Karnataka J. Agric. Sci., 20(3) : (466-468), 2007

Productivity and Economics of Sugarcane as Influenced by Leaf Colour Chart Based Nitrogen Management

S. A. GADDANAKERI, D. P. BIRADAR, N. S. KAMBAR AND V. B. NYAMGOUDA

College of Agriculture, Bijapur-586101
E-mail : gaddanakerisa@rediffmail.com

(Received ; November, 2006)

Abstract: : An experiment was conducted in the affiliation of Department of Agronomy, College of Agriculture, Bijapur and Research and Development division, Nandi Co-operative Sugar Factory, Galagali, Karnataka, India during 2004 and 2005 on medium black soil to study the efficacy of using leaf colour chart (LCC) for nitrogen management in sugarcane. The experiment was laid out in randomized block design with five replications and four treatments (N as per LCC index 4, 5 and 6 and N as per recommended practice 250 kg /ha in 4 splits). The cane yield and net return recorded with application of N as per LCC 6 (152.2 t/ha and 1.25 lakh/ha) and LCC 5 found on par with each other (145.10 t/ha and 1.18 lakh/ha). Both the treatments were significantly superior than application of N as per LCC 4 (101.8 t/ha and 0.69 lakh/ha) and LCC N (124.3 t/ha and 0.94 lakh/ha). Similarly, significantly higher cane height (238 and 233 cm), single cane weight (1.24 and 1.29 kg) and B:C ratio (2.11 and 2.17) were recorded in treatments LCC 5 and 6 respectively as compared to LCC 4 (184 cm, 0.95 kg and 1.29) and recommended N treatments (202 cm, 1.15 kg and 1.71)

Key words : Productivity, economics, sugarcane, leaf colour chart, nitrogen

Introduction

Farmers use leaf colour as a visual and subjective indicator of the crop's need for N fertilizer. It is more relevant in case of cereals like rice, maize, sugarcane which are grown in assured moisture supply condition and the nitrogen need of these crops are more and N application in these crops is in splits as basal and top dressing. Rice genotypes and LCC-based N management significantly influenced rice yield and yield components (Nagappa *et al.,* 2002). When the leaves are pale or yellowish green rather than dark green, farmers believe that plants need more nitrogen. According to research, it has been found that leaf colour intensity is directly related to leaf chlorophyll content and leaf nitrogen status. A leaf colour chart (LCC) developed from a Japanese scientist (Furuya, 1987) will help the farmers to measure the leaf colour intensity. LCC is a simple easy to use and inexpensive tool to determine the time of N top dressing for rice crop. The same LCC is adopted here in sugarcane crop. LCC can help in promoting need based, variable rate N application to crops, based on soil N supply and crop demand. It is an ideal tool to optimise N use. Irrespective of the source of N applied *viz.,* organic, inorganic, bio fertilizers etc. Though the use of LCC for N management in sugarcane is first experience, the colour of LCC is matching well with the leaves of varieties having uniform colour intensity. That's why the LCC index needs to be standardized for a particular sugarcane variety at particular location. Hence, the present investigation was planned to standardized the LCC index for N management in sugarcane variety CoC-671.

Material and Methods

A field experiment was conducted for two years at Research and development farm, Nandi Co-operative Sugar Factory, Galagali Krishnanagar, Karnataka, during 2004 and 2005 (autumn season). The experiment was laid out in randomised block design with four nitrogen application treatments (as per LCC index 4.0, 5.0 and 6.0 and N as per recommended practice). The general crop of Daincha as green manuring crop was grown during *kharif* season and incorporated before sugarcane planting (July-August months of both the years and the entire plot of one acre was supplied with 5 t pressmud (May month of both the years). The variety planted in this study was CoC -671. The colour of leaves was not uniform as that of variety Co-86032. The recommended dose of phosphorous and potash were applied at the time of planting. The amount of nitrogen used as per recommendation treatment was 250 kg N/ha. In LCC treatments, an initial dose of 25 kg N ha^{-1} was applied at 49 days after planting. There after the LCC reading was taken on youngest fully expanded & healthy leaf at fourteen days interval. When the average LCC index showed below the desired index level the crop was top dressed with N. The quantity of nitrogen applied in different LCC treatment in different years is given in Table 1 and 2 which indicates N application pattern. The application rate in LCC treatments was fixed based on growth stages as 25 kg N per hectare during early vegetative growth (3-7 weeks), 50 kg N per hectare during rapid vegetative growth (9-17 weeks) and 25 kg N per hectare during late vegetative growth (19-21 weeks). The soil of the experimental site was medium black, neutral to alkaline in reaction with 277-272 kg N, 21-25 kg P_2O_5 and 360- 373 kg K_2O/ha. The organic carbon content was 0.37 %. All the agronomic practices like weeding, inter cultivation practices and irrigation management were carried uniformly in all the treatments. The observation on growth parameters like cane height, girth of cane, no of inter nodes and yield attributes like single cane weight, cane yield plot and quality parameters like purity, brix and pole percentage were recorded at the time of harvest (Table 5). The economics was worked out based on the prevailed market prices of both inputs and outputs during the years of experimentation.

Results and Discussion

The cane yield as influenced by nitrogen management through leaf colour chart is given in Tabel 3. Among the different N management practices, the application of N as per LCC 6.0 has recorded significantly higher cane yield during both the years as well as in pooled data. The cane yield recorded with the application of N as per LCC index 5 (145.10 t/ha) was found to be on par with LCC 6 (152.2 t/ha). However, the yield recorded in the treatment where N was applied by referring LCC index 4 has recorded significantly lower yield (101.8 t/ha) as compared to recommended practice of N application (124.30 t/ha). The significantly higher cane yield with N management by referring LCC was due to supply of N in more number of splits, which satisfy the requirement of sugarcane crop more often. This was reflected in increased cane height (287.40 cm) number of inter nodes (29.20) and single cane weight (1.27.kg). The quality parameters did not show any significant difference to the treatments (Table 5).

The economics (gross and net returns) of sugarcane as influenced by nitrogen management through leaf colour chart is given in Table 5. The difference in gross and net returns due to LCC treatments and recommended N was significant. On an average over two years, application of N as per LCC 6.0 has recorded significantly higher net returns (Rs. 1,25,040 /ha) as compared to other treatments. The net returns recorded with application of N as per LCC 5.0 (Rs. 1,18,120 /ha) was found on par with LCC 6.0. The amount of N in LCC 6.0 and LCC 5.0 was (300 and 250 kg per hectare respectively). Keeping in mind the amount N applied, the yield and net returns obtained in LCC 5.0 is found to be acceptable. Though the quantity of nitrogen applied by referring LCC index 5.0 was equal to the recommended nitrogen, the number of nitrogen splits are more in LCC 6 treatments (6 splits) as compared to recommended N treatment (4 splits). It was found from fertigation studies that the sugarcane crop needs 33 per cent of its N requirement up to 6th week (3-6 weeks), 33 percent of its N requirement up to 14th week (7-14 weeks), 28 per cent of its N requirement up to 26th week (15-26

Table 1. The amount of nitrogen applied at different growth stages of sugarcane during 2004-05

Sl. No.	Treatment	Qty. of Nitrogen applied (kg/ha)	Early vegetative growth			Rapid vegetative growth				Late vegetative growth	
		Week Days	3 (21)	5 (35)	7 (49)	9 (63)	11 (77)	13 (91)	15 (105)	17(119)	19 (133)	21 (147)
1	LCC 4	175 (4 splits)	-	-	25	-	50	50	-	50	-	-
2	LCC5	250 (6 splits)	-	-	25	50	-	50	50	50	25	-
3	LCC 6	300 (7 splits)	-	-	25	50	50	50	50	50	25	-
4	Rec. N.	250 (4 splits)	1 (0) 25	-	6 (42) 50	-	10 (70) 75	-	14 (98) 100	-	-	-

Initial N status (Av. N Kg/ha): 207
Biomass contribution from Daincha incorporation (t/ha): 20 % N in Diancha biomass : 0.55
Contribution of N from Diancha (Kg N/ha): 22 Pressmud application (t/ha): 15

Table 2. The amount of nitrogen applied at different growth stages of sugarcane during 2005-06

Sl. No.	Treatment	Qty. of nitrogen applied (kg/ha)	Early vegetative growth			Rapid vegetative growth				Late vegetative growth	
		Week Days	3 (21)	5 (35)	7 (49)	9 (63)	11 (77)	13 (91)	15 (105)	17(119)	19 (133)	21 (147)
1	LCC 4	175 (4 splits)	--	--	25	--	50	50	--	50	--	--
2	LCC5	250 (6 splits)	--	--	25	50	--	50	50	50	25	--
3	LCC 6	300 (7 splits)	--	--	25	50	50	50	50	50	--	25
4	Rec. N.	250 (4 splits)	1 (0) 25	--	6 (42) 50	--	10 (70) 75	--	14 (98) 100	--	--	--

Initial N status (Av. N Kg/ha): 272 Biomass contribution from Daincha incorporation (t/ha) : 22 % N in Diancha biomass : 0.60 Contribution of N from Diancha (Kg N/ha): 26 Pressumed application (t/ha): 15

weeks) and 6 per cent of its N requirement up to 36th week (27-36 weeks). The significantly higher B:C ratio in LCC 6 and LCC 5 treatments were observed in case of rice grown in TBP area under irrigated condition as compared to RDN. The similar results were obtained with yield attributing characters and yield of irrigated rice. The significantly higher number of panicles per square metre, 1000 grain weight and grain yield of rice were obtained with LCC 5 and LCC 6 treatments as compared to recommended N (Biradar *et al.,* 2005). It is very difficult to enter and fertilize the crop when sugarcane crop was grown by

Table 3. Cane yield (t/ha) of sugarcane as influenced by nitrogen management through LCC.

Sl. No.	Treatment	Qty. of N applied (kg/ha)	Cane yield (t/ha)			
			Remarks			
			2004-05	2005-06	Pooled	% increase in yield
1	LCC4	175 (4 Splits)	98.20	105.40	101.80	
2	LCC5	250 (6 Splits)	139.80	150.40	145.10	16.7
3	LCC6	300 (7 Splits)	148.60	155.80	152.20	22.4
4	Rec. N	250 (4 Splits)	120.60	128.00	124.30	
		S. Em ±	5.18	7.10	6.14	
		C.D. at 5%	15.98	21.87	18.93	

Table 4. Growth and yield attributes of sugarcane as influenced by nitrogen management through LCC.

Sl	Treatment	Cane height (cm)			No of inter nodes			Single cane weight (kg)			Cane girth (cm)		
No.		04-05	05-06	Pooled	04-05	05-06	Pooled	04-05	05-06	Pooled	04-05	05-06	Pooled
1	LCC 4	180	187	184	17	17	18	0.92	0.93	0.95	2.14	2.24	2.19
2	LCC 5	227	228	228	23	22	23	1.26	1.22	1.24	2.68	2.72	2.70
3	LCC 6	230	236	233	25	24	25	1.31	1.27	1.29	2.80	2.86	2.83
4	Rec. N	207	197	202	20	20	21	1.09	1.19	1.15	2.44	2.40	2.42
	S.Em ±	8.97	8.18	8.58	1.38	1.35	1.37	0.083	0.049	0.066	0.079	0.126	0.103
	C.D. at 5%	27.65	25.22	26.44	4.27	4.15	4.21	0.256	0.157	0.207	0.244	0.388	0.316

Table 5. Quality parameters of sugarcane as influenced by nitrogen management through LCC.

Sl.	Treatment	Brix %			POL %			Purity %			C.C.S %		
No.		04-05	05-06	Pooled	04-05	05-06	Pooled	04-05	05-06	Pooled	04-05	05-06	Pooled
1	LCC 4	19.44	18.35	18.90	17.08	17.61	17.35	85.43	84.70	85.07	10.95	10.87	10.91
2	LCC 5	18.21	19.01	18.61	16.24	17.35	16.80	87.25	89.53	88.39	11.15	11.63	11.39
3	LCC 6	18.83	19.47	18.15	16.77	16.99	16.88	88.70	88.13	88.42	11.62	11.24	11.43
4	Rec. N	19.13	18.78	18.96	16.80	16.67	16.74	86.04	85.83	85.94	11.17	11.76	11.47
	S.Em ±	0.59	0.52	0.56	0.38	0.41	0.39	1.84	1.72	1.78	0.28	0.30	0.29
	C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 6. Economics of sugarcane cultivation as influenced by nitrogen management through LCC.

Sl. No	Treatment	Quantity of N applied (Kg /ha)	No of splits	Pooled (2004-05 and 2005-06)			
				Gross returns (Rs /ha)	Cost of cultivation (Rs /ha)	Net returns (Rs /ha)	B: C ratio
1	LCC 4	175	4	122160	53330	68830	1.29
2	LCC 5	250	6	174120	56000	118120	2.11
3	LCC 6	300	7	182640	57600	125040	2.17
4	Rec. N	250	4	149160	55000	94160	1.71
	S.Em ±			8150		4135	
	C.D. at 5%			24450		12405	

adopting 3 ft row spacing. But the adoption of wider row spacing (4 ft) permits the N application by referring LCC for longer period (21 weeks) and satisfies the phase wise N requirement of crop and result in higher cane yield.

References

BIRADAR, D.P., SHIVAKUMAR, NAGAPPA AND BASAVANNEPPA, M.A., 2005, Productivity of irrigated rice as influenced by leaf colour chart – based N management in the Tungabhadra project (TBP) area in Karnataka. *International Rice Research Notes*, **30** : 40-42.

FURUYA, S., 1987, Growth diagnosis of rice plants by means of leaf colour. *Japanese Agricultural Research Quarterly,* **20**:147-153.

MANJAPPA, K., KATARAKI, NAGARAJ AND KELAGINA MANI, S.V., 2006, A simple tool for Integrated nitrogen management in rainfed lowland rice. *Karnataka Journal of Agricultural Sciences*, **19** : 84-89.

NAGAPPA, BASAVANNEPPA M.A. AND BIRADAR, D. P., 2002, Response of hybrid rice to different levels of nutrient application in TPB area. *Karnataka Journal of Agricultural Sciences*, **15** : 356 -358.