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Economics of sugarcane cultivation under organic and integrated nutrient management practices in Cauvery Command Area

■ K.V. KESHAVAIAH, Y.B. PALLED[1] AND B.S. NANDIHALLI[2]

AUTHORS' INFO

Associated Co-author :

[1]Department of Agronomy and Fodder Scheme, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA

[2]Department of Agricultural Entomology, College of Agriculture, BIJAPUR (KARNATAKA) INDIA

Author for correspondence :
K.V. KESHAVAIAH
Zonal Agricultural Research Station, V.C. Farm, MANDYA (KARNATAKA) INDIA
Email : kvkeshavaiah@gmail.com

ABSTRACT : A field experiment was conducted at Zonal Agricultural research station, V.C.Farm, Mandya, Karnataka, on the effect of nutrient management practices on yield, economics and B:C ratio in the plant crop of sugarcane. The results revealed that Co 62175 variety of sugarcane recorded higher cane yield (149.4 t/ha), gross (Rs 164834/ha) and net income (Rs 77044/ha) and B: C ratio (1.88) over Co 86032 variety. Among the nutrient management practices, N7 recorded significantly higher gross income (Rs 192870/ha) but the net income (Rs 105543/ha) and B:C ratio (2.28) were higher with N6 when 50 per cent of organic and 50 per cent of inorganic component of nutrients were blended and applied indicating a balance of organic and inorganic nutrients is the right way of supplementing nutrients to sugarcane crop.

Key Words : Economics of sugarcane, Organic, Integrated nutrient management

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Sugarcane in agricultural sector shares seven per cent of total value of agricultural output and occupies only 2.5 per cent of Indian gross cropped area. In the country, there are 571 sugar industries in operation in rural areas. It is estimated that about 35 million farmers and their dependents are engaged in cultivation of sugarcane and another 0.5 million skilled and unskilled workers including highly qualified technologists engaged in manufacturing sugar. The sugarcane growers and their dependents receive Rs 5000 crores annually for the cane they supply. The industry generates 50 million employments through 571 sugar factories across the country. India's domestic sugar market is estimated to be Rs. 250 billions (Anonymous, 2009).

Sugarcane is a long duration crop which requires considerable quantity of nutrients during its crop growth period. The nutrient demand is particularly high during its initial grand growth period. Careful and efficient nutrient management system needs to be designed for achieving higher productivity and quality of cane. Long term fertilizer experiments have indicated the need for basal application of FYM for maintaining optimum fertility status. In sugarcane cropping system, legumes are grown either in sequence or as an intercrop for green manure, grain or fodder. Sunnhemp and *Sesbania* are the common green manure crops. Legumes in sugarcane cropping system benefit in terms of nitrogen nutrition of sugarcane and amelioration of yield decline.

Results from the long term experiments have also envisaged that application of organic or chemical fertilizers alone failed to maintain the productivity of soil and sugarcane. Hence, there should be a proper blend of organic manures and inorganic fertilizers to maintain the soil health as well as to prepare the soil to supplement the required nutrients in available form in soil for sustained sugarcane production over a long period of time.

While comparing the organic and inorganic sources of nutrients for management of sugarcane , the cost factor comes into picture in addition to the long term effect of these components. Considering this a field experiment was conducted at Zonal Agricultural Research station, V.C. Farm, Mandya during 2007-08 to study the effect of organic and integrated nutrient management practices on cane yield, economics and B:C ratio of sugarcane cultivation.

RESEARCH PROCEDURE

A field investigation was carried out to study the effect nutrient management practices on growth, yield and quality of sugarcane and jaggery. Two field experiments were laid out in split plot design with two sugarcane varieties as main plot treatments and eight nutrient management practices as sub plot treatments in plant crop of sugarcane.

The treatments included two varieties of sugarcane *viz.*, Co 62175 (V1) and Co 86032 (V2) as main plot treatments and the details of nutrient management practices as the sub plot treatments are as under.

Sub-plot treatments :

N_1	Pressmud (150 kg N equivalent/ha)	Sunnhemp(50 kg N equivalent/ha)		Biofertilizers (50 kg N equivalent/ha)
N_2	Pressmud (100 kg N equivalent/ha)	Farmyard manure (100 kg N equivalent/ha)		Biofertilizers (50 kg N equivalent/ha)
N_3	Pressmud (75 kg N equivalent/ha)	Farmyard manure (75 kg N equivalent/ha)	Frenchbean as intercrop (50 kg N equivalent/ha)	Biofertilizers (50 kg N equivalent/ha)
N_4	Pressmud (87.5 kg N equivalent /ha)	Farmyard manure (87.5 kg N equivalent/ha)	Neem cake (25 kg N equivalent/ha)	Biofertilizers (50 kg N equivalent/ha)
N_5	Pressmud (87.5 kg N equivalent /ha)	Farmyard manure (87.5 kg N equivalent/ha)	Vermicompost (25 kg N equivalent/ha)	Biofertilizers (50 kg N equivalent/ha)
N_6	50% N equivalent through organic and 50% NPK through chemical fertilizers			
	Pressmud (75 kg N equivalent/ha)	Chemical fertilizer (125 kg N, 50 kg P and 62.5 kg K_2O/ha)		Biofertilizers (50 kg N equivalent/ha)
N_7	Recommended package of practices			
	Chemical fertilizers (250 kg N : 100 kg P_2O_5 : 125 kg K_2O/ha)	Farmyard manure (25 t/ha)		
N_8	Chemical fertilizers alone (250 kg N : 100 kg P_2O_5 : 125 kg K_2O/ha)			

The experiment was laid out with three replications with a gross plot size of 9.0 m × 6.0 m (54 m^2) and net plot of 7 m × 4 m (28 m^2) with a spacing of 150 cm apart. The data recorded during the course of investigation were compiled and analysed for statistical significance as per the analysis of variance to the split plot design. Fisher's method of analysis of variance (ANOVA) as per method outlined by Cochron and Cox (1965) was adopted for the purpose.

RESEARCH ANALYSIS AND REASONING

The data on sugarcane yield harvested from the plant crop are provided in Table 1 and Fig. 3. Sugarcane varieties significantly differed with respect to cane yield. Variety Co 62175 recorded significantly higher cane yield (149.40 t/ha) compared to C0 86032 (130.05 t/ha). Trials conducted at ZARS, V. C. Farm, Mandya under the AICRP (sugarcane), have revealed that Co. 62175 variety of sugarcane performed better with respect to cane yield (121.33 t ha^{-1}) and CCS (15.59 t ha^{-1}) compared to Co. 86032 (111.44 t ha^{-1} and CCS 12.50 t ha^{-1}) (Anonymous, 2010).

Among the nutrient management practices, 50 per cent N through pressmud and 50 per cent N through fertilizer and biofertilizer recorded significantly higher cane yield (170.33 t/ha) over all other practices except recommended package of practices (RPP- N_7) (174.82 t/ha) which was at par with it. Among the organic nutrient management practices, combination of pressmud, FYM, French beans and biofertilizers recorded significantly higher (132.02 t/ha) yield over N_2 and was at par with rest of the practices including the chemical fertilizer alone.

The interaction effect was statistically significant. Combination of Co 62175 and 50 per cent N through pressmud and 50 per cent N through fertilizer and biofertilizer recorded significantly higher sugarcane yield (187.94 t/ha) over rest of the combinations except the RPP (191.65 t/ha) with which it was at par. The interaction effect of organic nutrient management practices with Co 62175 was at par with each other. The chemical fertilizer alone with Co 62175 was also at par with all the organic nutrient combinations. Similar trend of interaction was observed between Co 86032 and nutrient management practices.

The gross income, net income and the B: C ratio computed for the plant crop for both the varieties separately are presented in Table 2.

There was significant difference with gross income (Fig.1) among varieties as higher income was recorded with Co 62175 variety of sugarcane (Rs. 164834 ha^{-1}) compared to Co 86032 (Rs. 143494 ha^{-1}). Among the nutrient management practices, the gross returns obtained was significantly higher with N_7 (Rs. 192870 ha^{-1}) followed by N_6 (Rs. 187918 ha^{-1}). Among the

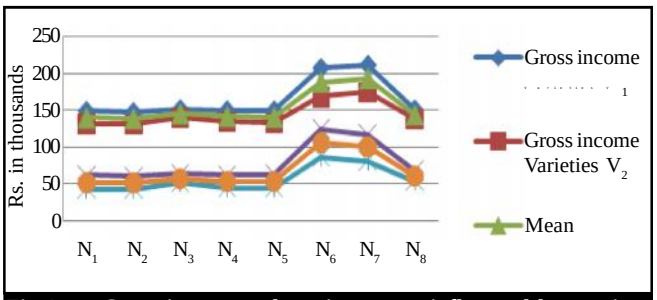

Fig. 1 : Gross income and net income as influenced by nutrient management practices

organic management practices N_3 recorded significantly higher gross income (Rs. 145672 ha^{-1}) over N_2 and it was at par with rest of the organic management practices. The interaction effect was significant due to varieties and nutrient management practices. Co 62175 variety with RPP recorded significantly higher gross income over V_1N_6. The interaction effects among organic nutrient management practices registered at par gross income among each other.

The net income was significant due to sugarcane varieties. Co 62175 variety of sugarcane recorded significantly higher net income (Rs. 77044 ha^{-1}) over Co 86032 (Rs. 55705 ha^{-1}). Among the nutrient management practices, N_6 recorded significantly higher net income (Rs. 105543 ha^{-1}) over RPP (Rs. 99277 ha^{-1}). Among the organic management practices N_3 recorded significantly higher net income (Rs. 56880 ha^{-1}) over N_2 and it was at par with rest of the organic management practices. The interaction effect was significant due to varieties and nutrient management practices. V_1N_6 recorded significantly higher net income over V_1N_7. The interaction effects among organic nutrient management practices registered at par net income among each other.

The B:C ratio was significant due to sugarcane varieties. Co 62175 variety of sugarcane recorded significantly higher B: C ratio (1.88) over Co 86032 (1.64). Among the nutrient

Table 1 : Sugarcane yield (t ha^{-1}) as influenced by nutrient management practices in plant crop of sugarcane

Nutrient management practices (N)		Varieties		Mean
		V_1	V_2	
N_1	Pressmud + sunnhemp + biofertilizers	135.31	118.95	127.13
N_2	Pressmud + FYM + biofertilizers	133.83	118.52	126.17
N_3	Pressmud + FYM + French beans + biofertilizers	137.35	126.69	132.02
N_4	Pressmud + FYM + neem cake + biofertilizers	136.11	121.25	128.68
N_5	Pressmud + FYM + vermicompost + biofertilizers	135.99	119.69	127.84
N_6	50% N through pressmud + 50% NPK through fertilizer + biofertilizer	187.94	152.72	170.33
N_7	Recommended package of practices	191.65	157.99	174.82
N_8	100% NPK through fertilizers only	137.04	124.63	130.83
	Mean	149.40	130.05	-
		S.E.m ±		C.D. (P=0.05)
	Varieties (V)	0.94		2.73
	NMP (N)	1.73		5.02
	V × N	2.45		7.10
	N × V	2.48		7.18

V_1 = Co.62175 V_2 – Co.86032

Table 2 : Gross income (Rs. in thousand), net income (Rs. in thousand) and B:C ratio as influenced by nutrient management practices in plant crop of sugarcane

Nutrient management practices (N)		Gross income			Net income			B:C ratio		
		Varieties		Mean	Varieties		Mean	Varieties		Mean
		V_1	V_2		V_1	V_2		V_1	V_2	
N_1	Pressmud + sunnhemp + biofertilizers	149.29	131.24	140.27	61.03	42.98	52.00	1.69	1.49	1.59
N_2	Pressmud + FYM + biofertilizers	147.65	130.76	139.20	59.59	42.70	51.14	1.68	1.48	1.58
N_3	Pressmud + FYM + French beans + biofertilizers	151.54	139.81	145.67	62.75	51.01	56.88	1.71	1.57	1.64
N_4	Pressmud + FYM + neem cake + biofertilizers	150.18	133.79	141.99	61.18	44.80	52.99	1.69	1.50	1.60
N_5	Pressmud + FYM + vermicompost + biofertilizers	150.03	132.05	141.04	61.94	43.96	52.95	1.70	1.50	1.60
N_6	50% N through pressmud + 50% NPK through fertilizer + biofertilizer	207.35	168.49	187.92	124.97	86.12	105.54	2.52	2.05	2.28
N_7	Recommended package of practices	211.43	174.31	192.87	117.84	80.71	99.28	2.26	1.86	2.06
N_8	100% NPK through fertilizers only	151.20	137.50	144.35	67.06	53.31	60.21	1.80	1.63	1.72
	Mean	164.83	143.49	-	77.04	55.71	-	1.88	1.64	-
		S.E.m ±	C.D. (P=0.05)		S.E.m ±	C.D. (P=0.05)		S.E.m ±	C.D. (P=0.05)	
	Varieties (V)	1.00	6.08		0.99	6.01		0.01	0.07	
	NMP (N)	1.89	5.49		1.90	5.50		0.02	0.06	
	V × N	2.68	7.76		2.70	7.76		0.03	0.09	
	N × V	2.70	7.82		2.70	7.82		0.03	0.09	

V_1 = Co.62175 V_2 – Co.86032

management practices, N_6 recorded significantly higher B: C ratio (2.28) over RPP (2.06). Among the organic management practices N_3 recorded significantly higher B: C ratio (1.64) over N_2 and it was on par with rest of the organic management practices. The interaction effect was significant due to varieties and nutrient management practices. V_1N_6 recorded significantly higher B: C ratio (2.52) over V_1N_7 (2.26). The interaction effects among organic nutrient management practices registered on par B:C ratio among each other. However, Co 62175 variety of sugarcane recorded higher B: C ratio compared to Co 86032.

B:C ratio recorded was significantly higher with N_6 (2.28) followed by N_7 (2.06) (Fig. 2). This is possible with blending of 50 per cent organic and 50 per cent inorganic nutrients. Inorganic nutrients are cost prohibitive. As a result of higher yields realized with comparatively lesser cost through N_6 it has resulted in higher net returns and B:C ratio. Nutrient management practices where only organic sources were used has resulted in lower yields, though have resulted in lower net returns and B:C ratio. Shankaraiah and Kalyanamurthy (2005) reported that integrated use of enriched pressmud at 15 tons ha^{-1} with fertilizers resulted in additional income of Rs. 23181 and saving of NPK fertilizers by 50 per cent by addition of pressmud at 10 tons ha^{-1}. Paul *et al.* (2005) also reported highest net returns with 50 per cent recommended NPK + 20 tons of pressmud per hectare. Nagaraju *et al.* (2000) reported highest net returns (Rs. 13278 ha^{-1}) and B: C ratio when pressmud @ 15 t ha^{-1} and 75 per cent of recommended dose fertilizers were applied. Saving of 50 per cent inorganic nitrogen is reported by Sharma *et al.* (2002) with the application of PMC and urea in the ratio of 1:1.

It can be inferred that for a sugarcane crop to supplement the nutrients, either organic or inorganic nutrient sources alone is not ideal and rather it is the combination of sources in the right blend will make an ideal foil in supplementing the nutrients in addition to maintaining the soil in good condition to sustain on a long run for higher returns and profit.

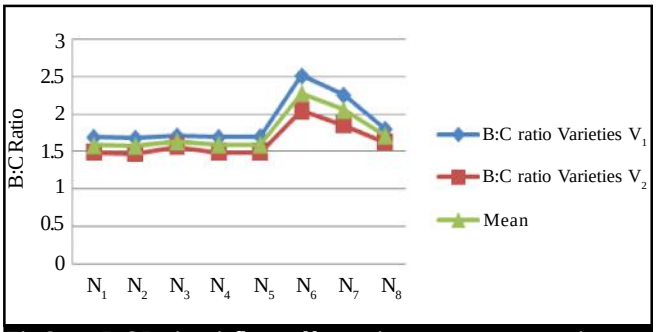

Fig. 2 : B:C Ratio as influenced by nutrient management practices

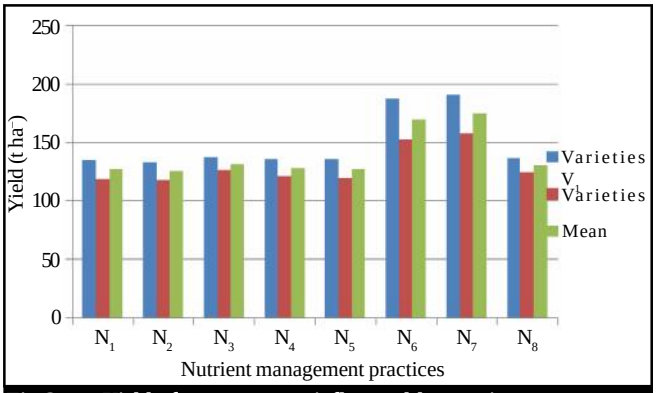

Fig. 3 : Yield of sugarcane as influenced by nutrient management practices

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