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Selection of Suitable Potting Mix for Hardening of Tissue Cultured Sugarcane Plantlets in Greenhouse

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Abstract

Tissue Culture is one of the best techniques to produce disease-free, true-to-type and vigorous plants of sugarcane which can be used as seed cane. Transfer of in vitro sugarcane plantlets from their sterile culture vessels to the soil requires a careful and stepwise procedure and suitable potting mixes because this is one of the important criteria for the survival of tissue-cultured plantlets. The present study was undertaken using tissue-cultured plantlets of sugarcane variety 'Co 86032' to develop a procedure for hardening of tissue-cultured sugarcane plantlets. The treatment FU2 (F1 + 0.5% solution of urea spraying two times i.e., at 15 days and 30 days after transplanting @200ml solution each time on 160 plantlets) was found suitable treatment (potting mix) for survival of tissue cultured sugarcane plantlets in green house.

Keywords: Fertilizers; Growth Mediums; Nutrients; Plantlets; Survival

Introduction

Transfer of in-vitro sugarcane plantlets from their sterile culture vessel to the soil requires a careful and stepwise procedure and suitable potting mix as this is one of the important criteria's for survival of tissue cultured plantlets. In vitro raised plantlets are tender and fragile and therefore their hardening requires special attention. Direct transfer of plants to soil or sand in absence of exogenous nutrient supply results in their failure. The survival of plantlets often determines whether or not the technology is economically feasible [1]. Although the roots may have been formed on cultures, these might not necessarily be functional after transplanting in polybags. If roots are not functional, the shoots will be prone to wilting and desiccation until fully functional roots have been formed. An optimum condition for healthy root development is of importance because poor rooting is frequently a cause of failure. Therefore, the most critical part is the initial step of inducing the formation of fully functional roots in a potting mix [2]. The plant survival in hydroponic system was almost 100% and in potting mixtures (soil + sand+ FYM) it was found 80-90% [3].

The proper development of leaves is also one of the important factors for survival in the field. Juvenile leaves, which are produced initially often, do not carry out photosynthesis when transferred to the field and hence the development of secondary leaves in sufficient number is essential before transfer to field condition [1]. Considering this, the present study was aimed to investigate the effect of different growth medium on survival, plant height, and growth of leaves and roots of the micro propagated sugarcane plantlets. Transfer of in vitro sugarcane plantlets from their sterile culture vessels to the soil requires a careful and stepwise procedure and suitable potting mixes because this is one of the important criteria for the survival of tissue-cultured plantlets. The in vitro raised plantlets are tender and fragile, and therefore their hardening requires special attention

Materials and Methods

The present study was undertaken using tissue-cultured plantlets of sugarcane variety 'Co86032' to develop a procedure for hardening of tissue-cultured sugarcane plantlets. In vitro rooted plantlets were taken out of glass bottles and then washed under tap water to remove traces of media and then excess leaves were trimmed out. Then, these plantlets were used for transplanting in the greenhouse. The rooted shoots of about 6-8cm height from in vitro conditions were washed with water to remove the traces of medium if any. These were transplanted into polybags of 15x10cm size containing growth medium made up of mixture of soil, sand, vermiculite and vermicompost in different proportions.

The different treatments were made up of as follows:

a) C (Control) - Soil: Vermiculite: Sand in 4: 1: 1 proportion (by volume).

b) F1 – C + Vermicompost @ 25% by volume of medium and NPK (55mg urea, 360mg single super phosphate and 95mg muriate of potash/kg of the medium).

c) F2 – C +Vermicompost @ 50% by volume of and NPK @ double dose of fertilizer as in F1.

d) FU1– F1+ 0.5% solution of urea spray at 15 days after transplanting @ 200ml solution on 160 plantlets.

e) FU2 – F1+0.5% solution of urea spray two times i.e. at 15 days and 30 days after transplanting @ 200ml solution each time on 160 plantlets.

f) V1– C + Vermicompost @ 25% by volume of medium.

g) V2 – C + Vermicompost @ 50% by volume of medium.

h) M - C + Multination's sprays.

The multi nutrient was made up of N, P, K, Fe, Mn and Zn in 9: 9: 5: 2: 2: 2 proportions. These were sprayed three times. The first was sprayed on the 2nd day after planting @30ml/liter. The second was sprayed at 15 days after planting @50ml/liter and the third was sprayed 45 days after planting @75ml/liter. In the greenhouse study, the meristem cultured plantlets were transplanted on poly bags in the greenhouse. Each treatment consisted of 20 plantlets. All poly bags were labeled and were placed in a completely randomized design in the greenhouse. Observations were recorded 2 months age before transplanting in the field.

Results and Discussion

The survival and growth of tissue cultured plantlets of sugarcane are given in Table 1. The survival of plantlets with the use of chemical fertilizers and/or vermicompost was higher and the same was above 85% whereas this was 70 % in control. In multi nutrient spray this was only 45%. The scorching effect of multi nutrient spray was also observed on leaves of the plantlets. There was effect of growth medium on tillering. The use of fertilizers along with urea spraying gave tillering in 80% of plants. In all other treatments only 20 to 30% of plants showed tillering at 2 months age. The harmful effect of multi nutrient spray was observed on tillering also. Height of plants: Sugarcane plant height at 60 days crop age was between 7.73 to 12.31cm. Plant height was significantly higher in all the treatments than that of 8.73cm in control. Growth of leaves: The number of leaves per plant ranged from 5.28 to 6.70cm. The leaf width was between 0.64 to 0.81cm. However, there was no significant difference in number and width of leaves due to different growth mediums. In case of length of 4th leaf also, which was between 31.49 and 44.90cm.

Table 1: Survival and growth of tissue cultured plantlets of sugarcane in different growth mediums (Means).

S. N	Treatment	Survival (%)	% Plants showing Tillers	Height of Plant (cm)	Number of leaves per shoot	Length of 4th leaf (cm)	Width of 4th leaf (cm)	Weight of shoot (gm)	Weight of roots (gm)
1	Control(C)	70	20	8.73	5.28	39.11	0.64	1.8	0.36
2	Fertilizer(F1)	95	25	12.31	5.31	42.55	0.7	3.07	1.42
3	Fertilizer(F2)	85	25	10.81	6.13	44.9	0.81	2.67	1.1
4	Fertilizer & Urea (FU1)	90	50	10.91	5.64	35.86	0.73	2.4	0.97
5	Fertilizer Urea (FU2)	95	80	11.15	7.15	41.1	0.72	2.82	1.41
6	Vermicompost (V1)	85	30	10.14	6.7	31.41	0.65	1.48	0.63
7	Vermicompost (V2)	85	30	10.19	6.33	36.35	0.67	2.16	0.9
8	Multicurrent (M)	45	5	10.38	5.44	39.44	0.68	1.52	0.47
	CD(P=0.05)	-	-	**0.46**	**N.S.**	**N.S.**	**N.S.**	**0.12**	**0.07**

There was no significant difference due to different growth medium as compared to that of 39.1cm in control. Weight of shoots and roots: The shoot weight per plant was between 1.48 to 3.07g. Shoot weight differed significantly due to difference in growth medium. Use of fertilizers (F1) and vermicompost at higher dose i.e., 50 % by volume (V2) gave higher shoot weight of 2.16 to 3.07g as compared to that of 1.80g in control. The lower dose of vermicompost i.e., 25% by volume of growth medium had no effect on shoot weight. There was no additional benefit on shoot when fertilizers were used at double the rate or spraying of urea along with fertilizers. Weight of shoots in multicurrent spray was 1.52g and this was lower than that of 1.80g in control. The lower dose of vermicompost i.e., 25% by volume of growth medium had no effect on shoot weight. There was no additional benefit on shoot weight

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when fertilizers were used at double the rate or spraying of urea along with fertilizers. Weight of shoots in multicurrent spray was 1.52g and this was lower than that of 1.80g in control.

The trend in weight of roots was similar to that of weight of shoots. Root weight was significantly higher in fertilizer and higher dose of vermicompost treatments where in these were from 0.90 to 1.42g as compared to that of 0.36g in control. In case of root weight also similar to that in shoot weight there was no additional benefit of increased fertilizer dose or urea spraying. There appears to be a positive relation between shoot weight and root weight as the root weight increased from 0.36 to 1.42g the shoot weight also increased from 1.80 to 3.07g except in the treatment of multicurrent spray.

Conclusion

Experiment was conducted to find out suitable potting mix for hardening of tissue cultured sugarcane plantlets in greenhouse. It has been observed that survival, shoot weight and root weight of tissue cultured sugarcane plantlets was higher when chemical fertilizers and vermicompost @50% by volume were used in growth medium. Potting mix Fertilizer & Urea FU2 (F1 + 0.5 % solution of urea spraying two times i.e. at 15 days and 30 days after transplanting @200ml solution each time on 160 plantlets) was found suitable potting mix for survival of tissue cultured sugarcane plantlets in green house. There was no additional benefit of chemical fertilizer when used at double the rate. In case of urea spraying along with fertilizer application there was increase in number of plants showing tillers. There was a positive relation between root growth and shoot growth as indicated by their weight.

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