatments were at par with T8- FYM 10 t/ha + biofertilizers application with 100% RDF and T9- FYM 10 t/ha + biofertilizers with soil test based fertilizers application.

Table AS 68.4.1: Performance of second ratoon crop as influenced due to nutrient management in plant-ratoon system at Uchani

Tr. No.	Treatments	Tillers (000/ha)	NMC (000/ha)	Cane weight (g)	Cane yield (t/ha)
	Ratoon-II				
T1	Trash 10 t/ ha + 50% RDF	91.1	80.3	695	54.0
T2	Trash 10 t/ ha + 100% RDF	131.3	106.7	796	82.2
T3	Trash 10 t/ ha + soil test basis (NPK)	132.2	107.0	800	82.9
T4	FYM 20 t/ ha + 50% RDF (inorganic source)	107.7	91.3	750	66.3
T5	FYM 20 t/ ha + 100% RDF	140.3	113.3	825	90.5
T6	FYM 20 t/ ha + soil test basis (NPK)	141.7	114.7	828	91.9
T7	FYM 10 t/ ha + biofertilizer + 50% RDF	100.7	87.0	741	62.4
T8	FYM 10 t/ ha + biofertilizer + 100% RDF	132.7	108.7	813	85.5
T9	FYM 10 t/ ha+ biofertilizer + soil test basis (NPK)	133.3	108.0	816	85.3
	CD at 5%	9.1	9.0	36	5.8

PENINSULAR ZONE

5. SANKESHWAR

The yield and yield attributes recorded in second ratoon cane indicated significant differences among the treatments. Application of FYM at 20 tonnes/ha along with soil test based nutrients application recorded higher cane yield (93.39 t/ha), number of millable canes (72,370/ha) and CCS yield (12.72 t/ha). However, treatments with application of trash at 10t/ha +100% RDF or soil test based nutrients application and application of FYM 20 t/ha + 50 % RDF or soil test based nutrients application recorded on par cane yield. The lowest cane yield (64.78t/ha) was recorded in 50 percent inorganics with application of FYM at 10 tonnes/ha along with microbial inoculants. All the quality parameters differed non - significantly for treatment variations in second ratoon cane except brix (%). Significantly lowest brix was

recorded in 100 percent inorganics with application of FYM at 10 tonnes/ha along with microbial inoculants.

Significantly higher BC ratio were noticed with application of nutrients based on soil test value with application of trash 10 t/ha or application of trash 10 tonnes/ha along with 50 % or 100% RDF or with application of FYM/Compost at 20 tonnes/ha along with application of nutrients based on soil test value or 50 % RDF or 100%RDF. Similar trend was noticed with respect to net returns and gross returns.

SUMMARY: Application of nutrients based on soil test value with application of trash 10 t/ha or application of trash 10 t/ha along with 100% RDF or with application of FYM/Compost at 20 tonnes/ha along with application of nutrients based on soil test value or 50 % RDF or 100%RDF recorded higher cane yield and yield parameters.

Table AS 68.5.1: Performance of sugarcane Second ratoon crop as influenced due to nutrient management at Sankeshwar

Treatments	Cane height in (cm)	Single cane weight (kg)	Cane girth in cm	NMC 000/ha	Cane yield t/ha	CCS Yield t/ha
1	2.28	1.37	2.67	62.67	81.74	10.67
2	2.37	1.65	2.69	69.45	89.87	11.89
3	2.38	1.67	2.81	69.98	91.72	12.72
4	2.03	1.35	2.74	69.12	89.67	12.27
5	2.21	1.67	2.78	68.19	91.95	12.56
6	2.35	1.64	2.91	72.37	93.39	12.72
7	1.91	1.08	2.62	69.88	64.78	7.91
8	1.94	1.24	2.66	63.91	66.32	8.18
9	2.00	1.28	2.69	65.70	78.64	9.68
S.Em ±	0.09	0.10	0.09	5.14	2.74	1.24
CD at 5 %	0.26	0.39	0.28	15.40	8.20	3.72
CV	7.18	14.09	6.03	14.66	6.25	22.17

EAST COAST ZONE

6. NAYAGARH

Results obtained from second ratoon crop indicated that application of FYM/ Compost @ 10 t/ha + (Azotobacter + PSB) + 100% RDF (T8) and application of FYM/ Compost @ 10t/ha + Azotobacter + PSB + Soil test based (NPK) fertilizer application (T9) recorded higher percentage of sprouting at 45 DAR i.e. 39.29 and 40.56%, respectively. These treatments subsequently performed better than other treatment combinations leading to higher yield parameters and cane yield. The length and girth of the cane were also higher 3.06 m & 2.41 cm in T8 and 3.29m & 2.64 cm in T9, respectively. The NMC and Cane yield were 66.75'000 & 73.03 t/ha in T8 and 67.97'000 & 74.60 t/ha in T9, respectively. This exhibits the positive effect of organic manures and bio fertilizers on cane yield (**Table AS 68.6.1**).

Table AS 68.6.1: Performance of sugarcane second ratoon crop as influenced due to nutrient management in plant-ratoon system at Nayagarh

Treatment		Sprouting %	No of shoots (000/ha)		Length of cane (m)	Girth of cane (cm)	Weight of cane (kg)	NMC (000/ha)	Cane yield (t/ha)
			120 DAR	150 DAR					
T ₁	Trash @ 10 t/ha + 50% RDF	28.37	44.9	46.01	2.23	1.58	1.21	53.75	56.1
T ₂	Trash @ 10 t/ha + 100% RDF	30.67	52.2	54.30	2.72	1.94	1.52	59.77	64.3
T ₃	Trash @ 10t/ha + Soil test based fert. application (NPK)	32.11	54.4	56.25	2.96	2.03	1.55	62.22	67.2
T ₄	FYM/Compost @ 20 t/ha+ 50% RDF	30.73	50.6	53.38	2.27	1.93	1.22	56.25	62.1
T ₅	FYM/Compost @ 20 t/ha+ 100% RDF	31.50	56.4	58.00	2.78	2.27	1.52	62.87	68.7
T ₆	FYM/Compost @ 20 t/ha+ Soil test based fert. application (NPK)	32.24	59.1	59.68	2.91	2.33	1.58	64.13	70.4
T ₇	FYM/Compost @ 10t/ha+(Azotobacter + PSB) +50% RDF	34.65	54.0	55.84	2.83	2.14	1.28	59.55	64.8
T ₈	FYM/Compost @ 10t/ha +(Azotobacter + PSB) +100% RDF	35.07	63.0	63.62	3.06	2.41	1.56	66.75	73.0
T ₉	FYM/Compost @ 10t/ha + Azotobacter + PSB + Soil test based fert application (NPK)	36.44	65.5	65.98	3.29	2.64	1.61	67.97	74.6
CD at 5 %		1.92	5.10	5.27	0.57	0.45	0.27	5.54	5.94
CV%		5.89	5.30	5.49	11.7	12.28	10.64	5.21	6.12

NORTH CENTRAL ZONE

7. PUSA

The experimental soil was calcareous, low in organic carbon (0.441%) and available N (221.4 kg/ha) & K (74.1 kg/ha) and medium in P (11.6 kg/ha). The mid-late variety (BO 154) of sugarcane was planted on 07.02.2017 and harvested on 05.03.2018 after that first ratoon crop was taken which was harvested on 06.02.2019 and thereafter second ratoon crop was taken which was harvested on 22.01.2020. The effect of growth and yield attributing parameters are presented in AS 68.7.1. The results indicated that number of tillers, millable cane, single cane weight (SCW) and cane yield were significantly affected due to different treatments but plant height and girth was non- significant. The maximum number of tillers at 150 DAR (153670 /ha) and NMC (108670 /ha) were recorded in T6 receiving fertilizer on

soil test basis along with organics @ 20 tonnes/ha and lowest tillers (77000/ha) and NMC (5900/ha) in T1 receiving only 50% RDF. The cane yield was significantly higher in treatments T2 (60.75 t/ha) and T3 (67100 t/ha) receiving RDF and application of fertilizer on soil test basis over T1 (30.35 t/ha) having 50% RDF.

Addition of organics @ 10 & 20 t/ha along with fertilizers further increased the cane yield. The highest cane yield (74.23 t/ha) was recorded in treatment T6 receiving fertilizer on soil test basis along with FYM @ 20 tonnes/ha which was significantly superior over T4 (40.39 t / ha) receiving 50% RDF along with FYM @ 20 tonnes/ha. The cane juice quality viz. brix, sucrose and purity percent was not affected due to different treatments. However, Sugar yield followed the similar trend of cane yield and maximum sugar yield (9.11 t/ha) was noticed in T6. The post-harvest soil showed significant improvement in available soil nutrients viz. N, P, K, treated plots over control. The available N, P, K ranged from 188 - 285, 10.44 – 18.03, and 62.80 – 89.07 kg/ha. Integration of nutrients with compost @ 10 & 20 t/ha significantly improved the organic carbon status of the post-harvest soil. The organic carbon in FYM treated plots ranged from 0.47- 0.62%. However, the integration of nutrients had not significant effect on pH and EC.

Summary: Integrated application of nutrients was found effective in improving soil fertility and cane yield. The application of fertilizers on soil test along with organics @ 20 t/ha was found suitable for boosting cane yield and maintaining soil fertility in calcareous soil of Bihar.

Table AS 68.7.1: Performance of sugarcane second ratoon crop as influenced due to nutrient management in plant-ratoon system at Pusa

Treatment	Tiller (x 10 ³ /ha) 150 DAR	Plant height (cm)	Girth (cm)	SCW (g)	NMC (x 10 ³ /ha)	Cane Yield (t/ha)
T ₁	77.00	210	2.05	516	59.00	30.35
T ₂	123.00	246	2.23	614	98.67	60.75
T ₃	129.33	250	2.21	657	101.67	67.10
T ₄	90.00	229	2.21	532	75.67	40.39
T ₅	141.00	255	2.22	648	103.00	67.03
T ₆	153.67	254	2.28	684	108.67	74.23
T ₇	93.33	222	2.17	530	68.33	36.28
T ₈	134.33	244	2.27	645	102.67	66.34
T ₉	142.00	242	2.31	657	104.00	67.97
SEm ±	7.79	9	0.05	20.85	7.28	5.34
CD (P=0.05)	23.57	28	NS	63.05	22.02	16.20
CV (%)	11.21	6.79	3.81	5.91	13.81	14.67

8. SEORAH I

The experimental field was medium in organic carbon, medium in available phosphorus and low in potash with pH ranging from 7.7 to 8.1. Sugarcane ratoon crop was initiated on April 01-2019 and harvested on March 28-2020. Application of FYM @ 10 t/ha+ biofertilizers (Azotobacter + PSB) + soil test basis NPK practice (T9) produced significantly higher clump population (33.60 thousand /ha), shoot population (181.58 thousand per ha) and

NMC (98.01 thousand per ha) over other practices but at par with trash 10 t/ha + soil test basis NPK, FYM 20 t/ha + biofertilizers +100 per cent RDF. Significantly higher Cane yield (84.13 t/ha) was observed with application of FYM @ 10 t/ha+ bio-fertilizer (Azotobacter + PSB) + soil test basis NPK application over other remaining practices except application of trash 10t/ha+ soil test based NPK, FYM @20 t/ha with soil test basis NPK and FYM 10t/ha + biofertilizers with 100 per cent RDF practices. Sucrose percent was not affected significantly by different treatments but maximum sucrose value (18.22) was obtained with application of FYM @ 20t/ha+ soil test basis NPK application practice (T6) (**Table AS 68.8.1**).

Summary: Significantly higher Cane yield (84.13 t/ha) was observed with application of FYM @ 10 t/ha+ bio-fertilizer (Azotobacter + PSB) + soil test basis NPK application (T9) over other treatments except treatment i.e. application of trash 10t/ha soil test basis NPK, FYM @20 t/ha with soil test basis NPK and FYM 10t/ha + biofertilizers with 100 per cent RDF. Sucrose percent was not affected significantly by different practices.

Table AS 68.8.1: Performance of ratoon crop as influenced due to nutrient management in plant-ratoon system at Seorahi

Treatment	Clumps (000/ha)	Shoots (000/ha)	NMC (000/ha)	Cane Yield (t/ha)	Sucrose Per cent
T ₁	23.81	114.38	71.43	49.07	17.88
T ₂	27.78	137.31	79.50	62.04	16.80
T ₃	31.35	166.25	89.55	75.00	17.84
T ₄	25.26	123.49	74.60	59.26	18.13
T ₅	30.69	163.25	93.78	70.10	17.51
T ₆	31.75	168.07	90.08	79.10	18.22
T ₇	27.51	140.96	76.59	58.20	18.15
T ₈	33.47	180.61	95.90	81.48	17.97
T ₉	33.60	181.58	98.01	84.13	17.68
SEm±	1.21	7.75	5.59	3.23	0.39
CD(P=0.05)	3.66	23.43	16.89	9.77	NS
C.V.%	7.11	6.78	11.32	8.14	3.87

IMPORTANT OBSERVATIONS:

The experiment was carried out at 08 stations as a number of stations have already completed two cycles of the system. Following salient points emerged from findings:

- Combined application of organic and inorganic sources of nutrients was found conspicuously better over the use of fertilizers alone across the centres located in different agro-climatic conditions.
- Sugarcane trash used as mulch in ratoon crops has little contribution as a source of nutrients as organic amendments like FYM or compost recorded significant improvement in cane and sugar yield over that with trash mulching under the use of recommended dose of fertilizers across the locations.
- Use of organic sources of nutrients in plant ratoon system brings about substantial enhancement of soil health parameters in most of the sugarcane growing soils.

PROJECT NO.: AS 72

PROJECT TITLE: Agronomic performance of elite sugarcane genotypes

- Objective** : To assess the performance of promising sugarcane genotypes of Advanced Varietal Trial (AVT)
- Year of start** : 2016-2017
- Duration** : One year
- Locations** : All centres where post of Agronomist has been provided as well as any voluntary centre.
- Planting time** : North West, North Central & North East Zones: February-March
Peninsular & East Coast Zones: Ist fortnight of January
- Treatments** :
1. **Genotypes** : Varieties and checks of the zone are given at the end.
 2. **Agronomy** : **Spacing** : Spacing for all the entries
 - 120 cm (for North West, North Central, North East and East Coast Zones).
 - 150 cm (for the Peninsular Zone).
- Fertilizer levels:** (2)
100 % and 125% of the recommended dose of NPK for the zone
- Design** : RBD
- Replication** : 2 or 3
- Plot size** : North West, North Central, North East and East Coast Zones: 5 rows of 6 m length.
Peninsular Zone: 4 rows of 6 m length.

- Note:** 1. Seed material of the test varieties may please be obtained from concerned breeder of the center.
2. Separate trials to be laid out for early and mid-late maturity groups along with zonal checks.

- Observations to be recorded** :
- i) Initial soil fertility status for available NPK, soil texture, physico-chemical properties of the soil.
 - ii) Data on germination, no. of millable canes, cane yield, Pol (%), CCS (t/ha).

List of varieties (zone-wise) for the Experiment AS 72 during 2019-20

I. North West Zone (AVT II Plant)

Early maturing varieties (4): Co 14034, CoLk 14201, CoPb 14181 and CoPb 14211

Zonal Check (3): CoJ 64, Co 0238 and Co 05009

Mid-late maturing varieties (7): Co 14035, CoH 14261, CoLk 14203, CoLk 14204,
CoPb 14184, CoPb 14185 and CoS 14233

Zonal Check (3): CoS 767, CoPant 97222 and Co 05011

II. North Central & North East Zones (AVT II Plant)

Early maturing varieties (4): CoLk 14206, CoP 14437, CoSe 14451, CoSe 14454

Zonal Check (3): CoLk 94184, CoSe 95422, CoSe 01421

Mid-late maturing varieties (5): CoLk 14208, CoLk 14209, CoP 14438, CoP 14439,
CoSe 14455

Zonal Check (3): BO 91, CoP 06436, CoP 9301

III. Peninsular Zone (AVT II Plant)

Varieties (17): Co 13002, Co 13003, Co 13004, CoN 13072, CoSnk
13101, MS 13081, Co 13006, Co 13008, Co 13009, Co
13013, Co 13014, Co 13018, Co 13020, CoN 13073,
CoSnk 13103, CoSnk 13106 and PI 13132

Zonal Check (3): Co 86032, CoC 671 and CoSnk 05103

IV. East Coast Zone (AVT II Plant)

Early maturing varieties (3): CoC 15336, CoC 15338 and CoV15356

Zonal Check (3): CoA 92081, CoC 01061 and CoOr 03151

Note: Varieties other than listed above should not be included or substituted.

SUMMARY OF RESULTS OBTAINED DURING LAST YEAR (2018-19)

The trial was initiated during 2016-17 and was allotted to all the centres. During the year (2018-19) 12 centres reported the results. Centre wise summary of findings for the year are given below:

NORTH WEST ZONE

1. FARIDKOT

Among early genotypes cane yield was at par at 90 and 120 cm spacing. The number of shoots and millable canes were better at 90 cm spacing but single cane weight was better at 120 cm spacing. The highest cane yield was of CoPb 13181 (134.4 t/ha) followed by Co 5009 (110.6 t/ha). For mid-late genotypes cane yield was significantly better at 90 cm spacing than 120 cm spacing. The number of shoots and millable canes were better at 90 cm spacing. The highest cane yield was of CoH 13263 (141.6 t/ha) which was at par with CoPb 13182 (131.3 t/ha), Co 05011 (128.4 t/ha) and Co 13035 (125.1 t/ha).

2. KOTA

For early maturing genotypes at closer spacing (90 cm), genotype Co 13034 recorded significantly higher germination (49.13 %), single cane length (237.50 cm), cane yield (94.40t/ha), single cane weight (1070.00 gm) and number of millable canes (88.97 thousand/ha). There was no significant effect of spacing. Mid-late maturing genotype Co 13035 recorded the highest cane yield significantly higher over rest of genotypes and zonal checks.

3. LUCKNOW

The shoot and NMC count for early genotypes were significantly lower at 120 cm spacing compared to 90 cm spacing in all the three genotypes. Significantly higher cane yield (104.0 t/ha) was reported in Co 0238 sown at 90 cm over CoS 13231 and CoJ 64. Further, the genotype CoS 13231 and Co 0238 gave significantly lower cane yield at 120 cm row spacing. Cane length, cane girth, cane weight were higher in Co 0238 than remaining two genotypes. Among mid-late genotypes CoLk 13204 gave highest cane yield (84.76 ton/ha) sown at 90 cm spacing followed by the same genotype sown at 120 cm spacing (68.49 ton/ha). The higher yield in CoLk 13204 was mainly attributed to its higher NMC/ha. Brix varied from 17.3 to 21.07 at 10 months stage and 18.87 to 20.72 at 12 months stage in different genotypes.

4. SHAHJAHANPUR

Early genotypes revealed that Co 0238 produced significantly higher cane yield (105.10 t/ha) followed by genotype CoS 13231 (77.40 t/ha). Regarding spacing significantly higher cane yield (82.20 t/ha) was recorded with 90 cm row spacing than that of 120 cm (67.90 t/ha). CCS% in cane at harvest was found significantly higher in Co13034 (12.36) followed by Co 0238 (12.03). Co13035 produced significantly higher cane yield (82.55 t/ha) at par with CoPant 13224 (82.00 t/ha) in mid-late group. Regarding spacing significantly higher cane yield were obtained in early and mid-late genotype at 90 cm row spacing.

5. UCHANI

Germination was not affected significantly due to different spacing. Significantly higher number of tillers, number of millable canes, cane yield and sugar yield were recorded at 90 cm spacing as compared to 120 cm spacing irrespective of the maturity group. Cane weight was significantly better at 120 cm as compared to 90 cm spacing. Among early maturing varieties, highest and lowest and cane yield was recorded in variety Co 0238 (85.8

t/ha) and CoS 13231 (68.7 t/ha), respectively. Among mid maturing entries, CoH 13263, CoLk 13204, Co 13035 and CoPant 13224 being at par recorded significantly highest cane yield. Interaction was not found significant.

PENINSULAR ZONE

6. PUNE

The results of the plant crop indicated that for the early genotypes tillering (1.02 & 1.26 lakh/ha) at 90 & 120 DAP, single cane weight (1.43 kg), cane yield (117.32 t/ha) and B:C ratio (1:2.55) was highest in Co11001. The mid-late genotype CoM 11085 performed better in tillering at 90 & 120 DAP (1.03 & 1.18 lakh/ha) and NMC (0.80 lakh/ha) while cane yield (129.20 t/ha), CCS yield (18.38 t/ha), B:C ratio (1:2.81) was higher in Co11012. Whereas, CoM11086 showed superior juice quality.

7. MANDYA

Among the genotypes, Co 12009 found superior with respect to cane yield (122.29 t/ha) as compared to others. But, was on par with CoM 12085 (109.25 t/ha) and VSI 12121 (108.4 t/ha). This increased cane yield was due to enhanced yield parameters viz., single cane weight, cane length, cane girth, inter-nodal length, number of internodes and number of millable cane/ha. Quality parameters viz., sucrose % and CCS% did not vary significantly for the genotypes.

8. SANKESHWAR

There was significant difference among the early genotypes tested for yield and yield attributes. Significantly higher cane yield (92.11 t/ha) was recorded in Co 12007 on par with CoC 671(87.95 t/ha). The lowest cane yield (76.81 t/ha) was recorded in Co 12008. The lowest NMC was recorded in CoC 671(49,780/ha) and the highest was recorded in Co 12007 (68,140/ha). For mid-late genotypes significantly higher cane yield (121.43 t/ha) and CCS yield (15.18 t/ha) was recorded in Co 12009 and was on par with Co12012 (115.42 t/ha). The lowest cane yield (106.33 t/ha) was recorded in VSI 12121. The highest NMC (122280/ha) was recorded in Co 12009 and lowest NMC (57550/ha) was recorded in CoM 12085.

9. COIMBATORE

Cane yield differences were non-significant for two row spacing wherein planting sugarcane at 120 cm row spacing recorded higher cane yield (137.09 t/ha) than 150 cm row spacing (120.71 t/ha). In the plant crop the NMC (000/ha) showed significant difference due to varieties, wherein, promising early genotype Co 12012 (129460 NMC/ha) recorded significantly higher NMC than the check varieties Co 86032 (89670 NMC/ha) and CoC 671(76700 NMC/ha). Juice Brix, Sucrose (%), Purity (%) and CCS (%) at harvest showed significant varietal difference. In the plant crop CoC 671 recorded significantly highest mean brix of 22.37 than other elite sugarcane genotypes. Amongst the 11 elite sugarcane genotypes VSI 12121 and Co 12012 was found more promising and recorded marginally higher CCS yield of 22.91 and 20.85 t/ha than the check entries CoC 671(20.41t/ha) and Co 86032 (18.59 t/ha).

EAST COAST ZONE

10. NAYAGARH

Findings suggested significant variations among the genotypes with respect to germination %, number of tillers at 180 days and number of millable canes ('000/ha). The genotype PI 14377 with 90 cm spacing produced the highest average cane yield of 106.54 t/ha with application of 125 % RD of fertilizer.

NORTH CENTRAL ZONE

11. PUSA

Performance of early genotypes indicates that 90 cm row spacing recorded significantly higher plant population (178800 /ha), millable canes (123700 /ha) and cane yield (101.3 t/ha). Though, marked variation in single cane weight (897.7 g/plant) was obtained due to 120 cm row spacing. Row spacing did not exert significant impact on sucrose content juice. 125 % recommended dose of fertilizer significantly increased the plant population (171100 /ha), millable canes (116500 /ha), single cane weight (899.4 g/plant) and cane yield (100.1 t/ha). Though, sucrose content juice remained unaffected due to fertility levels.

12. SEORAH I

In the early group CoSe 13452 genotype obtained significantly higher germination per cent (43.24), shoot population (154.67 thousand per ha) and NMC (89.64 thousand per ha) over check i.e. CoSe 01421 but significantly more cane yield was recorded in this genotype over all the zonal checks. Cane yield of CoSe 13451 genotype was recorded significantly higher as compared to zonal checks i.e. CoLk 94184 and CoSe 01421. Effect of row spacing on shoot population, NMC and cane yield was found significantly higher in the treatment of 90 cm row spacing.

IMPORTANT OBSERVATIONS:

Best performing genotypes across the centres located in different zones are listed herewith:

Sl. No.	Zone	Early genotypes	Mid-late genotypes	Spacing
1	North Western	Co 13034, CoPb 13181, CoS 13231	CoH 13263, Co 13035, CoLk 13204	At all the centres cane yield at 90 cm spacing was significantly superior over that of 120 cm.
2	Peninsular	Co 12009, Co 12012, CoM 12085, VSI 12121		Wider spacing was found to yield lower yield.
3	East Coast	No entries	PI 14377, CoC 13031	No variation in yield due to row spacing
4	North Central	CoSe 13451, CoP 13437, CoSe 13452	No entries	Significant yield improvement at closer spacing (90 cm).

CURRENT YEAR (2019-20) REPORT

NORTH WESTERN ZONE

1. FARIDKOT

Early

The experiment was conducted by planting seven sugarcane genotypes at 120 cm spacing and by applying 100% and 125% of recommended dose of fertilizers. The yield was at par at 100% and 125% of recommended N (**Table AS 72.1.1 a**). The number of millable canes was better 125% of recommended N than 100% N (Table AS 72.1.1 b). Although interaction between N levels and genotypes was non- significant but yield of all genotypes were better at 125% N. The highest cane yield was of CoPb 14181 (92.1 t/ha) followed by CoPb 14211 (89.2 t/ha).

Mid-late

The experiment was conducted by planting ten sugarcane genotypes at 120 cm spacing and by applying 100% and 125% of recommended N. The yield was significantly better at 125% N than 100% N (Table AS 72.1.2 a). The number of millable canes was better at 125% N than 100% N (Table AS 72.1.2 b). The highest cane yield was of CoPb 14185 (88.4/ha) which was at par with CoPb 14184 (87.9 t/ha) and was significantly better than other all genotypes.

Table AS 72.1.1a: Cane yield (t/ha) of early maturing genotypes at different nitrogen levels at Faridkot

N level/ Genotype	100% RDF	125%RDF	Mean
Co 14034	76.4	89.6	83.0
CoLk 14201	56.3	59.7	58.0
CoPb 14181	91.0	93.1	92.1
CoPb 14211	88.5	89.9	89.2
CoJ 64	63.9	67.0	65.5
Co 238	71.9	73.3	72.6
Co 5009	80.9	86.8	83.9
Mean	75.6	79.9	77.7
CD (5%)	Fertilization	Genotypes	Interaction
	NS	11.2	NS

Table AS 72.1.1 b: Growth performance of early maturing genotypes at Faridkot

N level/ Genotype	Germination %	No. of Shoots 000/ha	NMC 000/ha	Cane length (cm)	Cane diameter (cm)	Single cane wt. (g)	Sucrose (%)
Fert. level							
100 % RDF	32.8	78.3	77.8	183	2.78	1030	17.66
125% RDF	33.0	83.8	83.2	187	2.86	1081	17.66
CD (5%)	NS	NS	4.7	NS	NS	NS	NS
Genotypes							
Co 14035	31.6	80.1	76.0	213	2.66	1015	17.51
CoH 14261	37.5	93.7	81.9	170	3.08	1096	17.98
CoLk 14203	33.4	88.5	78.9	221	2.52	1088	17.44
CoLk 14204	29.5	70.7	64.3	159	2.95	1059	18.72
CoPb 14184	38.8	98.9	85.9	200	2.95	1220	17.13
CoPb 14185	39.7	88.8	80.8	186	3.15	1250	18.25
COS 14233	34.6	108.4	94.7	168	2.70	967	17.31
CoS 767	30.6	102.5	93.5	191	2.56	879	17.65

CoPant 97222	24.5	76.2	69.9	180	2.89	1041	17.65
Co05011	28.3	96.7	84.3	163	2.81	940	16.97
CD (5%)	5.9	18.4	10.6	22	0.19	128	0.47

Table AS 72.1.2 a: Cane yield of mid-late maturing genotypes at Faridkot

Fwet level/ Genotype	100% RDF	125% RDF	Mean
Co 14035	64.9	67.0	66.0
CoH 14261	72.2	75.7	74.0
CoLk 14203	74.3	77.1	75.7
CoLk 14204	46.5	52.1	49.3
CoPb 14184	85.4	90.3	87.9
CoPb 14185	86.8	89.9	88.4
COS 14233	76.4	76.0	76.2
CoS 767	68.1	73.9	71.0
CoPant 97222	70.8	75.7	73.3
Co05011	69.4	75.0	72.2
Mean	71.5	75.3	
CD (5%)	RDF level	Genotypes	Interaction
	3.1	6.9	NS

Table AS 72.1.2 b: Growth and quality performance of different mid-late genotypes at Faridkot

Fert. level/ Genotype	Germination %	No. of Shoots 000/ha	NMC 000/ha	Cane length (cm)	Cane diameter (cm)	Single cane wt. (g)	Sucrose (%)
RDF Level							
100%	38.9	100.1	71.4	197	2.80	1247	17.72
125%	38.4	101.7	74.3	207	2.85	1335	17.50
CD (5%)	NS	NS	2.2	NS	NS	NS	NS
Genotype							
Co 14034	33.3	105.5	74.9	214	2.79	1543	17.85
CoLk 14201	34.2	74.8	59.4	201	2.94	1338	17.68
CoPb 14181	40.8	115.3	76.4	199	2.66	1205	17.61
CoPb 14211	40.3	98.5	79.4	202	3.03	1426	17.32
CoJ 64	42.0	95.9	70.8	191	2.90	1185	17.85
Co 238	38.4	103.8	72.8	181	2.79	1109	17.44
Co 5009	41.5	112.5	76.4	227	2.69	1229	17.53
CD (5%)	4	12.7	4.2	NS	NS	205	NS

2. KOTA

Early

The experiments crop was planted in spring on 08.03.2019 and harvested in 19.03.2020. The experiment consisted of 7 genotypes viz Co 14034, CoLk 14201, CoPb 14181 & CoPb 14211 and Zonal checks: CoJ 64, Co 0238 and Co 5009 were planted at 120 cm row spacing with 125% & 100% of the recommended dose of NPK kg/ha (200:60:40)

Perusal data of different early maturing genotypes at 120 row spacing and at 125% fertility level (**Table AS 72.2.1**) showed that among genotypes CoLk 14201 recorded significantly higher germination (52.17%), no. of tillers (141.07 thousand/ha) and cane length (223.00 cm) over zonal check CoJ 64 and at par with CoPb 14211, Co 14034 & Co 0238 (Zc) and Co 5009 (Zc) genotypes. Genotypes were found at par with each other in case of single cane weight, cane yield. Highest number of millable canes was recorded (94.00 thousand/ha) under CoLk 14201 which is significantly superior over CoJ 64 (zc) and at par with other genotypes. Similarly CoLk 14201 recorded maximum and significantly higher

Brix (22.67 %), sucrose (22.20%) CCS percent (14.03%) and CCS yield (13.54 t/ha) over, CoJ 64 (zc), and at par with other genotypes and Co 0238 (zc) and Co 05009 (zc).

Similarly at 100 % RDF level (Table AS 72.2.1) among genotypes CoLk 14201 recorded significantly higher germination (51.40 %), no. of tillers (140.30 thousand/ha) and cane length (221.63 cm) over zonal check CoJ 64 and at par with CoPb 14211, Co 14034 & Co 0238 (Zc) and Co 05009 (Zc) genotypes. Genotypes were at par with each other in case of single cane weight and cane yield. Highest number of millable canes was recorded (90.33 thousand/ha) under CoLk 14201 genotype which is significantly superior over CoJ 64 (zc) and at par with other genotypes. Similarly, CoLk 14201 recorded maximum and significantly higher quality parameters i.e. Brix, (22.03 %), Sucrose (19.55%) CCS percent (13.55%) and CCS yield (13.07 t/ha) over, CoJ 64 (zc), and at par with other genotypes and Co 0238 (zc) and Co 5009 (zc).

Mid-late

The experiments was planted in spring on 09.03.2019 and harvested on 19.03.2020. The experiment consisted of 10 mid-late maturing genotypes viz Co 14035, CoH 14261, CoLk 14203, CoLk 14204, CoPb 14184, CoPb 14185, CoS 14233 and zonal checks CoS 767, CoPant 97222 and Co 05011 were planted at 120 cm row spacing with 125 & 100% levels of the recommended dose of NPK (200:60:40 kg/ha).

Mid-late maturing genotypes at 120 cm row spacing with 125% fertility level (**Table AS 72.2.2**) showed that among genotypes CoLk 14203 recorded significantly higher germination (50.75 %), over rest of the genotypes and zonal check while, at par with CoH 14261, CoPb 14184, Co 14035 and Co 05011 (zc). Significantly superior cane length (240.40 cm), single cane weight (1160.00 gm), tillers (143.50 thousand/ ha) and number of millable cane (93.40 thousand/ha) were recorded with CoLk 14203. Similarly, CoLk 14203 recorded maximum and significantly higher CCS yield (13.12 t/ha) over CoS 14233, CoS 767(zc), and CoPant 97222(zc). Whereas, brix (22.40), sucrose (19.93 %), CCS (13.83 %) was recorded highest with CoLk 14203 genotype and also significantly superior over zonal checks (CoS 767, Co Pant 97222 and Co 05011) and result of this was at par with Co 14035 and CoPb 14184, CoPb 14185 and CoH 14261 genotypes. However, cane yield was recorded maximum with CoLk 14203 genotype which was significantly higher over rest of the genotypes and zonal checks.

Performance of mid-late maturing genotypes at 100% RDF level revealed that among genotypes CoLk 14203 recorded higher germination (50.30 %), over rest of the genotypes and zonal check while, at par with CoH 14261, CoPb 14184, Co 14035 and Co 05011 (zc). Significantly superior cane length (239.65 cm), single cane weight (1015.00 gm), tillers (142.75 thousand/ ha) and number of millable cane (92.80 thousand/ha) were there under CoLk 14203. Similarly, CoLk 14203 recorded maximum and significantly higher CCS yield (12.77 t/ha) over CoS 14233, CoS 767(zc), and CoPant 97222(zc). Whereas, Brix (22.05), sucrose (19.57 %) and CCS (13.56 %) was recorded highest with CoLk 14203 and also significantly superior over zonal checks (CoS 767, CoPant 97222 and Co 05011) and at par with Co 14035 and CoPb 14184, CoPb 14185 and CoH 14261 genotypes. Cane yield (94.35 t/ha) was recorded maximum with CoLk 14203 which was significantly higher over rest of genotypes and zonal checks.

Table AS 72.2.1: Performance of early genotypes of sugarcane at Kota at different RDF levels

Treatment	Tillers 180 DAP (000/ha)		Millable cane (000/ ha)		Cane yield (t/ha)		CCS (%)		CCS yield (t/ha)	
	125	100	125	100	125	100	125	100	125	100
Co 14034	135.0	134.1	87.0	86.0	91.5	90.57	13.39	12.7	12.1	11.5
CoLK14201	141.0	140.3	94.0	90.3	96.5	95.73	14.03	13.5	13.5	13.0
CoPb 14181	136.0	134.7	88.2	87.5	90.4	89.50	13.98	13.5	10.4	10.4
CoPb 14211	134.8	134.1	81.7	80.8	80.7	79.87	13.17	12.7	10.6	10.3
CoJ 64 (zc)	130.4	129.3	84.9	84.1	87.9	90.27	12.45	12.0	10.9	10.5
Co 0238(zc)	138.8	136.4	85.0	84.1	84.3	82.83	13.37	13.0	11.2	11.0
Co 05009	138.3	137.0	85.5	84.9	84.3	83.27	13.52	13.1	11.4	11.1
SEm ±	1.84	1.74	2.86	2.48	1.73	1.12	0.30	0.30	0.33	0.34
CD (P=0.05)	5.81	5.49	9.01	7.82	5.47	3.54	0.93	0.96	1.04	1.06
CV	2.01	1.91	4.90	4.31	2.93	1.91	3.27	3.47	4.28	4.48

Table AS 72.2.2: Performance of mid-late genotypes at Kota

Treatment	Tillers (000/ha)		Malleable cane (000/ ha)		Cane yield (t/ha)		CCS (%)		CCS yield (t/ha)	
	125	100	120	100	125	100	125	100	120	100
Co 14035	140.90	139.90	90.95	90.00	91.85	91.10	13.14	12.87	12.07	11.73
CoH 14261	141.00	139.90	89.85	89.30	92.45	91.60	13.37	13.14	12.36	12.04
CoLk 14203	143.50	142.75	93.40	92.80	95.05	94.35	13.83	13.56	13.12	12.77
CoLk 14204	137.25	136.35	87.60	87.05	91.85	90.85	13.60	13.22	12.51	12.03
CoPb 14184	141.65	141.00	91.50	90.65	92.95	92.25	13.75	13.41	12.78	12.37
CoPb14185	138.80	137.80	90.00	88.85	83.25	82.35	13.37	13.14	11.16	10.85
CoS 14233	136.60	135.60	87.45	86.50	78.60	77.60	12.76	12.57	10.09	9.80
CoS767 ((Zc)	135.40	134.25	82.90	82.00	80.75	79.35	12.76	12.53	10.30	9.94
CoPant 97222	134.95	134.05	83.55	82.85	82.75	81.90	12.57	12.30	10.41	10.09
Co 05011	132.20	131.35	81.00	80.35	79.90	78.80	13.06	12.84	10.52	10.11
SEm ±	1.78	1.78	2.94	2.97	2.69	2.77	0.89	0.87	1.02	0.98
CD (P=0.05)	5.82	5.80	9.58	9.67	8.78	9.04	2.89	2.85	3.32	3.19
CV	17.18	17.23	46.15	47.00	42.89	44.77	86.38	86.52	123.14	122.97

3. LUCKNOW

Mid-late

Results showed that germinating % ranged from 15.6 -34.1 % among different genotypes. Higher germination was reported under CoLk 14204, CoLk 14203, Co 05011 and CoS 14233. Lower germination was recorded in CoS 767 and Co 14035. Significant differences were observed in number of tillers (000/ha) counted at 120 and 150 DAP. Tiller count in different genotypes ranged from 111.3 – 311.67 and 81.3- 286.58 at 120 and 150 DAP respectively. The genotypes CoLk 14203, CoLk 14204 and CoS 14233, Co 05011 gave higher tillers at both the stages (**Table AS 72.3.1**). The application of 25 % higher RDF did not result any significant improvement on germination and tillers count over RDF. There were significant differences in number of NMC (000/ ha) and cane yield recorded among different genotypes. The genotype CoLk 14204 and CoLk 14203 followed by CoS 14233 and Co Pant 97222 gave higher values of NMC and yield over the other genotypes. The overall mean cane yield recorded at two fertilizer doses were 63.17 t/ ha and 67.10 t/ ha at RDF and 125 % of RDF respectively. Higher cane yield reported at 125 % of the RDF over RDF was non- significant.

Significant variation in different quality parameters were observed among genotypes. The brix value ranged from 18.33 to 20.88 at 10 months stage and 19.37 to 21.7 at 12 months stage in different elite genotypes tested. The purity coefficient at 10 months stage and brix percent at 12 months stages did not differ significantly among different genotypes. Higher brix containing genotypes were CoH 14261, CoPb 14185, CoLk 14203 and Co 05011. Similarly, sucrose % varied from 15.62 to 19.91 in different genotypes at both the stages. Genotypes CoH 14261 was having higher sucrose % (18.11) at 10-month stage while CoPB 14185 having higher value (19.91 %) at 12-month stage. The genotypes CoLk 14204 found lowest sucrose containing genotypes at both the stages. CCS (t/ ha) measured at 10 and 12-months stage was significantly higher in genotype CoLk 14203 and CoLk 14204 over all the other genotypes tested. Higher CCS yield in CoLk 14203 and CoLk 14204 despite the lower brix and sucrose content was mainly attributed to the higher cane yield in these two genotypes. On the basis of overall mean of CCS yield data, it was clear that application of 125 % of RDF of NPK improved the CCS yield but the differences were not significant at both the stages.

SUMMARY: Among different genotypes CoLk 14204 gave highest MNC, cane and CCS yield closely followed by CoLk 14203 over rest of the genotypes. The 125 % RDF did not affect any of the growth and yield parameters significantly over recommended doses of fertilizer.

Table AS 72.3.1: Performance of mid-late genotypes at Lucknow

Treatments	Germination%	Tillers at 120 DAP (000)	Tillers at 150 DAP (000)	Shoot (000)	NMC (000)	Per cane wt.(kg)	Yield (t/ ha)
Co14035 at RDF	17.7	111.33	81.33	40.67	30.90	1.25	47.94
Co14035 25 % higher	18.3	126.00	98.33	43.67	32.59	1.357	56.19
CoH 14261 at RDF	20.4	148.67	122.93	54.33	38.94	0.697	50.26
CoH 14261 25 % higher	22.1	157.00	132.00	52.33	36.83	0.93	43.6
CoLk14203 at RDF	26	187.67	163.67	67.33	52.17	0.97	62.22
CoLk14203 25 % higher	33.4	220.33	196.33	92.00	69.21	1.227	93.65
CoLk 14204 at RDF	31.3	311.67	286.33	115.67	87.83	1.09	103.81
CoLk 14204 25 % higher	34.1	291.33	269.33	121.33	92.59	0.977	98.41
CoPb 14184 at RDF	24.3	198.33	170.33	73.67	53.44	1.013	67.41
CoPb 14184 25 % higher	30.3	199.00	170.00	69.83	49.95	0.957	62.91
CoPb 14185 at RDF	27	154.33	125.33	49.67	36.51	1.36	60.32
CoPb 14185 25 % higher	30.3	153.33	121.33	61.50	44.34	1.157	62.86
CoS 14233 at RDF	29.3	245.00	218.17	83.67	63.70	0.79	58.63
CoS 14233 25 % higher	34.5	245.67	220.67	95.00	70.90	0.827	66.56
CoS 767 at RDF	15.6	167.17	137.33	74.67	57.99	0.91	63.70
CoS 767 25 % higher	17.4	152.67	124.50	63.67	46.77	0.99	55.98
CoPant 97222 at RDF	20	168.33	142.00	71.00	53.76	1.007	62.12
CoPant 97222 25 % higher	21.2	180.33	157.33	65.33	51.11	1.117	68.04
Co 05011 at RDF	32.9	220.20	190.17	68.00	49.21	0.963	55.35
Co 05011 25 % higher	33.6	205.67	176.33	78.83	54.71	1.053	66.14
CD at 5 %	7.163	15.76	14.50	10.07	11.13	0.212	12.20

4. SHAHJAHANPUR

The soil of experimental field was medium in organic carbon (0.58%), phosphorus (12.00 kg/ha) and potash (129 kg/ha) with PH 7.10. Experimental sugarcane crop of early and mid – late genotypes were planted on 10.02.2019. Crop of early genotypes was harvested on 13.01.2020 and mid –late genotypes on 12.02.2020.

Early

Experimental results of early genotypes (**Table AS 72.4.1**) revealed that standard Co 0238 produced significantly higher cane yield (94.00 t/ha) followed by genotype

CoLk 14201 (85.60 t/ha). Regarding fertility levels significantly higher cane yield (77.90 t/ha) was recorded with 125% recommended dose of NPK than that of 100% RDF of NPK (69.70 t/ha). CCS% in cane at harvest was not found significant among all early genotypes.

Mid-late

Experimental data of mid – late genotypes (**Table AS 72.4.2**) showed that standard Co 05011 produced significantly higher cane yield (84.10 t/ha) followed by standard CoS 767 (80.30 t/ha) and genotype CoPb 14184 (79.20 t/ha). Regarding fertility levels significantly higher cane yield (82.20 t/ha) was recorded with 125% recommended dose of NPK than that of 100% RDF of NPK (72.80 t/ha). CCS% in cane at harvest was observed non- significant among all mid-late maturing genotypes.

Summary: In early group, standard Co 0238 produced significantly higher cane yield (94.00 t/ha) followed by genotype CoLk 14201 (85.60 t/ha). In mid – late group standard Co 05011 produced significantly higher cane yield (84.10 t/ha) followed by standard CoS 767 (80.30 t/ha) and genotype CoPb 14184 (79.20 t/ha). Regarding fertility levels significantly higher cane yield was obtained with 125% recommended dose of NPK than that of 100% RDF of NPK in both early and mid-late genotype.

Table AS 72.4.1: Performance of early maturing genotypes at Shahjahanpur

Treatment	Germination (%)	Shoots (000/ha)	NMC (000/ha)	Cane yield (t/ha)	CCS (%)
A- Genotype					
Co14034	36.6	93.6	78.0	68.3	13.7
CoLk 14201	40.2	110.8	96.1	85.6	13.8
CoPb 14181	40.6	133.7	94.2	63.2	13.6
CoPb 14211	42.4	114.6	94.4	77.1	13.0
CoJ 64	40.3	122.6	102.4	71.6	13.1
Co 0238	40.9	105.3	90.5	94.0	13.4
Co 05009	35.7	120.7	94.7	57.1	13.5
SE±	0.82	2.57	2.10	1.75	0.46
CD at 5%	1.70	5.87	4.31	5.08	NS
B –Fertilizer level					
100% RDF of NPK	39.97	110.8	89.9	69.7	13.8
125% RDF of NPK	39.39	118.0	95.8	77.9	13.1
SE±	0.44	1.53	1.12	0.93	0.24
CD at 5%	NS	3.14	2.30	1.92	NS

Table AS 72.4.2: Performance of mid-late genotypes at Shahjahanpur

Treatment	Germination (%)	Shoots (000/ha)	NMC (000/ha)	Cane yield (t/ha)	CCS (%)
A- Genotype					
Co14035	35.1	131.7	107.0	78.3	13.4
CoH 14261	41.5	130.4	102.1	71.3	13.5
CoLk 14203	42.3	118.8	97.8	65.8	13.2
CoLk 14204	42.8	131.9	106.7	76.7	13.9
CoPb 14184	42.8	128.2	105.4	79.2	12.8
CoPb 14185	44.8	127.4	106.7	78.6	12.9
CoS 14233	45.3	145.6	116.1	78.1	13.9
CoS 767	50.7	138.0	109.0	80.3	13.1
CoPant 97222	40.7	134.7	105.8	75.6	13.4

Co 05011	49.1	137.0	110.1	84.1	12.8
SE±	0.99	3.70	2.78	1.94	0.38
CD at 5%	2.01	7.49	5.62	3.93	NS
B –Fertilizer level					
100% RDF of NPK	43.6	127.7	102.7	72.8	13.3
125% RDF of NPK	43.3	137.1	110.7	82.2	13.2
SE±	0.44	1.17	1.24	0.867	0.17
CD at 5%	NS	2.37	2.51	1.76	NS

5. UCHANI

All the genotypes along with check varieties were planted at 120 cm spacing with RDF (150-50-50 NK kg/ha) and 125 % of recommended dose of NPK (187.5+ 62.5+62.5 kg/ha) in randomized block design with three replications during spring season on March 11-12, 2019. Separate trials were conducted for early and mid-late varieties. The soil of the experimental field was sandy loam in texture with pH 8.0, EC 0.4 dSm⁻¹, organic carbon 0.41%, available P 12.2 kg/ha and available K 197 kg/ha. The crop was irrigated at 8-10 days interval during pre-monsoon seasons and 15-20 days interval during post monsoon seasons. Rest of the inputs were applied as per package of practices of CCSHAU, Hissar. The early and mid-late trial were harvested on March 18, 2020 and March 28, 2020, respectively.

Early

Germination per cent, tillers, NMC, cane weight and cane yield were not affected significantly due to different fertility levels. No significant response of higher fertilizers was observed under wider row spacing. Varieties differed significantly in terms of germination percent, tillers, cane weight and cane yield. Varieties CoLk 14201, CoJ 64 and Co 0238 being at par recorded significantly higher germination as compared to varieties Co 14034, CoPb 14184, CoPb 14181 and Co 05009, the later four being at par with each other. Variety CoLk 14201 produced significantly highest number of tillers (142.7 thousand/ha) and millable canes (117.5 thousand/ha) as compared to rest of the varieties and other varieties were at par with each other. Highest cane weight was recorded in variety Co 0238 (1021 g) followed by Co 14034, CoLk 14201, Co 05009, CoPb 14211, CoJ 64 and lowest in CoPb 14181 (789 g). Varieties Co 0238 (107.2 t/ha) and CoLk 14201(104.9 t/ha) being at par produced significantly highest cane yield in comparison to rest of the varieties. Varieties CoJ 64 (79.1 t/ha) and CoPb 14211(80.6 t/ha) being at par produced the lowest cane yield. Interaction between fertility levels and varieties was not found significant (**Table AS 72.5.1**).

Mid-late

Germination per cent, tillers, NMC, cane weight and cane yield were not affected significantly due to different fertility levels. No response of higher fertilizers was observed under wider row spacing.

Varieties did not differ significantly in terms of germination (49.2-52.5%). Varieties CoPb 14184, CoLk 14203 and Co 05011 being at par recorded significantly highest number of tillers among all the varieties whereas varieties Co 05011, CoLk 14203 and CoH 14261 were found at par with each other. Lowest number of tillers were recorded in variety Co 14035 (139.0 thousand/ha). Varieties CoPb 14184 and CoH 14261 produced the highest number of NMC whereas variety Co 14035 produced the lowest. Varieties CoH 14261 (941 g) and CoPb 14185 (972 g) being at par recorded highest cane weight among all the entries. Variety CoH 14261 and CoPb 14184 were at par with each other in terms of cane weight. Lowest cane weight was recorded in variety CoS 14233 (821 g). Varieties CoH 14261 (108.0 t/ha), CoPb 14184 (107.2 t/ha) and CoPb 14185 (106.8 t/ha) being at par produced significantly highest cane yield among all the entries. Lowest cane yield was recorded in variety CoS 14233 (91.9 t/ha). Interaction was not found significant (**Table AS 72.5.2**).

Summary: Germination per cent, tillers, NMC, cane weight and cane yield were not affected significantly due to different fertility levels. Varieties in early group differed significantly in terms of germination whereas, mid late entries did not differ significantly. Varieties Co 0238 (107.2 t/ha) and CoLk 14201 (104.9 t/ha) being at par produced significantly highest cane yield in comparison to rest of the varieties. Varieties CoJ 64 (79.1 t/ha) and CoPb 14211 (80.6 t/ha) being at par produced the lowest cane yield. Interaction between fertility levels and varieties was not found significant. Among mid maturing entries, Varieties CoH 14261 (108.0 t/ha), CoPb 14184 (107.2 t/ha) and CoPb 14185 (106.5 t/ha) being at par produced significantly highest cane yield among all the entries. Lowest cane yield was recorded in variety CoS 14233 (91.9 t/ha). Interaction was not found significant.

Table AS 72.5.1: Performance of early maturing genotypes at Uchani

	Co 14034	CoLk 14201	CoPb 14181	CoPb 14211	CoJ64	Co 0238	Co 05009	Mean
Germination (%)								
RDF	44.3	54.7	47.3	43.4	52.5	50.9	46.1	48.5
125 % RDF	46.2	51.9	45.5	45.9	55.7	60.3	46.8	50.3
Mean	45.2	53.3	46.4	44.7	54.1	55.6	46.4	
CD at 5 %	Fertility	NS	Variety	4.5	Interaction	NS		
Tillers (000/ha)								
RDF	124.8	141.9	124.8	121.4	128.3	128.7	123.9	127.7
125 %RDF	127.1	143.5	125.8	125.5	130.6	131.4	128.1	130.3
Mean	126.0	142.7	125.3	123.5	129.5	130.1	126.0	
CD at 5 %	Fertility	NS	Variety	7.0	Interaction	NS		
NMC(000/ha)								
RDF	105.2	117.0	104.9	103.0	101.4	106.9	104.8	106.2
125 %RDF	106.5	117.9	105.6	106.0	102.8	108.8	108.2	108.0
Mean	105.9	117.5	105.2	104.5	102.1	107.9	106.5	
CD at 5 %	Fertility	NS	Variety	6.9	Interaction	NS		
Cane weight (g)								
RDF	906	825	783	822	795	1020	825	854
125 %RDF	923	838	794	828	799	1022	831	862
Mean	915	832	789	825	797	1021	828	
CD at 5 %	Fertility	NS	Variety	34	Interaction	NS		
Cane yield (t/ha)								
RDF	84.2	103.6	83.9	79.1	78.0	106.1	83.4	88.3
125 %RDF	86.3	106.1	85.2	82.1	80.2	108.3	86.8	90.7
Mean	85.3	104.9	84.6	80.6	79.1	107.2	85.1	
CD at 5 %	Fertility	NS	Variety	4.6	Interaction	NS		

Table AS 72.5.2: Performance of mid-late maturing genotypes at Uchani

Varieties	Co 14035	CoH 14261	CoLk 14203	CoPb 14184	CoPb 14185	CoS 14233	CoS 767	CoPant 97222	Co 05011	Mean
Germination (%)										
RDF	49.7	49.1	52.5	51.1	50.5	50.0	49.0	52.6	50.9	50.6
125 %RDF	47.8	50.4	53.8	51.7	50.9	48.8	48.9	52.7	50.7	50.6
Mean	48.7	49.8	53.2	51.4	50.7	49.4	48.9	52.6	50.8	
CD at 5 %	Fertility	NS	Variety	NS	Interaction	NS				
Tillers (000/ha)										
RDF	137.7	149.3	146.8	158.2	143.5	155.2	148.5	144.5	151.7	148.4
125 %RDF	140.2	152.0	148.5	160.0	146.9	158.6	151.2	149.4	155.4	151.3
Mean	139.0	150.6	147.6	159.1	145.2	156.9	149.9	147.0	153.5	
CD at 5 %	Fertility	NS	Variety	8.2	Interaction	NS				
NMC (000/ha)										
RDF	108.7	115.8	112.9	117.7	111.4	112.9	112.7	110.4	110.3	112.5
125 %RDF	111.6	118.6	114.5	119.5	114.6	115.7	115.1	114.0	113.3	115.2
Mean	110.1	117.2	113.7	118.6	113.0	114.3	113.9	112.2	111.8	
CD at 5 %	Fertility	NS	Variety	7.0	Interaction	NS				

Cane weight (g)										
RDF	892	938	890	921	970	817	882	875	883	896
125 %RDF	895	944	888	921	973	825	890	881	895	901
Mean	894	941	889	921	972	821	886	878	889	
CD at 5 %	Fertility	NS	Variety	45	Interaction	NS				
Cane yield (t/ha)										
RDF	95.0	106.6	97.7	106.2	104.9	90.5	96.9	94.7	95.7	98.7
125 %RDF	97.5	109.4	99.6	108.2	108.0	93.3	99.4	98.0	98.6	101.3
Mean	96.3	108.0	98.7	107.2	106.5	91.9	98.2	96.4	97.2	
CD at 5 %	Fertility	NS	Variety	5.7	Interaction	NS				

PENINSULAR ZONE

6. PUNE

Sugarcane was planted on 12.01.2019 and harvested on 17.02.2020. The recommended dose of fertilizers were 250, 115 and 115 kg/ha NPK. The mean data on germination percentage revealed that, different fertilizer levels did not influence significantly on germination percentage at 45 DAP. Data pertaining to germination percentage as influenced by different genotypes are, showed that, significantly higher germination (85.91%) was observed in genotype Co 13020 at 45 DAP, which was at par with Co 13008, CoSnK 13106 and CoSnK 05103. While, Co 13018 registered significantly lower germination percentage (56.77) at 45 DAP. According to data furnished, interaction between fertilizer levels and genotypes failed to exert its significant effect on germination percentage at 45 DAP.

Data indicated that, application of 125% of RDF recorded significantly higher tiller Count (1.37 lakh/ha) at 120 DAP as against 100% RDF. Different genotypes manifested their significant influence on tiller Count at 120 DAP. Genotype CoSnK 13106 registered significantly maximum tiller Count (1.47 lakh/ha) at 120 DAP. Among the treatments 125% RDF recorded significantly highest internode girth (11.57 cm), total cane height (285.00 cm) and single cane wt. (1.76 kg), but no. of internodes found to be non-significant. Genotype MS 13081 registered significantly maximum no. of internodes (28), girth (12.44 cm), in the case of total cane height (315 cm) found to be higher in genotype CoN 13072, whereas, with respect to single cane weight, genotype Co 13009 showed higher value (2.06 kg) over rest of the genotypes.

The result showed significant difference in NMC Count at 12 MAP due to different fertilizer levels. Significantly highest NMC Count (0.83 lakh/ha) gained at 12 MAP respectively by applying 125% RDF over 100% RDF. It is evident from data that genotypes are responsible for maximization of NMC Count. Significantly higher values of NMC Count 0.89 lakh/ha was observed under genotype CoSnK 05103 at 12 MAP, which was more or less similar with Co 13004, CoN 13072, Co 13006, Co 13008, Co 13009, Co 13013, Co 13014, Co 13018, CoSnK 13073, CoSnK 13106, CoSnK 05103, Co 86032 and CoC 671. While, Co 13003 showed lower NMC Count (0.70 lakh/ha) at 12 MAP.

The highest cane yield (141.96 t/ha) and B: C ratio (2.50) was noted in treatment 125% RDF as compared to 100% RDF. The significantly higher cane yield (150.35 t/ha) and BC ratio (2.65) was observed under genotype Co 13008, which was similar with other genotypes except, Co 13002, Co 13003, CoSnK 13103 and PI 13132. Whereas, significantly lower cane yields (80.75 t/ha) and B: C ratio (1.43) gained under genotype Co 13002. Among the possible interactions with respect to cane yield and B: C ratio interaction effect (fertilizer levels \times genotypes) was non-significant.

Highest CCS yield was observed (21.10 t/ha) in treatment 125% RDF as Compared to 100% RDF. Significantly higher CCS yield (21.81 t/ha) was observed under genotype Co 13009, which was comparatively similar with several genotypes. Whereas, significantly lower CCS yield (12.58 t/ha) registered under genotype Co 13002. Among the possible interactions with respect to CCS yield, interaction effect (fertilizer levels \times genotypes) was non-significant.

Summary: In the light of results obtained from present investigation, it can be concluded that, for securing maximum cane yield and net returns crop should be fertilized with 125% RDF. In the case of genotypic performance Co 13020 found better with maximum germination, whereas, CoSnK 13106 performed better in tillering, CoSnK 05103 for NMC and MS 13081 for growth attributes. While cane yield, CCS yield and B:C ratio was higher in Co 13008. Whereas, CoC 671 showed superior juice quality.

Table AS 72.6.1: Performance of genotypes at Pune

Treatment	NMC at 12 MAP (Lakh/ha)	Single cane weight (kg)	Cane yield (t/ha)	CCS (t/ha)	B:C ratio
Factor A: Fertilizer levels					
F1: 100% RDF	0.76	1.51	108.20	16.09	1.91
F2: 125% RDF	0.83	1.76	141.96	21.10	2.50
SE_m±	0.011	0.049	4.59	0.67	-
C.D. @ 5%	0.033	0.14	13.13	1.93	-
Factor B: Genotypes					
V1: Co13002	0.76	1.10	80.75	12.58	1.43
V2: Co13003	0.70	1.68	94.76	14.05	1.67
V3: Co13004	0.75	1.71	122.35	19.01	2.16
V4: CoN 13072	0.85	1.67	124.46	17.56	2.20
V5: CoSnk13101	0.72	1.51	109.31	16.25	1.93
V6: MS13081	0.74	2.11	138.91	20.65	2.45
V7:Co13006	0.88	1.34	120.09	19.19	2.12
V8: Co13008	0.89	1.93	150.35	21.53	2.65
V9: Co13009	0.82	2.20	149.79	21.81	2.64
V10: Co13013	0.79	2.06	135.12	19.34	2.38
V11: Co13014	0.82	1.50	131.95	19.50	2.33
V12: Co13018	0.88	1.34	127.82	18.70	2.26
V13: Co13020	0.78	1.38	109.76	16.03	1.94
V14: CoSnk13073	0.88	1.97	147.82	20.42	2.61
V15: CoSnk13103	0.77	1.27	103.09	15.25	1.82
V16: CoSnk 13106	0.76	1.92	135.69	19.20	2.40
V17: PI13132	0.71	1.38	103.37	14.86	1.82
V18: Co86032	0.87	1.43	143.95	21.58	2.54
V19: CoC671	0.82	1.71	124.42	20.08	2.20
V20: CoSnk05103	0.89	1.15	119.91	17.76	2.12
SE_m±	0.036	0.15	14.52	2.13	-
C.D. @ 5%	0.10	0.44	41.54	6.11	-
Interaction F×V					
SE_m±	0.051	0.22	20.54	3.02	-
C.D. @ 5%	NS	NS	NS	NS	-
C. V. %	9.14	19.15	23.22	22.97	-

7. KOLHAPUR

The yield attributing characters viz., tillers, number of millable canes (NMC), single cane weight, yield parameters and CCS yield did not differ significantly due to fertilizer levels. However, cane yield differed significantly due to fertilizer levels. Among the genotypes/cultivars, Co 13008 recorded significantly superior cane yield (80.00 t/ha) and CCS yield (10.30 t/ha). It was followed by CoC 671 (54.90 t/ha) and found at par with CoSnk 13103 (54.30 t/ha) and Co86032 (47.90 t/ha). Whereas, in terms of CCS yield genotype Co 13008 was followed by CoC 671 (7.44 t/ha), CoSnk 13103 (7.29 t/ha) and Co 13003 (7.01 t/ha). The interaction effect was found non- significant in respect of all the characters (**Table AS 72.7.1**).

The quality parameters did not differ significantly due to fertilizer levels except sucrose % as 100 % RDF recorded significantly higher sucrose (18.73 %). However, significant differences were observed among studied genotypes. The standard check CoC 671 recorded significantly higher °Brix (22.35°), sucrose (19.64 %) and CCS (13.55 %) and was found at par with other genotypes. Significantly highest purity was found in Co 13008 (95.28 %) at par with CoN 13073 (95.07 %). However, the interaction effect was found to be non-significant.

Summary: Among genotypes cane yield and yield parameters did not differ significantly with 100 or 125 % RDF application and also due to interaction between fertilizer levels and cultivars. Among the cultivars Co 13008 recorded significantly superior cane yield and CCS yield.

Table AS 72.7.1: Performance of different genotypes at Kolhapur

Fertilizer levels(F) /Cultivars (C)	Tillers (000/ha) (120DAP)	NMC (000/ha)	Single cane weight (kg)	CCS Yield (t/ha)	Cane yield (t/ha)
Fertilizer levels					
100 % RDF	114.19	58.20	0.75	5.66	43.85
125 % RDF	121.28	56.14	0.74	5.30	41.42
SEm ±	9.56	0.22	0.00	0.03	0.02
CD at (5 %)	NS	NS	NS	NS	0.28
Cultivars					
Co 13002	124.7	57.6	0.59	4.03	34.2
Co 13003	132.1	70.8	0.81	7.01	57.6
Co 13004	60.8	43.7	0.66	3.53	28.6
CoN 13072	114.9	48.0	0.68	4.29	32.7
CoSnk 13101	117.2	55.1	0.82	6.02	45.2
MS 13081	84.0	55.5	0.68	4.87	37.5
Co 13006	144.4	66.3	0.71	6.11	46.9
Co 13008	129.0	73.9	1.08	10.30	80.0
Co 13009	97.7	44.4	0.80	4.51	35.4
Co 13013	114.9	60.2	0.64	5.06	38.6
Co 13014	89.6	54.4	0.76	4.73	41.4
Co 13018	126.6	59.5	0.58	4.71	34.6
Co 13020	154.5	54.1	0.64	4.09	34.7
CoN 13073	97.7	46.9	0.69	4.41	32.2
CoSnk 13103	123.8	50.6	1.07	7.29	54.3
CoSnk 13106	131.1	62.7	0.76	6.07	47.3
PI 13132	115.5	45.8	0.66	3.87	30.2
Co 86032 (c)	158.0	57.7	0.83	6.36	47.9
CoC 671 (c)	104.9	58.2	0.94	7.44	54.9
CoSnk 05103 (c)	133.4	78.0	0.49	4.87	38.5
SEm ±	8.53	2.45	0.024	0.31	2.26
CD at (5 %)	24.42	7.02	0.07	0.90	6.47
Interaction (F x C)					
	NS	NS	NS	NS	NS

Table AS 72.7.1: Quality performance of different genotypes at Kolhapur

Fertilizer levels(F) /Cultivars ©	°Brix	Sucrose %	CCS %	Purity %
Fertilizer levels				
100 % RDF	21.34	18.73	12.89	87.93
125 % RDF	20.70	18.30	12.77	88.60
S.Em±	0.20	0.02	0.08	0.58
CD at (5 %)	NS	0.43	NS	NS
Cultivars				
Co 13002	20.17	17.17	11.79	85.08
Co 13003	21.11	17.91	12.18	84.86
Co 13004	21.55	18.19	12.30	84.41
CoN 13072	20.60	18.72	13.11	90.86
CoSnk 13101	20.98	18.99	13.28	90.55
MS 13081	21.23	18.76	13.00	88.48
Co 13006	21.10	18.85	13.03	89.43
Co 13008	21.14	18.82	12.87	89.04
Co 13009	21.35	18.13	12.75	84.92
Co 13013	20.97	18.75	13.13	89.64
Co 13014	20.98	17.05	11.44	82.13
Co 13018	19.97	19.02	13.61	95.28
Co 13020	20.48	17.46	11.85	85.39
CoN 13073	20.10	19.11	13.70	95.07
CoSnk 13103	20.85	18.78	13.44	90.09
CoSnk 13106	21.35	18.83	12.81	88.24
PI 13132	20.85	18.46	12.82	89.62
Co 86032 (c)	21.82	19.25	13.30	88.24
CoC 671 (c)	22.35	19.64	13.55	87.91
CoSnk 05103 (c)	21.46	18.47	12.64	86.07
S.Em ±	0.28	0.22	0.23	1.34
CD at (5 %)	0.81	0.64	0.67	3.82
Interaction (F × C)				
NS				

8. SANKESHWAR

Sugarcane yield, CCS yield and number of millable canes (NMC) did not differ significantly due to fertilizer levels (100 and 125 % RDF). Whereas, application of 125 % RDF recorded significantly higher cane height, cane girth and single cane weight than application of 100% RDF. Among the cultivars MS 13081 recorded significantly higher cane yield (153.08 t/ha) which was on par with the cultivar Co 13008 (147.80 t/ha). The significantly lower yield was with cultivar Co 13002 (93.74 t/ha). The NMC and single cane weight followed the same trend. Significantly higher cane girth was with cultivar Co 13014 and CoSnk 13106. While significantly higher cane height was with Co 13004 followed by MS 13081 and CoSnk 13106 which are at par with each other. The interaction effect was non- significant for both fertilizer levels and cultivars with respect to yield and yield parameters (**Table AS 72.8.1**).

Quality parameters namely, brix, pol (%) and purity (%) did not differ significantly among the fertilizer levels, cultivars and for interaction effects for both fertilizer levels and cultivars.

Summary: Among cultivars cane yield and yield parameters did not differ significantly with 100 or 125 % RDF application and for interaction effects of both fertilizer levels and cultivars. Among the cultivars MS 13081 recorded significantly higher cane yield. The next best cultivar was Co 13009 which was on par with MS 13081 with respect to cane yield.

Table AS 72.8.1: Growth performance of elite genotypes at Sankeshwar

Fertilizer levels(F) /Cultivars (C)	NMC (000/ha)	Cane Height (cm)	Cane Girth (cm)	Single cane weight (kg)	Cane yield (t/ha)
Fertilizer levels					
100 % RDF	83.83	2.53	2.72	1.71	125.27
125 % RDF	84.69	2.63	2.84	1.88	127.11
S.Em±	0.41	0.03	0.04	0.05	0.71
CD at (5 %)	NS	0.08	0.11	0.16	NS
Cultivars					
Co 13002	82.32	2.12	2.32	1.18	93.74
Co 13003	87.33	2.67	2.59	1.80	139.60
Co 13004	85.74	2.85	2.68	1.80	132.83
CoN 13072	82.67	2.63	2.54	1.58	115.28
CoSnk 13101(07342)	81.02	2.40	2.52	1.67	118.32
MS 13081	88.78	2.73	2.97	2.33	153.08
Co 13006	85.22	2.69	2.63	1.85	121.53
Co 13008	80.90	2.59	2.88	1.68	114.42
Co 13009	86.70	2.71	2.97	2.32	147.80
Co 13013	83.69	2.74	2.74	2.30	133.45
Co 13014	82.61	2.58	3.27	1.82	125.91
Co 13018	86.91	2.35	2.50	1.67	122.97
Co 13020	80.99	2.46	2.93	1.82	113.75
CoN 13073	83.39	2.49	2.67	1.71	122.57
CoSnk 13103(07680)	80.51	2.59	2.87	1.60	125.46
CoSnk 13106	84.41	2.70	3.05	2.02	138.11
PI 13132	83.29	2.34	2.97	1.73	121.92
Co 86032 (c)	85.54	2.50	2.92	1.92	134.87
CoSnk 05103 (049) (c)	84.36	2.68	2.94	1.30	127.10
CoC 671 (c)	88.83	2.73	2.59	1.79	121.03
S.Em ±	0.73	0.07	0.09	0.03	2.51
CD at (5 %)	2.10	0.21	0.25	0.09	7.52
Interaction (F × C)					
NS					

Table AS 72.8.1: Quality performance of elite genotypes at Sankeshwar

Fertilizer levels (F)/ Cultivars (C)	Brix (%)	Pol (%)	Purity (%)	CCS yield (t/ha)
Fertilizer levels				
100%	22.1	19.77	82.36	17.21
125%	21.9	20.19	84.14	18.09
S.Em ±	0.22	0.17	0.69	0.14
CD at 5 %	NS	NS	NS	NS
Cultivars				
Co 13002	23.33	21.37	91.64	14.09
Co 13003	22.53	20.70	91.93	20.35
Co 13004	23.2	21.36	92.04	20.01
CoN 13072	23.25	20.60	88.44	16.45
CoSnk 13101(07342)	23.13	20.74	89.69	17.09
MS 13081	23.14	21.08	91.17	22.64
Co 13006	23.85	21.60	90.53	18.36
Co 13008	20.09	18.16	90.36	14.52

Co 13009	18.14	16.21	89.30	16.66
Co 13013	22.05	19.98	90.65	18.65
Co 13014	20.15	17.99	89.15	15.72
Co 13018	22.34	20.35	91.05	17.56
Co 13020	20.56	18.99	92.40	15.25
CoN 13073	20.98	18.79	89.51	16.05
CoSnk 13103(07680)	22.37	20.20	90.24	17.70
CoSnk 13106	21.51	19.86	92.32	19.36
PI 13132	21.48	19.91	92.71	17.16
Co 86032 (c)	24.27	22.29	91.81	21.15
CoSnk 05103 (049) (c)	21.87	19.82	90.62	17.64
CoC 671 (c)	21.76	19.61	90.18	16.58
S.Em ±	0.37	0.41	1.7	0.44
CD at 5 %	1.05	1.17	4.87	1.27
Interaction (F × C)				
NS				

9. COIMBATORE

The experiment was laid out in split plot design with two replications. In all 8 elite sugarcane genotypes Co 13006, Co 13008, Co 13009, Co 13018, Co13020, Co 86032, CoC 671 and Co 09004 with two fertilizer levels (100%RDF and 125 % RDF) were planted in wide row spacing (150 cm). Sugarcane cane yield was influenced significantly due to different elite genotypes wherein, elite sugarcane genotype Co 13008 recorded significantly higher cane yield (134.00 t/ha) than two standard check varieties Co 86032 (122.65 t/ha) and CoC 671(118.39t/ha). Cane yield and juice quality were not influenced significantly due to fertilizer levels.

Juice quality (Brix, sucrose, purity and CCS percent) was studied by collecting cane samples at harvest. Juice Brix, Sucrose%, Purity % and CCS % at harvest showed significant varietal differences. Among different entries, Co13020 recorded significantly higher mean sucrose % of 20.57 than Co 86032. Amongst the 8 elite sugarcane genotypes Co 13020 was found more promising and recorded significantly higher CCS yield of 19.70 t/ha than the check entries CoC 67 (18.40 t/ha) and Co 86032 (16.86 t/ha).

Table AS 72.9.1: Growth performance of evaluated genotypes at Coimbatore

Particulars	Cane length (cm)	No of internodes	Cane girth (mm)	SCW (kg)	NMC (000/ha)	Cane yield (t/ha)
Fertilizers levels						
100 %RDF	274.79	28.48	31.18	1.83	71.81	129.98
125%RDF	264.48	27.58	29.52	1.74	70.20	122.16
Se d	0.31	0.35	1.03	0.11	1.543	1.23
CD	3.99	NS	NS	NS	NS	NS
Varieties						
Co 13006	285.84	31.33	29.98	1.82	67.92	118.11
Co 13008	281.25	26.92	26.7	2.03	66.03	134.00
Co 13009	268.34	30.92	32.43	1.94	74.38	121.06
Co 13018	247.92	22.34	29.26	1.37	81.60	126.83
Co 13020	258.33	28.58	31.83	1.97	74.45	133.62
Co 86032	268.75	28.83	33.31	1.80	71.04	122.65

CoC 671	254.17	27.25	32.2	1.78	63.26	118.39
Co 09004	292.50	28.08	27.11	1.54	69.38	133.96
Se d	8.21	2.00	0.89	0.15	2.88	3.28
CD	17.79	4.32	1.93	0.32	6.24	6.87
Interaction (F*V)						
Se d	11.62	2.82	1.26	0.21	4.075	5.42
CD	25.26	NS	8.45	NS	NS	14.92

Table AS 72.9.2: Quality performance of evaluated genotypes at Coimbatore

Fertilizers level	Brix	Sucrose %	Purity %	CCS %	CCS Yield (t/ha)
100 %RDF	20.40	19.80	96.19	14.35	18.65
125%RDF	20.58	20.08	97.10	14.51	17.77
Se d	0.15	0.36	0.48	0.13	0.38
CD	NS	NS	NS	NS	NS
Varieties					
Co 13006	20.05	19.36	96.60	13.93	16.44
Co 13008	19.20	19.10	96.81	14.21	19.06
Co 13009	18.75	18.00	95.99	12.92	15.61
Co 13018	21.27	20.64	96.14	14.89	18.89
Co 13020	21.50	20.57	95.74	14.75	19.70
Co 86032	19.52	19.04	97.01	13.76	16.86
CoC 671	21.60	21.34	98.59	15.50	18.40
Co 09004	22.07	21.48	96.29	15.51	20.71
Se d	0.58	0.71	1.33	0.6	0.78
CD	1.26	1.53	NS	1.3	1.68
Interaction (F*V)					
Se d	0.82	1.01	1.88	0.85	1.10
CD	NS	NS	NS	NS	3.76

EAST COAST ZONE

10. NAYAGARH

The experiment was laid out in randomized block design with three genotypes from AVT namely CoC 15336, CoC 15338 and CoV15356 along with three standard check i.e. CoA 92081, CoC 01061 and CoOr 03151 on red laterite soil of the experimental farm of Sugarcane Research Station, Nayagarh. The soil was acidic (pH 5.33) in reaction with electrical conductivity of 0.206 dS⁻¹. Available N content was in lower range (155 kg/ha), but the soil was medium in available P (19.6 kg/ha) and (K 164 kg/ha) content. Analysis of variance suggested that there is significant variations among the genotypes with respect to germination %, number of tillers at 180 days and number of millable canes ('000/ha). The genotype CoC 15338 produced the highest average cane yield of 95.36 t/ha with application of 125 % RD of fertilizer (**Table AS 72.10.1**).

Table AS 72.10.1: Performance of early genotypes at Nayagarh

Treatment	Germination % at 45 DAP	No of tillers (000/ha) at 180 DAP	NMC (000/ha)	Cane yield (t/ha)	Juice Brix %	Juice Sucrose %	CCS %
CoC 15336 (100% RDF)	56.80	82.13	84.10	90.89	18.20	16.80	11.20
CoC 15336 (125% RDF)	55.33	84.90	86.86	92.17	18.09	17.00	11.04

CoC 15338 (100% RDF)	50.27	85.43	87.84	94.73	18.09	17.50	11.60
CoC 15338 (125% RDF)	50.97	86.10	88.14	95.36	18.22	17.80	11.03
CoV15356 (100% RDF)	54.83	82.93	83.89	87.05	17.40	16.60	11.58
CoV15356 (125% RDF)	57.77	84.10	84.34	88.54	18.47	18.55	11.90
CoA 92081 (100% RDF)	55.43	84.33	84.41	87.77	18.12	17.50	11.23
CoA 92081 (125% RDF)	53.30	85.93	86.11	88.27	18.37	18.20	11.62
CoC 01061 (100% RDF)	60.27	83.28	88.12	93.68	18.23	17.65	11.25
CoC 01061 (125% RDF)	59.65	84.13	88.32	95.15	18.73	16.67	11.56
CoOr 03151 (100% RDF)	58.48	83.90	84.18	90.79	19.27	17.30	11.36
CoOr 03151 (125% RDF)	59.22	84.43	86.27	92.73	18.83	16.80	11.67
SEm±	2.263	1.342	2.276	1.504	0.597	0.359	0.294
CD at 5 %	7.433	5.042	5.869	4.563	NS	NS	NS
CV%	7.20	5.96	5.35	6.84	5.28	5.31	4.42

NORTH CENTRAL ZONE

11. PUSA

Early

Genotypes had significant impact on growth, yield and quality of sugarcane except single cane weight and purity percentage. Zonal check variety CoSe 95422 noticed maximum cane yield (102.6 t/ha) which was followed by test variety CoSe 14454 (98.7 t/ha) and CoSe 14451 (92.5 t/ha) and CoP 14437 (88.8 t/ha). Though, higher brix (21.6) and pol (18.92%) percent juice was noticed due to the check variety CoLk 94184 which was followed by check variety CoSe 01421 and test variety CoP 14437. Fertility level had significant impact on plant population, millable canes and cane yield. The maximum plant population (149200/ha), millable canes (1, 07,300/ha) and cane yield (94.6 t/ha) was obtained with 125% recommended dose of NPK. Though, fertility level did not cause significant impact on brix, pol and purity percentage (**Table AS 72.11.1**).

Mid-late

The genotypes differed significantly in terms of growth, yield and quality of sugarcane. Genotype CoP 06436 (zonal check) recorded good germination (36.2%), higher plant population (168700/ha), millable canes (115100/ha) and cane yield (103.8 t/ha) which was closely followed by CoSe 14455. Maximum pol percent (18.67%) juice was obtained with the variety CoLk 14209 which was closely followed by CoLk 14208 (18.62%). Among the fertility levels, 125% recommended dose of NPK gave higher plant population (1, 50,400/ha), millable canes (1, 07,300/ha) and cane yield (91.4 t/ha). Though, brix, pol and purity percent juice was found to be non-significant (**Table AS 72.11.2**).

Summary: Zonal check variety (early) CoSe 95422 was still doing best among the varieties. Among mid-late group variety CoP 06436 recorded higher growth, yield attributes and cane yield which was statistically similar to CoSe 14455. Application of 125% recommended dose

of NPK brought significant improvement in plant population, millable canes and cane yield for both the group of genotypes.

Table AS 72.11.1: Performance of early genotypes at Pusa

Treatment	Germination (%)	Plant population ($\times 10^3$ /ha)	Millable canes ($\times 10^3$ /ha)	Single cane weight (g)	Cane yield (t/ha)	Brix (%)	Pol (%)	Purity (%)
CoLk 14206	29.2	111.4	88.6	825	72.9	21.0	18.42	87.9
CoP 14437	33.7	138.6	102.4	874	88.8	21.0	18.43	88.0
CoSe 14451	35.2	142.5	101.6	934	92.5	20.8	18.31	88.0
CoSe 14454	37.8	159.0	112.8	883	98.7	20.4	17.95	88.2
CoLk 94184 (ZC)	29.8	126.5	98.9	896	87.4	21.6	18.92	87.6
CoSe 95422 (ZC)	38.5	165.8	114.5	898	102.6	20.4	18.08	88.6
CoSe 01421 (ZC)	31.6	135.1	101.7	878	88.2	21.2	18.61	87.8
SEm \pm	1.11	5.52	4.06	30.6	3.36	0.24	0.180	0.43
CD (P=0.05)	3.2	16.0	11.8	NS	9.8	0.7	0.52	NS
Fertility level (% Recommended dose of NPK)								
100	34.5	130.4	98.5	878	85.7	20.9	18.37	87.9
125	32.9	149.2	107.3	890	94.6	20.9	18.40	88.1
SEm \pm	0.60	2.95	2.17	16.4	1.79	0.13	0.096	0.23
CD (P=0.05)	NS	8.6	6.3	NS	5.2	0.4	NS	NS
CV (%)	8.1	9.7	9.7	8	9.1	2.8	2.40	1.2

Table AS 72.11.2: Performance of mid-late genotypes at Pusa

Treatment	Germination (%)	Plant population ($\times 10^3$ /ha)	Millable canes ($\times 10^3$ /ha)	Single cane weight (g)	Cane yield (t/ha)	Brix (%)	Pol (%)	Purity (%)
Mid-late promising genotype								
CoLk 14208	28.0	125.2	93.8	811	75.0	21.2	18.62	88.0
CoLk 14209	28.2	121.7	91.6	836	75.6	21.1	18.67	88.5
CoP 14438	28.7	129.6	94.8	908	85.7	19.4	17.05	87.9
CoP 14439	29.6	136.7	98.9	892	87.7	20.1	17.85	88.8
CoSe 14455	35.8	162.5	113.5	905	102.0	20.4	18.29	88.2
BO 91 (ZC)	34.9	156.2	109.2	774	83.9	19.5	17.25	88.7
CoP 06436 (ZC)	36.2	168.7	115.1	912	103.8	19.0	16.55	87.4
CoP 9301 (ZC)	31.0	144.1	102.7	856	87.1	20.5	18.09	88.5
SEm \pm	1.03	4.91	3.31	26.2	3.01	0.26	0.252	0.30

CD (P=0.05)	3.0	14.2	9.6	76	8.7	0.7	0.73	0.85
Fertility level (% Recommended dose of NPK)								
100	31.9	135.8	97.6	860	83.8	20.1	17.85	88.3
125	31.2	150.4	107.3	864	91.4	20.1	17.74	88.1
SEm±	0.51	2.45	1.66	13.1	1.50	0.13	0.126	0.15
CD (P=0.05)	NS	7.1	4.8	NS	4.3	NS	NS	NS
CV (%)	8.0	8.4	8.2	8	8.4	3.1	3.5	1.4

12. SEORAH I

Early

Significant variation was observed in germination per cent by different genotypes. Genotype CoSe 14454 gave significantly higher germination (49.37 %) against genotypes used as check i.e. CoSe 95422 and CoSe 01421. Shoot population (168.81 thousand per ha), NMC (116.67 thousand per ha) and cane yield (97.28 t/ha) were found significantly higher in CoSe 14454 against all check. Sucrose per cent was not affected significantly by different genotypes and fertility levels but found maximum (17.92) in CoSe 14451. 125 per cent RDF application gave significantly higher shoot population (157.09 thousand per ha), NMC (110.89 thousand per ha) and cane yield (90.85 t/ha) against 100 per cent RDF application (**Table AS 72.12.1**).

Mid-late

Germination per cent was found significantly higher (47.22) in CoSe 14455 over all the genotypes used as check. CoP 14438 and CoSe 14455 genotypes produced significantly higher shoot population (153.47 and 156.56 thousand per ha, respectively) against CoP 06436 and CoP 9301. NMC recorded was significantly higher in CoLk 14209 and CoP 14438 over checks. CoP 14438 produced significantly higher sucrose per cent (17.98) as compared to CoP 06436. Cane yield was significantly more (89.22 t/ha) in CoLk 14208 over all the zonal checks. 125 per cent RDF gave significantly higher shoot population (155.19 thousand per ha), NMC (107.64 thousand per ha) and cane yield (84.88 t/ha) as compared to 100 percent application of RDF. No significant variation was observed in germination and sucrose per cent for RDF application @100 and @125 per cent but maximum value was when RDF applied @ 125 per cent (**Table AS 72.12.2**).

Summary: In early genotypes significantly higher cane yield was observed in CoSe 14455, CoSe 14451 and CoLk 14206 over checks i.e. CoLk 94184 and CoSe 01421. Among mid late genotypes CoLk 14208 produced significantly higher cane yield over all genotypes and checks except CoSe 14455. Sucrose per cent was not affected significantly by different treatments of fertility levels and early genotypes. RDF applied @125 per cent improved the shoot population, NMC and cane yield significantly but there was no significant improvement observed for germination and sucrose per cent.

Table AS 72.12.1: Performance of early genotypes at Seorahi

Treatments	Germination %	Shoot population (000/ha)	NMC (000/ha)	Cane Yield (t/ha)	Sucrose %
Genotypes					
CoLk 14206	48.48	140.15	103.03	87.44	17.24
CoP 14437	45.96	130.87	94.95	76.90	17.38
CoSe 14451	46.78	152.14	114.14	89.87	17.92
CoSe 14454	49.37	168.81	116.67	97.28	17.44
CoLk 94184	44.51	151.13	102.02	72.62	17.59

CoSe 95422	41.67	146.40	95.96	77.75	16.77
CoSe 01421	39.77	139.52	92.93	73.33	17.31
SEm±	2.02	5.29	3.08	4.49	0.23
CD(P=0.05)	5.91	15.45	9.01	13.16	NS
Fertility Levels					
100 % RDF	44.23	136.92	94.73	73.99	17.35
125 % RDF	46.21	157.09	110.89	90.85	17.41
SEm±	1.08	2.43	1.65	2.40	0.12
CD(P=0.05)	NS	7.09	4.82	7.01	NS
C.V.%	10.93	7.56	7.34	13.50	3.22

Table AS 72.12.2: Performance of mid-late genotypes at Seorahi

Treatment	Germination %	Shoot population (000/ha)	NMC (000/ha)	Cane Yield (t/ha)	Sucrose %
Genotypes					
CoLk 14208	41.48	138.25	103.03	89.22	17.31
CoLk 14209	40.53	151.07	108.59	80.13	17.71
CoP 14438	44.13	153.47	120.45	79.10	17.98
CoP 14439	43.62	127.84	82.83	75.22	16.83
CoSe 14455	47.22	156.56	104.55	81.22	17.25
Bo 91	40.78	148.36	96.72	68.15	17.45
CoP 06436	42.05	134.28	89.90	78.50	17.05
CoP 9301	40.03	141.98	91.41	73.68	17.72
SEm±	1.53	3.40	3.52	3.11	0.23
CD(P=0.05)	4.48	11.59	10.22	9.09	0.63
Fertility Levels					
100 % RDF	41.62	132.76	91.73	71.42	17.36
125 % RDF	43.34	155.19	107.64	84.88	17.46
SEm±	0.77	1.20	1.76	1.55	0.11
CD(P=0.05)	NS	5.80	5.11	4.51	NS
C.V.%	8.92	6.80	8.66	9.74	3.05

13. BETHUADHARI

Early

The highest NMC, cane yield, pol (%) and CCS yield was obtained with the check variety CoSe 95422. Among elite genotypes tested numerically higher cane yield (71.83 t/ha) was recorded with CoP 14437 followed by CoLk 14206 and CoSe 14451. Effect of fertilizer levels was not found significant as far as growth, yield and quality of various genotypes are concerned.

Mid-late

Among elite mid-late genotypes CoSe 14455 performed better than other genotypes by recording highest germination (43.66%), NMC, cane yield (74.41 t/ha) and CCS yield (8.51 t/ha). However, the performance was not significantly better over superior check CoP 06436 which performed at par.

Table AS 72.13.1: Performance of early genotypes at Bethuadhari

Treatment	Germination (%)	NMC (000/ha)	Cane yield (t/ha)	Pol (%)	CCS (t/ha)
Main Plot (Entry)					
CoLk 14206	40.36	112.62	70.87	16.28	7.8
CoP 14437	37.98	127.97	71.83	17.13	8.36
CoSe 14451	36.04	120.72	70.54	17.41	8.53
CoSe14454	42.43	119.81	67.17	16.86	8.15
Stnds					
CoLk 94184	41.52	131.22	72.95	17.89	8.85
CoSe 95422	40.76	134.63	75.98	17.97	9.35
CoSe 01421	35.13	117.54	62.62	16.56	6.89
SEm(±)	0.70	4.12	1.95	0.08	0.34
CD at 5%	2.11	12.35	5.85	0.23	1.02
Sub Plot (Fertilizer Levels)					
F1(100%NPK)	39.06	122.88	69.99	17.15	8.24
F2(125%NPK)	39.28	124.12	70.46	17.18	8.33
SEm(±)	-	-	-	-	-
CD at 5%	NS	NS	NS	NS	NS
Interaction	NS	NS	NS	NS	NS
CV	6.33	7.56	5.46	6.44	5.65

Table AS 72.13.1: Performance of mid-late genotypes at Bethuadhari

Treatments	Germination (%)	NMC (000/ha)	Cane yield (t/ha)	Pol (%)	CCS (t/ha)
Main Plot (Entry)					
CoLk 14208	35.85	111.51	66.61	17.77	8.18
CoLk 14209	38.49	109.73	69.19	16.86	8.08
CoP 14438	36.29	108.96	67.72	17.70	8.26
CoP14439	37.47	115.44	70.46	17.68	8.41
CoSe 14455	43.66	126.53	74.41	17.90	8.51
Stnds					
BO 91	38.55	114.45	69.66	17.09	8.23
CoP 06436	41.01	119.21	71.47	17.82	8.41
CoP 9301	40.83	116.34	67.67	16.94	8.22
SEm(±)	0.66	3.98	1.55	0.32	-
CD at 5%	1.97	11.95	4.65	0.95	NS
Sub Plot (Fertilizer Levels)					
F1(100%NPK)	38.22	113.86	68.88	17.36	8.22
F2(125%NPK)	39.82	116.68	70.41	17.58	8.35
SEm(±)	-	-	-	-	-
CD at 5%	NS	NS	NS	NS	NS
Interaction	NS	NS	NS	NS	NS
CV	6.48	6.80	5.65	6.88	5.44

PROJECT NO.: AS 73

PROJECT TITLE: Assessment of climate change impact on sugarcane productivity

- Objective** : To assess long term variability in weather parameters and the change of sugarcane production.
- Year of start** : 2018-2019
- Duration** : One year
- Locations** : All centres where post of Agronomist has been provided as well as any voluntary centre.
- Methodology** : Long term daily weather data (30 years or more) is to be collected from nearest meteorological station for following parameters.
1. Daily maximum temperature
 2. Daily minimum temp.
 3. Daily relative humidity morning
 4. Daily RH noon
 5. Daily rainfall
 6. Daily wind velocity
 7. Daily evaporation
 8. Daily BSSH (Bright Sun Shine Hours)

Analysis for means and general trends of weather over the years has to be performed by the stations at the following intervals.

1. Weekly
2. Monthly, seasonal
3. Annual
4. Decadal

Daily weather data and analyzed data is to be submitted to P.I. in soft format using MS and excel sheets along with following:

1. Representative cane yield for corresponding years
2. Representative sucrose content for corresponding years
3. Soil data
4. Plant data (Biometric)
5. Lat long information including elevation

SUMMARY OF RESULTS OBTAINED DURING LAST YEAR (2018-19)

The project was initiated during this year and was allocated to the centres where agronomists are posted in the scheme. Only two centres Lucknow and Nayagarh submitted a report presented here under:

1. LUCKNOW

The long term (1956-2018) weather parameters viz. temperature (minimum and maximum), relative humidity (morning and afternoon), rainfall, evaporation, wind speed and bright sun shine hours were studied to assess the climate change impact on sugarcane productivity at ICAR- Indian Institute of Sugarcane research, Lucknow. The results revealed that all the studied weather parameters showed significant trend either increasing or decreasing at monthly, seasonal or on annual level. Rainfall is one of the important weather parameter which showed decreasing pattern at the rate of 28.97 mm decade⁻¹.

2. NAYAGARH

Nayagarh located in the east-coast zone experiences annual temperature ranging from 22.1 as minimum to 33.05 °C as maximum. The average annual rainfall for the last 21 years stand at 1576.2 mm with a variation from 1031 to 2129.9 mm showing wide inter-annual variability in the rainfall.

CURRENT YEAR (2019-20) REPORT

NORTH WESTERN ZONE

1. LUCKNOW

The long term (1956 to 2019) data of weather parameters viz. temperature (minimum and maximum), relative humidity (morning and afternoon), rainfall, evaporation rate, wind speed and bright sunshine hours (BSS) were studied at ICAR-Indian Institute of Sugarcane Research, Lucknow. The minimum temperature variation during the different months of year varied from 7.27 °C in the month of January to 26.59 °C in the month of June (**Table AS 73.1.1**). The long term minimum temperature of February, March and December showed significantly increasing trend at the rate of 0.29, 0.26 and 0.21 °C, per decade, respectively. The maximum temperature minimum value was recorded in January (21.76 °C) and maximum value in May (39.23 °C). It showed decreasing trend in the months of January (-0.37 °C decade⁻¹) and May (-0.32 °C decade⁻¹) however increasing trend was recorded in the month of August (0.12 °C decade⁻¹). The relative humidity in morning showed significantly increasing trends during all the months of year except the month of August. The increasing trend in the morning relative humidity varied from 0.38% (December) to 2.58% (May) per decade. The similar increasing trend in relative humidity of afternoon was observed during the months from January to May and further from November to December. The minimum significantly increasing trend in afternoon relative humidity was recorded 0.80% per decade in the month of April and significantly maximum decadal increasing trend was recorded 2.32% in the month of February. The long term monthly average of rainfall indicated that the highest monthly rainfall was recorded in the month of July (268.14 mm) and the minimum rainfall in the month of November (4.14 mm). The rainfall showed significantly increasing trend in the month February (0.97 mm decade⁻¹) however declining trend was recorded in the month of August (17.28 mm decade⁻¹). The data of evaporation rate and wind speed were

considered from 1989 to 2019. The average monthly evaporation rate varied from 1.59 mm day⁻¹ (December) to 8.40 mm day⁻¹ (May). It showed significantly declining trend from January to May and further from November to December. The variation in the average wind speed during the different months was from 1.48 km hr⁻¹ (November) to 4.82 km hr⁻¹ (April). The declining trend was also found in the wind speed from the month of January to May and from July to September. The significantly declining trend in the bright sunshine hours was recorded from January to April, July, and September and further from November to December.

Summary: The long term trend analysis of weather parameters reveals that minimum temperature of February, March and December showed significantly increasing trend and maximum temperature showed decreasing trend in the months of January and May but an increasing trend was recorded in the month of August. Morning relative humidity showed an increasing trend in all the months except August and similar increasing trend was also observed in afternoon relative humidity from January to May and further from November to December. Monthly rainfall showed significantly increasing trend in February (0.97 mm decade⁻¹) however declining trend was recorded in August (17.28 mm decade⁻¹). Significantly declining trend in evaporation rate and wind speed was also recorded in different months of year.

Table AS 73.1.1: Long term trends pf important weather parameters at Lucknow

Parameter	Months/SD & DC	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
T min. (°C)	Mean	7.27	10.13	14.73	20.74	24.80	26.59	26.03	25.63	24.18	18.75	12.14	7.90
	SD	1.40	1.33	1.24	2.42	2.42	2.44	2.08	1.27	1.53	2.15	2.76	2.06
	Decadal change	NS	0.29**	0.26**	NS	NS	NS	NS	0.12	NS	NS	NS	0.21*
T max. (°C)	Mean	21.76	25.49	31.36	36.80	39.23	37.64	33.46	32.72	32.70	32.05	28.29	23.59
	SD	1.77	1.80	1.72	3.79	2.44	3.04	1.64	1.37	1.69	3.05	2.31	2.35
	Decadal change	-0.37**	NS	NS	NS	-0.32**	NS	NS	0.12*	NS	NS	NS	-0.11*
R.H. 7:30 hrs. (%)	Mean	92.03	85.46	72.62	53.84	55.69	69.64	86.84	89.90	89.68	88.73	90.26	92.76
	SD	3.54	5.76	6.32	7.88	9.21	9.63	4.51	3.76	3.43	4.34	3.77	3.18
	Decadal change	0.56*	2.00**	1.73**	1.54**	2.52**	1.80**	0.63**	NS	0.43*	1.18**	1.00**	0.38*
R.H. 14:30 hrs. (%)	Mean	48.65	39.82	28.42	22.33	28.77	45.43	70.91	73.24	66.89	49.04	39.18	44.48
	SD	11.31	10.81	9.84	7.22	7.84	10.81	5.94	5.47	7.15	8.94	6.31	8.46
	Decadal change	2.08**	2.32**	1.38**	0.80*	1.80**	NS	NS	NS	NS	NS	1.05*	1.50**
Rainfall (mm)	Mean	16.54	15.16	7.85	5.21	21.01	109.54	268.14	267.12	188.40	41.63	4.14	8.70
	SD	19.17	23.08	12.60	9.13	23.07	90.05	127.80	137.28	128.22	64.01	10.67	17.00
	Decadal change	NS	0.97*	NS	NS	NS	NS	NS	-17.28	NS	NS	NS	NS
Evaporation ¹ (mm/day)	Mean	1.72	3.06	5.42	8.27	8.40	6.83	3.96	3.52	3.37	3.00	2.20	1.59
	SD	0.55	0.65	0.91	1.41	1.58	1.46	0.85	0.69	0.54	0.48	0.41	0.47
	Decadal change	-0.42**	-0.33*	-0.42*	-0.84**	-0.56*	NS	NS	NS	NS	NS	0.33**	0.29**
Wind speed ¹ (km/hr.)	Mean	2.68	3.58	4.71	4.82	4.17	3.92	3.41	2.87	2.67	1.57	1.48	1.78
	SD	0.67	0.73	0.86	0.93	0.89	0.85	0.95	0.68	0.60	0.31	0.32	0.36
	Decadal change	-0.37**	-0.30*	-0.29*	-0.43**	-0.46*	NS	-0.62**	-0.41**	-0.25**	NS	NS	NS
BSS (hrs./day)	Mean	7.01	8.18	8.71	8.85	9.23	7.28	5.51	5.38	6.64	8.02	7.92	6.95
	SD	1.71	1.17	0.98	1.27	1.01	1.23	1.26	1.27	1.52	1.72	1.83	1.76
	Decadal change	-0.55**	-0.25**	-0.10*	-0.17*	NS	NS	-0.27*	NS	-0.25*	NS	0.44**	0.71**

2. FARIDKOT

The correlation and regression analysis has been carried out to establish the crop-weather relationship using crop phenology and yield attributes as dependent variables and different weather parameters along with the computed indices viz., maximum temperature (Tmax), minimum temperature (Tmin), rainfall (RF), morning relative humidity (RHmax),

afternoon relative humidity (RHmin), evaporation (Evap), bright sunshine hour (BSS), growing degree days (GDD), helio-thermal units (HTU) and photo thermal units (PTU) as independent variable. Weather variables were pooled for different cultivars as well as for planting dates using three years (2015-17) data.

The correlation between weather parameters and phenological stages were combined for different planting dates and cultivars. Except at physiological maturity stage, occurrence of rainfall during all remaining phases was beneficial for crop. Maximum temperature had negative but significant association ($r = -0.934^{**}$) at germination, tillering ($r = -0.743^{**}$) and grand growth ($r = -0.453^{**}$) though, it was positively correlated with days taken to physiological maturity stages ($r = 0.405^{**}$) of sugarcane. Hence, numbers of days of germination, tillering and grand growth stages were increasing with decrease in maximum temperature. Days taken to germination and tillering stage had significant negative correlation with minimum temperature ($r = -0.927^{**}$ and -0.366^{**} , respectively) that had positive association at grand growth stage and physiological maturity stage. Morning relative humidity had significant positive correlation at germination ($r = 0.819^{**}$) and tillering ($r = 0.837^{**}$) but, negative correlation during maturity ($r = -0.192^{*}$) whereas; afternoon relative humidity was positive correlation with germination ($r = 0.621^{**}$), tillering ($r = 0.841^{**}$), grand growth stage ($r = 0.383^{**}$) and maturity ($r = 0.298^{**}$) stages. Bright sunshine hours had significant positive related during tillering ($r = 0.638^{**}$), grand growth stage ($r = 0.170^{**}$) and maturity ($r = 0.346^{**}$). GDD, HTU and PTU had positively correlated at all the phenological stages of the sugarcane (**Table AS 73.2.1**).

The correlation between weather parameters including agrometeorological indices and yield attributes has been performed and presented in Table 2. Results described that, the maximum and minimum temperatures during germination, tillering and grand growth stage negatively affected the cane yield, number of millable canes and plant height however, and during maturity stage these variables positively supported them.

During grand growth stage (July to September, in autumn planting) of sugarcane the high relative humidity and rainy days significantly contributed for higher yield. Results also depicted that rainfall during germination and maturity stages had negative impacts on sugarcane yield however, during tillering and grand growth stage rainfall increased the cane yield, number of millable canes and plant height. Morning relative humidity during germination stage had significant positive correlation with cane yield ($r = 0.878^{**}$), number of millable canes ($r = 0.846^{**}$) and plant height ($r = 0.849^{**}$). Morning relative humidity during tillering and grand growth stages had also positive influence on cane yield, number of millable canes, plant height and brix percentage. Rainfall and relative humidity crop maturity negatively affected the cane yield, number of millable canes and plant height. Similarly, the duration of the bright sunshine hours was positive but not significant all growth stages except the tillering and maturity stages of the crop. Results also revealed that at physiological maturity stage of the crop air temperatures had positive impacts on the cane yield, number of millable canes and plant height of sugarcane though; it affected negatively at previous phases of the crop.

Table AS 73.2.1: Correlation coefficient between weather parameters and phenological stages

Parameters	Germination stage	Tillering stage	Grand growth stage	Physiological maturity stage
Tmax	-0.934**	-0.743**	-0.453**	0.405**
Tmin	-0.927**	-0.366**	0.717**	0.218**
RF	0.525**	0.453**	0.799**	-0.015
RHmax	0.819**	0.837**	0.047	-0.192**
RHmin	0.621**	0.841**	0.383**	0.298**
BSS	0.084	0.638**	0.170**	0.346**
GDD	0.872**	0.285**	0.836**	0.484**
HTU	0.786**	0.169*	0.336**	0.325**
PTU	0.896**	0.249**	0.207**	0.482**

*= correlation significant at 0.05 level **= correlation significant at 0.01 level

Table AS 73.2.2: Correlation coefficient between weather variables at different stages and yield attributes

Parameters	Cane yield (t/ha)	NMC (000/ha)	SCW (kg)	Plant height (cm)
Germination stage				
Tmax	-0.955**	-0.880**	-0.956	-0.879**
Tmin	-0.940**	-0.878**	-0.932	-0.875**
RF	-0.536**	-0.479**	-0.536	-0.454**
RHmax	0.878**	0.846**	0.866	0.849**
RHmin	0.699**	0.631**	0.688	0.646**
BSS	0.054	0.001	0.074	0.012
Tillering stage				
Tmax	-0.809**	-0.842**	-0.771	-0.848**
Tmin	-0.421**	-0.353**	-0.415	-0.351**
RF	0.440**	0.458**	0.441	0.443**
RHmax	0.949**	0.946**	0.905	0.945**
RHmin	0.938**	0.947**	0.898	0.957**
BSS	0.728**	0.751**	0.692	0.761**
Grand growth stage				
Tmax	-0.584**	-0.649**	-0.538	-0.664**
Tmin	-0.896**	-0.950**	-0.821	-0.973**
RF	0.849**	0.821**	0.826	0.795**
RHmax	0.128	0.127	0.127	0.163**
RHmin	0.451**	0.450**	0.396	0.450**
BSS	0.128	0.135	0.105	0.102
Physiological maturity				
Tmax	0.601**	0.729**	0.501	0.773**
Tmin	0.390**	0.545**	0.265	0.582**
RF	-0.037	-0.071	-0.048	-0.085
RHmax	-0.294**	-0.366**	-0.239	-0.380**
RHmin	-0.465**	-0.545**	-0.416	-0.583**
BSS	0.420**	0.461**	0.34	0.476**

*= correlation significant at 0.05 level **= correlation significant at 0.01 level

3. PUSA

Geographically Pusa enjoys sub-humid, sub-tropical climate with moderate rainfall, hot dry summer and cold winter. Generally south-wet monsoon sets in third or fourth week of June and continues up to September. The average annual rainfall on the basis of thirty year data (1990-2019) is 1202 mm out of which nearly 90% are received during the monsoon extending from the middle of June to middle of October with an average winter rainfall of about 10% only by north-east monsoon. The heavy rainfall is in the month of July-August. The period between last week of December and first half of January receives occasional winter showers. May and early part of June happens to be the hottest month. December-January is the coldest month of year. On the basis of ten years average comparatively higher cane yield (82.7 t/ha) and sucrose content juice (17.23%) noticed during 2010 to 2019. The increase in cane yield and sucrose content juice by 2010 to 2019 and 2000 to 2009 over 1990 to 1999 was to the extent of 16.2; 1.29 and 23.6; 1.95 per cent, respectively.

PROJECT No.: AS 74

PROJECT TITLE: Evaluation of sugarcane varieties for drought tolerance

- Objective** : Identification of drought tolerant varieties suitable for specific agro-climatic condition.
- Year of start** : 2018-2019
- Duration** : Long term (Based on 2-years crop performance)
- Locations** : All centres where post of Agronomist has been provided as well as any voluntary centre.
- Planting time** : North West, North Central & North East Zones: February-March
Peninsular & East Coast Zones: 1st fortnight of January
- Treatments** : (a) **Newly released varieties:**
- Early maturing (3)
 - Mid-late maturing (3)
- (b) **Irrigation regimes: 2**
- IW/CPE ratio 1.0
 - IW/CPE ratio 0.3
- Total no. of treatments:** 12
- Design** : Strip plot design
- Replication** : 3
- Plot size** : North West, North Central, North East and East Coast Zones: 8 rows of 8 m length.
Peninsular Zone: 8 rows of 8 m length.
- Methodology** : All the irrigation regimes would be applied 50 days after planting
in the main season crop of the region.
- Observations to** :
- i) Root dry weight at 50, 100, 150 and 200 DAP.
 - ii) Relative leaf water content 24 hrs before and after each irrigation 50 DAP onwards.
 - iii) Soil moisture content before and after each irrigation.
 - iv) Leaf area index and specific leaf weight at 50, 100, 150 and 200 DAP.
 - v) Dry matter accumulation at 50, 100, 150, 200 and at harvest.
 - vi) Monthly tiller count and other plant biometric data.
 - vii) Yield attribute and cane yield
 - viii) Juice quality at 10 and 12 months stages including juice extraction percentage.

Protocol for determination of:

1. Relative leaf water content
2. Leaf area index (LAI) and specific leaf weight

SUMMARY OF RESULTS OBTAINED DURING LAST YEAR (2018-19)

The project was initiated during this year. In all 09 centres conducted the trial and centre wise report are presented here under:

NORTH WEST ZONE

1. FARIDKOT

Well-watered (I1) crop gave significantly higher cane yield (**Table AS 74.1.1**) than water stressed crop (I2). The yield reduction varied from 6.3 percent (CoPb 92) to 24.4 percent (CoPb 93). During the crop season there was about 462 mm rainfall and most of it was up to September.

2. KOTA

CoPk 05191 was found better with respect to number of tillers, plant height, millable canes, cane yield, brix, CCS yield (t/ha) resulting in significantly higher net return over other varieties under early maturing group and CoS 8436 variety in respect of germination, growth, juice extraction and quality parameters but in respect to cane length, cane diameter, cane yield Co 05011 performed best under mid-late group. The higher GR (239708.33 Rs/ha) and NR (131160.00 Rs/ha) and B:C ratio (2.21) recorded with CoPk 05191 in early maturing group and with Co 05011 in mid-late group with gross return (221833.33 Rs /ha), net return (113285.00 Rs /ha) and B:C ratio (2.04). The higher GR (234834.72Rs/ha) and NR (125138.06 Rs/ha) and B: C ratio (1:2.14) was recorded with I1 (I/W CPE ratio 1.0) irrigation regime over I2 (I/W CPE ratio 0.3) irrigation regime.

3. LUCKNOW

Among the six varieties of sugarcane, CoPK 05191 produced highest NMC, cane length, cane girth, sugarcane yield, juice extraction percentage, CCS t/ha, which may be due to production of higher root dry weight, LAI and average cane weight. Minimum reduction in sugarcane yield (13.7%) due to moisture stress was found with CoPk 05191 followed by CoLk 11206 which was at par with CoLk 94184 (18.38%).

4. SHAHJAHANPUR

Genotype CoLk 94184 produced significantly higher cane yield (92.80t/ha) followed by CoSe 11453 with cane yield of 88.20 t/ha. IW/CPE ratio 1.0 recorded significantly higher cane yield of 85.75 t/ha.

5. UCHANI

No significant differences in terms of growth and yield were observed between 1.0 and 0.3 IW/CPE ratios due to frequent rains during pre-monsoon period. Variety CoH 119 (96.9 t/ha) in mid late and Co 0238(96.2 t/ha) in early group being at par produced significantly higher cane yield as compared to variety CoH 167 (90.5 t/ha), Co 0118 (88.4 t/ha), Co 5011 (91.6 t/ha) and CoH 160 (91.4 t/ha) and later four being at par with each other. Among early varieties Co 0238 (12.97 kg) and CoH 119 (12.99 kg) among mid late varieties produced the highest yield of cane produced/1000 litres of irrigation at irrigation schedule of 0.3 IW/CPE ratio. Total irrigation water applied during pre-monsoon season was calculated 22.5 and 15.0 cm at 1.0 and 0.3 IW/CPE schedule, respectively. Total (pre+ post monsoon) irrigation water of 82.5, and 75 cm was applied at 1.0 and 0.3 IW/CPE irrigation schedule, respectively. Total (Irrigation+ rainfall) water was calculated as 219.9 and 212.4 at 1.0 and 0.3 IW/CPE irrigation schedule, respectively.

PENINSULAR ZONE

6. SANKESHWAR

The combined effect of genotypes and irrigation regimes on yield and yield attributes differed significantly. Among the mid-late genotypes Co 86032 with IW/CPE ratio 1.0 recorded significantly higher cane yield (164.40 t/ha) which was on par with SNK 09227 with IW/CPE ratio 1.0. Early variety SNK 088789 recorded higher cane yield (141.04 t/ha) with IW/CPE ratio 1.0 compared to other varieties. At IW/CPE ratio 0.3 the mid-late genotype SNK 09227 performed better (135.27 t/ha) as compared to Co 86032 and SNK 09268. In early genotypes SNK 088789 performed better than CoC 671 and SNK 07680. Similar trend was noticed with NMC, Cane girth, Single cane weight, and CCS yield and quality parameters.

NORTH CENTRAL ZONE

7. PUSA

It can be concluded that sugarcane varieties, CoP 2061, CoP 16437 and CoP 9437 when irrigated at IW: CPE ratio 1.00 are better for higher productivity under Bihar condition.

8. BETHUADHARI

The field experiment was planted on 16.3.2018 with early maturing (3): V1-CoLk 94184, V2 -CoSe 95422, V3 -BO 130 and mid – late maturing(3): V4 - BO 91, V5 - CoP 06436, V6 -CoP 9301 varieties for their performance at varying irrigation regimes. Moisture stress (IW: CPE 0.3) caused significant reduction in cane yield across the varieties. Among the varieties CoLk 94184 performed best with highest yield (94.28 t/ha) followed by BO 91 (90.8 t/ha). These two varieties were found to be most resilient against moisture stress with least reduction in cane yield.

EAST COAST ZONE

9. NAYAGARH

Among early maturing varieties, CoOr 03151 with IW/CPE ratio 0.3 recorded significantly different growth and yield parameters compared to other varieties CoOr 03152, CoOr 05346. Similarly among mid-late maturing varieties, CoOr 04151 with IW/CPE ratio 0.3 recorded significantly different growth and yield parameters compared to other varieties CoOr 10346, Co 86249. So this is possibly due to better drought tolerant capacity of these two varieties compared to other varieties.

CURRENT YEAR (2019-20) REPORT

NORTH WESTERN ZONE

1. FARIDKOT

Well-watered (I1) crop gave significantly higher cane yield (Table AS 74.1.1) than water stressed crop (I2). The yield reduction varied from 11.0 percent (CoPb 92) to 37.8 percent (CoPb 94). During the crop season there was about 451 mm rainfall and most of it was up to July. Among early maturing genotypes CoPb 92 yielded highest under both the irrigation regimes, whereas CoPb 94 could give higher yield among mid-late genotypes.

Table AS 74.1.1: Cane yield of sugarcane genotypes under different Irrigation regimes.

Irrigation regimes /Genotypes	I1	I2	Mean
CoPb 92	101.1	90.0	95.6
Co 118	78.1	61.1	69.6
CoJ 64	81.9	66.3	74.1
CoPb 91	106.7	74.5	90.6
CoPb 93	78.5	63.3	70.9
CoPb 94	114.4	71.1	92.8
Mean	93.5	71.1	
CD (5%)	Irrigation regimes	Genotypes	Interaction
	2.9	6.2	13.3

Table AS 74.1.2: Growth and quality parameters of sugarcane genotypes under different irrigation regimes

Treatment	Germination (%)	No. of Shoots (000/ha)	NMC (000/ha)	Cane length (cm)	Cane diameter (cm)	Single cane wt. (g)	Sucrose (%)
Irrigation regime							
IW/CPE 1.0	39.9	165.99	104.38	203	2.75	1170	18.15
IW/CPE 0.3	40.5	132.66	76.72	148	2.89	893	18.11
CD (5%)	NS	8.45	18.96	10	NS	143	NS
Genotype							
CoPb 92	40.9	202.3	121.95	206	2.35	808	18.37
Co 118	42.2	102.88	66.2	181	2.99	1225	18.13
CoJ 64	41.9	128.98	95.48	153	2.73	794	18.38
CoPb 91	37	149.53	78.33	186	3.11	1323	17.61
CoPb 93	42.5	122.78	76.19	155	2.8	969	18.21
CoPb 94	36.8	189.45	104.43	171	2.96	1070	18.05
CD (5%)	NS	20.79	14.29	25	0.18	113	NS

2. KOTA

A field experiment was planted on 7th March, 2019 to evaluate sugarcane varieties for drought tolerance and water productivity. Early maturing V1- CoPk 05191(Pratap Ganna-1), V2- Co 0238, V3- Co 05009 and mid-late maturing V4-Co 05011, V5-CoH 9264 & V6-CoS 8436 varieties were planted at 90 cm row distance. Significant variation on germination and tiller population at monthly interval from 90 DAP to harvest stage was observed. CoPk 05191, variety of early maturing group and CoS 8436 under mid-late maturing varieties performed better among respective groups. However, germination and tiller population was recorded significantly higher under I₁ regime over I₂. Data showed that CoPk 05191 in early maturing varieties recorded significantly higher root dry weight at different stages. It recorded highest root dry weight at 50 DAP (0.41 g/plant), 100 DAP (1.48 g/plant), 150 DAP (172.93 g/plant) and 200 DAP (207 g/plant) with. While CoH 9264 genotype in mid-late maturing group, recorded highest root dry weight at 100 DAP (1.25 gm/plant), 150 DAP ((170.00 gm/plant) and 200 DAP (207.48 g/plant). For dry matter accumulation highest value

was recorded with Co 0238 at 50 (42.4 g/plant), 100 (52.9 g/plant) and 150 DAP (133.5 g/plant) & at harvest (336.3 g/plant) in early maturing group and with CoH 9264 at 50 (41.1 g/plant), 100 (53.0 g/plant), 150 DAP (136.9 g/plant), 200 DAP(224.0 g/plant) and at harvest (335.7 g/plant) in mid-late maturing varieties. Maximum leaf area index recorded with Co 0238 in early maturing group and CoH 9264 in mid-late maturing group at different stages. However, highest dry weight of roots, highest dry matter accumulation of plant and leaf area index recorded with I1 irrigation regime over I2 irrigation regime.

Significantly higher NMC (134.52 thousand/ha), cane length (252.0 cm), cane yield (88.33 t/ha), juice extraction at 10 month (42.98 %) and at 12 month (45.43 %) were obtained with the CoPk 05191 over rest varieties under early maturing group. Whereas, highest NMC (126.42 thousand/ha), cane length (245.6 cm) and cane yield (81.25 t/ha) were recorded with CoH 9264 genotype in mid-late group. Whereas, juice extraction at 10 month (41.04 %) and at 12 month (46.15 %) were obtained higher with the CoS 8436. Cane diameter recorded maximum (2.6 cm) with Co 0238 and Co 05011 variety in early and mid-late maturing varieties. However, I1 irrigation regime recorded significantly higher NMC (128.07 000/ha), cane length (248.4 cm), cane diameter (2.443), single cane weight (842.78 gm), cane yield (86.32 t/ha) and juice extraction at 10 month (43.71%) & at 12 month (45.52 %) over I2 irrigation regime.

Data also revealed that there were differences in cost of cultivation, gross return, and net return owing to production cost. The higher gross return (265000 Rs/ha) and NR (152040 Rs/ha) and B: C ratio (1:2.34) recorded with CoPk 05191 in early maturing group. However, CoH 9264 in mid-late maturing group recorded highest gross return (243755 Rs /ha), net return (130795 Rs /ha) and B: C ratio (1:2.16). The higher gross return (258950 Rs/ha), net return (144823 Rs/ha) and B: C ratio (1:2.27) recorded with I1 (I/W CPE ratio 1.0) irrigation regime over I2 (I/W CPE ratio 0.3) irrigation regime.

Table AS 74.2.1: Growth and yield parameters of sugarcane genotypes under different irrigation regimes at Kota

Treatment	Cane length (cm)	Cane diameter (cm)	NMC (000/ ha)	Cane weight (g)	Cane yield (t/ha)	Juice Extraction (%)	
						10 month	12 month
Varieties:							
Early Maturing							
V ₁ : CoPk 5191 (Pratap Ganna- 1)	252.0	1.9	134.52	692	88.33	42.98	45.43
V ₂ : Co 0238	241.0	2.6	120.47	890	81.65	41.94	43.90
V ₃ : Co 5009	237.6	2.2	120.22	950	84.83	42.86	43.10
Mid-late Maturing							
V ₄ : Co 05011	242.9	2.7	125.72	798	80.67	40.17	41.02
V ₅ : CoH 9264	245.6	2.5	126.42	645	81.25	40.30	40.58
V ₆ : CoS 8436	234.8	2.0	124.72	925	78.67	41.04	46.15
SEm ±	2.543	0.089	4.346	38.068	2.963	0.833	1.974
CD (P=0.05)	8.012	0.279	13.690	119.929	9.335	2.623	6.219
CV	2.571	9.461	8.492	11.418	8.791	4.910	11.151
B. Irrigation schedule (I/W/CPE)							
I ₁ : 1.00	248.422	2.443	128.07	842.78	86.32	43.71	45.52
I ₂ : 0.30	236.194	2.148	122.62	790.56	78.82	39.38	41.21
SEm ±	2.474	0.042	1.302	8.616	1.792	0.647	0.504
CD (P=0.05)	15.050	0.255	7.922	52.421	10.905	3.937	3.067
CV	4.331	7.745	4.407	4.476	9.210	6.608	4.932

Table AS 74.2.2: Quality parameters of sugarcane genotypes under different irrigation regimes at Kota

Treatment	Brix (%)	Sucrose (%)	Purity (%)	CCS (%)	CCS yield (t/ha)
varieties	At 12 month				
Early Maturing					
V ₁ : CoPk 5191 (Pratap Ganna- 1)	24.07	21.6	89.9	15.1	12.4
V ₂ : Co 0238	22.62	20.2	89.1	14.0	12.3
V ₃ : Co 5009	21.90	19.4	88.6	13.4	11.4
Mid-late Maturing					
V ₄ : Co 05011	22.67	20.2	89.1	14.0	11.4
V ₅ : CoH 9264	21.87	19.4	88.6	13.4	10.9
V ₆ : CoS 8436	23.57	21.1	89.6	14.7	11.6
SEm ±	0.403	8.994	-	0.307	25.564
CD (P=0.05)	1.269	28.333	-	0.967	80.538
CV	4.331	94.155	-	5.324	178.913
B. Irrigation schedule (IW/CPE)					
I ₁ : 1.00	23.41	20.96	89.53	14.59	12.59
I ₂ : 0.30	22.16	19.68	88.78	13.64	10.76
SEm ±	0.283	11.602	-	0.215	32.996
CD (P=0.05)	1.721	70.591	-	1.311	200.765
CV	5.269	210.379	-	6.477	399.976

3. LUCKNOW

The experiment was laid out on 8th March 2019 in Strip plot design with three replications. Sugarcane crop was irrigated 10 times in treatment IW/CPE ratio 1.0 (IS 1.0), and four times in IW/CPE ratio 0.3 (IS 0.3). Crop was irrigated 7.5 cm in depth in each time of irrigation. Well distributed 1267.7 mm rainfall was received during the crop duration in 48 rainy days. Rainfall was distributed from June to September. Maximum tiller production was recorded with variety CoPk 05191 in the months of May, June, July, August, September, October and November followed by CoLk 11206. Difference in tiller production among the varieties at 50, 120, 150, and 180 DAP was numerically significant. Wet moisture regime recorded significantly superior LAI over IS 0.30 at 100, 150 and 200 DAP. Among the varieties LAI differed significantly at 50 and 200 DAP.

The highest number of millable cane (NMC) of 100.23 thousand/ha and cane girth 24.54 mm was recorded with variety CoPk 05191 followed by CoLk 11206. Maximum cane length 231.00 cm was recorded with CoLk 11206 followed by CoPk 228.83 cm. Highest average cane weight 788 gram (g) was recorded with variety CoPk 05191 followed by CoLk 11206. Maximum sugarcane yield (79.04 t/ha) was recorded with CoPk 05191 followed by CoLk 11206 (75.60 t/ha). Quality parameters of sugarcane was recorded at harvest and were statistically analyzed. Irrigation schedule treatment recorded significantly higher juice extraction percentage with IS 1.0 over IS 0.30. Maximum CCS production was recorded with variety CoPk 05191 (9.81 t/ha) followed by CoLk 11206 (9.61 t/ha).

Table AS 74.3.1: Yield attributes and cane yield of sugarcane genotypes under different irrigation regimes at Lucknow

Treatment	NMC '000/ha	Cane length (cm)	Girth (mm)	Av. /cane wt. (Kg)	Yield (t/ha)
A. Irrigation Schedule					
IS1.0	95.72	233.11	25.17	0.792	75.48
IS0.3	86.26	208.56	22.20	0.740	63.92
CD 5%	9.44	11.16	0.84	0.016	6.51
B. Varieties					
Co Lk 94184	90.78	217.67	23.74	0.773	70.20
Co Pk 05191	100.23	228.83	24.54	0.788	79.04
Co Lk 9709	85.01	215.17	23.22	0.736	62.74
Co Lk 9204	86.36	217.00	23.15	0.754	65.33
Co Lk 11206	96.48	231.00	24.01	0.782	75.60
CoS 08279	87.06	215.33	23.47	0.763	66.37
CD 5%	8.61	2.39	0.52	NS	7.29

Table AS 74.3.2: Root dry weight and total dry matter production of sugarcane genotypes under different irrigation regimes at Lucknow

Treatment	Root dry wt. kg/ha				Total dry weight kg/ha				At harvest
	50 DAP	100 DAP	150 DAP	200 DAP	50 DAP	100 DAP	150 DAP	200 DAP	
A. Irrigation schedule									
IS1.0	58.53	114.18	315.82	508.24	584.5	1459.06	5203.40	19371.72	39139.30
IS0.3	58.31	99.66	276.59	464.24	584.79	1277.49	4513.93	17563.54	33288.89
CD at 5%	NS	3.15	8.74	27.31	NS	75.56	120.87	1124.32	NS
B. Varieties									
Co Lk 94184	60.61	107.70	296.87	491.30	602.12	1370.52	4873.80	18726.89	35929.45
Co Pk 05191	62.50	118.68	325.70	526.55	624.51	1512.38	5301.95	19871.21	39452.23
Co Lk 9709	56.79	98.71	279.67	459.37	574.50	1272.75	4588.98	17257.10	33058.77
Co Lk 9204	56.15	101.64	279.83	463.54	558.53	1303.92	4600.88	17662.16	34725.96
Co Lk 11206	59.40	112.25	307.27	500.41	592.31	1441.25	5066.36	19117.70	38855.70
CoS 08279	55.09	102.59	287.80	476.57	555.90	1308.85	4720.03	18134.71	35262.46
CD at 5%	2.67	10.34	8.54	20.09	28.15	81.69	152.36	703.15	3371.95

4. UCHANI

Varieties differed significantly in terms of germination, tillers, millable canes, cane weight and cane yield. Varieties Co 0238 (55.3%) and Co 0118 (51.7%) being at par recorded significantly higher germination among all the varieties. CoH 160 (144.6 thousand/ha) recorded highest number of tillers among all the varieties whereas rest of the entries were at par with each other. Regarding millable canes, CoH 167 (108.1 thousand/ha) recorded significantly highest number of NMC whereas, CoH 119, Co 5011, CoH 160 and Co 0238 being at par were at second number. Significantly highest cane weight was recorded in

variety Co 0238. Co 119 and Co 0118 being at par were rated at number two. Varieties CoH 167, Co 05011 and CoH 160 being at par produced the lowest cane weight. Regarding cane yield, variety Co 0238 (95.2 t/ha) and CoH 119 (91.2 t/ha) being at par recorded the highest cane yield. Variety CoH 119 and CoH 167 were at par with each other. Variety Co 0118 (74.6 t/ha) recorded significantly lowest cane yield.

No significant differences in terms of germination were recorded between 1.0 and 0.3 IW/CPE ratios as drought treatment were imposed after complete germination. Significant differences were observed in terms of tillers, NMC, cane weight and cane yield. Significantly higher number of tillers, NMC, cane weight and cane yield were recorded in 1.0 IW/CPE (145.0 thousand/ha, 102.8 thousand/ha, 938 g, 93.6 t/ha, respectively) as compared to 0.3 IW/CPE (120.2 thousand/ha, 90.3 thousand/ha, 874 g, 76.6 t/ha, respectively). Total irrigation water applied during pre-monsoon season of 60.0 and 22.5 cm was calculated at 1.0 and 0.3 IW/CPE schedule, respectively. During post monsoon, 52.5 cm irrigation water was applied in both the irrigation levels. Total (pre+ post monsoon) irrigation water of 112.5 and 75.0 cm was applied at 1.0 and 0.3 IW/CPE irrigation schedule, respectively. Total (Irrigation+ rainfall) water was calculated as 183.0 and 145.5 at 1.0 and 0.3 IW/CPE irrigation schedule, respectively. Among varieties Co 0238 (11.56 kg) and, CoH 119 (10.97 kg) and CoH 167 (10.67 kg) produced the highest yield of cane produced/1000 litres of irrigation at 0.3 IW/CPE ratio.

Table AS 74.4.1: Yield attributes and cane yield of sugarcane genotypes under different irrigation regimes at Uchani

Treatment	Germination (%)	Tillers (000/ha)	NMC (000/ha)	Cane wt. (g)	Cane yield (t/ha)
Varieties					
CoH 167(ML)	38.9	134.9	108.1	838	88.7
CoH 119 (ML)	42.9	127.5	98.3	949	91.2
Co 5011(ML)	41.0	131.3	94.9	859	79.5
CoH 160 (Eary)	45.6	144.6	99.1	845	81.5
Co 0238 (Eary)	55.3	130.4	94.6	1036	95.2
Co 0118 (Eary)	51.7	127.1	84.4	909	74.6
CD at 5%	3.6	7.6	5.7	41	4.8
Irrigation schedule (IW/CPE)					
1.0	45.8	145.0	102.8	938	93.6
0.3	46.0	120.2	90.3	874	76.6
CD at 5%	NS	3.1	2.1	25	3.1

Table AS 74.4.2: Irrigation water applied, rainfall received and other water parameters during the crop season at Uchani

Varieties	IW/ CPE	Total Pre-monsoon irrigation (cm)	Post monsoon irrigation (cm)	Total rainfall (cm)	Total water (Irrigation + rainfall) (cm)	Cane yield (t/ha)	Cane yield /1000 litres of irrigation water (kg)
CoH 167	1.0	60.0	52.5	70.5	183.0	97.1	8.63
CoH 119	1.0	60.0	52.5	70.5	183.0	100.1	8.90
Co 5011	1.0	60.0	52.5	70.5	183.0	87.2	7.75

CoH 160	1.0	60.0	52.5	70.5	183.0	89.7	7.97
Co 0238	1.0	60.0	52.5	70.5	183.0	103.7	9.22
Co 0118	1.0	60.0	52.5	70.5	183.0	83.7	7.44
CoH 167	0.3	22.5	52.5	70.5	145.5	80.0	10.67
CoH 119	0.3	22.5	52.5	70.5	145.5	82.3	10.97
Co 5011	0.3	22.5	52.5	70.5	145.5	71.8	9.57
CoH 160	0.3	22.5	52.5	70.5	145.5	73.2	9.76
Co 0238	0.3	22.5	52.5	70.5	145.5	86.7	11.56
Co 0118	0.3	22.5	52.5	70.5	145.5	65.5	8.73

5. SHAHJAHANPUR

The soil of experimental field was medium in organic carbon (0.58%), phosphorus (12.00 kg/ha) and potash (129 kg/ha) with PH 7.10. Experimental sugarcane crop was planted on 11.02.2019 and harvested on 12.02.2020. Data (Table AS 74.5.1) revealed that variety CoLk 94184 produced significantly higher cane yield (94.10 t/ha) followed by CoSe 11453 with cane yield of 89.80 t/ha. IW/CPE ratio 1.0 gave significantly higher cane yield of 86.80 t/ha than that of IW/CPE ratio 0.3 with cane yield of (78.90 t/ha). CCS% was not affected significantly with different varieties and IW/CPE ratio.

Table AS 74.5.1: Yield attributes and cane yield of sugarcane genotypes under different irrigation regimes at Shahjahanpur

Treatment	Germination (%)	Shoots (000/ha)			NMC (000/ha)	Cane (yield t/ha)	CCS (%)
		90 DAP	120 DAP	150 DAP			
A - Varieties							
V ₁ - UP 05125	56.5	112.6	141.7	154.9	118.1	73.8	13.45
V ₂ - CoS 13231	47.3	116.0	140.7	160.5	127.7	68.2	13.47
V ₃ - CoLk 94184	38.6	111.4	131.7	157.0	131.2	94.1	13.44
V ₄ - CoS 08279	57.8	98.6	124.8	159.0	116.4	87.9	13.42
V ₅ - CoS 09232	43.1	97.8	115.1	137.6	107.4	83.5	13.58
V ₆ - CoSe 11453	42.3	108.8	124.2	155.4	119.0	89.8	13.38
SE±	4.91	3.29	4.33	5.60	3.73	2.91	0.43
CD at 5%	10.93	7.34	9.65	12.47	8.31	6.49	NS
B - Irrigation regimes							
I ₁ - IW/CPE ratio 1.0	42.6	111.3	133.8	157.5	124.4	86.8	13.6
I ₁ - IW/CPE ratio 0.3	52.5	101.8	125.6	146.8	115.6	78.9	13.3
SE±	2.44	1.49	0.35	1.75	1.47	0.14	0.18
CD at 5%	NS	6.41	1.52	7.51	6.31	0.58	NS

PENINSULAR ZONE

6. PUNE

The field experiment was conducted on evaluation of sugarcane varieties for drought tolerance at VSI, Pune. Data pertaining to effect of treatments on various aspects of growth, yield, quality, moisture studies, physiological parameters were recorded. Perusal of data (**Table AS 74.6.1**) revealed that significantly highest tiller Count (0.55, 1.31 lakh/ha) at 90 & 120 DAP was found with application of irrigation at 1.0 IW/CPE ratio. Data regarding tiller count showed significant differences among the genotypes. Genotype Co 86032 registered significantly higher tiller Count (0.70 & 1.40 lakh/ha) at 90 & 120 DAP, but more or less at par with CoM 0265, VSI 12121, CoVSI18121 & VSI 12003. Whereas, significantly minimum tiller Count (0.39 & 1.17 lakh/ha) registered by VSI 434 during 90 & 120 DAP respectively. Irrigation at 1.0 IW/CPE ratio gave significantly higher cane yield (122.42 t/ha) over application of irrigation water at 0.3 IW/CPE ratio. Among genotype VSI 12121 registered significantly higher cane yield (137.48 t/ha), but in the same line with the CoM 0265 & CoVSI 18121. Genotype VSI 434 recorded lower cane yield (81.19 t/ha).

The interaction effect between irrigation levels and genotypes was found to be significant. Combination of irrigation at 1.0 IW/CPE ratio and genotype VSI 12121 registered significantly maximum (152.31 t/ha) cane yield, which remained at par with treatment combination I1V1, I2V1, I2V3. Whereas lower cane yield (63.31 t/ha) recorded with combination of irrigation at 0.3 IW/CPE ratio and genotype VSI 434. It is evident from data that different irrigation levels positively impacted CCS yield. Irrigation at 1.0 IW/CPE ratio recorded significantly highest CCS yield (19.83 t/ha). Genotype VSI 12121 registered significantly maximum CCS yield (21.61 t/ha), at par with the CoM 0265, CoVSI 18121 and Co 86032. Minimum CCS yield (12.07 t/ha) was registered by genotype VSI 434.

The interaction effect between irrigation levels and genotypes was found to be significant. Combination of application of irrigation water at 1.0 IW/CPE ratio and genotype VSI 12121 registered significantly maximum (23.07 t/ha) CCS yield, which remained on same line with treatment combination I1V1, I2V1, I2V3. Whereas lower CCS yield (9.08 t/ha) recorded in treatment Combination of application of irrigation water at 0.3 IW/CPE ratio and genotype VSI 434.

Table AS 74.6.1: Growth attributes and cane yield of sugarcane genotypes under different irrigation regimes at Pune

Treatment details	Germination at 45 DAP (%)	Tiller Count at 90 DAP (lakh/ha)	Tiller Count at 120 DAP (lakh/ha)	Cane yield (t/ha)	CCS yield (t/ha)
Irrigation levels					
I ₁ : 0.3 IW/CPE	56.88	0.48	1.23	94.26	14.07
I ₂ : 1.0 IW/CPE	54.97	0.55	1.31	122.42	19.83
SEm±	0.40	0.010	0.009	3.98	0.30
C.D. @ 5%	NS	0.06	0.057	24.22	1.88
CV%	3.50	9.94	3.63	18.00	8.92
Genotypes					
V ₁ : CoM0265	58.47	0.56	1.38	136.45	20.73
V ₂ : VSI12121	58.33	0.56	1.33	137.48	21.61
V ₃ : Co86032	52.33	0.70	1.40	104.97	18.24
V ₄ : CoVSI18121	54.00	0.62	1.36	110.45	17.05

V ₅ : VSI12003	59.83	0.55	1.30	104.14	16.12
V ₆ : CoVSI03102	55.83	0.43	1.16	100.44	15.71
V ₇ :CoVSI13020	57.33	0.44	1.16	99.64	15.31
V ₈ : VSI434	51.33	0.39	1.17	81.19	12.07
SEm±	1.62	0.04	0.039	10.53	1.53
C.D. @ 5%	4.91	0.12	0.11	31.94	4.66
CV%	7.10	19.14	7.51	23.81	22.22
Interaction I×V					
SEm±	2.73	0.07	0.089	12.35	1.89
C.D. @ 5%	NS	NS	NS	37.46	5.76
CV%	8.45	23.65	12.15	19.74	19.40

Table AS 74.6.2: Interaction effect of irrigation levels and genotypes on cane yield (t/ha) at Pune

Irrigation levels	I₁: 0.3 IW/CPE	I₂: 1.0 IW/CPE
Genotypes		
V ₁ : CoM0265	119.28	144.46
V ₂ : VSI12121	108.59	152.31
V ₃ :Co86032	102.61	122.76
V ₄ :CoVSI18121	99.97	102.28
V ₅ : VSI12003	87.17	99.69
V ₆ : CoVSI03102	96.20	100.91
V ₇ :CoVSI13020	76.99	104.64
V ₈ : VSI434	63.31	99.07
SEm±	12.35	
C.D. @ 5%	37.46	
CV%	19.74	

Table AS 74.6.3: Interaction effect of irrigation levels and genotypes on CCS yield (t/ha) at Pune

Irrigation levels	I₁: 0.3 IW/CPE	I₂: 1.0 IW/CPE
Genotypes		
V ₁ : CoM0265	17.46	22.97
V ₂ : VSI12121	17.15	23.07
V ₃ :Co86032	15.89	20.12
V ₄ :CoVSI18121	15.28	15.94
V ₅ : VSI12003	12.03	16.98
V ₆ : CoVSI03102	14.80	16.26
V ₇ :CoVSI13020	11.29	16.52
V ₈ : VSI434	9.08	15.02
SEm±	1.89	
C.D. @ 5%	5.76	
CV%	19.40	

7. SANKESHWAR

Among irrigation regimes, IW/CPE ratio 1.0 irrigation schedule recorded significantly higher cane yield (122.55 t/ha) compared to IW/CPE ratio 0.3 (103.73 t/ha). The higher cane yield recorded with IW/CPE ratio 1.0 was owing to significantly higher yield attributing characters viz., number of millable canes (83080 / ha) and single cane weight (1.74 kg / cane) compared to IW/CPE ratio 0.3. The data on sugarcane juice quality indicated that IW/CPE

ratio 1.0 recorded significantly superior viz., brix, Pol, CCS % and CCS yield (14.92 t/ha) compared to irrigation scheduling at IW/CPE ratio 0.3. The mid-late cultivar CoSnk 09227 recorded significantly higher cane yield (133.93 t/ha) compared to other cultivars except mid-late cultivar Co 86032 (124.61 t/ha) which was on par with CoSnk 09227. However, cane yield with early cultivar SNK 088789 (117.20 t/ha) and mid-late cultivar SNK 09268 (117.06 t/ha) were on par with each other. Significantly lower yield was with early cultivar CoC 671 (91.23 t/ha). Similar trend was noticed with NMC and single cane weight.

Effect of cultivars on sugarcane juice quality parameters viz., brix, pol and CCS % indicated that, significantly higher value were with mid-late cultivar CoSnk 09227 and Co 86032, both were on par with each other. However, purity % did not significantly differ among the cultivars. Mid-late cultivars CoSnk 09227 (16.03 t/ha) and Co 86032 (15.24 t/ha) recorded significantly higher CCS yield compared to other cultivars. Significantly lower CCS yield was with CoSnk 07680 (12.14 t/ha).

Higher cane yield and yield attributes were recorded for interactions. Among the interaction CoSnk 09227 with IW/CPE ratio 1.0 (148.09 t/ha) recorded significantly higher cane yield as compared to other interactions. This was due to higher NMC and single cane weight in this interaction. The next best interactions were I1 C1 and I1 C3 which were at par with each other. Irrigation scheduling at IW/CPE ratio 0.3 with mid-late cultivar CoSnk 09227 and early cultivar SNK 088789 recorded higher cane yield of 119.77 t/ha and 105.81 t/ha respectively. Mid-late cultivars CoSnk 09227 and Co 86032 with IW/CPE ratio 1.0 recorded significantly higher brix, Pol and CCS yield, both were on par with each other. The purity % did not differ significantly due to interaction effects.

Table AS 74.7.1: Yield attributes and cane yield of sugarcane genotypes under different irrigation regimes at Sankeshwar

Vertical strips {Cultivars}		Cane yield (t ha ⁻¹)			NMC 000 ha ⁻¹			Single cane weight (kg)		
		Horizontal strips (IW/CPE ratio)								
		I ₁	I ₂	Mean	I ₁	I ₂	Mean	I ₁	I ₂	Mean
C ₁	Co 86032 (Midlate)	133.9	115.26	124.61	88.19	76.50	82.34	1.96	1.56	1.76
C ₂	Co SNK 09227 (Midlate)	148.0	119.77	133.93	93.51	78.26	85.89	1.93	1.53	1.73
C ₃	SNK 09268 (Midlate)	127.3	106.80	117.06	81.25	69.32	75.28	1.72	1.46	1.59
C ₄	Co SNK 07680 (Early)	101.6	87.98	94.82	74.79	62.70	68.74	1.64	1.40	1.52
C ₅	SNK 088789 (Early)	128.5	105.81	117.20	88.82	70.33	79.58	1.72	1.44	1.58
C ₆	CoC 671 (Early)	95.68	86.78	91.23	71.94	61.08	66.51	1.45	1.53	1.49
	Mean	122.5	103.73		83.08	69.70		1.74	1.49	
		S.Em±		C.D at 5%	S.Em±		C.D at 5%	S.Em±		C.D at 5%
	IW/CPE ratio (I)	1.50		9.1	0.95		5.8	0.01		0.03
	Cultivars (C)	2.25		7.1	1.53		4.9	0.02		0.07
	Horizontal strips at same level of Vertical strips	2.66		10.9	1.61		6.41	0.02		0.08
	Horizontal strips at same or different level of Vertical strips	2.82		8.9	1.83		NS	0.03		0.09

C1 – IW/CPE=1.0

C2 – IW/CPE=0.3

Table AS 74.7.2: Juice quality attributes of sugarcane genotypes under different irrigation regimes at Sankeshwar

Vertical strips {Cultivars}		Brix (%)			Pol (%)			CCS %			CCS yield t ha ⁻¹		
		Horizontal strips (IW/CPE ratio)											
		I ₁	I ₂	Mean	I ₁	I ₂	Mean	I ₁	I ₂	Mean	I ₁	I ₂	Mean
C ₁	Co 86032 (Midlate)	19.34	18.34	18.84	17.50	17.19	17.35	12.24	12.2	12.2	16.4	14.0	15.24
C ₂	Co SNK 09227 (Midlate)	19.34	18.51	18.93	17.21	17.03	17.12	11.94	12.0	11.9	17.6	14.3	16.03
C ₃	SNK 09268 (Midlate)	18.84	18.68	18.76	17.42	17.23	17.33	12.30	12.1	12.2	15.6	12.9	14.33
C ₄	Co SNK 07680 (Early)	19.51	20.34	19.93	17.08	19.51	18.30	11.76	14.0	12.8	11.9	12.3	12.14
C ₅	SNK 088789 (Early)	19.29	18.01	18.65	17.21	16.49	16.85	11.96	11.5	11.7	15.3	12.2	13.82
C ₆	CoC 671 (Early)	20.01	20.51	20.26	18.40	19.69	19.05	12.96	14.1	13.5	12.4	12.2	12.33
	Mean	19.39	19.07		17.47	17.86		12.19	12.6		14.9	13.0	
		S.Em±	C.D at 5%		S.Em±	C.D at 5%		S.Em±	C.D at 5%		S.Em±	C.D at 5%	
	IW/CPE ratio (I)	0.17	NS		0.09	NS		0.11	NS		0.28	1.68	
	Cultivars (C)	0.19	0.61		0.16	0.51		0.15	0.47		0.30	0.94	
	Horizontal strips at same level of Vertical strips	0.30	0.24		0.23	0.85		0.24	0.91		0.50	2.01	
	Horizontal strips at same or different level of Vertical strips	0.28	0.87		0.23	0.73		0.23	0.71		0.43	1.37	

EAST COAST ZONE

8. NAYAGARH

The experiment was laid out in strip plot design with three early maturing varieties viz: CoOr 03151, CoOr 03152, CoOr 05346, three mid-late maturing varieties: CoOr 04151, CoOr 10346, Co 86249 with two irrigation regimes i.e IW/CPE ratio 1.0 and IW/CPE ratio 0.3 to evaluate the drought tolerance capacity of the varieties. Among early maturing varieties, CoOr 03151 with IW/CPE ratio 0.3 recorded significantly different growth and yield parameters compared to other varieties CoOr 03152, CoOr 05346. Similarly among mid-late maturing varieties, CoOr 04151 with IW/CPE ratio 0.3 recorded significantly different growth and yield parameters compared to other varieties CoOr 10346, Co 86249. So this is possibly due to better drought tolerant capacity of these two varieties compared to other varieties.

Table AS 74.8.1: Yield attributes and cane yield of sugarcane genotypes under different irrigation regimes at Nayagarh

Treatments	Germination % at 45 DAP	No of tillers (000/ha) at 120 DAP	NMC (000/ha)	Cane yield (t/ha)	Juice Brix %	CCS %	CCS yield (t/ha)
Irrigation schedule							
I₁	53.63	86.41	87.65	99.89	21.13	11.91	11.91
I₂	51.19	76.29	76.88	86.46	20.96	11.74	10.16
Sem ±	0.47	0.478	0.400	0.564	0.324	0.072	0.124
CD at 5 %	NS	2.905	2.434	3.430	NS	NS	0.753
Variety							
V₁	52.42	84.76	84.97	95.86	21.12	12.09	11.59
V₂	53.33	81.38	81.62	92.10	21.57	11.76	10.85
V₃	51.43	80.62	81.45	92.96	21.60	11.81	10.98
V₄	53.13	81.33	83.23	95.97	21.01	11.82	11.39
V₅	53.42	80.74	81.29	91.15	20.87	11.63	10.58
V₆	50.73	79.27	81.04	91.03	20.11	11.86	10.80
SEm ±	1.11	0.925	0.860	0.975	0.504	0.206	0.219
CD at 5 %	NS	2.727	2.537	2.876	NS	NS	0.647

Table AS 74.8.2: Drought tolerance characteristics of sugarcane genotypes under different irrigation regimes at Nayagarh

Treatment	Relative Water content (before irrigation)	Relative Water content (after irrigation)	Specific leaf weight (g/cm ²)
Irrigation schedule			
I₁	88.85	90.31	0.41
I₂	75.6	82.21	0.37
Variety			
V₁	84.3	90.26	0.38
V₂	81.23	84.74	0.364
V₃	80.21	84.8	0.362
V₄	85.55	90.27	0.387
V₅	81.64	85.82	0.37
V₆	81.93	86.53	0.374

NORTH CENTRAL & NORTH EASTERN ZONE

9. PUSA

Varieties had significant impact on growth, yield attributes, cane yield and most of the quality parameters of sugarcane. Higher plant population (189600/ha), LAI (3.68) and millable canes (126500/ha) were recorded with CoP 2061 except cane diameter and single cane weight. Hence, CoP 2061 gave highest cane yield (90.5 t/ha) which was statistically similar to CoP 16437 (87.3 t/ha) and CoP 9437 (83.2 t/ha). Though higher brix, pol, juice recovery, CCS percent at 10 and 12 months stage and sugar yield at harvest were obtained from CoP 16437.

Among irrigation regimes significantly higher growth and yield attributes viz., plant population (157800/ha), plant height (298 cm), LAI (3.69), millable canes (109300/ha) and single cane weight (896 g/plant) were obtained with IW: CPE ratio 1.00. Similarly significantly higher cane yield (95.8 t/ha), juice recovery at 10 and 12 months stage and sugar yield (11.9 t/ha) were obtained with IW: CPE ratio 1.00. The number of irrigation was 8 and

2 at IW: CPE ratio 1.00 and 0.30, respectively. The total water applied on the basis of depth (7.5 cm) and number of irrigations was 60 and 15 cm at IW: CPE ratios 1.00 and 0.30, respectively.

Table AS 74.9.1: Yield attributes and cane yield of sugarcane genotypes under different irrigation regimes at Pusa

Varieties	Plant population ($\times 10^3$ /ha)	Plant height (cm) at 240 DAP	Cane diameter (cm)	LAI	Millable canes ($\times 10^3$ /ha)	Single cane weight (g)	Cane yield (t/ha)
CoP 16437	107.5	293	2.83	3.65	85.9	10.35	87.3
CoP 112	121.2	282	2.44	2.82	90.5	778	69.7
BO 153	160.8	242	2.01	3.29	114.2	681	75.9
CoP 2061	189.6	295	2.34	3.68	126.5	721	90.5
BO 154	138.7	281	2.41	3.28	98.7	765	74.7
CoP 9437	125.3	268	2.58	2.96	93.4	901	83.2
SEm (\pm)	5.87	13.2	0.11	0.14	4.48	38.4	3.67
CD (P=0.05)	18.5	NS	0.34	0.44	14.1	121	11.6
CV (%)	10.2	12	10.90	10.43	10.8	12	11.2
Irrigation regimes (IW/CPE)							
I ₁ :1.00	157.8	298	2.56	3.69	109.3	896	95.8
I ₂ : 0.30	123.2	256	2.31	2.87	93.8	731	64.6
SEm (\pm)	2.78	5.8	0.05	0.07	1.95	17.0	1.8
CD (P=0.05)	16.9	35	0.32	0.41	11.8	103	10.9
CV (%)	8.4	9	9.21	8.79	8.1	9	9.5

Table AS 74.9.2: Juice quality of sugarcane genotypes under different irrigation regimes at Pusa

Treatment	Brix (%)		Pol (%)		Purity (%)	
	10 th month	12 th month	10 th month	12 th month	10 th month	12 th month
Variety						
CoP 16437	21.1	21.8	18.49	19.19	87.7	88.0
CoP 112	20.0	20.5	17.88	18.16	89.4	88.8
BO 153	19.0	19.6	16.61	17.35	88.5	88.5
CoP 2061	18.5	18.9	16.14	16.62	87.6	87.9
BO 154	19.1	19.3	16.75	17.13	87.7	88.7
CoP 9437	19.8	20.4	17.61	18.11	89.0	88.8
SEm (\pm)	0.18	0.22	0.11	0.23	0.72	0.44
CD (P=0.05)	0.56	0.69	0.36	0.73	NS	NS
CV (%)	2.23	2.69	1.63	3.18	1.99	1.21
Irrigation regimes (IW/CPE)						
I ₁ : 1.00	19.6	20.2	17.28	17.90	88.7	88.5
I ₂ : 0.30	19.6	19.9	17.20	17.62	87.9	88.4
SEm (\pm)	0.09	0.12	0.15	0.10	0.39	0.33
CD (P=0.05)	NS	NS	NS	NS	NS	NS
CV (%)	1.96	2.58	3.65	2.35	1.87	1.58

10. BETHUADHARI

The experiment was planted during March 2019 with early maturing: V1- CoLk 94184, V2 -CoSe 95422, V3 -BO 130 and mid – late maturing: V4 - BO 91, V5 -CoP 06436, V6 -CoP 9301 varieties evaluated under different moisture regimes.

Table AS 74.10.1: Yield attributes and cane yield of sugarcane genotypes under different irrigation regimes at Bethuadhari

Treatments	Brix(%) 10 month	Brix (%) 12 month	Sucrose (%) 10month	Sucrose (%) 12month	Cane yield(t/ha)	CCS (%)	CCS(t/ha)
Irrigation schedule (IW/CPE)							
I ₁	16.43	16.94	15.30	15.84	67.30	9.57	6.51
I ₂	15.67	16.05	14.66	15.38	58.43	8.71	5.20
SEm(±)	0.18	0.21	0.11	0.15	2.11	0.34	0.41
CD at 5%	0.56	0.63	0.34	0.44	6.34	1.02	1.24
Varieties							
V ₁	16.77	16.79	15.87	15.83	77.69	9.82	7.65
V ₂	15.88	15.89	15.33	15.76	58.70	9.09	5.35
V ₃	16.07	16.09	15.02	15.50	53.95	8.50	4.61
V ₄	17.04	18.48	15.77	16.63	80.02	10.59	8.47
V ₅	15.73	16.05	13.96	15.23	57.03	8.70	4.99
V ₆	14.83	15.65	13.87	14.69	49.79	8.13	4.07
SEm(±)	0.31	0.25	0.29	0.32	2.82	0.41	0.34
CD(P=0.05)	0.94	0.76	0.89	0.95	8.46	1.22	1.02
CV	8.95	4.55	9.56	5.64	5.32	4.35	5.65
Interaction	NS	Sig	NS	Sig	Sig	NS	Sig

Table AS 74.10.2: Interaction effect of different levels of irrigation schedule and varieties on the qualitative and quantitative parameters of different sugarcane varieties

Treatments	Brix (%) 12 month		Sucrose (%) 12 month		Cane yield (t/ha)		CCS (t/ha)	
Varieties	Irrigation schedule(IW/CPE)							
	I ₁	I ₂	I ₁	I ₂	I ₁	I ₂	I ₁	I ₂
V ₁	17.36	16.23	16.37	15.29	83.18	72.20	8.56	6.75
V ₂	16.53	15.26	15.73	15.80	63.15	54.25	6.04	4.67
V ₃	16.41	15.78	15.46	15.55	59.65	48.25	5.36	3.86
V ₄	18.72	17.25	16.70	16.57	81.80	78.25	8.72	8.23
V ₅	16.52	15.59	15.69	14.78	62.71	51.35	5.80	4.18
V ₆	16.10	15.20	15.10	14.28	53.29	46.29	4.63	3.51
SEm(±)	0.18	0.31	0.21	0.25	2.98	3.41	0.33	0.34
CD(P=0.05)	0.55	0.94	0.64	0.75	8.96	10.23	0.98	1.02
	V X I	I X V	V X I	I X V	V X I	I X V	V X I	I X V

IMPORTANT OBSERVATIONS:

- Moisture stress during pre-monsoon growth phase brought about significant reduction in cane yield across all the zones. The loss in yield ranged within 20 to 35 % in different sugarcane growing zones.
- Sugarcane varieties found resilient against moisture stress in different sugarcane growing zones are:

Zone	Early maturing	Mid-late maturing
North West	CoPb 92, CoPk 05191, CoLk 94184, Co 0238	CoPb 94, Co 05011, CoLk 11206, CoSe 11453, CoH 119, CoH 9264, CoPb 91
Peninsular	SNK 088789	Co 86032, CoM 0265, VSI 12121, CoSnk 09227
North central	CoP 16437, CoLk 94184	CoP 2061, BO 91
East coast	CoOr 03151	CoOr 04151

SUMMARY OF THE ACHIEVEMENTS FOR THE YEAR 2019-20

A look on advancements in sugarcane research, its production scenario and the transfer of technology to the stake holders during the recent past evinces encouraging trends and new challenges. On the research front development of new high yielding high sugar varieties supported with suitable production and protection technologies made sugar sector viable on one hand and left ample scope for diversification on the other. During the year 2019-20 as per the latest estimates sugar production is expected to be around 27 million tonnes with sugarcane production of more than 355 million tonnes produced from 4.83 million hectares. The largest sugarcane and sugar producing state of Uttar Pradesh is estimated to produce about 12 million tonnes of sugar by crushing comparatively less cane with a high recovery of 11.48%. The increased production and sugar recovery have provided scope for diverting sugarcane juice, B-heavy molasses and other substrates for the production of ethanol to be used as bio-fuel for automobiles. With the development of high biomass producing sugarcane cultivars it is required to develop suitable production technologies for enough anchorage to roots to hold the crop from lodging, enhanced water and nutrient use efficiency in view of price escalation of these resources, technologies for bringing in resilience against adverse impacts of climate change and micro and macro level crop and product diversification to enhance the income of sugarcane growers. For the year 2019-20 the trials under Crop Production discipline of AICRP on Sugarcane were designed and carried out to develop recommendations for addressing these issues. These were concentrated on aspects such as agronomic evaluation of promising genotypes for their performance potential under broader row spacing and enhanced fertility level, integrated nutrient management schedule for sugarcane production system to ensure soil health and crop productivity, and also to assess the water productivity and drought tolerance potential of newly released varieties of sugarcane. Most of the centres carried out these trials in the true research spirit and reported the results as per the prescribed format. However, Akola faced the constraints like scarcity of irrigation water and could not conduct the trials. A summary table showing no. of centres allotted, conducted and not conducted the stipulated experiments during 2019-20 is given in Appendix I.

The experiment wise summaries of the results are presented below:

AS 68: Impact of integrated application of organics and inorganics in improving soil health and sugarcane productivity

The trial initiated during the year 2010-15 with allotment to all the centres. However, during the year 2019-20 only 08 centres carried out the trial.

NORTH WEST ZONE

1. FARIDKOT

The second ratoon (CoJ 88) crop was initiated on 11.02.2019 and the ratoon cane yield (75.6 t/ha) was the highest with application of FYM/Compost @ 20 tonnes/ha + inorganic nutrient based on soil test (T6) which was significantly higher than all treatments except, T2 (67.8 t/ha), T3 (70.7 t/ha), T5 (71.5 t/ha), T6 (75.6 t/ha), T8 (69.3 t/ha) and T9 (71.5 t/ha). These treatments also have the residual effect of FYM applied to plant crop. Same trend was there for CCS t/ha.

2. LUCKNOW

The data of second ratoon sugarcane growth, yield and quality (Table AS 68.2.1) indicates significant variations among the treatments. Highest number of tillers (132.4 thousand /ha at 120 days after ratooning), shoot count (135.6 thousand/ha at 150 DAR) and (136.9 thousand/ha at 180 DAR), higher number of millable cane (NMC- 122.8 thousand/ha), sugarcane yield (66.17 t/ha) and sugar yield (7.91 t/ha) were recorded under the treatment, where application of FYM @ 20 t/ha was done along with soil test (rating chart) based inorganic fertilizer recommendations.

3. SHAHJAHANPUR

Experimental mean data of two crop cycle (Table 1b) indicated that application of FYM @ 10 tonnes/ ha + bio – fertilizers (Azotobacter + PSB) + inorganic nutrients on soil test basis produced significantly higher cane yield of 113.60 t/ha, 99.02 and 88.96 in plant, 1st ratoon and second ratoon cane, respectively than those of other treatments. CCS% in cane was not affected significantly with different treatments in plant cane, first ratoon and second ratoon cane.

4. UCHANI

FYM 20 t/ ha + 100% RDF through inorganic source (T6) and FYM @ 20 t/ ha + soil test basis fertilizer (T5) were found best treatments in terms of number of tillers (141.7, 140.3 thousands/ha), millable canes (114.7, 113.3 thousands/ha) and ratoon cane yield (91.9, 90.5 t/ha) as compared to rest of the treatments. These treatments were at par with T8- FYM 10 t/ha + biofertilizers application with 100% RDF and T9- FYM 10 t/ha + biofertilizers with soil test based fertilizers application.

PENINSULAR ZONE

5. SANKESHWAR

Application of nutrients based on soil test value with application of trash 10 t/ha or application of trash 10 t/ha along with 100% RDF or with application of FYM/Compost at 20 tonnes/ha along with application of nutrients based on soil test value or 50 % RDF or 100%RDF recorded higher cane yield and yield parameters.

EAST COAST ZONE

6. NAYAGARH

Results obtained from second ratoon crop indicated that application of FYM/ Compost @ 10 t/ha + (Azotobacter + PSB) + 100% RDF (T8) and application of FYM/ Compost @ 10t/ha + Azotobacter + PSB + Soil test based (NPK) fertilizer application (T9) recorded higher percentage of sprouting at 45 DAR i.e. 39.29 and 40.56%, respectively.

NORTH CENTRAL ZONE

7. SEORAH

Significantly higher Cane yield (84.13 t/ha) was observed with application of FYM @ 10 t/ha+ bio-fertilizer (Azotobacter + PSB) + soil test basis NPK application (T9) over other treatments except treatment i.e. application of trash 10t/ha soil test basis NPK, FYM @20

t/ha with soil test basis NPK and FYM 10t/ha + biofertilizers with 100 per cent RDF. Sucrose percent was not affected significantly by different practices.

8. PUSA

Integrated application of nutrients was found effective in improving soil fertility and cane yield. The application of fertilizers on soil test along with organics @ 20 t/ha was found suitable for boosting cane yield and maintaining soil fertility in calcareous soil of Bihar.

IMPORTANT OBSERVATIONS:

The experiment was carried out at 08 stations out of allotted 24. Following salient points emerged from findings:

- Combined application of organic and inorganic sources of nutrients was found conspicuously better over the use of fertilizers alone across the centres located in different agro-climatic conditions.
- Sugarcane trash used as mulch in ratoon crops has little contribution as a source of nutrients as organic amendments like FYM or compost recorded significant improvement in cane and sugar yield over that with trash mulching under the use of recommended dose of fertilizers across the locations.
- Use of organic sources of nutrients in plant ratoon system brings about substantial enhancement of soil health parameters in most of the sugarcane growing soils.

AS-72: Agronomic performance of elite sugarcane genotypes

The trial was initiated during 2016-17 and was allotted to all the centres. During the year (2019-20) 13 centres reported the results. Centre wise summary of findings for the year are given below:

NORTH WEST ZONE

1. FARIDKOT

For early maturing genotypes although interaction between fertilizer levels and genotypes was non- significant but yield of all genotypes were better at 125% RDF. The highest cane yield was of CoPb 14181 (92.1 t/ha) followed by CoPb 14211 (89.2 t/ha). Among mid-late genotypes the yield was significantly better at 125% RDF than 100%. The number of millable canes was better at 125% than 100%. The highest cane yield was of CoPb 14185 (88.4/ha) which was at par with CoPb 14184 (87.9 t/ha) and was significantly better than other all genotypes.

2. KOTA

Among early genotypes CoLk 14201 recorded significantly higher germination (52.17 %), no. of tillers (141.07 thousand/ha) and cane length (223.00 cm). Genotypes were found at par with each other in case of single cane weight, cane yield. Highest number of millable canes was recorded (94.00 thousand/ha) under CoLk 14201 which is significantly superior over CoJ 64 (zc) and at par with other genotypes. Similarly CoLk 14201 recorded maximum and significantly higher Brix (22.67 %), sucrose (22.20%) CCS percent (14.03%) and CCS yield (13.54 t/ha).

Performance of mid-late maturing genotypes at 100% RDF level revealed that among genotypes CoLk 14203 recorded higher germination (50.30 %). Significantly superior cane length (239.65 cm), single cane weight (1015.00 gm), tillers (142.75 thousand/ ha) and number of millable cane (92.80 thousand/ha) were there under CoLk 14203. Similarly, CoLk 14203 recorded maximum and significantly higher CCS yield (12.77 t/ha). Whereas, Brix

(22.05), sucrose (19.57 %) and CCS (13.56 %) was recorded highest with CoLk 14203 and also significantly superior over zonal checks (CoS 767, CoPant 97222 and Co 05011) and at par with Co 14035 and CoPb 14184, CoPb 14185 and CoH 14261 genotypes. Cane yield (94.35 t/ha) was recorded maximum with CoLk 14203 which was significantly higher over rest of genotypes and zonal checks.

3. LUCKNOW

Among different mid-late genotypes CoLk 14204 gave highest MNC, cane and CCS yield closely followed by CoLk 14203 over rest of the genotypes. The 125 % RDF did not affect any of the growth and yield parameters significantly over recommended doses of fertilizer.

4. SHAHJAHANPUR

In early group, standard Co 0238 produced significantly higher cane yield (94.00 t/ha) followed by genotype CoLk 14201 (85.60 t/ha). In mid – late group standard Co 05011 produced significantly higher cane yield (84.10 t/ha) followed by standard CoS 767 (80.30 t/ha) and genotype CoPb 14184 (79.20 t/ha). Regarding fertility levels significantly higher cane yield was obtained with 125% recommended dose of NPK than that of 100% RDF of NPK in both early and mid-late genotype.

5. UCHANI

Germination per cent, tillers, NMC, cane weight and cane yield were not affected significantly due to different fertility levels. Varieties in early group differed significantly in terms of germination whereas, mid late entries did not differ significantly. Varieties Co 0238 (107.2 t/ha) and CoLk 14201 (104.9 t/ha) being at par produced significantly highest cane yield in comparison to rest of the varieties. Varieties CoJ 64 (79.1 t/ha) and CoPb 14211 (80.6 t/ha) being at par produced the lowest cane yield. Interaction between fertility levels and varieties was not found significant. Among mid maturing entries, Varieties CoH 14261 (108.0 t/ha), CoPb 14184 (107.2 t/ha) and CoPb 14185 (106.5 t/ha) being at par produced significantly highest cane yield among all the entries. Lowest cane yield was recorded in variety CoS 14233 (91.9 t/ha). Interaction was not found significant.

PENINSULAR ZONE

6. PUNE

In the light of results obtained from present investigation, it can be concluded that, for securing maximum cane yield and net returns crop should be fertilized with 125% RDF. In the case of genotypic performance Co 13020 found better with maximum germination, whereas, CoSnK 13106 performed better in tillering, CoSnK 05103 for NMC and MS 13081 for growth attributes. While cane yield, CCS yield and B;C ratio was higher in Co 13008. Whereas, CoC 671 showed superior juice quality.

7. KOLHAPUR

Among genotypes cane yield and yield parameters did not differ significantly with 100 or 125 % RDF application and also due to interaction between fertilizer levels and cultivars. Among the cultivars Co 13008 recorded significantly superior cane yield and CCS yield.

8. SANKESHWAR

Among cultivars cane yield and yield parameters did not differ significantly with 100 or 125 % RDF application and for interaction effects of both fertilizer levels and cultivars. Among the cultivars MS 13081 recorded significantly higher cane yield. The next best cultivar was Co 13009 which was on par with MS 13081 with respect to cane yield.

9. COIMBATORE

Sugarcane cane yield was influenced significantly due to different elite genotypes wherein, elite sugarcane genotype Co 13008 recorded significantly higher cane yield (134.00 t/ha) than two standard check varieties Co 86032 (122.65 t/ha) and CoC 671(118.39t/ha). Cane yield and juice quality were not influenced significantly due to fertilizer levels. Juice quality (Brix, sucrose, purity and CCS percent) was studied by collecting cane samples at harvest. Juice Brix, Sucrose%, Purity % and CCS % at harvest showed significant varietal differences. Among different entries, Co13020 recorded significantly higher mean sucrose % of 20.57 than Co 86032.

EAST COAST ZONE

10. NAYAGARH

Analysis of variance suggested that there is significant variations among the genotypes with respect to germination %, number of tillers at 180 days and number of millable canes ('000/ha). The genotype CoC 15338 produced the highest average cane yield of 95.36 t/ha with application of 125 % RD of fertilizers.

NORTH CENTRAL ZONE

11. PUSA

Zonal check variety (early) CoSe 95422 was still doing best among the varieties. Among mid-late group variety CoP 06436 recorded higher growth, yield attributes and cane yield which was statistically similar to CoSe 14455. Application of 125% recommended dose of NPK brought significant improvement in plant population, millable canes and cane yield for both the group of genotypes.

12. SEORAH

In early genotypes significantly higher cane yield was observed in CoSe 14455, CoSe 14451 and CoLk 14206 over checks i.e. CoLk 94184 and CoSe 01421. Among mid late genotypes CoLk 14208 produced significantly higher cane yield over all genotypes and checks except CoSe 14455. Sucrose per cent was not affected significantly by different treatments of fertility levels and early genotypes. RDF applied @125 per cent improved the shoot population, NMC and cane yield significantly but there was no significant improvement observed for germination and sucrose per cent.

13. BETHUADHARI

In early group the highest NMC, cane yield, pol (%) and CCS yield was obtained with the check variety CoSe 95422. Among elite genotypes tested numerically higher cane yield (71.83 t/ha) was recorded with CoP 14437 followed by CoLk 14206 and CoSe 14451. Effect of fertilizer levels was not found significant as far as growth, yield and quality of various genotypes are concerned. Among elite mid-late genotypes CoSe 14455 performed better than other genotypes by recording highest germination (43.66%), NMC, cane yield (74.41 t/ha) and CCS yield (8.51 t/ha). However, the performance was not significantly better over superior check CoP 06436 which performed at par.

IMPORTANT OBSERVATIONS:

Best performing genotypes across the centres located in different zones are listed herewith:

Sl. No.	Zone	Early genotypes	Mid-late genotypes	RDF levels
1	North Western	CoPb 14181, Co 14034, CoLk 14201	CoPb 14184, CoPb 14185, CoLk 14203, CoLk 14204, CoH 14261	Majority of the centres did not report any significant influence of higher RDF on sugarcane growth, yield and quality.
2	Peninsular	Co 13008, Co 13009, CoSnk 13073, MS 13081		Significant influence of higher RDF was not found.
3	East Coast	CoC 15338	--	No influence of higher RDF
4	North Central	CoSe 14454, CoP 14437	CoSe 14455, CoLk 14208	Significant effect of higher RDF was noticed.

AS- 73: Assessment of climate change impact on sugarcane productivity

The trial was initiated during 2018-19 and was allotted to the centres equipped with meteorological observatory. During the year only 03 centres reported. Centre wise summary of findings for the year are given below:

1. LUCKNOW

The long term (1956-2018) weather parameters viz. temperature (minimum and maximum), relative humidity (morning and afternoon), rainfall, evaporation, wind speed and bright sun shine hours were studied to assess the climate change impact on sugarcane productivity at ICAR- Indian Institute of Sugarcane research, Lucknow. The results revealed that all the studied weather parameters showed significant trend either increasing or decreasing at monthly, seasonal or on annual level. Rainfall is one of the important weather parameter which showed decreasing pattern at the rate of 28.97 mm decade⁻¹.

2. FARIDKOT

The correlation and regression analysis has been carried out to establish the crop-weather relationship using crop phenology and yield attributes as dependent variables and different weather parameters along with the computed indices viz., maximum temperature (Tmax), minimum temperature (Tmin), rainfall (RF), morning relative humidity (RHmax), afternoon relative humidity (RHmin), evaporation (Evap), bright sunshine hour (BSS), growing degree days (GDD), helio-thermal units (HTU) and photo thermal units (PTU) as independent variable. Weather variables were pooled for different cultivars as well as for planting dates using three years (2015-17) data.

3. PUSA

The average annual rainfall on the basis of thirty year data (1990-2019) is 1202 mm out of which nearly 90% are received during the monsoon extending from the middle of June to middle of October with an average winter rainfall of about 10% only by north-east monsoon. May and early part of June happens to be the hottest month. December-January is the coldest month of year. On the basis of ten years average comparatively higher cane yield (82.7 t/ha) and sucrose content juice (17.23%) noticed during 2010 to 2019. The increase in cane yield and sucrose content juice by 2010 to 2019 and 2000 to 2009 over 1990 to 1999 was to the extent of 16.2; 1.29 and 23.6; 1.95 per cent, respectively.

AS – 74: Evaluation of sugarcane varieties for drought tolerance

The trial was initiated during 2018-19 and was allotted to all the willing centres. During the year only 10 centres reported. Centre wise summary of findings for the year are given below:

NORTH WEST ZONE

1. FARIDKOT

Well-watered (I1) crop gave significantly higher cane yield than water stressed crop (I2). The yield reduction varied from 6.3 percent (CoPb 92) to 24.4 percent (CoPb 93). During the crop season there was about 462 mm rainfall and most of it was up to September.

2. KOTA

CoPk 05191 was found better with respect to number of tillers, plant height, millable canes, cane yield, brix, CCS yield (t/ha) resulting in significantly higher net return over other varieties under early maturing group and CoS 8436 variety in respect of germination, growth, juice extraction and quality parameters but in respect to cane length, cane diameter, cane yield Co 05011 performed best under mid-late group. The higher GR (239708.33 Rs/ha) and NR (131160.00 Rs/ha) and B:C ratio (2.21) recorded with CoPk 05191 in early maturing group and with Co 05011 in mid-late group with gross return (221833.33 Rs /ha), net return (113285.00 Rs /ha) and B:C ratio (2.04). The higher GR (234834.72Rs/ha) and NR (125138.06 Rs/ha) and B: C ratio (1:2.14) was recorded with I1 (I/W CPE ratio 1.0) irrigation regime over I2 (I/W CPE ratio 0.3) irrigation regime.

3. LUCKNOW

Among the six varieties of sugarcane, CoPK 05191 produced highest NMC, cane length, cane girth, sugarcane yield, juice extraction percentage, CCS t/ha, which may be due to production of higher root dry weight, LAI and average cane weight. Minimum reduction in sugarcane yield (13.7%) due to moisture stress was found with CoPk 05191 followed by CoLk 11206 which was at par with CoLk 94184 (18.38%).

4. SHAHJAHANPUR

Genotype CoLk 94184 produced significantly higher cane yield (92.80t/ha) followed by CoSe 11453 with cane yield of 88.20 t/ha. IW/CPE ratio 1.0 recorded significantly higher cane yield of 85.75 t/ha.

5. UCHANI

No significant differences in terms of growth and yield were observed between 1.0 and 0.3 IW/CPE ratios due to frequent rains during pre-monsoon period. Variety CoH 119 (96.9 t/ha) in mid late and Co 0238(96.2 t/ha) in early group being at par produced significantly higher cane yield as compared to variety CoH 167 (90.5 t/ha), Co 0118 (88.4 t/ha), Co 5011 (91.6 t/ha) and CoH 160 (91.4 t/ha) and later four being at par with each other. Among early varieties Co 0238 (12.97 kg) and CoH 119 (12.99 kg) among mid late varieties produced the highest yield of cane produced/1000 litres of irrigation at irrigation schedule of 0.3 IW/CPE ratio. Total irrigation water applied during pre-monsoon season was calculated 22.5 and 15.0 cm at 1.0 and 0.3 IW/CPE schedule, respectively. Total (pre+ post monsoon) irrigation water of 82.5, and 75 cm was applied at 1.0 and 0.3 IW/CPE irrigation schedule, respectively. Total (Irrigation+ rainfall) water was calculated as 219.9 and 212.4 at 1.0 and 0.3 IW/CPE irrigation schedule, respectively.

PENINSULAR ZONE

6. PUNE

. Irrigation at 1.0 IW/CPE ratio gave significantly higher cane yield (122.42 t/ha) over application of irrigation water at 0.3 IW/CPE ratio. Among genotype VSI 12121 registered significantly higher cane yield (137.48 t/ha), but in the same line with the CoM 0265 & CoVSI 18121. Genotype VSI 434 recorded lower cane yield (81.19 t/ha).

7. SANKESHWAR

At IW/CPE ratio 0.3, genotypes SNK 09227 (mid-late) and SNK 088789 (early) performed better than rest of the genotypes. The cane yield differed significantly due to influence of irrigation regimes and genotypes. Among mid-late genotypes Co 86032 recorded significantly higher cane yield (157.47 t/ha) than SNK 09227 and SNK 09268. In early genotypes SNK 088789 recorded higher yield (133.71 t/ha) over SNK 07680 and CoC 671.

NORTH CENTRAL ZONE

8. PUSA

It can be concluded that sugarcane varieties, CoP 2061, CoP 16437 and CoP 9437 when irrigated at IW: CPE ratio 1.00 are better for higher productivity under Bihar condition.

9. BETHUADHARI

Moisture stress (IW: CPE 0.3) caused significant reduction in cane yield across the varieties. Among the varieties CoLk 94184 performed best with highest yield (94.28 t/ha) followed by BO 91 (90.8 t/ha). These two varieties were found to be most resilient against moisture stress with least reduction in cane yield.

EAST COAST ZONE

10. NAYAGARH

Among early maturing varieties, CoOr 03151 with IW/CPE ratio 0.3 recorded significantly different growth and yield parameters compared to other varieties CoOr 03152, CoOr 05346. Similarly among mid-late maturing varieties, CoOr 04151 with IW/CPE ratio 0.3 recorded significantly different growth and yield parameters compared to other varieties CoOr 10346, Co 86249. So this is possibly due to better drought tolerant capacity of these two varieties compared to other varieties.

IMPORTANT OBSERVATIONS:

- Moisture stress during pre-monsoon growth phase brought about significant reduction in cane yield across all the zones. The loss in yield ranged within 20 to 35 % in different sugarcane growing zones.
- Sugarcane varieties found resilient against moisture stress in different sugarcane growing zones are:

Zone	Early maturing	Mid-late maturing
North West	CoPb 92, CoPk 05191, CoLk 94184	CoPb 94, Co 05011, CoLk 11206, CoSe 11453, CoH 119
Peninsular	SNK 088789	Co 86032
North central	CoP 16437, CoLk 94184	CoP 2061, BO 91
East coast	CoOr 03151	CoOr 04151

COMMENTS

- Most of the participating centres have reported the results and other required information like initial soil fertility level, date of planting and harvest and weather conditions as per the suggested format. This need to be regularly followed and may be made more systematic.
- Use of organics in nutrient management schedule for sugarcane has shown its potential as reflected from the results obtained under the trial AS 68 for plant – ratoon system. Addition of 20 t/ha FYM/ compost along with inorganic fertilizers applied on the basis of soil test, soil test crop response for targeted yield or on the basis of general recommendation for the region has shown positive effect on sugarcane growth and yield both in plant and ratoon crops. Response of bio-fertilizers (*Azotobacter/ Acetobacter/ Azospirillum/ PSB*) was more pronounced in peninsular zone.
- Elite genotypes belonging to early and mid-late maturity groups were found to perform well at wider spacing of 120 cm in sub-tropical region and at 150 cm in peninsular and east-coast zones. Response to higher recommended dose of fertilizers was not conspicuous in North West, peninsular and east coast zone, whereas north central zone showed positive response to higher dose of fertilizers.
- Long term weather data (provided by 03 centres only) indicated continuous reduction in rainfall in the north- west zone combined with conspicuous rise in minimum temperature.
- Water efficient varieties belonging to early and mid-late maturity groups were identified for different zones.
- All the centres are requested to give meaningful summary of different trials by making it more informative and true representative of the findings.

SUGGESTIONS

- The crop performance, in general, must be given in light of prevailing climatic condition particularly with reference to sucrose content & flowering behaviour.
- The treatments as decided should not be modified/ deleted.
- One or two pages of research highlights of all the experiments conducted at the centre must be enclosed with the annual report.
- Summary must be clear, to the point and self-explanatory.
- Still many centres are not reporting CV with their data, it is requested that CV must be reported for all the characters in all the trials.

ACKNOWLEDGEMENT

The hard work, sincerity and scientific rigour on the part of investigators at respective centres in implementation of different trials included in this report are acknowledged and put on record that without the same it was not possible to come out with the findings having country wide applicability. All round support and guidance received from Project Coordinator is duly acknowledged. Facilities and official provisions extended by Director, Indian Institute of Sugarcane Research, Lucknow for effective and timely implementation of various trials are sincerely recorded and acknowledged. The group humbly record its indebtedness to Indian Council of Agricultural Research, New Delhi for providing all required facilities, manpower and guidance in the course of implementation of the programme.

*Annexure I***Details of Experiments allotted to and conducted by different Centres during 2019-20**

Sl. No.	Centre	Trial allotted				Trial conducted			
		AS 68	AS72	AS73	AS74	AS68	AS72	AS73	AS74
1	Faridkot	AS 68	AS72	AS73	AS74	AS68	AS72	AS73	AS74
2	Kota	AS68	AS72	AS73	AS74	-	AS72	-	AS74
3	Lucknow	AS68	AS72	AS73	AS74	AS68	AS72	AS73	AS74
4	Shahjahanpur	AS68	AS72	AS73	AS74	AS68	AS72	-	AS74
5	Uchani	AS68	AS72	AS73	AS74	AS68	AS72	-	AS74
6	Coimbatore	AS68	AS72	AS73	AS74	-	AS72	-	-
7	Kolhapur	AS68	AS72	AS73	AS74	-	AS72	-	-
8	Pune	AS68	AS72	AS73	AS74	-	AS72	-	AS74
9	Sankeshwar	AS68	AS72	AS73	AS74		AS72	-	AS74
10	Nayagarh	AS68	AS72	AS73	AS74		AS72	AS73	AS74
11	Pusa	AS68	AS72	AS73	AS74		AS72	AS73	AS74
12	Seorahi	AS68	AS72	AS73	AS74		AS72	-	AS74
13	Bethuadhari	AS68	AS72	AS73	AS74	-	AS72	-	AS74

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