Transplanting Space Effect on In-vitro Raised Sugarcane

Sonali Gangwar*[1], Saurabh Pathak[2] and Maya Datt Joshi[3]

1.* Centre for Biological Engineering, Shobhit University, Gangoh, Saharanpur, U.P., -247341, India; e-mail : sonali.gangwar@shobhituniversity.ac.in
2 and 3. Department of Biotechnology, Shobhit University, Meerut 250110.

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***Corresponding author :**
Sonali Gangwar
e-mail :
sonali.gangwar@shobhituniversity.ac.in

Abstract

Tissue cuture is considered to be a best technique for rapid multiplication and production of disease free, healthy seed cane. With a view to studying the effect of transplanting spacing on growth and yield of micropropagated crop of sugarcane, an experiment was carried out at Tissue Culture Laboratory, Shobhit University, Meerut. Tissue culture raised plantlets of sugarcane variety. In vitro cultured sugarcane were transplanted at various spacing of 90 x 45, 90 x 60, 90 x 90 and 120 x 60 cm. Among the four spacings, the highest plant growth, number of tillers, number of malleable canes, cane height and cane yield were recorded at 90 x 60 cm. Thus, a spacing of 90 x 60 cm was found most suitable for transplantation of tissue culture raised plantlets of sugarcane.

1. INTRODUCTION

Modern commercial sugarcane varieties are developed through conventional breeding following a multi-stage selection programme requiring over a period of approximately 10 years (Krishnamurthy, 1994). Due to limited availability of seed cane of a new variety at the time of its release, it further takes about 8-10 years to cover the desired area for commercial cultivation, by the time the variety starts deteriorating (Pawar *et al* ., 2002, Sengar *et al*., 2011) and keep on accumulating the pathogens. In conventional method of seed multiplication, about 6-8 tones seed cane is required for planting an area of one hectare and a multiplication rate of about 8-10 times per annum can be achieved which is quite low (Shukla et al ., 1994). It has been realized that the growing demand of seed cane material of newly released varieties of sugarcane could not be fulfilled in time only by the conventional method of seed multiplication. Effect of tissue culture explants sources on sugarcane yield component (Hey et al 2003) has been studied and *in-vitro* morphogenesis of sugarcane hybrid on physiological and biochemical basis was done by A.K.Singh (2005). New sugarcane varieties has been developed through somaclonal variation studies (Jalaja 2006). Therefore, the use and exploitation of modern techniques of biotechnology seem to be quite essential for rapid multiplication of new varieties (Sengar *et al* ., 2011). Tissue culture techniques are now emerging as powerful tools for crop improvement and also for rapid multiplication of different crops. Micropropagation is one of the most important and perhaps the most utilized technique of plant tissue culture through which millions of healthy and disease free plants and stress tolerant plants (Wagih et al., 2004) can be produced. Shanaz et al., 2008 done rapid micropropagation of three elite sugarcane varieties by shoot tip culture. Effect of treatment potentially influencing the supply of assimilate on its partitioning in sugarcane was also studied by Pammeter et al. 2002.

In sugarcane production programme, the role of quality seed material in obtaining higher cane yield is obviously well known. The use of micropropagation technique is now being

emphasized for rapid multiplication of sugarcane. Although in vitro micropropagation of sugarcane has rapidly progressed under laboratory condition, no much attention has been paid on the agronomical performance of plantlets under field condition. It has been experienced that transplanting geometry plays an important role in production of seed cane. An experiment was therefore conducted at the farm of Tissue culture laboratory, Shobhit University, Meerut, to find out a suitable transplanting spacing using in vitro raised plantlets of sugarcane variety Co 05011.

2. MATERIALS AND METHODS

2.1 *Production of plantlets and field transplantation*

Plantlets of sugarcane were produced from shoot tip explants in tissue culture laboratory, using in vitro micropropagation technique as detailed earlier (Singh et al ., 2006). The healthy rooted plantlets were transplanted in small polythene bags (size 3 x 4 inch) containing different soil mixtures such as field soil, soil + sand (1:1), soil + sand + fly ash (2:2:1), soil + compost (1:1) and soil + sand + compost (1:1:1). The transplanted plantlets were kept in green house under controlled environmental conditions at 30 ± 2^0C temperature and 80-90% humidity. The plantlets were hardened in green house for 45-60 days and then transferred to net house for further acclimatization. The hardened plantlets were transplanted in well prepared field at 45 cm spacing between the plants in rows 90 cm apart. The observations were taken on percent survival of plants in green house as well as in open field.

The micropropagated shoots were rooted, hardened in green house and properly, acclimatized under shade house. After 40-45 days of acclimatization, when shoots attained the height of 15-20 cm, the plantlets were transplanted in well prepared plots at different spacing i.e. 90 x 45 cm, 90 x 60 cm, 90 x 90 cm and 120 x 90 cm. After transplantation, the plants were irrigate immediately.

The field experiment regarding the impact of spacing on agro morphological traits was conducted at the research farm during 2015-16. The transplantation was carried out in randomized block design (RBD) with three replications. The recommended agronomic practices were followed during the crop growth.

3. RESULTS AND DISCUSSION

The data presented in Table 1 shows the performances of tissue culture raised crop regarding cane yield and yield parameters. Maximum 12.43 tillers per plant could be recorded at a spacing of 90 x 60 bcm followed by 90 x 45 cm (i.e, 10.54 tillers per plant). The number of tillers recorded at spacing of 90 x 90 cm and 120 x 90 cm was statistically at par. Tissue culture plants normally gave rise to higher number of tillers possibly due to the carry over effect of cytokinins used in the medium during sub culturing and multiplication. Number of malleable cane per clump was recorded at 10 month crop age and it was found that an average of 9.71 malleable cane per clump could be counted at the spacing of 90 x 60 cm which was significantly higher than those recorded at other spacing (table 2). Least number of malleable cane per clump (7.84) was recorded at the spacing (90 x 45 cm). Formation of higher number of malleable cane in tissue culture raised plants was due to low mortality of tillers. There is a uniform and wide spacing between the plantlets in the transplanted crop which makes sufficient light available to the growing plants and helps in higher survival of tillers and subsequent formation of malleable canes.

The cane height was also found to be influenced by the spacing. At the spacing of 90 x 60 cm the cane height was recorded to be maximum (234.17 cm) which was significantly higher than those transplanted at other spacing. Minimum cane height (198.76 cm) was recorded at 120 x 90 cm which was significantly lower than other treatments.

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This indicated that an optimum spacing is required for maximum cane height. This observation is in conformity with the previous result of Raghu et al., (2006) who have also reported maximum cane height at a spacing of 90 x 60 cm. Length of internodes varied with the transplanting distance, however, the differences were not significant.

Table-1 : Effect of transplanting spacing on growth and yield of tissue culture raised plants of sugarcane variety

Transplanting Spacing(cm)	No. of tillers per plant	No. of millable cane per clump	Cane height (cm)	Internode length (cm)	Cane yield (t/ha)
90 x 45	10.54	7.84	224.34	13.08	98.52
90 x 60	12.43	9.17	234.17	13.87	102.34
90 x 90	9.87	8.23	206.59	13.17	84.47
120 x 90	9.12	8.47	198.76	12.64	77.91
CD at 5%	1.56	1.22	12.27	NS	11.07

As far as cane yield (t/ha) is concerened, the highest cane yield (102.34 t/ha) was recorded at the spacing of 90 x 90 cm which was significantly higher than those recorded at other spacing except at 90 x 45 cm. The cane yield at 90 x 45 cm (98.52 t/ ha) was statistically at par to that recorded at 90 x 60 cm. High tonnage recorded at 90 x 60 cm and 90 x 45 cm spacing were due to production of higher number of millable cane per clump and also due to higher plant population in the field due to narrow spacing. The cane yield recorded at 90 x 90 cm and 120 x 90 cm, being statically at par, were significantly lower than recorded at narrow spacing (90 x 45 cm and 90 x 60 cm).

4. CONCLUSION

Thus it may be concluded that the spacing of 90 x 60 cm was found most suitable for transplanting of tissue culture raised plantlets of sugarcane for obtaining maximum cane yield and multiplication ratio in terms of number of malleable canes.

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