NAVSARI AGRICULTURAL UNIVERSITY

ICAR

MACRO-PROPAGATION TECHNIQUE FOR PRODUCTION OF BANANA PLANTS

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❖ Background:

Banana is a second important and popular fruit crop after mango in India. Looking to the area under banana cultivation in India about 1000 million plants per annum required. This is an enormous requirement in a vegetatively propagated crop like banana. Presently nearly 35-40 viable companies are involved in a production of tissue culture banana plants with an annual production of 250-280 million plants. Thus, the gap is approximately 700 million plants, while the rest of planting material requirement is being catered as suckers (ICAR-NRC for Banana, Trichy, 2020).

❖ ALTERNATE TECHNIQUE :

Most of the cultivars are location specific, therefore, non-availability of quality planting material and tissue culture planting material is one of major issue among banana growers. These constraints can be overcomed by-

- Alternate technique must be avail equivalent to tissue culture plantlets.
- Minimum infrastructure facility.
- Less cost of production.
- Less skill.

Therefore, Macro-propagation remain as the next best alternative with tremendous potential for production of quality planting material. The macro-propagation techniques involved decortications and decapitation, which is likely to produce nearly 15-20 plants/suckers depend on the cultivar. These shoots could be

rooted and hardened like tissue culture plantlets. The farmer will be benefitted by this simple method because of easy multiplication of their own choice of variety and thus minimize the cost of planting material.

❖ **Validation of technology :**

ICAR-National Research Centre for Banana located at Tiruchirappalli (Tamil Nadu) started work on macro-propagation in banana at seven centres (Karnataka, Gujarat (Gandevi), Maharashtra, Assam, Andhra Pradesh, West Bengal and ICAR New Delhi) in 2013 under ICAR-AICRP on fruits programme. After 6 years research at Gandevi centre, technology has been recommended in Group discussion of ICAR-AICRP on Fruits and in AGRESCO at Navsari Agricultural University.

❖ **Basic Concept :**

1. Decortications:

In decortication process, the pseudostem of mother corm or sword sucker is cut transversely 2 cm above the collar region and then the apical meristem is removed with cavity @ 4 cm depth. Such decortication activate the lateral buds induces side suckers as a result of the breaking of the apical dominance or removal of the apical dom. Because of Auxin is synthesized in meristematic portion of the plant and when it removed, it will enhance the cytokinin. Later, on this cytokinin accumulated in main region and is spread in all the lateral portion, so that more number of homogenous plants from lateral portion will develop. This is the basic concept of this technique.

2. Decapitation:

The apical meristem is removed to a depth of 4 cm leaving a cavity of 2 cm diameter in the rhizome and the rest of the corm is given 6-8 cross-wise cuts. Due to that, there is no sprouting from upper side of the meristematic part of sucker.

❖ **Preparation of suckers for macro propagation :**

➢ Selection of sword sucker from the healthy field and healthy

plant, which should be pest and disease free and high yielded. Don't choose the water suckers.

- Collect healthy sword suckers and wash with 60° C boiled water for 1 minute.
- Sword sucker having high nutrition in the corm as well as narrow pointed leaves should be used to prepare plantlets.
- Sword sucker should have weight of 500 gm to 1.0 kg.
- Treat the suckers with fungicide solution. Deep the suckers in solution for 30 minutes.
- Trim the suckers which are ready for further process.

❖ **Methodology :**

1. **Decortication:** Treated suckers are detopped just above the juncture of the corm and aerial shoot.
2. **Decapitation:** Corm is given 6-8 cross wise cuts.
3. Put the rhizomes in shed condition and placed and filled with 2 kg/corm saw dust substrate and irrigate regularly with sprinkler can.
4. Suckers are treated with VAM (Vascular Arbuscular Mycorrhizae) and *Tricoderma viride* each @ 30 gm/sucker.
5. Primary shoots are develops after 20-30 days of putting the suckers in the bed.
6. Primary buds are decapitated by removing the juvenile meristem and 4-6 horizontal cuts to be given for the young rhizome.
7. Secondary shoots take place within 40-50 days with 5 to 8 shoots after putting the suckers in the bed.
8. The same procedure of primary shoots removing must be repeated for secondary buds to produce tertiary buds. For true to type plant, same technique apply further *i.e.* multiplication of shoots from suckers.
9. After 3 to 4 month of planting suckers, tertiary shoots with 15-30 numbers depends on variety will developed.
10. At the opening of full leaves, separate all the tertiary shoot with

roots from the suckers. Then place them in to plastic bag with media containing red soil : sand : FYM in the ratio of 1 : 1 : 1.

11. For hardening of plant, keep all plants in shed net house for 15 to 20 days.

After 3-4 months, plants will be ready for plantation. From this technique, uniform planting material can be prepared.

❖ **Merits of macro-propagation :**

Sr. No.	Merits	Macro	Suckers	Micro (Tissue culture)
1.	Initial establishment cost	Low	Low	High
2.	Skilled man power	Low	Low	High
3.	Requirement			
a)	Material needed	Available in and around farm	Limited availability	Depends on company requirement
b)	Sophisticated lab	No	No	Yes
c)	Electricity	Not required	Not required	Required
d)	Risk of contamination	Nil	High	Possible
e)	Production rate/ explants (depends on cultivar)	Up to 55	Depend on availability	Up to 1000
f)	Pest and dieses incidence	Low	High	Low
g)	Plantlet Uniformity	Yes	No	Yes

❖ **Experiment and Results of Macro-propagation technique in banana at ICAR-AICRP (Fruits), FRS, NAU, Gandevi Centre (2013-2016):**

❖ **Important characters of macro-propagated plants of banana:**

Treatment	No. of days taken for bud initiation	No. of Tertiary bud	Plants produce/corm
T_1	16.73	3.86	11.61
T_2	15.62	4.24	12.84
T_3	**17.43**	**5.96**	**19.63**
T_4	19.16	3.89	11.05
T_5	17.19	3.84	10.18
T_6	17.60	3.70	9.24
T_7	16.40	3.52	9.05
CD @ 5%	1.06	0.44	1.95
CV %	9.53	10.15	25.84

Results: There were seven different treatment carried out at Fruit Research Station, NAU, Gandevi farm *viz.* T_1: Saw dust + AM (30 g)/ sucker, T_2: Saw dust + *Trichoderma Viride* (30 g)/ sucker, T_3: Saw dust + AM (30 g) + *Trichoderma Viride* (30 g)/ sucker, T_4: Saw dust + IBA (dipping in 0.25% solution) + *Azospririllum* (30 g) / sucker, T_5: Saw dust + BAP (4 ml) + *Bacillus substills* (30 g) /sucker, T_6: Saw dust + AM (30 g) + BAP (4 ml) + *Bacillus substills* (30 g) /sucker and T_7: Saw dust + BAP (4 ml) + NAA 4 ppm (4 ml)/ sucker. The three years pooled results revealed that with the treatment Saw dust + AM (30 g) + *Trichoderma Viride* (30 g)/ sucker (T_3) recorded minimum days (17.43) taken for bud initiation, maximum primary (3.06), tertiary buds (5.96) and highest plants/corm (19.63) as well as maximum plant height of 15.14, 18.59 and 22.99 cm; stem girth of 4.35, 5.15 and 5.92 cm, leaves per plant as 4.55, 7.01 and 7.94, leaf width of 7.61, 9.75 and 11.04 cm, no. of roots as 8.06, 9.81 and 13.28, root length of 23.87, 33.56 and 39.06 cm, secondary roots as 3.50, 4.72 and 7.33 at 30, 60 and 90 days after bagging, respectively.

❖ Field performance:

SN	Macro propagation (New Technology)	Parameter	Conventional method (Sucker)
1.	**Bunch weight (kg/plant)**		
(a)	19.11 to 26.80	Grand Naine	13.00 to 25.10
(b)	15.20 to 28.59	Robusta	13.90 to 22.83
2.	**B:C Ratio**		
(a)	2.85 to 4.57	Grand Naine	2.58 to 3.53
(b)	2.63 to 4.25	Robusta	2.33 to 3.55
3.	**Advance flowering (Days)**		
(a)	206.30 to 261.50	Grand Naine	211.70 to 351.55

Uniform Flowering in macro propagated plants

Uniform performance as well as early bunch in Macro propagation banana in field in first row and late bunch in behind row with sucker plantation

Macro propagation plant may be recommended as low-cost planting material for banana cultivation instead of using conventional sucker for cultivation of regional varieties. This technology may be adopted in different districts of Gujarat where sucker is conventionally used as planting material and adoption of tissue culture plant is very low or regional variety (farmer's choice variety) is not available in tissue culture form.

Chart- 1: Procedure for Macro Propagation in Banana

Note: For more information regarding macro-propagation banana, on-farm training as well as for plants, please content to Associate Research Scientist (Fruit), Fruit Research Station, Navsari Agricultural University, Gandevi - 396 360, Gujarat.