YIELD AND TUBER QUALITY IMPROVEMENT IN TARO RAISED FROM TRUE SEEDS

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Taro (*Colocasia esculenta* (L.) Schott)

- Indo-Malayan origin
- Belongs to the monocotyledonous family Araceae
- Herbaceous, 0.5-1.5 m tall
- Peltate leaves
- Enlarged starchy underground stems (corms) with primary, secondary and tertiary branches (cormels)
- Vegetative propagation
Ranks 14th among staple vegetable crops of the world

10.64 million tons produced globally from 1.83 million ha. with an average productivity of 5.81 t/ha (FAO, 2005)

Staple food in several South Pacific Countries and in West Africa

Popular all over India as a vegetable

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**Taro improvement program at the CTCRI**

**(a) Gene Bank**

- Total accessions – 436
- Field gene bank, in vitro conservation, characterization and cataloguing
- Cytological screening – diploids & triploids identified
- Evaluation trials and identification for desirable types
- Flowering frequency assessed & breeding barriers identified
- Triploids – Higher yield, sterile
- Diploids – fertile
- Released five superior clonal selections
- Molecular characterization in progress
(b) Intervarietal Hybridization

- Fertile diploids identified
- Floral biology studied
- Hybridization technique standardized
- True seed production achieved
- A superior hybrid selection released

Breeding barriers

- Erratic and seasonal flowering
- Very low flowering frequency
- Non-synchrony
- Occurrence of sterile triploids
- Protogyny
Objective

Production and evaluation of true seed progeny and identification of superior selections based on yield and quality

Breeding methodology:
- Inter varietal hybridisation
- Sexual progeny
- Screening based on yield and quality
- Selection of superior hybrids
- Row trial and multiplication
- Preliminary trial and multiplication
- Advanced trial and multiplication
- Multilocation / Onfarm trials
- Release proposal
Mature bud

Pollination
No seed dormancy
Seedlings raised inside the glass house
Transplanted to field 2-3 months after germination
10,898 seedlings
Seedling Evaluation done
Wide spectrum of genetic variability generated
10-15 % showed wild characters
Selections carried over to clonal evaluation
Recombinant breeding enabled to enhance the genetic variability for:

- Plant type
- Yield
- Cooking quality
- Longer shelf – life
- Leaf blight tolerance and
- Flower productivity

1214 hybrids are being evaluated

- Height: 50 – 60 cm
- Duration: 4.5 – 5 months
- Cormal yield: 15.0 t / ha
- Longer shelf – life (50 – 60 days)

- Profuse tillering
- Stoloniferous
- Yield 5.0 – 7.5 t / ha
- TLB tolerant
Vigorous growth
Open sheath
6 – 7 months
> 16.0 t / ha
Shelf – life (70 days)

Erect plant type
More plant / plot
Yield 14 – 15.5 t / ha
TLB tolerant

Ornamental type.
Low yield
Fertile, seed setting

Profuse flowering
Highly fertile
OP seed set
Tuber variations

Yield > 16.0 t / ha

Stoloniferous

Eddoe

Dasheen

Intermediate
## Cormel Yield of Hybrid Selections (AVT-I)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Lines Tested</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4 – 3</td>
<td>22.2</td>
</tr>
<tr>
<td>2</td>
<td>4 – 6</td>
<td>17.0</td>
</tr>
<tr>
<td>3</td>
<td>4 – 10</td>
<td>21.8</td>
</tr>
<tr>
<td>4</td>
<td>5 – 6</td>
<td>19.2</td>
</tr>
<tr>
<td>5</td>
<td>9 – 5</td>
<td>17.5</td>
</tr>
<tr>
<td>6</td>
<td>16 – 3</td>
<td>18.2</td>
</tr>
<tr>
<td>7</td>
<td>23 – 2</td>
<td>17.6</td>
</tr>
<tr>
<td>8</td>
<td>Sree Kiran</td>
<td>17.2</td>
</tr>
<tr>
<td></td>
<td>CD (5%)</td>
<td>2.911</td>
</tr>
</tbody>
</table>

## Cormel Yield of Hybrid Selections (AVT-II)

<table>
<thead>
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<th>Sl. No.</th>
<th>Lines Tested</th>
<th>Yield (t/ha)</th>
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<tbody>
<tr>
<td>1</td>
<td>3 – 01</td>
<td>16.2</td>
</tr>
<tr>
<td>2</td>
<td>4 – 01</td>
<td>13.5</td>
</tr>
<tr>
<td>3</td>
<td>23 – 02</td>
<td>19.0</td>
</tr>
<tr>
<td>4</td>
<td>30 – 02</td>
<td>16.2</td>
</tr>
<tr>
<td>5</td>
<td>31 – 02</td>
<td>9.7</td>
</tr>
<tr>
<td>6</td>
<td>35 – 02</td>
<td>18.6</td>
</tr>
<tr>
<td>7</td>
<td>73 – 02</td>
<td>12.6</td>
</tr>
<tr>
<td>8</td>
<td>160 – 02</td>
<td>19.9</td>
</tr>
<tr>
<td>9</td>
<td>Sree Kiran</td>
<td>16.9</td>
</tr>
<tr>
<td>10</td>
<td>Sree Rashmi</td>
<td>14.2</td>
</tr>
<tr>
<td></td>
<td>CD (5%)</td>
<td>3.001</td>
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</tbody>
</table>
Five superior hybrids viz. 4-3, 4-10, 23-02, 35-02, 160-02 are being tested in onfarm / multilocation trials in Kerala. They possess higher yield (> 18.6 t / ha), good cooking quality and longer shelf – life.

An improved taro hybrid released during 2004

- Intervarietal hybridization (C-303 x C-384)
- True seed production (2160 seeds)
- 1860 seedling progeny (86.1%)
  - Seedling evaluation
    - 192 1st clonal selections (10.3%) based on yield (>250g/plant) and quality (non-acrid)
  - Row trial and selection of 21 clones (2nd clonal, > 400 g/plant)
- RRT with 21 second clonal progeny
- PYT with 8 superior hybrids (3rd clonal, >450 g/plant)
AVT with 4 hybrids (H-4, H-35, 12-23 and H-13) for three seasons in CTCRI farm (1999 – 2001)

OFT at 12 locations in three districts of Kerala (2001 – 2003)

Yield performance of taro

(Pooled mean, 2001-2003)

<table>
<thead>
<tr>
<th>Entries</th>
<th>Cormel yield (t ha⁻¹)</th>
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<tbody>
<tr>
<td>H- 4</td>
<td>16.06</td>
</tr>
<tr>
<td>H-35</td>
<td>12.91</td>
</tr>
<tr>
<td>12-23</td>
<td>12.49</td>
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<tr>
<td>H-13</td>
<td>17.78</td>
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<tr>
<td>Local</td>
<td>09.74</td>
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<tr>
<td>CD (0.05)</td>
<td>3.111</td>
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</table>

- H–13 was released by the Kerala State Seed Sub–Committee for variety release under the name ‘Sree Kiran’ during 2004
- First hybrid variety of taro released in India
**Sree Kiran**

**Shoot characters**

- **Plant type**: Semi erect, medium tall (70-80 cm)
- **Petiole colour**: Green (top)  
  Greenish brown (middle)  
  Brownish green (base)
- **Leaves**: Broad, droopy with undulate purple margin
- **Flowering nature**: Moderate

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**2n=28**

- **Highly fertile**
**Tuber characters**

- Corm shape: Oval
- Cormel shape: Round to oval
- Outer skin colour: Light brown
- Cormel flesh colour: White
- Mean cormel yield: 17.0 t ha\(^{-1}\)
- Duration: 190-210 days
- Shelf-life: 65-75 days
- Starch (%): 18.0
- Sugar (%): 1.03
- Protein (%): 2.5

- Cooked well within 20 minutes, Soft, Non-sticky texture
- No excess mucilaginous or slimy mouth feel
- No off flavor, White, non – sweet.

**Inference:**

- Although taro is propagated asexually, it can also flower and set seed.
- Wide genetic variability among the hybrid progeny
- Direct selection from crossings between two cultivars is useful when selection is directed at one or a few genetically controlled characters
- Several hundreds of F\(_1\) hybrids produced have been evaluated and the best one was released for general cultivation in Kerala under the name ‘Sree Kiran’
- Popularization of this superior hybrid may enhance the competitive position of taro in traditional cropping system.
- Several selections are in the advanced stage of evaluation
- Genetic improvement for flower productivity achieved
Prospects of taro breeding in India are encouraging

Genetic improvement is becoming more sophisticated and the number of traits which need to be improved is increasing

International collaboration among taro breeders is to be established

Future thrust:

- Assess and characterize genetic resources using molecular markers
- Identification of a core sample of available collections to breeders
- Intensive breeding programme for resistance against leaf blight
- International co-operation among breeders and procedure for germplasm exchange
Thank You