EFFECT OF SPACING AND SEED PLACEMENT ON YIELD AND YIELD CONTRIBUTING CHARACTERS OF SUGARCANE VARIETY THATTA-10 UNDER AGRO ECOLOGICAL CONDITIONS OF THATTA

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ABSTRACT: Field experiments were carried out to study the effect of inter row spacing and seed placement on yield and yield contributing characters of sugarcane variety Thatta-10 at National Sugar Crops Research Institute, farm Thatta during autumn 2003-04 and 2004-05. Inter row spacings were 0.75, 1.00, 1.25 and 1.50m and two seed placement methods were overlapping set and double set. The experiment was conducted in spilt plot design using main plots (10x 15m) for spacing and subplot (5x15m) for seed placement with three replications. The recommended fertilizer dose of NPK at the rate of 275-112-175 Kg ha-1 was applied. Yield parameters viz number of millable canes, cane thickness, number of internodes per plant, cane weight, plant height and CCS% were influenced by inter row spacing and seed placement. Among the all row spacings tested, 1.25m was found best for obtaining maximum cane yield (143.032 tons ha-1) and sugar content (12.83%).

Key words: *Sugarcane, Thatta-10, Inter row spacing, Seed placement, Yield and Yield components.*

INTRODUCTION

Sugarcane (Saccharum officinarum L.) is one of the major cash crops of Sindh province. Its significance in improving farmer's economy was realized after independence. In Pakistan sugarcane was grown on an area of 1074.5 thousand hectares. Its annual production was about 53419.3 thousand tones, with an average yield of 60 tons ha-1. While in Sindh the area under sugarcane was 259.9 thousand hectares and the production was 14611.8 thousand tones (Agri. Statc. of Pak.2003-04). This has been made possible through higher returns from this crop and installation of 30 sugar mills in the province. Therefore, the quality of cane and high yielding varieties are the need of time for farmers and also improving the efficiency of sugar mills.

There are several reasons for low cane yield and sucrose recovery from the cane but with improved varieties and management of proper inter row spacing it may be possible to increase the yield and sugar recovery significantly.

Khandaga vb etal. (2005) found that the 120 cm row spacing produced high cane yield (123.4 tons ha-1) than conventional 90 cm row spacing. Singh and Singh (1984) reported that sugarcane grown in 90cm spaced rows has slightly higher sucrose content and available sugar than that grown 60 cm spaced rows. Mali and Singh (1985) found that commercial cane sugar production was significantly higher (10.42 t ha-1) at 90 cm and 10.44 t ha-1 at 120cm than planted in 60 cm row spacing 8.72 t ha-1 , while in contrast , Malik etal. (1996) and Ali et al. (1999) reported that row spacing of 0.75,1.00 ,125 and 1.50 m had no significant effect on CCS% and total sugar yield of cane. On the contrary, El-Geddawy et al. (2002) recorded significantly higher sugar yield per fed at row spacing 100 cm than 120 or 140 cm. Singh etal. (1981) reported that germination increased significantly at wider row spacing over closer row spacing, might be due to availability of wider space and consequent greater availability of moisture, more aeration to individual sets of cane seed. There is greater demand for sugarcane in the worlds economy because of the demand for sugar, and it's byproducts. This demand is not being met by the relatively shrinking supply of commercially grown sugar in tropic regions. If scientist could continue research and enhance the methods used to grow sugarcane, a global sugar shortage could be averted.

It has been observed that new sugarcane varieties require their own peculiar setup of inputs. In this study efforts have been made to find out appropriate inter row spacing of sugarcane variety Th-10 to get the maximum cane and sugar variety Th-10 to get the maximum cane and sugar yield per unit area.

MATERIALS AND METHODS

The experiment was conducted to observe the effect of inter row spacing and seed placement on the growth, yield and sugar contents of sugar cane variety Thatta-10 under agro-climatic condition of Thatta during the two consecutive planting seasons of the year 2003-04 and 2004-05. Four spacing S 1 (0.75), S2 (1.00) ,S3 (1.25) and S4 (1.50m) and two seed placement methods SP1 (Overlapping set) and SP2 (Double set) were arranged under split plot using main plot of 10x15m for spacing and subplot of 5x10m was used as seed placement with three replications. The seed rate for each row spacing was different i.e.T1= S1 SP1 (120,000), T2= S1 SP2 (160,000), T3= S2 SP1 (90,000), T4= S2 SP2 (120,000), T5= S3 SP1 (72,000), T6= S3 SP2 (96,000), T7= S4 SP1 (60,000) and T8= S4 SP2 (90,000 sets ha-1). The crop was planted in autumn 2003 and 2004 at National Sugar Crops Research Institute, experimental farm Thatta. The recommended fertilizer dose @275-112-175 kg NPK ha-1 was applied as, all PK and 1/3 N at the time of sowing while remaining 2/3 N in two equal splits, first at the completion of germination and second at the time of fist earthing up. Recommended agronomic practices were carried out as and when required during both the years. At the time of harvesting five stools were randomly taken from each plot to record the data for cane thickness, number of internodes per cane and plant height. While millable canes data were collected from canes in five meter row length, three rows of each plot were randomly taken and counted. Weight of the same millable canes was used to calculate the cane yield tones per hectare without tops and commercial cane sugar (CCS%). Data were statistically analyzed using MSTATC, computer program,(MSTATC,manual,1991).

After getting satisfactory results from the first year's trial, the same study was continued for the second year in succeeding ratoon and plant crop to find out the more stable results so as to recommend suitable row spacing and seed placement technique for getting better returns per unit area from sugarcane varietyThatta-10.

RESULTS AND DISCUSSION

The data regarding the study for the year 2003-04 is presented in Table-1&2, which reveals that sugarcane yield and yield parameters were increased significantly at wider row spacing (1.25m) as compared to closer row spacing (0.75m), Moreover, the cane yield was slightly higher under overlapping set placement as compared to double set placement in all row spacings. The same trend was observed in case of cane thickness, cane height and number of internodes per plant. Moreover, the results trend was same during the 2nd year's trial during 2004-05 (table-1&2) but the average cane yield and all other yield contributing parameters like cane thickness mms, plant height cm and millable cane ha-1 were higher in first year as compared to second year trial. While the seed placement (Overlapping and double set) showed non significant effects during both the year, but on overall average basis overlapping method performed better than the double set placement. During 2003-04 the highest cane yield of 175.28t ha-1was observed when variety Thatta-10 was planted at 1.25m row distance with overlapping set placement. However, under double set placement method and same wider row spacing cane yield in Thatta -10 was 167.51t ha-1 (table-1&2). The data for the year 2004-05 in table-1&2 reveals that highest cane yield of 117.93 t ha-1 was observed when variety Thatta-10 was planted at 1.25 m row distance with over lapping method. However, with double seed placement technique and same row distance (1.25 m) cane yield in Thatta-10 was 111.40 t ha-1. The higher yield at the wider row spacing was mainly owing to better survival of tillers, which resulted in taller stalks and increased stalk weight at harvest. Due to dense plant population in closer inter row spacing the rate of tiller death reached at high. Plants planted at wider row spacing (1.50 m) could not compensate for excess plant inter row spacing. Soopramanien and Julien (1980) opined that the inter-tiller competition is related to the micro-climate within the crop canopy, which is the main cause of tiller death. Similarly, Shih and Gascho (1980) observed that the competition for light caused decay of about 50% of the smaller sugarcane stalks. About 52% of the smaller stalks in wider rows and 71% in narrow rows had decayed until August. Patel etal. (1988) reported lesser mortality of tillers in wider spaced sugarcane crop. The similar results were obtained by Patel et al.(1988),Shih and Gascho (1980) and Soopramanien and Julien (1980) who reported that the higher cane yield at the wider row spacing were mainly due to better survival of tillers, which resulted in taller stalks and increased stalk weight at harvest.

The quality analysis data for the year 2003-04 in table-1&2 reveals that maximum CCS of 12.73% was obtained with the overlapping method under wider row spacing (1.25m). While under double set placement and same wider spacing CCS of 12.70% with very slight decrease was recorded, which was due to high tiller mortality in closer inter row spacing (tables-1&2). While during 2004-05 maximum CCS of 12.96% was obtained with over lapping method at

row spacing of 1.25 m, which was at par with CCS value obtained with over lapping method at row spacing of 1.75 m. While under double set placement with row spacing of 1.25 m next maximum CCS of 12.92% was recorded. The results are in agreement with the findings of Naidu (1982), who observed that the maximum commercial cane sugar percent achieved when crop planted at wider inter row spacing (1.20m) than narrow row space. In ratoon crop, the same tendency of increased yield in Thatta-10 sugarcane variety was observed at 1.25 m row spacing with over lapping technique. However, slight decline in sugar content was observed with over lapping method technique as compared to double set placement technique in all row spacings. Maximum cane yield of 94.89 t ha-1 was exhibited at 1.25 m row spacing with over lapping method. While, with double set placement technique under same row spacing (1.25 m) the cane yield in Thatta-10 was 92.55 t ha-1 Maximum CCS of 12.94% was recorded with over lapping method at 1.25 m row spacing. While with

Table 1: Cane yield and yield components of sugarcane variety Thatta-10 as affected by different row spacings and seed placement techniques during 2003-04 and 2004-05 at NSCRI, farm Thatta.

Treatments	Cane thickness (mm)		Cane height (cm)		Number of internodes Plant^{-1}	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
S 1 Sp1 (0.75 m row spacing with over lapping set placement)	25.20	22.30	283.00	259.00	23.66	19.77
S 1 Sp2 (0.75 m row spacing with double set placement)	25.07	22.82	280.00	267.00	23.55	20.00
S 2 Sp1 (1.0 m row spacing with overlapping set placement)	26.32	22.77	304.66	289.00	25.55	20.77
S 2 Sp2 (1.0 m row spacing with double set placement)	26.26	23.20	304.00	293.66	25.44	21.55
S 3 Sp1 (1.25 m row spacing with over lapping set placement)	27.64	22.88	340.00	303.33	27.22	21.88
S 3 Sp2 (1.25 m row spacing with double set placement)	27.44	23.88	330.33	318.00	25.66	22.66
S 4 Sp1 (1.50 m row spacing with over lapping set placement)	25.93	22.33	283.33	264.00	23.70	19.51
S 4 Sp2 (1.50 m row spacing with double set placement)	25.92	22.88	271.66	265.00	23.00	20.11
LSD-.5%	1.18	1.103	15.27	8.153	1.76	2.14

Table-2: Cane yield and yield components of sugarcane variety Thatta-10 as affected by different row spacings and seed placement techniques during 2003-04 and 2004-05 at NSCRI, farm Thatta.

Treatments	Millable canes (000 ha^{-1})		Cane Yield (t ha^{-1})		CCS%	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
S 1 Sp1 (0.75 m row spacing with over lapping set placement)	108.266	86.40	114.76	94.43	11.29	11.84
S 1 Sp2 (0.75 m row spacing with double set placement)	108.80	92.21	117.51	99.21	11.24	11.80
S 2 Sp1 (1.0 m row spacing with overlapping set placement)	123.466	93.75	135.51	99.56	12.71	12.86
S 2 Sp2 (1.0 m row spacing with double set placement)	127.066	98.00	142.31	103.66	12.67	12.55
S 3 Sp1 (1.25 m row spacing with over lapping set placement)	140.933	104.32	167.51	111.40	12.73	12.96
S 3 Sp2 (1.25 m row spacing with double set placement)	148.533	111.01	175.28	117.93	12.70	12.92
S 4 Sp1 (1.50 m row spacing with over lapping set placement)	105.60	84.87	122.44	88.28	12.68	12.96
S 4 Sp2 (1.50 m row spacing with double set placement)	108.177	92.02	121.82	93.94	12.65	12.52
LSD-0.5%	14.0	5.985	11.40	5.194	NS	0.64

S= Spacing
Sp= Seed placement

Table 3: Cane yield, yield components and quality performance of sugarcane variety Thatta-10 in row spacing and seed placement trial (Ratoon crop) during 2004-05 at NSCRI, farm Thatta.

Treatments	Cane thickness (mm)	Cane height (cm)	Number of internodes Plant^{-1}	Millable canes 000 ha^{-1}	Cane Yield (t ha^{-1})	CCS%
S 1 Sp1 (0.75 m row spacing with over lapping set placement)	21.44	188.66	18.00	97.05	76.17	12.17
S 1 Sp2 (0.75 m row spacing with double set placement)	21.68	205.00	19.66	99.99	79.12	11.87
S 2 Sp1 (1.0 m row spacing with overlapping set placement)	22.22	197.33	19.66	101.20	81.93	12.78
S 2 Sp2 (1.0 m row spacing with double set placement)	22.10	205.66	19.00	104.72	86.09	12.62
S 3 Sp1 (1.25 m row spacing with over lapping set placement)	21.99	221.00	21.33	110.11	92.55	12.94
S 3 Sp2 (1.25 m row spacing with double set placement)	22.44	226.66	19.66	113.65	94.89	12.81
S 4 Sp1 (1.50 m row spacing with over lapping set placement)	21.66	188.00	18.00	94.95	75.30	12.79
S 4 Sp2 (1.50 m row spacing with double set placement)	22.31	197.66	19.33	96.81	77.04	12.45
LSD-0.5%	1.117	15.28	2.10	6.64	4.381	1.351

double set placement technique at the same row spacing (1.25 m) next maximum CCS of 12.81% was observed. Moreover, the plants at more wider and narrow row spacings showed no patent enhancement in cane yield and sugar content with both seed placement techniques (table-3).

It was concluded that over lapping method with 1.25 m row spacing is suitable for Thatta-10 sugarcane variety for obtaining higher cane yield per hectare and sugar content.

This might be due to availability of wider space and consequent greater availability of moisture, more aeration to individual sets of cane seed and increased in plant population. Higher mortality of the tillers was observed in narrow spacings mainly due to competition for light, nutrients and other factors. Of the many variables involved in the production of sugar from the cane plant, probably the most significantly related factor was the number of stalk per unit area of land at harvest. Soopramanien and Juien (1980), attributed the tillers mortality in closer planting to inability of late emerged tillers to acquire adequate light and nutrients in competition with early formed tillers. The primary components of cane yield are stalk population and weight. In conventional row planting spacing and seed rate affects the plant weight through tillering and stalk weight. A drastic decrease in plant weight was observed when inter row spacing was reduced from 1.25 m spacing. Irvin and Benda (1980) reported that

decrease in plant weight with closer spacing is essentially linear.

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