WESTERN ZONE - STATUS PAPER

1. Geographical divisionwise distribution :

This zone comprises of 21 revenue taluks carved out of 7 districts *viz*., Coimbatore, Erode, Namakkal, Karur, Dindigul, Madurai and Theni. It comprises of all the revenue taluks of Coimbatore and Erode districts, Thiruchengodu of Namakkal, Karur and Manapparai of Karur, Nilakottai and Palani of Dindigul, Usilampatti of Madurai and Uthamapalayam and Periyakulam of Theni districts.

The Erode district comprising of 7 taluks constitutes more geographical area of 8228 sq.km. followed by Coimbatore district with 7469 sq.km. The minimum geographical area is from Namakkal district wherefrom Thiruchangodu taluk alone falls under the zone with a spread of 864 sq.km. The geographical area of the zone altogether is put at 24567 sq.km.

The zone is situated between 9° 30' and 12° North latitude and 70° 30' - 78° East longitude. The attitude of the zone ranges from 160 to 2700 m above MSL. The 21 taluks of the zone comprises of 67 blocks covering 1369 villages.

The zone has undulating topography sloping towards west to east with small hillocks here and there having an altitude ranging from 171 to 1525 m above MSL. The western and northern parts of the zone are bounded by the western ghats bordering Kerala and Karnataka states with peaks ranging from 1000 to 2700 m above MSL. The Nilgiris on the Nort-west and Anamalais on the South are the chief ranges that attain heights over 2400 m. The eastern part of the zone is bordered by the Namakkal, Karur and Dindugul districts. The southern part of the zone lies in Madurai and Theni districts having contours of various altitudes.

The northern part of the zone bordering Karnataka state which contains one block namely Thalavadi, has undulating plains and hills. The rest of the area is an undulating plain sloping gradually from west to east. The mountain pass in the western

ghats lining the Coimbatore district brings the South-West monsoon from Kerala to the bordering taluks of the zone.

Palani hills forming the northern spur of the western ghat range in height from 1000 - 2700m and comprise three valleys viz., Parapalar-Devankarai valley, the Guntur valley and the Upper Amaravathi valley and contain several peaks like Perumal, hill, Vandarani hill. The lower plains consist of a heterogeneous jumble of peaks from 1000-1700 m height separated from one another by steep and beautiful wooded valleys. The hills in this part are Thandikudi and Virupakshi and on the east Sirumalai and Alagarmalai.

In the southern part of the zone, Ulamparai of Uthampalayam taluk has the maximum altitude of 2400 m above MSL having dense forest reserves. The rest of the area have undulating plains having the slope from North to East.

The talukwise area and related particulars are given in Table 1.

Table 1. Geographical and Physiography of Western Zone

Sl. No.	District/Taluk	No. of taluks	No. of blocks	No. of villages	Area sq.km
I. COIMBATORE DISTRICT					
1.	Coimbatore	1	5	68	1330
2.	Mettupalayam	1	1	71	697
3.	Avinashi	1	2	53	665
4.	Palladam	1	5	132	1519
5.	Udumalpet	1	3	55	1418
6.	Pollachi	1	4	86	1840
	Total	**6**	**20**	**465**	**7469**
II. ERODE DISTRICT					
1.	Erode	1	3	46	751
2.	Perundurai	1	3	90	805
3.	Gobichettipalayam	1	3	44	777
4.	Sathyamangalam	1	3	40	2203
5.	Bhavani	1	3	48	1477
6.	Dharapuram	1	3	51	1366
7.	Kangeyam	1	2	24	845
	Total	**7**	**20**	**343**	**8228**
III. NAMAKKAL DISTRICT					
1.	Tiruchengodu	1	4	115	864
	Total	**1**	**4**	**115**	**864**
IV. KARUR DISTRICT					
1.	Karur	1	5	43	1065
2.	Manapparai	1	3	52	697
	Total	**2**	**8**	**95**	**1762**
V. DINDIGUL DISTRICT					
1.	Nilakottai	1	2	43	327
2.	Palani	1	3	117	302
	Total	**2**	**5**	**160**	**629**
VI. MADURAI DISTRICT					
1.	Usilampatti	1	3	87	1089
	Total	**1**	**3**	**87**	**1089**
VII. THENI DISTRICT					
1.	Periyakulam	1	4	50	1514
2.	Uthamapalayam	1	4	54	1350
	Total	**2**	**8**	**104**	**2864**

2. Rainfall data of each division :

The Western Zone is blessed both by South West and North East Monsoons unlike the entire Tamil Nadu which is largely benefited by the latter. For instance, Pollachi taluk gets about 50 per cent of rainfall from South West Monsoon (Table 2). On the contrary, nearby Udumalpet taluk is benefited largely by North East Monsoon contributing 57 per cent of total rainfall. The rainfall thus is bimodal in many other taluks. Among the 21 taluks, Pollachi followed by Usilampatti and Erode receive > 350mm of rainfall from South East Monsoon. Manapparai, Gopichettipalayam, Trichengodu and Perunthurai taluks receive a little over 300mm of rainfall from the same monsoon. Because of relatively larger amount of rainfall from first monsoon (South West) double cropping is a practice in rainfed lands. The taluks *viz*., Dharapuram, Palladam receive 124 and 166mm of rainfall respectively. Thus these taluks are highly rain shadowed and hence drought prone.

As regards North East Monsoon, Usilampatti taluk receives rainfall more than 500mm (582.1mm). It is followed by Udumalpet and Coimbatore receiving about 425mm of rains from this monsoon.

Pollachi taluk receives just 221mm from the second monsoon and is still low in Karur receiving hardly 174mm of rainfall. Thus, this brief analysis cautions us that rainfed cropping should not depend much on this monsoon's rainfall in these two taluks. To clarify further, rainfed cropping should terminate well in advance before the closure of North East Monsoon.

A high rainfall of 384mm from the first monsoon in Pollachi taluk preceded by reliable summer rains during April, May favours summer rainfed Groundnut cropping in this tract.

The total rainfall ranges from as low as 470.2mm in Dharapuram taluk to as high as 1120.7mm in Usilampatti taluk. Taluks like Palladam (663.1mm) receive low rainfall.

The analysis thus further reveals that taluks such as Dharapuram, Palladam, Bhavani should receive more attention on the promotion of agro-based industries in view of poor rains.

Though bimodal rainfall is received in many taluks, the quantum of rainfall particularly from South West Monsoon is not so high in almost all the taluks except Pollachi. This indicates that drought tolerance has to be the primary objective in breeding and developing varieties for rainfed situation. Possibly that might be the season why cultivation of spreading groundnut variety is in vogue traditionally in Trichengodu and nearby taluks.

There is more variation from taluk to taluk with regard to receipt of rain from both the monsoons. This variation again clearly indicates that taluk level or still at block level site specific recommendations right from the selection of varieties to the usage of various inputs are required particularly for rainfed cropping.

The zone's average rainfall is 774.6mm which is considerably less than the state's average emphasizing our greater attention on rainfed research be it crop improvement or crop management or plant protection aspects. This research need is further confirmed from the rainfall related indices such as water balance studies (AE/PE) (Table 3). The favourable period as per AE/PE ratio with least stress is less than 10 weeks in 7 out of 17 taluks of Western Zone studied.

The success of rainfed agriculture depends inter alia offseason tillage to utilise summer showers. Monthwise analysis of rainfall of 21 taluks spread over 7 districts reveal that during the month of May (vide monthwise rainfall), fairly good amount of summer showers are received. The summer showers during May are more in Coimbatore and Erode districts particularly. This should be capitalised and summer ploughing is to be seen that the farmers are following in large scale during the month of May.

Table 2. Season wise rainfall data

Sl. No.	Taluk	South West Monsoon (mm)	North east Monsoon (mm)	Total annual rainfall (mm)
1.	Avinasi	255.7 (36.42)	306.7 (43.68)	702.1
2.	Mettupalayam	140.5 (19.94)	397.3 (56.38)	704.7
3.	Palani	171.1 (26.74)	357.3 (55.84)	639.9
4.	Karur	253.0 (46.87)	173.5 (32.15)	539.8
5.	Manappari	315.6 (38.71)	374.4 (45.93)	815.3
6.	Usilampatti	352.1 (31.41)	582.1 (51.94)	1120.7
7.	Uthamapalayam	208.5 (33.09)	274.1 (43.49)	630.1
8.	Nilakottai	268.2 (37.17)	317.9 (44.06)	721.5
9.	Periyakulam	181.9 (24.70)	317.3 (43.08)	736.5
10.	Gobichettipalaym	312.7 (42.76)	294.4 (40.26)	731.4
11.	Sathyamangalam	279.5 (38.30)	325.1 (44.55)	729.9
12.	Erode	347.2 (44.97)	306.3 (38.79)	789.7
13.	Kankeyam	209.3 (36.39)	261.6 (45.48)	575.2
14.	Perundurai	301.0 (42.97)	299.0 (42.67)	700.4
15.	Bhavani	294.1 (45.31)	249.0 (38.36)	649.1
16.	Dharapuram	123.8 (26.32)	240.9 (51.24)	470.2
17.	Coimbatore	305.5 (31.52)	426.0 (43.95)	969.3
18.	Udumalpet	192.2 (25.64)	428.6 (57.18)	749.6
19.	Palladam	166.1 (25.05)	356.7 (32.79)	663.1
20.	Pollachi	384.0 (50.22)	221.0 (28.91)	764.5
21.	Trichengodu	302.9 (35.76)	302.9 (35.76)	847.1
	Average	-	-	774.6

Table 3. Water balance studies

Sl. No.	Taluks	Dry period AE/PE less than 0.5		Less favourable period (AE/PE=0.5 to 0.74) with modest stress		Favourable period (AE/PE=0.75 to 1.00) with least stress	
		Std. Week Number	Period (No. of weeks)	Std Week Number	Period (No. of weeks)	Std Week number	Period No. of weeks)
1.	Mettupalayam	1-37,39,40	39	38, 41	2	42-52	11
2.	Avinashi	1-17,21-34	32	18-20,35-38	9	39-49	11
3.	Coimbatore(N)	1-38	38	39-41,50-52	6	42-49	8
4.	Coimbatore(S)	1-38	38	39-41,50-52	6	42-49	8
5.	Udumalpet	1-40	40	41,42,50-52	5	43-49	7
6.	Palladam	1-37	37	38-41,50-52	7	42-49	8
7.	Bhavani	1-19,22-33, 52	32	20-21,34-37	8	38-49	12
8.	Erode	1-18,22-31	27	19-21,32-36	11	37-50	14
9.	Kankeyam	1-37	37	38-40,50-52	6	41-49	9
10.	Dharapuram	1-37	37	38-40,50-52	6	41-49	9
11.	Perundurai	1-34	34	35-37.50-52	6	38-49	12
12.	Gobichetti-palayam	1-18.22-34	31	19-21,35-38 50-52	10	38-50	13
13.	Sathyaman-galam	1-18.22-34	31	19-21,35-38 50-52	10	39-49	11
14.	Trichengodu	1-18, 23-29	25	19-22,30-36 50-52	15	38-49	12
15.	Palani	3-37	35	1-3,38-40	5	41-52	12
16.	Manapparai	3-33	31	1,2,34,35	4	36-52	17
17.	Karur	1-36	36	37-40,49-52	7	41-48	9

3. Different soil types :

This zone has a variety of soil types. There are (i) red non-calcareous (ii) red calcareous (iii) black calcareous (iv) alluvial (v) colluvial, mixed soils and associations (vi) forest soil and (vii) saline alkali soil. Among the different types the red non-calcareous soil is dominating in this zone. It comprises of Irugur, Vannapatti and Pichanur series. The soils of Irugur series alone account for 37 per cent of the total area of the zone, and distributed widely in Erode and Coimbatore districts and smaller extent in other districts. Vannapatti series is another red non-calcareous soil occupying major area in Karur taluk. The Vylogam soil series is in limited area and is subjected to crust formation and erosion. They are found in Nilakkottai, Usilampatti and Karur taluks. Palaviduthi series is seen mainly in Nilakkottai and Usilampatti taluks and to some extent in Palani taluk.

The next predominant soil type is red-calcareous. It comprises Palladam, Tulukanur, Palathurai and Anaiyur series. Palladam series is found mostly in Coimbatore district and Tulukanur series in Erode district and Karur taluk.

In black calcareous soil type, Peelamedu series is an important one occupying almost all taluks of this zone.

In this zone, progressive farmers are more. They calculate and change crops frequently based on the returns, labour and water requirements. When the trend in switching over crops is so, many crops incompatible to calcareousness of the soil are being grown nowadays by the farmers inviting plant disorders such as iron induced chlorosis.

Alluvial, colluvial and soil associations are distributed in Nilakottai, Usilampatti and Karur taluks. In some pockets of Coimbatore taluk mixed type is found. Peelamedu, Anaiyur, Palathurai series are associated with sodicity.

Forest soils are distributed in Erode and Coimbatore districts as well as in Nilakottai, Palani and Usilampatti taluks. They occupy about 30 per cent of the total geographical area of the Western Zone.

Table 4. Soil types and series of Western Zone

Soil series & type	Features (Potentials)	Limitations	Distribution
(1)	(2)	(3)	(4)
Red Soils Red Soil (Calcareous) Palladam series	Colour of the AP horizon dark reddish brown (2.5 YR 3/2) to dark brown (7.5 YR 4/4) surface texture from gravelly sandy loam to loamy sand that of surface soil colour from dark reddish brown (2.5 YR 4/3) to dark brown (7.5 YR 4/2) and texture from sandy loam. Well drained and moderate permeability	Thickness of the solum is barely 15 cm or less in places of severe sheet erosion. In certain places lime is exposed on the surface. Excessive drainage high evaporation, low in fertility water holding capacity and organic matter content	Avinashi, Erode, Palladam, Pollachi, Mettupalayam village of Karur taluk.
Okkalipalayam series	Colour AP horizon ranges from dark grey brown (10 YR 4/2) to reddish brown (5 YR 3/2) and that of the sub-soil from dark brown (7.5 YR 3/2). The texture of the surface soils ranges from loamy sand to sandy loam and the sub soil from loam to sandy clay loam	Alkaline pH and ameliorative measures should be taken as a pre-cautionary measures.	Coimbatore taluk
Chikkarasampalayam series	Yellowish brown to dark brown, clay to sandy clay loam, pH 7, gneisis with calcium carbonate well drained.	Rapid permeability	Gobichetti-palayam taluk
Kuppandampalayam series	Dark yellowish brown to dark brown, sandy clay loam calcareous moderately well drained pH 8.5 gneisis with Calcium carbonate	Moderate to strong alkaline low organic matter in Zn, Fe and B	Bhavani taluk

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Alluvial (Calcareous) Kangeyampalayam series	Dark grey brown to dark brown very deep non-calcareous moderately well drained, pH 7.3	Subject to erosion, low CEC excessive drainage, poor water holding capacity and organic matter content	Erode taluk
Kallivalasu	Yellowish brown to brown, calcareous, very deep, well drained, very deep loamy to sandy loam lime concretions pH 8.0	Severe erosion shallow, poor water holding capacity, organic matter and fertility status	Dharapuram taluk
Kodiveri series	Dark grey clay loam, deep calcareous, moderately well drained, pH 7.8	-	Gobichetti-palayam taluk
Noyyal series	Brown to dark brown, very deep non-calcareous sandy loam to loam, pH 8.3	-	Coimbatore & Palladam taluks
Mixed Soils Periyanaicken-palayam (Black soil overlying the red calcareous soil)	Dark brown clay loam, calcium carbonate concretion, deep to very deep pH 8.4, clayey lime concretions	Poor drainage	Coimbatore taluk
Alluvium series	Dark yellowish brown sandy clay loam, moderately drained pH 9.0, show stratification of layers. Calcareous soils are deep to very deep	-	Distributed in the areas adjoining the river Cauvery and Amaravathi of Udumalpet & Karur taluks

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Tulukkanur series	The colour of AP horizon ranges from yellowish red (5 YR 4/6) to reddish brown (5 YR 4/4) and that of the B horizon from reddish brown (5 YR 4/4) to dark red (2.5 YR 3/6). The texture of the surface soil ranges from clay loam to sandy clay loam and that of the sub soil' gravelly clay loam to sandy clay loam. The structure varies from granular to blocky. Inclusions in this series are eroded soils on slope have 7" to 8" thick solum with quartise gravel and lime Kankar on the surface.	Moderately drained with moderate permeability. Poor organic matter and nutrient content highly calcareous excessive drainage	Dharapuram and Karur taluks
Palathurai series	The colour of A horizon ranges from yellowish red (5 YR 4/6) to dark reddish brown (2.5 YR 3/2) Texture of the sub soil ranges from sandy loam to gravelly clay loam. Over certain areas calcium carbonate concretions are found right on the surface. Thickness of the horizon ranges between 5 to 20 cm decreasing with gradient and intensity of erosion. The pH of the AP horizon ranges from 8.2 to 8.5 and that of B horizon from 7.4 and 8.5	Well drained with moderate permeability, poor in water holding capacity, poor in organic matter, Alkaline, low exchangeable Ca, poor fertility	Coimbatore, Avinashi and Erode taluks.

Cont. ..

Red soils (non-calcareous) Vellalur series	The texture of the top soil varies from sandy loam to gravelly loam and that of the sub soil from gravelly clay loam. Iron gravels are also present on the surface but it varies depending upon the extent of erosion.	Well drained internally with moderate permeability; low in fertility, exchange-able Ca per cent and organic matter content	Avinashi, Coimbatore and Palladam taluks
Vannapatti series	The colour of the surface soil varies from reddish brown (5 YR 4/4) to yellowish red (5 YR 4/6) and that of the sub soil from dark (2.5 YR 3/6) to red (2.8 YR 4/8). The texture of the sub-soil varies from sandy clay loam to gravelly clay loam. On B slopes, the soils have moderate erosion and quartz gravel is distinctly seen on the surface.	Well drained with moderately rapid permeability poor soil depth, severe erosion, excessive drainage, poor available nutrient status and organic matter content.	Coimbatore, Dharapuram, Vellalapatti village of Karur taluks.
Anamalai series	Texture of the A horizon range from sandy loam to sandy clay loam and the colour from dark reddish brown to dark brown quartz pieces are seen throughout the B horizon	Moderate to rapid drainage from the surface and moderate internally.	Pollachi taluk

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Thalavadi series	The colour of the surface soil ranges from reddish brown (5 YR 4/4) yellowish red (5 YR 4/6) to brown (7.5 YR 5/4). The texture of the surface soil ranges from loamy sand to sandy clay loam. The colour of the sub soil ranges from dark reddish brown (2.5 YR 4/6) to dark red (2.5 YR 3/6) and its texture varies from gravelly clay loam to clay loam.	Shallow soil severe erosion well drained rapid permeability, poor water nutrient storage, poor organic matter content and fertility.	Gobichetti-palayam taluk
Pichanur series	Texture of the A horizon ranges from loamy sand to coarse sand depending upon the degrees of sheet erosion. Colour ranges from dark reddish brown (2.5 YR 3/4) to dark brown (10 YR 4/3). Few to numerous small fragments to quartz and gneissic material occur sometimes on the surface and throughout the B horizon.	Well drained with moderately rapid permeability, subjected to erosion at higher elevations.	Coimbatore, Avinashi, Nilakkottai and Usilampatti taluks.
Irugur series	The texture of the surface soil from loamy sand to sandy loam and the colour varies from yellowish red (5 YR 4/6, 5 YR 3/6). The texture of the sub soil varies from sandy clay loam to gravelly clay loam. The quartz gravel is absent in some places and is also seen with lime which produces strong effervescence in some places where water stagnates but is never a common feature on this series	Moderately well drained, permeability rapid from the surface and moderately rapid internally shallow soil, subject to erosion excessive with evaporation low cation exchange capacity and organic matter poor fertility	Coimbatore, Avinashi, Erode, Gobichetti-palayam, Bhavani, Pollachi, Udumalpet & Nilakkottai taluks.

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Somayyanur series	The colour of the A horizon varies from yellowish red (5 YR 5/6) to dark yellowish (5 YR 3/4) brown and the sub soil from dark red (2.8 YR 3/6) to dark reddish brown (2.5 YR 3/4). The texture of the surface soil is sandy and the texture of the sub soil varies from sandy loam to loamy sand. Occasionally 5 to 8 cm thick quartz gravel is present in the B horizon. The pH of the sub soil ranges from 6.3 to 7.3.	Excessively drained from the surface	Coimbatore, Avinashi and Uthama-palayam taluks.
<u>Red colluvial soils (Non-calcareous)</u> Chavadiparai series	Reddish brown, sandy loam pH 6.9 medium week granular structure.	Well drained	Coimbatore taluk
Sathyamangalam series	Yellowish brown to dark brown sandy clay loam pH 7.9 moderate permeability highly calcareous shallow to moderately deep gneissic rock with calcium carbonate	Shallow soil severe erosion low organic matter and not suited for orchard	Gobichetti-palayam taluk
Malupatti series	Yellowish brown to dark brown sandy clay loam pH 7.9 moderate permeability highly calcareous shallow to moderately deep gneissic rock with calcium carbonate	Shallow soil severe erosion low organic matter and not suited for orchard.	Gobichetti-palayam taluk
Syamalagounden-pudur series	Dark brown to dark yellowish brown, calcareous loamy pH 8.1, calcium carbonate as nodules or sheet at C horizon well drained rapid permeability	-	Udumalpet taluk
Soorianallur series	Brown to yellowish brown sandy loam to clay loam pH 8.0, well drained, deep to very deep	-	Dharapuram taluk

Cont. ..

Black soils (Calcareous) Peelamedu series	Very dark brown, clay loam blocky, pH 8.6, high exchangeable Ca and water holding capacity, free from salinity deep soil	Poor drainage alkaline soil low organic matter, low fertility, low permeability	Usilampatti, Avinashi, Coimbatore, Gobichetti-palayam, Palladam, Pollachi, Udumalpet & Nilakottai taluks.
Dhasarapatti series	Very dark brown clay loam, pH 7.0 moderately drained deep to very deep, presence of gypsum	Low permeability	Palladam, Dharapuram and Pollachi taluks.
Ammapet series	Dark grey brown deep calcareous clay pH. 7.8 presence of iron concretions, faint mottling presence of calcium carbonate	Imperfectly drained, low permeability poor organic matter	Bhavani taluk.

4. Different crops cultivated, area covered, popular varieties and their performance

Area of important cereals and millets, pulses, oilseeds, commercial crops and vegetables is furnished talukwise in Tales 5 to 9. Similarly area, production, productivity of these crops are furnished districtwise in Tables 10 to 12. Barring Combatore and Erode districts, only certain taluks in the remaining five districts viz., Karur, Namakkal, Madurai, Theni and Dindigul fall under Western Zone. Therefore the districtwise figures may not represent the taluks that fall under the zone. Nevertheless, the possibility of increasing area of certain field crops and improving the productivity of crops at taluk level could be analysed from the districtwise figures.

4.1 Cereals and millets:

Among different taluks, rice is under more area in Erode (20,296 ha), jowar in Trichengodu (1460 ha), bajara in Nilakkotai (407 ha) and maize in Udumalpet (7534 ha) taluks. An interesting feature is that maize area in this zone outdo the traditional millet jowar warranting shift in our focus on the former.

Maize assumes more industrial importance and it becomes more a commercial crop. Since its area is increasing surpassing even jowar and as it is having more industrial importance, the Western Zone could very well be earmarked for promoting maize based industries.

4.2 Pulses :

Pulses area by and large is meager and individual pulses occupy even less than 100 ha in many taluks. Relatively the area under cowpea is more. With 5' spacing for sugarcane becoming obligatory as insisted by the sugar factories in Erode district, there is large scope now for intercropping of pulses.

4.3 Oilseeds :

The area under groundnut is more in Tiruchengodu taluk mainly with spreading variety. Since there is price crash in edible oils in general, switching over to table varieties of groundnut particularly in Tiruchengodu and Erode districts would be worth attempting. It requires research on screening of suitable varieties.

4.4 Commercial crops :

The area under commercial crop is skewed. They are under more area in Coimbatore and Erode districts of Western Zone. It requires further investigation in detail as to why commercial crops are not popular in other districts of the zone. The banana area is more in Avinashi taluk. Similarly turmeric area in more in all the taluks of Erode district except Kangayam and Dharapuram taluks.

4.5 Vegetables :

Tomato is the major vegetable crop followed by onion. Drumstick is under more area in Dharapuram taluk.. Tomato based industries are worth to promote particularly in Coimbatore district were the area is large and the drumstick in Dharapuram district as price of these vegetable is fluctuating widely sometimes even not meeting the cost of production.

Table 5: Talukwise area (in ha) of important cereal crops (1998-99)
(Figures collected from Commissioner of Statistics, Chennai)

Sl. No.	DISTRICT / TALUK	RICE	JOWAR	BAJRA	MAIZE	RAGI
I. Coimbatore						
1.	Avinasi	210	121	6	109	4
2.	Palladam	86	804	1	3551	-
3.	Pollachi	5333	1259	1	723	3
4.	Udumalpet	9672	581	41	7534	5
5.	Coimbatore	1091	129	5	755	14
6.	Mettupalayam	641	214	12	106	28
II. Erode						
1.	Erode	20296	17	1	92	10
2.	Perundurai	4138	51	11	19	10
3.	Gobichettipalayam	17010	3	167	166	135
4.	Bhavani	7324	-	11	61	154
5.	Sathy	3705	441	91	253	86
6.	Dharapuram	5628	583	67	949	4
7.	Kangayam	3411	873	16	78	39
III. Madurai						
1.	Usilampatti	8395	147	-	61	15
IV. Nammakal						
1.	Trichengodu	5907	1460	-	98	261
V. Theni						
1.	Uthamapalayam	8895	219	22	171	6
2.	Periyakulam	2174	55	-	147	9
VI. Karur						
1.	Karur	2599	366	42	-	1
2.	Manaparai	4279	92	48	-	47
VII. Dindugal						
1.	Nilakottai	3342	371	407	-	-
2.	Palani	3069	303	11	2709	5

Table 6 : Talukwise area (in ha) of important pulse crops (1998-99)
(Figures collected from Commissioner of Statistics, Chennai)

Sl. No.	DISTRICT / TALUK	GREEN GRAM	BLACK GRAM	BENGAL GRAM	RED GRAM	COWPEA
I. Coimbatore						
1.	Avinasi	12	11	-	11	185
2.	Palladam	118	19	-	19	141
3.	Pollachi	6	10	18	10	46
4.	Udumalpet	29	23	-	23	140
5.	Coimbatore	27	89	-	5	25
6.	Mettupalayam	23	40	-	-	80
II. Erode						
1.	Erode	33	49	-	-	5
2.	Perundurai	22	50	-	13	46
3.	Gobichettipalayam	29	39	-	23	41
4.	Bhavani	83	87	-	83	30
5.	Sathy	30	83	-	22	78
6.	Dharapuram	76	64	-	3	80
7.	Kangayam	59	207	-	6	105
III. Madurai						
1.	Usilampatti	23	1	-	38	24
IV. Nammakal						
1.	Trichengodu	249	239	3	-	57
V. Theni						
1.	Uthamapalayam	-	10	-	50	-
2.	Periyakulam	-	26	-	-	37
VI. Karur						
1.	Karur	-	6	-	1	-
2.	Manaparai	2	31	-	1	-
VII. Dindugal						
1.	Nilakottai	136	52	-	37	6
2.	Palani	23	28	-	4	-

Table 7 : Talukwise area (in ha) of important Oilseed crops (1998-99)
(Figures collected from Commissioner of Statistics, Chennai)

Sl. No.	DISTRICT/ TALUK	Groundnut	Gingelly	Sunflower	Castor	Coconut
I. Coimbatore						
1.	Avinasi	39	247	3	-	798
2.	Palladam	181	24	48	-	5677
3.	Pollachi	7467	2	30	1	36755
4.	Udumalpet	1600	45	234	1	14243
5.	Coimbatore	285	33	-	-	5024
6.	Mettupalayam	27	12	-	-	811
II. Erode						
1.	Erode	2048	3522	5	3	1343
2.	Perundurai	1248	869	4	22	741
3.	Gobichettipalayam	2013	90	7	25	797
4.	Bhavani	4336	1080	14	63	609
5.	Sathy	382	136	92	23	708
6.	Dharapuram	1995	270	597	1	1889
7.	Kangayam	1248	1146	508	-	1281
III. Madurai						
1.	Usilampatti	320	3	5	-	356
IV. Nammakal						
1.	Trichengodu	4355	1101	55	-	185
V. Theni						
1.	Uthamapalayam	920	5	105	4	5336
2.	Periyakulam	68	375	2	10	2369
VI. Karur						
1.	Karur	924	72	30	1	1073
2.	Manaparai	1830	7	11	3	1925
VII. Dindugal						
1.	Nilakottai	65	138	9	1	2187
2.	Palani	981	17	152	6	1618

Table 8 : Talukwise area (in ha) of important commercial crops (1998-99)
(Figures collected from Commissioner of Statistics, Chennai)

Sl. No.	District	Cotton	Sugar cane	Banana	Chillies	Turmeric	Tobacco	Tapioca	Curry leaf
I. Coimbatore									
1.	Avinasi	1346	1096	1893	83	464	280	60	52
2.	Palladam	214	142	473	566	93	411	67	30
3.	Pollachi	2064	677	186	-	79	1	421	9
4.	Udumalpet	1976	3961	95	465	6	35	2	-
5.	Coimbatore	562	1886	4	444	912	-	88	14
6.	Mettupalayam	311	548	172	142	8	309	71	521
II. Erode									
1.	Erode	61	2592	678	3	3122	27	1601	1
2.	Perundurai	1675	1168	518	118	884	151	267	2
3.	Gobichetti-palayam	1193	7336	1296	71	1627	2220	66	7
4.	Bhavani	823	7167	403	115	1600	238	791	1
5.	Sathy	746	3530	1099	227	867	1755	17	4
6.	Dharapuram	4189	1201	116	701	13	520	-	2
7.	Kangayam	1114	1806	95	146	64	370	110	2
III. Madurai									
1.	Usilampatti	893	1748	-	5	-	-	-	-
IV. Nammakal									
1.	Trichengodu	489	1714	16	38	147	-	537	-
V. Theni									
1.	Uthamapalayam	377	902	2730	37	1	3	8	5
2.	Periyakulam	1400	3904	446	31	3	64	17	-
VI. Karur									
1.	Karur	129	2369	449	164	133	-	203	-
2.	Manaparai	802	593	51	420	-	-	5	-
VII. Dindugal									
1.	Nilakottai	374	1175	-	36	31	1	26	1
2.	Palani	500	3599	-	179	-	37	6	2

Table 9. Talukwise area (in ha) of important vegetable crops (1998-99)
(Figures collected from Commissioner of Statistics, Chennai)

Sl. No	District	Tomato	Brinjal	Onion	Bhendi	Moringa	Gourds (S.gourd alone)	Cauli flower
I. Coimbatore								
1.	Avinasi	86	104	83	9	-	9	2
2.	Palladam	322	98	122	83	5	6	4
3.	Pollachi	1442	68	254	61	1	1	-
4.	Udumalpet	558	95	700	32	20	9	4
5.	Coimbatore	1404	95	325	63	2	36	13
6.	Mettupalayam	120	48	36	75	-	21	-
II. Erode								
1.	Erode	35	30	47	11	1	1	-
2.	Perundurai	89	61	72	21	3	-	-
3.	Gobichetti-palayam	36	29	338	9	3	-	-
4.	Bhavani	33	127	299	1	-	-	-
5.	Sathy	98	45	284	19	2	-	5
6.	Dharapuram	64	41	747	50	263	-	2
7.	Kangayam	46	31	69	40	64	-	-
III. Madurai								
1.	Usilampatti	64	49	148	49	-	-	-
IV. Nammakal								
1.	Trichengodu	56	13	115	26	7	4	-
V. Theni								
1.	Uthamapalayam	935	64	153	18	1	11	-
2.	Periyakulam	117	51	37	21	17	-	-
VI. Karur								
1.	Karur	29	17	2	-	14	8	-
2.	Manaparai	77	24	6	9	4	-	-
VII. Dindugal								
1.	Nilakottai	799	16	78	7	11	8	-
2.	Palani	155	66	52	30	26	-	-

Table 10. Districtwise area (in ha) of important field crops (1998-99) (Figures collected from Season and Crop Report of Tamil Nadu for the Agricultural year 1998-99, Dept. of Economics and Statistics, Chennai).

Crops	Coimbatore	Erode	Karur	Dindigul	Namakkal	Madurai	Theni
Cereals							
1. Rice	12258	57833	16245	27119	24603	87230	18582
2. Jowar	6451	1814	885	432	7850	369	1820
3. Bajra	185	368	171	2966	123	98	524
4. Maize	13322	1524	-	9533	466	72	1876
5. Ragi	80	268	30	126	371	143	105
Pulses							
1. Greengram	5491	3770	92	5614	7025	5913	1694
2. Blackgram	4268	1427	308	7542	8894	1177	982
3. Redgram	1200	1548	5090	3414	8249	1863	2951
4. Bengalgram	5888	12	0	517	525	21	0
5. Cowpea	9020	3589	291	11974	4739	1701	2925
Oilseeds							
1. Groundnut	35159	55577	10727	31884	67973	11003	10953
2. Gingelly	1741	16058	8632	4996	2007	2642	2223
3. Sunflower	279	831	224	761	1527	493	694
4. Castor	240	1976	16	272	10224	30	89
5. Coconut	79165	9983	3121	17091	2053	9320	10845
Commercial Crops							
1. Cotton	17425	11946	857	9969	2326	11367	7626
2. Sugarcane	12355	29663	7406	6718	9586	10179	12688
3. Banana	7561	4853	5605	3538	803	2065	4086
4. Chillies	2700	1148	2500	1963	350	574	284
5. Tapioca	1214	4489	298	215	10441	56	51
6. Turmeric	2910	12845	677	33	1193	10	12
7. Tobacco	779	4905	6	864	5	0	72
Vegetables							
1. Onion	2537	1906	169	4972	5659	1338	544
2. Brinjal	798	459	95	992	515	310	715
3. Tomato	5827	593	257	3337	1097	383	2583
4. Bhendi	381	100	15	442	480	156	99
7. Cablrge	2	22	0	90	0	0	110

Table 11. Districtwise production (tonnes) of important field crops (1998-99) (Source : Season and Crop Report of Tamil Nadu for the Agricultural year 1998-99, Dept. of Economics and Statistics, Chennai).

Crops	Coimbatore	Erode	Karur	Namakkal	Madurai	Theni	Dindigul
Cereals							
1. Rice	44250	272600	67340	120430	409870	69670	148140
2. Jowar	44790	10190	7840	20120	9360	23140	65090
3. Bajra	800	2560	3170	1310	1570	4420	18580
4. Maize	17580	5200	0	870	620	7820	40900
5. Ragi	920	13660	90	3740	530	350	730
Pulses							
1. Greengram	2660	1790	50	5240	3260	920	3840
2. Blackgram	2210	740	160	6980	610	510	5150
3. Redgram	770	1000	2380	6970	1200	2420	3000
4. Bengalgram	4360	0	0	240	10	0	270
Oilseeds							
1. Groundnut	63680	102640	20620	132320	19490	14450	77550
2. Gingelly	680	12970	2490	1660	1590	1010	2360
3. Sunflower	300	1320	240	1680	530	740	1160
4. Castor	80	550	10	3080	10	20	110
5. Coconut (Estimated yd rate/ha in nuts)	13133	11498	15807	17987	6835	21194	20387
Commercial Crops							
1. Cotton	37120	26300	1890	6030	16640	21390	25050
2. Sugarcane	1105140	3774080	974520	1535460	1940110	1850530	861040
3. Banana	261040	217800	156720	29760	117430	320560	52170
4. Chillies	3360	710	1750	200	340	400	770
5. Tapioca	42070	181990	10330	442190	1940	1760	7450
6. Turmeric	16250	73960	3440	6010	50	60	170
7. Tobacco	1160	7770	10	10	0	160	1290
Vegetables							
1. Onion	33540	18790	1390	34150	8060	8060	36730
2. Brinjal	14000	4430	920	3950	3040	3040	4250
3. Tomato	89210	7080	3070	8120	4570	4570	15240
4. Bhendi	2530	700	110	1850	1620	1620	1650
5. Cabbage	150	1640	0	0	0	0	6720

Table 12. Districtwise production (kg ha^{-1}) of important field crops (1998-99) (Source : Season and Crop Report of Tamil Nadu for the Agricultural year 1998-99, Dept. of Economics and Statistics, Chennai).

Crops	Coimbatore	Erode	Karur	Namakkal	Madurai	Theni	Dindigul
Cereals							
1. Rice	3610	4703	4145	4888	4699	3749	5463
2. Jowar	497	906	299	2000	942	1654	1344
3. Bajra	2243	1639	242	1421	1313	1522	1844
4. Maize	1125	2286	-	1861	2003	2001	1976
5. Ragi	1872	1077	2976	1909	2615	2783	2160
Pulses							
1. Greengram	485	476	543	746	551	543	684
2. Blackgram	518	518	518	785	518	518	683
3. Redgram	644	644	467	845	644	819	879
4. Bengalgram	740	684	0	464	621	0	513
Oilseeds							
1. Groundnut	1811	1847	1922	1947	1771	1319	2432
2. Gingelly	392	808	288	826	603	452	472
3. Sunflower	1086	1586	1071	1104	1071	1071	1526
4. Castor	360	277	339	301	184	183	399
5. Coconut (Estimated prod. In lakhs)	17389	2275	742	472	1297	3134	3583
Commercial Crops							
1. Cotton	362	374	375	441	249	477	427
2. Sugarcane (t ha^{-1})	89	127	132	160	191	146	128
3. Banana							
4. Chillies	1243	615	701	569	600	1425	391
5. Tapioca	34654	40451	34654	42351	34654	34654	34654
6. Turmeric	5586	5758	5090	5037	5090	5090	5090
7. Tobacco	1494	1584	1192	992	0	2208	1492
Vegetables							
1. Onion	13221	9861	8220	6035	6023	8220	7387
2. Brinjal	17538	9659	9659	7679	9085	4251	4288
3. Tomato	15311	11934	11934	7400	11934	4417	4566
4. Bhendi	6646	6979	6979	3853	10375	6371	3742
5. Cabbage	74657	745657	0	0	0	74657	74657

5. Constraints, problems and suggestions to alleviate them :

Commercial and horticultural crops are grown under more area in this zone. In command areas, rice is the dominating crop.

Erode district is the turmeric belt of the State. Whenever turmeric market is good, farmers are tempted to grow this crop in larger area in the subsequent year resulting in steep fall in prices. This see-saw price trend is a problem and farmers voice their concern when the price goes down.

The concern due to fluctuating turmeric market could some extent be corrected by having suitable cropping strategies. For instance, pulses like blackgram fetch more price nowadays. They can be intercropped with turmeric instead of crops like maize which is not so remunerative again because of price fluctuation.

Turmeric cultivation is extended to calcareous soils also posing problems of yellowing. The solution lies in delineating highly calcareous soils and advising the farmers not to cultivate in such soils. Alternatively they can go in for varieties like BSR 2 which is fairly tolerant to yellowing.

In taluks like Palladam, poultry is an allied activity. Feed cost is the main concern of the farmers. When maize price goes up, the feet cost is escalated. The recent research findings indicate that pearlmillet could be a substitute to maize besides it could be a better rainfed crop for Palladam taluk which is drought prone. With such alternate feed ingredients, it is possible to cut down the cost of feed.

In Dharapuram and nearby taluks, area under moringa is large. Here again, price fluctuation is the concern. The remedy lies in manufacturing of value added products such as moringa pickle, moringa powder, moringa seed oil for industrial purpose, moringa chutney etc. Industries have to be started in these taluks for production of these value added materials. Similarly in Trichengodu taluk of Namakkal district, castor is largely intercropped in groundnut. Castor oil could be used for many industrial purposes.

Commissioning of such industries would buffer the price fluctuation besides it would give employment to local rural people.

In Erode and certain taluks of Coimbatore district, powerlooms are increasing every year. Manufacture of hosieries particularly in Tiruppur indeed causes movement of agricultural labourers to this industry. As a result, agriculture labour shortage is a major problem witnessed by many farmers.

Although many tools and implements were released from TNAU and elsewhere, many farmers are not aware of them. These tools and implements have to be popularised by way of large scale demonstrations to ease the labour situation.

Another worrying concern is the fall in water table particularly in Coimbatore and Erode districts. The solution lies in effective rain water harvesting. Mandatory impounding of rain water for certain minimum period in the existing ponds, tanks etc., would help improving water table. So also, more percolation ponds have to be constructed to improve the water table which is all the more essential considering the zone falling largely under rain shadow.

6. Technologies developed

6.1 Varieties

Six new crop varieties were released so far from the Agricultural Research Station, Bhavanisagar. Similarly, three groundnut varieties from Agricultural Research Station, Aliyarnagar and Paradise tree, *Simaruba glauca* from Forest College and Research Institute were released.

Table 13. Varieties released from Agricultural Research Station, Bhavanisagar.

Sl. No	Crop	Variety	Year of release	Parentage	Duration (days)	Yield	Other special attributes
1.	Redgram	BSR 1	1986	Mutant from Myladum-parai local	Perennial	1.5 kg/ plant/ year	Perennial, bushy, both for grain and vegetable purpose.
2.	Turmeric	BSR 1	1986	Selection from Erode local	285	30.5 t/ha.	-
3.	Turmeric	BSR 2	1994	X-ray mutant of Erode local	245	32.7 t/ha.	Resistant to scales, recovery after curing is 20%
4.	Groundnut	BSR 1	1994	ICGS 44 x (Robut 33-1 x WCAC 2821)	105	2845 kg/ha	21 days seed dormancy, moderate resistance to rust, leaf spot and bud necrosis.
5.	Sorghum	BSR 1	1994	ICSV [(Sc 108-3 x ICSV 4) 16-3-1] x [(MR 801 x R 2751) 4-1-1]	105	3.5 t/ha rainfed 6.5 t/ha irrigated	Suited for grain & fodder; can be grown under irrigated/ and rainfed condition.
6.	Amla	BSR 1	1995	Selection from Thimbam local	Fruit tree	155 kg/ tree/year	Fruits in clusters, big in size with more ascorbic acid content.

Table 14. Groundnut varieties released from Agricultural Research Station, Aliyarnagar.

Year of release	Name of variety	Special features
1987	ALR 1	Resistant to Rust and late leaf spot diseases. Duration 120 days. Yield 1400 kg/ha
1994	ALR 2	110 days duration. Yield 1,800 kg/ha. Resistant to rust and moderately resistant to late leaf spot diseases.
1999	ALR 3	110 to 115 days duration. Yield 2095 kg/ha. Resistant to rust; moderately resistant to late leaf spot diseases. Resistant to leafhopper and thrips.

Description of the paradise tree released from Forest College and Research Institute, Mettupalayam.

Simaruba glauca, belonging to the family Simarubaceae, is a native of El Salvador, Brazil. It is an evergreen tree with a male to female ratio of 3:2. This tree grows to a height of 12-15 m with a large circular crown. The bark is smooth and grey in colour. The leaves are opposite, pinnately compound, oblong, acuminate, dark oily green dorsal side and a pale green ventral side. Inflorescence is raceme with white/light yellow flowers. Flowers are small, unisexual, and actionmorphic in axillary racemes. Calyx gamosepalous, 5 imbricate and corolla as many as calyx, imbricate. The stamens are as many as petals, anthers 2 celled, dehiscing longitudinally. Carpels 2-5, free, styles 5, ovules solitary, axile placentation, fruit is a drupe, 1-seeded, pinkish when ripe.

The trees start flowering in the 3rd year with a yield of 1-2 kg of seeds / tree. The yield increases progressively and reaches 20-25 kg / tree in the 10th year. In its native place, this species is grown in a rotation of 40-60 years. The kernel contains 55-60% oil; the oil is used as edible oil in Brazil and 40 year old wood as a good timber.

Specific Area for its Adaptation : In plains throughout Tamil Nadu
Recommended Ecology : Suitable for cultivation under rainfed conditions, in all the soils except coastal sandy soil.

6.2. Management practices

Several management practices were evolved scientifically in crops like rice, groundnut, coconut and forest trees. In rice, it is established now that rice can be intercropped with daincha and they can be sown in alternate rows using a newly developed seeder of TNAU. The daincha can be trampled when it attains about 40 cm height using conoweeder. This is a significant technology being popularised in view of multiple advantages to the farmers. The benefits are : 1) Avoidance of nursery and planting of rice 2) No. separate cultivation of greenmanure 3) Rice yield increase to the tune of one tonne/ha. 4) Saving in labour cost for weeding 5) Drudgery of women labour for rice planting and weeding is avoided greatly.

In coconut, the daily water requirement through drip irrigation is standarised. For Pollachi tract, it was estimated at 65 l/day/palm during February to May. The requirement is 55 lit. during January, August and September months. In other months, it is 43 lit. Similarly in banana with paired rows and drip in between was found to be advantageous from the point of water economy and weed control. Drip irrigation is being standardised for 5' sugarcane, curryleaf etc. The feasibility of microsprinkler irrigation in groundnut is being studied. Similarly in forestry, package of practices for the paradise tree were developed.

A total number of 73 one-parent families were identified from important neem growing areas of the country. Among the fractions of azadirachtin analysed, Azadirachtin A was found to be higher than the other fractions. Micro propagation of teak was established and it is yet another important technology developed from Forestry College and Research Institute, Mettupalayam. Mass multiplication techniques have also

been developed for *Dendrocalamus strictus* and *Bambusa bambos* using nodal segments as explants.

6.3. Plant protection

Practices to control sprial white fly at Agricultural Research Station, Bhavanisagar were developed. Similarly root feeding of monocrotophos was found to reduce the pest population of *O. arenosella* in coconut palm. Measures to control slug caterpillar in coconut were also found out. The technology of using castor cake suspension to lure adult rhinoceros was found to be more useful. Likewise groundnut varieties resistant to leaf spot, rust were released from Agricultural Research Station Aliyarnagar.

6.4. Technologies developed

TNAU-Main Campus – COIMBATORE

a. AGRICULTURE

Rice	:	Variety : CO 1 to CO 47 Hybrids : CORH 1, CORH 2 Introduced Var : Bhavani
Maize	:	Variety : CO 1, CO Bc 1 (Baby corn) Hybrids : CoH 1 to CoH 3
Sorghum	:	Variety : CO 1 to CO (FS) 2g) Hybrids : CoH 1 to CoH 4
Cumbu	:	Variety : CO 1 to CO 7 Hybrids : X 1 to X 7, Co (Cu) H8
Ragi	:	CO 1 to CO 13
Tenai	:	CO 1 to CO 6
Samai	:	CO 1 to CO 3
Varagu	:	CO 1 to Co 3
Panivaragu	:	CO 1 to CO 4
Kudirai vali	:	CO 1

PULSES

Redgram	:	Variety : CO 1 to CO 6 Hybrid : COH 1, COH 2
Blackgram	:	CO 1 to CO 5
Greengram	:	CO 1 to CO 6
Bengalgram	:	CO 1 to CO 4
Cowpea	:	CO 1 to CO 6
Soybean	:	CO 1, CO 2
Lab-Lab (Avarai)	:	CO 1 to CO 13
Lab-Lab (Mochai)	:	CO 1, CO 2
Horsegram	:	CO 1
Lima bean	:	LBS 1
Sword bean	:	SPS 1

OILSEEDS

Groundnut	:	CO 1 to (Gn) 4
Gingelly	:	CO 1
Castor	:	CO 1
Sunflower	:	CO 1 to CO 4 Hybrid : TCSH 1
Safflower	:	CO 1
Cotton	:	Hybrids : CBS 156, TCHB 213 Varieties :

FORAGE CROPS

Cumbu Napier Hybrid	:	CO 1 to CO 3
Blue Buffel	:	CO 1
Lucerne	:	CO 1
Velimasal	:	Introduction
Muyal masal	:	Introduction
Leucaena	:	CO 1, Introduction
Guinea grass	:	CO 1, CO 2
Fodder cumbu	:	CO 8
Deenanath grass	:	CO 1

GREEN MANURE

Sunhemp	:	CO 1
Sesbania rostrata	:	CO 1

6.4.1 : Varieties Developed

b. HORTICULTURE

Banana	:	Wather , CO 1
Papaya	:	CO 1 to CO 7, SOLO
Pomegranate	:	CO 1
Sapota	:	CO 1 to CO 3
Amaranthus	:	CO 1 to CO 5
Ashgourd	:	CO 2
Bhendi	:	CO 1 to CO 3

Bittergourd	:	CO 1, CO (Bgo) 1
Bottlegourd	:	CO 1
Brinjal	:	CO 1, CO 2, COBH 1
Coleus	:	CO 1
Colocasia	:	CO 1
Cucumber	:	CO 1
Greater yam	:	CO 1
Snake gourd	:	CO 1, CO 2
Sweet Potato	:	CO 1 to CO 3, COCIP 1
Tapioca	:	CO 1 to CO 3
Tomato	:	CO 1, CO 2, COTH 1
Pumpkin	:	CO 1, CO 2
Ribbedgourd	:	CO 1, CO 2
Radish	:	CO 1
Pandal Avarai	:	CO 1
Barleria	:	CO 1
Chrysanthemum	:	CO 1, CO 2
Hibiscus	:	Thilagam, Punnagai
Mullai	:	Parimullai, CO 1, CO 2
Jathi Malli (Pitchi)	:	CO 1, CO 2
Chillies	:	CO 1 to CO 4
Coriander	:	CO 1 to CO 3
Fennel	:	CO 1

Fenugreek	:	CO 1, CO 2
Onion	:	CO 1 to CO 4, CO (On) 5
Turmeric	:	CO 1

6.4.2 : Centre for Soil and Crop Management Studies

Agricultural Microbiology

- The Soybean rhizobial strain CRS –3 identified performed better than the existing strain COS 1 used in the inoculant production and will be used in future in the mass scale production.

- In groundnut the slow growing Bradyrhizobium strain Tt 9 in combination with PGPR Pseudomonas enhanced the pod yield of groundnut over the uninoculated control as well as individual inoculation of rhizobia. The OST conducted at RRS, Paiyur, ARS, Bhavanisagar and Aliyarnagar confirmed the results and this technology of combined inoculating has been suggested for adoption in SWC 2000.

- The already existing CoC 10 Rhizobium sp is being replaced by new strain CRU 15.

- Four new temperature tolerant rhizobial strains were developed for black gram suitable for high soil temperature zones.

- Combined inoculation of Rhizobium and antagonistic bacteria (AB 3) had given higher plant growth and grain yield compared to individual inoculation of Rhizobium alone.

- Acetobacter diazotrophicus inoculation increased the cane yield of sugarcane than Azospirillum.

- Two Frankia strains UGL 020604 isolated from nodules from Cuddalore and UGL 020605 isolated from Mettupalayam are found effective and could be used for Casuarina nursery inoculation of coastal areas of Tamil Nadu.

Agronomy

Maximization of yield in rice hybrids and varieties

- The result of the experiments conducted at Coimbatore during Kuruvai and Thaladi seasons from 1995-1998 revealed that maximum yield of 7655 kg $ha^{-1}$and 7072 kg ha^{-1} was obtained by adopting a population of 100 hills/M^2 with 100:50:50 kg NPK/ha) having recorded 5.7 and 5.0 t ha^{-1} respectively.

- In medium duration variety ADT.38 a population level of 66 hills/M^2 (15x10 cm) with NPK at 200:75:100 kg ha^{-1} gave maximum yield (6813 kg ha^{-1}) than the recommended practices (50 hills ha^{-1} with 100:50:50 kg NPK/ ha) recording 5462 kg ha^{-1} respectively.

Mechanical weed control in rainfed maize

- The experiments were conducted during North East monsoon season of 1997 and 1998 at Coimbatore in black soils with a view to develop suitable mechanical method of weed control in rainfed maize. The results revealed that pre-emergence application of Atrazine @ 0.25 kg ha^{-1} with one hand weeding on 40m Das gave higher yield (2979 kg ha^{-1}) and BC ratio (2.51). However, where mechanical method is viewed with environmental concern. While manual method is labour intensive, combined method of mechanical weed control with power tiller drawn sweep weeder + H.W. on 40 DAS proved cost effective (B.C ratio of 2.36) and is an alternate non-chemical method for weed control in line sown rainfed maize.

Intercropping in pearl millet

- The studies carried out from 1996-1999 under rainfed conditions at Coimbatore revealed that sowing of pearl millet (x7) with sunflower (CO.3) in the ratio of 2:1 at a spacing of 45 X 15 cm recorded highest net return of Rs. 5786 and it was higher by 3590 over sole crop pearl millet.

Time of application NPK to cotton

- The result of the experiment conducted at Coimbatore during winter irrigated season of 1998-99 in cotton MCU.5 showed that application of NPK at 80:40:40 in two equal splits on 45 and 60 DAS, by skipping basal application increased the kappa's yield by 3.5 q ha^{-1} over recommended practices of 40:40:40 at basal and 40 kg N at 45 DAS.

Crop Physiology

- The on-farm trials on greengram conducted at Coimbatore, Vamban and Paiyur showed mean yield increase from 887 kg ha^{-1} (in control) to 1026 kg ha^{-1} due to foliar spray of salicylic acid @ 50g/ 500 lit. ha^{-1} on 30 and 45 DAS under irrigated condition.

- Foliar spray of Brassinolides (BR) at 0.3 ppm at panicle initiation and flowering stages was found highly effective recording an average yield of 6473 kg ha^{-1} as against 4886 kg in control. This increase in yield accounted for 32.4% over unsprayed control. The yield enhancement was associated with increased leaf area photosynthetic pigments, soluble proteins and enhanced activity of NRase besides higher HI in the BR treatment.

- In rice, Brassinolide 0.3 ppm sprayed at panicle initiation and flowering stages registered the highest grain yield of 6560 kg ha^{-1}.

- In Thermosensitive Genic Male Sterility line of rice TS 29, the salicylic acid 800 ppm sprayed at panicle initiation + pollen mother cell formation + filling phase of pollen, induced 100 per cent sterility.

- In greengram, foliar spray of 100 ppm salicylic acid on 30 and 45^{th} day after sowing of CO 5 greengram enhanced the pod weight by 18 per cent and grain yield by 13.6 per cent over control.

- In coconut, root feeding of micronutrients along with full dose of NPK increased the nut production by 4.5 fold compared to pretreatment stage. The cost benefit ratio is 1:2:3.

- In sesamum, foliar spray of salicylic acid (100 ppm), during flowering and capsule filling stage increased the seed yield (750 kg ha^{-1}) over control (578 kg ha^{-1}).

- In cotton variety MCU.5 0.1 ppm Brassinolide sprayed at square formation and flowering stages was effective in increasing the seed cotton yield by 11 per cent over control.

Soil Science & Agricultural Chemistry

Micronutrients fertilization for Banana in acid soils of Kanyakumari District

- Rice and Banana yield in acidic soils of Kanyakumari district havig excess iron can be increased by resorting to lime application . However, multinutrients spray of 1% DAP, 1% MOP, 0.5% $ZnSO_4$ and 0.2% Boric

acid is economical and increased the grain yield of rice by 16% and yield of banana by 26%.

IPNS for increasing rice yields in Cauvery delta

- Increased productivity, higher fertilizer use efficiency and profitability of STCR- technology have been well brought forth by increased yields, response ratio and BCR, recorded by the STCR treatments. Adoption of STCR technology under Integrated Plant Nutrients Supply System (IPNSS) has further enhanced the yield levels, use efficiency of added chemical fertilizers and benefit cost ratio. Following the soil test based fertilizer doses for a pre-set yield level suited to the situation, recorded 66 to 68 quintals of paddy in Western Zone and 72 to 74 quintals of paddy in Cauvery delta zone as against 56 and 64 q ha^{-1} for blanket recommendation. In the other crops also similar trend of results were achieved.

Fertilizer optima for maximum economic yields in rice based cropping system

- Nutrient sorption study was conducted in the laboratory using two soils, one representing Kalathur series in Cauvery Delta Zone and the other representing Irugur series in LBP ayacut. The results revealed that N,P,K and Zn were the yield limiting nutrients in both the experimental soils. In the second phase, the above result was confirmed in a green house experiment utilizing the same soils. In the third phase, field experiments were conducted in both location with varying levels and combinations of these limiting nutrients. From the plot of grain yield data on a quadratic polynomial surface, the economic optima were derived for ADT 36 (194 kg N, 56 kg P_2O_5 and 50 kg K_2Oha^{-1}) and CO 43 (187 kg N, 67 kg P_2O_5 and 67 kg K_2O ha^{-1}) rice crops in Cauvery Delta Zone and ADT 38 (138 kg N, 39 kg P_2O_5 and 56 kg K_2O ha^{-1}) rice in LBP ayacut.

Seed Science & Technology

- **In paddy**, seed storage in humid coastal and deltoic areas poses problem in the maintenance of germination and vigour of seeds. To overcome this, seeds can be dried to 10-11 percent moisture treated with halogen mixture ($CaOCI_2$ + $CaCO_3$ at 1:1 ratio) and packed in polylined gunny bags. Seeds stored in this manner recorded more than 80 per cent germination even after 15 months in ADT 38, CO 43 and CO 46 rice varieties. The cost of seed treatment and container works out to Rs. 1 kg^{-1} of seed stored.

- **In pumpkin**, the application of nitrogen and ethrel foliar spray significantly increased the fruit set, seed yield and quality in cv CO.1. The application of 12 g nitrogen pit^{-1} with two spray of 250 ppm ethrel at two and four leaf stage in June- July season is found to increase the number of

female flowers (14.5), fruit number plant^{-1} (12.80), fruit yield plant^{-1} (99.95 kg), seed yield plant-1 (13.97 g) and germination of seeds (93.7%).

- **In jack**, fresh seeds could be stored for 60 days with 30 per cent germination by mixing the seeds with damp charcoal at 1:2 ration and packed in polythene bag (300 gauge) and storing at 10^{o}C. The seeds mixed with dry charcoal and stored at 10^{0}C maintained 45 per cent germination for 40 days. The seeds stored in dry charcoal and damp charcoal at room temperature lost their viability after 40 and 20 days of storage, respectively.

- **In phlox**, soaking the fresh seeds in GA3 at 100 ppm for 8 h enhanced the germination to 90 per cent. Application of 60:30:30 kg NPK ha^{-1} recorded the highest yield (118.4 kg ha^{-1}) of quality seeds. A spacing of 40 x 10 cm is found optimum. Spraying DAP 1% at first and 50% flowering stage recorded the highest yield of quality seeds (125.99 kg ha^{-1}).

6. 4.3 : Centre for Plant Protection Studies

The following techniques were developed by the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore – 641 003.

PEST MANAGEMENT IN RICE

1. Remove/destroy stubbles after harvest
2. Trim field bunds
3. Provide effective drainage if required
4. Avoid use of excessive 'N' fertilizers
5. Avoid close planting, especially in BPH and leaf folder prone areas/seasons
6. Leave 30 cm space at every 2.5 m.
7. Use irrigation water judiciously
8. Keep the fields free from weeds
9. Use light traps to monitor pest incidence
10. Remove egg masses of stemborer
11. In BPH prone areas/seasons, avoid use of synthetic pyrethroids, Methyl parathion and Quinalphos and use recommended chemical at recommended doses
12. Use insecticides based on ETLs

Worked out ETL levels

Pests	E.T. Levels
Stemborer	2 egg masses / M^2 or 10% dead hearts
Gall midge	10% silver shoots
Whorl maggot	25% damaged leaves
Green leaf hopper	60/25 net sweeping or 5/hill at vegetative stage or 10/hill at flowering or 2/hill in tungro endemic area

Spray any one of the following/ha. Fenthion 100 EC 500 ml, endosulfan 35 EC 1000 ml, Fenitrothion 50 EC 1000 ml, Phosalone 35 EC 1500 ml, Quinalphos 25 EC 1000 ml, Phosphamidon 85 WSC 300 ml.

Thrips : Spray Phosphamidon 85 WSC 300 ml, Monocrotophos 36 WSC 500 ml, Endosulfan 35 EC 1000 ml.

SORGHUM

1. Take up early sowing of sorghum immediately after the receipt of South West or North East monsoon to minimize the shootfly incidence.
2. Use seeds pelleted with insecticides.
3. In case of direct seeding, use increased seed rate upto 12.5 kg per hectare and remove the shootfly damaged seedlings at the time of thinning or raise nursery and transplant only healthy seedlings.
4. Plough soon after harvest, remove and destroy the stubbles.
5. Set up the TNAU low cost fish meal trap @ 12/ha till the crop is 30 days old. Arpocarb Fishmeal formulation is more effective in attracting the shootfly adults especially the females.

Preparation of Arpocarb fishmeal formulation for shootfly attraction

Fishmeal powder is to be sprayed first with 2.0 per cent starch dissolved in hot water as a sticking agent. The insecticide Arpocarb should then be sprayed at 50 ml/kg of fishmeal powder. The resultant mixture is shade dried and can be used at 50g/trap.

The formulated product should be moistened well before placing in the trap. The formulation can be changed once in 10-14 days depending upon the smell.

MAIZE

1. Mix any of the granular insecticides with sand to make up a total quantity of 50 kg and apply in the leaf whorls on the 20th day of sowing : Quinalphos 5 G 15 kg/ha, Carbaryl 4 G 20 kg/ha.
2. If granular insecticides are not used, spray Quinalphos 25 EC 1 lit or Carbaryl 50 WP 2 kg/ha on the 20th day of sowing for the control of stemborer, weevils and aphids (500 l of spray fluid/ha).

GROUNDNUT

Apply anyone of the following insecticides at 25 kg/ha to control leaf miner and other insect pests. Phosalone 4% D; Endosulfan 4% D; Carbaryl 10% D; Fenitrothion 2% D or spray Endosulfan 35 EC 750 ml/ha; Dichlorvos 76 WSC 625 ml/ha; Monocrotophos 36 WSC 750 ml/ha; Phosphamidon 85 WSC 375 ml/ha; Chlorpyriphos 20 EC 1250 ml/ha; Phosalone 35 EC 750 ml/ha; Quinalphos 25 EC 750 ml/ha and Phenthoate 50 EC 750 ml/ha in 375 l of water.

a. ETL 1 larva per metre row (leaf miner)
b. Intercrop groundnut and cumbu at 4:1 raio

For leaf miner control, set up light traps between 8 and 11 p.m. at ground level.

Application of NPV @ 250 LE/ha along with the adjuvant jaggery 2.5 kg/ha and Teepol 250 ml/ha either one or two application depending on the incidence of early instars at 10 days interval reduce the larval population of *Spodoptera litura*.

GROUNDNUT

Red hairy caterpillar

a. Dig out and destroy the pupae from the fields bunds and shady spots prior to summer rains.
b. Set up 3 to 4 light traps and bonfires immediately after receipt of rains, after sowing in the rainfed season to attract and kill the moths and also to know brood emergence.

c. Collect and destroy gregarious, early instar larvae on lace-like leaves of intercrops such as redgram and cowpea.
d. Collect and destroy egg masses in the cropped area.
e. Apply any one of the following insecticides at 25 kg/ha (for young caterpillars). Quinalphos 1.5% D; Phosalone 4% D; Endosulfan 4% D; Carbaryl 10% D or spray Endosulfan 35 EC 750 ml/ha; Fenitrothion 50 EC 750 ml/ha; Quinalphos 25 EC 750 ml/ha; Dichlorvos 76 WSC 625 ml/ha; Chlorpyriphos 20 EC 1250 ml/ha; Ethion 50 EC 500 ml/ha; Phosalone 35 EC 750ml/ha in 375 l of water or use nuclear polyhedrosis virus (NPV) at 250 larval equivalents per ha as detailed below:

Use of NPV

Get nucleus culture of NPV either from TNAU, Regional Research Station, Paiyur or Coimbatore or Madurai campuses of TNAU, for multiplication and field use as indicated below:

Collect medium sized larvae of *Amsacta albistriga* from the field and starve them over night. Make a pure suspension of virus with the nucleus culture, in water. Dip *Calotropis* leaves in virus suspension, shade dry and feed them to starved larvae 1 or 2 days. From third day, normal, untreated leaves can be fed to these larvae. From 5^{th} day, the treated larvae will start dying. Virus infected larvae can be diagnosed by their pinkish ventral surface, their head hanging downwards with white body contents oozing out through ruptured body wall in the late stage. Collected the dying larvae, keep in fresh potable water for a few days, grind the larvae and filter through several layers of fine cloth and collect filtrate (Crude virus suspension). Use virus suspension obtained from 750 medium sized larvae for spraying one hectare along with a sticker 250 ml or Triton in 350 l of water. Use potable water for spraying and spray in the evenings.

POD BORER (Earwig)

1. Apply Malathion 5% D 25 kg/ha or Endosulfan 4% D 25 kg/ha to the soil prior to sowing in areas where the earwig is endemic.
2. Repeat soil application of any one of the above dust formulations on the 40^{th} day of sowing and incorporate in the soil during the earthing up.

Spodoptera

1. Grow castor as border or intercrop in groundnut fields to serve as indicator or trap crop.
2. Monitor the emergence of adult moths by setting up light and pheromone traps.
3. Collect egg masses and destroy.
4. Collect the gregarious larvae and destroy them as soon as the early symptoms of lace-like leaves appear on castor, cowpea and groundnut.
5. Apply any one of the following insecticides per ha to control the early instar (1^{st} to 3^{rd} instar larvae) Carbaryl 10 D 25 kg; Fenitrothion 50 EC 750 ml; Carbaryl 50 WP 2.0 kg; Carbaryl + Molasses 40 LV 2.0 l; Quinalphos 25 EC 750 ml; Fenthion 100 EC 500 ml; Phenthoate 50 EC 1250 ml; Dichlorvos 76 WSC 750 ml; Endosulfan 35 EC 1.0 l.
6. Spray any one of the following insecticides per ha to control the 4^{th} to 6^{th} instar larvae. Chlorpyriphos 20 EC 2.0 l; Dichlorvos 76 SC 1.0 l; Phenthoate 50 EC 2.0 l; Fenitrothion 50 EC 625 ml + Chlorpyriphos 20 EC 1.25 l in 1000 l of water.
7. Spray both the upper and lower surface of leaves and also the soil and bunds.
8. Avoid migration of larvae by digging a trench 30 cm deep and 25 cm wide with perpendicular sides around the infested fields.
9. Prepare a bait with the following materials to cover one ha. Rice bran 12.5 kg; Molasses or brown sugar 2.5 kg or Carbaryl 50 WP 1.25 kg. Mix the ingredients to obtain a homogeneous mixture, sprinkle water gradually and bring the bait to a dough consistency. Distribute the above bait on the soil, around the field and inside in the evening hours immediately after preparation.
10. Apply nuclear polyhedrosis virus for the control of *Spodoptera*. Methods of mass culturing and application are the same as for *Amsacta* NPV use castor leaves for larvae. Combined use of NPV of *S. litura* and *H. armigera* on groundnut indicated that single application of NPV of each pest at 250 LE/ha with crude sugar 2.5 kg/ha is as effective as that of Chlorpyriphos at 200 g a.i./ha at 7 days interval in reducing the larval population.

COCONUT

Biological control

In nature, the rhinoceros beetle is suppressed by entomophogens like *Baculovirus oryctus* virus and *Metarhizium anisopliae*. Release of *Baculovirus oryctes* minimize the pest incidence.

Cultural control

1. Field sanitation and elimination of breeding sites like dead palm trunks, empty bunch heaps etc., within the plantations are essential for the management of both red palm weevil and rhinoceros beetle.
2. When the infestation by rhinoceros beetle is very high, especially in young plantations, Hand picking of the adult beetles using hooks is very effective.
3. For red palm weevils, use of attractants incorporating fermented sugarcane juice, acetic acid, yeast etc., to collect and kill the adult weevils is recommended.

Chemical control

1. For rhinoceros beetles, placing 3-4 napthalene balls in the youngest spear axils at weekly intervals is recommended.
2. For palms with advanced stage of infestation by red palm weevil, stem injection of 5-8 ml of monocrotophos is advised.

SPECIFIC PROBLEMS

Tobacco cutworm (*Spodoptera litura*)

1. Use of light trap to monitor and kill the attracted adult moths. Sep up the sex pheromone trap Pherodin S.L. at 12/ha to monitor the activity of the pest and to synchronise the pesticide application, if need be, at the maximum activity stage.
2. Growing castor along border and irrigation bunds.
3. Removal and destruction of egg masses in castor and cotton crops.
4. Removal and destruction of early stage larvae found in clusters which can located easily even from a distance.
5. Collection and destruction of shed materials.
6. Hand picking and destruction of grown up caterpillars

7. Spray any one of the following insecticides per ha using, a high volume sprayer covering the foliage and soil surface. Chlorpyriphos 20 EC 2.0 l/ha; Dichlorvos 76 WSC 1.0 l; Phenthoate 50 EC 2.0 l/ha; Chlorpyriphos 20 EC and Fenitrothion 50 EC 1.25 l and 625 ml respectively.
8. Spraying Nuclear Polyhedrosis Virus at 250 larval equivalent per ha.
9. Spraying of insecticide should be done either in the early morning or in the evening and virus in the evening.
10. Use of poison bait pellets prepared with rice bran 12.5 kg, jaggery 1.25 kg, Carbaryl 50%, WP 1.25 kg and water 7.5 litres. This bait can be spread in the fields in the evening hours so that the caterpillars coming out of the soil, feed and get killed.

TOBACCO

Monitoring

Pest monitoring through light traps, pheromone traps and *in situ* assessments by roving and fixed plot surveys has to be intensified at farm level, village level, block level, regional and state levels. For bollworm, *H. armigera* management, an action threshold of one egg per plant or 1 larva / plant may be adopted.

Cultural practices

1. Synchronised sowing of cotton preferably with short duration varieties in each cotton ecosystem.
2. Avoiding continuous cropping of cotton both during winter and summer seasons in the same area as well as ratooning.
3. Avoiding monocropping. Growing of less preferred crops like greengram, blackgram, soyabean, castor, sorghum etc., along with the cotton as intercrop or border crop or alternate crop to reduce the pest infestation.
4. Removal and destruction of crop residues to avoid carry over of the pest to the next season and avoiding extended period of crop growth by continuous irrigation.
5. Optimising the use of nitrogenous fertilizers which will not favour the multiplication of the pest.

6. Judicious water management for the crop to prevent excessive vegetative growth and larval harbourage.

Biological control

1. Application of nuclear polyhedrosis virus (NPV) at 500 LE/ha in evening hours at 7^{th} and 12^{th} week after sowing.
2. Conservation and augmentation of natural predators and parasites for effective control of the pest.
3. Inundative release of egg parasite, *Trichogramma* spp., at 6.25 cc/ha at 15 days interval 3 times from 45 DAS egg-larval parasite. *Chilonus blackburnii* and the predator *Chrysoperla*. 1,00,000/ha at 6^{th}, 13^{th} and 14^{th} week after sowing.
4. ULV spray of NPV at 450 LE/ha with 10% cotton seed kernel extract, 10% crudie sugar, 0.1% each of Tinopal and Teepol for effective control of *Helicoverpa*.

NOTE : Dicofol, Endosulfan, Methyl demeton, Monocrotophos and Phosalone are comparatively safer to *Chrysoperla* larva recording low egg mortality.

Chemical control

1. Discouraging the indiscriminate use of insecticides, particularly synthetic pyrethroids and DDT.
2. Use of proper insecticides which are comparatively safer to natural enemies such as Endosulfan, Phosalone etc., at the correct dosage and alternating different groups of insecticides for each round of spray.
3. Avoiding combination of insecticides as tank mix.
4. Adopting proper delivery system using spraying equipments like hand compression sprayer, knapsack sprayer and mist blower to ensure proper coverage with required quantity of spray fluid and avoiding ULV applications of Akela spray applications.
5. Proper mixing and preparation of spray fluid for each filling of spray fluid tank.

Monitoring kit for detection of resistance to insecticides in *H. armigera*

This kit helps to find out the resistance level in various populations of *H. armigera* to various insecticides. The resistance level ranged from 8-24, 68-84 and 30-54 per cent for endosulfan, fenvalerate and cypermethrin respectively.

Improved techniques in biological control

Improved adult feeding techniques for *Trichogramma*

Trichogramme adult feeding through cotton swabs will trap the adults which get entangled in the sticky cotton lint. To avoid this, a better adult feeding technique is developed.

Making small dotted holes in a thick mylar film sheet or old film negative by using a sewing machine, leaving a gap of 1 cm between the dotted holes horizontally. One side of the sheet (7 x 6 cm) will be smooth and the other will be eruptive. Streak 50% honey solution on the smooth side by using a camel hair brush. Then fold the sheet in such a way that the honey-smeared surface is on the inside and the eruptive surface outside and staple it. The gap between the dotted holes will provide free movement for the adults, which imbibe the honey through eruptive surface. In this method, the adults do not get trapped in the honey solution.

COCONUT ERIOPHYID MITE

Spot application of carbosulfan 5 ml, azadirachtin 5 ml and triazophos 5 ml per tree at 45 days interval against coconut eriophyid mite is recommended.

Earlier, root feeding of monocrotophos was recommended with a safety period of 45 days from application to harvest.

In case of triazophos or carbosulfan, no significant residues were found in the nuts.

DEPARTMENT OF PLANT PATHOLOGY

SALENT FINDINGS FOR THE STATUS PAPER OF WESTERN ZONE

- In the servey of rice growing areas of Erode district indicated the prevalence of food rot disease in ADT 38 rice cultivar.

- *Helminthosporium oryzae* accounted for maximum seed infection in majority of rice seed samples followed by *Sarocladium oryzae* and *Trichoconis padwickii*

- Root rot pathogen *Macrophomina phaseolina* was found to be present both internally and externaly in blackgram and greengram seeds.

- The infection due to *Macrophomina phaseolina* in pigeonpea seeds ranged from 0.5 - 37% while in sunflower maximum seed infection of 17.5% was recorded.
- The leaf extract of *Prosopis juliflora* and *Eucalyptus globulus* reduced the seed infection of *H. oryzae* in rice.
- For the management of diseases in ecofriendly manner the biocontrol agents viz., *Pseudomonas fluorescens* and *Trichoderma viride* has been identified. *Pseudomonas fluorescens* (Pf1) is recommended as seed treatment @ 10g/kg of seed, root dipping @ 1.5kg/ha, soil application 30DAT @ 2.5kg/ha and foliar spray at boot leaf stage and 10 days later @ 1kg/ha is recommended for the management of rice diseases.
- Root rot diseases of gingelly, groundnut, pulses, panama wilt of banana are also effectively checked by seed treatment with *Pseudomonas fluorescens*
- *Trichoderma viride* the fungal biocontrol agent is recommended for the root rot diseases of blackgram, greengram, cowpea, groundnut, gingelly, sunflower, cotton, tomato, brinjal as seed treatment @ 4g/kg of seed. For quick wilt of pepper disease management *T. viride* has to be applied in nursery @ 1g/kg of pot mixture and in the mainfield @ 20g/vine along with Farm Yard Manure.
- Neem based products viz., Neem Oil 3% and NSKE 5% is recommended for the management of rice sheath rot rice BLB and Powdery mildew disease of pulses. Neem oil 60 EC (A) and (C) is recommended for the management of rice grain discoloration.
- For the management groundnut ring mosaic disease sorghum or coconut leaf extract at 10% concentration is recommended. Spraying Ipomea or prosopis leaf extract (25kg/ha) is recommended for the management of rice sheath rot disease.
- For the Integrated Disease Management of phytophthora wilt of betelvine soaking of seed vines for 30 min. in streptocycline 5000 ppm or Bordeaux mixture 0.5% is recommended. Application of 150kg Nitrogen/ha/year through neem cake (75kg Nitrogen) and Urea (75kg N) and 100 kg $P_2 0_5$ through superphosphate and 30kg MOP in 3 split doses first at 15 days after lifting the vines and second and third dose at 40 to 45 days interval has to be carried out. Application of shade dried neem leaf or colotrophis leaves in beds @ 2t/ ha and covering it with mud (2tonnes in 2 split doses) is recommended.

Nematode control methods in Grapevine, Groundnut, Bitter gourd

i. Grapevine:-

Field experiments conducted for the control of nematodes affecting grapevine revealed that the application of ***Pseudomonas fluorescens*** formulation in talc containing 15 x 10^3 colony forming units/gm., 30 cm away from the base of the vine, at 15 cm depth along with **NPK** fertilizers at the rate of 100g N, 80g P and 300g K per vine at the time of pruning reduced infestation by the root knot nematode ***Meloidogyne incognita*** and increased the yield significantly.

ii. Groundnut:-

Application of phorate 10G @ 1 kg a.i/ha managed the population of scab nematode ***Tylenchorhynchus brevilineatus*** by 9.8% and increased the yield by 64.2%. The cost-benefit ratio was 1:5.9. It was also found that the cultural practice of gypsum application 200 kg/ha 45 days after sowing, would also help in significantly reducing nematode infestation and damage.

iii. Bitter gourd:-

The survey at Kallimanthayam in Coimbatore district revealed the heavy incidence of root knot nematode with a highest gall index of 5.00 and the population rages from 400-650 juveniles/200 cc soil.

SERICULTURE

- Four mulberry genotypes were evaluated for their suitability for Western Zone of Tamil Nadu. V1 has recorded higher fresh leaf yield (10,432kg/ha/ harvest) than DD(8271kg), kanva 2 (7530kg) and MR 2 (6703 kg) at 7^{th} month after planting.

- Application of single super phosphate to Kanva 2 variety of mulberry as EFYM produced 6.22 percent higher leaf yield (8271 kg/ha/harvest) over single super phosphate application without enrichment (7787 kg/ha/harvest).

- High level of thrips leaf damage (> 40%) was noticed in four mulberry varieties viz., DD, Kanva 2, MR 2 and V1 during July 2000. In the field experiment conducted with four chemical insecticides and three plant products against thrips, maximum reduction of 80.41 percent was observed in dichlorvos (2ml/lit) closely followed by triazophos (78.18%) and malathian (77.53%) when compared to control. The percent reduction in thrips population was 68.33, 63.47, 60.81 and 59.61 respectively in endosulfan, Neem oil (C), Thuja and Neem oil (A).

- During field survey, upto 98 percent shoot damage by leaf webber, *Glyphodes pulverulentalis* was recorded. A population density of 10 *Glyphodes* larvae/bush

caused 40.78 percent reduction in leaf weight. The loss in income due to leaf webber damage in mulberry garden was estimated to be Rs. 1073/100 DFLs.

- The damage by *Aleurodicus dispersus* was severe in guava, tapioca, mulberry, chillies, papaya, brinjal and *Solanum trilobatum*. Feeding the silkworm cross breed (PM x NB4D2) with 50 percent spiralling whitefly damaged leaves caused a reduction of 20kg of cocoons when 100 DFLs of silkworm were reared. Fifty spirals of whitefly could cause 44 percent leaf damage.

- Decreasing order of efficacy of five insecticides against the spiralling whitefly adults was dichlorvos, fenthion, phosalone, triazophos and malathion with LC 50 values of 10.06, 12.88, 21.26, 21.31 and 32.97 respectively.

- The population of coccinellid predators *viz., Menochilus sexmaculatus* and *Axinoscymnus puttarudriahi* and *Stethorus* sp. ranged from 2 to 12 per 20 plants and the spiders *viz., Plexippus paykulli, Oxyopus linealyx, Micromonata virescens, Araneus* sp., *Argiope* sp., *Tetragnatha* sp., *Philodromus* sp *Thomisus* sp., *Peucetia viridana* and *Olios* sp ranged from 2 to 15 per 20 mulberry plants.

- Antagonistic bacterium, *Bacillus subtilis* was found to be inhibitory to the mulberry root rot pathogen, *Macrophomina phaseolina* under laboratory and field conditions. *Bacillus subtilis* carrier based inoculum @ 25g/plant near the root zone at the time of planting/pruning reduced the population root rot pathogen.

- Adoption of IPM practices brought down the uzifly incidence to 14 percent from 32 percent and increased the mulberry silkworm cocoon yield by 19.5kg/100 dfls in hot spot areas.

- A new disinfectant viz : Sodium Dichloro isocyanurate (Bacticid) suppressed the population of *Serratia marcescens* by 100 percent both at 200 and 500ppm and 86.5 percent at 100ppm followed by Ciprofloxacin at 500ppm which could suppress by 81.6 percent.

6. 4.4 : HORTICULTURE

TAMARIND

CROP MANAGEMENT

The seeds collected from six agroclimatic zones of Tamil Nadu (except high attitude and hilly areas) expressed that high rainfall zone of Tamil Nadu comprising of Nagarkoil, Kanyakumari and Pechiparai were better suited for collection of seed with respect to fruit, seed and seedling quality characters. This zone also recorded higher recovery of larger seeds than other zones.

Nursery Techniques

Larger sized seeds 27/64" round perforated metal sieve sown in larger containers (25 x 15 cm) produced elite seedlings than bulk seeds and smaller containers respectively.

Seed pelleting with Azospirillum followed by soil application of VAM improved the elite seedling production at nursery.

Hardening of seeds with $ZnSO_4$ and pelleting with arappu leaf powder (*Albizia amara*) produced the elite seedling in nursery.

COCONUT

CROP MANAGEMENT

FOR INFORMATION

Among all the varieties Chowghat Dwarf Green can be recommended for tender nut purposes at 6^{th} month stage because it contains higher total soluble solids (6.45° Brix), Total sugars (7.15%), reducing sugars (5.58%), potassium (2145 ppm) and sodium (24 ppm) content which contribute to the best quality tender nuts and has better consumer preference.

Four coconut varieties viz., West Coast Tall, Chowghat Dwarf Orange, Tall x Dwarf and Dwarf x Tall were used for the minimal processing study. The results revealed that cultivar CDO was superior with respect to weight of minimal processed nut, volume of tender coconut water, biochemical and sensory qualities as compared to other varieties. Dipping the minimal processed nuts in a solution of 0.50 per cent Potassium metabisulphate (Kms) + 0.5 per cent Citric acid effectively prevented browning of external surface of minimal processed nuts for 24 days. Packaging light processed nuts in LDPP (0.023 mm) or LDPE (0.025 mm) covers with 40 ventilation holes of four millimeter diameter and storing the nuts in a refrigerator at 5 to 7° C extended shelf life of tender coconut water upto 24 days. Minimal processing technology reduced weight of tender coconut by 67.3 per cent and volume by 78.2 per cent thus permitting three times the number of light processed nuts in a place of whole tender coconuts transported at

present. The husk of tender coconut was found to contain (on dry weight basis) 6.7 per cent crude protein, 65.2 per cent easily digestible carbohydrates (nitrogen free extract) 5.1 per cent minerals indicating its rich nutritional value for use as cattle feed. The minimal processing technology standardized has made it possible to include tender coconuts among chilled RTS beverages. In talls (ECT and WCT) oil content is more in 13^{th} month stage ie. 69.68% and 70.48% respectively and tall varieties can be recommended for oil extraction. During summer (March to May) the inflorescence , bunch and nut production and yield are more in all the varieties than other seasons. Among all the varieties, hybrid (T x D) recorded the highest yield of 167 nuts / tree followed by Chowghat Dwarf Green (127 nuts / tree). From September to November (North East Monsoon Season) leaf production is more in case of hybrids (35.Nos.) than other varieties .

SPICES

CORIANDER

CROP MANAGEMENT

01. Foliar application of growth regulators

Among the growth regulators tried to improve the yield in Coriander, CCC and MH have expressed positive results while 2,4-D had a negative influence. GA_3 appeared to be neutral, while CCC found beneficial at higher concentration (> 200 ppm). MH was useful at lower concentration (< 50 ppm). Best results were obtained with two sprays of CCC at 200 ppm given after 30^{th} and 40^{th} day of sowing with an increased yield of 9.80 g per plant as against 6.30 g in control. GA_3 significantly increased the plant height while MH, CCC and 2, 4-D exhibited dwarfing effect.

Effect of growth regulators on the yield of Coriander.

Sl. No.	Growth regulators	Plant height (cm)	Yield / Plant (g)
1.	Control	39.70	6.30
2.	CCC 200 ppm	30.80	9.80
3.	GA 50 ppm	55.40	6.70
4.	MH 50 ppm	27.00	8.90
5.	2,4-D 50 ppm	36.80	5.40

03. Seed technological studies in Coriander

- The physiological dormancy of coriander seeds can be overcome by soaking the seeds in 0.5% KNO_3 solution for 24 hr or leaching mericarps in running water for 16 hours followed by soaking the seeds in 100 GA_3 for 16 hr.
- The seeds of Coriander, Fennel and Fenugreek can be stored with high vigour and viability under ambient conditions in 300 gauge polylined cloth bag with halogen formulation treatment (3 g kg^{-1}) for more than 5 months.
- Genotypes differed in their storability in all the three spices. The genotype GM-ACC-123 of coriander, UF 133 of fennel and GM-ACC-29 of fenugreek were comparatively good storers than the rest.
- Hardening of seeds with 2% arappu leaf extract with 24 hr soaking in 1:0.60 ratio followed by drying was the best for Coriander and Fennel and one hour at 1:0.3 ratio for Fenugreek. The hardened seeds (2% arappu leaf extract) can be stored for four months, in all the three spices.
- Pelleting of seeds using $CaCO_3$@200g kg^{-1} improved the germination, vigour and seedling characters in all the three spices. The pelleted and hardened cum pelleted seeds could be stored for 2 months in corinander and three months in Fennel and Fenugreek without much reduction in vigour and viability of seeds.
- The hardened seeds stored better than the pelleted and hardened cum pelleted seeds.

02. Growth regulators in Rose

In Hybrid Tea Rose cv. First Red, different growth regulating chemicals viz., Gibberellic acid at 100, 200 and 300 ppm, Benzyl adenine at 500, 1000 and 1500 ppm, Salicylic acid at 50, 100 and 150 ppm and Brassinolide at 0.25, 0.50 and 0.75 ppm were tried to influence growth and flowering. Among them, Gibberellic acid at 200 ppm increased growth and flowering besides enhanced flower yield and improved quality.

CHRYSANTHEMUM

DRY FLOWERS

01. Standardisation for dry flower technology

To assess the plant species suitable for dry flower production, three flowers viz., Celosia, Rose and Chrysanthemum at young stages of maturity were dried at Sun, Hot Air oven, Micro wave oven and silica gel methods and subjected to bleaching and dyeing. For all the three flowers, the half bloom and full bloom stages were found ideal for drying. Sodium chlorite at 10 per cent with nine hours was found to be the effective bleaching agent. Among the five colour groups tried, Vat group was found good for celosia. Floral crafts made with dry flowers require polyethylene lining to prevent insect damage and dust. When stored in card board boxes, silica gel is placed in poaches to prevent dampness in the floral crafts.

BANANA

CROP MANAGEMENT

01.High density planting in banana

During this year a new spacing cum nutritional trial was taken up with a view to find out the effect of HDP in banana cv. Robusta (AAA) with planting of three suckers and four suckers per hill with 100%, 75% and 50% of the recommended doses of fertilizers. The results obtained are presented below :

Table: Influence of Density and Nutrition on Banana cv. Robusta

Treat-ments	Plant spacing	Suc-kers /hill	Planting density / ha	Dosage of N:P:K g / hill	Bunch weight (Kg)	No. of hands	No. of fingers	Finger weight (g)	Crop Duration (days)	Cost benefit ratio
T1	1.8x1.8	1	3086	200:60:300	28.00	9.73	139.97	200.45	327.2	1:2.75
T2	1.8x3.6	3	4630	600:180:900	22.45	9.00	126.73	177.58	364.7	1:2.94
T3	1.8 x3.6	3	4630	450:135:675	23.45	9.13	131.60	178.55	370.4	1:3.35
T4	1.8 x3.6	3	4630	300:90:450	24.38	9.19	135.22	180.25	379.6	1:3.85
T5	1.8 x3.6	4	6172	800:240:1200	17.47	8.00	108.62	159.53	403.7	1:1.48
T6	1.8 x3.6	4	6172	600:180:900	17.57	8.09	110.27	160.79	408.8	1:1.67
T7	1.8 x3.6	4	6172	400:120:600	18.23	8.33	112.81	161.45	425.5	1:1.82
T8	3.6 x3.6	3	2314	600:180:900	25.38	9.05	134.61	188.48	355.4	1:2.96
T9	3.6 x3.6	3	2314	450:135:675	25.58	9.15	134.27	190.45	363.8	1:3.25
T10	3.6 x3.6	3	2314	300:90:450	26.40	9.65	137.45	192.05	390.0	1:3.53
T11	3.6x3.6	4	3086	800:240:1200	17.36	7.98	111.11	153.53	412.3	1:1.69
T12	3.6x3.6	4	3086	600:180:900	17.45	8.05	112.11	155.60	418.8	1:1.82
T13	3.6x3.6	4	3086	400:120:600	17.60	8.13	113.69	158.50	431.9	1:1.97
S.Ed					0.49	0.077	4.15	3.07	1.11	
CD (5 %)					1.01	0.16	8.43	6.22	2.25	

The specific influence of multiple sucker per hill is presented below :

Table . Influence of number of suckers on performance of cv. Robusta

Characters	Single sucker /hill	Three suckers/ hill	Four suckers / hill
Plant height (m)	2.21	2.42	2.65
Plant girth (m)	0.85	0.72	0.66
Number of leaves	19.48	19.70	19.97
Leaf area (m^2)	26.28	26.40	26.47
Days to shooting	242.15	279.74	312.15
Shooting to harvest	85.00	100.98	101.67
Total crop duration	327.15	370.69	416.82

When compared to conventional planting, all the HDP treatments under 1.8x3.6 m spacing alone registered higher yield per hectare. Planting of three suckers at a spacing of 1.8 x 3.6 m with application of 300: 90: 450 g NPK / pit registered the highest cost: benefit ratio.

02.Micronutrient spray for bananas

Studies were undertaken to confirm the results of the previous experiment which was conducted to understand the influence of micronutrients on yield and quality parameters of banana cv. Robusta.

The results of two year study showed that micronutrients significantly influenced the yield attributes. Among them, combined foliar application of $ZnSO_4$ (0.5%), $FeSO_4$ (0.2%), $CuSO_4$ (0.2%) and H_3BO_3 (0.1%) significantly improved the bunch weight (23.15 kg), number of hands/ bunch (12.75), number of fingers/bunch (121.3) and TSS (19.15 °Brix) (Table…….).

Table: Effect of micronutrients on banana cv. Robusta

Treatments		**Bunch weight (kg)**	**No.of hands/ bunch**	**No.of fingers/ Bunch**	**TSS (°Brix)**
T1	Control	17.30	10.25	94.4	18.15
T2	$ZnSo_4$ (0.5%) at 3rd, 5th and 7th month	19.00	11.40	105.0	18.65
T3	$FeSo_4$ (0.2%) at 3rd, 5th and 7th month	19.05	11.05	104.8	18.80
T4	$CuSo_4$ (0.2%) at 3rd, 5th and 7th month	18.03	10.70	101.8	18.40
T5	H3Bo3 (0.1%) at 3rd, 5th and 7th month	18.95	11.30	110.9	19.15
T6	$ZnSo_4$ + $FeSo_4$ at 3rd, 5th and 7th month	20.70	11.95	112.3	18.80
T7	$ZnSo_4$+ $FeSo_4$ + $CuSo_4$ at 3rd, 5th and 7th month	21.80	12.40	118.8	19.05
T8	$ZnSo_4$ + $FeSo_4$ + $CuSo_4$ + H_3Bo_3 at 3rd, 5th and 7th month	23.15	12.75	121.3	19.15
T9	Soil application of micronutrients	19.55	12.00	118.1	19.05
CD (P:0.05)		3.18	1.45	20.5	1.26

03.Fertigation in Banana :

With the aim of economising the use of nutrients and water in banana, this trial was carried out in banana cv. Robusta with the following treatments, replicated thrice.

W_1F_1, 25 litres of water/day/plant + 200:30:300 g NPK/plant
W_1F_2 **25** litres of water/day + 150:30: 225 g NPK/plant
W_1F_3 25 litres of water/day + 100:30:150 g NPK/plant
W2F1 20 litres of water/day + 200:30:300 g NPK/plant
W2F2 20 litres of water/day + 150:30:225 g NPK/plant
W2F3 20 litres of water/day + 100:30:150 g NPK/plant
W3F1 15 litres of water/day + 200:30:300 g NPK/plant
W3F2 15 litres of water/day + 150:30:225 g NPK/plant
W3F3 15 litres of water/day + 100:30:150 g NPK/plant
WoFo Control (conventional irrigation + 200:30:300 g NPK/plant)

The results indicated that all the fertigation treatments were significantly superior over the control for major yield contributing characters. Among the fertigation treatments, the treatment 25 liters per day + 200:30:300g of NPK / plant recorded the highest average bunch weight (44.53 kg/bunch), bunch length (1.08 m), number of hands per bunch (10.51), number of fingers per bunch (193.73), finger length (29.13 cm), finger mid – circumference (17.10 cm) and finger weight (298.84g). An yield increase of 101.2% and a saving of 21.88% of water over control was observed through fertigation. Fertigation with even 50% fertilizer dose and 15 liters per day showed an yield increase of 31.5% over control with a water saving of 53.13%.

Table:Effect of fertigation on yield of Robusta (AAA)

Treatments	Bunch weight (Kg)	No. of hands / bunch	No. of fingers /bunch	Mean finger weight (g)	Pulp : peel ratio
$W1F_1$	44.533	10.517	193.733	304.840	3.930
W1F2	42.748	10.000	179.270	295.777	4.393
W1F3	38.000	9.343	153.943	282.173	4.453
W2F1	41.947	10.637	183.890	298.783	4.583
W2F2	38.947	10.121	151.440	284.423	4.350
W2F3	35.610	9.833	146.970	248.240	5.353
W3F1	35.507	10.057	157.900	260.767	4.933
W3F2	32.097	9.203	141.693	224.403	3.883
W3F3	29.110	8.927	127.360	212.360	3.740
W0F0 Control	24.747	8.121	118.013	189.177	4.017
CD (P=0.05)	2.991	0.434	8.760	10.423	0.274

PAPAYA

CROP MANAGEMENT

02. Effect of micronutrients (zinc and boron) on papaya cv. CO.5 :

To confirm the results of the first experiment, investigations were undertaken on papaya cv.CO.5 with the micronutrients, zinc and boron at different concentrations and different stages of growth. The treatment details are as below.

T1 – Control
T2 – $ZnSO_4$ 0.5% one spray (4^{th} month)
T3 – $ZnSO_4$ 0.5% two sprays (4^{th} and 8^{th} month)
T4 – H_3BO_3 0.1% one spray (4^{th} month)
T5 – H_3BO_3 0.1% two sprays (4^{th} month & 8^{th} month)
T6 – $ZnSO_4$ 0.5% + H_3BO_3 0.1% one spray (4^{th} month)
T7 – $ZnSO_4$ 0.5% + H_3BO_3 0.1% two sprays (4^{th} and 8^{th} month)
T8 – Soil application of Zn + B

Foliar application of $ZnSO_4$ 0.5% +H_3BO_3 0.1% during 4^{th} and 8^{th} month (T7) significantly influenced growth attributes and yield characteristics. Number of fruits and fruit weight were found to be maximum in T7 by registering 166.76 and 2.22 kg / fruit respectively. The cavity index was also observed maximum (26.76). The same trend was observed in the case of wet latex yield and TSS. The maximum latex yield of 37.99 g / fruit and TSS of 14.8 °Brix were resulted due to the treatment, T7.

Table: Effect of zinc and boron on yield and quality attributes in papaya cv. CO.5

Treatment	No. of fruits/tree	Fruit weight (kg)	Yield / plant (kg)	Latex yield (g/fruit)	TSS (°Brix)
T1	137.13	1.78	244.89	31.07	12.30
T2	144.35	1.83	264.16	32.25	12.41
T3	148.18	1.89	280.06	32.82	12.90
T4	154.39	1.94	299.52	33.80	13.23
T5	155.52	2.01	312.59	35.18	13.58
T6	161.58	2.15	347.40	36.37	14.63
T7	166.76	2.22	370.20	37.99	14.80
T8	160.20	2.09	334.81	36.74	14.30
CD(0.05)	5.11	0.13	85.23	1.37	0.43

JACK

Fresh seeds of jack could be stored for 60 days with 30 per cent germination by mixing the seeds with damp charcoal at 1:2 ratio and packed in polythene bag (300 gauge) and storing at 10°C.

The seeds mixed with dry charcoal and stored at 10°C maintained 45 per cent germination for 40 days.

Mixing of fresh seeds of jack with sand (seed : sand ratio 1.2) moistened by "Jalashakti" 10 per cent and keeping the seeds in loosely bound polythene bag (300 gauge) at room temperature maintained 100 per cent viability after three months. Seeds mixed with dry sand lost viability within two months .

POST HARVEST TECHNOLOGY

Food Science and Nutrition

01. Papaya Flakes

Fully matured and firm papaya fruits were washed, peeled and cut into 7 x 5 x 3 cm cubes. The flakes were pre-soaked in two per cent calcium chloride for half an hour and soaked in 70° brix sugar syrup containing 0.1 per cent potassium meta-bi-sulphite. The temperature was maintained at 50°C for two hours. The flakes were drained from sugar syrup and dried under shade or mechanical drier to final moisture level of 12 per cent. The osmo-dried flakes were packed in polypropylene bags (200 gauge) and stored in ambient condition and refrigerated condition. The sensory evaluation of papaya flakes revealed a shelf-life of six months at an ambient temperature and nine months in refrigerated conditions. This technology can be adopted for commercial preparation of papaya flakes as in the case of papaya candy.

02. Value added product from Sweet Potato

Sweet potato tuber paste and flour were processed and substituted in extruded, bakery, convenience and processed foods for evaluation. Processed foods like ready to serve beverage, Jam, sauce and pickle were prepared from sweet potato paste and cubes. Five extruded products namely vermicelli, noodles, macaroni, spaghetti and sticks (sevai) were pared with 30 per cent sweet potato flour incorporation. Three bakery products namely cake, biscuit and cookies were prepared by the addition of 40 per cent level of sweet potato flour. Convenience foods like murukku, payasam, halwa and custard mixes were developed using 50 per cent of sweet potato flour. The sensory evaluation of sweet potato based products revealed high acceptability. The developed products also had higher shelf life qualities.

03. Guava – Lime – Ginger Ready To Serve Beverage

A study was conducted to develop a 'ready to serve' beverage from guava with lime and ginger in the proportion of 7:2:1. This contains 15.0 per cent fruit juice. TSS 15° brix, acidity 0.3 per cent, vitamin C-48 mg/100 ml of juice and preservative sodium benzoate l00 ppm. RTS was evaluated organoleptically by a panel of 10 members. The colour and appearance, flavour, texture, taste and over all acceptability were found to be highly acceptable with an average score of above 80.0 per cent. The shelf life study of this beverage was also conducted for a period of three months and found to be acceptable with the minimum loss of 15.5 per cent vitamin C. This beverage could be considered as a health drink since it contains extracts of guava and lime rich in Vitamin C and ginger which is carminative in nature.

04. Moringa Chutney:

Ingredients :

Moringa pulp 250g, Tamarind 250g, Garlic 10 pods, Asafoetida a pinch, chilli powder 15g, mustard powder 10g, turmeric powder 5g, salt 7g, gingelly oil 200 ml, vinegar 5g, fenugreek powder 10g.

Method

Moringa pulp was cooked. Cleaned tamarind was soaked in hot water and thick tamarind juice was extracted. The mustard powder, garlic, asafoetida and moringa pulp were added to the heated oil. They were allowed to cook for 10 minutes till oil is separated. At this stage, chilli powder, turmeric powder, salt and vinegar were added and mixed well. Finally, chutney was cooled and filled in sterilized dry bottles.

Post harvest handling studies : Banana

Bunch covering with black polythene covers with 0.1 to 0.3 per cent ventilation and of 100 gauge thickness, reduced light penetration, tended to build up marginally higher level of temperature, enhanced the maturity of bunches, increased the fruit length and circumference, showed superior quality, reduced the peroxidase activity and enhanced the amylase enzyme activity and reduced the level of mechanical damage and thrips.

Hydrocooling appeared to be the best pre-storage treatment taking 13.64 days for ripening as against 11.8 days taken by untreated fruits in control. Dipping in hot water at 55 ° C for 10 minutes reduced the storage rot besides delaying ripening. A dip in 4 ppm of kinetin and 150 ppm of GA_3 delayed the ripening of fruits.

An indigenous Potassium permanganate based ethylene absorbent material made of clay + coir pith base effectively delayed the ripening of fruits (18.67 days) while in control the fruits ripened within 10.35 days. Among the different sized ethylene absorbents tested, 6 x 6 cm proved to be more beneficial for ethylene absorption. The ethylene peak was much lower (0.001 in mV) recorded in control.

In Banana cv. Robusta under ambient conditions, the alkaline $KmnO_4$ based indigenous (clay 2.5: coirpith 1.0) ethylene absorbent was found to extend the shelflife by 20 days compared to the sealed control (14 days).

Under cold storage conditions (13°C), the alkaline $KmnO_4$ based indigenous ethylene absorbent (clay 2.5:Coirpith, 1.0) was found to extend the shelf-life for 31 days compared to the sealed control (17.50 days).

Polythene bags with 300 gauge thickness with 0.5% ventilation is effective in improving the shelf life of banana cv. Robusta with acceptable levels of biochemical parameters.

Effect of indigenous ethylene absorbent (alkaline $KMnO_4$ based) on biochemical changes in banana cv. Robusta under cold storage

Treatments	Edible maturity (days)	TSS (%)	Acidity (%)	Ascorbic Acid (mg/100g)	Total Sugars (%)	Reducing sugars (%)
T_1- Clay + Coirpith (1.0 : 1.0)	22.25	21.38	0.30	10.13	19.71	13.63
T_2 - Clay + Coirpith (1.5 : 1.0)	24.63	19.32	0.27	10.11	20.63	15.71
T_3 - Clay + Coirpith (2.0 : 1.0)	26.16	22.16	0.27	9.86	21.32	16.32
T_4 - Clay + Coirpith (2.5 : 1.0)	29.38	23.89	0.25	10.62	21.50	16.47
T_5 - Sealed Control	22.63	21.86	0.33	9.61	19.63	13.16

Treatments	Shelf life	PLW (%)	TSS (°Brix)
300 gauge thickness with 0.5% ventilation	15 days	8.19	17.54
400 gauge thickness with 0.5% ventilation	16 days	7.13	17.21
500 gauge thickness with no ventilation	18 days	4.52	16.85
Control	7 days	19.2	13.73

VEGETABLES

CAPSICUM

Fertilizer requirement of hybrid capsicum

For hybrid capsicum 'Bharath' application of 180 : 120:80 kg NPK/ha proved to be significantly superior by recording the highest fruit yield of 6.37 t/ha with highest BCR of 3.98:1.

Effect of N & P application on yield of hybrid capsicum (Mean of three seasons)

Treatments NP (kg/ha)	Yield (q/ha)	BCR
60 : 60	37.6	2.70
60 : 120	44.7	3.01
60 : 180	47.8	3.05
120 : 60	44.7	3.09
120 : 120	53.2	3.46
120 : 180	56.0	3.44
180 : 60	54.9	3.33
180 : 120	63.7	3.98
180 : 180	64.7	3.89
240 : 60	50.3	3.21
240 : 120	58.9	3.55
240 : 180	62.7	3.67
CD 5%	3.34	-

BHENDI

01.Weed Management in Bhendi

Application of metolachor at 0.75 kg/ha (dual 50 EC at 1.11/ha) are pre-emergence followed by hand weeding once on 45 DAS efficiently controlled weeds in bhendi and produce highest yield of 6.31 t/ha with highest benefit cost ratio of 3.67:1.

Treatments	Fruit yield (t/ha)	WCE %	BCR
Metolachor 0.75 kg/ha + HW	6.31	63.9	3.67
Basalin 1.0 kg /ha + HW	5.90	57.8	3.36
Weed free	6.68	-	3.34
Weedy check	3.61	-	2.58
CD 5%	**0.33**	**-**	**-**

CROP MANAGEMENT

CASSAVA

Sequential cropping of cassava with vegetable cowpea

This experiment was conducted for two seasons from 1998-1999 to 1999-2000. Prior to planting of cassava, vegetable cowpea cv. CO.2 was raised for haulms and green pods. The green pods were harvested at periodical intervals of one week. Totally, six harvests were made for green pods in each season. The mean data recorded on vegetable cowpea is furnished below.

Estimated yield of vegetable cowpea pods and haulms (mean of two seasons)

Haulm yield (kg/ha)	Pod yield (kg/ha)	Total biomass yield (kg/ha)
16,750	4,750	21,500

After the harvest of green pods, the haulms of cowpea were incorporated into the soil by insitu ploughing. Later, sets of cassava cv. CO.2 were planted and different treatments, as per the technical programme were imposed. The results of the trial have indicated that among nine treatments, T5 (FYM –12.5 t/ha, P-30kg/ha and N & K 60:160 kg/ha) recorded the highest mean tuber yield of 3.44kg/plant followed by 3.31 kg in T9 (FYM-25 t/ha, P-60 kg/ha and N & K 60 : 160 kg/ha). The plants of T5 showed increased vigour and stability through foliage yield (6.10 kg/plant), tuber length (29.3cm), girth (21.9cm), tuber dry matter (46.7%) and total biomass yield (9.40 kg/plant). Though the tuber yield recorded by T9 is on par with T5, considering the economics of cultivation, the treatment T5 was found to be most effective. This is because the benefit cost ratio for T5 is 4.1 as against 3.25 in T9.

Treatments	Tuber yield (t/ha)	Total cost of production (Rs.)	Gross income (Rs.)	Net returns (Rs.)	Cost benefit ration
T1 (F1P1)	26.9	16041	56235	40193	1:3.4
T2 (F1P2)	33.2	18389	60985	42595	1:3.3
T3 (F1P3)	35.9	19430	65302	46199	1:2.4
T4 (F2P1)	36.4	20012	67717	47696	1:3.4
T5 (F2P2)	41.2	19596	80895	61298	1:4.1
T6 (F2P3)	36.1	20133	71476	51343	1:3.5
T7 (F3P1)	31.3	22797	64417	41620	1:2.8
T8 (F3P2)	35.2	23184	70877	47692	1:3.1
T9 (F3P3)	40.9	24944	80732	57288	1:3.3

6. 4.5 : AGRICULTURAL ENGINEERING

Research on the development of improved agricultural machinery / implements / technologies in different areas of Agrl. Engineering namely Farm Machinery, Agrl. Processing, Bio-Energy and Soil and Water Conservation Engineering is carried out in the College of Agricultural Engineering. The technologies developed in this college are transferied to the farming community through intensive trials, demonstrations and training. Krishi Vigyan Kendras of the University help in popularization of the technologies developed in this college. The proven agrl. machineries / implements are being manufactured under revolving fund scheme and prototype manufacturing scheme and supplied to the needy departments and farmers.

The Zonal Research Centre, CAE is yet another research center concentrates the research programmes on mechanization study in Tamil Nadu to identify mechanization gaps and development of cotton picker, dibber for pulse / cotton, hoist for training / pruning / lopping / harvesting of orchard tree crops, deep trencher for paired row planting of sugarcane, vegetable planter, horticultural and preparation of directory of horticultural tools.

7. PROSPECTS OF AGROBASED INDUSTRIES

Crop concentration is a prerequiste for starting any agrobased industry. Maize is concentrated in taluks like Udemalpet. Similarly tomato in Coimbatore, coconut in Pollachi, turmeric in many taluks of Erode district and drumstick in Dharapuram district are concertrated. Therefore the zone has more potential for starting agrobased industries which are to be promoted in large scale in view price fall in many commodities. Copra and oil extraction units, bottling tender coconut water, coconut milk production, drumstick pickle, drumstick seed oil, tomato sauces, value added products of turmeric, glucose producing units using maize are all having more scope in this zone.

8. Future thrust

* For further increase in rice productivity, hybrid rice has to be necessarily promoted in larger area particularly in Erode district where rice area is more so far as this zone is concerned.

***** Minor diseases such as Foot rot causes considerable loss in rice yield, of late. Studies in detail as to how they slowly become major diseases have to be programmed and pursued.

***** Pulses area is abysmally low in this zone although the potential is more. With the insistence of 5' spacing for sugarcane, intercropping of pulses has to be promoted.

* Man to machine approach : As indicated in the constraints and suggestion to alleviate them (vide Sl. No. 5 and 8), movement of agricultural labour to industries such as powerloom, hosieries is inevitable. To keep the momentum of agriculture in tact, 'man to machine approach' is all the more essential. Massive demonstration of implements, machines developed so far has to be carried out with a sense of urgency. The feedback from the farmers has to be sincerely utilised for modificatin of the machines if needed.

***** Coconut suffers both by price fall and minor pests becoming major ones. Extensive cultivation under coconut alone is therefore risky. To dilute the risk, feasibility of intercropping, value added by products such as bottled tender water have to be studied with more emphasis.

***** Crop based industries particularly in maize in Udumalpet taluk, tomato in Coimbatore, drumstick in Dharpuram taluk and castor in Tiruchengodu taluk would be worth to consider.