RESEARCH ARTICLE

EVALUATION OF DRIP FERTIGATION IN SUGARCANE IN NORTH COASTAL ZONE OF ANDHRA PRADESH

V. Gouri*, T. Chitkala Devi, K. Prasada Rao and R. Ankaiah

Abstract

A replicated field experiment was conducted at the Regional Agricultural Research Station, Anakapalle, Andhra Pradesh, India, to study the effect of surface drip fertigation on yield and juice quality of sugarcane (cv 97A 85 (Visakha)) planted in paired rows with a spacing of 60/120 cm during 2010-11 and 2011-12. Solid, liquid and water soluble forms of N and K fertilizers were applied at 100% (112 kg N/ha and 100 kg K/ha) and 150% recommended doses; only nitrogen fertilizer without potassium at 100 and 150% recommended doses was also applied. The results indicated that application of 150% recommended dose of N and K fertilizers yielded higher number of millable canes, cane yield and sugar yield. Among different forms of fertilizers, application of 150% recommended dose of solid N and K fertilizers in the form of urea and murate of potash recorded significantly higher mean cane yield. There was no significant difference in cane yield of sugarcane among different forms of fertilizers at higher doses of fertigation, i.e. at 150% recommend dose of fertilizers. Juice quality in terms of sucrose and CCS % was not influenced significantly by different treatments. Application of only N fertilizer in the form of urea at 100% recommended level gave lowest mean cane yield. The study revealed that solid nitrogen and potassium fertilizers in the form of urea and murate of potash at higher dose can be used in fertigation in order to achieve higher cane yields in North Coastal Zone of Andhra Pradesh.

V. Gouri, T. Chitkala Devi, K. Prasada Rao and R. Ankaiah
Acharya N.G. Ranga Agricultural University,
Regional Agricultural Research Station,
Anakapalle, Andhra Pradesh, India
email: tv_gouri@rediffmail.com

Key words: *Sugarcane, drip fertigation, forms of fertilizers, cane yield*

Introduction

In Andhra Pradesh (India) since 1950s, the land area under sugarcane cultivation, production and productivity of sugarcane in the country have increased dramatically since 1950s, despite year-to-year fluctuations. Area has grown from 1.71 million ha to 4.5 million ha and production increased from 57 MT to 335 MT. However, cane area and production fluctuated widely year after year. Also, consumption of sugar in India is increasing with time and by 2025 there is an expected gap of 11.9 MT between demand and supply of sugar. The area under cane cultivation is not likely to increase and the increasing demand has to be achieved from the same area through improved productivity (Nair 2009). Natural resources are declining at faster rate than predicted and are approaching a tipping point. India's water demand will nearly double in 2030 from the present 740 billion m^3 to 1.3 trillion m^3, thus necessitating efficient water management for improving agriculture productivity. Sugarcane, being a long duration crop, requires considerable quantity of water to the extent of 1400 – 1500 mm in the subtropics (Solomon, 2012). Its peak water requirement coincides with the deficit period. Providing optimum soil moisture conditions throughout the crop growing period is therefore of paramount importance to realize higher yields (Sundara 1998; Gopalasundaram 2009). Drip fertigation offers a great scope to increase cane productivity up to 200-220 t/ha (Senthil kumar, 2009), saves 40-50% irrigation water and enhances nutrient efficiency by 40% (Solomon 2012). The combined use of fertigation techniques and drip irrigation is expected to offer the possibility to optimize the water and nutrient distribution over time and space (Nanda 2010). Field studies are therefore essential to

evaluate different forms and levels of fertilizers on yield and quality of sugarcane under drip fertigation. This study was conducted to determine the yield response of sugarcane to various forms of fertilizers at different nutrient levels under drip fertigation.

Materials and Methods

A field experiment was conducted at the Regional Agricultural Research Station, Anakapalle, Andhra Pradesh, during 2010-11 and 2011-12. The soils of the experimental field are sandy loam in texture, neutral in pH, normal in EC, low in available nitrogen, medium in available phosphorus and high in available potassium (Table 1).

Table 1. Physico-chemical properties of experimental site

Parameter	Value / Type
pH	7.29
EC (dS/m)	0.08
Organic Carbon (%)	0.44
Available Nitrogen (kg/ha)	220
Available Phosphorus (kg/ha)	30.21
Available Potassium (kg/ha)	247
Texture	Sandy Loam

The experiment was designed in Randomized Block Design with eight treatments and three replications. The treatments included: T1: 100% recommended dose of N (112 kg N/ha) and K (100 kg K/ha) fertilizers applied in the form of urea and MOP (solid fertilizers); T2: 150% recommended dose N & K fertilizers in the form of solid fertilizers; T3 :100% recommended dose of N&K fertilizers applied in the form of water soluble fertilizers; T4: 150% recommended dose of N&K fertilizers applied in the form of water soluble fertilizers; T5: 100% recommended dose of N&K fertilizers applied in the form of liquid fertilizers; T6 : 150% recommended dose of N&K fertilizers applied in the form of liquid fertilizers; T7:100% recommended dose of N fertilizer applied in the form of urea and T8:150% recommended dose of N fertilizer applied in the form of urea. Drip was operated daily to replenish 100% evaporation losses taking into account rainfall, pan and crop coefficients. An early maturing sugarcane variety 97A85 (Visakha) was planted in paired rows (60 cm/120 cm) using three budded setts @ 40,000/ ha in the month of February during two seasons. Fertigation schedule was started at 30 days after planting (DAP) with a weekly interval and continued up to 180 days after planting. Thus the N and K fertilizers in different forms at 100% and 150% recommended doses were applied through drip in 21 equal splits. All other agronomic practices like hand weeding, earthing up, trash twist propping, etc. were carried out according to recommendations. Yield attributing parameters like number of millable canes (NMC) and cane length were recorded at the time of harvest. Cane yield was recorded after stripping the leaves and detopping. Juice quality parameters, *viz*. sucrose%, CCS % and sugar yield were recorded at harvest by following standard procedures (Spencer and Meade, 1963). Data collected were statistically analyzed and the results were compared.

Results and discussion

Results pertaining to the yield, yield attributes and juice quality parameters are presented in Table 2. Significant variation in NMC was found in different treatments. N&K applied in the form of solid fertilizers at 150% recommended dose gave significantly higher NMC over other treatments and it was statistically on par with150% recommended dose of N&K applied in the form of liquid fertilizer. Significantly higher cane population at higher doses of N&K applied in the form of solid and liquid fertilizers indicated higher conversion efficiency of tillers into millable canes. Variation in number of millable canes due to drip fertigation was also reported by Raskar and Bhoi (2001). The rate of elongation and length of internodes were not significantly influenced by different drip fertigation treatments. However, the tallest canes were recorded with 100% recommended dose of N&K applied in the form of solid fertilizers. Cane yield showed significant difference with different levels and types of fertilizers under drip fertigation. A significant increase in cane yield was observed at higher dose of nitrogen and potassium fertilizers. Increase in sugarcane yield with increase in fertilizer level was also reported by Rajanna and Patil (2003). Significantly higher cane yield was recorded with

Table 2. Yield and juice quality attributes of sugarcane as influenced by drip fertigation

Treatments	NMC ('000/ha)	Length of millable cane (cm)	Cane yield (t/ha)	Sucrose (%)	CCS (%)	Sugar yield (t/ha)
100% recommended dose of N&K fertilizers applied in the form of solid fertilizers	83,476	322	98.8	17.85	13.08	13.0
150% recommended dose N & K fertilizers applied in the form of solid fertilizer	87,401	321	106.9	18.10	13.23	14.3
100% recommended dose of N&K fertilizers applied in the form of water soluble fertilizers	78,903	302	89.5	17.55	12.85	11.7
150% recommended dose of N&K fertilizers applied in the form of water soluble form of fertilizers	81,004	313	98.1	17.1	12.65	12.7
100% recommended dose of N&K fertilizers applied in the form of liquid fertilizers	80,687	295	96.4	17.3	12.60	12.3
150% recommended dose of N&K fertilizers applied in the form of liquid fertilizers	85,206	313	103.9	18.0	12.00	13.8
100% recommended dose of N fertilizer applied in the form of urea	76,058	321	85.9	18.2	13.33	11.5
150% recommended dose of N fertilizer applied in the form of urea	79,566	315	89.6	18.75	13.20	11.9
SE ±	433	3.58	3.2	6.93	13.63	
C.D(P=0.05)	4243.5	NS	9.7	NS	NS	

150% recommended dose of N&K applied in the form of solid fertilizers but it was on par with the 150% recommended dose of N&K applied in liquid and water soluble forms. Highest shoot population coupled with efficient conversion of tillers into millable canes at harvest might have contributed to higher cane yield. Raskar and Bhoi (2001) reported that application of straight fertilizers as urea and murate of potash were the best alternative source of water soluble fertilizers.

Juice quality parameters such as sucrose %, CCS % and sugar yield were not affected by drip fertigation treatments. Rajanna and Patil (2003) reported that quality parameters such as Brix, pol% and percentage of commercial cane sugar were not affected by fertigation. Juice quality mainly depends on genetic nature of the variety (Yanam et al, 1997). Since the sugar yield is dependent on cane yield, it followed the same pattern as the cane yield as discussed above. The highest sugar yield was recorded with 150% recommended dose of N&K applied in the form of urea and murate of potash.

The results indicated that application of 150% recommended dose of N&K fertilizers applied in the form of urea and murate of potash through drip fertigation is the best alternative to using expensive water soluble and liquid fertilizers.

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