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Tribhuwan Kumar

Assistant Professor-cum-Jr. Scientist
Discipline of Bio-Technology
Bihar Agricultural University
Sabour, Bhagalpur
India – 813 210

Awadhesh Kumar Pal

Assistant Professor-cum-Jr. Scientist
Department of Plant Physiology
and Biochemistry
Bihar Agricultural College
Sabour, Bhagalpur
India – 813 210

Ravi Shankar Singh

Assistant Professor-cum-Jr. Scientist
Department of Plant Breeding
and Genetics
Bihar Agricultural College
Sabour, Bhagalpur
India – 813 210

Deepak Kumar Patel

Assistant Professor-cum-Jr. Scientist
Discipline of Extension Education
Bihar Agricultural University
Sabour, Bhagalpur
India – 813 210

Corresponding Author

Tribhuwan Kumar
tribhuwanbau@gmail.com

Production of Banana (Grand Naine) Through Tissue Culture Technology

Tissue culture is a recent and advanced technology that has proved as a spring board for the multiplication and regeneration of most of the horticultural crops, particularly, banana. The traditional production systems of banana often fall short to commercial demands; therefore, there is need to produce tissue cultured plantlets to meet the demand of virus free and true to type plantlets. Among the various varieties of bananas, the Grand Naine is a high yielding one and is gaining more popularity. Banana can be harvested after 10 to 11 months from the tissue cultured raised plantlets by adopting good agronomic practice and integrated pest & disease management. This Popular article incorporates importance of Grand naine variety of banana, involved techniques in their tissue culture and agronomic practice.

INTRODUCTION

Horticultural crops are very important crops which give maximum returns to farmers in addition to its role in diversification of crops, generation of employment and nutritional security to the Indian population. India has made a tremendous head way in the horticulture at the International level. Banana holds second position in terms of both area and production in India after mango. It is cultivated in more than 1.5 Lakh hectares in different parts of India including Bihar. It loves moisture and heat and hate frost or arid conditions. The height of banana ranges between two to five meters and contain milky juice in most of the parts. Grand naine, Robusta, China and

Malbhog are few important varieties of banana. More than ten percent produced bananas in India is exported to the United States and European Union. Among the fruits, banana is the most nutritious, cultivated and consumed particularly in developing countries as it contains almost all essential components of food. A banana is rich in tryptophan, a kind of amino acid which converts into serotonin and gives feeling of relaxation and happiness. It helps to control anaemia, blood pressure and reduces the risk of stroke, being richer in potassium. The special kind of vitamins and minerals available in the fruit of banana helps to quash the effect of nicotine.

PRODUCTION OF BANANA (GRAND NAINE) THROUGH TISSUE CULTURE

Tissue culture is recent and advanced technology and is generally used in the multiplications of elite crops. Banana can be produced easily by tissue culture as it has tremendous capacity of asexual propagation and can overcome the shortcoming that comes by conventional propagation. The average per capita availability of quality banana in India through traditional culture is not at the par to serve the Indian population. Modern Tissue Culture Techniques has helped entrepreneurs and farmers to propagate banana as per the rising demands. Changing life styles and consciousness towards health of Indian people holds good scope for the producers and entrepreneurs involved in tissue culture of banana. Grand Naine variety of banana is the choice variety for production through tissue culture technology. Grand Naine is a high yielding (Average 30 Kg/Plant) Cavendish variety which has been introduced in India from Israel. Average height of this plant is 6.5 to 7.5 feet. Crop period of tissue culture raised banana of this variety is about 11-12 months. Each bunch comprises 10 to 12 hands with 175 to 225 numbers of quality fruits. It is more delicious and has more shelf life as compared to indigenous varieties. Fruits are of fascinating yellowish green colour when it ripens, therefore, both fresh fruit and processed form of fruits are internationally acceptable. Pulp to peel ratio of this variety is higher and highly suitable for the value addition and fortification. Tissue culture raised plantlets of this variety are not only high yielding, but also of good quality, true-to-type, uniform and elite than rest of other varieties. These are virus free at the time of planting and can be maintained throughout after diligent management practice. Tissue culture raised plantlets of this variety

exhibit good vegetative growth and performance at the farmers' field. These plantlets are available around the year and multiply more in limited space and time. It shows uniform maturity and harvesting period and gains lucrative price after market oriented planting. It also save extra cultivation period as compared to the plantlets grown through conventional propagation.

TECHNOLOGY INVOLVED IN TISSUE CULTURE OF BANANA

Sucker rich in dividing tissue is surface sterilized and inoculated on artificial nutrient media for the generation of shoot buds under controlled aseptic conditions. Owing to fast cell proliferation from this region, it outgrows systemic microbes, particularly virus and virioids, therefore resulting culture is virus free. However for the confirmation virus indexing is preferred before initiation.



Initiation of Culture From Sucker



Shoot Initiation of Banana

Tissue Culture Media for the production of banana is available commercially. This media is added with the prescribed quantity of Plant growth regulator (PGR) based on the stage of culture and subculture. Before initiation/culture/subculture, culture media of particular strength is prepared and sterilized in the autoclave.



Rooting of Multiplied Shoot

subculture. Sucrose and glucose serves as the sources of carbohydrate or fuel molecule. IAA and 6 BAP are plant growth regulators and plays important role in the modulation of growth. One time multiplication requires incubation period of about five weeks, relative humidity of about 60% , temperature around 22°C and photoperiod of 16:8 (Day: Night) hours. The initiated tissue under aseptic condition and controlled environment are multiplied many times to procure requisite number of each cultivar as per the demand of consumers. Like shooting medium, rooting medium also consist of vitamins, Plant Growth Regulators (PGR), Sucrose, Activated charcoal & Agar (solidifying agent). Rooting medium of banana has been developed for the *in-vitro* rooting of banana shoots developed from suckers. Like shooting, rooting in the multiplied banana needs incubation period of 5 weeks, relative humidity near 60%, temperature around 25°C and photoperiod of 16:8 (days/night) hours.



Culture of Banana in Culture Room

Medium is sterilized by autoclaving at standard condition i.e. 15 lbs or 121°C for 20 minutes before every culture/subculture. Autoclaved medium is cooled to 45°C, filter sterilized and heat labile supplements are added, if needed. Required amount of sterilized medium is added aseptically in sterile culture container in the Laminar Air Flow Cabinet. Proliferated shoot buds in clumps are individually transferred to and nourished in multi- media to form shoots of banana. This medium consists of Calcium chloride, Vitamins, Sucrose, Glucose, Vitamin C, Indole 3-Acetic Acid (IAA), 6-Benzyl Adenine Purine (BAP). It also contains gel as a solidifying agent to provide firm support to explants, culture and



Primary Hardening



Secondary Hardening

After rooting, rooted plantlets of banana, are isolated from containers, graded, and planted into trays filled with soilless peat mix growing media under optimum relative humidity, air circulation, light intensity and temperature to get primarily hardened in the poly house. It takes 9 to 12 weeks to complete the primary hardening process. The plantlets generally have four to five leaves and well developed root system at the end of primary hardening. These plantlets further need secondary hardening. For this plantlets are grown in net house for 9-12 weeks before transplanting in the farmer fields. Now these tissue culture banana plantlets, contained in poly bags of height of 28 to 40 cm with 7 – 8 leaves are ready to be sold and transplanted into the farmer's fields.

TRANSPLANTATION TO THE MAIN FIELD AND PRODUCTION

Before planting into the field grading is essential, which is done based on height and thickness of plant. Generally banana is cultivated at 8 North to 28 North latitudes where temperature is 10-45°C and annual rainfall is 500 mm-2000mm. Deep and friable loam soil with good drainage and aeration are choice soil for the growth of banana. Banana does not resist water logging condition and but can tolerate a wide range of soil pH i.e. 6-7.5. However off-season planting of banana can be done and secondary nursery can be raised around the year, provided irrigation properly. Adjustment of secondary nursery planting before pre monsoon periods is advised as per the climatic condition of particular agro-climatic zone. Fully hardening or acclimatized plants of at least 5 leaves stage in poly-bags becomes in condition to transplant into the farmer field. However cutting back of the pseudo-stem in poly-bags is avoided in case of tissue cultured banana. Before planting, soil is tilled fine followed by ploughing and harrowing. 6' X 6' is the general spacing pattern for planting Grand Naine variety of banana. Generally planting of 1200 plants / acre with spacing of 6ft X 6 ft. is recommendable. Nine to ten grams of furadan 3G granules per pit is added and mixed well into the soil mixture near the root zone about seven days before to planting and allowed to moist the soil after application. Pits size of 2ft X 2ft is dug and pits are packed with equal amount of top soil: well decomposed FYM or compost or manure. Poly bag can be perforated and/or is removed and the plant may be put into the middle of the packed pit without harming the roots. It is advisable to maintain the soil level as of poly bag.

Immediate irrigation after planting and subsequent irrigations preferably drip irrigation once in 3-4 days depending upon the soil and weather conditions should be done. This is not only essential to save water and but also to enhance the production. 200 gms. Nitrogen, 100 gms. Phosphorous and 210 gms. Potassium is required to complete the life cycle of banana and accordingly it must be availed to the growing plants. However Tissue cultured plants are disease free at the time of supply and further with the application of integrated disease and pest management, disease and pest free banana can be produced.

CONCLUSION

Banana cultivation is a very economic and profitable agriculture business in India due to high consumer's demand. Tissue culture technology has established new trends of banana production to lower the risk and get higher banana production particularly "Grand Naine". This variety of banana holds much scope for the banana growers of the nation owing to well established multiplication system by tissue culture and high yielding agronomic practice.