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Comparative performance of micropropagated and conventional plants of sugarcane

Swapanil Yadav* and Aquil Ahmad
Department of Biotechnology
Gandhi Faiz-E-Aam College, Shahjahanpur, Uttar Pradesh, India
*Corresponding author: *swapanilgfc@gmail.com*

Abstract

An experiment was performed to study the comparative performance of micropropagated and conventional plants. A total of 200 micropropagated plantlets of each variety, hardened for one month, were transplanted in the field. Simultaneously, the donor varieties were also planted using 1 bud-setts in three rows for comparison of various qualitative traits like Brix %, Sucrose % and Purity %. A comparative perusal of data showed that the sugarcane variety CoSe 01235 had higher Brix % as well as Sucrose % than the variety CoS 99259 in their respective counterparts, in a particular month. The Brix % and Sucrose % were marginally higher in tissue cultured plants than their donors in all the three months. However, the purity % was recorded to be marginally higher in CoS 99259 in both micropropagated and donor plants as compared to the respective plants of variety CoSe 01235.

Keywords: Brix, Micropropagation, Sugarcane, Quality traits.

Introduction

Plant tissue culture offers the best methodology through micropropagation of sugarcane for quality and phytosanitary planting material at a faster rate in a shorter period of time. The main advantage of micropropagation is the rapid multiplication of new varieties, improved plant health and its usefulness in germplasm storage. It is the best method for propagation as it produces plants phenotypically similar to the mother plant and gives much more rapid multiplication rate. Shaw (1990) reported that micropropagation is being used in several sugar industries, for the development of disease free clones, mostly to facilitate their safe and speedy movement through quarantine. It has now become a valuable alternative to the conventional clonal propagation methods for seed production. Tissue culture can increase the propagation potential by 20-35 times (Geijskes et al., 2003, Snyman et al., 2006). In addition, plants can be disease-indexed (Snyman et al., 2007) and healthy material multiplied in much less time compared to the conventional vegetative route. Establishment of *in vitro* culture is the first stage in any micropropagation system. Its success depends on choice of explants, varied compositions of nutrients and hormones in culture media, methods of subculturing and also on aseptic environmental conditions. Newly released varieties due to different genetic and physiological nature show different requirements of nutrient media, plant growth regulators and environment for proper development under *in vitro* condition. The present experiment was carried out to study comparative performance of micropropagated and conventional (donor) plants for their quality traits using CoSe 01235, an early

maturing variety and CoS 99259, a mid late maturing variety of sugarcane (*Saccharum* species complex)..

Materials and Methods

Spindle segment were dissected out from the freshly collected top. The segment was washed under running tap water for 20 minutes followed by 5 minute rinsing with 1% detergent solution. After washing with water several times, the segment was finally surface sterilized with 1% aqueous mercuric chloride ($HgCl_2$) solution for 10 minutes followed by several washing with sterile distilled water. About 1.5 cm long shoot tip explant comprising apical meristem and 1-2 leaf primordial and meristem explant (2-3mm) were carefully excised from the sterilized segment. Explants were inoculated in to MS (Murashige and Skoog, 1962) media supplemented with different concentrations of BA and Kinetin alone or in combination with NAA and IBA for shoot induction. The sucrose concentration used was 30g/l and pH of the media adjusted to 5.8 prior to autoclaving. Cultures were incubated at 25±ºC with a 16 hour illumination provided by cool white fluorescent tube. Subcultures were done 15 days interval to promote multiple shoots and healthy plantlets formation. Healthy shoots were excised individually and transferred to half strength of MS media supplemented with different concentrations of IBA and NAA with sucrose for root induction. Plantlets, with a well developed root system, were washed carefully and transferred in green house. With a view to study the comparative performance of micropropagated and donor plants, a total of 200 plantlets of each variety, hardened for one month, were transplanted in the field. Simultaneously, the donor varieties were also planted using 1 bud-setts in three rows for comparison of various qualitative traits like Brix %, Sucrose % and Purity %. The observations were made on randomly selected 20 plants of tissue cultured and conventionally raised donor (control) plants in both the varieties. The data were recorded at 10 month crop age (at maturity) in the months of November, January and March.

Results and Discussion

The growth regulators had a marked effect on the frequency of shoot initiation and establishment of shoot cultures. The highest frequency of shoot initiation and culture establishment was obtained on MS medium containing BAP and Kinetin (0.5 mg/l each). The highest rate of multiplication in terms of number of shoots per culture was obtained on medium containing BAP, Kinetin and NAA (0.5 mg/l each). The results suggested that a balance between cytokinins and auxin was essential for production of good quality shoots at a higher multiplication rate. The highest frequency of rooting was achieved on ½ strength MS medium containing NAA (5.0 mg/l) in combination sucrose (50 g/l).

Table 1: Quality traits in micropropagated and conventional plants of sugarcane varieties CoSe 01235 and Cos 99259.

Quality traits	Months	CoSe 01235		CoS 99259	
		Tissue Culture raised plants	Conventional plants	Tissue Culture raised plants	Conventional plants
Brix %	Nov	17.4	17.2	17.1	16.8
	Jan	18.8	18.2	17.6	17.2
	Mar	19.5	19.1	18.4	17.9
Sucrose %	Nov	15.5	15.2	14.4	14.2
	Jan	16.3	16.1	15.8	15.6
	Mar	17.6	17.3	17.2	16.8
Purity %	Nov	85.4	84.6	87.2	87.4
	Jan	88.4	87.2	89.6	89.2
	Mar	86.6	86.3	87.2	87.0

The results presented in Table 1 showed a gradual increase in the Brix % and Sucrose % from November to March in tissue cultured as well as conventionally raised donor plants. In variety CoSe 01235, the Brix % was recorded to be 17.4 and 17.2 in November and 19.5 and 19.1 in March in micropropagated and donor plants, respectively. Similarly, the sucrose % was 15.5 and 15.2 in November and 17.6 and 17.3 in the month of March in tissue cultured and donor plants, respectively. The Brix % and Sucrose % were

marginally higher in tissue cultured plants than their donors in all the three months. A marginal increase in juice purity was observed in the month of January as compared to November; however, it decreased further in the month of March. The purity % in juice in tissue cultured and donor plants was also different in both the varieties. A comparative perusal of data showed that the sugarcane variety CoSe 01235 had higher Brix % as well as Sucrose % than the variety CoS 99259 in their respective counterparts, in a particular month. However, the purity % was recorded to be marginally higher in CoS 99259 in both micropropagated and donor plants as compared to the respective plants of variety CoSe 01235. This improvement possibly occured due to rejuvenation of plants rendered by *in vitro* technique. Improvement regarding qualitative traits have also been reported earlier (Lal and Pande, 2003, Ramanand et al., 2005, Sood et al., 2006). With the improvement in micropropagation protocol for establishment, multiplication, rooting and hardening, more efficient and cost effective production of plants can be ensured which will help in rapid replacement of old deteriorated varieties of sugarcane with the newly released high yielding cultivars.

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