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Effect of Different Concentration of Cytokinin on Shoot Development of Sugarcane

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ARTICLE ID: 23

Introduction

The genus Saccharum contains six significant species, which go by the common names *Saccharumofficinarum*, *S. Sinense*, *S. barberi*, *S. robustum*, *S. spontanuem*, and *S. ilude*. India has been growing sugarcane since the Vedic era. Barber (1931) thought that some *Saccharumspontaneum* (Kans)-related plants were probably the origin of the thin Indian canes in the wet areas of northeastern India. It belongs to the order glumaceae subfamily panicoidae of the tribe Saccharininea, subtribe Andripogoneae of the family Gramineae (Poaceae), class Monocotyledons, and family Gramineae. *Saccharumoficinarum* (S. barberi and S. sinense), two hardy north Indian types, and thick, juicy noble canes are the two main groups of cultivated canes. The cane *S. officinarum* is very valuable. It most likely descended from other genera by introgression from S. robustum. It is generally accepted that the Indo-Myanmar China border, which serves as the primary centre of diversity, is where *S. officinarum* originated. The modified back crossing of wild cane is the nobilization process in sugarcane. Back crosses to the noble parent (*S. Officinarum*) are made repeatedly between *S. spontaneum* and *S. Officinarum*. It is said that the area where two wild species, *Saccharumspontaneum* and *Saccharumrobustum*, are present is the birthplace of farmed sugarcane. The origin of *Saccharumrobustum* is New Guinea and it results from a spontaneous cross between *Saccharumspontaneum* and *Miscanthisfloridulus*.

Sugarcane is the most important cash crop in India. In spite of the difficulties, farmers can still expect to make a profit because there is less risk involved. In the agricultural sector, sugarcane accounted for 2.6% of India's gross cropped area and 7% of the overall value of agricultural output. After textile, the second-largest agro-based industry uses sugarcane as its primary raw material. In the country in 2010–11, there were approximately 527 active sugar

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factories, with a combined crushing capacity of about 242 lbtones. The sugar industry directly and indirectly generates a sizeable portion of the jobs in the rural economy. About 50 million farmers and their dependents are thought to be involved in the cultivation of sugarcane, and about 0.5 million trained and unskilled workers work in sugar factories. Sugarcane is a multipurpose crop grown by farmers in Maharashtra that is a rich source of sugar, ethanol, biogas, manure, electricity production, paper, etc. Sugarcane leaves, which require less water than other crops and take at least ten months to mature, were utilized as cow feed during the growing process. Despite the longer plantation period, individuals frequently choose to plant sugarcane because of its advantages. Many seedlings failed to develop into plantlets throughout the cultivation phase, therefore researchers concentrated on developing healthy, disease-free plants using biotechnological methods like micro propagation. Traditionally the sugarcane is being planted through sugarcane sets. These are very rough and tough method of plantation. Now a day sugarcane crops suffer with diseases and pest and their by farmers are put in to the huge losses. To overcome these problems use of disease free seedlings/sets are very essential. The disease free seedlings can be grown only through tissue culture. Where, disease free material is used as a source of explants. Considering the importance of tissue culture to grow the disease free crop on farmers field the present project has been under taken with the following objectives.

In general, sugarcane cultivation in India can be divided into two main agro-climatic regions: tropical and subtropical. Five agroclimatic zones have been determined, nevertheless, primarily for varietal development. They are the Peninsular Zone, North Western Zone, North Central Zone, and North Eastern Zone. Objectives To the study in vitro growth of sugarcane from shoot tip and to study the effect of cytokinines on shoots development of sugarcane.

Material and Method

The experiment effect of different concentration of cytokinin on shoot development of sugarcane was carried out in SDMVM'S College of Agriculture Biotechnology and further investigation was carried out in Department of Genetics and Plant Breeding, ITM University Gwalior, M.P., India. In 2021-22, the details of materials used and methods for followed for the present investigation as given as follow.

Materials:

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Explant material:

Variety of sugarcane co-86032

Surface sterilization:- The explants were extensively cleaned in a laminar air flow cabinet after being properly washed in running tap water for 20 to 30 minutes, followed by 10 minutes of bavistin 0.2% treatment. For 30 seconds to a minute, juvenile meristem explants were exposed to 0 alcohol. 01% (wiv) mercuric chloride (HgCh) treatment follows for an additional 5 minutes. Finally, the immature meristem cuttings were thoroughly cleaned with sterile distilled water for three to five minutes. All of the aforementioned procedures were carried out in a laminar airflow cabinet under aseptic circumstances. Then bottles were parafilm-wrapped. For better shoot induction, all the inoculated bottles were incubated in a growth environment with a l6h photo period (cool, white fluorescent light) and a temperature of 25 + 2°C and 70-80e relative humidity. The observations were recorded after 30 days are presented in result chapter.

Result

A significant cash crop in the tropical and subtropical parts of the world is sugarcane (*Saccharumofficinarum*). The types of sugarcane are extremely heterogeneous, and they often spread vegetative by stem cutting. Due to the heterogeneity of the sugarcane setts, farmers encountered numerous issues and were unable to produce the required yield. Through the micro-propagation of sugarcane, plant tissue culture offers the finest solution for producing high-quality, homogeneous planting material quickly. After inoculating from the meristem on modified MS media containing various concentrations of BAP, NAA, and 2,4-D, shoot induction was seen within two weeks. In the present study the results obtained are presented as follow.

For the purpose of inducing shoots, various concentrations of the cytokinins BAP and 2,4-D and the auxin NAA were utilized. The type and concentration of the growth regulators used throughout this experiment had a significant impact on shoot induction. For shoot induction, the MS medium supplemented with BAP (2.0 mg/L) and NAA (0.5 mg/L) showed the greatest effectiveness among various concentrations and combinations. 92% of the explants generated shoots on this combination. The shoots had an average length of 7.5 1.02 cm. BAP (2.0 mg/L) and NAA (1.0 mg/L) were added to MS medium as supplements, and the mean length of the shoot was 5.5 0.47 cm.Additionally, BAP alone demonstrated positive

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results, although it was not superior than BAP+NAA alone. However, mixtures of a high cytokinin level and a low auxin level

Outcome of the Programme

The present study 'Effect of different concentration of cytokinin on shoot development of sugarcane' efforts has been made to see the effect of different concentrations of BAP, NAA and 2,4-D on regeneration of sugarcane from shoot tip. Amongst the various plant growth regulators tested it has been observed that the highest regeneration of shoot was recorded in MS medium supplemented with BAP@2.0 gm/L+ NAA@0.5gm/L.

Summary

Sugarcane is one of the most important cash crops grown by the farmers of Maharashtra. Generally co 86032 Co 9814, Co Pant 97222, Co 0238, Co 87263, Co 0239, Co 87268, BO 128 Co 91230 varieties are grown by the farmers. The sugarcane is heterogeneous due to which farmers could not harvest bumper yield. To overcome the problems and get homogenous growth tissue culture plants is best option. Many tissue culture labs have undertaken the multiplication program through tissue culture and farmers are responding positively. In the present study efforts has been made to see the effect of different hormones on shoot induction viz., BAP, 2,4-D, NAA were tested. Standardization of protocol for shoot induction was established through in vitro culture using young shoot tip of Sugarcane (Co86032) as an explant. The multiple shoot regeneration at various frequencies was observed by using different concentrations and combinations of growth regulators. In terms of multiple shoot induction, MS medium supplemented with BAP at 2.0 mg/L and NAA at 0.5 mg/L showed the best response. For shoot regeneration, different combinations of cytokinin (BAP and 2,4-D) and auxin (NAA) concentrations were utilized. Shoot formation during this inquiry was significantly impacted by the types and concentrations of growth regulators utilized in the experiment. Various concentrations and mixtures were evaluated for shoot induction. The best outcomes were obtained using MS medium supplemented with BAP (2.0 mg/L) + NAA (0.5 mg/LL).

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