

CHAPTER IV

RESEARCH

The scientists of TNAU have been taking up research projects with the objective of meeting the needs of the farmers and the problems the farmers face in their fields. apart from the crop improvement, crop management and the results are highlighted in this chapter, cropwise under crop improvement, crop management and crop protection areas. The scientists also carry out research works in water management, plant molecular biology, biochemistry, sericulture, rural development, agricultural engineering post harvest technology areas which help in the accelerated development of agriculture.

During 2003-04 the following new crop varieties, implements and management technologies have been released from this university for the benefit of farming community.

A. Varieties

1. Rice : PMK (R) 3
2. Blackgram : VBN(Bg) 4
3. Sapota : PKM (Sa) 4
4. Custard Apple : APK (Ca) 1
5. Cinnamon : PPI (Ci) 1

B. Implements

1. Tractor drawn tapioca harvester
2. Improved direct paddy seeder
3. Foot wear operated manual sprayer
4. Technology for extrusion cooking of finger millets
5. Fluidised bed dryer for mushroom
6. Mechanical thresher for pepper
7. Wood based down draft gasifier

C. Management Technologies

1. Drip fertigation for yield maximization in sugarcane crop
2. Leaf Colour Chart (LCC) based nitrogen management in transplanted and direct (drum) seeded wet land rice
3. Potassium application to increase the productivity of pulses
4. New biofertilizer for sugarcane : TNAU Biofert –1
5. TNAU Coconut tonic
6. High density planting in banana
7. Fertigation technology for increased productivity in banana
8. Affordable micro irrigation system
9. Management of clubroot –rootknot nematode complex disease in cabbage and cauliflower using *Pseudomonas fluorescens* (Pf 1) and *Trichoderma viride* (TvMNT 7)
10. *Trichoderma viride* for the management of root rot in pulses and cotton

**RICE : PKM (R) 3
(Paramakudi 3)**

Special Features

- Drought tolerance
- High yielder
- Long bold white rice
- Field tolerant to leaf folder and stem borer

Parentage	:	UPLR1 7/ CO 43
Duration (Days)	:	115
Season	:	Rainfed (Direct seeding during September / October)
Yield (kg/ha)	:	3025 (13 and 17% increase over PMK 2 & TKM 11)
Area of adaptability	:	Ramanathapuram, Sivagangai, Virudhunagar and Thoothukudi districts.

**BLACKGRAM : VBN (Bg) 4
(Vamban 4)**

Special Features

- High yielder
- Highly resistant to yellow mosaic virus disease
- Late senescence
- Suitable for all seasons

Parentage	:	CO 4 / PDU 102
Duration (Days)	:	75 – 80
Season	:	June – July ; Sept – Oct and Feb – March
Yield (kg/ha)	:	Irrigated : 890 Rainfed : 790 (28.3 and 25.8% increase over ADT 5 & VBN 3)
Area of adaptability	:	Throughout Tamil Nadu in all soils except problem soils and heavy clay soils.

**SAPOTA : PKM (Sa) 4
(Periyakulam 4)**

Special Features

- High yielder
- Compact canopy
- Cluster bearing
- Spindle shaped fruits suitable for dry flakes production
- Attractive pulp with light pinkish honey brown colour
- Crisp and sweet flesh with a TSS of 24-25° Brix
- Less seeded (2-3 seeds only)

Origin	: Open pollinated clone of PKM 1
Duration (Days)	: Perennial
Season	: June – July and October - November
Yield (t/ha)	: 20.8 (100.4 kg/tree/year, 138.29 percent increase over PKM 1)
Area of adaptability	: Varied soil types of tropical conditions.

**CUSTARD APPLE : APK (Ca) 1
(Aruppukottai 1)**

Special Features

- High yield in rainfed vertisol (Black soil)
- Drought tolerant
- Sweet Fruits (TSS of 24.5 Brix with an acidity of 0.2 per cent)
- Fruit weight 207.5 g with a mean of 72 fruits per tree per year

Origin	: Clonal selection from a high yielding type in the State Horticulture Farm, Courtallam
Duration (Days)	: Perennial (First bearing commences in a graft / budded plant at 3 – 3 ½ years. Optimum productive life is 25 yrs)
Season	: May – June / August - September
Yield (kg/ha)	: 7300 (14.90 kg/tree, 30.7 per cent higher than Balanagar)
Area of adaptability	: Plains of Tamil Nadu especially semi arid regions. Marginal soils of both vertisol and alfisol in dry tracts. Suitable for both rained and irrigated conditions.

**CINNAMON : PPI (Ci) 1
(Pechiparai 1)**

Special Features

- Tolerant to drought
- Resistant to pest and diseases
- Good regeneration capacity
- Suitable for coppicing an interval of 18-24 months

Origin	:	Selection from the germplasm of open pollinated seedlings maintained at HRS, Pechiparai.
Duration (Days)	:	Perennial (upto 50 years)
Season	:	June - July
Bark Yield (kg/ha)	:	980 (248.42 kg of quills and 731.58 kg of chips and dust), 25 per cent higher than Pechiparai local.
Area of adaptability	:	Lower elevation (100-500 m) high rainfall region with wide range of soil.

TRACTOR DRAWN TAPIOCA HARVESTER

Special Features

- Easily attached to any 35 HP tractor
- 98 per cent harvesting efficiency
- Cost of saving 66% compared to manual harvesting
- All tubers dug in the field
- Additional irrigation not necessary
- No drudgery

Cost/Unit	:	Rs.6300/-
Area coverage	:	One ha/day
Expenditure	:	Rs.2000 per ha

IMPROVED DIRECT PADDY SEEDER

Special Features

- Optimized parameters : Drum shape – hyperboloid, drum diameter – 200 mm, number of seed metering holes – 9 and seed metering hole diameter – 10 mm.
- Uniformity in seed sowing
- Filling of drum – half of its capacity
- Reduction in seed rate
- Hill dropping of seed
- Thinning cost reduced

Cost/Unit	:	Rs.3000/-
Area coverage	:	0.8ha/day
Expenditure	:	Rs.200 per ha

FOOT WEAR OPERATED MANUAL SPRAYER

Special Features

- Energized by the walking action of the operator
- Operator to guide the nozzle only
- Eco friendly
- Suitable for ULV & LV applications

Cost/Unit	:	Rs.750/-
Area coverage	:	0.25 ha/day
Expenditure	:	Rs.150 per ha

TECHNOLOGY FOR EXTRUSION COOKING OF FINGER MILLETS

Special Features

- Value addition of finger millets
- Industrial application of finger millet

Extruder Cost	:	Rs.75000/-
Capacity	:	20 kg/hour
Production	:	Rs.40/kg

FLUIDIZED BED DRYER FOR MUSHROOM

Special Features

- Suitable for drying oyster and milky mushroom
- Dries oyster mushroom in 2 hours and milky mushroom in 6 hours
- 5 hp power is required for the blower and heaters

Dryer cost	:	Rs.30000/-
Capacity	:	6 kg of mushroom per batch
Cost of drying	:	Rs.50 per kg of dry mushroom

MECHANICAL THRESHER FOR PEPPER

Special Features

- Suitable for threshing black pepper from the pepper vine
- Operated by a 2hp electric motor
- 95% efficiency

Cost of the thresher	:	Rs.20000/-
Capacity	:	320 kg/hour
Cost of operation	:	Rs.125 per tonne of pepper

WOOD BASED DOWN DRAFT GASIFIER

Special Features

- Fuel wood can be used as fuel
- 40% fuel saving due to higher thermal efficiency
- No smoke
- Best suited for processing industries with steam
- Fulfill the heat energy requirement in rice mills, turmeric and arecanut processing units etc.

Cost/Unit	:	Rs.72000/-
Fuel consumption	:	20 to 25 kg/hour
Gas production rate	:	50 m ³ /hr
Thermal output	:	500000 kcal/hr
Capacity	:	20 kW

DRIP FERTIGATION FOR YIELD MAXIMIZATION IN SUGARCANE CROPS

- Details of technology :
- Planning setts obtained from 7-8 months old healthy nursery and planted in paired row planting system with the spacing of 30x30x30 / 150 cm
 - Nine setts per meter per row have to be planted on either sides of the ridges thus making it as four row planting system.
 - 12mm drip laterals have to be placed in the middle ridge of each furrow with the lateral spacing of 240 cm & 8 'Lph' clog free drippers should be placed with spacing of 75 cm on the lateral lines. The lateral length should not exceed more than 30-40 m.
 - phosphorus @ 62.5 kg ha⁻¹ has to be applied as basal at the time of planting.
 - Nitrogen and Potassium @ 112.5 kg ha⁻¹ have to be injected into the system as urea and muriate of potash by using "Ventury" assembly in 10-12 equal splits starting from 15 to 150-180 days after planting.
 - Low or medium in nutrient status soil to be given with 50 per cent additional dose of nitrogen and potassium.
 - Irrigation is given once in three days based on the evapo-transpiration demand of the crop.
- Benefits :
- Cane yield 175-200 t ha⁻¹ which is 70-96 t/ha higher than average yield.
 - Save 25-50 per cent irrigation water
 - Can wither go for additional area under cane cultivation or double the yield with same area with the saved water.
 - Irrigation water saved and produce more cane per unit of electricity used.
 - Irrigation, fertilizer application, weed management cost reduced considerably.
- Economics : A net profit of Rs.75,000/- per ha from drip fertigation system can be obtained compared to Rs.58000 per ha under conventional method.

LEAF COLOUR CHART (LCC) BASED NITROGEN MANAGEMENT IN TRANSPLANTED AND DIRECT (DRUM) SEEDED WET LAND RICE

Details of technology	<p>: The quantity of N to be applied at each time when the LCC mean value falls below the critical value of 3 for improved white ponni and 4 for the other varieties / hybrids is as follows</p> <p>Kar / Kuruvai / dry: 35 kg N / ha for each weather season application</p> <p>Samba / thaladi : 30 kg N/ha for each / pisanam / wet season application</p> <p>Details - Leaf Colour Chart (LCC) measures the green color intensity of rice leaves. The chart consists of six color strips – from light yellowish green (No.1) to dark green (No.6). The topmost fully expanded leaf is chosen for leaf color measurement as it is highly related to the N status of rice plants. The color of a single leaf is measured by holding the LCC vertically and placing the middle part of the leaf 1 cm in front of a color strip for comparison. During measurement always shade the leaf being measured with your body. Every time same person should take leaf color measurements at the same time of the day. Take readings of ten leaves at random for each field to determine the need for N topdressing. LCC readings are normally taken once in a week, starting from 14 days after transplanting (DAT) for transplanted rice: and 21 days after seeding (DAS) for wet-seeded rice. If six or more leaves read below the specified threshold value, one top dressing of N has to be done. If the value is above the threshold value, there is no need for top dressing during that week.</p>
Benefits	<p>: </p> <ul style="list-style-type: none"> • Simple and easy-to-use by farmers • Cheaper cost • Promote need based N application based on soil N supply and crop demand • To determine the time of N top dressing to rice • Saving of about 20-40 kg N ha⁻¹ • N use efficiency is high
Economics	<p>: Saving of 20-40 kg N/ha with a net saving of Rs.200-400/- in the fertilizer cost.</p>

POTASSIUM APPLICATION TO INCREASE THE PRODUCTIVITY OF PULSES

- Details of technology :
- For irrigated pulses potassium can be mixed with nitrogen and phosphorus and applied by placement method below the seeding zone. It can also be applied as broadcast before sowing of seeds and incorporated.
 - For rainfed pulses potassium can be mixed with nitrogen and phosphorus and applied at the last ploughing by broadcasting before sowing as basal.

Proposed recommendation (Redgram, blackgram, greengram and cowpea (kg/ha).

	:	N	P	K I		
Irrigated	:	25	: 50	: 25		
Rainfed	:		:	12.5	: 25	: 12.5

- Benefits :
- Potassium induces pulses crop to switch over quickly from vegetative to reproductive phase
 - Induces drought tolerance in the crop
 - Improves the quality of the gram
 - Increases yield by 20 per cent

Economics : **Additional (per ha)**

	Expenditure (Rs.)	Yield (kg)	Income (Rs.)
Irrigated	160	100	1500
Rainfed	80	60	900

NEW BIOFERTILIZER FOR SUGARCANE : TNAU BIOFERT-1

- Details of technology : TNAU Biofert-1 is recommended for sett treatment (2 kg/ha) and soil application (2.4 kg/ha each at 30, 60 and 90 days after planting) as that *Azospirillum*.
- Benefits :
 - Four to 17 per cent increased cane yield
 - Application of 75 per cent of recommended nitrogen with TNAU biofert-1 will increase the cane yield compared to 100 percent N
 - Five to 26 percent increased cane yield is obtained due to the new biofertilizer over the *Azospirillum*

This new biofertilizer enhances the growth and cane yield and found more suitable for sugarcane than *Azospirillum*
- Economics : The minimum benefit/cost ratio is 2:1

TNAU COCONUT TONIC

- Details of technology : A pit is to be dug three feet away from the coconut trunk a fresh new root of pencil thickness is chosen, a slanting cut is to be given at the tip of the root. The root is to be inserted into the polybag containing TNAU coconut tonic in such a way that the root is fully immersed in the solution and the bag is tied to the root. Absorption of the whole solution within 24 hours should be monitored. If not, another root is selected and inserted in the same solution. It should be repeated for every six months.
- Benefits :
 - About 29% additional nut yield
 - Rejuvenates the eriophyid mite infested trees
 - Prevent button shedding
- Economics : The cost benefit ratio is 1:4:5

HIGH DENSITY PLANTING IN BANANA

- Details of technology :
 - Planting more number of suckers per pit at a wider spacing
 - Nendran banana 2 x 3 m spacing with 3 suckers per pit
 - Robusta banana 1.8 x 3.6 m spacing with 3 suckers per pit
- Benefits :
 - Reduced labour and cost in weeding and desuckering
 - Efficiency utilization of land, water, fertilizer and solar radiation.
 - Economic use of water and fertilizer sucker
 - Reduces the cost of production of fruits
 - Yield increases
- Economics : For every Rs.1 invested Rs.1.32 is obtained as net profit compared to Rs.0.65 in the conventional system.

FERTIGATION TECHNOLOGY FOR INCREASED PRODUCTIVITY IN BANANA

- Details of technology : Fertigation a technique that combines fertilizer application with any micro-irrigation system especially through drip irrigation

Time of fertilizer application (Weeks after planting)	50 percent of recommended fertilizer dosage	
	Urea (g/pit)	Potash (g/pit)
10 to 20 th week	3.60	5.50
21 to 33 rd week	5.00	9.20
34 to 45 th week	2.00	7.40
46 to 49 th week	-	5.50

- Benefits :
 - Fertilizers can be applied in small quantities, one or any number of times amounting to required doses
 - Nutrient uptake is higher (>80-90%)
 - Reduces the loss of nutrient due to leaching and run off
 - Nutrient and water applied at the root zone save 30-50% of fertilizers and reduces weed growth

- Economics : • Application of fertilizers reduced to 50% from recommended dosage
 • Cost benefit ratio is 1:1.36 compared to 1:0.65 in the conventional system

AFFORDABLE MICRO IRRIGATION SYSTEM

Details of technology : In this minor irrigation system the following are subsystem

- Bucket drip system
- Drum drip system
- Micro sprinkler system

- Benefits : • Easy to design and maintenance
 • 40 to 50 per cent irrigation water saved
 • 10 to 30 per cent increased yield
 • Reduced labour expenditure
 • Control of weed growth
 • Increased fertilizer use efficiency in micro irrigation
 • Payback period is two years
 • No electricity use
 • Affordable investment expenditure

These equipments useful in irrigating vegetable gardens, horticultural crops, nurseries, home gardens and watering potted decorative plants

Economics : The cost and other details of the equipments of this system are given below

Item	Selling cost/unit	Area covered by the kits
Bucket kit (drip system)	Rs.225	20 m ² (0.5 cent)
Drum kit (drip system)	Rs.600 (Excluding drum cost)	120 m ² (3.0 cents)
Micro sprinkler kit	Rs.900	240 m ² (6.0 cents)

MANAGEMENT OF CLUBROOT-ROOTKNOT NEMATODE COMPLEX DISEASE IN CABBAGE AND CAULIFLOWER USING *PSEUDOMONAS FLUORESCENS* (PF 1) AND *TRICHODERMA VIRIDE* (TV MNT 7)

- Details of technology : *Trichoderma viride* mutant TvMNT 7 and *Pseudomonas fluorescens* (Pf 1) mixture seed treatment @ 10 g/kg along with chitin (0.2 per cent) controls clubroot and rootknot nematode complex disease in cabbage and cauliflower. Soil application of the bioformulation mixture @ 2.5 kg/ha has to be done on 45 and 75 DAS
- Benefits :
- A biological method of control and hence environmental safety
 - Controls clubroot and root knot nematode complex diseases effectively
 - Equal effect of fungicides and nematicides in the management of diseases
 - Has systemic resistance against both fungus and nematode pathogens
- Economics :
- Seed treatment with *Trichoderma* and *Pseudomonas fluorescens* gives an income of Rs.1.35 per rupee invested in cabbage and cauliflower
 - Seed treatment with fungicides gives a income of Rs.1.26 per rupee invested in cabbage and cauliflower.

***Trichoderma viride* for the management of root rot in pulses and cotton**

- Details of technology : *Trichoderma viride* mutant MG 6 and MNT 7 @ 10 grams/kg of seeds controls the root rot diseases in pulses and cotton
- Benefits :
- A biological method of disease control and hence environmental safety
 - Controls root rot diseases effectively
 - Pulses diseases controlled to the extent of 88.1 percent (MG 6) and 84.6 per cent (MNT 7)
 - Cotton diseases controlled to the extent of 63.4 per cent (MG 6) and 61.1 per cent (MNT 7)
- Economics :
- Seed treatment with *Trichoderma viride* give an income of Rs.1.80 per rupee invested in pulses
 - Seed treatment with *Trichoderma viride* give an income of Rs.1.80 per rupee invested in cotton

The progress of ongoing research programmes in different crops are summarized below;

AGRICULTURE

PADDY

Crop improvement

For information

SWMRI 5, a cross derivative of Cr 1009 x GEB 24 suited to late kuruvai and early samba seasons. It is high yielding (6900 kg/ha), medium slender, non-lodging culture developed at Soil and Water Management Institute, Thanjavur which is resistant to major pest and diseases.

At Agricultural Research Station, Ambasamudram fifteen new cultures AS 00152, AS 00158E, AS 00159, AS 00161, AS 00163, AS 00160, AS 00153, AS 00165, AS 00164, AS162, AS 00157, AS 00154, AS 00171, AS 00166 and AS00155 were tested during kharif season for their yield. These cultures expressed an yield of 6936, 6696, 6647, 6410, 6178, 6081, 5972, 5930, 5923, 5900, 5876, 5869, 5852, 5827 and 5780 kg/ha respectively. When compared with ASD16 variety which can yield 5680 kg/ha these new cultures has sown an yield of 22.0, 17.8, 16.9, 12.7, 8.7, 7.0, 5.0, 4.3, 4.2, 3.8, 3.3, 3.2, 2.9, 2.5 and 1.7 % more yield respectively.

In a research trial 24 new cultures and 5 control varieties were screened. Ten new cultures namely, AS 0078, AS 0094, AS 0048, AS 0080, AS 0004, IET 16943 were tested which yielded 6111, 5972, 5941, 5721, 5720, 5709, 5538, 5460, 5427 and 5332 kg/ha yield respectively. When compared to ASD 16 which can yield (5326 k/ha) these new cultures has sown an yield of 14.7, 12.1, 11.6, 7.2, 4.0, 2.5, 1.9 and 0.1 % more yield respectively.

Comparative Research Trial was conducted with 20 new cultures and 5 control varieties. Thirteen new cultures namely, AS99051, AS 95119, AS 00004, IET 17052 AS 98024, AS 97051, AS 95119, AS 00004, AS 00'49, AS 99048, AS 00080, AS 00004, IET 16943 were tested which yielded 6111, 5972, 5941, 5721, 5720, 5709, 5538, 5460, 5427 and 5332 kg/ha yield respectively. When compared to ASD 16 which can yield (5326 k/ha) these new cultures has sown an yield of 14.7, 12.1, 11.6, 7.2, 4.0, 2.5, 1.9 and 0.1 % more yield respectively.

For on farm trial

Extra early rice AD 95128 for tail-end water-deficit area

Extra early rice is preferred for planting in tail-end area whenever water is reaching late or inadequate rainfall. At TRRI Aduthurai, one extra early culture AD95128 (IET11412 /IR64) was evolved and found to yield 4.7 t/ha which is 7 and 15 percent higher than MDU 5 and ASD17, respectively. So this culture is recommended for OFT in five districts viz., Thiruvavur, Nagapattinam, Kanyakumari, Chengleput and Tiruvelore sp.at 50 locations with check varieties viz., MDU5 and ASD17.

High yielding early duration rice ADT 99110

The culture AD 99110 has been evolved from the cross ADT 43 and Jeeragasamba. The growth duration of this culture is 115 days. The special features are

its high yielding potential (7-10 t/ha), high tillering (suitable for SRI method) and fine grain (1000 grain weight of 13.5 g). This culture is already spreading fast among farmers due to its high yield and adaptability. At present this culture is evaluated in ART during first season (Jun- Sep) in 25 districts at 125 locations. It is compared against the check varieties ADT 43, ADT (R) 45 and Co47.

Long duration rice AD99039

One long duration rice culture has been developed at TRRI, Aduthurai for the single crop area (samba). This culture is derived from the cross CR1009 x GEB24. Its growth duration is 150 days. In the ART conducted during 2003-04, this culture yielded 5.4 t/ha which is eight per cent higher than ADT44. This culture is being tested in ART during this year (2004-05) at 80 locations in eight districts.

Crop management

For adoption

Suitable cropping system for Cauvery New Delta Zone

The alternate cropping system namely onion in Kharif followed by rice in Rabi and blackgram in Summer recorded the highest rice grain equivalent yield of 22,133 kg/ha/yr with net income of Rs.83,345/- with CB ratio of 3.05 followed by rice in Kharif rice in Rabi with Bhendi in Summer which recorded rice grain equivalent yield of 19,280 kg/ha/yr with net income of Rs.63,348/= with CB ratio of 2.42 may be the suitable alternative and sustainable cropping system compared to the conventional cropping system of Rice-Rice-Blackgram / Sesame.

Site-Specific Nutrient Management for Irrigated Rice of Cauvery Delta Zone

The SSNM is a generic approach tailored to the site-specific conditions of a recommendation region. A major innovation compared to current, blanket fertilizer recommendations was the selection of season-specific yield targets that are economically sensible. Fertilizer requirements are then calculated based on the plant nutrient requirement considering the soil indigenous nutrient supply. Simple tools such as leaf color chart (LCC) help for detecting plant nitrogen deficiencies within a season allowing real-time adjustment of nitrogen management. By applying the nitrogen, phosphorus and potassium based on the indigenous soil nutrient supply, the targeted yields could be achieved as compared to the farmer's fertilizer practice.

Real time 'N' management (Leaf Color chart)

Irrigated rice yield must be raised for achieving the yield level of 5 t/ha to 8 t/ha by the year 2020 to secure the targeted production. It is necessary to increase the N fertilizers recovery efficiency at 50% to maintain the higher yield production with minimum pest and disease incidences by using the N management tools like LCC.

Broadcasting seedlings

A new and novel method of rice crop establishment known as broadcasting seedlings will be the answer for shortage of labourers and escalation of the wages for transplanting. With the same quantity of rice seedlings, broadcasting of seedlings can be accomplished by saving of one third of labourers required for transplanting without any sacrifice on yield.

Integrated Crop Management (ICM)

The ICM components of young and single seedling, wider spacing, cono-weeding, intermittent irrigation and LCC based N management are beneficial for not only increasing higher productivity but also enhancing profitability to the farmers by reducing the cost of inputs like seeds, water, fertilizer and labour.

Among the young and normal seedlings, planting of young seedlings recorded significantly higher grain yield of 4908 kg ha⁻¹ than normal seedling (4506 kg ha⁻¹). Regarding the number of seedlings per hill, planting one seedling per hill produced higher grain yield of 4977 kg ha⁻¹. Among the row spacing followed, planting at 20 x 20 cm spacing registered higher grain yield of 4950 kg ha⁻¹. Irrigating the crop as and when the water disappears in the paddy field can save water considerably and reducing the water consumption of paddy in the cauvery delta. Adoption of these practices will enhance the productivity, reduce the cost of irrigation water, seed and labour thereby enhancing the BC ratio considerably.

Refinement of viable Integrated Farming System (IFS) model for Cauvery Delta Zone.

Integrated Farming Systems suitable for Cauvery Delta Zone have been developed involving the components like fishery/dairy farming/goat rearing/poultry etc. These models are being extended in the delta with needed modifications utilizing NABARD funding.

Economics of poultry cum fish culture

Particulars	Net income (Rs. ha ⁻¹)	Per day income (Rs.)	Employment generation (man days)	
			Farmers cropping	IFS
Existing system (Rice-rice-blackgram)	8,312	27	-	-
Improved system (rice-rice-cotton & Maize)	15,009	47	-	-
Poultry cum fish	17,209	48	-	-
		-	262	385

Economics and employment generation under deep litter system of goat rearing

Particulars	Cost of production (Rs.)	Net return (Rs.)	Per day income (Rs.)	Employment generation (man days)		
				Conventional cropping	Modified cropping	IFS
Modified cropping	19,408	15,409	42	-	-	-
Goat rearing under deep litter system	7,500	4,330	24	305	347	414
Total	26,908	19,739	66	-	-	-

Economics and employment generation of dairy as component in IFS

Particulars	IFS		Existing cropping system		Total empl. generation (Man days)	
	Expenditure (Rs. ha ⁻¹)	Net income (Rs. ha ⁻¹)	Expenditure (Rs. ha ⁻¹)	Net income (Rs. ha ⁻¹)	IFS	Existing cropping
Improved cropping (Rice-Rice-Cotton)	16,889	10,913	14,138	3,422	-	-
Dairying	15,704	8,987	-	-	702	393
Total	32,593	19,900	14,138	3,422		

Permanent Manurial Experiment

In the Permanent Manurial Experiment, continued application of recommended dose of NPK (125:50:50 and 150:60:60 kg/ha in kuruvai and thaladi, respectively) along with organic manure (6.25 t/ha GM in kuruvai and 12.5 t/ha FYM in thaladi) and gypsum @ 500 kg/ha in both seasons registered consistently the highest rice grain yield (5620 kg/ha in kuruvai 2003 and 5508 kg/ha in thaladi 2003-04 with maintenance of soil nutrient status.

Site Specific Nutrient Management (SSNM) in the existing pilot villages of old Cauvery Delta always recorded higher mean grain yield (6370 kg/ha) than the Farmers Fertilizer Practices (6067 kg/ha), since the SSNM accounts the soil nutrients supplying capacity, and adoption of N management with LCC. The extrapolation of SSNM technology in new villages of the same agro-climatic conditions with farmer's participation also had marked impact in maintaining the yield level indicating a possibility of upscaling the SSNM technology appropriately in the delta.

In the Southern districts of Tamil Nadu the proven technologies of the application recommended doses of NPK viz @ 125:50: 50 Kg/ha for Kar rice and 150:60:60 Kg/ha for rabi rice in a rice-rice system was verified under on-farm conditions, besides testing the feasibility of skipping either P or K in the system.

Application of recommended doses of NPK @ 150:60:60 Kg/ha respectively, for Kar and Rabi rice in a rice-rice system found highly essential for realizing the maximum grain yield of 9608 Kg/ha.

Skipping either of the major nutrients P or K in the sequence resulted in an yield reduction by 726 Kg/ha (9.37%) for 'P' and by 1024 Kg/ha (13.22%) for "K" in the soils of Tirunelveli and Thoothukudi districts where the initial soil status was low for N, low to medium for 'P' and medium high for K.

On-farm trials were conducted to study the feasibility of crop intensification and diversification of the existing rice-rice-fallow system.

The highest total yield as rice equivalent of 14916 Kg/ha was recorded by the system rice-rice-vegetables (Bhendi) followed by rice-rice-oilseeds (Groundnut). The net return realized was Rs.58598 and Rs.49838 per/ha respectively for the rice-rice-vegetable (Bhendi) and rice-rice –oilseed (Groundnut)sequence . The least and lowest net return was recorded by rice-rice-fallow (Rs.33918/-).

Application of zinc sulphate at recommended dose i.e. 25 kg/ha and removal of the production constraint viz, zinc deficiency recorded the highest total grain yield of 9554 Kgs/ha. in the rice-rice system as against 8033 Kg./ ha. recorded by the treatment non application of zinc sulphate. The increase in the yield was 18.93%as compared to control. Zinc deficient soils of the NARP southern Zones need to be corrected with the application of recommended doses of $Z_nSO_4 @ 25Kg/ha$ to realize the sustainable grain yield of rice in the rice-rice-system.

Study on the use of rice straw as a source of 'K' for transplanted rice revealed that incorporation of entire K straw (1st season) and bioinoculants viz., Si solubilising bacteria @ 2.0 Kg/ha + *Pleurotus* @ 2.0 Kg/ha + *Trichoderma viridi* @ 2.0 Kg/ha with recommended inorganic fertilizer with or without K fertilizer recorded highest yield attributing characters and ultimately resulted in higher grain yield.

Crop Protection

For adoption

Management of Paddy Leaf webber

Need based application of Profenophos 50 EC @ 1 lit./ha recorded the lowest leaf folder incidence of 1.7 per cent with a C:B ratio of 4.6 compared to 2.2 per cent and 2.8 respectively, in standard check (Chlorphriphos). Therefore application of Profenophos 50 EC @ 1000 ml/ha on ETL basis is recommended for the management of leaf folder. It is also comparatively safe to natural enemies.

Management Of Diseases

Among the botanical formulations tested against sheath blight disease, Neem Azal and Neem Gold were effective which recorded lesser disease severity of 28.8% and 28.9% respectively, as compared to the control (48.4%). However, the botanicals were less effective than the recommended fungicides Propiconazole (23.5%) and Carbendazim (26.8%).

For information

Field Virulence Trial

In an experiment, 50 cultures consisted lines with one, two or three gene pyramids in the background of IR 64 developed at CRRRI, Cuttack. 14 cultures were found to be resistant to BLB disease. The results indicated that the cultures with the combination of two genes Xa 13 and Xa 21 or three genes Xa 5, Xa 13 and Xa 21 performed well in various AICRIP test locations at national level. The cultures CRMAS 2231-32, 35, 37, 38, 42, 43, 44 and 50 were found to be resistant to BLB disease.

In yet another trial at Thirupathisaram, among the 42 cultures screened, the culture TP 1127 was found as resistant to sheath rot disease and moderately resistant to BLB disease.

Termite control

Termites can be attracted and killed by using gunny bags dipped in *Chlorpyrifos* solution kept at different places or by placing the sugarcane thrash i.e, dipped in *Chlorpyrifos* in various locations. This practice has yielded good results in the control of termite.

Integrated Pest Management (IPM)

IPM is the best option to take up need based preventive measure to contain pest damage resulting in not only reducing the cost in incurring for the purchase of pesticide but also contributing ecological sustainability through natural resource bases.

Large scale rice IPM demonstrations conducted in the villages of Kattukurichi, Chithragudi, Kulichapattu, Vennugudi, Vellangkuzhi and Aarsuthipattu in Thanjavur district encompassing seed treatment with *Pseudomonas*; pest and disease management in nursery; adoption of cultural practices like using resistant variety, spacing, rogueing space, water management, 'N' management by LCC, inclusion of neem products ; release of bio-control agents; ETL based pesticide application and adopting integrated rodent management practices proved to be more effective in achieving higher yield by not only controlling the pest and disease incidence but also recorded higher load of predators like green mirid bugs, spiders, ground beetles. In nutshell, the IPM adopted fields recorded the multi benevolence of higher grain yield, natural enemies and lower level of pests.

Spider taxonomy and ecology on rice and rice based cropping systems

Calendar based spraying of recommended insecticide on 20, 40 and 60 days after transplanting in rice significantly reduced the spider populations as against the spraying based economic threshold levels of pests.

Raising of *Sesbania rostrata* @ 6:1 or application of azolla @ 2 kg/cent favoured significantly higher number of spiders per unit area in the rice ecosystem.

Predatory potential of two common rice spiders indicated that the wolf spider was superior to lynx spider and could prey 7.60 Nos. of BPH and 3.50 Nos. on GLH in one day. Lynx spider prey a little more of GLH (4.60 Nos.) in one day.

Pest and Nutrient relationship in Irrigated Rice

Incidences of rice pests viz., yellow stem borer, gall midge, tat leaf folder, whorl maggot and case worm were generally more in Farmers Fertilizer Practice (FFP) compared to SSNM plots. The increased incidence of pests in FFP is attributed due to imbalanced nutrition of crop. Enhanced application of K was achieved invariably in all SSNM fields. When the nutrients application is optimized and well timed it minimizes the ill effects of interaction of major nutrients thereby achieving the targeted yields with reduced pest incidence.

Seed Science and Technology

Synchronisation studies for the parental line of CORH -2 revealed that under Ambasamudram conditions, sowing of A line plants to be taken up during the last week of May. This is clearly indicated by the May 30th sowing of A line recorded superiority in all the components of yield and quality attributes of seed. The staggering interval to be followed for better seed setting percentage is 5 days and 8 days compared to 2 days and 6 days of interval.

The best time of sowing of A line plants for hybrid rice ADTRH-1 seed production is October 15th compared to other two time of sowings. The staggering interval for sowing of R line is 10 days and 13 days. In all the biometrics, yield and quality attributes studied in the investigation, the sowing of A line during October 15th and following a staggering interval of 10 and 13 days for R line sowing performed better compared to other sowings.

Studies on preharvest sanitation spray with botanics revealed that spray with leaf extract of *Vitis negundo* improves the germination and vigour of stored paddy seeds

The rice fallow black gram yield was markedly influenced by methods of sowing. The grain yield was relatively higher with Dibbling of blackgram seeds under rice fallow condition than broadcasting of seeds.

Information Technology and Agricultural Production -HAM Radio

Farmers in HAM net work aimed at constructive public service through facilitation of communication of scientific and technical information and experiences related to special interest in agriculture among and between farmers, extension officials, researchers and managers have raised interest in knowing the technologies in the order of pest and disease management followed by rice fallow crops, nutrient management, varietal details of various crops and others.

MILLETS

Crop Improvement

SORGHUM

A high yielding sorghum culture TNS 590 (a cross derivate of CO 25 x SPV 942) with a yield potential of 4650 kg/ha kg of grain and 13.8 t/ha of dry fodder with an increase of 14.6 % and 10.6 % over CO (S) 28 for grain (3970 kg/ha) and fodder (12.3 t/ha) respectively.

CUMBU

In a multi-locational on on-farm trial hybrid No.8702 recorded 25 per cent increased yield over CDHCu.8. UCC 26 registered 7 percent more yield than CO.7.

RAGI

The finger millet culture TNAU 946 is a hybrid derivate between Malawi 1305 x CO 13 and has a the medium duration of 105-110 days. The mean straw yield is 8420 kg/ha, which is 20.5% increase over the check CO 13 (6690 kg/ha) and 27.8% increase over GPU 28 (6588 kg/ha). The mean grain yield of this culture under irrigated condition is 2892 kg/ha and 2774 kg/ha in rainfed condition against 2248 kg/ha of GPU 28 and 2487 kg /ha and 2396 kg/ha of CO 13. This culture has been released during 2004 by the state variety release committee as CO (Ra) 14. GPU 28 ragi variety has been included in MLT and ART as one of the checks and performance was studied. In OFT, TNAU 946 recorded 13.3% increased grain yield (2774 kg/ha) over the check, GPU 28 (2448 kg/ha) and 9.0% increase over the check CO 13 (2546 kg/ha) in a total of 134 trials for the last five years.

Ragi GCC 23 varieties is selected from ICMV 93752, ICRISAT Hyderabad. This variety is tested under various research trials and farmers fields. The average yield 2865 kg/ha under rainfed condition. It recorded 25% increased over Co.7 (2289 kg /ha) and 15% ICMV 221 (1909 kg/ha) respectively. Under rainfed condition average yield is 2354 kg/ha. It is 21% higher yield than Co.7 (1932 kg/ha) and 38% higher than ICMV 221 (1708 kg/ha).

PULSES

REDGRAM

Crop improvement

For ART

The redgram CORG 9701 is a high yielding medium duration culture. It is the derivative of selection from PB 9825 [a cross derivative of (ICP 8863 x AL 101) x (PA 128 x TT 6)].It comes up well under both irrigated and rainfed conditions. This culture matures in 120-130 days. It is photoinensitive and suited for all seasons. In multilocation trials conducted during kharif 2000 it gave an average yield of 833 Kg/ha

which is 26% increased yield over CO 5 in MLT. In Adoptive Research Trials conducted during 2001-2002 and 2002-2003, the culture gave an average yield of 914 Kg/ha which is 9.7% increased yield over CO 5 (833 Kg/ha).

For information

Two new CMS lines were developed in redgram viz., CORG 990052 A and 990047 A. The identification of restorers and best hybrid combination is in progress. PA 128 is found to restore CORG 990052 A while ICPL 84031 and ICPL 90028 were found to restore CORG 990047 A. This will be further confirmed.

BLACKGRAM

For ART

From the Department of Pulses at Coimbatore, the blackgram culture COBG 632 [(T9 x Vamban 1) x Vamban 1] with 65 days duration with an average yield of 802 Kg/ha is proposed for ART in fifty four locations in Tamil Nadu.

One high yielding culture of Blackgram ADB 2003 has been evolved at TRRI, Aduthurai from the cross of London x ADT5. Its duration is 65 days. It is recording an average grain yield of 680 kg/ha in Thai pattam which is 9.5 and 16.5 per cent increase over the existing ADT 3 and ADT 4 varieties, respectively. In Chithirai pattam, this culture has recorded a grain yield of 725 kg/ha which is 11.6 % increase over the check variety viz., Vamban 2. Under OFT during 2003-04 rice fallow conditions, it has recorded 645 kg/ha with 20.7% higher yield than the ruling variety, ADT 3. This culture will be proposed for release during 2005.

GREENGRAM

The greengram culture COGG 913 (COGG 2 x VGG 4) with 65 days duration with an average yield of 818 Kg/ha is being tested in MLT.

The greengram culture COGG 917 (VGG 4 x Vamban 1) with 65 days duration with an average yield of 792 Kg/ha and another culture COGG 924 (CO 5 x WGG 37) with 65 days duration with an average yield of 805 Kg/ha have been evolved. These will be tested in MLT during 2004.

Studies on the effect of foliar spray with botanics on flowering and fruiting of *Vigna mungo* seeds revealed that the germination and vigour of seeds were influenced by the combined spray with *Pongamia pinnata*, *Azadirachta indica* and Nutgrass rhizome extract.

COWPEA

The culture CO(CP) 711 a selection from Nigerian line IT 82 D 889 B has been nominated to MLT and IVT Coordinated trials during kharif 2003. This has recorded a grain yield of 923 Kg/ha against the check variety CO(CP) 7 (802 Kg/ha), which is 15.1% increased seed yield over check variety.

SOYBEAN

TNAU S 7 – an entry which is a cross derivative of UGM 69 x JS 335, has recorded an yield of 1448 Kg/ha (23% higher than the check variety CO 2). The duration of the entry falls around 80 – 85 days. It is tolerant to YMV at field conditions. This culture will be evaluated as OFT in different locations of Coimbatore and Erode districts.

BENGALGRAM

The entry CoBe 29-1 is a cross derivative of CO 3 x ICC 12237, which has recorded an yield of 839 Kg/ha and matures in 90 days. It is moderately resistant to root rot under natural condition. 100 seed weight (34 g) is higher than CO 3 and CO 4. The culture CoBe 29-1 is being evaluated under OFT/ART in 50 locations of Coimbatore and Dharmapuri districts.

Crop management

BLACKGRAM

For adoption

Effect of soil and foliar application of nutrients on Blackgram yield (ADT 5) – kg/ha

Apart from recommended dose as soil application (25:50:25 kg NPK/ha), spraying of 2% Urea + 2% KH_2PO_4 at 30,45,60 DAS recorded higher yield of 1068 kg/ha. This was closely followed by top dressing of 25 kg N/ha in three splits on 30,45,60 DAS (945 kg/ha) and the treatment 2% DAP spray on 30,45,60 DAS (898 kg/ha). Soil application alone recorded the minimum of 692 kg/ha.

In the All India Coordinated Trials of IVT(E) and AVT 1 (E) an average yield of 1699 Kg/ha and 1483 Kg/ha was recorded, respectively. The overall performance of this culture is 1168 Kg/ha, which is 30.6 per cent increased yield over CO 5 (821 Kg/ha) under irrigated and rainfed conditions it gives an average yield of 915 Kg/ha which is 9.7 per cent increased yield over the check CO5 (834 Kg/ha). The pest and disease score of CO (RG) 7 is comparable to that of the variety CO 5. It has good cooking quality and has 23 per cent protein content. This culture is suited for Redgram growing tracts of Coimbatore, Salem, Dindugal, Pudukkottai, Namakkal, Vellore, Thiruvannamalai, Sivagangai, Theni, Madurai and Thirunelveli districts of Tamil Nadu.

GREENGRAM

For adoption

- Cultivating the disease resistant varieties Vamban 4.
- Planting 6 rows of sorghum crops as bund crop.
- Seed treatment with Imidachloprid 70 WS @ 5 ml / kg of seeds.
- Foliar spray with dimethoate @ 750 ml/ha at 45 DAS

COTTON

Crop improvement

For ART

A high yielding cotton culture TCH 1452 was released as MCU 13 for the winter irrigated tract of Tamil Nadu. The *Gossypium hirsutum* culture TCH 1452 is a multi cross derivative involving eight parents. It matures in 150 days. It is highly suitable for growing in the Winter Cambodia Tract of Tamil Nadu comprising the districts of Coimbatore, Erode, Salem, Dharmapuri, Namakkal, Dindigul and Theni. This variety recorded an average seed cotton yield of 1735 kg/ha which is 20.2% increase over MCU 5 (1444 kg/ha), 22.0% increase over LRA5166 (1422 kg/ha) and 20.0% increase over MCU 12 (1445 kg/ha).

In respect of fibre quality parameters, it possesses a ginning outturn of 34.0% as compared to 35.0% for MCU 5, 34% for MCU 12 and 34.6% for LRA5166. It recorded a mean 2.5% span length of 30.3 mm as compared to 32.0mm for MCU5, 30.0 mm for MCU 12 and 26.0mm for LRA 5166. This culture recorded fibre strength of 22.6 g/tex which is comparable to the varieties under cultivation. It is capable of spinning upto 50's counts.

For MLT

The cultures TCH 1623 and TCH 1627 are being tested in the multilocation trials. The culture TCH 1623 has recorded the highest yield of 2885 kg/ha which 9.9% increase over check Surabhi (2625 kg/ha) and 14.6% over MCU 12 (2577 kg/ha) in MLT. Another culture TCH 1627 has recorded an yield of 2760 kg/ha.

One intra *hirsutum* hybrid TCHH 5826 is found to be superior in yield and quality. This hybrid registered an average yield of 3217 kg/ha which is 24% increase over MCU 12 (2599 kg/ha). It has a span length of 31.2 mm and a bundle strength of 23.4 g/tex with a ginning out turn of 36 per cent.

Crop Management

For adoption

Under pot culture/laboratory conditions the technique for seed treatment with bio-fertilizers, bio-inoculants, chemicals etc., were standardized.

Seeds coated with polymer + (imidacloprid + carbendazim) + *P. fluorescens* + Azophos (T₄) were pelleted. This treatment registered 80 % germination; higher vigour index (2472) and dry matter production (0.682 mg / 10 seedlings) than the other treatments tested.

Crop Protection

For adoption

Seed treatment with *Trichoderma viridie* @ 4 g/kg followed by basal application of zinc sulphate @ 50 kg/ha increased the seed germination, reduced the root rot incidence and increased the yield with the C: B ratio of 7.2.

OILSEEDS

GROUNDNUT

Crop improvement

In groundnut, cultures BS 9714 and BS 9707 are being evaluated under state ART and MLT respectively. Cultures BSG 9802 and BSG 9906 are being evaluated under All India Coordinated Research Project on Oilseeds - Groundnut.

TNAU 325 (Selection from Pollachi red)

In groundnut a bunch type with red kernel was developed and named as TNAU 325. It has a high yield potential of 1360 and 1930 kg/ha in rainfed and irrigated situations, respectively. It is 4.6, 43.0 and 30.6% over VRI 3, TMV 2 and Local Red respectively under rainfed situations and 15.4, 29.8 and 24.6% over VRI 3, TMV 2 and Local red respectively under irrigated situations. It has 50% oil content and 71.4 percentage as shelling.

Crop management

For adoption

The present recommended dose of 17:34:54 kg NPK/ha. may be applied as below.

- a) Entire p+ 33.3% N&K as basal
- b) 33.3% N & K as top dressing at flowering
- c) 33.3% N & K as top dressing at pod initiation stage.

This has given 2143 kg/ha.

Crop protection

For information

At Oilseeds Research Station, Tindivanam among the nine treatments tested on incidence of prodenia observed on 7 DAS and 15 DAS showed that endosulfan @ 1lit/ha was found superior followed by pungam oil 2% (1.33larva/5 pls on 7 DAS) and 0.33 larva/5 pls on 15 DAS. However, 15 DAS neem oil 2%, pungam oil 2%, NPV @ 250 l.e/ha and endosulfan were on par. Regarding percent leaflets affected observed on 15 DAS, endosulfan had 21%, pungam oil 2% had 21.67% and neem oil 2% had 22.67%.

Among the nine treatments tested, endosulfan sprayed plots had least number of larva (0.67 larva/5plants on 7 DAS and 1.33 larva/5plants 15 DAS) followed by neem oil 2% (3 and 2.33 larva/5plants on 7& 15 DAS respectively), whereas pungam oil 2% had 3.33 and 2.33 larva/5 plants. Regarding the incidence on the basis of affected leaflets, endosulfan was found superior with 3.3% and 6.6% on 7&15 DAS respectively. Yield wise, endosulfan sprayed plots recorded 1825 kg/ha followed by pungam oil 2% with 1732 kg/ha and neem oil 2% with 1646 kg/ha while control plots recorded 1330 kg/ha.

In the studies on the management of late leaf spot and rust disease of groundnut foliar spray of Mancozeb (0.1%) + Carbendazim (0.05%) at the initiation of the disease and the second spraying 15 days later was found to reduce late leaf spot and rust diseases. However, spraying Calotropis leaf extract (10%), which is a botanical pesticide, also effectively controlled the diseases.

GINGELLY

Crop improvement

VS 9701 is a cross between VS 9003 x TMV 6. It matures in 80-85 days. Oil content is 51.9%. Overall, the culture has recorded 683 kg/ha registering 13.3% increase in yield over VRI 1.

Crop management

For irrigated gingelly, application of present recommended level of 35:23 kg N&K/ha (50% Basal + 50% 30 DAS) + Enriched Farm Yard Manure (FYM) with 75% recommended P₂O₅ (17.25 P kg/ha all basal) as single supper phosphate along with phosphobacteria (2 kg/ha) in TMV 3 gingelly variety recorded the highest seed yield of 855 kg/ha.

SUNFLOWER

Crop improvement

For MLT & ART

TNHSF 239 (Gene pool 1) is a highly self fertile population recorded 1139 and 1275 kg/ha during kharif 2000 and rabi 2000-01 respectively in MLT. It is an increased seed yield of 5.2 and 10.0 per cent over CO 4 (1083 and 1158 kg/ha) and 25 and 10.7 per cent over Morden (911 and 1152 kg/ha) during kharif and rabi respectively.

In Adaptive Research Trials, this population recorded 1191 and 1289 kg/ha during kharif 2002 and rabi 2002-03 respectively. It is 10.1 and 24.8 % over 004 (1082 and 1033 kg/ha) and 16.0 and 34.7 percent over Modern (1026 and 9.57 kg/ha) during kharif and rabi respectively.

Crop protection

For adoption

Management of Sunflower necrosis virus disease

Seed treatment with imidacloprid (2g/Kg) + foliar spray of imidachloprid (0.01%) Raising border crop sorghum one month prior to sowing sunflower was effective in controlling necrosis virus disease. The package is also cost effective with CB ratio of 1.8.

CASTOR

Crop improvement

For information

During kharif 2003 , fresh crosses were made in 34 cross combinations. Among the 34 F1's studied during the season, the following 4 hybrid combinations were found to be good.

- | | |
|---------------------|---------------------|
| 1) NES 6 x YRC 64/2 | 2) JP 65 x YRC 359 |
| 3) NES 6 x YRC 53/1 | 4) LRES 17 x YRC 14 |

The entry IAVT 11 (1362 kg/ha) was found to be superior by recording 10.28% increased yield over TMV5(1235 kg/ha) in Initial Advanced Varietal Trial.

In Initial Hybrid Trial, IHT 32 recorded the highest yield of 1772 kg/ha which is 10.28% increased yield over TMV5 (1235 kg/ha) .

In Advanced Hybrid Trial , among the 9 hybrids tested along with the local hybrid TMVCH1, AHT 56 was found to be the best with a yield of 1536 kg/ha which is 71% increased yield over TMVCH1 (898kg/ha), followed by AHT 54 (1324 kg/ha) and AHT 57 (1279 kg/ha).

Among the 450 types studied in germplasm maintained at this centre, 23 numbers were found to be good pollinators and hence used for developing fresh crosses.

Seed coating with gypsum (300g / kg of seeds) , ammonium molybdate , $MnSO_4$, $ZnSO_4$ and borax each at 300mg / kg of seeds using maida gruel as adhesive followed by foliar spraying with DAP 0.5% , ammonium sulphate 0.2%, boric acid 0.1% and salicylic acid 100ppm on 25th and 40th DAS recorded maximum seed yield (690 kg/ha), while the control treatment (no seed coating and foliar spraying) recorded the minimum seed yield (647 kg/ha) in TMV6 rainfed castor.

Crop management

For adoption

Fertilizer schedule for rainfed hybrid castor:- 45:15:15 kg NP2o5 kg/ha.

Fertilizer schedule for irrigated hybrid castor: - 30:30:30 kg NP2O5K2O /ha basal, and 30 kg N/ha as top dress on 30 and 60 days.

To control perennial weeds spraying of alyphosate @ 2 kg/ha + 2% Ammonium Sulphate Activator at 20 days before sowing followed by a manual weeding after sowing.

Black polythene film mulch (7 micron) with fluchloralin @ 1 kg/ha as preplant incorporation in a flat bed system.

For information

In Zn and Fe deficient soil, basal application of 25 kg $ZnSO_4$ + 50 kg $FeSO_4$ / ha along with recommended dose of NP&K to rainfed hybrid castor TMVCH1 registered the highest seed yield of 1545 kg/ha , while the control treatment registered the lowest seed yield of 1290 kg/ha.

Under rainfed condition , recommended dose of fertilizer to main crop of groundnut (10:10:45 kg NPK / ha) + full dose of N of intercrop of castor (40kg N/ha) top dressed on 30th and 50th DAS recorded the highest pod yield of groundnut (1334 kg/ha) as well as seed yield of castor (1323 kg/ha).

Fifteen front line demonstrations , five on hybrid castor, five on whole packages and five on plant protection were laid out in Attur taluk of Salem district. In the hybrid castor demonstrations, the highest yield of 1700 kg/ha was recorded by Th. S. Kanagaraj of Thennampillaiyur with DCH 177 castor hybrid whereas the local check recorded only 900 kg /ha . In the whole package demonstrations, the highest yield of 1258 kg/ha was recorded by Thiru. Vadamalai of Umaiyaipuram , while the local check recorded the lowest seed yield of 791 kg/ha . In the plant protection demonstrations, the highest seed yield of 1338kg/ha was recorded by Thiru. Ramasamy of Thalavaipatti, while without any plant protection measures, the average yield was 802 kg/ha.

Under rainfed condition, hand weeding on 30th and 45th DAS recorded the highest seed yield of 1408 kg/ha while unweeded check recorded the lowest seed yield of 637 kg/ha.

Crop protection

For information

In a field trial on the management of castor capsule borer, the damage was low in profenophos 0.05% (21.42%) and acephate 0.075% (23.19%) treated plots with the seed yield of 1165 and 1096 kg/ha, respectively, while the untreated control recorded the capsule damage of 36.15% with the seed yield of 794 kg/ha.

Among the 100 germplasms screened, the leaf hopper population was nil in 16 entries in 30 days old crop and low (7 to 10 numbers / 3 leaves / plant) in 5 entries in 90 days old crop. Capsule borer infestation was nil in 12 entries and low (less than 10 per cent) in 28 entries. In IAVT entries, leaf hopper population was low (9.00 to 13.67 numbers / 3 leaves / plant) in 3 entries viz., IAVT 7,5 and 8. Capsule borer infestation was below 10 percent in 2 entries viz., IAVT 9 and 1. In AHT entries, leaf hopper population was low (9.33 to 14.67 numbers / 3 leaves / plant) in 2 entries viz., AHT 59 and 58. Capsule borer infestation was low (3.71 to 5.95 per cent) in 3 entries viz., AHT 54,55 and 56.

In the first year trial on the management of castor defoliators, larval population reduction was high in the plots treated with chlorphyriphos 0.04 per cent on 3 days after the treatment (79.52 per cent) and 7 days after the treatment (69 .74 per cent) with the highest seed yield of 1264 kg/ha when compared to the untreated control (742 kg/ha).

The results of the trial on management of castor grey rot through biocontrol agents revealed that the treatments of prophylactic spray of *Pseudomonas fluorescens*, carbendazim, *Trichoderma viride* (each at 2g/l of water) recorded the minimum grey rot incidence of 9.27 , 14.40 and 16.25 per cent and seed yield of 1261 , 1253 and 908 kg/ha respectively, while , the control (no treatment) recorded the maximum disease incidence of 65.17 per cent and the lowest seed yield of 599 kg/ha .

SUGARCANE

Crop Improvement

For on farm testing

Testing of prerelease sugarcane clone G 95716 in tannery effluent affected soils in Vellore district is being taken up.

For information - The clone G 00728 was found to be promising with the highest cane yield of 127.67 t/ha and the highest sugar yield of 16.14 t/ha in Advanced Yield Trial (Early) 1 year.

In the Advanced Yield Trial (Early) II year the clone G 99728 was found to be promising with highest cane yield of 119.20 t/ha. The clone G 99728 was also found to be promising with the highest sugar yield of 15.98 t/ha.

In the Advanced Yield Trial (M/L) I year, the clone G 00889 was found to be promising with highest cane yield with the sugar yield of 140.15 t/ha and 16.83 t/ha respectively. In the Advanced Yield Trial (M/L) II year, the clone G 99764 was found to be promising with highest cane yield of 131.00 t/ha with the highest sugar yield of 17.77 t/ha.

For ART

From SRS, Cuddalore a high yielding derivative of the open pollinated parent of Co 8208. GC was tested as clone C 95093 in Advanced yield trial (AYT) and Co-ordinated Agronomic Experiments (CAE) from 1998-2003. The clone C95093 was nominated to the All India Co-ordinated Research project on Sugarcane AICRP (S) as "CoC 20062" for testing is a mid late sugarcane variety with a duration of 330-360 days. It has an erect, medium thick cane. It is non lodging and non flowering.

It showed excellence for cane yield, commercial cane sugar per cent (CCS%) and sugar yield both in plant and ratoon crops of AYT and CAE. The clone C 95093 is being tested in 151 trials.

SPECIAL MLT

Six special MLT clones viz., C 95295, C 960067, C 960696, C 961427, C 97465, C 98171 along with checks CoC 671, Co 86032, Co 86249, CoC 90063, CoC 98061 and CoV 92102 were planted in 50 locations throughout Tamil Nadu covering the University Research Stations, Cooperative Sugar Mills, Public Sector Sugar Mills and Private Sugar Mills. Irrespective of the locations, the clone C 960696 registered the maximum mean

sugar yield of 16.11 t/ha and it was 9.0 % higher than the best standard CoC 671 producing 14.78 t of sugar yield /ha. The new clone C 961427 also recorded 14.15 t sugar yield /ha. Based on the performance, the new clones C 961427 and C 960696 were

supplied in bulk quantities to sugar factories for multiplication and large scale on-farm demonstrations.

In the experiment conducted at Sugarcane Research Station, Sirugamani the clone Si 94045 out yielded the early season check variety 5.3% over CoSi 95071 and 16.7% over Co 86032. In terms of sugar yield, Si 94045 recorded 9% increase over CoSi 95071 and 13% over Co 86032.

In Co-ordinated Agronomic Experiments on Sugar cane, clone Si 94045 recorded over all cane mean yield of 154.5 t/ha with 18.8 t/ha sugar yield. The percentage increase in cane yield recorded by this clone over checks CoSi 95071, Co 86032 and Co 86249 were 7.1, 10.0 and 15.9% respectively.

In terms of sugar yield this entry recorded increase of 13.3% 14.3% and 27.0% over CoSi 95071, Co 86032 and Co 86249 respectively. Besides the high yield, it is moderately resistant to red rot disease.

Crop management

The available sulphur content of the post harvest soil samples of the plant crop of sugarcane Co 86249 and CoC 99061 were significantly increased due to the soil application of various sources and levels of sulphur (6.02 ppm). The mean available sulphur content ranged from 6.01 to 11.81 ppm. The highest available sulphur content was recorded in the treatment that received sulphur @ 60 kg/ha in the form of gypsum and was found to be on par with sulphur @ 60 kg/ha in the form of Amophos (11.78 ppm), whereas the control recorded the lowest available sulphur content of 6.01 ppm. The results revealed that the availability of sulphur in soil increased with increased levels of sulphur application. Among the various sources, gypsum and Amophos were found to be equally effective in increasing the sulphur availability in soil. However, elemental sulphur is found to be slow in enhancing sulphur availability in soil. The sulphur content of third index leaf of sugarcane as influenced by various sources and levels of sulphur ranged from 901.6 and 1695 ppm. The highest sulphur content of leaf was recorded in treatment that received sulphur @ 60 kg/ha as Amophos and was found to be on par with sulphur @ 60 kg/ha as gypsum (1671 ppm). The lowest sulphur content in index leaf was recorded in control. The result revealed that except the control, all other treatments were found to contain the sulphur level in index leaf at optimum level.

In sugarcane drip irrigation at 60 and 80% of Pan Evaporation once in 2 days under wider row spacing (5 feet) with one lateral per row recorded the maximum yield (134 t and 123 t ha⁻¹, respectively) with the water saving of 33% compared to irrigation at 5 cm in 0.75 IW/CPE ratio under normal spacing.

Drip irrigation at 60% of Pan Evaporation in chillies + onion as intercrop recorded 1576 kg ha⁻¹ of dry fruit of chillies and 1336 kg ha⁻¹ of bulb in onion on an average of two years.

Crop protection

For adoption

Adoption of different sett rate of sugarcane at planting on the shoot borer incidence and yield characters.

Treatment in sett rate/ha	Cumulative shoot borer incidence (%)	No.of reduction of shoot borer damage over control	CCS %	Cane yield (t/ha)	Per cent increase in yield over control
2002-2003 season					
Conventional sett rate 75000	72.95	-	12.08	17.98	-
10% higher – 82500	82.65	13.29	13.02	18.58	3.34
20% higher – 90000	73.68	1.00	12.56	24.68	37.26
30% higher – 97500	59.73	18.12	12.01	30.28	68.41
40% higher – 105500	55.36	24.11	11.98	43.76	143.38
50% higher – 112500	42.52	41.71	12.30	53.63	198.27
CD (0.05)	7.671			12.616	
2003-2004 season					
Conventional sett rate 75000	32.17	-	12.11	53.53	-
10% higher – 82500	32.79	+1.02	13.79	61.06	14.07
20% higher – 90000	27.74	13.77	12.65	65.48	22.32
30% higher – 97500	24.47	23.94	13.13	68.75	28.43
40% higher – 105500	22.99	28.54	12.01	68.07	27.16
50% higher – 112500	21.57	32.95	11.00	67.29	25.71
CD (0.05)	1.470			3.175	

Four Cuddalore clones is Co 86249. C 20096. C 20141 and C 20740 and twenty Sirugamani clones were moderately resistant to red rot by plus method of inoculation. The incidence of red rot was noticed in Co 86032 variety and occurred in coastal region sugar factories of Tamil Nadu.

Hence, it is recommended that adoption of higher sett rate up to 30% level can help to serve as a eco-friendly cultural practice for the management of shoot borer of sugarcane in the endemic areas during the late season planted crop.

HORTICULTURE

FRUIT CROPS

Crop improvement

BANANA

At the Department of Fruit Crops, Horticultural College and Research Institute, Coimbatore, a promising nematode tolerant hybrid, H.212 has been identified for on farm testing. This hybrid is akin to widely cultivated 'Ney Poovan' (AB) variety which is susceptible to nematodes.

A triploid hybrid (NPH-02-01) has been found promising with resistant to wilt and tolerant to nematode. The suckers of the hybrid NPH-02-01 are being multiplied under *in-vitro* and *in-vivo* conditions for large scale evaluation.

STRAWBERRY

At Horticultural Research Station, Udagamandalam, three promising accessions of strawberry were identified from the 22 accessions. Among them FV-21 has performed better with a mean per plant yield of 646.8 g/year with a mean number of 47.5 fruits per plant, which was 50.5 per cent higher than the local ruling variety Phenomenal. The FV-21 has produced 3 crowns per plant. It has produced large fruits with a mean fruit weight of 15.5 g, mean fruit length of 28.7 mm and mean fruit width of 25.3 mm. The computed yield was 12.8 t/ha as against 8.5 t/ha in local variety.

PEPINO

For on farm trial

In this experiment seven accessions were evaluated and comparative yield performance recorded. Among the seven accessions evaluated SMu-1 registered the highest mean yield of 87.6t/ha as against 18.9t/ha of SMu-7.

APPLE

At Horticultural Research Station, Ooty nine accessions of low chill apple varieties from Himachal Pradesh were evaluated. Among them the accession MS-9 recorded the highest yield of 8.4 kg/tree/year.

PEAR

At Horticultural Research Station, Ooty, five cultures of butter pear were evaluated. Among them, PC-5 recorded the highest fruit yield of 11.6 kg/tree/year which was 34.8 per cent higher than the local type. The fruits are very sweet and soft like butter and possess very good market quality. It is an early type culture and the fruits are ready

for harvest during the peak summer (April – May) when there is a huge demand for the fruits of this culture, whereas the conventional varieties are ready for harvest only during the month of August.

PLUM

Fourteen cultures of Plum imported from Taiwan were planted for evaluation at Wood House Farm, Horticultural Research Station, Ooty. Among them the culture PD 10 recorded the highest fruit yield of 2.56 kg/tree/year which was 68 per cent higher than the local ruling Hale variety.

Crop management

For adoption

For tissue cultured banana cv. Robusta application of 165 g of N, 52.5 g of P₂O₅, and 495 g of K₂O is recommended at bimonthly intervals starting from 2nd month after planting.

Cycocel 1000ppm applied as foliar spray at 4th and 6th month after planting was found to be more effective in increasing the yield in banana cv. Grand Naine.

In banana, under modified crop geometry (paired row) with drip irrigation, there was yield increase on increasing the nitrogen level. Irrigation levels had no marked variation in yield (59.3 to 63.3 t ha⁻¹). Water use efficiency was maximum (31.5 kg ha⁻¹ mm⁻¹) in drip irrigation once in 2 days with modified crop geometry (one lateral for two rows) @ 48 litres/2 plants. The B:C ratio was 7.70.

Maximising the productivity and quality in banana through drip fertigation with water soluble fertilizers. In banana, drip fertigation with water soluble fertilizer at 100% recorded 37.45 t ha⁻¹ yield which accounts about 46.40% more yield with a water saving of 47.57% and with a WUE of 32.47 kg ha⁻¹ mm⁻¹ over control.

Crop protection

Field test

Predetermination of fruit rot in banana by using polyclonal antiserum

Polyclonal antiserum for fruit rot was identified in banana. In selected *Colitrotrichum musae* fungi of Tamil Nadu, 65 kg Dolton protein was identified. By ELISA, TIPA and Western blot technique identified anti serum destroyed *Colitrotrichum musae* fungi in banana effectively.

Pseudomonas fluorescens FP 7 and Kitien containing new bio fertilizer is identified. This fertilizer @ 10 g/ plant was applied in 5th and 7th month of banana through foliar spraying (0.5%) or soil application. For controlling the fruit rot in banana spraying done at two times with 30 days interval. This controlled 86% damage and increased 25 % of production.

APPLE AND TEMPERATE FRUITS

Crop management

From November to February pruning operation is done in horticultural research station, Kodaikanal to obtain apple and plums.

Sandolin 2% spray in apple tree reduces dormant period.

In country Pear topping operation facilitates grafting.

Using T budding, peach and plum plants can be produced easily during November to February.

To improve the seed germination in peach, seeds and sand are arranged in alternate layers with enough moisture.

To increase apple production a quantity of 0.05, 0.25, 1.75 kg urea, super phosphate and potash per tree should be applied.

In peach nursery by applying 10 pockets of Azospirillum and Phosphobacteria per ha. makes grafting possible within 10 months.

Crop protection

Aphelinous mali parasitoid controlled wolly aphid in apple by 43 to 90 %. Also 1-2% of neem oil spray effectively controlled wolly aphid.

JACK

Identification of superior jack trees with sweet, non sticky carpels, off-season bearing and medium to large sized fruits from different parts of Tamil Nadu is in progress.

A local selection Pathirakottai was found superior recording higher fruit weight (15kg) medium sized fruits with sugar content of 22.2%.

A superior Jack tree from Kollankarai village has been selected for its non-sticky, long flakes (14.6) with high sugar content (24.4%) and large sized fruits (23.7kg).

VEGETABLE CROPS

Crop Improvement

TOMATO

Two hybrids viz; COLCNRH. 1 and COLCNRH.2 performed well with high level of resistance to TLCV (PDI -0 and 10.25, respectively) and root knot nematode (gall index 1 (HR) and 2 (R) respectively, along with high yield (3.21 and 3.71 kg per plant respectively).

CHILLI

Three hybrids viz., COCH 1, COCH 2 and COCH 3 were resistant to anthracnose without spraying fungicide.

BRINJAL

The inter varietal hybrids viz., EP 65 X Pusa uttam and EP 12 X MDU 1 showed earliness and number of fruits per plant and gave maximum marketable yield EP 65 X Pusa uttam recorded 16.5 percent of fruit borer infestation.

TAPIOCA

Among the 284 cassava accessions evaluated during the year 2003-04, 17 accessions recorded tuber yield of more than 2kg/plant. The accessions ME 359, ME 572 and ME 422 recorded higher yields of 2.83, 2.63 and 2.60 kg /plant respectively.

During 2003-04, 14 entries were evaluated under IET. Among them, the entry TCH2 recorded the highest tuber yield of 22.64 t/ha followed by H 740 / 92 (21.98 t/ha), PDP2 and CO3 (21.37 t/ha) and TCH1 (21.07 t/ha). The screening for ICMV incidence revealed that the entry CO3 recorded the lowest ICMV incidence of 3.14% followed by MNGA1 (6.03%) and H 740 / 92 (16. 82%).

Disease free planting materials of CO2, CO3 and CO(TP)4 were distributed to 106 farmers covering an area of 30 acres.

Crop management

For information

Fertilizer control in Tapioca

The recommended fertilizer rate of irrigated tapioca is 90:90:240 kg NPK / ha.

Combined application of recommended P as single superphosphate and soil application of VAM recorded the highest tuber yield of 11.84 t/ha, while the control treatment (no P and no VAM application) resulted in the lowest tuber yield of 9.22t/ha.

Application of half the recommended dose of P + full recommended dose of N and K + FYM + VAM + *Phosphobacteria* recorded the highest tuber yield of 30.83 t/ha

which was on par with application of recommended N, P and K (100:50:100kg NPK/ha) + FYM (12.5 t/ha) recording the yield of 30.20 t/ha .

Demonstrations laid out in farmer's holdings at Attur and Rasipuram taluks for evaluating the yield performance of eleven cassava varieties revealed that the highest tuber yield was recorded in Sree Jaya (24.0 t/ha) followed by Sree Prabha (23.07 t/ha), Sree Vijaya (21.30 t/ha) and CO3 (21.0 t/ha). The highest starch content was recorded in Sree Vijaya (28.0%) followed by Sree Rekha (27.0%) and Sree Prabha (25.0%) .

For adoption

Selection of setts with triple buds or double buds and sett treatment with combination of micronutrients ($ZnSO_4$ and $FeSO_4$ each @ 0.5%) and biofertilizers (*Azospirillum* and *Phosphobacterium* each @ 3%) for higher tuber yield of rainfed cassava.

Crop protection

For information

Placement of delta yellow sticky traps @ 10/acre and spraying fish oil rosin soap 20 g /l of warm water along with neem oil 30 ml / l of water reduced the whitefly population from 6 to 1 adult / leaf with the highest tuber yield of 14.80 t/ha when compared to the untreated control with the whitefly population of 6 adults/ leaf and the lowest tuber yield of 10.68 t/ha.

The minimum tuber rot incidence of 8.61, 11.13 and 13.06 per cent was recorded by CO2, CO3 and CO(TP)4 respectively, while H226 , Mulluvadi 1 and Kunguma rose recorded the higher incidence of 43.73 , 41.71 and 35.09% respectively. The maximum tuber yield of 39.34, 32.11 and 27.48 t/ha were recorded by CO2, CO3 and CO(TP)4 respectively, while H226, Kunguma Rose and Mulluvadi 1 recorded the lowest tuber yield of 25.05 , 22.04 and 23.89 t/ha respectively .

TEMPERATE VEGETABLES

VELVET BEANS

In velvet beans *Mucuna puriens* L., two cultures MP 1 and MP 2 (collected from USA) were evaluated at Hybrid Rice Evaluation Centre, Gudalur and Nanjanad Farm, HRS, Ooty. These two cultures have failed to flower in higher elevation in Nanjanad Farm but were found to perform well under Gudalur climatic conditions. Culture MP – 1 has recorded the highest pod yield of 5.5 kg/plant which was 30% higher than the culture MP-2. The culture MP-1 recorded the seed yield of 1.3 kg/plant which was 41% higher than the culture MP-2.

SWORD BEANS

In Sword beans *Canavalia ensiformis* L., two cultures CE 1 and CE 2 (collected from USA) were evaluated at Hybrid Rice Evaluation Centre, Gudalur and Nanjanad Farm, HRS, Ooty. These two cultures have failed to flower in higher elevation in Nanjanad Farm but were found to perform well under Gudalur climatic conditions. Culture CE – 2 has recorded the highest pod yield of 7.3 kg/plant which was 12% higher than the culture CE-1. The culture CE-2 recorded the seed yield of 1.5 kg/plant which was 17% higher than the culture CE-2.

CABBAGE

Crop management

According to research conducted at Horticulture Research Station, Kodaikanal, in cabbage and cauliflower the production was increased by 22.2% by applying 135:135:135 kg NPK fertilizers along with 10 pockets of *Azospirillum* and *Phosphobacteria* and 2.5 tonnes of Farm Yard Manure.

POTATO

The production was increased by 34% due to application 120:420:120 kg NPK / ha along with 10 pocket of *Azospirillum* and *Phosphobacteria* at two times i.e., one at basal and another one at 45 DAS.

BEANS

In Peas and Beans, yields were increased by 6-8 percent by treating the seeds with *Rhizobium*, *Azospirillum* and *Phosphobacteria*.

GARLIC

The yield was increased by applying 100:75:30 kg NPK / ha along with 25 kg of zinc sulphate in Garlic.

Crop protection

The results of research conducted at Horticulture Research Station, Kodaikanal reveals the following information.

To control the leaf borer in beans about 1% of neem oil, pinnai oil, eluppai oil were sprayed which controlled 40% of the damage.

Knol-khol attacking beetle is controlled by spraying 1% of neem oil and eluppai oil to the tune of 75-64 % of the damage.

Diatecma semiclasam parasitoid controlled diamond back moth's larva and cocoon.

Euphodium leaf extract at 5% spray controlled red spider damage.

To control pea leaf borer, 2 ml of monocrotophos / 1 l of water is sprayed.

MUSHROOM

PS1 strain with Circular Compact Method

PS1 strain recorded higher yield (1010g/bed) and bio efficiency (25 %). Among the methods, Circular compact bed system recorded maximum yield (1021 g/ bed) and higher bio efficiency (28.4 per cent).

Standardization of Outdoor cultivation of paddy straw mushroom

Paddy straw mushroom is generally cultivated indoor. However, outdoor cultivation was attempted in the inter row space (60 X 30 cm) of maize field 30 DAS. An average yield of 1734 g/bed with 8.75% bio-efficiency was achieved. This practice gave an additional income as well provided organic manure when the spent substrate is ploughed *in situ*.

SPICES AND PLANTATION CROPS

Crop protection

CORIANDER

Management of powdery mildew disease in coriander

Spraying of Neem Seed Kernal Extract 5% thrice, the first spray immediately after the appearance of disease second and third at 15 days intervals is recommended for controlling the powdery mildew disease in coriander.

Management of wilt disease in coriander

Seed treatment with *Pseudomonas fluorescens* @ 10 g/kg + soil application of *Pseudomonas fluorescens* @ 10 kg /ha is recommended for the control of coriander wilt disease.

Drip irrigation in curry leaf

In curry leaf, irrigation levels and methods had no significant influence on the yield which varied between 49.7 to 58.3 t ha⁻¹. Drip and micro sprinkler irrigation once in 2 days at 40% of PE under paired row planting and drip at 40% of PE under normal spacing registered a water saving of 38% compared to surface irrigation at 5 cm, in 0.8 IW/CPE ratio. Water use efficiency was maximum in the same drip and micro sprinkler treatments (12.92 to 14.4 kg ha⁻¹ mm⁻¹).

TURMERIC

On farm testing

Management of tuber rot disease

A mixture of *Bacillus subtilis* and *Pseudomonas chlororabis* is found to control tuber rot disease. This mixture was applied as dipping of tubers and soil application at the time of 3rd and 5th month after planting.

Crop improvement

From the germplasm pool of turmeric CL 101 and CL 147 were identified for high yield which recorded the yield of 45 and 43 t/ha. The clone CL 147 is also found to have high curcumin content of 5.5 per cent.

PEPPER

Crop improvement

In pepper germplasm berry set was observed in 27 accessions of which PN. 2 recorded the highest value of 11.6 kg for green and dry berry yield. The accession PN. 55 recorded the highest value for spike length (11.0) and number of berries (110.0).

Crop management

The height of the vine was higher (100.6 cm) in the treatment inorganic N 75% + *Azospirillum* 50 g + 10kg FYM and the number of leaves and leaf area were higher (37.5, 63.0 cm²) in the treatment inorganic N 50% + *Azospirillum* 50 g + 10 kg FYM.

COCONUT

Crop improvement

Among the 28 coconut germplasm evaluated (D/P 1963) West Coast Tall (WCT) recorded the highest annual nut yield of 180.0 nuts/palm followed by Thailand (174 nuts / palm)

Among the 14 coconut hybrids which were planted during 1984, the hybrid COD X ECT recorded the highest annual nut yield of 117.4 nuts / palm followed by WCT X COD 102.3 nuts/ palm and GBD X PHO (105 nuts/palm).

Crop Management For adoption

Months	Normal condition	Water scarcity condition	Water stress condition
Drip irrigation			
March - September	80 l / day	55 l / day	27 l / day
October – February	50 l / day	35 l / day	18 l / day

Crop Protection

Soil application of *Trichoderma viride* and *Pseudomonas fluorescens* @ 200 g / palm was found to be effective in controlling the basal stem rot disease of coconut. ECT X BSR tolerant ECT had a higher rate of survival (66.7%) in BSR sick soil.

FLOWER CROPS

Crop improvement

CHRYSANTHEMUM

A pre release culture Accession No.103 has been identified as a promising type of Chrysanthemum. The flowers are bright yellow in colour and this culture yields 2441.5 flowers/plot (1.2 X 1.2 m) weighing 6103.6 g/plot. Further research is in progress.

ROSE

Crop management

In cut rose cv. First Red, pulsing treatment (Sucrose 3%) + Aluminium sulphate (300 ppm) for 12 hours at 20°C, holding solution (Sucrose (1.5%) + Aluminium sulphate (300 ppm), wrapping (cellophane sleeves) and cold storage (3°C for 12 hours) increased the vase life of flowers stalks.

ANTHURIUM

Crop improvement

In Anthurium eighteen genotypes have been tested under Coimbatore condition. The preliminary observation on plant growth and flower yield showed that the varieties Temptation, Sunset orange, Sunshine orange and Leema white were found to be promising.

The maximum plant height of 28.45cm was recorded by the variety Tiffany. The maximum flower yield/plant was recorded in Mini (11.28). The highest stalk length (56.87cm) was measured by Tiffany White. The maximum of 0.68 cm was measured as diameter of the flower stalk and the maximum of flower diameter of 11.87cm was measured by the variety in Rosalin . It also recorded the longest vase life period of 10.27 days.

Breeding programme was initiated with five female parents viz., Deep Red, Liver red, Flesh Red, Verdon Red and Orange and the male parents White, Pink and Linda Demole. They were selected based on dark spathe colour and high ploriferous nature. The male parents viz., Pale Pink, Linda Demol and White were chosen based on their resistance nature. They were crossed in full ' Line x Tester mating Design'.

i. Crossing method	-	Line x Tester
ii. Number of Line	-	5
iii. Number of Tester	-	3

The crosses were made during the year of report as and when the flowers are ready in the female parents the pollen grains collected from the male parent and crossing was effected. The seeds were collected from the following crosses

1. Orange x White
2. Deep Red x White
3. Verdon Red x White
4. Orange x Pink
5. Verdon Red x Pink

The seeds were subjected to nursery for further evaluation.

FORESTRY

Crop management

For adoption

Integrated nutrient management in *Casuarina*

Application of 13.5 kg N, 54.0 Kg P₂O₅ and 27.0 kg of K₂O along with FYM and *Frankia* proved to be the ideal dose for raising *Casuarina equisetifolia* seedlings in a red noncalcareous soil and the cost of fertilizer applied for the production of 1000 seedlings worked out to be Rs.75/-. The maintenance cost was reduced by Rs.255 and a reduction of 61 days in the nursery period was observed.

Integrated nutrient management in *Tamarindus indica*

In a non-calcareous red soil low in available N, P and K, application of 0.6 kg urea, 2 kg SSP and 0.6 kg MOP with 5 kg compost and 0.5 kg *Phosphobacteria* recorded a significant increase in shoot length (48.7 cm), root length (32.23 cm) and dry weight (11.24 g) in Tamarind.

Crop protection

Assessment of microbial diversity and fertility status of shola soils of Nilgiris

With a view to assess and document microbial diversity and fertility of various sholas in Nilgiris viz., Longwood shola, Tiger hill shola, Thai shola and their adjoining vegetation, laboratory studies were carried out. In general, the density of microflora varied widely among sholas as well as between shola and other vegetation. The density of bacteria and actinomycetes was higher in Longwood shola, while Thai shola exhibited greater bacterial diversity. The grasslands showed greater fungal population than sholas and other vegetation. The fungi *Penicillium* was dominant in sholas, while the grasslands harboured greater number of *Fusarium*. The beneficial microbes viz., *Azotobacter*, *Azospirillum* and phosphate solubilizers were found to be greater in shola soils. Even though VAM spores were observed in shola soils, complete absence of VAM fungal infection was noticed in shola seedlings (wildlings). Numerous pigmented bacterial isolates were obtained from Thai shola.

The physico-chemical analyses of soil samples showed that sholas were less acidic with higher organic carbon content, macronutrients and micronutrients. Thus the study reveals the richness of microbes as well as nutrients in the shola forests of the

study area. Also the presence of pigmented bacteria indicated the potential for biotechnological studies.

Mass production and supply of biofertilisers

Biofertilizers viz., *Azospirillum*, *Phosphobacteria* and *Rhizobium* were mass multiplied and supplied Joint Director of Horticulture, Ooty. About 2 tonnes of VAM fungal biofertilizers was produced and 500 kg was supplied to tissue culture laboratory for hardening of tissue-cultured plantlets.

Studies on *Rhizobia* nodulating *Acacias*

Rhizobial isolates were obtained from *Acacia nilotica*, *A. leucophloea* and *A. mellifera* and characterized by morphological and cytological studies. The cross inoculation studies with these rhizobial isolates indicated that they are promiscuous. But the degree of nodulation varied with the homologous and heterologous hosts.

NEMATOLOGY

Survey for parasitic nematodes

Mettupalayam – Out of nine tree species examined at Mettupalayam, three tree species viz., *Albizia lebbbeck*, *Aegle marmelose* and *Bassia latifolia* were found to have seven nematode infestation. Root knot nematode, *Meloidogyne incognita*, *Pratylenchus* sp. and *Helicotylenchus dihystera* in *Aegle marmelose* and reniform nematode *Rotylenchulus reniformis* in *Bassia latifolia* were found to be the key nematode parasite.

Poluvampatty – Out of 10 tree species examined at Poluvampatty, 6 tree species viz., *Dalbergia latifolia*, *Pterocarpus marsupium*, *Tamarindus indica*, *Anona squamosa*, *Delonix regia* and *Tectona grandis* were found to have seven nematode infestation.

Sirumugai – Generally, the nursery farm at Sirumugai was found to be severely infested with root knot nematodes, *Meloidogyne incognita*.

Bhavanisagar – Out of seven tree species examined, three species viz., *Pongamia pinnata*, *Tamarindus indica* and *Tectona grandis* were found to be infested with *Pratylenchus* species.

Studies on *Meloidogyne incognita* on *Acacia nilotica*

A field survey on six villages in farmers holding of Coimbatore district conducted from six months showed the presence of six plant parasitic nematodes in *Acacia nilotica* trees. Among them, *Helicotylenchus dihystera*, *Meloidogyne incognita* and *Tylenchorynchus brassicae* occurred in all the sample collected at relative density of 22.4, 48.4 and 8.0 per cent respectively. It was found that 27.3 per cent, 58.9 per cent and 9.8 per cent are their prominence values and 63.5, 88.5 and 41.5 are their importance value (IV) respectively.

The pathogenicity studies conducted on *Acacia nilotica* seedlings with *M. incognita* larvae indicates that when the level of population exceeded 50 larvae/plant, significant reduction in shoot length was found to occur at 60 Dai and thereafter. Highly

significant reduction in shoot length was recorded for 1000 and 5000 larvae/plant after 90 and 120 DAI.

Identification and quantification of allelochemicals in important agroforestry tree species

The results from the Gas Chromatography revealed the presence of the following allelochemicals viz., benzoic acid, catechol, salicylic acid, coumaric acid, ferulic acid, pthalic acid, gentistic acid, protocatechuic acid, P-hydroxy benzoic acid, gallic acid, chinnamic acid, chlorogenic acid, vanillic acid, 2-naphthol, syringic acid, palmitic acid, pyrogallol, phenol, tannic acid and oxalic acids in *Acacia nilotica*, *Tectona grandis*, *Azadirachta indica* and *Gmelina arborea* and it ranged from 0.0024 mM (catechol) to 6.947 mM (vanillic acid).

Studies on bioassay of allelochemicals on agricultural crops

The results showed that the allelopathic compounds identified in the tree species had allelopathic effect on germination and seedling growth of the four test crops viz., cowpea, red gram, black gram and green gram. The results showed that maximum inhibition on germination of the test crops was observed in ferulic acid and catechol at 1 mM and 2 mM concentrations respectively and the minimum inhibition was observed in vanillic acid in both the concentrations. In the case of total seedling length ferulic acid recorded the maximum inhibitory effect whereas oxalic acid observed the promontory effect on test crops at both concentrations.

Studies on sewage and sewage water for increasing wood production

The five selected tree species viz., *Eucalyptus tereticornis*, *Tectona grandis*, *Azadirachta indica*, *Casuarina equisetifolia* and *Acacia nilotica* were raised in the polythene bags containing different potting media. The results revealed that the over all performance on growth characters of tree species was better in the potting media containing Soil + Sand + 4 weeks Composted Sewage Sludge. Among the tree species, *Eucalyptus tereticornis*, *Casuarina equisetifolia* and *Acacia nilotica* were responded well in growth characters viz., seedling height and collar diameter. With respect to the potting media, Soil + Sand mixed Composted Sewage Sludge was better when compared to that of Raw Sewage Sludge alone treatments.

All the five tree species planted in the main field and irrigated with sewage performed better under sewage water irrigation.

Spacing cum fertilizer trial in *Jatropha curcas*

Jatropha curcas was planted with the following treatments. Spacing: S₁ – 1 m x 1 m, S₂ – 2 m x 2 m, S₃ – 1.5 m x 1.5 m, S₄ – 3 m x 3 m and Fertilizer: F₁ – N₀P₀K₀, F₂ – N₁₀P₁₅K₁₅, F₃ – N₂₀P₃₀K₃₀, F₄ – N₃₀P₄₅K₄₅. The work is in progress.

Production of grafted neem plants

Neem trees identified for 6000 ppm and above Azadirachtin content were multiplied vegetatively through grafting approaches. This method resulted in more than 50 per cent success across season and is recommended for adoption for commercial multiplication.

Production of industrial wood species

Eucalyptus tereticornis and *Casuarina equisetifolia* clones were multiplied through Coppice shoot cuttings and sprigs respectively, in the low cost poly tunnels with success of 65 per cent and above across the seasons. This technique is recommended for adoption for large-scale multiplication of these species by the stake holders (Pulp and paper industries).

Production of sex specific clones in Simaruba

A cleft grafting methodology has been developed for adoption for commercial production of male and female clones in *Simarouba glauca*. This method of production resulted in 70% and success across seasons.

DNA finger printing of *Eucalyptus* clones

A RAPD protocol has been developed for molecular characterization of *Eucalyptus* clones of ITC origin. The methodology has been transferred to ITC for registration and patenting of ITC clones.

Micropropagation studies

In *Jatropha curcas* shoot bud proliferation using nodal segments as explants was achieved on MS medium supplemented with 2 mg/ l BAP plus 3 mg/ l Kinetin.

Grain amaranthus

An advanced varietal trial has been conducted in Grain amaranthus with 16 entries. Out of the 16 entries, 2 entries were from Mettupalayam viz., MGA-1 and MGA-2, MGA-2 ranked second in 11 locations in terms of yield and other attributes. MGA – 2 gave an yield of 18-22 q/ha with a protein content of 11.6% and duration of 90-95 days. It will be proposed for national variety release by ICAR during 2004-2005.

Alangium arboreum

Seed germination studies were conducted in *Alangium arboreum*. The results show that treating the seeds with commercial grade Sulphuric acid for 35 minutes increased the germination percent from 50-80 and decreased the germination initiation period from 21 – 14 days.

Establishment of CTA and Screening clones

Clonal testing areas have been established for *Eucalyptus* and *Casuarina* at the fields of pulpwood industry in Tamil Nadu (TNPL). Among 30 clones evaluated in *Eucalyptus*, the clone F.C.& R.I. 14 had 38% increase in plant height and 48% increase in collar diameter compared to the average growth of other clones. In *Casuarina*, clonal evaluation trial with 30 clones, two clones viz., F.C.& R.I.12 and F.C.& R.I. 14 expressed superiority. The clone F.C.& R.I. 12 had 220% increase in plant height and the clone F.C.& R.I. 14 had 93% increase in collar diameter compared to general mean.

On farm testing of *Simarouba glauca* seed sources

Fifteen seed sources were evaluated in three localities (Mettupalayam, Coimbatore and Thindivanam) resulted in early superiority of Mettupalayam seed source in terms of growth and establishment.

On farm testing of *Jatropha* seed sources

Four potential seed sources in *Jatropha curcas* were evaluated in agro farm at Annur, Coimbatore District (TNMC – 4,5,6 and 7). Evaluation study indicated that the culture TNMC – 7 (Thondamuthur, Coimbatore) has showed early superior growth and development.

Technology Development Under Progress

Germplasm bank

Gene and clone banks for teak, Red Sanders, neem, Mahua, Simaruba, *Jatropha*, *Eucalyptus*, *Casuarina*, Bamboo and *Prosopis* have been assembled at Forest College, Mettupalayam.

Clonal propagation studies : Production of quality seedlings

In *Eucalyptus* and *Casuarina*, quality seedlings were produced through rooting of coppice shoot cuttings (*Eucalyptus*) and through sprigs (*Casuarina equisetifolia*) on treatment with IBA 6000 ppm. The rooting of cuttings of identified clones was achieved to the tune of 73% in *Casuarina* and 78% in *Eucalyptus*.

Quality seedlings in Teak were produced on treatment of semi hardwood cuttings with IBA 3000 ppm, to the tune of 51% rooting

In neem, quality seedlings were produced through rooting of cuttings (30-40%) and also through grafts (40-50%).

Thorn less Prosopis, a sterile hybrid was multiplied through stem cuttings using IBA at 3000 ppm.

Screening potential seed sources for higher oil content in *Jatropha*

In *Jatropha curcas* potential seed sources were assessed through extensive survey and potential pockets were identified based on distribution and fruit yield. The seeds were collected and assessed for oil content on kernel basis. The oil content ranged between 26.6% and 35.5%. The highest oil content was recorded by the seed source TNMC-6.

Screening potential seed sources for higher oil content in *Simarouba glauca*

In *Simarouba glauca* 15 seed sources representing different parts of the country were analyzed for oil content, which ranged between 42.06% and 53.63%. A seed source from Trichy was screened as a higher oil content source (53.63%).

Technology Developed

Standardization of seed rate for higher plantable seedling recovery in Silver oak

Effect of Seed quality on seedling recovery and their characters at different seed rates in silver oak

Effect of different mulches on seedling recovery in *Casuarina equisetifolia* in the primary nursery

Standardization of nursery techniques for elite seedling production in *Casuarina equisetifolia* under coastal conditions

Impact of irrigation and integrated nutrient management (INM) on the decongested *Bambusa bambos* (L.)

Effect of method and intensity of felling on culm production and growth in *Bambusa bambos* (L.).

Cowpea is the compatible crop with four multipurpose trees viz., *Acacia holosericea*, *A. nilotica*, *Azadirachta indica* and *Ailanthus excelsa* for western zone of Tamil Nadu.

Gymnema sylvestre is the best shade tolerant medicinal crop for well-grown Teak and Kapok based agroforestry system.

Among the many forage crops viz., Guinea grass, Cumbu Napier, Para Grass and Cenchrus raised under Teak and Gmelina, Guinea grass is the best shade tolerant forage for Teak and Gmelina based agroforestry systems.

The following tree species viz., *Eucalyptus tereticornis*, *Acacia nilotica*, *Acacia auriculiformis*, *Acacia leucophloea* are found suitable to grow under sewage water

In the diagnosis and design survey, the potential agroforestry tree species found to be suitable for Tamil Nadu were *Ceiba pentandra* and *Tamarindus indica*

In the studies on the evaluation of multipurpose tree species of agroforestry utility, *Eucalyptus camaldulensis* was found to produce the maximum dry matter output

In the standardization of vegetative propagation in Kapok, patch budding recorded a success percentage of 50, which can be adopted

Among the grafting methods tried in Kapok, the highest success percentage was registered in cleft grafting. Cleft grafting could be a useful tool in Kapok propagation

In the intercropping experiment, a minimum distance of 2.0m from the trunk was found to be optimum for growing intercrops in *Simarouba glauca*

Study on the effect of 'N' fixing tree (Casuarina) on fruit trees like Amla and Jamun revealed that planting of 'N' fixing tree and fruit tree in the ratio of 3:1 gave the highest girth and height indicating earlier flowering and better yields.

Rain water management for teak, neem and mango in arid and semi-arid regions

Integrated Nutrient Management for casuarina seedlings

Nutrient dynamics in *Gmelina arborea*, teak and silver oak based silvi pastoral system

Soil conservation and moisture distribution under different tree species.

Biofertilizers of rhizobium, phoshobacteria and VAM were isolated from tree species, mass multiplied and supplied to Forest Department, tree cultivators and other stakeholders.

The nematode for arecanut was examined and remedial measures of adding phorate was found to be successful.

More than 2500 insects were documented in forest plantations and natural forests.

Herbaria for diseases were developed for over 200 diseases in forest nurseries natural forests.

Screening shade tolerant medicinal plants for the teak based agroforestry system

The different medicinal plants viz., *Withania somnifera* (Amukara), *Solanum trilobatum* (Thuthuvalai), *Adathoda vasica* (Adathoda), *Ocimum batilicum* (Thiruneetru pachilai), *Aloe vera* (Chothukathalai) and *Ocimum sanctum* (Thulasi) were studied. The results revealed that the medicinal plant *Withania somnifera* performs well under teak plantation followed by the medicinal plant Adathoda.

Studies on the spacing and fertilizer dose in *Simarouba glauca*

Based on the height, diameter and number recorded so far, the spacing 7 m x 7 m recorded the maximum tree height and diameter. Among the fertilizer dose, the dose 150:300:0 kg NPK ha⁻¹ recorded the appreciable increased tree height and diameter.

Studies on the compatibility of agricultural crops with *Simarouba glauca*

The study was conducted with four agricultural crops viz., cowpea, red gram, black gram and green gram. The results showed that among the four crops studied, cowpea was most compatible with Simarouba.

SERICULTURE

Mulberry cultivation

Plant protection

IPM package for leaf webber

An ecofriendly IPM technology involving use of parasitoids, cultural method and mechanical method was developed. The package consisted of flooding the mulberry field to expose the pupae, (on the day of pruning) release of pupal parasitoid, *Tetrastichus howardi* @ 50,000/ ha. (One day after pruning), release of egg parasitoid, *Trichogramma chilonis* @ 5 cc ha. (10 days after pruning), spraying of dichlorvos @ 1 ml/litre (500 ml/ha.) on 30 days after pruning. and mechanical clipping and burning of affected shoots.

IPM package for spiralling whitefly

IPM package was developed for the spiralling whitefly which consisted of installation of yellow sticky traps, removal of weed plants of spiralling whitefly in nearby main crop, spraying with imidachloprid 200 SL at 0.01 % during heavy incidence, release of predators such as *Cryptolaemus montrouzieri* and *Mallada aster* and release of parasitoids such as *Encarsia hatiensis* and *E. guadeloupe*.

BIOCONTROL

For information

Combination of *Helicoverpa armigera* nuclear polyhedrosis virus (HaNPV) and indoxacarb at sublethal concentrations enhances the mortality of 4th instar larvae of *H. armigera*.

Combination of *Helicoverpa armigera* nucleas polyhedrosis virus (HaNPV) and indoxa carb and spinosad at sublethal concentrations was harmful to the egg parasitoid, *Trichogramma chilonis* and the insect predator, *Chrysoperla carnea*.

The entomopathogenic virus, granulosis virus (GV) of *Spodoptera litura* is safe to the egg parasitoid, *Trichogramma chilonis* and the insect predator *Chrysoperla carnea*.

TOXICOLOGY

For information

Samples of seed spices such as cumin, black cumin, fenugreek, coriander, pepper, poppy, ocimum and fennel were analysed for their contamination with insecticide

residues and 3 samples were found to be contaminated with detectable amount of insecticide residues with chlorpyrifos and cypermethrin. But none of the samples had residues above the prescribed MRL.

Waiting periods for chlorpyrifos and λ Cyhalothrin on cardamom and pepper respectively were determined. Chlorpyrifos, being persistent took more than 3 weeks for dissipation both on green capsules and cured capsules of cardamom. The waiting period was around 19.5 days to reach the MRL of 0.5 mg kg⁻¹. Whereas, λ Cyhalothrin, took a little more than 3 weeks on pepper to reach the MRL of 0.02 mg kg⁻¹.

The analytical results of the butter samples analysed (28 samples) in duplicate revealed that 35.7 per cent of the samples were contaminated with HCH and the residues ranged from BDL – 0.0088 ppm. While that of DDT-R was 21.4 per cent (BDL – 0.0074 ppm) and endosulfan was 10.7 per cent (BDL – 0.0031 ppm). In case of ghee samples out of 33 samples analysed 15.2 per cent of the samples were contaminated with HCH (BDL – 0.0087), 21.2 per cent of the samples with DDT (BDL-0.0081) DDT and 12.1 per cent of the samples (BDL – 0.005 ppm) contaminated with endosulfan residues with respect to milk powder samples out of 31 samples analysed 35.5 per cent of the samples were contaminated with HCH residues and the residue level ranged from BDL – 0.0079 ppm. All the milk powder samples were free from DDTs endosulfan residues. Residues of organochlorine insecticidal compounds detected in butter, ghee and infant formulae. Samples were well below this maximum allowable residual limit (MRL) as safe for consumption.

The results of adsorption study of imidacloprid conducted with Entisol, Vertisol and Alfisol revealed that the quantity of imidacloprid adsorbed in soil gets decreased as the concentration in the soil increased. The relative order of adsorption is vertisol>Alfisol>Entisol. More strongly adsorbed slower will be desorption process. The order of desorption is Entisol>Alfisol>Vertisol. The results on the studies on the relative mobility of imidacloprid in the Alfisol system was high which may be due to the sandy loam – texture of the soil.

BEE KEEPING

For Adoption

Tall varieties of coconut were mainly entomophilic and an increased nut set of 13 per cent was recorded mainly due to honey bees visitation.

A special smoke generated by using coir pith and chicken feather as smoker fuel instantaneously drive out rockbees from their comb.

METEOROLOGY

On Farm Testing

Sowing of sorghum either one week earlier to identified sowing weeks through water balance model or as pre monsoon sowing in conjunction with compartmental bunding plus Kcl 1 percent spray each at Panicle Initiation and 50% flowering when Available Soil Moisture is at 50 percent had recorded increased growth, grain yield and BC Ratio. The recorded grain yield was 1246 kg ha⁻¹ under dryland.

Climate Change

Climate change scenarios have been developed to assess the impact of climate change on irrigated and rainfed crop production systems. The regional circulation model (Had RM2) runs developed through the boundary conditions from General Circulation Models (GCMS) were used for the analyses. The model results down scaled for seven locations of southern India showed increases in solar radiation, maximum temperature and minimum temperature by 0.35 MJ / M²/day and 3.4°C respectively. These climate change scenarios developed under control were compared with observed weather to ensure adequate model performance. The average difference between observed and predicted maximum temperature was 0.5°C (\pm 1.6°C), while it was 1.2°C (\pm 0.7°C) for minimum temperature. The radiation was over predicted by 4.3 MJ/M²/day.

Weather based forewarning for pest and disease out break (Cotton)

Aphid population in cotton crop is significantly influenced by wind speed and diurnal variation if the crop is sown on August 15th. One kilometer increase in wind speed had decreased the aphid population by 4 numbers, variation in aphid population is explained by change in wind speed (59.9%) and 72.8 percent variation in aphid population is explained by changes in wind speed and diurnal variation.

Almanac study

Based on the interaction between earth and moon in relation to sun, each month is governed by both new moon and full moon. In between these two, there are fourteen thithies covering 14 days interval. A study was undertaken to find out the association between rainfall and different thithies. Results revealed that the first eight thithies succeeding new moon, and eight thithies preceding the new moon did relate to annual rainfall events. Higher rainfall occurred normally during the eight thithies preceding the new moon as compared to thithies succeeding the new moon. Almost similar results could be noticed for both SWM and NEM seasons. Analysis also indicated that towards full moon phase, the thithie shashti (VI phase) is associated with high rainfall, while such effect was noticed at Ekadesi (XIth phase) thithi towards new moon. High intense rain events occurred frequently during new moon phase as compared to full moon phase.

AGRICULTURAL ENGINEERING

Tractor Mounted Three Row Rotary Weeder

Especially, for the wide row spaced crops like cotton and maize, where the tractor can be run in between rows of standing crop, development of multirow rotary weeder having two or more rotary weeding attachments spaced to run in between the crop rows has good scope of utilizing the tractor for weeding operation.

A three row tractor mounted rotary weeder has been developed at Tamil Nadu Agricultural University with an operating width of 600 mm; the spacing between consequent rotary weeding units is 300 mm. Hence the theoretical width of operation is 2400 mm. The depth of operation is 75 to 100 mm. The speed of operation is 1.00 to 2.00 kmph.

The rotary unit consists of 4 nos of “L” shaped blades per flange. The length of blade is 129 mm with a blade pitch of 46 mm and byte length of 20 mm. The orientation angle of blade is 50° with the horizontal. The speed of the rotary unit is about 200 rpm. The cost of weeding is Rs. 174.18/ha as against Rs. 2700 per ha in the case of manual weeding by women labourers. The field capacity of the machine is 2.5 to 4.0 ha/day.

Tractor mounted banana clump remover

A tractor operated banana clump remover has been developed at TNAU, Coimbatore to mechanize the clump removing operation and to reduce human drudgery involved in the operation. The equipment is designed to be attached to the 3 point linkage of a 35 hp tractor. The 9 tyne cultivator frame has been adopted for the development of the equipment. Two numbers of 100x15x1000 mm sub-soiler shanks with shares of size 190x40x5 mm have been fitted in the cultivator frame at 225 mm spacing. These two sub soilers act as a fork while removing the banana clump. A deflector is provided to push the soil sideward.

The tractor along with the attached banana clump remover equipment is positioned in such a way that the banana clump to be removed is just in front of the sub soiler shank. With the help of the hydraulic system of the tractor, the sub-soiler shank is pressed into soil and the tractor is gently moved forward, simultaneously lifting the sub-soiler shank. The effect of lifting by the sub - soiler shank and the simultaneous forward movement of the tractor helps in removal of the entire clump along with its root portion as a whole mass.

The cost of the equipment is Rs.6000/-. Savings in time and savings in labour when compared to manual digging is 85% and 90% respectively.

Improved Farm Level Turmeric Boiler

The steam boiling type improved turmeric boiler consists of a trough (outer drum), inner perforated drums and lid. The outer drum is made of 16 SWG thick galvanized iron sheet to a size of 1.2 x 1.2 x 0.55 m with four numbers of inner drums of 48 x 48 x 45 cm size, made of perforated sheet and provided in the outer drum. Further the outer drum can be made to any size to suit the requirement of the farmer with any capacity. A lid is provided with hooks for easy lifting and provided with an inspection door for checking

completion of boiling. The outer drum is placed with more than half of its height below the ground level which serves as a furnace. Water is filled in the outer drum for about 6-8 cm depth. About 50-60 kg of well washed rhizome is taken in each inner drum and placed in the boiler and the lid is placed in position. Boiling is done using the available agricultural waste materials, mostly, the dried turmeric leaves as fuel. It takes about 25 minutes to produce steam and boil the rhizomes and 10-15 minutes for the subsequent batches.

The capacity of the unit is 5 tonnes per day. The cost of the unit (with 200 or 240 kg per batch capacity) is about Rs.7,000/- and the cost of boiling of turmeric rhizomes is Rs.10 per quintal. The comparative savings in time and fuel are 65 and 30%. Comparative savings in water and drying time are 80 and 20%.

Bio diesel plant

In Tamil Nadu, *Jatropha* has been grown in dry tracts, particularly in places, where the altitude is upto 1400 m above MSL. It is estimated that *Jatropha* seeds contains 66-67 per cent kernel which has 46-58 per cent oil. Using expellers, it is possible to extract 30-35 per cent oil from the seed. The oil could be converted into liquid fuel by esterification process and this process has now been perfected.

The oil extracted from the seeds of *Jatropha* is mixed with methanol and caustic soda at suitable proportion and at a particular temperature. This solution is continuously stirred for two hours. During the above process, glycerol present in the solution separates out; which when settled can be removed. Whatever is left after removing the glycerol is the liquid fuel. When the liquid fuel is washed twice, purified biodiesel is obtained. This could be used directly for running the diesel engines.

The biodiesel pilot plant developed in the Department of Bio Energy consists of a reaction vessel with heater and stirrer, a container for supplying methanol and chemical, three settling tanks and a washing tank. By using the plant about 250 litres of biodiesel can be produced in a day. Depending upon the need, the size of the unit can be scaled up to higher production capacity.

HSC & RI, MADURAI

Herbal drink

Herbal drinks were prepared with herbal powders such as rose, lotus, avaram, shoe flower and cutch tree bark at various concentrations. Among the concentrations 1 percent was found to be organoleptically good. The herbal tea could be stored for a period of 180 days and the cost of production for rose, lotus powder, avaram powder and cutch tree bark powder was Rs. 35, Rs. 23 and Rs. 35 per 100 g respectively.

Soya based protein foods

Study was undertaken to develop supplementary food using spirulina. Spirulina powder was incorporated at 5 per cent in supplementary food preparation for the preschoolers. Children given spirulina supplementary food showed good improvement in the nutritional status.

BIOTECHNOLOGY

Production of high yielding rice varieties through biotechnology

The paddy hybrids developed through tissue culture and pollen culture methods were field tested. Results had shown that CP (Mass) 20001 culture had yielded 7185 kg/ha which is 25-35% higher yield than other varieties. 21 other cultures of paddy were also tested. The results shows that DH 48 culture had given higher yield of 5105 kg/ha with a duration of 125 days.

Resistant characters against yellow stem borer in paddy

Analysis on the rice characteristics and damage of yellow stem borer, revealed that rice stem length and breadth influences the yellow stem borer attack. Short length and breadth of stem in rice varieties tend to resist the yellow stem borer.

Molecular studies revealed that 12 micro satellite marker in the stem portion is found to be immune against the yellow stem borer.

Drought resistant varieties through molecular technology in paddy

The drought resistant local varieties of paddy were found to possess higher length and width of roots. It has been planned to incorporate these characteristics into the new high yielding varieties through molecular marker technology.

Under the scheme drought resistant local varieties like Noottripatthu, Norungan, Kallurundaikar and PKM 2 are crossed with high yielding varieties like CO 43, IR 20, IR 64 and 62266 to develop 56 hybrids.

Breeder seed production and distribution

With a view to supply quality seeds to the farming community and to support the state development departments connected with Agriculture and the Seed Industry, Tamil Nadu Agricultural University is supplying breeder seed for further multiplication and distribution. Against the total targeted indent of 1,82,611 kg of seed 1,66,779 kg have been supplied.

Crop	Indent for 2003-2004				Distribution 2003-2004			
	Central	State	Pvt.	Total	Central	State	Pvt.	Total
PADDY	4,300	23,691	26,575	54,566	1,050	27,246	45,960	74,256
MILLETS	-	281	-	281	-	377	189	566
PULSES	100	10,143	352	10,595	-	11,579	1,840	13,419
OILSEEDS	9,445	98,819	8,005	1,16,269	1,025	70,818	5,619	77,462
COTTON	15	278	497	790	15	252	476	743
FORAGE CROPS	110	-	-	110	-	-	333	333
	13,970	133,212	35,429	1,82,611	2,090	1,10,272	54,417	1,66,779