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Effect of Type of Planting Materials and Germinating Media on Growth and Yield of Suru Sugarcane under Coastal Zone of Maharashtra

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The present investigation was conducted during 2013-14 at the Agronomy Farm, College of Agriculture, Dapoli. The experiment was laid out in factorial randomized block design (FRBD) replicated thrice. Factor A comprised two types of planting materials viz., single bud setts (BS) and scooped bud chips (BC) and factor B comprised of seven types of germinating media viz : B_1- Soil alone (Sa), B_2- Cocopeat alone (Ca), B_3- Cocopeat 50% + Vermicompost 50% by weight (CV), B_4- B_3 + PSB (CV+P), B_5- B_3 + *Acetobacter* (CV+Ac) , B_6- B_3 + *Trichoderma viride* (CV+T), B_7- B_3 + PSB + *Acetobacter* + *Trichoderma viride* (CV+Al), T_{15}- An additional treatment of conventional *in-situ* planting of three budded setts, in addition to combinations of these treatments was taken. Result revealed no significant difference between different planting materials. Use of Cocopeat + Vermicompost + *Acetobacter* [B_5 (BS+CV+Ac)] and Cocopeat + Vermicompost + PSB [B_4 (BS+CV+P)] as a germinating media recorded significantly maximum number of shoots, number of leaves, height of plant and dry matter as compared to rest of the germinating media during all the growth stages of plant and it was remained at par with each other. The treatment B_5 recorded significantly maximum number of millable canes per unit area, cane yield and was found significantly superior over rest of the treatments except treatment B_4.

*(**Key words**: Cocopeat, Media, Planting, Sugarcane)*

Sugarcane is an important commercial multipurpose crop that provides sugar and jaggery as by-products with ecological sustainability. It is also a renewable, natural agricultural resource. Sugarcane juice is used for making white sugar, brown sugar (*Khandsari*), Jaggery (*Gur*) and ethanol. The main by-products after the juice extraction are molasses and bagasse. The cultivation of sugarcane dates back to the *Vedic* period. The most ancient reference to sugarcane is in Athervaveda which is 4,000 years old and the word sugar is derived from the Sanskrit word Sarkara. In the 1400–1500 in India, cows belonging to the Sultan of Mandu were fed with sugarcane to make their milk sweet for use in puddings.

Sugarcane is one of the important crops in contributing to the country's economy and farmer's livelihood development. In India, sugar is 550 billion rupees worth industry, supporting more than 50 million farmers. There is a growing demand for sugar in India. Hence, there will be more and more stress on the sugarcane eco-system in future. The present scenario of cane cultivation is not sustainable enough to meet this demand as the input and labour costs are increasing and the national mean cane productivity is at 66.9 t ha^{-1} only. So, it is necessary to improve the cane productivity in a sustainable way with minimum usage of inputs through some alternate methods on the principles of "more with less".

Sugarcane yields in some areas of Uttar Pradesh were moderate, due to late planting and excessive rain. However, western and southern Indian states tended to benefit from timely and evenly distributed monsoon rains, which increased cane productivity in those regions. With the rise in cane production, total centrifugal sugar production in 2013-14 is also revised up from 25.4 MMT to 27 MMT, mostly due to higher than expected sugar production levels, particularly from Maharashtra and Karnataka. Additionally, favourable monsoon conditions have improved India's overall sugarcane recovery to 10.25 percent, an increase of 0.25 percent over last year (Anonymous, 2013-14).

Indian Institute of Sugarcane Research, Lucknow evolved a planting method namely, 'Spaced transplanting technique - STP' (Anonymous, 1976 and Srivastava *et al*.

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2006). In this method single bud settlings are raised in nursery from single eye setts and transplanted in actual field after about four weeks when settlings do have 2 to 3 green leaves. Transplanting single bud settlings at 30 and 60 cm distance within a row gave fewer yields of 176.70 and 166.77 MT ha^{-1} respectively than that of conventional method of planting three budded setts which yielded 183.80 MT ha^{-1}. The results of the trials conducted at Lucknow, Pantnagar and Shahajanpur under All India Co-ordinated Research Project on Sugarcane showed that, STP method produced fewer yields than conventional method (Anonymous, 1977-78).

MATERIALS AND METHODS

The field experiment was conducted during the year 2013-14 on seasonal sugarcane at the Agronomy Farm, College of Agriculture, Dapoli in plot number 54 of the 'C' block. The site was selected on the basis of suitability of soil for growing sugarcane. Media were prepared as per the treatments. For the treatments T_1 and T_8, soil from the experimental plot itself was used as medium for raising settlings from single bud setts and single bud chips respectively. In case of the treatments T_2 and T_9 cocopeat alone was used. For the treatment T_3 and T_{10} media were prepared by mixing cocopeat and vermicompost in equal proportion on weight basis 12.5 kg + 12.5 kg for single bud setts and 7.5 kg + 7.5 kg for scooped bud chips. In case the treatments viz. T_4 and T_{11}, T_5 and T_{12}, T_6 and T_{13} bacterial and fungal inoculants *viz.,* PSB (*Bacillus megatherium*), *Acetobacter* (*Glucano acetobacter diazotrophicus*) and *Trichoderma viride* were added @ 5 g kg^{-1} medium prepared as per treatment.

Seed canes of sugarcane variety CoM 0265 having age of 10 months obtained from Regional Sugarcane and Jaggery Research Station, Kolhapur were used. Single bud setts were prepared with the help of sharp knife by cutting seed canes 2.5 cm above the bud and 5-6 cm below the bud. These single bud setts were sown in plastic trays of 56 cm x 36 cm size having 42 rectangular cups each with 70 mm length, 50 mm width and 75 mm depth. Using the same source of seed canes, scooped bud chips were obtained by separating each bud keeping the distance of 20 to 25 mm all around the bud with the help of specially prepared bud scooping machine. For raising settlings from scooped bud chips plastic trays of 56 cm x 36 cm size having 60 circular cups each with 50 mm circumference and 62.5 mm depth were used.

The recommended dose of fertilizer *viz.,* 250 kg N, 125 kg P_2O_5 and 125 kg K_2O ha^{-1} was used for field experiment. At the time of planting 10 per cent dose of Nitrogen and entire dose of P_2O_5 and K_2O were applied by placement method just before planting of sugarcane crop. Remaining N were applied in three split doses @ 40, 10 and 40 per cent at an interval of six weeks from each preceding dose. When settlings attained an age of 28 days, they were transplanted in ridges and furrows spaced 90 cm apart keeping the distance of 30 cm between two hills in a row. Other common package of practices was followed time to time and periodical growth observations were recorded.

RESULTS AND DISCUSSIONS

Effect of type of planting materials and germinating media on growth parameters

Treatments receiving different types of planting material did not produce any significant effect on growth parameters as well as yield attributes of sugarcane. Effect of germinating media was observed on growth characters of sugarcane throughout the crop growth period (Table 1). Use of cocopeat + vermicompost + acetobacter [B_5] and cocopeat + vermicompost + PSB (B_4) as a germinating media recorded significantly maximum number of shoots as compared to rest of the germinating media during all the growth stages of plant and it was remained at par with each other. This was mainly because of increase in the cell elongation and cell division by acetobacter and PSB leads to increase the shoot and leaves. The treatment B_5 recorded significantly maximum number of leaves at 60, 90, 120, 150, 180, 210, 240, 270, 300, 330 days after planting (DAP) and at harvest over rest of the treatments except treatment B_4.

The different germinating media show significant response in relation to girth of sugarcane at harvest but did not show same response at 150 DAP. At harvest, treatment B_5 recorded significantly maximum girth (11.91 cm) which was remained at par with treatment B_4 but found significantly superior over rest of the treatments *i.e.* B_6, B_7, B_3, B_2 and B_1. The dry matter production per plant of sugarcane was significantly influenced due to different germinating media under study. At 120, 150 DAP and at harvest, the total dry matter accumulation per plant of sugarcane was found to be maximum under treatment B_5, which was significantly superior over rest of the treatments excluding treatment B_4. This might be due to supply of ample amount of acetobacter and PSB for producing higher chlorophyll

Table 1. *Effect of type of planting materials and germinating media on growth of suru sugarcane*

Treatments	Plant height (cm)	No. of leaves running m^{-1}	No. of shoots running m^{-1}	Cane girth (cm)	Dry matter running m^{-1} (g)
Factor A- Type of planting material					
A_1 – Single bud setts	293.31	20.67	4.39	10.84	2981.94
A_2 – Scooped bud chips	290.56	19.32	4.13	10.38	2954.10
S.Em. ±	2.14	0.92	0.15	0.29	19.72
C.D. at 5%	NS	NS	NS	NS	NS
Factor B- Germinating media					
B_1: Sa	276.90	14.35	2.76	8.92	2849.07
B_2: Ca	282.18	16.10	3.20	9.49	2888.20
B_3: CV	287.21	18.43	4.04	10.08	2926.77
B_4: CV+ P	302.68	24.00	5.14	11.87	3057.82
B_5: CV+ Ac	303.83	24.60	5.41	11.91	3086.61
B_6: CV+ T	298.00	22.17	4.88	11.30	3003.37
B_7: CV+ Al	292.74	20.30	4.39	10.71	2964.32
S.Em. ±	1.40	0.60	0.10	0.19	12.9
C.D. at 5%	4.06	1.74	0.28	0.51	37.40
Interaction effects					
S.Ed. ±	3.7	1.59	0.26	0.50	34.16
C.D. at 5%	NS	NS	NS	NS	NS
General mean	291.94	19.99	4.26	10.61	2968.02
CIP v/s rest					
Mean of factors A and B(Rest)	291.94	19.99	4.26	10.61	2968.02
CIP mean	284.62	22.65	4.55	11.55	2979.16
S.Ed. ±	3.84	1.65	0.27	0.52	35.35
C.D. at 5%	NS	NS	NS	NS	NS

content which enables the crops photosynthetically more active and therefore, higher dry matter accumulation which was reflected in recording of superior values of growth parameters has also been reported by Jaykumar and Thangaraju (1996), Muthukumarsamy *et al.* (1994), Khanizadeh *et al*. (1995) and Bastin *et al*. (1998).

Effect of type of planting materials and germinating media on yield attributes and yield

The main objective of the agronomist is to increase the economic yield of crop. The yield contributing characters studied such as number of millable cane (per unit area), number of millable cane per ha, number of internode per cane, weight per millable cane (kg), cane yield (t ha^{-1}), green top weight (kg $cane^{-1}$), green top weight (t ha^{-1}), weight of trash (t ha^{-1}) are presented in Table 2.

It is observed that these yield contributing characters as well as yield was significantly influenced due to different germinating media. Among the different treatments containing germinating media, the treatment B_5 recorded significantly maximum number of millable cane (per unit area), number of millable cane per ha and number of internode per cane than all other treatments except treatment B_4. Similarly, treatments B_5 and B_4 also produced significantly maximum weight per millable cane (kg), cane yield (t ha^{-1}), green top weight (kg $cane^{-1}$), green top weight (t ha^{-1}) as well as weight of trash (t ha^{-1}) over rest of the treatments and remained at par with each other.

The application of acetobacter and phosphate solubilizing bacteria increased the cane yield due to acetobacter phosphorus increase the dry and fresh weight of sugarcane and it also helps to increase the nutrient uptake, growth promoting substance and synergetic interaction with other soil beneficial microorganisms

Table 2. *Effect of type of planting materials and germinating media on yield attributes and yield of suru sugarcane*

Treatments	No. of millable cane (running m^{-1})	No. of millable cane (ha^{-1})	No. of internode ($cane^{-1}$)	Wt. per millable cane (kg)	Cane yield (t ha^{-1})	Green top weight (kg $cane^{-1}$)	Green top wt. (t ha^{-1})	Wt. of trash (t ha^{-1})
Factor A- Type of planting material								
A_1 – Single bud setts	10.15	101542.32	24.75	1.03	111.49	0.20	20.06	5.09
A_2 – Scooped bud chips	10.00	99980.24	23.75	1.01	108.38	0.18	19.23	5.07
S.Em. ±	0.26	2583.44	0.81	0.03	2.83	0.01	0.47	0.22
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
Factor B- Germinating media								
B_1: Sa	8.59	85931.31	18.45	0.79	82.29	0.15	14.39	3.58
B_2: Ca	9.10	90996.39	20.00	0.87	89.87	0.16	16.51	4.08
B_3: CV	9.61	96072.13	22.33	0.89	96.22	0.16	19.01	4.55
B_4: CV+ P	11.14	111444.68	28.50	1.19	133.52	0.21	21.78	6.21
B_5: CV+ Ac	11.33	113326.16	29.50	1.21	134.68	0.21	22.92	6.42
B_6: CV+ T	10.63	106328.13	26.83	1.13	119.17	0.20	21.87	5.61
B_7: CV+ Al	10.12	101230.17	24.17	1.05	112.80	0.18	20.06	5.11
S.Em. ±	0.17	1691.26	0.53	0.03	1.85	0.004	0.31	0.11
C.D. at 5%	0.49	4899.39	1.53	0.09	5.37	0.011	0.89	0.40
Interaction effects								
S.Ed. ±	0.45	4474.65	1.40	0.10	4.91	0.010	0.81	0.38
C.D. at 5 %	NS	NS	NS	NS	NS	NS	NS	NS
General mean	10.08	100761.28	24.25	1.03	109.94	0.20	19.65	5.08
CIP v/s rest								
Mean of factors A and B (Rest)	10.08	100761.28	24.25	1.02	109.94	0.20	19.65	5.08
CIP mean	10.59	105947.1	26.67	1.09	115.93	0.21	19.68	5.27
S.Ed. ±	0.46	4631.71	1.45	0.06	5.08	0.044	0.84	0.42
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS

which enhance the yield of sugarcane. The significant response of acetobactor and PSB on these characters has also been reported by Jaykumar and Thangaraju (1996), Muthukumarsamy *et al.* (1994) and Mahadevi *et al.* (1991).

CONCLUSION

From the results of the present investigation it can be concluded that sugarcane crop should be grown with single bud setts along with cocopeat + vermicompost mixture in 1:1 proportion and inoculated with acetobacter as a rooting media for obtaining higher yield.

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