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Performance of Early Maturing Sugarcane (*Saccharumspp* Hybrid complex) Varieties under different Row Spacing and Fertilizer Levels in Plant Cane-Ratoon-Wheat System

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ABSTRACT

A field experiment was conducted to assess performance of newly developed six mid early maturing sugarcane cultivars *i.e.* Co 0116, Co 0118, Co 0237, Co 0238, Co 0239 and Co J 64 (Standard), with two row spacing (75 and 90 cm) under three fertility levels *i.e.*75, 100 and 125% of recommended dose of fertilizers (RDF) NPK (N_{150} $P_{21.8}$ $K_{41.5}$) with plant-ratoon-wheat system. Varieties 'Co 0238' and 'Co 0118' recorded the maximum and significantly higher cane yield (93.1 and 88.9 t/ha) and commercial cane sugar (11.76 and 12.49 t/ha) and outperformed rest cultivars in plant and ratoon crop, respectively. However, both cultivars did not differ significantly for cane yield and commercial cane sugar (CCS). Growth attributes like cane length and cane girth of plant crop were not affected at closer spacing of 75 cm, but number of millable canes (NMC), cane yield and sugar yield increased by 23.94, 20.29 and 19.63% than 90 cm row spacing. While in the subsequent ratoon crop number of millable canes (NMC), cane yield and CCS yield increased substantially by 19.25, 16.70 and 16.92 per cent respectively at 75 cm than 90 cm row spacing. Closer spacing (75 cm) fetched maximum net return (₹ 209280 and ₹ 118823) with benefit: cost ratio of 1.42 and 2.27 with plant as well as ratoon crop respectively. Except varieties, the quality parameters did not undergo significant variation due to change in row spacing and fertility treatments. In monetary terms also, 100 % RDF found almost equally remunerative with 125 % RDF. Cultivar × fertility level interactions indicated that varieties 'Co 0238' and 'Co 0239' were equally productive at normal fertility level of 100% RDF. In monetary terms, sowing of Co 0238 of sugarcane variety fetched maximum net returns (₹ 285633) followed by Co 0239 (₹ 253406) and Co 0118 (₹ 247453) in two years cropping system of Sugarcane-Ratoon-Wheat system under the sub tropical conditions.

Key words: Sugarcane, Cropping system, Sugarcane varieties, Fertility levels, Ratoon, Commercial cane sugar, Millable canes

INTRODUCTION

Sugarcane (*Saccharumspp* complex hybrid) is an important commercial crop of the country occupying around 4.99 million hectares of land with an annual cane production and productivity of around 352.1 million tonnes and 70.52tonnes/ha, respectively (ISMA, 2015).Though primarily a tropical crop, cultivation of sugarcane is distributed over two agro-climatic zones i.e. the sub-tropical and the tropical. In India, most of the sugarcane cultivation is concentrated in the sub-tropical zone (Uttar Pradesh, Uttarakhand, Bihar, Punjab, Haryana) that accounts for 67 per cent of the area and 62 per cent of the production, but its productivity in this region is mere 53 t/ha as compared with106 t/ha in tropical states like Tamilnadu. Sugarcane-ratoon-wheat (S-R-W) system is the most prevalent sugarcane based cropping system in Haryana, Punjab and western Uttar Pradesh. A drastic reduction in the yield of late planted sugarcane is observed under this system. In spite of low yield of plant cane, farmers prefer to delay the planting of cane till wheat harvest as wheat meets the immediate need of both food and fodder for their families and the animals they keep. Besides poor climatic suitability, non-availability and adoption of appropriate cultivars with their specific agro-recommendations are the some bottlenecks of higher productivity in this region. Variety plays a vital role in increasing cane productivity and to exploit genetic potential of a variety, proper environment in the form of optimum inputs are required. Although sugarcane is one of the most efficient converter of solar energy to chemical energy, conventionally planted crop is unable to harvest solar radiation at its optimum capacity. Improved crop geometry through proper spacing of the plants is thus crucial for upgrading productivity. Different clones may require different row spacing for proper utilization of solar radiations and/or exploitation of minerals and water from the soil. Sugarcane is considered to be matured when it attains over 16% sucrose. The varieties which attain their level in 9 months are called early varieties. The varieties attaining this level in 14 and 16 months are named as mid and late varieties. To ensure proper supply of cane of desired quality throughout the crushing period in a sugar mill, the proportion should be equally divided in three types of varieties. Despite all attempts, productivity of sugarcane in this sub-tropicalzone is quite less than the southern states. The situation can be overcome by using high yielding genotypes of different maturity group having better production potential and also

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adopting proper nutrient management and density management practices. As sugarcane is an input-intensive crop needs high quantities of N,P and K during the period of its efficient utilization, particularly at formative and grand growth stages for higher productivity. Application of major plant nutrients in right proportion and in optimum quantity using proper method for specific soil-climatic condition is the key input for sustained crop production. Among the nutrients N, P and K are the key elements in increasing the productivity and the response of applied fertilizer depends on the inherent potential of the varieties to absorb and utilizes them for the production of dry matter. There is a differential response of the genotypes to higher level of nutrients due to differential genetic potentiality of the particular genotypes (Sinha *et al.*,2005).To obtain the maximum yield potential of the varieties appropriate management technologies are required. Among many variables that contribute to cane yield, number of millable canes (NMC) per unit area is the most significant one which is the outcome of genotypic tillering potential with planting density and fertility status. Since there are differential response to applied nutrients, it is imperative to evaluate the performance of recently developed or pipeline genotypes before commercial release for their efficiency and response to nutrients. Keeping theses points in view, the present study was undertaken to find out the optimum row spacing and fertilizer levels before the release of newly evolved five early maturing cultivars of the Sugarcane Breeding Institute (SBI), Regional Centre, Karnal for North Western Zone of the country in sugarcane-ratoon-wheat system.

MATERIALS AND METHODS

A field experiment was conducted at ICAR-Sugarcane Breeding Institute, Regional Centre, Karnal during the years 2008 to 2010 in sandy loam soil having 252.4, 16.5and 276 kg ha^{-1} available N, P and K respectively**.** Treatments consisting of recently developed six varieties of early maturing group *i.e.* Co 0116, Co 0118, Co 0237, Co 0238, Co 0239 and CoJ 64 (Standard), two row spacing of 75 and 90 cm and three fertility levels *i.e.* 75 %($N_{112.5}$ $P_{16.2}$ $K_{31.1}$kgha^{-1}), 100 % (N_{150} $P_{21.8}$ $K_{41.5}$kgha^{-1}) and 125%($N_{187.5}$ $P_{27.3}$ $K_{51.8}$ kgha^{-1}) of recommended NPK doses (150: 21.8: 41.5 kg ha^{-1}) were tested in split plot design by keeping row spacing and fertility levels in main plots and varieties in sub plots with three replications. Sugarcane crop was planted on 31stMarch, 2008 and ratooning was done on 10th March, 2009. The ratoon was harvested in the last week of November, 2009. Full doses of phosphorus and potash were applied at the time of planting as per treatments while nitrogen was applied in three equal split at planting, 90and 150 days after planting and ratooning. Plant crop was raised as per recommended crop protection and production management practices. Rainfall received during the both the crop seasons i.e., plantand ratoon crop were 501.2 mm and 694.6 mm, respectively. After harvest of ratoon, field was prepared as per layout of the experiment and uniform crop of wheat with recommended practice was taken which was harvested during April, 2010. The biometric observations on plant as well as ratoon crop were recorded at harvest based on 5 randomly selected millable canes. The quality parameters for sugarcane were determined before the harvest of both the crops as per the method of Meade and Chen (1977). Cane yield of plant as well as ratoon crop was recorded on the basis of net plot size and is converted in tonnes per hectare (t/ha).Sugar yield was calculated as; sugar yield (t/ha) =[S-0.4(B-S) x cane yield (t/ha)/100];where S and B are sucrose and brix per cent in cane juice respectively. To work out the feasibility of sugarcane production in plant-ratoon-wheat system, the common cost of cultivation for sugarcane plant, ratoon and wheat were ₹ 76092, 47434 and 29506, respectively (average of 2 years). Whereas the treatment cost for 75% of NPK, 100% of NPK (RDF) and 125% of NPK were ₹ 5154, 6872 and 8590, respectively which was incurred for application of fertilizers (N, P and K) in addition to the common cost of cultivation of sugarcane plant as well as ratoon crop. The average (2008-2010) sale price for sugarcane was ₹ 1700 per tonne, whereas the prevailing price for wheat grain and wheat straw were ` 11.00 and 1.25/kg during the experimental year and same were used for calculating the gross and net returns, The net monetary returns were calculated by deducting the total cost of cultivation from the gross realization for each treatment. Net return was calculated by deducting the total cost of cultivation from the gross returns of each treatment and expressed as as ₹ ha^{-1} on the basis of cost of inputs and prices of outputs prevailed during experimentation year. The benefit: cost ratio was calculated as ratio of gross return to cost of cultivation.

RESULTS AND DISCUSSION

Effect of row spacing on yield parametres

Data on growth, yield and quality parameters of plant crop presented in Table 1 revealed that closer row spacing (75 cm) gave significantly higher shoot populations at 90 and 120 days. This higher density of population, also reflect in final cane yield due to higher number of shoots and number of millable canesat closer spacingthan 90 cm spacing. As juice quality was also not altered significantly by row spacing, sugar yield followed trend to cane yield. Similar results were also reported by Mahadevaswamy, 1997 and Singh *et al,* 2011 where higher plant density due to narrow spacing gave higher pant cane yield. Ratoon crop also responded to varying plant densities (Table 2). The cane yield of plant crop was also remarkably affected by row spacing. Yield attributes, *viz*. cane length and girth were not affected substantially with row spacing, while number of millable canes (NMC) increased by 28.3 % at closer row spacing (75 cm) than wider spacing (90 cm). Singh *et al.,* 2005 also found higher number of NMC at closer spacing. Significantly higher (87.2 t/ha) cane yield was obtained with closer row spacing of 75 cm as compared to 90 cm spacing with (69.5t/ha) due to more number of millable cane per unit area obtained from closer spacing. These results were in close conformity with findings of Singh *et al.,*2014.Sucrose per cent was slightly lower at closer row spacing of 75 cm (19.58%) than wider row spacing of 90 cm (19.71%), however, sugar yield was 19.6 % more at 75 cm due to higher cane yield/ha. Planting of sugarcane at 75 cm row spacing gave significantly higher (23.8%) NMC as compared with 90 cm row spacing (80890) at harvest of ratoon. Where as cane girth, cane length and single cane weights were

improved under wider row spacing of 90 cm as compared with 75 cm row spacing. Planting at 75 cm row spacing recorded significantly higher cane yield (20.05 %) than 90 cm row spacing (83.99 t/ha) in ratoon. Planting at 75 cm row spacing enhanced the ratoon yield in all the varieties as compared with 90 cm, but the differences in yield between 75 and 90 cm row spacing was minimum (5.12 t/ha) in Co 0238. The maximum net return of ₹ 89510 and ₹ 133840with benefit:cost ratio of 1.52 and 3.56 were recorded with closer planting (75 cm) in plant and ratoon crop than wider planting (90 cm).

Table 1: Effect of row spacing, fertility levels and varieties on growth attributes, juice quality, cane yield, sugar yields and economics of plant crop

Treatments	Germination at 30 days	Shoot counts '000'/ha		Cane length (m)	Cane girth (cm)	NMC '000'/ha	Cane yield t/ha	Sucrose %	Purity %	CCS t/ha	Cost of cultivation (000'₹/ha)	Net returns (000'₹/ha)	B:C ratio
		90 days	120 days										
Row spacing													
75 cm	43.2	109.4	135.3	182.4	2.45	89.07	87.2	19.58	92.05	11.78	58.73	89.51	1.52
90 cm	41.8	100.5	115.9	188.7	2.51	67.74	69.5	19.71	92.41	9.47	58.73	59.42	1.01
CD(P=0.05)	**NS**	**8.3**	**10.4**	**NS**	**NS**	**2.06**	**8.8**	**NS**	**NS**	**1.18**	**-**	**11.13**	**0.33**
Fertility levels													
75% of RDF	39.2	101.4	110.8	184.4	2.46	71.54	70.6	19.50	91.97	9.49	57.97	62.05	1.07
100 % of RDF	43.9	105.7	129.4	181.4	2.48	82.72	79.7	19.70	92.32	10.84	58.73	76.76	1.31
125% of RDF	41.6	107.9	136.8	188.2	2.50	79.79	83.1	19.74	92.41	11.33	59.50	81.77	1.37
CD(P=0.05)	**NS**	**NS**	**12.8**	**NS**	**NS**	**2.53**	**10.7**	**NS**	**NS**	**1.32**	**-**	**10.69**	**NS**
Varieties													
Co 0116	32.5	90.7	104.3	154.2	2.34	66.34	51.1	19.72	91.76	6.94	58.73	28.14	0.48
Co 0118	50.7	97.8	130.1	182.4	2.56	88.33	88.9	20.32	92.64	12.49	58.73	92.40	1.57
Co 0237	34.8	93.7	107.3	194.2	2.40	69.15	69.1	20.35	94.03	9.79	58.73	58.74	1.00
Co 0238	42.2	115.9	145.4	199.8	2.63	79.51	93.1	18.51	89.93	11.76	58.73	99.54	1.69
Co 0239	42.7	110.8	125.2	189.2	2.56	76.01	87.4	20.14	92.71	12.18	58.73	89.85	1.53
CoJ64 (standard)	46.4	132.0	141.9	188.1	2.37	88.76	77.2	18.83	92.34	10.04	58.73	72.51	1.23
CD(P=0.05)	**5.0**	**11.6**	**14.8**	**7.3**	**0.12**	**3.57**	**15.2**	**0.21**	**1.27**	**1.67**	**-**	**15.67**	**0.45**

* RFD (Recommended fertilizer dose of NPK150: 21.8: 41.5 kg/ha); NMC (Number of millable canes); CCS (Commercial cane sugar)

Effect of fertility level on yield parametres

Successive increase in fertility levels increased the growth, yield attributes and cane yield of plant crop (Table 1). Application of 125% of RDF gave 15.04% and 4.09% more cane yields than 75 % and 100 % fertility levels respectively; however, differences were significant between 125 % and 75 % of RDF only. Singh *et al.* 2005 also reported significant increase in growth and yield parameters of sugarcane by application of nitrogen@ 150 kg ha^{-1}.

Progressive increase in sucrose and purity percent of juice was observed with increase in doses of fertilizers; however, differences were not significant. Application of 125% of RDF recorded 4.32% and 16.24% higher sugar yields than 100% and 75% of RDF. Shukla and Lal, 2007 reported that cane yield increased with increasing the sulphur levels.Likewise increasing fertility levels increased the ratoonyield attributes and cane yield (Table 2). Cane yieldof ratoon crop enhanced to the tune of 4.5% with increasing fertility from 75%to 100% of NPK and decreased by 2.8% from 100% to 125% NPK of recommended levels, however, increase in cane yield from 75 to 100% of RDF was also not significant. Sucrose percentage in juice decreased with increasing fertility levels in ratoon crop and values were 18.52, 18.17 and 17.83% with the application of 75, 100 and 125% NPK, and differences being insignificant. CCS yield values were almost equal at 75% and 125% fertility levels and maximum sugar yield (12.02 t ha^{-1}) was obtained at 100% fertility levels which were5.66% higher than 125 % of NPK level. Application of 125% NPK in plant crop and recommended dose of fertilizer (100% NPK) in ratoon crop fetched maximum net return 81,770 and 1, 23,470 with highest benefit: cost ratio of ₹ 1.37 and ₹ 3.29 from plant and ratoon crop, respectively.

Effect of variety

Significant variations were recorded in growth, tillers production;cane yield and juice quality parameters of plant crop due to varieties (Table 1). Co 0118, CoJ64, Co 0239 and Co 0238 were at par in tillers count with Co 0116. Sugarcane varieties Co 0116 and Co 0237 recorded significantly lesser number of tillers at both the dates of observations than Co 0238, Co 0239 and CoJ 64 (standard), and same trend were also observed in number of millable cane numbers (NMC). Although, Co 238 and Co 237 were at par in cane length and NMC but cane thickness was significantly more in former than the later.

Maximum cane yield was recorded in Co 0238(93.1t/ha) followed by Co 0118 (88.9 t/ha) and in turn both were significantly superior to Co 0239, CoJ64 and Co 0237. Co 0116 produced the lowest cane yield due to shorter cane height and value was even 33.8% lower than CoJ64.

Table 2: Effect of row spacing, fertility levels and varieties on growth attributes, juice quality, cane yield, sugar yields and economics of ratoon crop

Treatments	Shoot counts ('000'ha^{-1})		Cane length cm)	Cane girth (mm)	NMC '000'/ha	Cane yield t/ha	% increase over plant yield	Sucrose %	Purity %	CCS (t/ha)	Cost of cultivation(000' ₹ /ha)	Net returns (000' ₹ /ha)	B:C ratio
	90 days	120 days											
Row spacing													
75 cm	89.32	125.84	2.07	2.49	100.18	100.83	15.6	18.21	89.95	12.76	37.57	133.84	3.56
90 cm	78.84	102.35	2.07	2.51	80.89	83.99	20.8	18.14	90.10	10.60	37.57	105.21	2.80
CD(P=0.05)	**7.11**	**9.65**	**NS**	**NS**	**4.84**	**9.15**		**NS**	**NS**	**1.16**	**-**	**16.53**	**0.31**
Fertility levels													
75% of RDF	78.29	112.17	2.01	2.51	88.84	90.43	28.1	18.52	90.45	11.63	36.64	117.09	3.20
100 % of RDF	85.61	112.53	2.08	2.52	91.04	94.73	18.8	18.17	89.90	12.02	37.57	123.47	3.29
125% of RDF	88.34	117.58	2.13	2.48	91.72	92.07	10.8	17.83	89.73	11.38	38.70	117.82	3.04
CD(P=0.05)	**7.23**	**NS**	**NS**	**NS**	**NS**	**NS**		**NS**	**NS**	**NS**	**-**	**NS**	**NS**
Varieties													
Co 0116	81.45	111.52	1.81	2.28	88.71	66.81	30.7	19.01	90.35	8.83	37.57	76.01	2.02
Co 0118	82.27	121.21	2.14	2.70	80.23	98.55	10.8	18.84	91.08	13.01	37.57	129.97	3.46
Co 0237	90.71	119.36	2.00	2.28	92.97	75.19	8.8	18.22	90.61	9.59	37.57	90.25	2.40
Co 0238	84.19	107.25	2.32	2.70	87.23	111.89	20.2	17.43	88.42	13.48	37.57	152.64	4.06
Co 0239	70.69	88.85	2.17	2.68	77.44	102.53	17.3	18.62	90.61	13.37	37.57	136.73	3.64
CoJ64 (standard)	95.17	136.35	1.99	2.36	116.61	99.49	28.8	16.93	89.09	11.79	37.57	131.56	3.50
CD(P=0.05)	**8.12**	**10.69**	**0.18**	**0.16**	**8.19**	**17.13**		**0.69**	**0.76**	**2.29**	**-**	**23.57**	**0.45**

All the recently developed promising cultivars outperformed in sucrose per cent than CoJ64. Co 0237 gave maximum sucrose per cent followed by Co 0118, Co 0239, Co 0116 and Co0238 but differences were not significant. Significantly higher sugar (CCS)yield was obtained from Co 0118 (12.49 t/ha) than Co 0239 and in turn both produced significantly more sugar than Co0238, CoJ64, Co 0237 and Co 0116 in the plant crop. Sugarcane variety Co 0116 gave the lowest sugar yield (6.94 t/ha) due to low NMC and ultimately lowest cane yield. Significant variations in yield attributes and cane yield, among genotypes were also observed by Shukla,2007.

In ratoon, significantly maximum NMC ha^{-1} were recorded in CoJ 64 (116610) followed by Co 0237 (92975), Co 0116 (88710), Co 0238 (87230) and lowest in Co 0239 (77440). Maximum cane girth (2.70 cm), cane length (2.32m) and SCW (1.29 kg) were also recorded in Co 0238 which were higher by 14.4, 13.0 and 55.3% than the standard CoJ 64. Maximum ratoon yield were observed in Co 0238 (111.9 t/ha) followed by Co 0239 (102.5 t/ha), which is higher by 12.5 and 3.0 % than the standard CoJ 64 (99.5 t/ha) but the differences were non-significant. Among all the early maturing varieties significantly lower yield were recorded in Co 0116 (66.81 t/ha) and Co 0237 (75.19 t/ha) as compared to Co 0118, Co 0238 CoJ 64.

All the promising varieties recorded significantly higher sucrose % than standard CoJ 64. At 10 months stage, highest sucrose % were observed in Co 0116 (19.01%), followed in Co 0118 (18.84%) and Co 0239 (18.62%) which were significantly superior to CoJ 64 (16.93%) and Co 0238 (17.43%). Sugar yield was maximum in Co 0238 (13.48 t/ha) followed by Co 0239 (13.37 t/ha) and both in turn were significantly better than standard check CoJ 64 (11.79 t/ha). The sugarcane variety Co 0238 also proved to be excellent ratooner as it gave 20.2% higher cane yield than its plant crop. Ratoon cane yield in Co 0116 and CoJ 64 was also 30.7 and 28.8 % higher than that recorded in plant crop. Kadam *et al.* 2007 also reported varieties differ in their ratooning potential. Variety Co 0238 fetched highest net return (₹ 137625) with highest B:C ratio (3.62) than Co 0118.

Effect of variety and fertility levels interactions

A significant interaction between fertility levels and varieties was observed (Table3). Planting of variety Co 0238 with 125 % RDF gave significantly maximum cane yield in plant as well as in ratoon to the tune of 104.88 and 116.3 t ha^{-1}. Application of recommended NPK (150:50:50) recorded 4.75 and 3.35 % higher cane yield and sugar yield than 75 % of recommended NPK. Application of recommended and 125% of recommended dose did not show significant variation in ratoon yield as compared with 75% of recommended NPK. Sucrose percentage in juice was decreased non-significantly by 0.35 and 0.69 point with increasing fertility levels from 75% of recommended to recommended and 125% of recommended levels.

Effect of sugarcane-ratoon on wheat and economics of Sugarcane-ratoon-wheat system

After ratoon harvest, uniform crop of wheat was sown in the Sugarcane-ratoon-wheat (S-R-W) system. The results show that (Table 4), except fertility levels in plant and ratoon crop, the yield parameters and yield of wheat did not undergo significant variation due to change in row spacing and sugarcane varieties.

Application of 100 and 125 % of RDF levels in previous plant

cane and ratoon crop gave higher wheat grain yield to the magnitude of 197 and 449 kg ha^{-1} than 75% of RDF. Similar trend were also observed for wheat straw yield. In terms of sugarcane equivalent yield of sugarcane-ratoon-wheat system, planting of sugarcane at closer row spacing (75 cm) gave higher sugarcane equivalent yield (207.4 t ha^{-1}) with maximum net returns (` 250344) as compared with planting at 90 cm spacing.

Similarly, application of 125% of recommended dose of fertilizer gave maximum sugarcane equivalent yield with net returns of ` 225837 which were higher than preceding fertilizer levels. Among the early maturing sugarcane varieties, planting of Co 0238, Co 0239 and Co 0118 in S-R-W system gave ≥ 200 t/ha sugarcane equivalent yield. In monetary terms, sowing of Co 0238 of sugarcane variety fetched maximum net returns (` 285633) followed by Co 0239 (` 253406) and Co 0118(` 247453) in two years cropping system of Sugarcane-Ratoon-Wheat system under the sub-tropical conditions.

Table 3: Effect of fertility levels x varieties interaction on cane yield of plant and ratoon crop

Treatments	***Varieties***						
	Co 0116	Co 0118	Co 0237	Co 0238	Co 0239	CoJ64 (standard)	Mean
Fertility levels	**Plant crop**						
75% RDF	41.97	87.02	57.20	88.28	80.82	68.34	**70.61**
100% RDF	55.30	88.42	69.04	91.05	91.92	82.37	**79.68**
125 % RDF	56.09	91.25	81.02	104.88	84.52	80.83	**83.10**
Mean	**51.12**	**88.89**	**69.09**	**94.74**	**85.75**	**77.18**	**77.80**
CD P=0.05%	**17.56**						
	Ratoon crop						
Fertility levels							
75% RDF	55.58	92.12	62.15	109.52	100.06	96.54	**86.00**
100% RDF	71.63	101.23	77.02	109.86	103.48	98.25	**93.58**
125% RDF	73.24	102.31	86.40	116.30	104.04	103.70	**97.67**
Mean	**66.81**	**98.55**	**75.19**	**111.89**	**102.53**	**99.49**	**92.41**
CD P=0.05%	**19.83**						

Table 4: Effect of row spacing, fertility levels and sugarcane varieties on plant height, yield attributing characters, yield of wheat sown after harvest of sugarcane ratoon and economics of Sugarcane-Ratoon-Wheat (S-R-W) system (2 years system)

Treatments	Plant height (cm)	Effective tillers/m^2	Spike length (cm)	Grain yield kg/ha	Straw yield kg/ha	HI	Wheat		Sugarcane plant-Ratoon-Wheat (S-R-W) system (2 years)		
							Cost of Cultivation (₹/ha)	Net returns (₹/ha)	Sugarcane equivalent yield (t/ha)	Cost of Cultivation (₹/ha)	Net returns (₹/ha)
Row spacing											
75 cm	73.8	295	7.4	2498	4405	36.1	29506	3478	207.4	163340	250344
90 cm	71.6	293	7.1	2412	4352	35.6	29506	2466	172.3	163340	178331
CD(P=0.05)	NS	NS	NS	NS	NS	NS	-	851	7.9	-	10563
Fertility levels											
75% of RDF	71.1	268	6.9	2240	4333	34.1	29506	550	178.7	161282	191954
100 % of RDF	71.9	289	7.4	2437	4258	36.4	29506	2624	193.3	163341	221061
125% of RDF	75.1	325	7.4	2689	4545	37.2	29506	5754	195.9	165398	225837
CD(P=0.05)	NS	18	NS	168	201	NS	-	658	4.6	-	6789
Varieties											
Co 0116	70.4	276	7.2	2270	4090	35.7	29506	577	135.6	163340	103001
Co 0118	71.8	279	7.1	2263	4011	36.1	29506	401	205.0	163340	247453
Co 0237	72.3	310	7.3	2598	4670	35.7	29506	4910	164.5	163340	164692
Co 0238	73.8	301	7.1	2653	4911	35.1	29506	5816	225.8	163340	285633
Co 0239	73.8	298	7.2	2493	4228	37.1	29506	3202	209.2	163340	253406
CoJ64 (standard)	73.9	301	7.3	2456	4363	36.0	29506	2964	195.8	163340	223525
CD(P=0.05)	NS	NS	NS	NS	NS	NS	-	968	10.8	-	15782

CONCLUSION

From the present investigation, it may be inferred that application of 125% of recommended NPK or recommended fertility levels of nitrogen, phosphorus and potash is optimum for all the varieties under testing. For higher cane and sugar (CCS) yield with maximum net returns it is recommended to go for planting of 'Co 0238, Co 0118 and Co 0239' cultivars at 75 cm spacing followed by wheat in sugarcane-ratoon-wheat system in subtropical conditions.

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