

EFFECT OF BUD NUMBER PER SEED SETT ON CROP STAND, CANE YIELD AND SUGAR RECOVERY OF SUGARCANE VARIETY THATTA-10

Y.J. Minhas*, F. M. Baloch** and Saima Minhas***

*Sugarcane Specialist, Agriculture Research Institute, Tandojam.

**Assistant Research Officer (Sugarcane), Agriculture Research Institute, Tandojam.

***Department of Food Sciences and Technology, Sindh Agriculture University Tandojam.

ABSTRACT

The study was carried out to examine the effect of number of buds per seed sett on crop stand, cane yield and recovery of sugarcane variety Thatta during the year 2011 at Sugarcane Section, Agriculture Research Institute, Tandojam. The seed setts sown in this experiment contained 1, 2, 3, 4, 5, 6, 7 and 8-buds. The experiment was conducted in a three replicated Randomized Complete Block Design. It was noted that with the exception of germination and sugar recovery, the values for all the cane yield contributing traits were higher in crop sown with 4-budded seed setts, closely followed by 5-budded seed setts. The crop sown with 4-budded seed setts resulted 175 cm cane length, 2.90 cm cane girth, 6.40 tillers stool⁻¹, 23.25 internodes cane⁻¹ and cane yield of 104.975 tons ha⁻¹; while the crop sown with 5-budded seed setts resulted in 170.70 cm cane length, 2.2.81 cm cane girth, 5.80 tillers stool⁻¹, 22.50 internodes cane⁻¹ and cane yield of 100.678 tons ha⁻¹; whereas, germination showed a different trend and with increasing number of buds, the germination was decreased simultaneously; while sugar recovery show an inconsistent trend and was

unpredictable. However, the overall performance of the crop was markedly better when sown with 4-budded seed setts as compared to control i.e. generally 2-budded seed setts. Hence, it is suggested that 4-budded or 5-budded seed setts may be used for sowing of sugarcane for achieving the higher cane yields and reducing the labour cost in seed preparation.

Keywords: Sugarcane, seed sett, number of buds, cane length, girth, cane yield, recovery

INTRODUCTION

Sugarcane, *Saccharum officinarum* L. is an important commercial crop in developing and developed countries and is a member of Gramineae family (Miller and Gilbert, 2006). Sugarcane crop is the second major cash crop and is used as a raw material in the production of refined sugar and gur. Its share in value added in agriculture and GDP is 3.7 and 0.8 percent, respectively. Sugarcane was cultivated on an area of 1.046 thousand hectares, 5.9 percent higher than last year's level of 988 thousand hectares. Sugarcane production for the year 2011-12 is estimated at 55.3

million tons. This shows an increase of 4.9 percent over the production of last year. The main factors contributing to the production are lucrative market prices of last year's produce and timely availability of inputs encouraged the farmers to grow more sugarcane crop. However, the yield per hectare if compared with last year, posted a negative growth. The floods of 2010 enhanced the soil fertility of sugarcane crop, and as a result, yield per hectare posted a growth of 6.9 percent this year. However, productivity gain could be sustained because water receded very slowly in sugarcane area of lower Sindh (GOP, 2012). In the country, there are 78 sugar factories in function, while in Sindh province there are 31 sugar mills play remarkable role in the economy of the province. In Sindh province the sugarcane cultivation (2009-2010) was 280 thousand hectares with a production of 15350 thousand tons (Carroll and Rehman, 2010); while according to the Government of Sindh (GoS, 2011), the estimates for area under sugarcane in Sindh province were 270 thousand hectares, but the actual area under cane cultivation was 292.5 thousand hectares.

The effect of bud numbers in a seed sett of sugarcane has been reported on the crop stand as well as yield per unit area. However, there are numerous methods of sugarcane planting and number of buds in a seed sett is kept accordingly (Viator *et al.* 2005; Khan *et al.* 2005). Sugarcane is propagated from vegetative stalk cuttings (seed setts) and stalks of mature seed-cane varying from 4 to 8 ft in length are cut with a sharp edged axe that leaves the entire mature stalk intact. The seed setts with two to five buds are then placed end-to-end or side-by-side in a horizontal position in a planting furrow and covered with 2 to 3 inches of soil. The majority of planting occurs from August to October (autumn planting) and February and March (spring planting). This cane becomes established from August to November but becomes dormant in January and February due to low temperatures its foliar growth is checked (Afghan *et al.* 2010; Chattha *et al.* 2010).

In recent years, producers have faced increased challenges with planting stalks of cane with various buds or whole-stalk is also used because new varieties often lodge in July and August. Mechanically cutting /seed setts and planting lodged seed-cane with the traditional whole-stalk can result in severe nodal bud damage, with a large portion of the stalks being broken during harvesting. With the increased adoption of the chopper harvesters, the

number of whole-stalk harvesters has begun to decline. Due to these changes in varieties and harvesting system, many producers are now using chopper harvesters to cut seed-cane. This type of harvester cuts stalks into 20- to 24 cm billets (seed setts) and is capable of cutting lodged cane. After being cut, the billets are placed in the opened furrow and covered. Moreover, farmers obtain seed-cane for propagation of sugarcane using bud culture. The main problem, however, related to this technique is bud disinfection (Legendre, 2003). In view of the significance of number of buds in a seed sett of sugarcane, the present investigation was performed to investigate the effect of bud numbers on the sugarcane growth, cane yield and sugar recovery, under agro-ecological conditions of Tandojam.

MATERIALS AND METHODS

The experiment was conducted at the experimental fields of Sugarcane Section, Agri. Research Institute, Tandojam in a three replicated Randomized Complete Block Design having plot size of 8m x 3m (24m²). Treatments included the seed setts with 1, 2, 3, 4, 5, 6, 7 and 8 buds. The fertilizers were applied at the rates of N=220 kg ha⁻¹, P=120 kg ha⁻¹ and K=100 kg ha⁻¹. All P and K and 1/3rd of N was applied at planting time and remaining N in two equal doses at first earthing (3-1/2 months after planting)

and 1-1/2 month after first earthing respectively.

Methods for recording observations

Germination (%)

Germination was recorded on the basis of total buds in a plot and number of seedlings germinated in percentage.

Cane length

Cane length was recorded at the field in the labeled sugarcane plants by measuring tape from bottom of the cane up to the last internodes in centimeters and averaged.

Cane girth

Cane girth was measured in each plot on the basis of randomly selected (tagged) plants by means of Vernier Caliper in centimeters and average was worked out.

Tillers stool⁻¹

Tillers stool⁻¹ was observed by counting the stalks sprouted in each plant from the labeled plants in each plot and average was calculated.

Internodes cane⁻¹

Internodes cane⁻¹ was counted from the bottom of the cane up to the last internodes for all the tillers in each plant in each labeled plant in each treatment plot and averaged.

Cane yield ha⁻¹(mt)

The cane yield ha⁻¹ was calculated on the basis of following formula:

Yield plot⁻¹ of given treatment

$$\text{Cane yield (m.t ha}^{-1}\text{)} = \frac{\text{Yield plot}^{-1} \text{ of given treatment} \times 10000}{\text{Area of plot}}$$

Plot area (m²)

Sugar recovery (%)

Polarity was determined by the procedure and method described in laboratory manual for Queensland sugar mills (Anonymous, 1970) in order to calculate Pol and sugar recovery.

The data on the above characters were collected and subjected to statistical analysis. Analysis of variance and mean separation tests were applied (Steel *et al.* 1997).

RESULTS AND DISCUSSION

Germination (%)

Germination of seed plays a significant role in establishment of crop stand and subsequently affects the crop growth and yield contributing traits. The data (Table-1) indicated that the seed germination (sprouting) was highest (88.50%) when one-budded seed setts were used for sowing of sugarcane variety Thatta-10, while using seed setts with increased number of buds inversely affected the germination. In crop sown with 2-budded, 3-budded and 4-budded seed setts, the germination was 82.50, 78.40 and 75.40 percent; while in crop sown with 5-budded, 6-budded and 7-budded seed setts the germination was 73.50, 62.00 and 59.00 percent, respectively. However, crop sown with 8-budded seed setts produced germination of 52.50 percent. Johnson *et al.* (2011) also found similar effect of seed

buds in cane on its germination and reported that sowing of sugarcane with seed having more than certain number of buds (3-5) or full stalk would result negative impact on germination, but generally the effects of increasing the number of buds in cane seed were inconsistent.

Cane length (cm)

The data on cane length of sugarcane variety Thatta-10 (Table-1) showed that the cane length was highest (175 cm) when 4-budded seed setts were used for sowing, and cane length in crop planted by using 1-budded, 2-budded and 3-budded seed setts was 150, 153 and 165 cm, respectively. The cane length in crop sown with 5-budded, 6-budded and 7-budded seed setts was 170.70, 165.50 and 160.00 cm, respectively; while the minimum cane length (155 cm) was recorded in crop sown with 8-budded seed setts. This indicates that using seed setts other than 4-buds resulted in decreased cane length. However, the results clearly suggested that for sowing of sugarcane variety Thatta-10, 4-budded or 5-budded seed sets may be used for obtaining maximum cane length. These results have been partially supported by Viator *et al.* (2005) who tested the effect of seed setts with different number of buds as compared to full-stalk sowing. Their results indicated that sowing full-stalk may result complex tillering and hence the height of the plant may be adversely affected. However, they have suggested seed setts up to 4

buds for achieving desired results.

Cane girth (cm)

The cane girth of sugarcane variety Thatta-10 was measured and given in Table-1. It was observed that cane girth was maximum (2.90 cm) when crop was sown with 4-budded seed setts, and cane girth in crop planted with 1-budded, 2-budded and 3-budded seed setts was 2.36, 2.43 and 2.48 cm, respectively. The cane girth in crop sown with 5-budded, 6-budded, 7-budded and 8-budded seed setts was 2.81, 2.63, 2.56 and 2.48 cm, respectively; hence the minimum cane girth was noted in crop sown with 1-budded and 2-budded seed setts. This indicates that the crop sown with 4-budded seed setts resulted better performance for cane girth. The crop sown with seed setts below 4 buds or more than 5 buds resulted in reduced cane girth as compared to those sown with 4-budded or 5-budded seed setts. Similar results have also been reported by Legendre and Gravois (2003) who reported that for seed setts with 1-bud, 2-buds or 3-buds, more labor is needed for seed preparation and for saving the labor cost, full stalk can be used. However, full-stalk sowing system cannot be recommended for the farmers; and seed sett with 3, 4 or even 5 buds can be used for better cane development. However, the results were yet inconsistent for the treatments.

Tillers stool⁻¹

The data (Table-1) indicated that tillers stool⁻¹ of sugarcane variety Thatta-10 were maximum (6.40) when the sugarcane crop was planted with 4-budded seed setts, and tillers in crop planted with 1-budded, 2-budded and 3-budded seed setts was 4.00, 4.60 and 5.00 stool⁻¹, respectively. The numbers of tillers in crop sown with 5-budded, 6-budded, 7-budded and 8-budded seed setts were 5.80,

5.00, 5.00 and 4.20 stool⁻¹, respectively. Thus, the minimum tillers stool⁻¹ was noted in crop sown with 1-budded and 8-budded seed setts. The results clearly showed that using seed setts with other than 4 or 5 buds was not beneficial in relation to tillers stool⁻¹ in sugarcane variety Thatta-10 and it would be suggestible that for achieving desired results in tillering capacity of Thatta-10, the crop may be planted by using seed setts with 4 or

5 buds. The findings of the present research further supported by those of Legendre (2001) who reported that number of buds per seed set up to four can commonly be observed in the US sugarcane growing areas and found no statistical difference in cane yield from planting rate, but there was a slight numeric increase in cane yield as the planting rate was increased.

Table-1 Mean germination, cane length, cane girth and tillers stool⁻¹ of sugarcane variety Thatta-10 as affected by number of buds per seed set

Treatments	Treatments (No. of buds per seed sett)	Germination (%)	Cane length (cm)	Cane girth (cm)	Number of Tillers stool ⁻¹
T1	1 budded seed setts	88.50 a	150.00 f	2.36 e	4.00 d
T2	2 budded seed setts	82.50 a	153.00 e	2.43 d	4.60 c
T3	3 budded seed setts	78.40 b	165.00 c	2.48 d	5.00 c
T4	4 budded seed setts	75.40 b	175.00 a	2.90 a	6.40 a
T5	5 budded seed setts	73.50 b	170.70 b	2.81 b	5.80 b
T6	6 budded seed setts	60.00 c	165.50 c	2.63 c	5.00 c
T7	7 budded seed setts	59.00 c	160.00 d	2.56 c	5.00 c
T8	8 budded seed setts	52.50 d	155.00 e	2.48 d	4.20 d
S.E.±		3.057	1.672	0.023	0.052
LSD 0.05		6.982	4.154	0.091	0.584
LSD 0.01		9.446	6.097	0.153	0.815

No. of internodes cane⁻¹

The effect of number of buds in seed setts on internodes cane⁻¹ were examined and the results (Table-2) exhibited that maximum internodes (23.25) cane⁻¹ in sugarcane variety Thatta-10 were recorded in plots planted with 4-budded seed setts, and internodes in crop planted with 1-budded, 2-budded and 3-budded seed setts were 17.00, 20.25 and 21.50 cane⁻¹, respectively. The number of internodes in crop sown with 5-budded, 6-budded, 7-budded and 8-budded seed

setts were 22.50, 21.80, 21.00 and 20.80 cane⁻¹, respectively. Thus, the lowest number of internodes cane⁻¹ was noted in crop sown with 1-budded seed setts. This indicates that the internodes are directly proportional to the plant height or cane length and increasing cane length simultaneously increased the number of internodes cane⁻¹. Croft (1998) performed experiments on the effect of seed sett size for sowing sugarcane in Australia, and reported that at least more

than 3-budded seed setts would be economical and useful for achieving desired performance in sugarcane, regardless the variety.

Cane yield ha⁻¹

The results in regards to cane yield ha⁻¹ as affected by number of buds in seed setts and shown in Table-2 and concluded that highest cane yield of 104.975 tons ha⁻¹ was achieved in plots planted with 4-budded seed setts, closely followed by 5-budded setts where the cane yield was 100.678 tons ha⁻¹; while

cane yield in crop planted with 1-budded, 2-budded and 3-budded seed setts was 81.125, 90.375 and 93.20 tons ha⁻¹, respectively. The cane yield in crop sown with 6-budded, 7-budded and 8-budded seed setts was 93.10, 91.05 and 84.80 tons ha⁻¹, respectively. Thus, the cane yield ha⁻¹ was obtained in crop sown with 1-budded seed setts. The cane yield ha⁻¹ is found associated with multiple factors which included cane length, cane girth and tillers stool⁻¹. Cane yield ha⁻¹ increased considerably with increasing number of buds in seed setts up to 4 or 5, but further increase in number of buds in seed setts showed adverse effect on cane yield. These results are partially supported

by Legendre (2001), Legendre and Gravois (2003), Orgeron (2003), Molina *et al.* (2005), Viator *et al.* (2005) and Johnson *et al.* (2011) who their consolidated conclusions suggested that 4-5 buds in a seed sett would be economical in seed preparation and would result better cane yields than 1-3 buds or using full stalk as seed sett. However, some of the opinions showed that the effect of number of buds on cane yield ha⁻¹ is inconsistent.

Sugar recovery

The data in relation to sugar recovery of sugarcane variety Thatta-10 as influenced by number of buds in seed setts, given in Table-2 showed that

highest recovery of 10.56 % was recorded in crop planted with 3-budded seed setts, closely followed by 2-budded and 8-budded setts where the sugar recovery was 10.06 and 10.00 % respectively. However, the lower sugar recovery was recorded from all the rest treatments. These findings have suggested entirely inconsistent results regarding sugar recovery and no trend of effectiveness can be assessed for this trait related to juice quality of sugarcane variety Thatta-10 sown under different number of seed setts. Legendre and Gravois (2003) reported that effect on sugar content due to number of buds in seed sett were inconsistent and unpredictable.

Table-2 Mean number of internodes cane⁻¹, cane yield ha⁻¹ and sugar recovery of sugarcane variety Thatta-10 as affected by number of buds per seed set

Treatments	No. of buds per seed sett	No. of internodes cane ⁻¹	Cane yield (tons ha ⁻¹)	Sugar recovery (%)
T1	1 budded seed setts	17.00 d	81.125 c	9.50 b
T2	2 budded seed setts	20.25 c	90.375 b	10.00 a
T3	3 budded seed setts	21.50 b	93.200 b	10.50 a
T4	4 budded seed setts	23.25 a	104.975 a	9.50 b
T5	5 budded seed setts	22.50 a	100.678 a	9.50 b
T6	6 budded seed setts	21.50 b	93.700 b	9.50 b
T7	7 budded seed setts	21.00 b	91.050 b	9.50 b
T8	8 budded seed setts	20.25 c	84.500 c	10.00 a
S.E.±		0.332	1.052	0.084
LSD 0.05		1.098	4.541	0.631
LSD 0.01		1.524	6.287	0.954

CONCLUSIONS

With the exception of germination and sugar recovery, the values for all the cane yield contributing traits were higher in crop sown with 4-budded seed setts, closely followed by 5-budded seed setts.

Germination showed a different trend and with increasing number of buds, the germination was decreased simultaneously; while sugar recovery show an inconsistent trend and was unpredictable.

The overall performance of the crop was markedly better when sown with 4-budded seed setts as compared to control i.e. generally 2-budded seed setts.

SUGGESTIONS

It is suggested that 4-budded or 5-budded seed setts may be used for sowing of sugarcane for achieving the higher cane yields and reducing the labor cost in seed preparation.

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