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## Effect of nutrient management and cultivars on sugarcane yield and economics

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### Abstract

An experiment was conducted to study the effect of fertilizers levels and cultivars on Sugarcane yield and economics crop at Agriculture Research Station, Kumta, Uttara Kannada of University of Agricultural Sciences, Dharwad during 2018-19 and 2019. The experiment consisted three main plots (Cultivars) viz., C<sub>1</sub>-SNK635, C<sub>2</sub>- Co-86032 and C<sub>3</sub> – Konanakatte and five sub plots (Fertilizers levels) F<sub>1</sub>: 75% RDF, F<sub>2</sub>: 100% RDF, F<sub>3</sub>:125% RDF, F<sub>4</sub>: 150% RDF and F<sub>5</sub>: control. The experiment was laid out in Strip Block Design with three replication. The results indicated that the cane yield of plant cane was influenced significantly by RDF levels, and cultivars and their interactions. Among cultivars, SNK-635 recorded significantly higher cane yield (133.9 t ha<sup>-1</sup>) than Co-86032 (114.3 t ha<sup>-1</sup>) and Konanakatte (81.8 t ha<sup>-1</sup>). Cultivar Co-86032 also had significantly higher cane yield than Konanakatte. Different RDF levels treatments (F<sub>1</sub> to F<sub>4</sub>) recorded significantly higher cane yield than control treatment. There was increased cane yield with increased levels of fertilizers. Application of 150% RDF recorded significantly higher cane yield (137.6 t ha<sup>-1</sup>) than control (71.0 t ha<sup>-1</sup>) and 75% RDF (96.1 t ha<sup>-1</sup>) but on par with 125% (128.5 t ha<sup>-1</sup>) and 100% RDF (116.8 t ha<sup>-1</sup>). Sugarcane cultivar SNK- 635 recorded significantly higher net return (₹274933 ha<sup>-1</sup>) compared to Co-86032 (₹219103 ha<sup>-1</sup>) and Konanakatte (₹126559 ha<sup>-1</sup>). The cultivar Konanakatte gave lower net returns (₹126559 ha<sup>-1</sup>). Among nutrient management treatments, 150% RDF given significantly more net returns (₹268947 ha<sup>-1</sup>) than control (₹144968 ha<sup>-1</sup>), 75% RDF (₹160262 ha<sup>-1</sup>) and 100% RDF (₹214279 ha<sup>-1</sup>) but on par with 125% RDF (₹245868 ha<sup>-1</sup>). Significantly lower net returns was recorded in control treatment (₹144968 ha<sup>-1</sup>). Among RDF levels, lower net returns recorded in 75% RDF (₹160262 ha<sup>-1</sup>) than other RDF levels. With increased RDF levels, there was increase in net returns. But net returns increased significantly up to 100% RDF levels. Similar trend of plant cane was reported in ratoon cane also for cane yield and economics.

**Keywords:** Sugarcane, cultivars, fertilizers, cane yield and economics

### Introduction

Sugarcane, a complex hybrid of *Saccharum* spp., is one of the important cash crop of industrial importance, next only to cotton in India. Sugarcane occupies a pivotal position in the agricultural economy of India. Globally sugarcane is cultivated on an area of 26.54 million hectares with a production of 1861 million tonnes and productivity of 70.13 tonnes ha<sup>-1</sup> (Anon., 2019) [4]. The world sugar production was 179.64 MT (Anon., 2018) [2]. It is mainly a tropical crop, but it is also grown in sub-tropical areas in India. India has been known as the original home of sugar and sugarcane. Sugar industry is the 2nd largest agro-based industry in India and contributes significantly to the socio-economic development of the nation. Sugar industry is the source of livelihood for 50 million farmers and their families. It provides direct employment to over 5 lakh skilled and semi-skilled labours in sugar mills and allied industries across the nation. Indian sugar industry is also a major sector to create employment, probably 7.5% percent in Indian economy and plays a leading role in global market being the world's 2nd largest producer after Brazil, producing nearly 15 and 25% of global sugar and sugarcane respectively. Sugarcane crop and its products contribute about 1.1% to the national GDP which is significant considering that the crop is grown only in 3% of the gross cropped area (Abhishek Ranjan *et al.*, 2020) [1]. India is the second largest producer of sugarcane next to Brazil. The crop sustains with an area of 4.93 m ha, production of 348.45mt and productivity of 70.70 t ha<sup>-1</sup> (Anon., 2019) [4]. Karnataka state ranks 3<sup>rd</sup> in both area (0.44 m ha) production (27.38 million tonnes) with the productivity of 68.96 t/ha (Anon., 2019) [4]. Sugarcane cultivation limited to small area using local variety Konanakatte leading to lower yield and returns. The productivity is very low in Uttara Kannada district due to poor fertility, non-adoption of recommended dose of fertilizers and variety.

Hence, study was conducted on effect of fertilizers levels and cultivars on sugarcane yield and economics. The objective of study was to find optimum level of fertilizer for higher yield and higher returns.

### Material and Methods

An experiment was conducted to study the effect of fertilizers levels and cultivars on Sugarcane yield and economics crop at Agriculture Research Station, Kumta, Uttara Kannada of University of Agricultural Sciences, Dharwad during 2018-19 and 2019. It has lies in Coastal zone of Karnataka (Zone-10) and Region II of Agro-climatic zones of India. The experimental site is located at 14° 25' North latitude and 74° 25' East longitude with an altitude of 24.2 m above the mean sea level. The District is high rainfall area coming under malnad region. The average rainfall of the location for the past 23 years is 3722.28 mm, which is distributed over a period of six months from June to October with peaks during June, July and August (999.65, 1088.14 and 775.71 mm, respectively). The rainfall is well assured and evenly distributed. April and May are the months of mean maximum temperature ranging from 33.9 °C to 34.7 °C, while, January and February are the months of mean minimum temperature ranging from 18.1 °C to 20.1 °C. The rainfall peak was observed in the month of June (1013.9 mm), July (1024.6 mm) and August (952.1 mm) during 2018-19 and (July (1128.6 mm), August (1345.2) and September (659.7 mm) during 2019-20. However, the rainfall was well distributed during both the years in the months June to October. The year 2019-20 (4334.0 mm) received more rain than 2018-19 (3682.6). The soil of the experimental site was Sandy loam, belonged to the order alluvial soils.

The experiment consisted three main plots (Cultivars) viz., C<sub>1</sub>-SNK635, C<sub>2</sub>- Co-86032 and C<sub>3</sub> – Konanakatte and five sub plots (Fertilizers levels) F<sub>1</sub>: 75% RDF, F<sub>2</sub>: 100% RDF, F<sub>3</sub>:125% RDF, F<sub>4</sub>: 150% RDF and F<sub>5</sub>: control. The experiment was laid out in Strip Block Design with three replication. The plot size was 7.2 m X 14.1 m. The single eye budded setts of 10 months old cane were planted in furrows on 23<sup>rd</sup> march, 2018. A recommended dose of dolomite (500 kg/ha) during land preparation and farm yard manure 25 t ha<sup>-1</sup> were given. Nitrogen, phosphorus and potassium fertilizers were applied as per the treatments in the form of urea, rock phosphate and muriate of potash, respectively and micronutrient was applied in the form of ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> as soil application. Necessary plant protection and water management practices were followed. Intercultural operations were carried out by passing hoes at each top dressing. Two hand weeding were carried out at 40 days after planting/days

in ratooning and at final earthing up. Earthing up was done after final top dressing at 14 weeks after planting. The experimental plot was irrigated at an interval of 10 days during early phase up to commencement of kharif rain, and 12 days interval at maturity excluding rainy days. Wrapping and propping was done when the crop attained 3 to prevent nutrient loss by late born tillers and 6 months age to prevent lodging.

### Cane yield

The crop was harvested at maturity after 12 months and yield was estimated based on net plot yield. All the canes in the net plot from each treatment were cut close to the ground level. The green tops and trash were removed and cane yield per plot was recorded at 300 days after planting and harvest and expressed as t ha<sup>-1</sup>.

### Economic analysis

#### Cost of cultivation

The prices of the inputs that were prevailing at the time of their use were taken into account to work out the cost of cultivation. The labour wages, cost of inputs and outputs are furnished in Appendix II and VIII for both the sugarcane cultivation and jaggery preparation, respectively for both plant and ratoon cane.

#### Gross returns

Gross returns were calculated using the cane yield (t ha<sup>-1</sup>) and the prices of crop commodities at the time of marketing.

#### Net returns

The net return per ha was calculated by deducting the total cost of cultivation from gross returns per ha.

#### Benefit:Cost ratio

The benefit cost ratio was calculated as follows:

$$\text{Benefit cost ratio} = \frac{\text{Gross returns (ha}^{-1}\text{)}}{\text{Total cost of cultivation (ha}^{-1}\text{)}}$$

#### Analysis of statistical significance

The data recorded during the course of investigation were compiled and analysed for statistical significance as per the analysis of variance for strip block design with single control. Fisher's method of analysis of variance (ANOVA) as described by Gomez and Gomez (1984) [5] was adopted for the purpose. Standard error of mean and coefficient of variability have been worked out for set of observations under each character.

**Table 1:** Cane yield and yield parameters of plant cane as influenced by fertilizer levels and cultivars

Vertical strips [Nutrient management practice (NMP)]		Number of millable canes (000 ha <sup>-1</sup> )				Single cane weight (kg)				Cane yield (t ha <sup>-1</sup> )			
		Horizontal strips (Cultivars)											
		C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean
F <sub>1</sub>	75% of RDF	89.4	80.6	58.3	76.1	1.45	1.32	1.05	1.27	119.3	105.1	63.8	96.1
F <sub>2</sub>	100% of RDF	104.8	90.8	79.1	91.6	1.47	1.33	1.08	1.29	142.2	119.7	88.7	116.8
F <sub>3</sub>	125% of RDF	110.1	95.4	85.1	96.8	1.50	1.41	1.11	1.34	153.1	133.8	98.7	128.5
F <sub>4</sub>	150% of RDF	116.0	101.1	87.3	101.4	1.52	1.43	1.16	1.37	163.3	143.8	105.7	137.6
F <sub>5</sub>	Control	72.5	57.2	46.1	58.6	1.18	1.03	0.89	1.03	91.6	69.1	52.3	71.0
	Mean	98.5	85.0	71.2		1.42	1.30	1.06		133.9	114.3	81.8	
		S.Em±		CD @0.05		S.Em±		CD @0.05		S.Em±		CD @0.05	
Cultivars (C)		3.35		13.14		0.06		0.23		4.16		16.33	
RDF levels		4.18		13.64		0.07		0.22		5.70		18.58	
Cultivars at same level of fertilizers		10.76		11.07 NS		0.12		0.13 NS		8.30		22.99	
Cultivars at same or different levels of fertilizers		10.23		10.62 NS		0.12		0.13 NS		8.68		23.18	

C<sub>1</sub>- SNK 635, C<sub>2</sub> – CO 86032, C<sub>3</sub>- Konanakatte, DAP- Days after Planting, RDF: Recommended Dose of Fertilizer (186:125:125 NPK Kg ha<sup>-1</sup>)

**Table 2:** Cane yield and yield parameters of ratoon cane as influenced by fertilizer levels and cultivars

Vertical strips [Nutrient management practice (NMP)]		Number of millable canes (000 ha <sup>-1</sup> )				Single cane weight (kg)				Cane yield (t ha <sup>-1</sup> )			
		Horizontal strips (Cultivars)											
		C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean
F <sub>1</sub>	75% of RDF	89.73	80.27	58.31	76.10	1.44	1.32	1.05	1.27	116.29	102.11	60.82	93.07
F <sub>2</sub>	100 % of RDF	105.09	90.51	78.48	91.36	1.46	1.33	1.07	1.29	139.18	116.66	85.70	113.84
F <sub>3</sub>	125 % of RDF	110.38	94.73	84.72	96.61	1.49	1.41	1.11	1.34	150.07	130.83	95.66	125.52
F <sub>4</sub>	150 % of RDF	116.30	100.39	86.62	101.10	1.51	1.43	1.16	1.37	160.30	140.76	102.66	134.57
F <sub>5</sub>	Control	73.49	56.87	46.14	58.83	1.18	1.02	0.89	1.03	88.58	66.12	50.61	68.43
	Mean	99.00	84.55	70.85		1.42	1.30	1.06		130.88	111.29	79.09	
		S.Em±		CD @0.05		S.Em±		CD @0.05		S.Em±		CD @0.05	
Cultivars (C)		3.48		13.66		0.05		0.21		4.10		16.08	
RDF levels		4.19		13.65		0.06		0.21		5.63		18.37	
Cultivars at same level of fertilizers		10.91		NS		0.12		NS		8.16		22.60	
Cultivars at same or different levels of fertilizers		10.33		NS		0.11		NS		8.56		22.77	

C<sub>1</sub> - SNK 635, C<sub>2</sub> - CO 86032, C<sub>3</sub>- Konanakatte, DAP- Days after Planting, RDF: Recommended Dose of Fertilizer (186:125:125 NPK Kg ha<sup>-1</sup>)

## Results and Discussion

### Cane yield (cf. Table 1 and 2)

The cane yield of plant cane was influenced significantly by RDF levels, and cultivars and their interactions. Among cultivars, SNK-635 recorded significantly higher cane yield (133.9 t ha<sup>-1</sup>) than Co-86032 (114.3 t ha<sup>-1</sup>) and Konanakatte (81.8 t ha<sup>-1</sup>). Cultivar Co-86032 also had significantly higher cane yield than Konanakatte. Significantly lower cane yield was recorded with Konanakatte (81.8 t ha<sup>-1</sup>). Different RDF levels treatments (F<sub>1</sub> to F<sub>4</sub>) recorded significantly higher cane yield than control treatment. There was increased cane yield with increased levels of fertilizers. Application of 150% RDF recorded significantly higher cane yield (137.6 t ha<sup>-1</sup>) than control (71.0 t ha<sup>-1</sup>) and 75% RDF (96.1 t ha<sup>-1</sup>) but on par with 125% (128.5 t ha<sup>-1</sup>) and 100% RDF (116.8 t ha<sup>-1</sup>). Application of 75% RDF (96.1 t ha<sup>-1</sup>) obtained lower cane yield but on par with 100% RDF. The cane yield was not increased significantly after 100% RDF level. Different RDF levels treatments (F<sub>1</sub> to F<sub>4</sub>) recorded significantly higher cane yield than control treatment. In plant cane, increased in cane yield of 75, 100, 125, 150% RDF levels were 35.4, 64.5, 81.0 and 93.8%, respectively over control. Whereas, in ratoon cane, 75, 100, 125 and 150% RDF levels recorded increased cane yield percent of 36.0, 66.4, 83.4 and 96.7%, respectively over control. There was increased cane yield with increased levels of fertilizers. Cane yield was differed significantly due to interaction effect of different levels of RDF and cultivars. Significantly higher cane yield was recorded with C<sub>1</sub>F<sub>4</sub> (cultivar SNK-635 with 150% RDF) (163.3 t ha<sup>-1</sup>) and on par with C<sub>1</sub>F<sub>3</sub> (153.1 t ha<sup>-1</sup>), C<sub>1</sub>F<sub>2</sub> (142.2 t ha<sup>-1</sup>) and C<sub>2</sub>F<sub>4</sub> (143.8 t ha<sup>-1</sup>). Significantly lower cane yield was recorded in C<sub>3</sub>F<sub>5</sub> (52.3 t ha<sup>-1</sup>), C<sub>2</sub>F<sub>7</sub> (69.1 t ha<sup>-1</sup>) and C<sub>3</sub>F<sub>1</sub> (63.8 t ha<sup>-1</sup>). Similar trend of plant cane was reported for cane yield in ratoon cane. A field experiment was conducted Mahima Begum *et al.* (2017) [8] to evaluate the response of promising mid-late maturing sugarcane genotypes under three levels of fertilizers. Three mid-late maturing promising genotypes, viz. CoBln 14504, CoBln 14505, CoBln 14506 along with a recommended variety CoBln 94063 as check were tested

under three levels of NPK fertilizers i.e. 75% RD of NPK, 100%RD of NPK and 125% RD of NPK (135:70:60). Result revealed that among the tested genotypes, CoBln 14505 recorded significantly the higher cane yield (66.50t/ha), NMC (68.10 thousand/ha) over the check as well as other two genotypes. In case of fertilizer, 125% recommended dose of NPK recorded significantly higher cane yield (62.91 t/ha) than the both 75% and 100% recommended dose of NPK. The higher cane yield recorded with RDF levels in both plant and ratoon crops was mainly attributed to improvement in plant height and the better yield attributing characters like higher number of millable canes, single cane weight and cane diameter compared to control. There was increased number of millable, single cane weight, cane diameter and plant height with increasing levels of fertilizers. Application of 150% RDF recorded significantly higher number of millable and single cane weight than control and 75% RDF but on par with 125% RDF and 100% RDF. Application of 75% RDF obtained lower number of millable and single cane weight but on par with 100% RDF. After 100% RDF Level, number of millable and single cane weight were not increased significantly with increased RDF level. The results of experiment conducted by Aluri (2013) [7] at ARS, Mudhol, revealed that, significantly higher millable cane numbers and single cane weight were recorded with the application of RDF (250:75:190 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O ha<sup>-1</sup>) along with FYM @ 25 t ha<sup>-1</sup>, FeSO<sub>4</sub> and ZnSO<sub>4</sub> @ 25 kg each ha<sup>-1</sup> and biofertilizers viz., *Azospirillum* and PSB @ 10 kg ha<sup>-1</sup> over all other nutrient management practices. Kumara (2014) [8], reported that plot receiving 150 percent recommended NPK (250:100:125 kg NPK ha<sup>-1</sup>) + FYM @ 25 t ha<sup>-1</sup> recorded significantly higher cane yield (237.4 t ha<sup>-1</sup>) and yield parameters. Optimum yield was obtained in 100 percent recommended NPK (160.7 t ha<sup>-1</sup>) and marginal increase in yield by further increase in NPK dosage. The results of experiment conducted by Satwant *et al.* (2012) [9], reported significant increase in the cane yield with application of *Azotobacter* bio-fertilizer at both the nitrogen levels (75% Recommended of N and 100% Recommended levels of N) over the respective controls.

**Table 3:** Economic parameters of plant cane production as influenced by fertilizer levels and cultivars

Vertical strips [Nutrient management practice (NMP)]		Economic parameters												
		Cost of cultivation (₹ha <sup>-1</sup> )	Gross returns (₹ ha <sup>-1</sup> )				Net returns (₹ha <sup>-1</sup> )				B:C ratio			
			Horizontal strips (Cultivars)											
C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean			
F <sub>1</sub>	75% of RDF	113546	339987	299557	181880	273808	226441	186011	68334	160262	2.99	2.64	1.60	2.41
F <sub>2</sub>	100% of RDF	118727	405200	341018	252800	333006	286473	222291	134073	214279	3.41	2.87	2.13	2.80

F <sub>3</sub>	125% of RDF	120410	436255	381409	281170	366278	315845	260999	160760	245868	3.62	3.17	2.34	3.04
F <sub>4</sub>	150% of RDF	123131	465396	409705	301135	392078	342265	286574	178004	268947	3.78	3.33	2.45	3.18
F <sub>5</sub>	Control	57350	260989	196990	148974	202318	203639	139640	91624	144968	4.55	3.43	2.60	3.53
	Mean	106633	381565	325736	233192		274933	219103	126559		3.67	3.09	2.22	
			S.Em±		CD @ 0.05		S.Em±		CD @ 0.05		S.Em±		CD @ 0.05	
Cultivars (C)			11853		46539		11853		46539		0.18		0.71	
RDF levels			16236		52950		16236		52950		0.19		0.63	
Cultivars at same level of fertilizers			23641		71396		23641		70923		0.37		1.12	
Cultivars at same or different levels of fertilizers			24745		74977		24745		74729		0.35		1.05	

C<sub>1</sub>- SNK 635 , C<sub>2</sub>- CO 86032, C<sub>3</sub>- Konanakatte, RDF: Recommended Dose of Fertilizer (186:125:125 NPK Kg ha<sup>-1</sup>)

Price: ₹2850 t<sup>-1</sup> (Sugar cane)

**Table 4:** Economic parameters of ratoon cane production as influenced by fertilizer levels and cultivars

Vertical strips [Nutrient management practice (NMP)]		Economic parameters												
		Cost of cultivation (₹ha <sup>-1</sup> )	Gross returns (₹ ha <sup>-1</sup> )				Net returns (₹ ha <sup>-1</sup> )				B:C ratio			
			Horizontal strips (Cultivars)											
			C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean
F <sub>1</sub>	75% of RDF	80493	331437	291007	173330	265258	250944	210514	92837	184765	4.12	3.62	2.15	3.30
F <sub>2</sub>	100% of RDF	85681	396650	332468	244250	324456	310969	246787	158569	238775	4.63	3.88	2.85	3.79
F <sub>3</sub>	125% of RDF	85362	427705	372859	272620	357728	342343	287497	187258	272366	5.01	4.37	3.19	4.19
F <sub>4</sub>	150% of RDF	90078	456846	401155	292585	383528	366768	311077	202507	293450	5.07	4.45	3.25	4.26
F <sub>5</sub>	Control	34843	252439	188440	144224	195035	217596	153597	109381	160192	7.25	5.41	4.14	5.60
	Mean	75291	373015	317186	225402		297724	241894	150111		5.21	4.35	3.12	
			S.Em±		CD @ 0.05		S.Em±		CD @ 0.05		S.Em±		CD @ 0.05	
Cultivars (C)			11672		45829		11672		45829		0.29		1.12	
RDF levels			16053		52352		16053		52352		0.29		0.96	
Cultivars at same level of fertilizers			23248		70673		23248		69744		0.59		1.83	
Cultivars at same or different levels of fertilizers			24383		74551		24383		74368		0.56		1.71	

C<sub>1</sub>- SNK 635, C<sub>2</sub>- CO 86032, C<sub>3</sub>- Konanakatte, RDF: Recommended Dose of Fertilizer (186:125:125 NPK Kg ha<sup>-1</sup>)

Price: ₹2850 t<sup>-1</sup> (Sugar cane)

### Economic analysis (cf. Table 3 and 4)

Economic analysis is the ultimate yardstick to measure the applicability and economic feasibility of the production technology.

### Cost of cultivation

Cost of cultivation for sugarcane production varied differently for different nutrient management practices in both plant and ratoon cane. All RDF levels recorded higher cost of cultivation compared to control. Among different nutrient management practices, cost of cultivation was more for 150% RDF (₹123131 ha<sup>-1</sup>) followed by 125% RDF (₹120410 ha<sup>-1</sup>). Lower cost of cultivation was recorded in control (₹57350 ha<sup>-1</sup>). Among RDF levels, Lower cost of cultivation was recorded with 75% RDF (₹113546 ha<sup>-1</sup>) followed by 100% RDF (₹118727 ha<sup>-1</sup>). Similar trend was observed in ratoon also. But ratoon crop had lower cost of cultivation than cost of cultivation for plant cane. Increased cost of cultivation was due to increased cost for increased fertilizers and harvesting of increased cane production. Similar trend was observed in ratoon also. But ratoon crop had lower cost of cultivation than cost of cultivation for plant cane.

### Gross returns

The gross returns obtained for cane production in both plant and ratoon cane influenced significantly due to different nutrient management practices and cultivars and their interactions.

Sugarcane cultivar SNK- 635 recorded significantly higher gross return (₹381565 ha<sup>-1</sup>) compared to Co-86032 (₹25736 ha<sup>-1</sup>) and Konanakatte (₹233192 ha<sup>-1</sup>). The cultivar Konanakatte gave lower gross returns (₹233192 ha<sup>-1</sup>). Among nutrient management treatments, 150% RDF given significantly more gross returns (₹392078 ha<sup>-1</sup>) than control (₹202318 ha<sup>-1</sup>), 75% RDF (₹273808 ha<sup>-1</sup>) and 100% RDF (₹333006 ha<sup>-1</sup>) but on par with 125% RDF (₹366278 ha<sup>-1</sup>). Significantly lower gross returns was recorded in control treatment (₹202318 ha<sup>-1</sup>). Among RDF levels, lower gross returns recorded in 75% RDF (₹273808 ha<sup>-1</sup>) than other RDF levels. With increased RDF levels, there was increase in gross returns. But gross returns increased significantly up to 100% RDF levels. Same result of plant cane was obtained for gross returns due to RDF level in ratoon cane. In the interaction effect of cultivars and RDF levels, cultivar SNK-635 with 150% RDF recorded significantly higher gross returns (₹465396 ha<sup>-1</sup>) and on par with SNK with 125% RDF (₹436255 ha<sup>-1</sup>) and 100% RDF (₹405200 ha<sup>-1</sup>) and Co-86032 with 150% RDF (₹409705 ha<sup>-1</sup>). Lowest gross returns was recorded with Konanakatte with control (₹148974 ha<sup>-1</sup>), 75% RDF (₹181880 ha<sup>-1</sup>) and Co-86032 with control (₹196990 ha<sup>-1</sup>). Similar trend of interaction of plant cane production was observed in ratoon cane for gross returns. With increased RDF levels, there was increase in gross returns. But gross returns increased significantly up to 100% RDF levels due to significant response of sugarcane up to 100% RDF. Same result of plant cane was obtained for gross returns due to RDF level in ratoon cane.



### Net returns

Similar trend of gross returns was obtained for net returns in both plant and ratoon cane. The net returns obtained for cane production in both plant and ratoon cane influenced significantly due to different nutrient management practices and cultivars and their interactions.

Sugarcane cultivar SNK- 635 recorded significantly higher net return (₹274933 ha<sup>-1</sup>) compared to Co-86032 (₹219103 ha<sup>-1</sup>) and Konanakatte (₹126559 ha<sup>-1</sup>). The cultivar Konanakatte gave lower net returns (₹126559 ha<sup>-1</sup>). Among nutrient management treatments, 150% RDF given significantly more net returns (₹268947 ha<sup>-1</sup>) than control (₹144968 ha<sup>-1</sup>), 75% RDF (₹160262 ha<sup>-1</sup>) and 100% RDF (₹214279 ha<sup>-1</sup>) but on par with 125% RDF (₹245868 ha<sup>-1</sup>). Significantly lower net returns was recorded in control treatment (₹144968 ha<sup>-1</sup>). Among RDF levels, lower net returns recorded in 75% RDF (₹160262 ha<sup>-1</sup>) than other RDF levels. With increased RDF levels, there was increase in net returns. But net returns increased significantly up to 100% RDF levels. Same result of plant cane was obtained for net returns due to RDF level in ratoon cane. In the interaction effect of cultivars and RDF levels, cultivar SNK-635 with 150% RDF recorded significantly higher net returns (₹342265 ha<sup>-1</sup>) and on par with SNK with 125% RDF (₹315845 ha<sup>-1</sup>) and 100% RDF (₹286473 ha<sup>-1</sup>) and Co-86032 with 150% RDF (₹286574 ha<sup>-1</sup>). Lowest net returns was recorded with Konanakatte with control (₹91624 ha<sup>-1</sup>), 75% RDF (₹68334 ha<sup>-1</sup>) and Co-86032 with control (₹139640 ha<sup>-1</sup>). Similar trend of interaction of plant cane production was observed in ratoon cane for net returns. With increased RDF levels, there was increase in net returns. This was because of increased gross returns with increased cane yield for higher RDF levels. But net returns increased significantly up to 100% RDF levels. Same result of plant cane was obtained for net returns due to RDF level in ratoon cane.

### B:C ratio

The different nutrient management treatments and cultivars and their interactions had significant influence on B:C ratio cane production in both plant and ratoon cane. Cultivar SNK-635 recorded significantly higher B:C ratio (3.67) compared to Co-86032 (3.09) and Konanakatte (2.22). The cultivar Konanakatte gave lower B:C ratio (2.22). Among nutrient management treatments, 150% RDF recorded significantly more B:C ratio (3.18) than 75% RDF (2.41) and 100% RDF (2.80) but on par with 125% RDF (3.04) and control (3.53). Significantly lower B:C ratio was recorded in 75% RDF (2.41) and on par with 100% RDF (2.80). With increased RDF levels, there was increase in B:C ratio. But B:C ratio increased significantly up to 100% RDF levels. Same result of plant cane was obtained for B:C ratio due to RDF level in ratoon cane. In the interaction effect of cultivars and RDF levels, cultivar SNK-635 with control recorded significantly higher B:C ratio (4.55) followed by SNK-635 with 150% RDF (3.78) and 125% RDF (3.62). Lowest B:C ratio was recorded with Konanakatte with 75% RDF (1.60) followed by Konanakatte with 100% RDF (2.13), 125% RDF (2.34) and 150% RDF (2.45). Whereas, in ratoon cane production, Significantly higher B:C ratio was recorded in control (7.25). The next best interactions were C<sub>2</sub>F<sub>5</sub> (5.41), C<sub>1</sub>F<sub>4</sub> (5.07), C<sub>1</sub>F<sub>3</sub> (5.01), C<sub>1</sub>F<sub>2</sub> (4.63), C<sub>2</sub>F<sub>4</sub> (4.45), C<sub>2</sub>F<sub>3</sub> (4.37), C<sub>3</sub>F<sub>5</sub> (4.14) and C<sub>2</sub>F<sub>2</sub> (3.88). The lowest B:C ratio was recorded in C<sub>3</sub>F<sub>1</sub> (2.15) followed by C<sub>3</sub>F<sub>2</sub> (2.85), C<sub>3</sub>F<sub>3</sub> (3.19), C<sub>3</sub>F<sub>4</sub> (3.25) and C<sub>2</sub>F<sub>1</sub> (3.62).

### Conclusion

Application of 100% RDF (186:125:125 NPK kg ha<sup>-1</sup>) levels was optimum for significantly higher cane and yield and monetary benefit.

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