SURU SUGARCANE *(Saccharum officinarum,* L.) YIELD, QUALITY AND SOIL NUTRIENT STATUS IN RELATION TO PLANTING PATTERN AND INTERCROPPING

***[1]OMBASE, K. C.; [2]MEVADA, K. D.; [3]GHADAGE, H. L. AND [4]GAMAR, P. G.**

COLLEGE OF AGRICULTURE
PUNE, MAHARASHTRA, INDIA

****EMAIL: amt_kd@yahoo.com***

[1]PG scholar, College of Agriculture, Pune (Maharashtra)
[2]Associate Professor, Department of Agronomy, BACA, AAU, Anand (Gujarat)
[3]Associate Professor, College of Agriculture, Pune (Maharashtra)
[4]PG Scholar, Department of Agronomy, BACA, AAU, Anand (Gujarat)

ABSTRACT

An experiment was conducted at Agronomy Farm, College of Agriculture, Pune (Maharashtra) during spring season of 2008-09 to find out the effect of different planting methods along with intercropping on growth and yield of suru sugarcane (Saccharum officinarum L.) cv. Co 86032. The experiment was compromising of four planting patterns viz., 90 x 30 cm single row planting, 90-180 x 30 cm paired row planting, 180 x 30 cm single row planting and 120 x 30 cm single row planting with sugarcane planter as main plots and two intercropping systems viz., sugarcane + groundnut and sole sugarcane, laid out in strip plot design with three replications in medium deep black, well drained, clayey textured soils with alkaline reaction (pH 7.6). The field capacity and permanent wilting point values were 36.07 and 18.45 per cent, respectively. The bulk density was 1.21 g cm^{-3}. In single row planting system, single line of groundnut (TPG 41) was sown in inter-row space of sugarcane on one side of ridge and in paired row planting and in wide row planting two rows of groundnut was sown in inter-row space of sugarcane. Results revealed that intercropping of two rows of groundnut in paired row planting of sugarcane (2:2) was proved to be the most productive system with significantly the highest cane equivalent yield (152.96 t/ha). Significantly higher brix % (22.25%), Sucrose (20.61 %) and CCS % (14.56 %) were obtained under P_2 i.e. paired row planting of sugarcane. Appreciably higher CCS (14.30 %) was recorded with sole sugarcane planting.

KEY WORDS: Intercropping planting pattern, soil nutrient status, Suru sugarcane

INTRODUCTION

Sugarcane is a perennial crop and put forth dense canopy cover throughout the life period. This causes problems in aeration of the crop yield, which indirectly reduce the crop yield. The techniques like spaced planting with various row spacing have brought out promising results in this respect with very low additional cost in preparation of layouts. The population per unit area and distance between cane rows play a significant role in influencing the yield. Wide row sugarcane planting technology is spreading fast particularly in tropical states (Sundara, 200). Basically, the concept of wide rows planting was

developed to facilitate mechanical harvesting of the crop. The larger interspaces between the wide spaced sugarcane rows can be utilized by the intercrops for better exploitation of the natural resources like light, soil moisture, nutrients and carbon dioxide. Sugarcane is generally planted as sole crop in spring season. Wide row spacing and slow growth of sugarcane during early stages of the crop may provide ample opportunity for intercropping of summer crops. The slow establishment of sugarcane during the initial period and adoption of comparatively wider row spacing offers vast scope for intercropping. Temporal differences can be best exploited by using species or varieties of intercrops that are sufficiently early maturing and harvested before they compete with cane (Verma and Yadav, 1986).

Twenty five per cent of the total sugarcane area in Maharashtra is replaced in each year in *suru* season. It provides any opportunity to adopt intercropping to obtain additional income to the farmer. Intercropping in spring sugarcane with legume is quite a common practice and has been recognized as potential system to enhance the productivity of sugarcane based cropping systems. Non legume intercrops deplete more soil nutrient and bring economic reduction in sugarcane yield. Hence, there is need for better management and the selection of suitable intercrop for local conditions necessitate for harnessing maximum benefits and sustaining soil health. With the introduction of high tillering and high yielding varieties of sugarcane, it is possible to maintain the cane population and final cane yield even at relatively wider row spacing. increasing the row spacing of sugarcane from the present recommended spacing of 90 to 120 cm would greatly facilitate not only easy management of intercropping without any competition effects, but also provide enough scope for intercrops to get higher productivity, especially under frequently irrigated tropical climatic regions (Shahi, 2002). In light of this back ground, present experiment was conducted to find out the effect of planting pattern and intercropping on growth and yield of *suru* sugarcane cv. Co 86032.

MATERIALS AND METHODS

The field experiment was conducted at Agronomy Farm, College of Agriculture, Pune during spring season of 2008-09 to find out the influence of different planting patterns along with intercropping on growth and yield of *suru* sugarcane (*Saccharum officinarum* L.) cv. Co 86032 on medium deep black, well drained, clayey textured soils found low in available N (143 kg/ha), medium in available P (16.5 kg/ha), high in available K (416 kg/ha), moderately high organic carbon content (0.72 %) with low EC (0.24 dSm^{-1}) and alkaline in reaction (pH 7.6) with 36.07 % field capacity, 18.45 % permanent wilting point and 1.21 g cm^{-3} bulk density. The experiment was laid out in strip plot design with three replications. The treatment compromising of four planting patterns *viz.*, 90 x 30 cm single row planting (P_1), 90-180 x 30 cm paired row planting (P_2), 180 x 30 cm single row planting (P_3) and 120 x 30 cm single row planting (P_4) with sugarcane planter as main plots and two intercropping systems *viz.*, sugarcane + groundnut (I_1) and sole sugarcane (I_2). In single row planting system, single line of groundnut (TPG 41) was sown in inter-row space of sugarcane on one side of ridge and in paired row planting and in wide row planting two rows of groundnut was sown in inter-row space

of sugarcane. The recommended dose of 250:115:115 kg N, P_2O_5 and K_2O /ha to spring sugarcane and 25 kg N and 50 kg P_2O_5 /ha was applied to groundnut through urea, single super phosphate and muriate of potash, respectively. In sugarcane nitrogen was given in four splits. The Ist 10 per cent (25 kg N/ha) at the time of planting, IInd 40 per cent (100 kg N/ha) 45 DAP at tillering stage, IIIrd 10 per cent (25 kg N/ha) 90 DAP at light earthing up and remaining 40 per cent (100 kg N/ha) 120 DAP at the time of final earthing up. The P_2O_5 and K_2O fertilizers were applied in two equal splits, 50 % as a basal dose at planting and remaining 50% as top dressing at final earthing up. 40 % of recommended fertilizer (25-50-00 NPK/ha) was applied to groundnut separately as an intercrop i.e. 10 kg N/ha in two equal splits at planting and one month after planting and full dose of 20 kg P_2O_5/ha was applied as basal dose. The observations on different yield attributes *viz*., number of milleable canes, average cane yield (kg), cane yield (t/ha), commercial cane sugar yield (t/ha) and cane equivalent yield (t/ha) and quality parameters *viz*., Brix (%), sucrose (%), CCS (%) and purity (%) were recorded as per the standard procedure and formulae. Available N, P_2O_5 and K_2O as influenced by various treatments were also recorded. Also the ancillary observations *viz*., plant height (cm), plant spread (cm), Filled pods per plant, Unfilled pods per plant, pod weight per plant (g), kernel weight per plant (g) and dry pods yield (kg/ha) was recorded for groundnut crop. The data were analyzed following standard statistical procedure.

RESULTS AND DISCUSSION

Effect of planting patterns

Yield attributes presented in Table 1 revealed that number of millable cane (927800 /ha) was found significantly higher under P_1 i.e. single row planting with 90 x 30 cm, however, it was found at par with P_2 i.e .paired row planting of 90-180 x 30 cm spacing (91020 /ha). Prabhakar (1999) and Mahadevaswamy (2001) also observed the highest millable cane population under normal row spacing (90 cm) and was reduced under wider row spacing of 150 cm.

Conversely, being at par with 180 x 30 cm single row (P_3), appreciably higher average cane weight (1.45 kg/plant) was recorded under paired row planting of 90-180 x 30 cm spacing (P_2). The higher cane weight in paired row planting might be due to increase in number of internodes and length of internodes and millable height of cane. An outright increase in cane yield (131.95 t/ha), commercial cane sugar yield (19.21 t/ha) and cane equivalent yield (143.91 t/ha) was reported in paired row planting of 90-180 x 30 cm spacing. In paired row planting, main factors contributing towards cane yield was number of internodes and length of internodes, millable height of cane and weight of cane. Similar findings were reported by Nagendran and Palanisamy (1997) and More (2003).

The yield and yield contributing characters of groundnut did not differ significantly due to different planting patterns of sugarcane indicating no adverse impact of sugarcane on groundnut intercrop (Table 2).

Data pertaining to quality parameters (Table 4) indicated that the quality parameters recorded at harvest were significantly differed due to different planting patterns. The brix, sucrose and CCS per cent improved significantly in paired row planting system (90-180 x 30 cm) than single row planting systems. However, the

sucrose and CCS per cent was at par when sugarcane planted at 120 cm spacing. The planting system not influenced the purity per cent of the cane juice. This might be attributed to sink to source ratio due to higher light interception at wider row spacing. However, Devi *et al.,* (1990) reported non-significant differences per cent sucrose value due to different spacing. The variation in juice quality between spacing was also found marginal (Narwal and Malik, 1981; Jayabal, 1992).

The value of available nitrogen was influenced significantly by different planting patterns and it was significantly higher (138.17 kg/ha) in paired row planting patterns than single row planting. The values of available P_2O_5 and K_2O at harvest were not influenced significantly by any planting pattern (Table 5).

Effect of intercrop

Intercropping of sugarcane with groundnut had remarkable influence on weight of individual cane (1.36 kg/cane), mean cane yield (112.15 t/ha) and CCS (16.09 t/ha) (Table 1). They were found maximum with sole sugarcane over groundnut intercropped cane. The cane yield decreased by 4.89 per cent with intercropping of groundnut compared to sole sugarcane. Contrary to this, significantly higher cane equivalent yield (131.61 t/ha) was recorded by groundnut intercropped sugarcane than sugarcane alone (116.59 t/ha) and it was 12.88 per cent higher than sole planting of sugarcane. This might be owing to additional yield obtained from groundnut and attractive price of their pods in market. These results corroborated the findings of Kumar *et al.* (2006).

All the quality parameters except CCS per cent were not influenced significantly when groundnut planted in sugarcane as an intercrop (Table 4). However, CCS per cent was increased significantly in control plot than groundnut intercropped cane.

Available N (132.25 kg N/ha) and P_2O_5 (32.49 kg P_2O_5/ha) were enhanced significantly in groundnut intercropping system than sole sugarcane (Table 5). However, intercropping with groundnut did not exert any noticeable impact on available K_2O.

Interaction effect

The combined effect (Table 3) of planting patterns and intercrop clearly indicated that significantly maximum sugarcane equivalent yield (152.96 t/ha) was obtained from paired row planting at 90-180 x 30cm (P_2) accommodating two rows of groundnut in skip row as an intercrop (I_1) over rest of the combinations. The sugarcane + groundnut intercropping recorded 13.42 per cent higher CEY over sole sugarcane in paired row planting. Interaction effect between planting patterns and intercrop on all the quality parameters as well as status of available N, P_2O_5 and K_2O were found trivial**.**

CONCLUSION

In light of the above discussion it can be concluded that intercropping of two rows of groundnut in paired row planting of sugarcane proved most productive system. Quality parameters as well as available nitrogen were improved when sugarcane was planted in paired row planting at 90-180 x 30 cm.

REFERENCES

Kumar, S.; Rana, N. S.; Singh, R. and Singh, A. 2006. Production potential of spring sugarcane as influenced by intercropping of dual purpose legumes under *tarai* conditions of Uttarakhand. *Indian. J. Agron*., **51**(4): 271-273.

Devi, C.; Rao, K. L. and Raju, D. V. M. 1990. Studies on the effect of row spacing and nitrogen on cane yield and quality parameters of early maturing sugarcane varieties. *Indain Sugar*, **40**(7): 541-544.

Jayabal, V. (1992). Intercropping studies in sugarcane during eighties in South India. A review. Bharatiya sugar, pp. 27-30.

Mahadevaswamy, M. (2001). Studies on intercropping of onion in wide spaced sugarcane. Ph.D. Thesis (Unpublished) Submitted to Tamil Nadu Agricultural University, Coimbatore.

More, S. M. (2003). Study on the effect of row spacing, planting system and intercropping on growth, yield, quality and economics of *suru* sugarcane (cv. Co 86032) and its ratoon under drip irrigation. Ph.D. Thesis (Unpublished) Submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri.

Nagendran, K.R. and Palanisamy, P. (1997). Spaced row planting improves sugarcane yield. *Kisan World*. **24**(3): 11-13.

Narwal, S. S. and Malik, D. S. (1981). Sugarcane intercropping in India: A review. II. South India III. Annual and absali planted cane. *Coop.Sugar*,**12**: 559-561.

Prabhakar, L. N. (1999). Management practices for intercropping of soybean in wide row sugarcane. M. Sc. (Agri) Thesis (Unpublished) Submitted to Sugarcane Breeding Institute and Tamil Nadu Agricultural University, Coimbatore.

Shahi, H. N. (2002). Sugarcane "Crushing Prices Cause Concern". The Hindu Survey of Indian Agriculture. Pp. 119..

Sundara, B. (2003). Response of new sugarcane varieties to wide row spcing. Proceedings 65th Annual convention of the Sugarcane Technologista' Association of India, Bhubneshwar, Orissa, August A168-A177, pp. 22-24.

Verma, R. S. and Yadav, R. L. (1986). Growth and yield of sugarcane and potato in companion cropping system. *J. Agric. Sci.*, **107**(1): 125-231.

Table 1: Yield attributes, yield and cane equivalent yield of sugarcane as affected by different treatments

Treatment	NMC[1] ('000' /ha)	ACW[2] (kg)	Cane Yield (t/ha)	CCS[3] yield(t/ha)	CEY[4] (t/ha)
Planting patterns					
P_1 : 90 x 30 cm single row	92.78	1.11	102.55	14.51	118.91
P_2 : 90-180 x 30 cm paired row	91.02	1.45	131.95	19.21	143.91
P_3 : 180 x 30 cm single row	59.99	1.42	85.17	11.63	106.04
P_4: 120 x 30 cm single row with sugarcane planter	86.06	1.37	117.91	17.13	127.55
S.Em ±	1.16	0.01	1.36	0.16	2.19
CD at 5 %	4.02	0.04	4.70	0.57	7.59
Intercrops					
I_1 : Sugarcane + Groundnut	81.65	1.31	106.67	15.16	131.61
I_2 : Sole sugarcane	83.26	1.36	112.15	16.09	116.59
S.Em ±	0.89	0.01	1.49	0.22	0.99
CD at 5 %	NS	0.04	4.87	0.73	3.25
Interaction					
S.Em ±	1.79	0.02	2.99	0.45	1.99
Mean	82.46	1.34	109.39	15.62	124.10

[1]Number of milleable canes, [2]Average cane weight,
[3]Commercial cane sugar, [4]Cane equivalent yield

Table 2: Ancillary observations of Groundnut as influenced by various treatments of sugarcane planting patterns

Treatments	Plant Height(cm)	Plant Spread(cm)	Filled Pods/Pl.	Un Filled Pods/Pl.	Pod Weight /Pl.(g)	Kernel Weight /Pl.(g)	Dry Pod Yield (q/ha
P_1 :90x30 cm single row	25.78	30.02	14.18	3.78	28.88	18.02	9.93
P_2 :90-180x30 cm paired row	26.40	32.51	16.70	4.34	30.58	20.33	13.76
P_3 :180x30 cm single row	26.23	32.47	16.43	4.25	30.59	19.89	13.07
P_4:120x30 cm single row with sugarcane planter	26.05	32.18	14.99	4.01	29.36	18.44	11.10
S.Em ±	0.10	0.11	0.07	0.08	0.07	0.09	0.11
CD 5%	NS	NS	NS	NS	NS	NS	NS
General Mean	26.12	31.79	15.57	4.10	29.83	19.17	11.17

Table 3: Interaction effects of planting patterns and intercrop on cane equivalent yield (t/ha)

Treatment	Intercrop	
	Sugarcane + Groundnut	Sole sugarcane
Planting Patterns		
P_1 : 90 x 30 cm single row	123.04	114.77
P_2 :90-180 x 30 cm paired row	152.96	134.86
P_3 :180 x 30 cm single row	115.50	96.58
P_4 :120 x 30 cm single row with sugarcane planter	134.94	120.15
SEm ±	1.99	
CD at 5 %	8.95	

Table 4: Quality parameters in sugarcane as influenced by various treatments

Treatment	Quality parameters			
	Brix (%)	Sucrose (%)	CCS (%)	Purity (%)
Planting patterns				
P_1 : 90 x 30 cm single row	21.08	19.87	14.15	94.24
P_2 : 90-180 x 30 cm paired row	22.25	20.61	14.56	92.62
P_3 : 180 x 30 cm single row	21.33	19.45	13.65	91.23
P_4: 120 x 30 cm single row with sugarcane planter	22.00	20.50	14.53	93.19
S.Em ±	0.18	0.04	0.08	0.88
CD at 5 %	0.62	0.15	0.29	NS
Intercrops				
I_1 : Sugarcane + Groundnut	21.67	20.03	14.15	92.47
I_2 : Sole sugarcane	21.68	20.18	14.30	93.16
S.Em ±	0.07	0.05	0.04	0.26
CD at 5 %	NS	NS	0.13	NS
Interaction				
S.Em ±	0.13	0.09	0.08	0.51
CD at 5 %	NS	NS	NS	NS
Mean	21.67	20.11	14.22	92.82

Table 5: Available N, P_2O_5 and K_2O as influenced by various treatments

Treatments	Available Nutrients (kg/ha)		
	N	**P_2O_5**	**K_2O**
Planting patterns			
P_1 : 90 x 30 cm single row	129.45	28.21	306.77
P_2 : 90-180 x 30 cm paired row	138.17	30.81	309.57
P_3 : 180 x 30 cm single row	122.68	27.41	305.24
P_4: 120 x 30 cm single row with sugarcane planter	131.17	29.14	308.19
S.Em $\pm$	0.91	0.73	1.66
CD at 5 %	3.15	NS	NS
Intercrops			
I_1 : Sugarcane + Groundnut	132.25	32.49	307.99
I_2 : Sole sugarcane	128.49	25.29	307.02
S.Em $\pm$	0.93	0.59	1.49
CD at 5 %	3. 04	1.93	NS
Interaction			
S.Em $\pm$	1.86	1.18	2.99
CD at 5 %	NS	NS	NS
Mean	130.37	28.89	307.51

[MS received: February 12, 2017] *[MS accepted: February 26, 2017]*