Research and Outreach Initiatives of TNAU for Enhancing Farmers’ Income

Dr. N. Kumar, Vice- Chancellor
TNAU, Coimbatore
**Strategies**

<table>
<thead>
<tr>
<th>Productivity Improvement</th>
</tr>
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<tbody>
<tr>
<td>Diversifying - High value horticultural crops and Commercial Crops</td>
</tr>
<tr>
<td>Supply of Quality Inputs/planting materials</td>
</tr>
</tbody>
</table>
## Strategies

<table>
<thead>
<tr>
<th>Strategy</th>
</tr>
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<tbody>
<tr>
<td>Cost Effective Technology Transfer</td>
</tr>
<tr>
<td>Promoting Integrated Farming System</td>
</tr>
<tr>
<td>Promoting Agribusiness Ventures</td>
</tr>
<tr>
<td>Knowledge Transfer through ICT</td>
</tr>
</tbody>
</table>
# Ranking of Crops for Priority in Research Resource Allocation in Tamil Nadu

<table>
<thead>
<tr>
<th>Crop</th>
<th>Weighted Share (%)</th>
<th>Rank</th>
<th>Crop</th>
<th>Weighted Share (%)</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>23.48</td>
<td>1</td>
<td>Mango</td>
<td>3.13</td>
<td>9</td>
</tr>
<tr>
<td>Coconut</td>
<td>9.29</td>
<td>2</td>
<td>Maize</td>
<td>2.90</td>
<td>10</td>
</tr>
<tr>
<td>Banana</td>
<td>9.17</td>
<td>3</td>
<td>Black gram</td>
<td>2.71</td>
<td>11</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>8.59</td>
<td>4</td>
<td>Sorghum</td>
<td>2.67</td>
<td>12</td>
</tr>
<tr>
<td>Groundnut</td>
<td>7.4</td>
<td>5</td>
<td>Green gram</td>
<td>1.43</td>
<td>13</td>
</tr>
<tr>
<td>Cotton</td>
<td>4.6</td>
<td>6</td>
<td>Cashew</td>
<td>1.16</td>
<td>14</td>
</tr>
<tr>
<td>Tea</td>
<td>3.21</td>
<td>7</td>
<td>Turmeric</td>
<td>0.97</td>
<td>15</td>
</tr>
<tr>
<td>Tapioca</td>
<td>3.16</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: XII five year plan document
New Varieties and Technologies
TNAU Varieties in farmer’s field

- Oilseeds: 66
- Forages: 19
- Rice: 170
- Millets: 89
- Pulses: 116
- Small Millets: 67
- Cotton: 43
- Sugarcane: 38
- TNAU Varieties in farmer’s field
ADT43 (5.5t/ha, 1998) – Resistant to GLH, MR to stem borer and gall midge
ADT45 (5.9t/ha, 2001) - MR to stem borer and gall midge
ADT46 (6.1t/ha, 2002) - Tolerance to stem borer and leaf folder
CO50 (6.3t/ha, 2010) – MR to blast, sheath blight, brown spot, bacterial leaf blight
CO51 (6.6t/ha, 2013) – MR to blast, BPH, GLH
TKM13 (5.9t/ha, 2015) – MR to LF, stem borer, GLH
CR1009 sub1 (5.8t/ha, 2015) – MR to Brown spot, Leaf blast, BPH, WBPH

Sorghum CO 30 (2010) – Irrigated (3.36t/ha and Rainfed (2.80t/ha)
Sorghum K12 (3.00t/ha, 2015) – Rainfed
Cumbu CO 9 (2.9t/ha, 2004)
Ragi Paiyur 2 (2.52t/ha, 2008) – Drought tolerant
Ragi CO 15 (3.20t/ha, 2015) – Blast resistant

Productivity increase 0.95 t/ha through improved varieties
Productivity increase 1.55 t/ha through improved varieties
Area production and productivity for pulses and oilseeds during 2008-09 to 2017-18

**Pulses**

- Productivity increase 0.37 t/ha through improved varieties

**Oilseeds**

- Productivity increase over 0.95 t/ha through improved varieties

**Redgram CO7** (120 days, photo-insensitive, 2004),
- **Blackgram** : YMV resistant
  - VBN6 (988kg/ha, 2011) & VBN8 (2016, 890kg/ha)
- **Greengram** : Synchronous maturity
  - CO8 (845kg/ha) 2013), 55-60 days
- **Cowpea CO7** (1000kg/ha, 2002) – National check

**Groundnut** : Drought tolerant
- **TMV 13** (2124kg/ha, 2006), CO7 (2300kg/ha, 2013)
- **Sesame** TMV 7 (985kg/ha, 2009) – Tolerant to root rot
- **Castor hybrid** (YRCH 1 1861kg/ha, 2009) - Industrial oilseed crop
- **Sunflower CO 5** (1360kg/ha, 2006) - 85-90 days, 42% Oil content, O/L = 0.41
Productivity increase over a decade with increase in income

- **Rice**
  - 2008-07 productivity: 948 kg/ha
  - 2017-18 productivity: 1557 kg/ha
  - Income: Rs. 16000 /ha

- **Millets**
  - 2008-07 productivity: 363 kg/ha
  - 2017-18 productivity: 943 kg/ha
  - Income: Rs. 31000 /ha

- **Pulses**
  - 2008-07 productivity: 8000 kg/ha
  - 2017-18 productivity: 943 kg/ha
  - Income: Rs. 19000 /ha

- **Oilseeds**
  - 2008-07 productivity: 363 kg/ha
  - 2017-18 productivity: 943 kg/ha
  - Income: Rs. 19000 /ha
Rapid replacement of old varieties with newer varieties through enhanced breederseed production

Oilseeds
Pulses
Rice

Millets
Cotton
TNAU Popular varieties

Rice
- IR20, IR36, CR 1009, CO43, ADT36, ADT39, IWPonni, B Havani, ASD 16, TKM 9

Miaize-CO1 (Composite), COHM6

Kudiraivali-CO(Kv)2

Greengram-ADT3, ADT5

Blackgram-ADT3, ADT5, BSR1

Horsegram-Paiyur2

Perennial Redgram-BSR1

Groundnut-VRI2, TMV2, TMV7

Sesame-TMV3, TMV4, TMV6, SVPR1

Cotton-MCU5, MCU7, SVPR2

Cumbu Napier- CO5

Sugar cane- Coc 671

Fodder sorghum-COFS 29

Sugar cane-Coc 671

Rice Landmark varieties- TKM6, GEB 24 (Universal donor), ADT27 (Green revolution)
Varieties for specific purposes

Varieties for Mechanization

**Cotton**: CO 17
- Zero monopodia
- Short sympodial branch
- Synchronized boll maturity
- Yield: 1835 kg/ha

**Castor Oil**:
- Lubricants, soap & Paint industry
- Export possibilities to the tune of 500 crores/year
- Non shattering
- Oil content: 50%
- Yield (Kg/ha): Rainfed 1800 kg/ha, Irrigated 3500 kg/ha

Varieties for Export

**Paddy**: VGD 1
- Alternate for traditional Seeraga Samba
- Possible export of Rs.9 Crores
- Yield: 5859 kg/ha

Varieties for Industry requirement

**Castor**: YRCH 1
- Castor Oil:
- Lubricants, soap & Paint industry
- Export possibilities to the tune of 500 crores/year
- Non shattering
- Oil content: 50%
- Yield (Kg/ha): Rainfed 1800 kg/ha, Irrigated 3500 kg/ha

**Castor**: YRCH 2
- Zero monopodia
- Short sympodial branch
- Synchronized boll maturity

**Sunflower**: COH 3
- Hybrid: COH 3
- Variety: CO 5
- Oil content: 42%
- Volume wt: 47 g/100 ml

**Groundnut**:
- Varieties: BSR 2, VRI 8, CO 7
- Oil Content: 46-49%

---

Varieties for specific purposes

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Varieties for specific purposes

Rice Fallow cultivation of Black gram

ADT 3
ADT 6
VBN 9
Drought

- Sorghum (K12)
- Pearl millet (CO 9)
- Cotton (K 12)
- Blackgram (VBN 6, VBN 8)
- Greengram (CO 8)
- Foxtail millet (ATL 1)
- Panivaragu (CO 5)
- Rice (Anna 4 & CO 53)
- Maize (CoHM6)

Salinity

- Rice (TRY 1, TRY 2, TRY 3)
- Cowpea – CoCP7, VBN 3
- Finger millet (TRY1)
- Kudiraivali (COKv2 and MDU1)

Submergence

- Rice
- CR 1009 Sub 1 CO 43 Sub 1

Climate Resilient crop varieties of TNAU
TNAU varieties in other states

Rice - CO51
Maize - CO8
Rice - CO51
Blackgram - VBN8
Fodder Sorghum - CO31, CSV33MF, COFS29
Fodder sorghum - CSV33MF, COFS29

TNAU varieties in other states
All in one crop variety—Pyramiding of Genes

- Blast Resistance
- BLB Resistance
- Drought Resistance
- BPH Resistance
- Salinity Tolerance
- Submergence tolerance

Pyramiding of genes for Powdery mildew and Alternaria leaf spot resistance in Sunflower

Pyramiding of genes for Downy mildew and zinc deficiency tolerance in Cumbu

Pyramiding of genes for Powdery mildew, MYMV and bruchid resistance in blackgram

- Powdery mildew Resistance
- Alternaria leaf spot disease Resistance
- Downy mildew Resistance
- Zinc deficiency Resistance
- Mungbean yellow mosaic virus Resistance
- Bruchid Resistance
- Powdery mildew Resistance
Rice Genotypes with Special Traits

Therapeutic

High Photosynthetic Efficiency

Heat Tolerance

Fe & Zn fortified rice

Herbicide Tolerance

Classic Breeding
Advanced fortified lines
## Banana CO 2 (H 212)

<table>
<thead>
<tr>
<th>Characters</th>
<th>H-212</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parentage</td>
<td>Karpooravalli X Pisang Lilin</td>
</tr>
<tr>
<td>Crop duration (days)</td>
<td>360 - 390</td>
</tr>
<tr>
<td>Bunch weight (kg)</td>
<td>12 - 13</td>
</tr>
<tr>
<td>No. of hands</td>
<td>12 - 14</td>
</tr>
<tr>
<td>No. of fingers</td>
<td>150 - 160</td>
</tr>
<tr>
<td>Finger weight (g)</td>
<td>60 - 70</td>
</tr>
<tr>
<td>TSS (° Brix)</td>
<td>24 - 26</td>
</tr>
<tr>
<td>Reaction to Fusarium wilt</td>
<td>Moderately susceptible</td>
</tr>
<tr>
<td>Reaction to nematodes</td>
<td>Tolerant</td>
</tr>
<tr>
<td>Root lesion index</td>
<td>14.23</td>
</tr>
<tr>
<td>(Average of three years)</td>
<td></td>
</tr>
</tbody>
</table>
Crop Improvement

A promising gynodioecious selection (sel C1-33) was made between CP 96 and CO 8 papaya which has expressed field tolerance to PRSV.

Nursery
(Insect Proof Net 40-60 mesh)

Spraying of acephate 1.5g L⁻¹ 3 days before planting

Main Field

Growing 2 rows of maize one month before transplanting

Foliar spray of dimethoate @ 1.5ml L⁻¹ (5 sprays monthly intervals)

Spraying of zinc sulphate @ 5 g + Boric acid 1 g per litre of water (4th & 7th m)

Fruit yield : 237 t ha⁻¹
Number of Fruits : 77 per tree
✓ F₁ hybrid between LE 1226 X LE 1249

✓ Fruits are flat round, green shoulder with thick pericarp (5.84 mm)

✓ Fruits weigh 75 - 80 g

✓ Fruit yield is 92.3 t/ha (160-165 days)

✓ Yield increase is 27.31% over TNAU tomato hybrid CO 3 and 40.91% over Lakshmi

✓ Ascorbic acid content: 26.13 mg/100g, TSS: 6.1° Brix and Titrable acidity (0.70 %)

✓ Cost Benefit Ratio: (1:2.2)
Onion CO 6 (Aca 15)

- Attractive pink coloured bolder bulbs, with average clump weight of 90 -100 g
- No. of bulblets : 5 – 7/clump
- Bulb yield : 19.10 tonnes / ha
- Seed yield : 250 - 300 kg / ha
- TSS : 15.4 ° Brix
- Yield increase over check CO(On) 5 : 20.94%
- Duration: May- September - 40 + 90 days
- October - April (Seed production) – 40+ 100 days
- Suitable for growing under irrigated condition Namakkal, Tiruppur, Cuddalore and Coimbatore districts
**Duration**: 270 - 300 days

**Plant character**
- Plants are erect (170-190 cm), medium growing and top branching type

**Tuber character**
- The tubers are long, cylindrical with pale white skin and pink rind
- Flesh colour is white
- **Yield**: 6.28 kg/plant; 46.20 t/ha
- Starch content: 29.62 %
- HCN content in tuber: 368.58 ppm

**Special features**
- No visible symptom was observed for Cassava Mosaic Disease incidence
- Suitable for cultivation in Plains and Hills
- Dual purpose variety suitable for edible purpose and industry
Manila Tamarind  PKM 2

Regular and cluster bearing habit (3-4 fruits/cluster) red aril

High yield (90 kg/tree/year (13.50 tonnes/ha))

Harvest starts from 3rd year and economic yield obtained from 5th year onwards

Ascorbic acid (138 mg/100g of FW), anthocyanin (25.2mg/100g) and TSS (13.7° Brix)

Suitable for dry land cultivation, problematic soil and water logged conditions
 Duration: 160-180 days

 Fresh herbage yield: 35 t/ha

 Total alkaloid content: 0.389 %

 Rich in ascorbic acid (21.66 mg/g) and Iron content (6.10mg/100g)

 19.05 % increase in yield over check
Seed and Planting Material Production Centres

61 Centres

- Main campus: 9
- Colleges: 11
- Research stations: 33
- KVKs: 8

Seed and Planting Material Production Centres:
- Seed: 50 centres
- Seed & Pl. materials: 24 centres
- Pl. materials: 11 centres
Seed Production during 2017-18, 2018-19 and 2019-20

<table>
<thead>
<tr>
<th>Class of seeds</th>
<th>Foundation</th>
<th>Certified</th>
<th>TFL</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-18</td>
<td>4828</td>
<td>1495</td>
<td>4610</td>
<td>16810</td>
</tr>
<tr>
<td>2018-19</td>
<td>3174</td>
<td>2587</td>
<td>5811</td>
<td>11672</td>
</tr>
<tr>
<td>2019-20</td>
<td>5835</td>
<td>1533</td>
<td>1242</td>
<td>10933</td>
</tr>
</tbody>
</table>
Planting Materials Production during 2018-19 and 2019-20

111% increase in production over last year
Seed production under GOI Seed Hubs
(Pulses & Oilseeds – 2019:20)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Crop</th>
<th>Unit ( Qntl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pulses</td>
<td>390.72</td>
</tr>
<tr>
<td>2</td>
<td>Groundnut</td>
<td>624.20</td>
</tr>
<tr>
<td>3</td>
<td>Castor</td>
<td>368.80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1383.72</strong></td>
<td></td>
</tr>
</tbody>
</table>
Seed production under Farmers Participatory Mode (undertaken from 2006 onwards)

Unit in q

<table>
<thead>
<tr>
<th>Crop</th>
<th>2019-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddy</td>
<td>761.78</td>
</tr>
<tr>
<td>Pulses</td>
<td>390.72</td>
</tr>
<tr>
<td>Groundnut</td>
<td>624.20</td>
</tr>
<tr>
<td>Castor</td>
<td>368.80</td>
</tr>
<tr>
<td>Vegetable crops</td>
<td>90.13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2235.63</strong></td>
</tr>
</tbody>
</table>

Paddy CO 52
Aduthurai, Thanjavur

K. Seerangan, Kaligoundanpalayam, Salem Dt.
• 3000-5000 liters of water per kg of rice under **conventional method**
• 1200 – 1400 liters per kg in **drip**
• Yield increase in drip - 50% over conventional [\(Yield_{\text{max}} = 12 \text{ t/ha}\)]
Benefits

- Less seed rate
- Water saving: 40%
- Less incidence of pests, diseases and rodents
- 20-30% Higher yield

Components

- Square Planting of single seedling & wider Spacing (25 x 25 cm)
- Cono weeding (4 times from 10 DAT)
- Reduction in nursery area (100 m²/ha & seed rate 7.5 kg/ha)
- LCC based N application
- Alternate wetting & drying Irrigation
Ultra High Density Planting
Management Practices to Ensure Regular Bearing in Mango

- Pruning: June
- Vegetative growth: July
- Stop Vegetative growth: Aug
- Flower bud initiation and differentiation: Sep
- Flowering: Oct, Nov, Dec, Jan

Application Of Paclobutrazol
Productivity under UHDP

Spacing: 3 x 2 metre

Yield: 35 – 45 fruits / tree

4th Year: 2.25 MT/ac
5th Year: 6.0 MT/ac
6th Year: 7.2 MT/ac
7th Year: 8.0 MT/ac
8th Year & above: > 9 MT/ac

Normal yield: 2.4 MT/ac
Demonstration trial on Ultra High density planting in Mango

Name of the varieties: Salem Bangalore
Imampasand
Banganapalli and
Bangalore

Spacing: 4m x 2m
Date of Planting: 25.10.2019
<table>
<thead>
<tr>
<th>Intervention</th>
<th>Area (ha)</th>
<th>Beneficiaries</th>
<th>Financial support to farmers (Rs. in Lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water saving technologies in Rice in 34 sub basins of TN</td>
<td>5197</td>
<td>5443</td>
<td>129.00</td>
</tr>
<tr>
<td>• SRI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Alternate Wetting &amp; Drying</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Direct Seeded Rice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Green Manure- SRI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulses Area Expansion</td>
<td>2733</td>
<td>2600</td>
<td>130.00</td>
</tr>
<tr>
<td>Crop Diversification in Delta Region (Maize crop)</td>
<td>1261</td>
<td>450</td>
<td>126.00</td>
</tr>
<tr>
<td>Precision Farming in HDP Mango, Vegetables &amp; SSI</td>
<td>225</td>
<td>305</td>
<td>310.00</td>
</tr>
</tbody>
</table>
STCR Approach: Improved Soil Heath & Rice Productivity

- Consistent yield enhancement
- Higher fertilizer response ratio

Plan
Large Scale Demo to assess fertilizer saving in Cauvery Delta Zone

**Graphs**
- Organic carbon (g kg⁻¹)
- Available P (kg ha⁻¹)

**Key Points**
- OC doubled
- 30% Increase in P
**Zinc Solubilizing Bacteria**

**ZSB application:**
- Seed treatment: 125 ml/ha of seed
- Seedling dip: 250 ml/ha
- Soil application: 500 ml/ha.

- Ensures Zn availability throughout the crop in Zn-deficient soils
- Complementary with ZnSO$_4$ enhancing Zn use efficiency
- Yield increase: 15-20% than no-Zn
Drought Mitigation Technologies
Method of Application
500 ml/ha
Foliar Spray as 0.1 %
at 15-days interval

- Crop withstand the temporary drought for 25 days
- Crop recovered well after rain/irrigation and ensured revenue

Pasumai Vikatan

Pink-Pigmented Facultative Methylo troph (PPMF) for drought mitigation in Rice
Different growth stages of the rice crop to ensure yield maximization.
Nano Ceria Offers Protection from Drought

Nano Ceria donation of electrons that sequester ROS

Pollen Germination (%)

CONTROL Irrigated after Sprayed
72%

TREATED Irrigated Water Sprayed
74%

CONTROL Drought Stressed
48%

TREATED Drought Stressed
56%

Foliar spray of nano ceria (10 ppm) at pre-flowering improves pollen viability in sorghum during drought

Nano-ceria donates electrons that sequester ROS
Integrated Farming System models to increase income

Lowland IFS

- Dairy
- Crops
- Horticulture
- Fishery
- Azolla
- Poultry
- Vermicompost

IFS components for Cauvery Delta Zone

Irrigated upland (Garden land) IFS

- Cropping
- Dairy (2 + 1)
- Rs. 94,586
- Goat (Tulicerry 10 + 1)
- Rs. 6,71 t/year (Goat manure)
- Rs. 15,12
- 67 m³ (Water)
- Slurry 15.2 t/year
- Vermicompost (50 m³)

Dryland IFS: Crop + Pigeon + Goat + Buffalo + Agro-forestry + Farm pond

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Low land</th>
<th>Garden land</th>
<th>Dry land</th>
</tr>
</thead>
<tbody>
<tr>
<td>System productivity (t / ha / year)</td>
<td>25.4</td>
<td>38.3</td>
<td>12</td>
</tr>
</tbody>
</table>
| Net return (Rs. /ha / year)         | Rs. 2,20,796 | Rs. 2,43,980 | Nutritive value (kg/ha):
|                                    |          |             | Protein – 2329    |
|                                    |          |             | Carbohydrate – 1795|
|                                    |          |             | Fat – 2526        |
| Family employment (Mandays / year)  | 518      | 648         |                   |
| Production cost saving thr’ resource recycling | 34.5 %  | 23 %        |                   |
| Nutrient addition (kg NPK / ha / year) | 127:80:107 | 159:72:93  | Residue (kg/ha) 11,583 (N 105.9: 46.2 : 76.9) |
### Optimization of Area for Green Fodder Production

**Area: All districts of Tamil Nadu except hilly zone**

<table>
<thead>
<tr>
<th>Animals</th>
<th>Total area Required (cents)</th>
<th>Area for Green fodders (cents)</th>
<th>Productivity/ day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milch animal with milk yield of 10 lit/day (Ave. Body wt.- 400 kg)</td>
<td>14</td>
<td>CN hybrid: 9 Desmanthus: 5</td>
<td>30 kg grass + 10 kg legume</td>
</tr>
<tr>
<td>Goat with average body wt of 40 kg</td>
<td>2</td>
<td>4 kg grass + 1.5 kg legume</td>
<td></td>
</tr>
</tbody>
</table>

Inter calving period: 20 – 25 months will be reduced to 13 months with green fodder which supply enough Vitamin A. Goat: 10 – 12 months will be reduced to 7 months.
Pre-harvest Spray
(2%; 30 & 15 DBH)

Post-harvest Dip
(2%; 5 min)

Storage

Shelf-life

- Extended retention of fruits on trees by 2-3 weeks
- 2-3 weeks under storage
- Fruits stayed fresh for 2-3 weeks under storage
- Reduction in post-harvest diseases
Testing of Nano Stickers for Fruit Preservation

Nano-stickers

Nano-Stickers on Shelf-life of Fruits

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Varieties</th>
<th>Shelf-life (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Control</td>
</tr>
<tr>
<td>Banana</td>
<td>GrandNaine</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>NeyPoovan</td>
<td>5</td>
</tr>
<tr>
<td>Mango</td>
<td>Alphonso</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Neelum</td>
<td>5</td>
</tr>
</tbody>
</table>

Stakeholders’ Meet 13.8.2019

Testing of Nano Stickers for Fruit Preservation
Nano-Inputs to Boost Pulses Productivity

- Encapsulated Bt
- Tolerance upto 180°C
- Nano-fibre coating
- NF with Nutrients
- NF with Bioinoculants
- Encapsulated Pseudomonas
- Hydrogel
- Nutricapsule

Technology Capsule

- Control
- Treated
TNAU Sweet Flag EC Against Bruchid Beetle

Acorus calamus
10 ml / kg seed

ICAR adopted (2019)
Technology Released (2020)
Commercialized through ABD
Offers protection for 6 months in storage
Crop specific formulations for higher farm income

**TNAU Coconut Tonic**
- Reduces button shedding
- Increases nut yield: 20%
- Additional Income: Rs. 33,000 ha\(^{-1}\)

**TNAU Cotton Plus**
- Reduces flower and square shedding
- Improves boll bursting
- Increases yield: 18%
- Additional Income: Rs. 14,000 ha\(^{-1}\)

**TNAU Pulse Wonder**
- Decreases flower shedding
- Increases yield: 20%
- Additional Income: Rs. 6,000 ha\(^{-1}\)

**TNAU Maize Maxim**
- Improves grain filling
- Increases grain yield: 20%
- Additional Income: Rs. 10,000 ha\(^{-1}\)

**TNAU Groundnut Rich**
- Improves flower retention and pod filling
- Increases pod yield: 15%
- Additional Income: Rs. 5,500 ha\(^{-1}\)

**TNAU Sugarcane Booster**
- Improves internodal length
-Improves sugar content
- Increases cane yield: 20%
- Additional Income: Rs. 45,000 ha\(^{-1}\)
## Crop Specific TNAU Micronutrient mixtures and Chelates

### Micronutrient chelates

<table>
<thead>
<tr>
<th>Crops</th>
<th>Dosage (kg ha(^{-1}))</th>
<th>Rainfed</th>
<th>Sp sunrise</th>
<th>(\frac{1}{2})-basal</th>
<th>90 DAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice - wetland</td>
<td>25.0</td>
<td>12.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>30.0</td>
<td>7.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulses</td>
<td>5.0</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>50.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomato, Small Onion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Citric acid chelates</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crops</td>
<td>Tomato, Small Onion</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommendation</td>
<td>1.0 kg ha(^{-1})</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mode of application</td>
<td>Fertigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Glycinate chelates</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crops</td>
<td>Tomato, Small Onion</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommendation</td>
<td>1.0 kg ha(^{-1})</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Mode of application</td>
<td>Fertigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Basal**: as EFYM (1:10) for 15 days
- **Rate**: Rs. 70/kg
**Sources of microbes**

- Elephant dung
- Forest soil
- Biocompost
- Degraded wood

**Enrichment & Isolation of microbial cultures**

- Lignocellulosic microbial cultures

**Raw materials for composting**

- Crop residues
- Animal wastes
- Household wastes
- Fruits & vegetable wastes

**Commercialized TNAU Biomineralizer & Biocompost Production**

**Waste Collection**

- Mixing of brown & green wastes to adjust the C:N Ratio (30:1)

**Formation of Compost heap**

- Shredding of wastes (5-10 cm)

**Addition of TNAU Biomineralizer @ 2 Kg/ton of waste**

- Watering compost heap to maintain (60% moisture)

**Turning of compost heap for aeration**

**Waste generation**

- Agricultural wastes: 190 lakh tonnes/Annnum

**Supply of plant nutrients**

- \( \approx 1.0 \) lakh ton of N \( \approx 2.17 \) lakh tonnes of Urea (Rs.1.13 lakhs)
- \( \approx 0.5 \) lakh ton of P \( \approx 3.13 \) lakh tonnes of SSP (Rs.3.13 lakhs)
- \( \approx 2.0 \) lakh ton of K \( \approx 3.33 \) lakh tonnes of \( K_2O \) (Rs.66.66 lakhs)

**Maturity analysis**

- Sieving of matured compost (4 mm)

**Finished compost**
Grafting in Brinjal

- Nematode (Yield loss 32.7 to 80.0 %), Dry root rot (Yield loss 10.0 to 70.5 %), Shoot and fruit borer (Yield loss 40.5 to 85.0 %)
- Seedlings of any high yielding brinjal as scion and *Solanum torvum* as root stock
- Resistant to root knot nematode and dry root rot
- Extended harvest and prolonged yield

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Duration (Months)</th>
<th>Yield (t/ha)</th>
<th>B:C ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grafted</td>
<td>10.0</td>
<td>155.0</td>
<td>2.63:1</td>
</tr>
<tr>
<td>Non-grafted</td>
<td>6.0</td>
<td>50.0</td>
<td>2.16:1</td>
</tr>
</tbody>
</table>

Ratoon Crop
UAV for Spraying
AGROFORESTRY
AGROFORESTRY - Doubling Productivity and Profitability

1. HYSR Clones
2. MINI CLONAL TECHNOLOGY
3. MULTIFUNCTIONAL AGROFORESTRY
4. VALUE ADDITION TECHNOLOGY
5. CONSORTIUM mode AF
6. AF BUSINESS INCUBATION
1. HYSR Clones

a. Casuarina

Variety: MTP-2
Yield: 150 ton/ha
Duration: 30-36 months
Marketing: Paper & Construction

b. Eucalyptus

Variety: MTP-1
Yield: 150 ton/ha
Duration: 5 years
Marketing: Paper & Plywood

c. Melia

Variety: MTP-1 & MTP-2
Yield: 250 ton/ha
Duration: 2 years (Pulpwood)
5-6 years (Plywood)
Marketing: Plywood & Paper

d. Kadam

Variety: MTP-1
Yield: 135 ton/ha
Duration: 5 years
Marketing: Plywood & Matchwood
2. MINI CLONAL TECHNOLOGY

Casuarina

Melia

Kadam
3. MULTIFUNCTIONAL AGROFORESTRY

<table>
<thead>
<tr>
<th>Tree species</th>
<th>Number of trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moringa oleifera</td>
<td>4</td>
</tr>
<tr>
<td>Podium emarginatum</td>
<td>10</td>
</tr>
<tr>
<td>Acacia auriculiformis</td>
<td>12</td>
</tr>
<tr>
<td>MalvaDN dubia</td>
<td>12</td>
</tr>
<tr>
<td>Tectona grandis</td>
<td>12</td>
</tr>
<tr>
<td>Santalum album</td>
<td>12</td>
</tr>
<tr>
<td>Intercrop (Flowers)</td>
<td></td>
</tr>
<tr>
<td>Jasminum officinale</td>
<td>72</td>
</tr>
<tr>
<td>Jasminum grandiflorum</td>
<td>104</td>
</tr>
<tr>
<td>Moringa oleifera</td>
<td>4</td>
</tr>
<tr>
<td>Citrus limon</td>
<td>6</td>
</tr>
<tr>
<td>Aegle marmelos</td>
<td>11</td>
</tr>
<tr>
<td>Mollamaeckia cadamba</td>
<td>11</td>
</tr>
<tr>
<td>Swertia macrophylla</td>
<td>11</td>
</tr>
<tr>
<td>Paracarpus santalinus</td>
<td>12</td>
</tr>
<tr>
<td>Intercrop (Vegetables)</td>
<td></td>
</tr>
<tr>
<td>Moringa oleifera</td>
<td>4</td>
</tr>
<tr>
<td>Aegle marmelos</td>
<td>11</td>
</tr>
<tr>
<td>Terminalia arjuna</td>
<td>10</td>
</tr>
<tr>
<td>Tossa citrata</td>
<td>11</td>
</tr>
<tr>
<td>Lagerstroemia lanceolata</td>
<td>12</td>
</tr>
<tr>
<td>Aquilaria malaccensis</td>
<td>12</td>
</tr>
<tr>
<td>Intercrop</td>
<td>28</td>
</tr>
<tr>
<td>Nerium oleander</td>
<td>350</td>
</tr>
<tr>
<td>Murraya koenigii</td>
<td></td>
</tr>
<tr>
<td>Moringa oleifera</td>
<td>4</td>
</tr>
<tr>
<td>Syzygium cumini</td>
<td>11</td>
</tr>
<tr>
<td>Adhatoda vasica</td>
<td>12</td>
</tr>
<tr>
<td>Aegle marmelos</td>
<td>12</td>
</tr>
<tr>
<td>Chamaemelum ciricifolia</td>
<td>12</td>
</tr>
<tr>
<td>Intercrop</td>
<td></td>
</tr>
<tr>
<td>CO 3 Quina grass</td>
<td>303</td>
</tr>
<tr>
<td>Dismanthan</td>
<td></td>
</tr>
<tr>
<td>Intercrop</td>
<td></td>
</tr>
<tr>
<td>Jatropha curcas</td>
<td>50</td>
</tr>
<tr>
<td>Calophyllum inophyllum</td>
<td>5</td>
</tr>
<tr>
<td>Simarouba glauca</td>
<td>10</td>
</tr>
<tr>
<td>Pongamia pinnata</td>
<td>10</td>
</tr>
<tr>
<td>Madhuca longifolia</td>
<td>5</td>
</tr>
<tr>
<td>Total plants</td>
<td>1,174</td>
</tr>
</tbody>
</table>

Revenue: Rs.550 - 1,000 / day
4. VALUE ADDITION TECHNOLOGY

Agroforestry Residues into briquettes

Wood residues in to pellets
5. CONSORTIUM OF INDUSTRIAL AGROFORESTRY (CIAF)

- Linking Tree Growing Farmers and wood based Industries
- Technology Development and Transfer – Research & development
- Organized Plantation Establishment (5000 acres/ annum)
- Creation of Price Supportive System and Marketing Platform
- Facilitating Felling and Transportation (2.5 lakh MT/ annum)
5. AGROFORESTRY BUSINESS INCUBATOR

- Technology transfer
- Technology commercialization
- Developing business plans
- Quality testing services
- Field testing experiments
- Impact evaluation
- Facilitate certification process

STARTUPS

- Awareness
- Intensive training
- Facilitate company formation
- Technology transfer
- Product licensing
- Facilitate seed money
- Market linkages

ENTREPRENEURS WITH TECHNOLOGIES

WOOD BASED INDUSTRIES

- Awareness creation
- Hands on training
- Industrial exposure
- Technology transfer
- Seed money
- Market facilitation

FARMERS/INDIVIDUALS and STUDENTS

- Technology validation
- Prototype development
- Technology licensing
- Technology commercialization
- Financial linkages
- Market linkages

Incubatees – 41
Farm Mechanization
Complete Farm Mechanization

- Seed Drill
- Transplanter
- Herbicide Spray
- Conoweeding
- Sugarcane Planter
- Combined Harvester

Large scale Demonstrations in TNAU Farms & Farmers Fields

Exploitation of MOUs signed with major companies (TAFE, John Deere, Mahindra)

Evaluation of Labour saving, ergonomics, economics and drudgery reduction, BCR

Documentation of complete mechanization in selected crops
Chisel plough
Power Source: Tractor (45 HP)
Coverage: 1.5 ha/day
Cost: Rs. 10,000

IISR cutter planter
Power source: Tractor (45 HP)
Coverage: 2 ha/day
Cost: Rs. 1,20,000

SSI Transplanter
Power Source: Tractor (45 HP)
Coverage: 3.0 ha/day
Cost: Rs. 1,60,000

Inter row weeder
Power source: Mini Tractor (18 HP)
Coverage: 2.0 ha/day
Cost: Rs. 3,50,000

Ratoon manager
Power source: Tractor (45 HP)
Coverage: 3.0 ha/day
Cost: Rs. 1,50,000

Harvester
Power source: 350 HP (Diesel)
Coverage: 30 tonnes/hr
Cost: Rs. 1,00,00,000

Detrasher
Power source: Manual
Cost: Rs. 600

OR

Ornament

Harvester
Power source: 350 HP (Diesel)
Coverage: 30 tonnes/hr
Cost: Rs. 1,00,000,000
Exploitation of Solar Energy – Expansion Strategy

Solar Pumps

DARS, Chettinad

- Cost: Rs. 7.0 L
- Operation: 8 hr/d
- Water output: 80000 L/day
- Area: 70 ac
- Drip + Perennials

Solar Dryers

- Cost: 3.5 - 4 L
- Qty: 1000 nuts/d
- Tested Spices, Greens, Coconut
- Govt. subsidy
**Turmeric Value Chain Machinery**

**Turmeric Washer**
- Capacity: 300 kg/h
- Cost: Rs. 1.80 Lakhs
- Cost of Operation: Rs. 0.8/ kg

**Turmeric Boiler**
- Capacity: 300 kg/h
- Cost: Rs. 1.50 Lakhs
- Cost of Operation: Rs. 1.5/ kg

**Turmeric Dryer**
- Capacity: 500 kg/36 hours
- Cost: Rs. 4.00 Lakhs
- Cost of Operation: Rs. 13/ kg

**Turmeric Polisher**
- Capacity: 800 kg/h
- Cost: Rs. 3.15 Lakhs
- Cost of Operation: Rs. 0.70/ kg
Tamarind Processing Machinery

**Tamarind Dehuller**
- Capacity: 100 kg/h
- Cost: Rs. 0.50 Lakhs
- Cost of Operation: Rs. 2/kg

**Tamarind Deseeder**
- Capacity: 50 kg/h
- Cost: Rs. 0.70 Lakhs
- Cost of Operation: Rs. 2.5/kg

**Hand Operated Packing Unit**
- Capacity: 100 kg/8 h
- Cost: Rs. 2000/-
- Cost of Operation: Re. 1/kg
Structure for storage of aggregatum onion

- A blower unit with ducting inside the onion bulk
- Air flow of 1.15 m³/s
- Saving of 20-30% of onion bulbs

• 2 tonne storage capacity
• Shelf life: 6 months
• Cost: Rs. 1.00 Lakh
**Problem (70-80% Damage)**

- **Parrot Damage**
- **Peacock Damage**

**Solution**

- **ICARISAT Birds Scare Gun**

**TNAU**

Set a team to test / validate available technologies
Transfer of Technologies through ICT
Weather Information based Crop Advisories

- **Information used for**
  - Crop planning
  - Production input planning
  - Planning Crop field operation
  - Crop field level investment decisions
  - Mitigating negative soil impact
  - Livestock Production decisions
  - Agribusiness companies
Remote sensing based Crop Monitoring

- Crop area maps, Seasonality and yield maps
- Maps and Statistics for drought indices
- GAJA cyclone damage assessment
- Area under Prevented/Failed Sowing/total crop failure for crop insurances

- TN Drought report 2017-18 to 2019-20
- Area and Production estimates
- Crop loss assessment report for rice growing districts
Satellite and Drone technology to assess impact of Disasters for Relief

TN Floods - 2015

- METEOSAT Image on 9th November 2015
- Flooded areas of Cuddalore district seen from Sentinel 1A images
- Rainfall (mm) on 9th and 10th November, 2015
- Flood map and statistics of Cuddalore district as on 12th November, 2015

TN Drought - 2016

- Drought in Ramnad district
- TNAU distributed 50 t of paddy CO51 seeds for replanting
- Helped TN State Government to get drought relief of Rs. 1870 Cr.

GAJA Cyclone - 2018

- Coconut trees uprooted / damaged – 38.74 lakhs
PMFBY Crop Insurances - Dream realized through TNAU Remote Sensing technology

PMFBY Scheme Features

TNAU Crop Insurance Solutions

Prevented/Failed Sowing

On Account Payment

CCE Based Compensation

Start of Season & Early Rice Area Maps

Mid Season Yield Forecast for Expected Yield

End of the Season Yield Estimates & Smart CCE Sampling

Remote Sensing – Crop Maps

Drones – Damage Assessment

Village level PMFBY

Farmers benefitted: 537598
Claim Settled: Rs. 2340.84 Cr

PMFBY Crop Insurances - Dream realized through TNAU Remote Sensing technology

Good Crop

Failed sowing

Remote Sensing – Crop Maps

Drones – Damage Assessment

Farmers benefitted: 537598
Claim Settled: Rs. 2340.84 Cr
• Price forecasting for 16 major Agricultural and Horticultural Crops

• Price Advisories during pre-sowing and pre-harvest periods

• Information dissemination through SMS, e-mail, Web portal, Newspaper & Uzhavan App

• 12.6 Lakhs SMS were sent to the farmers during 2018-19
- ICT based extension approach
- Development of e-Velanmai app
- Integrated with Farm Crop Management System Software of the State Department of Agriculture
- Available with all state extension officials
- Provide Cost effective, Timely and Quality extension services
- Tablets and Mobiles are used for dissemination of technologies
Total viewers during 2019-20: 2,82,391

Daily Visitors (Average) - 2500

11.61 lakh page views during 2019-20
✓ Paddy,
✓ Sugarcane,
✓ Millets,
✓ Coconut,
✓ Banana.
✓ Animal sciences

Decision Support System – Query based on Multi Optional System

Crop Doctor – Deals with diagnosing the pests, diseases, nutritional disorders and key visual symptoms

Information System – Contains details of production technologies

Expert System developed in Tamil, English

Mobile apps on Google play store
• Production of video films, farmers success stories for telecast through DDK & Social media

Agro technology videos – 2526

Video in TNAU YouTube Channel-92

Video in 3gp format programmes-1000
Official KVK WhatsApp Group

- 98 KVK scientists / team and member from ATARI, Hyderabad, DEE.
- 25-30 extension messages posted / day
- Exclusively to share KVK activities.
- Good practices / activities are then analyzed and request other KVKs to adopt.

Farmers WhatsApp group – 74
Total Farmers – 8646

Technology messages on
- Improved crop production technologies
- Plant Protection techniques
- Input source on demand by farmers
- Trainings / events of KVK
- Frequently asked questions by farmers
- Reply to farmers queries
PM’s speech live telecast in Video conference for Farmers
AGRI BUSINESS ACTIVITIES
<table>
<thead>
<tr>
<th>S.No</th>
<th>Items</th>
<th>Number</th>
<th>License fee (Rs. in Lakhs)</th>
<th>Royalty (Rs. in Lakhs)</th>
<th>Total Income (Rs. in Lakhs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hybrids</td>
<td>6</td>
<td>53.00</td>
<td>40.69</td>
<td>93.69</td>
</tr>
<tr>
<td>2.</td>
<td>Technologies</td>
<td>13</td>
<td>472.90</td>
<td>38.40</td>
<td>511.30</td>
</tr>
<tr>
<td>3.</td>
<td>Equipments</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Consultancy Services Offered</td>
<td>9</td>
<td>44.41</td>
<td>-</td>
<td>44.41</td>
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<tr>
<td></td>
<td>Total</td>
<td>40</td>
<td>570.31</td>
<td>79.09</td>
<td>649.40</td>
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### Agri Business Export Consortium (ABEC) & Unnat Bharat Abhiyan

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Export Trainings conducted</td>
<td>7</td>
</tr>
<tr>
<td>No. of people Trained</td>
<td>101</td>
</tr>
<tr>
<td>No. of Consortium Membership given</td>
<td>34</td>
</tr>
<tr>
<td>Agri Commodities Exported</td>
<td>Mango, Coconut, Loose Flowers, Millet value added items, Arecanut plates and Jaggery</td>
</tr>
<tr>
<td>Countries Exported</td>
<td>USA, Qatar, Masqat, Dubai, Sri Lanka, Singapore, etc.,</td>
</tr>
<tr>
<td>Service Offered</td>
<td>Handholding, Product and Market Selection, Logistics and Documentation etc.,</td>
</tr>
</tbody>
</table>

### UNNAT BHARAT ABHIYAN

It is a flagship National program of MHRD Govt. of India for enabling Rural Development activities by the Higher Educational Institutions in their adopted villages.

TNAU, RCI
DABD acts as Regional Coordinating Institute for 156 PIs of 10 allotted districts.
### Innovation through Incubation

<table>
<thead>
<tr>
<th>Number of Agri-Business Incubation Forums in Tamil Nadu</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing Incubatees</td>
<td>465</td>
</tr>
<tr>
<td>Innovative Incubatees</td>
<td>120</td>
</tr>
<tr>
<td>Total No. of Incubatees</td>
<td>585</td>
</tr>
</tbody>
</table>

**RKVY-RAFTAAR-R-ABI**
- **Agripreneurs in Pre Seed (AOP)** – 12 entrepreneurs
- **Seed Stage Funding (SAIP)** – 16 entrepreneurs.

**NIDHI EIR 2020-2021**
- Ten Graduates will be incubated for one year

**Student AGPREUN Club**

Mr. Santhosh and Ms. Sneha from AC&RI, Madurai - Global Student Entrepreneur Award 2019-2020

Tamil Nadu Student Innovators 2019 (TNSI 2019) Fellowship Award of Rs. 1.00 lakh

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Mr. Santhosh and Ms. Sneha from AC&RI, Madurai for the idea of Fixsalt
Thank You …