# QUALITY PLANTING MATERIAL PRODUCTION IN TUBER CROPS

Dr. James George

Central Tuber Crops Research Institute
Sreekariyam, Trivandrum, India

## Tuber crops grown in India

| | |
|---|---|
| Cassava | *Manihot esculenta* |
| Sweet potato | *Ipomoea batatas* |
| Yams | *Dioscorea alata, D. esculenta, D. rotundata* |
| Elephant foot yam | *Amorphophallus paeoniifolius* |
| Taro | *Colocasia esculenta* |
| Tannia | *Xanthosoma sagittifolium* |
| Coleus | *Solenostemon rotundifolius* |
| Yam bean | *Pachyrrhizus erosus* |
| Arrowroot | *Maranta arundinacea* |

Cassava | Sweet Potato | Amorphophallus

## Important Tuber Crops

Yam | Colocasia | Coleus

## Major constraints in quality planting material production

**Lack of availability of healthy planting materials**

- Cassava mosaic disease
- Tuber rot in cassava

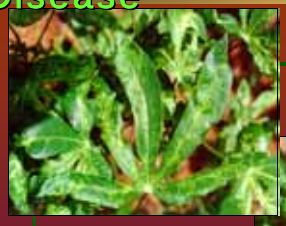
**Low multiplication ratio**

- Multiplication ratio in cassava is 1 : 10
- Multiplication ratio in amorphophallus is 1 : 4
- Multiplication ratio of colocasia is 1:20
- Multiplication ratio of Yams is 1:5

- Unlike other crops, planting material production techniques are not available in tuber crops
- Extremely low multiplication ratio compared to cereals
- Released varieties take many years to reach the farmer
- Clonal propagation practiced in tuber crops facilitates easy transmission of diseases
- Non availability of healthy planting materials render the farmer helpless


High demand for cassava stems as the crop has significant industrial use

## Indian Cassava Mosaic Disease



Leaf Distortion

Mosaic

Cassava stems – the planting material

## PLANTING MATERIAL :CASSAVA


Traditional setts of 20 cm length with 10 to 12 buds

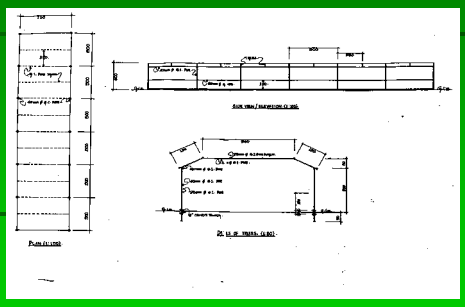

Method of planting

Minisetts of single, two and three nodes along with a traditional sett

Minisetts

## Shade net house for minisett nursery

## Structure of a Shade net house



Two node minisetts spread horizontally in the nursery

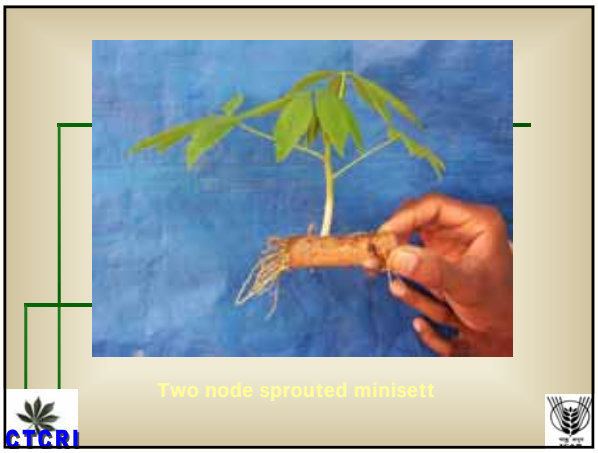

Planting tip of stems


Cassava minisett nursery


Remove infected minisetts
Treatment against white fly


Micropropagation of *in vitro* raised cassava plants

One month old minisetts being uprooted for transplanting



Two node sprouted minisett

Transplanting in main field

Transplanting : general view

Cassava minisetts experimental plot

Four month old transplanted minisetts – CMD

## Growth parameters of Cassava minisetts

| Treatments | Establishment (%) | DMP (t ha-1) | LAI | Root spread (cm) | Number of nodes (millions /ha) | Multiplication ratio (based on production of nodes) |
|---|---|---|---|---|---|---|
| Single node | 76.79 | 4.015 | 4.00 | 47.73 | 3.12 | 86.77 |
| Two node | 85.94 | 4.160 | 3.76 | 46.52 | 4.52 | 62.9 |
| Three node | 88.58 | 4.196 | 3.73 | 49.15 | 4.85 | 45 |
| CD | 3.616 | NS | NS | NS | NS | 13.1 |
| 45x45 cm | 79.30 | 5.602 | 4.39 | 46.79 | 5.39 | 109 |
| 60x45 cm | 81.42 | 4.314 | 4.18 | 47.78 | 4.50 | 121.5 |
| 60x60 cm | 88.66 | 3.221 | 3.19 | 49.62 | 3.66 | 131.7 |
| 75x45 cm | 85.83 | 3.356 | 3.55 | 47.00 | 4.00 | 135 |
| CD | 4.060 | 0.8578 | 0.690 | NS | 0.4731 | 8.11 |

## Growth parameters of Cassava minisetts

| Treatments | Establishment (%) | DMP (t ha-1) | LAI | Root spread (cm) | Number of nodes (millions /ha) | Multiplication ratio (based on production of nodes) |
|---|---|---|---|---|---|---|
| Direct planting | 75.18 | 4.07 | 3.79 | 53.69 | 4.26 | 118.5 |
| Transplanting | 92.42 | 4.18 | 3.87 | 41.91 | 4.52 | 125.7 |
| CD | 2.871 | NS | NS | 2.86 | NS | NS |
| Ridge method | 89.00 | 4.20 | 3.89 | 48.00 | 4.74 | 131.8 |
| Flat method | 88.60 | 4.05 | 3.77 | 47.60 | 4.63 | 128.8 |
| CD | NS | NS | NS | NS | NS | NS |

Transplanted minisetts at harvest stage (6 months) – Girth of stems comparable to traditional setts

**Comparison between traditional and minisett multiplication**

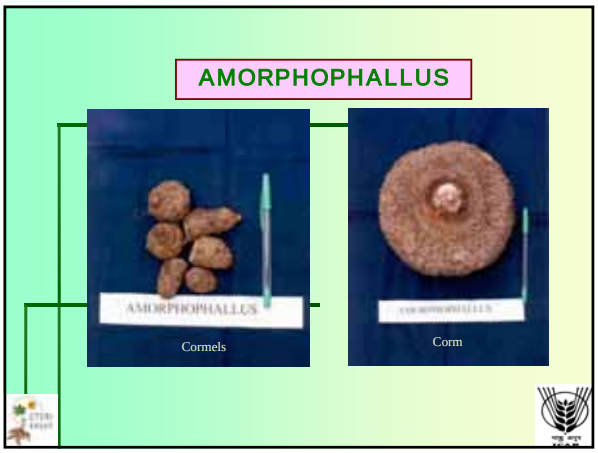
| Cassava | Traditional system | Minisett technique |
|---|---|---|
| Number of sprouts per setts | Two | One |
| Number of setts that could be obtained from a stem | 5 | 60 |
| Spacing adopted | 90X90 cm | 60x45cm |
| Number of plants /ha | 12500 | 37000 |
| Number of stems as planting material /ha | 2500 | 560 |
| Planting material yield per ha | 25000 | 37000 |
| Multiplication ratio | 10 | 70 |

Tuber production through cassava minisett- comparable to traditional setts

## Salient Findings in cassava

- Two node minisett is found to be ideal for rapid multiplication
- 45x45 cm spacing has been optimised for rapid multiplication
- Establishment percentage of minisetts are more in transplanted compared to direct planted one
- Multiplication ratio enhanced to 1:60 (from 1:10)


AMORPHOPHALLUS
(Gimmikhand )


AMORPHOPHALLUS
AMORPHOPHALLUS
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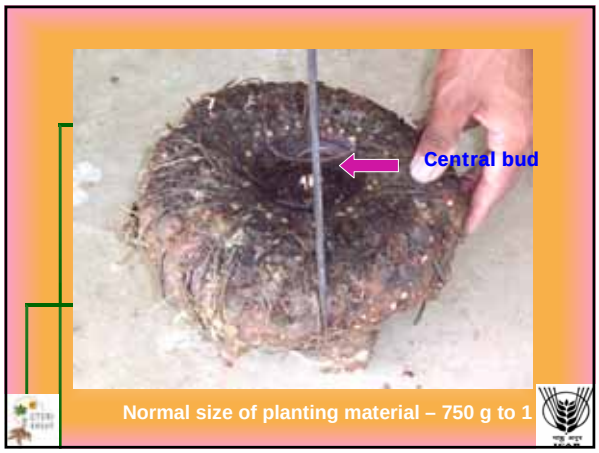
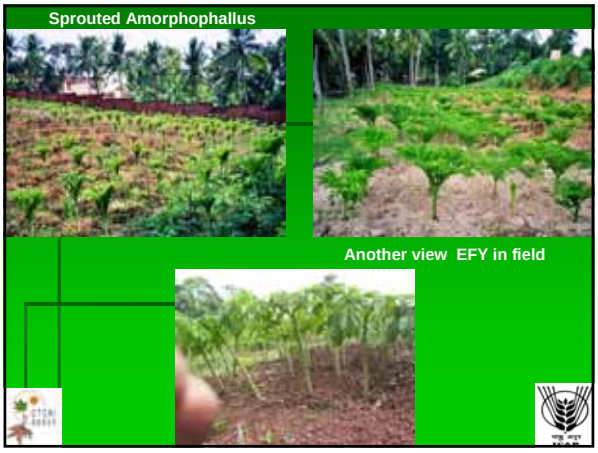
Low land cultivation – intercropping in banana very common
Amorphophallus intercropped in coconut garden – a common sight in Kerala


Harvested tubers – rich profit to the farmers


Central bud
Normal size of planting material – 750 g to 1


Preparing minisetts


100 g
200 g
300 g
1 k g
Minisetts compared with traditional sett


Sprouted Amorphophallus
Another view EFY in field

Commercial cultivation at Kovvur (AP)

Planting materials under storage under partial shade of banana crop – a common sight in Kovvur

## Growth and Yield parameters of Amorphophallus minisetts

| Treatments | Tuber Yield (t ha$^{-1}$) | Multiplication ratio | Sprouting percentage | Plant Girth (cm) | Canopy cover (cm) | Height of plant (cm) | Girth of tuber (cm) |
|---|---|---|---|---|---|---|---|
| 100 g | 53.35 | 14.84 | 88.8 | 11.83 | 69.3 | 49.2 | 47.23 |
| 200g | 50.43 | 7.01 | 87.3 | 12.40 | 81.1 | 55.0 | 46.41 |
| 300g | 53.35 | 4.95 | 84.0 | 13.40 | 80.8 | 55.1 | 50.30 |
| CD | NS | 8.45 | 3.9 | 1.304 | 9.40 | 5.66 | NS |
| 45x45 cm | 80.71 | 8.17 | 88.0 | 12.18 | 83.5 | 56.0 | 48.40 |
| 60x45 cm | 75.69 | 10.22 | 89.2 | 13.10 | 78.3 | 52.5 | 49.67 |
| 60x60 cm | 65.84 | 11.85 | 88.5 | 12.72 | 70.9 | 51.4 | 47.28 |
| 75x45 cm | 67.60 | 11.41 | 81.1 | 12.17 | 75.6 | 52.4 | 46.57 |
| CD | 5.13 | 1.98 | NS | NS | NS | NS | NS |

## Comparison between traditional and minisett multiplication

| Amorphophallus | Traditional system | Minisett technique |
|---|---|---|
| Number of setts that can be obtained from 1 kg planting material | 1 | 15 |
| Spacing adopted | 90X90 cm | 60x45 cm |
| Number of plants/ha | 12500 | 37000 |
| Planting material required kg/ha | 12500 | 3700 |
| Yield kg/ha | 34000 | 53000 |
| Multiplication ratio | 3 | 15 |

## Salient findings in Amorphophallus

- Multiplication ratio was found to be higher in 100 g minisetts
- 60x60 cm spacing is found to be ideal for rapid multiplication
- Multiplication ratio enhanced to 1:15 (Normal – 1:3)


D. rotundata

Sree Priya

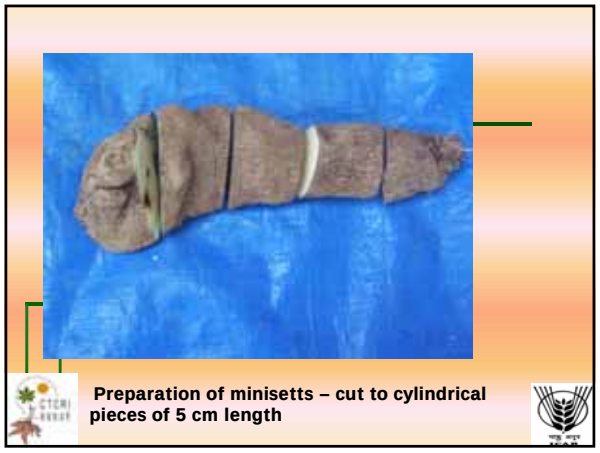
D. alata

Sree Keerthi

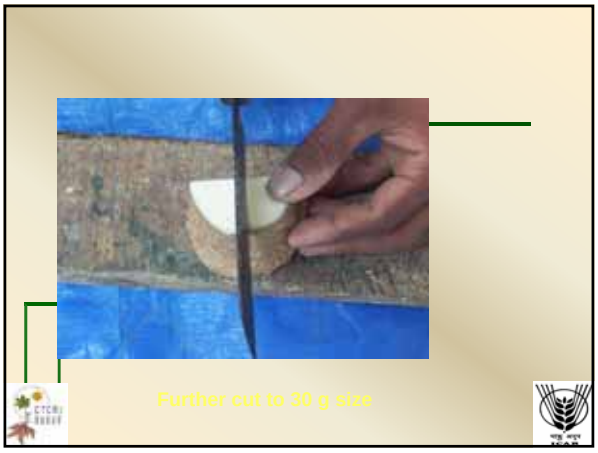
Commercial yam cultivation at Pathanapuram, Kerala

Field view of trailed yams – trailing enhances cost of cultivation by 40 %

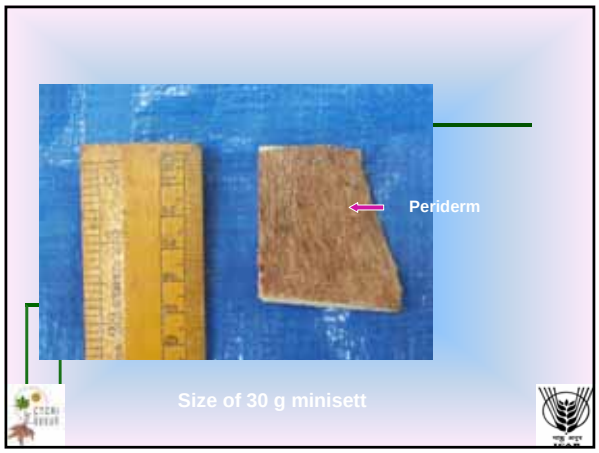
Extensive area under non-trailed yams (*D. alata*) in Kovvur



Preparation of minisetts – cut to cylindrical pieces of 5 cm length

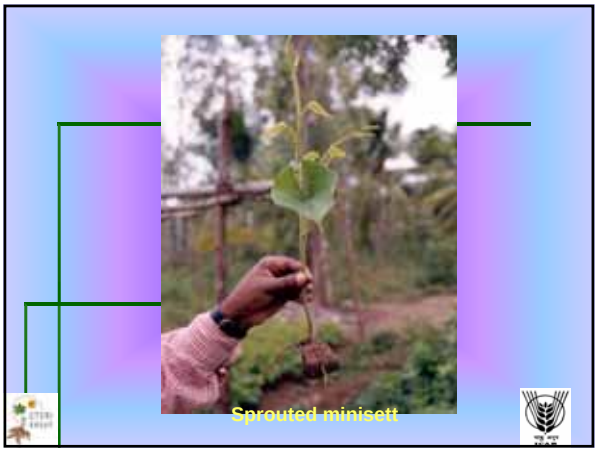


Further cut to 30 g size


Periderm
Size of 30 g minisett


Minisett laid in nursery with cut surface up – spaced 10 cm between rows


Yam minisetts in nursery


Sprouted minisett

Yams from minisett

## Yield contributing characters and multiplication ratio of yam minisetts

| Minisett size (g) | Tuber yield (t ha$^{-1}$) | Multiplication ratio | Mean number of tubers | Mean length of tubers (cm) | Mean girth of tubers (cm) |
|---|---|---|---|---|---|
| 15 | 9.78 | 32.6 | 1.1 | 18.39 | 14.20 |
| 30 | 15.51 | 25.9 | 1.3 | 20.56 | 16.42 |
| 45 | 17.35 | 19.3 | 1.2 | 20.23 | 16.78 |
| 60 | 21.68 | 18.1 | 1.3 | 24.50 | 17.85 |
| CD (0.05) | 5.14 | - | 0.18 | 1.39 | 2.03 |

## Comparison between traditional and minisett multiplication

| Seed yams | Traditional system | Minisett technique |
|---|---|---|
| Number of setts that can be obtained from 1 kg planting material | 4 | 30 |
| Spacing adopted | 90X90 cm | 60x60 cm |
| Number of plants/ha | 12500 | 28000 |
| Planting material required kg/ha | 4000 | 950 |
| Yield kg/ha | 16000 | 23000 |
| Multiplication ratio | 4 | 24 |

## Salient findings in yams

- Multiplication ratio was found to be higher in 30 g minisetts
- 60x60 cm spacing is found to be ideal for rapid multiplication
- Multiplication ratio enhanced to 1:24 (normal 1:4)

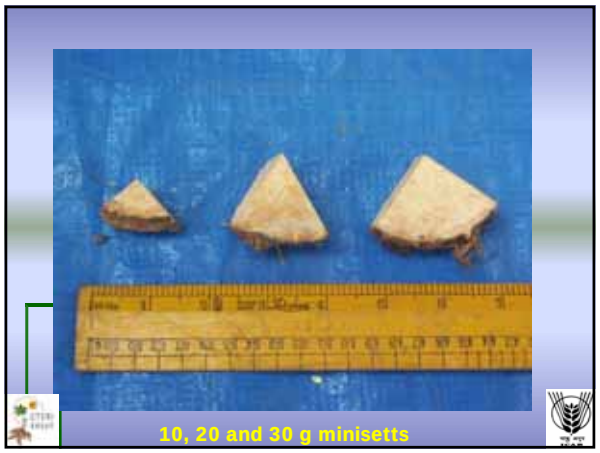
## Colocasia (Taro)

- Indo- Malayan origin
- Important source of starch
- A commercial crop and a staple food in Pacific islands
- An important vegetable
- Provide easily digestible starch
- Petiole, leaves and inflorescence are also used as vegetables
- Industrial use

Normal planting material size – 45 g. A field view of colocasia

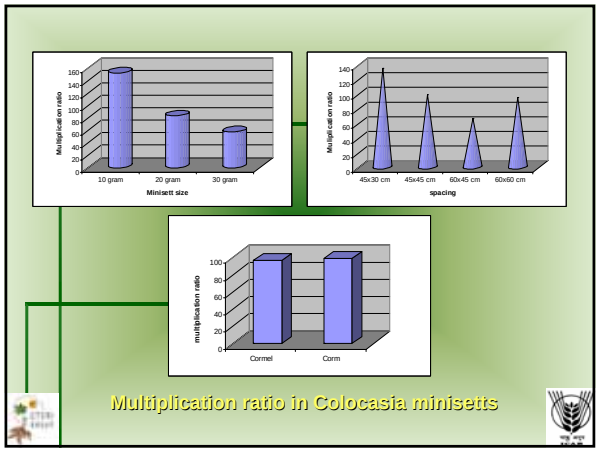
Micropropagated colocasia plants

Minisett preparation from corm of colocasia



10, 20 and 30 g minisetts

Planting material multiplication




Multiplication ratio in Colocasia minisetts

## Salient findings in Colocasia

- Multiplication ratio was found to be higher in 10 g minisetts
- Multiplication ratio enhanced to 1:120 (normal – 1:20)
- 40x30 cm spacing is found to be ideal for rapid multiplication

Planting materials under storage





Training Farmers' at Chipidi, Kovvur (A.P.)

Training Farmers' at Kalyani (West Bengal)

Farmers' Training at Sreekariyam




Training Students

Training Women Self Help Group


A trained farmer adopting minisett technique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