

**SHORT COMMUNICATION****PRODUCTION POTENTIAL OF SUGARCANE BASED CROPPING SYSTEM  
AS INFLUENCED BY NITROGEN LEVELS****P. Geetha\* and A.S. Tayade****Abstract**

Six crops namely, finger millet (*Eleusine coracana* (L.) Gaertn.), black gram (*Vigna mungo* L.), soybean (*Glycine max* L.), sesame (*Sesamum indicum* L.), amaranthus (*Amaranthus* sp.) and sunn hemp (*Crotalaria juncea* L.) were evaluated as intercrops in sugarcane (cv Co 86032) along with one sole crop of sugarcane (control) under wide row spacing (150 cm) with 100, 75 and 50% of recommended nitrogen (280 kg N/ha) for sugarcane and 50% of the recommended fertilizers for the intercrops in split plot design at the ICAR- Sugarcane Breeding Institute, Coimbatore, during 2014 and 2015. The performance of amaranthus, finger millet and sunn hemp was good while soybean, black gram and sesame did not perform well. Application of 100% N recorded higher cane equivalent yield (CEY) (103.1 and 164.3 t/ha) than 75% N (87.9 and 149.6 t/ha) and 50% N (75.3 and 103.2 t/ha) during 2014 and 2015, respectively. Among the intercropping systems followed, sugarcane + amaranthus recorded higher CEY (99.83 and 144.5 t/ha) than finger millet (77.7 and 133.6 t/ha) during 2014 and 2015, respectively.

**Key words:** Sugarcane, annual intercrops, nitrogen levels, cane yield, cane equivalent yield

Intercropping, the agricultural practice of cultivating two or more crops in the same space at the same time, is an old and commonly used cropping practice which aims to match efficiently crop demands to the available growth resources and labour. Self-sustaining, low-input and energy-efficient agricultural systems in the context of sustainable agriculture have always held the attention of farmers, researchers and policy makers worldwide (Altieri 1999). Sugarcane is a long duration crop and takes about 3-5 months for canopy development. When planted in wide row spacing of 150 cm, it allows room for growing intercrops during the early stage. Small and marginal sugarcane growers take advantage of this and grow various short duration intercrops like pulses, vegetables, etc. to obtain interim return instead of waiting to get return from

sole sugarcane crop. Solar radiation is a major resource determining growth and yield of component crops in intercropping, particularly when other resources like water and nutrients are not severely limiting the crop growth. During growth and development, crop plants intercept and absorb growth factors like light, energy, water and nutrients and use them to produce biomass. Since these growth factors are distributed variously in space and time, crop complementary and supplementary relations determine the magnitude of intercrop competition (Ofori and Gamedoaghao 2005). In intercropping systems involving legume crops, supplementary relation would exist due to nitrogen fixation. Consequently, pulses may not suffer competition for N supplies when grown with sugarcane. Higher yield advantage can be realized

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in intercropping systems when growth patterns in terms of time and space of component crops differ (Ghosh et al. 2006). The present experiment was aimed at studying the performance of selected intercrops under different N levels. The experiment was designed to study the feasibility of cereal, legume and oilseed intercrops in tropical sugarcane.

The experiments were conducted during 2014 - 2015 at two different locations of ICAR - Sugarcane Breeding Institute farm (11°N latitude and 77°E longitude). The soils of the experimental fields are moderately drained with adequate drainage, taxonomically classified as *typic haplustalf*. The experiment was conducted in red sandy loam soil in 2014 and black clay soil in 2015. The available major nutrient content ranged from 228-275 kg/ha N, 40-48 kg/ha P and 610-664 kg/ha K. The experiments were laid out in split plot design with three levels of N (100, 75 and 50% of recommended N) to sugarcane as main plot treatments and six intercrops, namely finger millet, black gram, soybean, sesame, amaranthus and sunn hemp along with sole crop of sugarcane as subplot treatments. The fertilizer recommendation followed for sugarcane was 280:62.5:120 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O/ha. The fertilizer doses in terms of N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O/ha followed for intercrops were 60:30:30 for finger millet, 25:50:25 for black gram, 20:40:20 for soybean, 35:23:23 for sesame and 15:15:15 for amaranthus. Since the population of the intercrops was 50% of the sole crop, half the recommended doses of fertilizers were applied to the intercrops; no fertilizer was applied to sunn hemp. Wide row spacing of 150 cm was followed for sugarcane which was planted in the furrows and the intercrops were sown on both sides of the ridges at three fourth height on the third day after planting sugarcane. At 10<sup>th</sup> day after sowing, the intercrops were thinned to maintain optimum population. Recommended irrigation and plant protection measures were followed.

Fertilizers were applied separately for sugarcane and intercrops. For sugarcane, 62.5 kg/ha P<sub>2</sub>O<sub>5</sub> was applied as basal dose in the furrows prior to planting. Nitrogen was applied as per treatment schedule and 120 kg/ha K<sub>2</sub>O was applied in two equal splits at 45<sup>th</sup> and 90<sup>th</sup> day of planting. For the intercrops, 50% of the recommended doses of fertilizers were applied. While amaranthus was harvested before flowering, sunn hemp was uprooted and incorporated in situ in the sugarcane furrows before flowering. Sesame and finger millet were harvested after maturity.

For better comparison of the different crops in the intercropping system, the yield of intercrops was converted to cane equivalent yield (CEY) and added to the cane yield by adopting the formula evolved by Verma and Modgel (1983) for calculating Wheat Equivalent Yield (WEY).

$$CEY = \sum_{i=1}^n (Y_i e_i)$$

where

n = 1, 2, 3..... n, total number of crops in association  
 Y<sub>i</sub> = the economic yield of the i<sup>th</sup> crop, and  
 e<sub>i</sub> = the cane equivalent factor of the i<sup>th</sup> crop  
 e<sub>i</sub> was calculated using the formula

$$e_i = \frac{P_i}{P_s}$$

where

P<sub>i</sub> = the price of unit weight of the i<sup>th</sup> crop, and  
 P<sub>s</sub> = the price of the unit weight of cane

In both crops, the growth of amaranthus, finger millet and sunn hemp was good whereas the performance of soybean, black gram and sesame crops was not

satisfactory. Since sunn hemp is incorporated in situ for addition of organic nutrients and its benefits can be realised in terms of cane yield, the biomass yield of sunn hemp was not taken for cane equivalent yield. The data on the performance of finger millet + sugarcane and amaranthus + sugarcane are presented.

The effect of nitrogen application and cropping systems on cane equivalent yield during 2014 and 2015 are presented in Tables 1 & 2. In 2014, the levels of N application adopted for sugarcane affected the cane equivalent yield (CEY) significantly. Application of 100% N recorded higher CEY (103.1 t/ha) than 75% N (87.9 t/ha) and 50% N (75.3 t/ha) (Table 1). Megha et al. (2008) reported that application of 125% recommended dose of fertilizer (RDF) produced significantly higher CEY (117.1 t/ha) than 100% and 75%. Among the cropping systems followed, sugarcane + amaranthus recorded higher CEY (99.8 t/ha) than sugarcane + finger millet (77.7 t/ha). This might be due to additional yield from amaranthus without adverse effect on sugarcane and good market price. According to Singh et al. (2009), two rows of

amaranthus can be intercropped in autumn sugarcane planted in paired rows (45:135 cm) with 150% RDF to achieve highest system productivity and profitability. The interaction effect was not significant.

In 2015, the yields of intercrops were lower than in 2014 due to heavy rain from flowering to maturity period, which affected the flowering and seed set of finger millet. However, application of 100% N has recorded significantly higher CEY (164.3 t/ha) followed by 75% N (149.6 t/ha) and 50% N (103.2 t/ha) (Table 2). As discussed earlier, different N levels had significant influence on the yield of intercrops (Megha et al. 2008). Sugarcane + amaranthus recorded significantly higher CEY (144.5 t/ha) than the sugarcane + finger millet (133.6 t/ha) cropping system. Although the trend in CEY was similar in both the years, the CEY of finger millet and amaranthus (value in parenthesis) was higher in 2014 than in 2015. The interaction effect was also not significant.

The results of the experiments in both the years suggested that cultivation of intercrops such as finger

**Table 1. Effect of N application and cropping system on cane equivalent yield (CEY) (t/ha) in red sandy loam soil during 2014**

N for sugarcane	Cane yield + CEY of finger millet	Cane yield + CEY of amaranthus	Mean
100 %	97.4 (6.9) <sup>@</sup>	114.8 (30.5)	103.1
75 %	76.9 (6.1)	98.9 (28.0)	87.9
50 %	64.7 (5.57)	85.8 (26.6)	75.3
Mean	77.7	99.8	
		SEd	CD (P=0.05)
	N levels (N)	0.99	2.74
	Intercrops (I)	0.65	1.60
	N x I	1.27	NS

<sup>@</sup> Values in parentheses are cane equivalent of intercrop yields (t/ha)

**Table 2. Effect of N application and cropping system on cane equivalent yield (CEY) (t/ha) in black clay soil during 2015**

N for sugarcane	Cane yield + CEY of finger millet	Cane yield + CEY of amaranthus	Mean
100 %	157.5 (3.8) <sup>@</sup>	171.1 (17.4)	164.3
75 %	144.4 (3.6)	154.7 (13.9)	149.6
50 %	98.7 (3.4)	107.7 (12.5)	103.2
Mean	133.6	144.5	
		SEd	CD (P=0.05)
	N levels (N)	2.31	6.42
	Intercrops (I)	0.36	0.88
	N x I	2.35	NS

<sup>@</sup> Values in parentheses are cane equivalent of intercrop yields (t/ha)

millet and amaranthus in sugarcane under wide row (150 cm) system of planting with 100% of recommended N application to the main crop and 50% of the RDF to the intercrop will produce additional benefits compared to the sole sugarcane crop.

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