QUALITY PLANTING MATERIAL PRODUCTION IN TROPICAL TUBER CROPS

Central Tuber Crops Research Institute
(Indian Council of Agricultural Research)
Thiruvananthapuram - 695 017
Quality planting material (seed) production in tropical tuber crops:

An overview of efforts made at CTCRI

Seed - the vital Life line

Seed is the vital life line for the production, propagation and sustenance of most of the crop species. As a matter of fact, production of quality seeds or planting material is of utmost importance for the production and productivity of a plant. Technology for production of quality planting material has been standardized for crops like rice, wheat, cotton, maize, vegetables, pulses etc. These crops in general are sexually propagated and hence it was essential and easier for the seed production techniques to be standardized. However, tuber crops are the food crops that sustain lives of millions of people living in the tropical and subtropical parts of the world and are generally propagated by asexual means viz; cuttings, tubers, corms, vines etc. In India, tuber crops have been cultivated since time immemorial, the popular ones being cassava, sweet potato, elephant foot yam and white yam.

Importance of Tuber crops

Apart from being a popular food crop among the poor in various countries of the world, they are also rich sources of starch and hence find an important place in the industrial sector as well. Another relevant characteristic of these crops is their potential to grow and yield even under low soil fertility conditions. With the increasing demand for tuber crops like cassava and elephant foot yam, which in recent times, is gaining the status of a commercial crop in States like Tamil Nadu, Andhra Pradesh West Bengal and Maharashtra, the demand for production of quality planting material is on the rise.

Major constraint- Quality planting materials

Tuber crops are vegetatively propagated and hence the rate of multiplication is very low as compared to cereals and pulses. The availability of healthy planting material is often limited. Further, due to the low multiplication rate, high yielding varieties released in the research stations take many years to reach the end user. The quality of planting materials also deteriorates due to biotic and abiotic factors arising from repeated vegetative propagation. Such unhealthy and infected materials when propagated, reduce tuber yield drastically and renders the cultivation of tuber crops uneconomical. Further, unlike cereal and commercial crops, there is no strategy available for planting material production in tuber crops.

Status of Tuber crop planting materials - Present and future

i. Cassava (Manihot esculenta) - Maracheeni (Malayalam), Maravalli Kizhangu (Tamil), Karra Pendalum (Telugu) and Mandshif (Hindi)
Requirement of planting materials
Present (2004-05): 1 million stems
Projection 2020: 2 million stems

Varieties recommended:
Hybrids- H-165, H-226, Sree Visakham, Sree Sahya
Pure line - Sree Jaya, Sree Vijaya, M-4, CMD resistant variety- Sree Padmanabha
Top Cross Hybrid- Sree Rekha, Sree Prabha
Triploid - Sree Athulya and Sree Apoorva

ii. Elephant foot yam (*Amorphophallus paeoniifolius*) - Chena (Malayalam), Chenai Kizhangu (Tamil), Kanda (Telugu), Jimmikand/Suran (Hindi)

Requirement of planting materials
Present (2004-05): 15 tons
Projection: 2020: 1500 tons

Varieties recommended:
Pure line : Sree Padma (released by CTCRI)
Gajendra (released by ANGRAU, Hyderabad)
Sree Athira (released by CTCRI)

iii. Yams (*Dioscorea alata* and *D. rotundata*) - Kachil (Malayalam), Vettilaivali kizhangu (Tamil), Pendalam (Telugu), Rathalu (Hindi)

Requirement of planting materials
Present (2004-05): 12 tons
Projection: 2020: 1000 tons

Varieties recommended:
*D. alata*: Sree Keerthi, Sree Roopa, Sree Shilpa, Sree Karthika
*D. rotundata*: Sree Subhra, Sree Priya, Sree Dhanya

A chronological view of attempts made at CTCRI on planting material production

Institute Project (Dr. S. Edison as Principal Investigator (PI))

One of the first attempts in this regard occurred when an Institute project was implemented during 1998 - 2005. This had some positive effect as large scale multiplication of yams and cassava was made possible. The Institute was able to produce planting materials of tuber crops as a result of this project and could be sold to the farmers, besides enabling their multiplication in Government Agricultural Farms.

RFS at Bhubaneswar (Dr. R. S. Misra as PI)
The second lead in this regard was obtained in the form of a Revolving Fund Scheme (RFS) that was implemented at CTCRI Regional Centre, Bhubaneswar, since 1997, with a modest budget of Rs 5.3 lakhs provided by the ICAR. The RFS at Bhubaneswar turned out to be a big success. The seed production started in the first year itself. In view of the profitability of elephant foot yam, more emphasis was given on this crop. The demand for planting material was enormous and the seed money was refunded to the ICAR well before the due date (year 2005). The scheme is continuing at the
Regional Centre of CTCRI and a surplus amount of nearly Rs. 6 lakhs is available now. The planting material produced is regularly supplied to the Directorates of Horticulture, KVK's, Development Agencies, NGO's and farmers. The planting material has been supplied to other States like Karnataka, Jharkhand, Uttar Pradesh, Madhya Pradesh and Rajasthan. Over 100 tons of elephant foot yam, yam and Colocasia planting material have been sold so far under RFS at CTCRI RC, Bhubaneswar.

**NATP on planting material production**  
(Dr. James George as PI and Dr. S. Edison as AED (NATP))

The third and the major thrust for planting material production materialized in the form of NATP on technology for quality planting material production in tuber crops, started at CTCRI head quarters during the period 2001 to 2005. This project was sanctioned as per PSR mode of the World Bank funded NATP under the Agro-ecosystem Directorate (Coastal). The total amount sanctioned for this project was Rs 60.47 lakhs involving CTCRI Trivandrum as the Lead Centre and two Cooperating Centers - Kovvur in Andhra Pradesh (ANGRAU) and Kalyani (BCKV) in West Bengal. The most significant contribution of this project was the rapid multiplication of planting materials through "minisett techniques" which significantly enhanced the multiplication ratio in tuber crops. Clean and disease free planting materials could be generated by this technique which could be easily adopted by farmers.

**Technologies Developed under the NATP**

1. Minisett Techniques for rapid and disease free planting material production in tuber crops
2. Technology for low cost storage of planting materials
3. Protocol for tissue culture techniques for rapid multiplication and procedure for micropropagation of planting materials

**Facilities created under the NATP at CTCRI**

- A low cost shed of 20 x 8 m for storage of planting materials
- Micro-propagation lab for mass multiplication of *in vitro* plants
- Three shade net houses, each of 30 x 7 m for minisett multiplication
- A water storage tank of 40,000 l capacity for irrigation.
- Sprinkler irrigation facility for 1 ha seed plot
The fourth and the major thrust for quality planting material production in tuber crops was obtained at CTCRI in the form of Mega Seed Project, funded by ICAR, amounting to Rs. 1.29 crores during the year 2006. The project aims at facilitating infrastructures including land development for large scale production of quality planting materials in tropical tuber crops. A revolving fund scheme for Rs 15 lakhs has also been sanctioned for operation under this project at both CTCRI head quarters in Trivandrum as well as at the Regional Centre of CTCRI, Bhubaneswar.

The table below gives a view of the production of quality planting materials achieved during the year 2006-07

<table>
<thead>
<tr>
<th>Item</th>
<th>CTCRI, Trivandrum</th>
<th>CTCRI RC Bhubaneswar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassava</td>
<td>3,00,000 setts</td>
<td>30,000 setts</td>
</tr>
<tr>
<td>Sweet potato</td>
<td>1,25,000 cuttings</td>
<td>20,00,000 cuttings</td>
</tr>
<tr>
<td>Elephant foot yam</td>
<td>10 tons</td>
<td>15 tons</td>
</tr>
<tr>
<td>Yams</td>
<td>16 tons</td>
<td>10 tons</td>
</tr>
</tbody>
</table>

An amount of one lakh rupees was already obtained as revenue by way of sale of planting materials produced under MSP during 2006-07 at CTCRI.

Success story of Minisett technique

All tuber crops are vegetatively propagated and hence the rate of multiplication of seed/planting material is very low as compared to cereals and pulses. The availability of healthy planting material is also considerably less. Further, due to low multiplication rate, high yielding varieties released by Research Institutes take many years to reach the end user. The quality of planting materials also deteriorates due to biotic and abiotic factors and debility arising from continuous and repeated vegetative propagation. Such unhealthy and infected materials when propagated tend to reduce tuber yield drastically and even renders the cultivation of tuber crops uneconomical.

Minisett technology developed for rapid multiplication of tuber crop planting material at CTCRI has produced significant results. The multiplication rate in cassava is only 1:10 and added to it, the severity of Cassava Mosaic Disease has become a major problem in all cassava growing regions of the world. Research on planting material production in cassava at CTCRI has proved that by adopting minisett techniques, the multiplication ratio can be enhanced to 1:60 from 1:10. This was done by raising two node minisetts in a nursery initially, and subsequently on sprouting, healthy plants were transplanted to the main field. In yams, multiplication ratio has been enhanced to 1:24 from 1:4. Elephant foot yam (Amorphophallus) is another major tuber crop which is popular all over India, though with a low multiplication rate of 3-4; however, the technology developed at CTCRI has the potential of enhancing the multiplication ratio to 1:15 from 1:3.
Outreach

The minissett technology developed has been transferred to tuber crop farmers by conducting awareness seminars and training them at CTCRI. Three major farmers' seminars were conducted viz: at Pathanapuram in Kollam district on February 1, 2003, Konni in Pathanamthitta district on March 3, 2004 and at Sreekariyam in Thiruvananthapuram district on 16 October 2004. The then Honourable Minister of Kerala for Transport, Sri. B. Ganeshkumar was the chief guest at Pathanapuram and Sri Adoor Prakash MLA was the chief guest at Konni. As Minister for Food, Govt. of Kerala, Sri. Adoor Prakash was also the chief guest for the Seminar at Sreekariyam. One seminar each was also conducted at Chidipi near Kovur in Andhra Pradesh and at Kalyani in West Bengal. Further, illustrative folders and pamphlets were released in English, Malayalam, Tamil, Telugu and Bengali for the benefit of farmers. Self help groups of both men and women at selected Panchayats have been trained. One such self help group functioning at Keralaadhin yapuram in Sreekariyam Panchayat, Kerala, has multiplied a high yielding cassava variety, Sree Vijaya and has distributed planting materials to other farmers in the Panchayat. Similarly, limited quantities of Sree Padma and Gajendra varieties of Amorphophallus and D. rotundata (African yam) variety- Sree Priya, was supplied to 5 Panchayats and the result and the response from farmers of those areas have been quite encouraging. A Farmers' Fair (Kisan Mela) organized at CTCRI on January 10, 2006 was a platform for the farmers to exhibit their produce and air their views. Sri Panniyin Ravindran, Hon’ble Member of Parliament of Thiruvananthapuram was the chief guest on the occasion and he inaugurated an exhibition of planting materials of tuber crops.

Quality requirement under the Seed Act

In the case of grain/seed crops, certified seeds are supplied to the farmers where as in tuber crops which are vegetatively propagated, Truthfully Labelled (TL) materials are provided as planting materials (for eg: ginger, turmeric). Tuber crops are vegetatively propagated and they are infected by several virus diseases, which are transmitted through planting material. In order to ensure the planting material free of diseases, a quality seed certification programme is a must. The programme is suggested as follows.

1. Initial planting material of single node micro-propagation plants or meristem derived plants are indexed for the virus infection (for eg: CMD in cassava) through ELISA, PCR and using nucleic acid probes

2. After indexing, virus free plants are micro-propagated and multiplied. At every stage of multiplication, the plants are subjected to indexing for presence of virus so as to ensure that they are virus free and no secondary infection occurs in field multiplication.

Subsequent to the development of suitable technology for quality planting material production in tuber crops, the need of the hour is a formal decision and declaration on standards and criteria for 'Truthfully Labelled seeds in Tuber Crops.'

Authored by: Dr. James George, Dr. S. Edison, Dr. C. S. Ravindran, Dr. M. Nedunchezhiyan, Dr. G. Byju
Published by: Dr. S. Edison, Director, CTCRI, Thiruvananthapuram
Ph : 0471-2598551 to 54, Email : cctrivm@yahoo.com, Website: http://www.ctcri.org