CAUVERY DELTA ZONE – STATUS PAPER

1. GEOGRAPHICAL DISTRIBUTION OF AREA OF EACH DIVISION OF CAUVERY DELTA ZONE

Cauvery Delta Zone (CDZ) lies in the eastern part of Tamil Nadu between 10.00-11.30, North latitude and between 78.15 – 79.45 longitude. It is bounded by the Bay of Bengal on the East and the Palk straight on the South, Trichy district on the west, Perambalur, Ariyalur districts on the north west, Cuddalore district on the North and Puddukkottai district on the South West.

CDZ encircles the entire revenue taluks of Thanjavur, Thriuvarur, Nagappatinam districts numbering 20, five revenue taluks of Trichy districts, two of Cuddalore and one taluk of Puddukkottai districts thus the zone comprises of 28 revenue taluks of the eastern belt of state. All these taluks are benefited by the river Cauvery.

S.No	District	Taluk
1.	Thanjavur	Thanjavur Thriuvaiyar Papanasam Kumbakonam Orathanadu Pattukkottai Peravurani Thiruvidaimarudur
2.	Nagappattimum	Sirkali Mayiladuthurai Tharangampadi Veddaranyam Nagappattinam
3.	Thiruvarur	Needamangalam Nannilam Thiruvarur Thiruthuraipoondi Valankaiman Kodavassal Mannarkudi
4.	Trichy	Trichy Thuraiyur Kulithalai Musiri

5.	Perambalur	Lalgudi
6.	Cuddalore	Chidambaram Kattumannarkoil
7.	Pudukkottai	Aranthangi

CDZ has a total geographic land area of 14.47 lakh ha which is equivalent to 11.13 percent of the state area. The erstwhile Thanjavur district occupies 57 percent of CDZ followed by Trichy, Ariyalur, Cuddalore and Pudukkottai districts.

S.No.	**District**	**Area (Lakh hectare)**
1.	Thanjavur Thiruvarur Nagapattinam	8.21 (56.74)
2.	Trichy and Ariyalur	4.73 (32.69)
3.	Cuddalore	1.05 (7.26)
4.	Pudukkottai	0.49 (3.39)
	CDZ total	14.47
	State Geographical area	130.02

(Figures in parentheses are percentage to the Geographical area of CDZ)

2. Rainfall data for 1970-1999

Annual rainfall (Mean) : 1078 mm
Seasonal Rainfall

Season	**Mean**
Winter	40.0 (mm)
Summer	69.2
South West Monsoon	295.4
North East Monsoon	673.8

Monthly rainfall

Months	**Mean**
January	22.6 (mm)
February	17.4
March	13.0
April	19.0
May	37.1
June	38.6
July	55.5
August	87.9
September	113.1
October	230.5

November	268.9
December	174.3

Weekly rainfall

S.No.	Standard weeks	Mean
1.	(Jan 1-7)	9.8 (mm)
2.	8-14)	6.3
3.	15-21)	5.5
4.	22-28)	0.9
5.	29-4)	1.2
6.	(Feb 5-11)	3.8
7.	12-18)	7.0
8.	19-25	5.4
9.	26-4)	3.0
10.	March 5-11)	8.3
11.	12-18)	0.8
12.	19-25	0.5
13.	26-1)	0.4
14.	(April 2-8)	2.4
15.	9-15)	4.2
16.	16-22)	6.6
17.	23-29)	5.8
18.	30-6)	2.9
19.	(May 7-13)	7.3
20.	14-20)	8.1
21.	21-27)	12.0
22.	28-3)	6.6
23.	(June 4-10)	8.9
24.	11-17)	18.0
25.	18-24	6.4
26.	25-1	5.1
27.	July 2-8)	8.4
28.	9-15)	10.9
29.	16-22)	13.4
30.	23-29)	22.7
31.	30-5)	10.6
32.	August 6-12)	13.0
33.	13-19)	14.5
34.	20-26	24.0
35.	27-2	25.6
36.	(Sep 3-9)	40.5
37.	10-16	25.0
38.	17-23)	20.7

39.	24-30)	26.9
40.	(Oct 1-7)	26.5
41.	8-14)	28.6
42.	15-21)	39.1
43.	22-28)	59.2
44.	29-4)	77.0
45.	(Nov 5-11)	88.1
46.	12-18)	66.8
47.	19-25)	69.1
48.	26-2)	44.9
49.	(Dec. 3-9)	72.6
50.	10-16)	45.2
51.	17-23)	36.7
52.	24-31)	19.7

3. Suggestion to alleviate the problem and constraints

SOILS IN CAUVERY DELTA

Geology of old Thanjavur soils

The geological formation of the Thanjavur District is made up of cretacious, Tertiary and Alluvial deposits and the major area is occupied by the Alluvial and Tertiary deposits.

The cretacious formations occur as a small patch west and South-west of Vallam. These formations have a very thick lateritic cap, consisting of impure limestones and sand stones of silt, Clay calcareous and argillaceous variety. In the coast these formations are overlain by Cuddalore sand stones of Tertiary age.

The Cuddalore sand stones of Tertiary age are well developed as best seen West of Grand Anicut canal and near Orathanad. These sand stones are covered by a thin layer of wind blown sandy clays, unconsolidated sands, clay bound sand and mottled clays with lignite seams. This tertiary formation is invariably capped by laterite.

In the East and Alluvial deposits of the river Cauvery and its tributaries lie over the tertiary sand stone. They consist of medium to firm sands, gravelly sands, clays and sandy clays. The thickness of these formations range from 30 metres to 400 metres.

Soils of Old Thanjavur District

The district has deep and fertile soils. It can be grouped into two categories namely 1) alluvial soil and 2) lateritic soil. Alluvial soil is found to occur in the old delta region comprising the major portion of the zone lying in the northern part whereas, lateritic soil covers new delta region lying in the southern part of the district. The alluvial soils is clayey in texture with 40-45 per cent clay fraction. Predominent clay minerals of alluvial soil are called montmorillonite, which has good capacity for adsorption and

retention of water and plant nutrients. But when dry, these alluvial soil cracks widely and deeply because of the presence of expanding montmorillonite clay. On the other hand, lateritic soil of new delta is sandy with less than 25% clay fraction. The dominant clay mineral of lateritic soil is kaolinitic having little capacity for adsorption and retention of water and plant nutrients. In certain pockets, these soils when dry, form hard surface layers (crusting) due to high proportions of free iron and aluminium oxides and hydroxides.

Fertility status of Thanjavur soils

The soils of Thanjavur district are potentially productive. The fertility evaluation of Thanjavur soils revealed that the entire district is low in available nitrogen. With respect to phosphorus, about 80% of the soils (i.e. soils from 27 blocks) have medium content of available P and the remaining 20% of the soils (i.e. soils from 7 blocks) have high content of available P. With regard to potassium, about 70% of the soils (i.e. soils from 24 blocks) have medium content of available K and the remaining 30% of the soils (i.e. soils from 10 blocks) have high content of available K. The low K content is due to the lateritic soils of the new delta region. With reference to micronutrients next to N, the deficiency of zinc is occurring widely. Heavy textured soils of old delta are more deficient in zinc (80.4%) than the new delta soils (47.4%). Next to zinc, copper is deficient in a small extent (19% old delta). The deficiency of iron and manganese is negligible.

Problem soils

The coastal soils are affected by salinity due to sea water intrusion. The special and problem areas and the approximate extent affected are furnished in the following table:

Special and problem areas in Thanjavur District

S. No	Problem	Area/location	Approx. area (acres)
1.	Salinity and sodicity	Peravurani, Sethubavachatram, Adirampattinam and other coastal areas	30,000
2.	Waterlogged/Ill drained	Kollidam, Sirkali, Nagapattinam areas	25,000
3.	Rainfed rice	Vedaranyam	20,000
4.	Uplands (single crop rice)	Pattukkottai, Orathanadu areas	1,00,000
5.	Deep water area	Thalainayar	10,000
6.	Kullankar area (waterlogging)	Mayiladuthurai and Sirkali	10,000

Important soil series in Thanjavur district

Twenty two soil series classified under fourteen soil sub-groups have been identified belonging to the orders of vertisols, entisols, alfisol in the district. Of these, eight series namely Kalathur, Madukkur, Adanur, Pattukkottai, Padugai, Alathur, Nedumbalam and Melkadu form the major ones. The distribution of the various soil series in the district is given below:

S. No	Soil sub group	Soil series	Sym-bol	Extent in hectares	Percentage to the total area of the district
1.	Aquic Udifluvent	Melkadu	Mlk	36,536.54	4.45
2.	Aqualtic Haplustalf	Kallivayal	Klv	15,390.60	1.87
3.	Entic Chromustert	Adanur	Adn	83,466.73	10.17
		Alangudi	Alg	21,386.48	2.60
		Kalathur	Klt	1,48,498.12	18.08
		Kivalur	Kvr	23,014.86	2.80
		Kohur	Khr	6,038.28	0.74
		Nedumbalam	Ndb	40,961.18	4.99
4.	Paralithic Rhodustalf & Paralithic Haplustalf	Vallam	Vlm	13,045.53	1.59
5.	Typic Chromustert	Sikar	Skr	19,167.02	2.33
		Kondal	Knd	13,877.01	1.69
6.	Typic Haplustalf	Alathur	Alt	48,430.37	5.90
7.	Typic Udipsamment	Valuthalakkudi	Vld	14,730.88	1.79
8.	Typic Ustirluvent	Nagapattinam	Ngp	4,053.40	0.49
		Padugai	Pdg	70,022.41	8.53
		Sethi	Sth	6,311.21	0.77
9.	Typic Ustochrept	Peravurani	Pvr	6,674.21	0.81
10.	Typic Rhodustalf	Budalur	Bdl	6,449.01	0.79
11.	Udic Haplustalf	Madukkur	Mdk	1,14,720.93	13.97
12.	Udic Rhodustalf	Mudukalam	Mud	9,265.40	1.13
13.	Ultic Haplustalf	Pattukkottai	Pkt	74,459.87	9.07
14.	Vertic Haplustalf	Thiruvengadu	Tvg	5,845.80	0.71
15.	Swamp			20,727.19	2.52
16.	Coastal sand			9,231.48	1.12
17.	Reserved Forest		R.F.	8,847.89	1.08
		Total		**8,21,152.38**	**100.00**

A brief description of the major 10 soil series of the CDZ is given below:

1) **Kalathur series**: Soils belonging to this series occur in Nannilam, Mayiladuthurai, Kumbakonam, Papasanam and Thanjavur taluks covering about 1300 km2. The texture of surface soils ranges from silty clay to silty clay loam. Manganese

concretions are found in surface soils and lime concretions are found in the subsoil which is under laid with sand below 175 cm.

2) **Adanur series**: Soils belonging to this series occur in Sirkali, a part of Mayiladuthurai, a part of Kumbakonam and Papanasam taluks covering about 1000 km^2. They have clay loam to sandy clay in texture. They are non-calcareous and neutral in reaction. Sand is found below 1 metre depth.

3) **Kivalur series**: Soils belonging to this series consists of grey brown to dark grey brown and relatively young alluvial ones with silty clay loam in texture. They occupy an area of 400 km^2. These soils have neutral reaction and are non-calcareous in nature. The profile development is not well defined.

4) **Sikar series**: Soils belonging to this series are found mostly in Nagapattinam taluk covering an extent of about 300 km^2. The series consists of very greyish brown to dark brown, clay soils developed from alluvial deposits of river Vennar, Vettar etc. The soil is free from gravel except small lime concretions distributed throughout the profile. Soils are deep to very deep moderately drained, silty clay to silty clay loam. The soil profile clearly indicates the river depositions in distinct horizons.

5) **Nedumbalam series**: This series consists of very deep, very heavy, clayey, grey brown soils laid over lateritic base and occurs on very level lands. They are imperfectly drained, mottled throughout the profile and are slightly saline at lower depths. These soils occur in Thiruthuraipoondi and Nagapattinam taluks covering an area of 400 km^2.

6) **Madukkur series**: These soils occur in new deltaic area covering an area of about 1400 km^2. They occur in Pattukkottai, Orathanadu, Peravurani taluks. The texture of these soils ranges from sandy loam to clay loam.

7) **Pattukkottai series**: These soils occur in new deltaic area covering an area of about 300 km^2 and occur mostly in Pattukkottai and Mannargudi taluks. This comprises of very deep, sandy loam, brown soils with sandy clay sub soil. They occupy the top portions of the gently sloping Cauvery-Mettur project area and are developed from lateritic parent materials. The soils are well drained and non-calcareous. Iron concretions and Kaolin are met with at lower depths.

8) **Nagapattinam series**: These soils occur in Nagapattinam taluk covering an extent of 37 sq.km. This series consists of very dark grey brown to dark grey brown soils derived from the alluvial deposits. The soils are very deep, moderately drained, clay to sandy clay loam in texture with deposits of sand in intermittant layers. The soils are somewhat saline in nature due to the influence of tidal waves.

9) **Kondal series**: Kondal series comprises soils derived from alluvium deposited by the river Cauvery and its branches occuring on nearly level lands. The soils are very deep, dark brown to very dark brown, clayey and non-calcareous. They are well

developed and are slowly permeable. These soils occur in Sirkali taluk covering extent of 120 sq.km.

10) **Padugai series**: The Padugai series consists of deep, dark, grey brown, sandy loam soils lying very near to the rivers and streams. They are conspicuous by their stratified layers. There is no textural sequence in this series. These soils occur in taluks of Mannargudi, Nannilam, Papanasam, Mayiladuthurai, Kumbakonam, and Thanjavur covering an extent of 519 sq.km.

The statement on parent materials of Thanjavur soils (22 soil series) are arranged hereunder:

		Parent material	Soil series
1.	Alluvium	a) River alluvium	Adanur, Kalathur, Alangudi, padugai, Nedumbalam, Peravurani, Sikar, Kondal, Thiruvengadu, Kivalur, Alathur
		b) Coastal alluvium	Sethi, Nagapattinam, Kohur, Valuthalagudi, Melkadu, Killivayal
2.	Gneiss		Budalur
3.	Laterite		Vallam, Mudukulam,Pattukkottai, Madukkur

Soil texture of Cauvery delta

Clayey, clayey loamy, silty clay, sandy clay, loamy, sandy loam and sandy are the predominant soil texture in CDZ. Clayey and clayey loam in the middle of the delta, sand fraction associated clay more towards the sea coast, loaming nature in new delta area and sandy loam in the western parts of the delta are the most prevalent textures.

Soil productivity

Riquier *et al.* (1970) proposed the method for working out the productivity rating of the soils taking into consideration the important soil properties such as the depth, the base saturation, the texture and the structure, the organic matter content, the mineral reserve and the soil moisture. Five productivity classes were recognised by him. This methods was adopted to work out the productivity ratings of the soils of the Thanjavur District and the measure necessary to increase the productivity.

Productivity ratings of Thanjavur district

S.No.	Rating	Productivity Grouping	Soil series
1.	0-7	Extremely poor (E.P)	..
2.	8-19	Poor (P)	Peravurani, Vallam, Valuthalakudi, Melkadu, Kallivayal
3.	20-34	Average (A)	Adanur, Alangudy, Alathur, Kalathur, Kivalur, Kohur, Kondal, Nagapattinam, Nedumbalam, Sikar, Thiruvengadu
4.	35-64	Good (G)	Budalur, Madukkur, Mudukulam, Padugai, Pattukkottai, Sethi
5.	65-100	Excellent (E)	..

Soil related constraints for rice production and suggestions for alleviation

Even though rice is grown extensively in many soil types, majority of the soils cannot be considered as typical rice soils. The soil-related constraints should be identified and suitable ameliorative measures adapted to improve the fertility and productivity of such soils. As far as cauvery delta is concerned the following are the major soil related constraints as described by Ramanathan (1986).

Problem soils

a) Saline soil
b) Sodic soil

Environmental problems

a) H2 S toxicity
b) Ill drained conditions and low lying areas

Nutritional disorders

a) Deficiencies of nutrients
b) Toxicities of nutrients

Problem soils

Saline soil: These soils contain sufficient soluble salts (chlorides and sulphates of Ca, Mg and Na) in the root zone and adversely affect the crop growth. The factors contributing for salinisation are high salt content in the profile, saline ground water, occurrence of salt layer, seepage from canals and higher adjacent areas, poor surface and subsurface drainage, saline irrigation water, industrial effluents and sea water intrusion.

Sodic soils: Impeded drainage coupled with accumulation of larger proportion of Na salts particularly Co 3 and HCO3 of Na produce sodic soils. These soils would contain sufficient exchangeable ‘Na’ to cause soil dispersion and increase in pH thereby affecting the physico-chemical and biological properties of the soil. The plant growth in such soil

is affected due to poor physical condition, nutrient imbalance and non-availability of most of the plant nutrient elements.

The reclamation of sodic soil requires the removal of part of or most of the exchangeable Na and its replacement by Ca. This can be achieved by the application of gypsum and incorporation in soil followed by leaching for removal of the resulting sodium sulphate. After reclamation, the soil should be kept well drained. Certain of the tolerant varieties like CO 43 and TRY 1 can be grown with advantage if the sodicity is moderate. Besides the above mentioned amelioration strategies, the following agronomic practices are suggested for nitrogen management:

1. Applying 25% more nitrogen
2. More number of split application
3. Using fertilizer like ammonium sulphate and ammonium chloride
4. Correcting other nutrient deficiencies
5. Addition of green manures like Dhaincha, Vadanarayana leaves and organic manures

4. Environment Problems

H_2S injury: Usage of artesian well water or deep bore well waters with H_2S produces this toxicity. Sulphides inhibit respiration and oxidative power of roots thus, retards the uptake of nutrients. Further destroyal of the oxidising power of rice roots also makes the plant more susceptible to Fe toxocity as the Fe_2 + concentration is increased. H_2S toxicity has been noticed in certain pockets of Mayiladuthurai, Sirkazhi, Nannilam and Kumbakonam taluks in cauvery delta. The problem is more acute during summer months or when the water table falls with non receipt of rains.

The problem of H_2S injury can be alleviated by the following management techniques.

1. Drawing the water with H_2S through long channels before irrigation
2. Application of lime at the rate of 500 kg/ha
3. Increase the dose of P_2O_5 and K_2O by 25% over and above the recommended dose
4. Alternate wetting and drying till hairline cracks are formed instead of deep submergence when the injury is noticed

Ill drained and low lying areas

The soils of the old delta with heavy clay experience problems associated with illdrained conditions during rainy season. This is more so in low lying areas. As a result the thaladi and samba crops suffer resulting in poor yield. The possible causes for low yield could be

1. Reduced mineralisation, availability and uptake of nutrients induced by low temperature
2. Inhibited decomposition of kuruvai stubbles
3. Generation of toxic substances as decomposition products

Besides improving the drainage, application of large quantities of organic matter coupled with less or slowly soluble nitrogenous fertilizer applied at frequent intervals has been found to be most suitable N strategy for the ill drained soil.

5. Nutritional disorders

Submergence of soil brings in a lot of changes in the electrochemical properties. A decrease in redox potential, increase in pH of acid soil and decrease in pH of alkali soils, increase in the concentration of electrolytes, in exchange reactions and sorption and desorption of elements are notable changes. These changes influence the growth of rice controlling nutrients availability and regulating their uptake.

a. Nutrient deficiencies

The problem of deficiency of certain nutrients (N, S and Zn) in rice soils of cauvery delta zone has been dealt already in this bulletin.

b. Toxicities of nutrients

1. Iron toxicity

This is one of the toxicities encountered on rice grown under submerged conditions. Submergence causing a reduction in the soil converts Fe3+ making it readily soluble and increasing the concentration of soluble iron to toxic levels. Fe toxicity is often associated with deficiencies of P, K and Zn. This is also associated with toxicities of H2S and in soils rich in organic matter. Affected plants have small brown spots on the green leaves starting near the tip. In severe cases the leaves turn brown and eventually the lower leaves die. In certain varieties the leaves turn orange yellow from the tips and later dry up. Application of lime and judicious fertilization with P, K and Zn are essential to avoid this toxicity.

2. Organic acid toxicity

This toxicity might occur in organic soils and in poorly drained soils (example Thaladi crop) when large quantities of straw are incorporated. The commonly produced organic acids under submergence are formic, acetic, propionic and butyric acid. High concentration of organic acids impair root elongation, respiration and nutrient uptake in rice.

Application of 25 kg N/ha to hasten the decomposition of Kuruvai stubbles or application of lime at 500 kg/ha or application of 50 kg P2O5/ha as rock phosphate are some of the techniques developed to overcome this problem.

The above mentioned strategies can be more appropriate for problem soils in terms of better nutrient management and increased fertilizer use efficiency.

PRINCIPAL CROPS

Cropping System: Rice-Rice-Pulses/cotton/gingelly major crops and area coverage

Crop	Area coverage
Rice	Kuruvai – 1.68 lakh ha
	Thaladi – 1.44 lakh ha
	Samba – 2.99 lakh ha
Total pulses	
Blackgram	1,42,944 ha
Greengram	45909 ha
Gingelly	10358 ha
Cotton	2711 ha

1. **Different crops cultivated in the CDZ, varieties popular in the zone and their performance**

In this zone, rice is the principal crop. In the rice based cropping system, it is either single or double cropped. Third crop rice is grown during summer in some parts. Because of the canal water water supply and with plentiful rainfall during NE monsoon, there cannot be any other crop but rice from September to December. Pulses blackgram and greengram are next importance grown in the rice fallows throughout the delta region from January onwards under no tillage condition. Summer irrigated blackgram is grown with splash irrigation, sowings commencing in April. Gingelly is also sown in April in prepared fields subsequent to summer showers. Vegetables like brinjal, chillies and greens are grown during summer months in limited area in the well drained fertile lands depending upon the underground water source. In light clay loamy soils under gardenland condition is brought out where crops like groundnut, maize, gingelly and irrigated pulses are altered. Banana, sugarcane and ornamentals like jasmine, rose, chrysanthemum, crossandia and arali are the annuals occupying the land for more than one year for the successive returns. Coconut gardens, bamboo and wood lots are scattered in the delta in different densities. Mango, Jack, citrus of various kinds, guava, pomegranate, custard, apple etc. are the more prevalent fruit trees in addition to cashew in specific pockets.

The short duration (105-110 days) rice varieties viz., ADT 36, ADT 37, ADT 42 and ADT 43 are popular among the farmers. They are cultivated during kuruvai (June-July), Navarai (Dec-Jan) and sornavari (April-May) seasons. The performance of these varieties are well satisfied. The medium duration varieties ADT 38, 39, ADT 40 and Improved white ponni are grown in thaladi and late thaladi (Sep to Nov.) seasons. The long duration variety CR 1009 gives higher grain yield 15-17 t/ha during samba season. It is also being grown under dry and semidry conditions also.

2. Constraints and problems in crops/varieties

The major production constraints that are met with in the CDZ are

i) Definite dates of opening and closing of Mettur Dam water for irrigation is not known. This reflects in planning of rice and rice based cropping system.

ii) Torrential rains during North East Monsoon, hindering both kuruvai harvest as well as thaladi transplantings.

iii) Monocrop of rice in the delta region coupled with unfavorable weather conditions in an year lead to heavy incidence of pests/diseases.

iv) Labour shortage during peak season of harvesting or planting

v) Lodging of rice crop leads to field germination. Lack of means to preserve kuruvai grain

vi) Lack of adequate drainage facility in the delta region

vii) Low light intensity prevailing in samba season results in poor yield

Standard price policy for the delta grown commodities especially rice, pulses, cotton, gingelly, groundnut and coconut. Regulated market facilities are to be extended. Timely input supply in kind and cash is to be assured.

TAMIL NADU RICE RESEARCH INSTITUTE – ADUTHURAI

TECHNOLOGIES SO FAR DEVELOPED – CROP IMPROVEMENT

In enhancing the rice production in our State, the Tamil Nadu Rice Research Institute, Aduthurai plays significant role by evolving high yielding rice pulses and cotton varieties to the farmers as detailed below

Rice varieties : 59 (ADT 1 – ADT 45 and 14 introduction)

Hybrid : 1 (ADTRH)

Pulses

Blackgram : 5 (ADT 1 – 5)
Greengram : 3 (ADT 1 – 3)
Soybean : 1 (ADT 1)
Cotton : 1 (ADT 1)

Among the rice varieties released to the farmers, 22 are pureline selections, 22 evolved by hybridization and selection, 2 spontaneous mutants and 14 introduced for general cultivation.

i) Varieties evolved by pureline selection
ADT 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,26

ii) Varieties evolved by hybridization and selection
ADT 8,20,25,27,28,29,30,31,32,33,34,35,36,37,38,39,40,42,43,44,45and ADTRH 1

iii) Spontaneous mutants identified and developed
ADT 15 and ADT 41

iv) Introduced rice varieties
IR 20, IR 34, IR 50, IR 64, Pusa 33, Pusa 2-21, IET 1444 (Rasi), IET 172 IET 4786 (Neikichidi), IET 3257, Red Ponni, Improved White Ponni, NLR 9672 and CR 1009 (Ponmani)

The release of ADT 27 (Norin 8/GEB 24) during 1964-65 through indica and japonica hybridisation programme had a major break through in increasing the rice productivity and paved way towards Green Revolution in Tamil Nadu.

Among the rice varieties released, ADT 36, ADT 37, ADT 42, ADT 43 and ADT 45 (short duration 100-120 days), ADT 38 and ADT 39 (medium duration 120-135 days) ADT 44 (long duration above 140 days) and introduced rice varieties like IR 50, IR 64 (short), Improved White Ponni (medium) and CR 1009 (Ponmani) (long) are very well accepted by the farmers and still popularly cultivated in a larger area in our State.

ADT 32 and ADT 41 are scented rice varieties and ADT 43 Non-scented quality rice variety coupled with high grain yield are noteworthy to mention.

ADTRH 1 (IR 58025A/IR66R) is the first rice hybrid released from this institute has proved its superiority for kuruvai season by recording 11.7t/ha of grain yield in the farmers field during 2000.

Besides a number of pre-release cultures are in the pipe lines. The following cultures are being tested ART in the farmers field.

Rice

- AD 94010 (ADT 38/CO 45), 135 days, medium slender white rice
- AD 97191 (CR 1009/Pankaj) 155 days, short bold white rice

Pulses : Blackgram ADB 2003

In the germplasm bank, a total of 1950 rice varieties are being maintained for genetic evaluation and utilisation

Short	duration	: 642 Nos
Medium	"	: 1009 Nos
Long	"	: 299 Nos
	Total	**: 1950 Nos**

Nucleus Seed Production

Genetic purity of the released varieties of this institute is being maintained by producing Nucleus seeds in the following varieties.

Rice : ADT 36, 37, 41, 42, 43, ADT 45, IR 36, IR 64, ADT 38, ADT 39 I.White Ponni, ADT 40, ADT 44, CR 1009, IR 58025A,B and IR 66R

Pulses Blackgram : ADT 3, ADT 4 and ADT 5
Greengram : ADT 2, ADT 3

Soybean ADT 1

Cotton ADT 1

Breeder seeds of the following varieties are regularly produced and supplied to the Dept. of Agriculture, Govt. of Tamil Nadu, Govt. of India and Private Seed Agencies.

Rice : ADT 42, ADT 43, ADT 44, ADT 45, I.White Ponni, ADT 40, CR 1009 , IR 58025A, IR 58025B and IR 66 R

Greengram : ADT 3

Cotton : ADT 1

Suggestions to alleviate the problems and constraints and improvement in Agricultural productivity and production

i) Among the rice varieties released from this institute, the varieties ADT 37 and ADT 38 are having slight seed dormancy and lose of viability of seeds during storage respectively. The seed dormancy of ADT 37 can be solved by soaking of seeds in 0.18% concentrated Nitric acid (240ml in 45 litres of water) at 1:1 (equal volume) for 12-16 hours. The seeds may then be air dried to original moisture. To increase germination in ADT 38 (I), the seeds are to periodically dried and treated with carbendazim @ 2g/kg of seed to achieve 82-86% seed germination even after 12 months of storage.

ii) Seeds soaking in water and then in Potassium di-hyrdrogen phosphate for 18 hours and incubation for 18 hours improves additional seed germination of 19 to 21% in the 8 months old seed.

iii) Mid storage correction can be given by hydration and dehydration with dehydration with disodium phosphate Na2 Po4 (3.60g per 100 litres of water for 100 kg of seed at 8 months stored seeds to get 18% increased germination.

iv) Before sowing ADT 38 given with soaking in water for 24 hours and incubation for another 24 hours results in 80% germination than 12 hours soaking and 12 hours incubation.

By adopting improved technologies and timely attend field operations the best yields can be achieved by all the farmers. To improve productivity of rice and other crops, timely supply of Mettur Dam water is highly essential since it is a major input in this zone.

Future Thrust

The farmers of Cauvery Delta Zone comprising Thanjavur, Nagapattinam and Thiruvarur district has realised the high yield potential of high yielding rice varieties. Further yield increase is possible by rice hybrids for which identification of new CMS system, TGMS lines and suitable restorers are challenging ahead.

TECHNOLOGIES SO FAR DEVELOPED IN CROP MANAGEMENT

a. Soil Science and Agricultural Chemistry

1. Green manure or green leaf manure applied at the rate of 6.25 t/ha to rice soil and incorporated before transplanting had reduced the loss of nitrogen by about 13 kgs/ha which otherwise would have lost through volatilisation and leaching as was observed in rice soil not applied with either green manure or green leaf manure.

2. Urea when mixed with gypsum and neem cake in the ratio of 5:4:1 and kept for 24 hrs prior to application in a rice soil, had slowed down the dissolution rate of urea granules and reduced the losses of nitrogen by about 8 kg/ha.

3. Rice husk ash (byproduce of Rice mills) when applied to thaladi rice crop twice (during cold weather period) @ 1 t/ha per application, had increased the rice grain yield by 10% over control.

4. In direct seeded semidry rice (CR 1009), spray of 1% FeSo4 and 0.5% ZnSo4 solution thrice during tillering to panicle initiation had increased the rice grain yield by 14% over control and 8% over the soil application of ZnSo4 and FeSo4.

5. Application of super digested compost @ 750 kg/ha to direct seeded semidry rice (CR 1009) had recorded rice grain yield of 5.4 t/ha which was on par to the treatment which received FYM @ 12.5 t/ha and equal quantity of phosphorus.

6. Combined application of Azospirillum and Azolla to rice soil had recorded the highest rice grain yield of 5.28 t/ha during thaladi season.

7. Studies on optimisation of phosphatic fertilizers indicated that the P source as DAP recorded the highest grain yield followed by single super phosphate and mussorie rock phosphate. The phosohobacterium plays a vital role in solubilising soil P and optimises the chemical fertilizer P to STL recommended P level.

8. Studies on optimisation of potassic fertilizer in Kalathur soil series revealed that Azolla biofertilizer recorded the highest grain yield as against control. There is a definite saving of 25% of chemical potassic fertilizer when Azolla or FYM is used in combination.

9. The zinc requirement by the rice crop is only 4 kg $ZnSo_4$ for kuruvai and thaladi respectively when composted with coirpith @ 750 kg/ha with a saving of 42 kg of $ZnSo_4$/ha/year.

10. Iron deficient soils require 50 kg FeSo4/ha along with NPK for higher rice grain productivity.

11. Application of N based on simulation model MANAGE-N or soil test crop response (STCR) or controlled release N fertilizer (CRN-Urea) to rice can increase the grain yield considerably during kuruvai season.

12. Application of recommended dose K (blanket K) either in the form MOP or in the form of paddy straw is effective in increasing the grain yield to a considerable extent both in kuruvai and thaladi seasons.

13. Continued application of recommended dose of NPK (125:50:50 and 150:60:60 kg/ha in kuruvai and thaladi respectively) along with organic manure (6.25 t/ha) GM in

kuruvai and 12.5 t/ha FYM in thaladi) and gypsum @ 500 kg/ha in both seasons registered the highest grain yield.

14. Continuous monitoring of the fertilizer application revealed that the grain yield due to the addition of N, NP, NK and NPK did not differ markedly indicating the major role played by the N applied for higher rice productivity.

15. Application of well composed poultry manure @ 5 t/ha along with four times recommended biofertiliser and 100 kg groundnut oil cake on 30 DAT recorded significantly higher grain yield compared to recommended inorganic fertiliser application.

16. In rice crop, for chlorophyll meter (SPAD) based N application, the SPAD value 35 is optimum for kuruvai season and 37 is optimum for thaladi season to get higher grain yield with greater nitrogen use efficiency.

17. Site Specific Nutrient Management (SSNM) always produced a higher grain yield with higher N use efficiency, since it accounts the soil nutrient supplying capacity. Therefore, the farmers can be advised to adopt judicious N fertilizer application based on the soil nitrogen supplying capacity.

Future thrust areas

1. Studies on silica nutrition in rice
2. Studies on Zinc use efficiency for rice, since almost the entire region of CDZ is deficient in available zinc
3. Increasing the productivity of rice fallow pulses with appropriate nutrient management
4. Nutrient requirement of pre-release rice cultures and newly released rice varieties in CDZ
5. Management of heavy and fulfly rice soils of CDZ
6. Site and situation specific nutrient management in rice and rice based cropping system.

b. Agricultural Microbiology

Technology developed

a. Skipping of second top dressing of nitrogen at 25 kg/ha which coincides with Azolla trampling saves fertilizer and labour while dual cropping of Azolla with rice
b. Phosphobacteria solubilize the insoluble rock phosphate more rapidly than the soluble super phosphate. The solubilization of phosphorus was high in the 50% rock phosphate + phosophobacteria (37.5 kg/ha) as compared to control (12.5 kg/ha)
c. Instead of applying biofertilizers through seed treatment for rice fallow cotton, soil application of Azospirillum and phosphobacteria at the time of I earthing up (30

DAS) and II earthing up (50 DAS) resulted in higher kapas yield of 1.52 t/ha, whereas control recorded 1.02 t/ha

d. Application of zinc solubilizing bacteria with half dose of phosphatic fertilizer recorded higher grain yield of 5.84 t/ha, as the control recorded only 4.89 t/ha.

Future thrust

- Alternative carrier material for blue green algae inoculum
- Biofertilizers for the supply of micronutrients may be identified
- Foliar application of bioinoculants may be thought of for different crops
- Combined inoculum of N2 fixing, P solubilizing and K mobilizing may be evolved

c. Seed Science And Technology

Constraints and problems in the crop/variety

- Farmers usually are not practiced to dry the seeds to the prescribed moisture level under condition
- Flowering duration of parental lines of hybrid rice, is not uniform under different seasons
- Conducting germination test, maintenance of required level of temperature and relative humidity could not be possible under open laboratory condition
- Breeder seed storage is done with other mixture varieties is a problem in further seed multiplication

Technologies so far developed in respect of crop improvement

- Pulse seed treatment with carbendazim @ 25 g/kg of seed
- Soybean seed storage for six months by cold stratification method @ 10 kg of 10% moist sand for 10 kg of seed
- In hybrid rice seed production, the difference in 50% flowering between parental lines of medium duration hybrid is 7-18 days and for long duration hybrid is 28-34 days in all the seasons studied
- Seed soaking for 18hrs either in water (or) potassium di-hydrogen phosphate has increased the germination percent
- Seeds stored in polylined gunny bag is increased the storability

Suggestions to alluviate the problems and constraints and improvement in Agricultural productivity and production

- Drying the seeds to the prescribed moisture level before storage
- Pulse seeds can be treated with activated day @ 1:100 ratio, carbendazim 2 g/kg, neem seed kernal powder @ 1:100 ratio
- Proper condition should be given for conducting germination test under laboratory condition

- Separate breeder seed godown varietywise is needed for maintaining varietal purity

Future thrust

- Seed storage should be done properly using recommended treatments and containers
- Germination test must be done constantly using germinator
- Facilities may be given for storing breeder seeds in hygenic and in a separate godown will enhance the varietal purity.

CROP PROTECTION

a. ENTOMOLOGY

Pest	Intensity	Season
Major pests		
Gall midge	Light – moderate	Samba/thaladi
Leaf folder	Moderate – severe	Kuruvai/thaladi
Yellow stem borer	Moderate – severe	Late kuruvai, samba, thaladi, summer
Brown plant hopper	Moderate to severe	Late kuruvai, samba, early thaladi
Green leaf hopper	Moderate to severe	kuruvai/early thaladi
Minor pests		
Pink borer	Light	Kuruvai
White backed plant hopper	Light	Late kuruvai/samba
Hispa	Light	Late kuruvai/early thaladi
Earhead bug	Light – moderate	Late thaladi/summer
Thrips	Light – moderate	Kuruvai, samba, thaladi
Whorl maggot	Light – moderate	Kuruvai/thaladi
Case worm	Light – moderate	Thaladi
Cut worm	Light	Thaladi/summer
New pests		
Mite	Light – moderate	Kuruvai, samba

Change of status of rice pests

a) **Major pests with increased severity**
   Brown plant hopper
   Yellow stem borer
   Leaf folder

b) **Minor pests becoming major problem**
   Thrips
   Whorl maggot
   Case worm
   Cut worm
   Black bug
   Ear head bug

Pink borer

c) **Now problem**

Mite

Earth worm

Pest management practices of farmers

Management practice	Awarness (%)	Adoption (%)
Summer ploughing	66	39
Using light traps to monitor pests	58	3
Weekly pest observation	97	97
Observing predatory organisms	63	27
Avoiding using pesticide when predators one more number	39	11
Application of insecticides based on ETL	61	12
Use of neem oil for pest control	20	18
Avoid using resurgence inducing insecticide	42	42
Release of biological agents	10	7
Use of bromodiolone	31	17
Use of zinc phosphide	46	42
Digging and killing rats	83	83

Common insecticides used for controlling pests

Pesticides	Leaf folder	Stemborer	BPH	Gall midge	Earhead bug
Monocrotophos	*	*	*	*	*
Endosulfan	*	*	*	*	*
Dichlorvos	*	*	*	-	*
Phosphamidon	*	*	*	*	*
Quinalphos	*	-	-	-	-
Methylparathion	*	*	-	-	-

Constraints and problems in managing insect pests

a) **Constraints**

- Lack of an easy pest assessment technique for following need based application of pesticides
- Lack of knowledge about IPM practices
- Lack of awareness on the use of bio control agents
- Additional costs
- Lack of coordination among farmers
- The quality control system is weak

b) Problems

- Intensive cultivation and agro climatic factors aggrevate pest problems
- Availability of labourers for plant protection work
- Availability of inputs like bio control agents, botanicals, chemicals, required for plant protection work
- Use of bio control agents/botanicals incur higher costs than chemicals
- More wages for the plant protection workers like snacks, soap for bathing etc.

Technologies sofar developed in insect pest management

Screening rice varieties for major pests, epidmiology of insects, evaluation of plant protection on rodents and insect pests and chemicals on rice and rice fallow crops were the main technical programmes.

Field and green house screening of rice resulted in the identification of resistant donors to many pests. TK 6 (yellow stemborer) ADT 36 and (brown planthopper), IR 50, CR 1009 and improved white ponni (moderately resistant to GLH), and AB 2057 and AB 2045 blackgram (leafbeetle and podborer) are a few to quote.

The cotton accessions of AICCIP viz., 9720, 9722 and Srivilliputhur accessions Viz., TSH 288 and TSH 192 are resistant to jassids while TSH 192 and TSH 188 are resistant to aphids.

GLH was identified as the vector to transmit the rice tungro virus (RTV).The research conducted had given IPM for rats viz., catching and killing of rats during summer period. Keeping mechanical traps and out perches in the field besides the use of bromodialone 0.005% rodenticide cake.

Biocontrol

Predators like **Cyrtorhinus lividipennis**, spiders (especially **Paradosa pseudoannulata**) frog **(Rana tigrina**) and parasitoids (**Platygaster oryzae**, **Telenomus sp** and **Tetrastichus sp**) were found to play a major role in the management of many pets in rice. Release of egg parasitoids for yellow stemborer and leaffolder viz**., Trichogramma japonicum** and **T.chilonis @** 40000 nos/ac respectively were found successful in the management of the pests.

Spraying biocides like delfin and dipel (**Bacillus thuringiensis**) reduced leaffolder and white-backed planthopper in rice.

Botanicals

Five percent neem seed kernel extract (NSKE 5%) and 3 % neem oil spray controlled BPH and GLH effectively while 5 % NSKE and 2 % palamarosa oil checked rice leaffolder. 5 % NSKE spray had effective control on galerucid beetle in pulses and soybean.

Future Thrust

- Continued screening of rice, pulses and cotton for different pests is needed for identifying the donors or varieties resistant to pests.
- Studies on the ecology of the different pests and their threshold have to be developed in rice and rice fallow crops.
- Evaluation of botanicals in rice pest control is to be continued for the rice fallow cotton and pulse crops.
- Forecasting of important pests and diseases for effective forewarning has to be developed for rice fallow crops.
- Studies on the integrated pest management and related strategies are to be worked out for the Rice and rice fallow crops**.**

b. PLANT PATHOLOGY

Crop	Disease(s)	Management strategies developed
Rice	Grain discolouration	Spraying Mancozeb 1000g/ha (or) IBP 500ml (or) carbendazim 250g at Boot leaf stage (or) spraying *P.fluorescens* – 1 1kg/ha twice, once at booting and again 15 days after first spray
	Sheath rot	Spraying carbendazim 250g (or) Edifenphos 500ml (or) Mancozeb 1kg (or) NSKE (5%) (or) Neem oil (3%) (or) Ipomoea Leaf powder extract 25kg (or) prosopis Leaf powder extract 25kg/ha at flowering phase
	Bacterial Leaf Blight	Spraying Streptomycin sulphate + tetracycline combi 300g + copper oxy chloride 1250g/ha (or) Nickel nitrate 0.3% (or) Fresh cow dung extract 20% (or) Neem oil 3% (or) NSKE 5%
	Sheath blight	Spraying of carbendazim 250g (or) IBP 500 ml (or) Edifenphos 500ml (or) neem oil 3% *P.fluorescens* ST (10g/ka) + NA (1.5kg/ha) + SA 2.5kg/ha 30 DAT + FS (1kg/ha) twice at 10d interval
	Brown spot	Spraying of Edifenphos 500ml or Mancozeb 1kg/ha
Rice fallow pulses	Root rot	Seed treatment with *T.viride* 4g (or) P.fluorescens 10g/ka ST with carbendazim or Thiram 2g/kg 24h prior to sowing spot drenching of carbendazim (0.1%)
	Powdery mildew	Carbendazim 250g Wettable sulphur 2.5kg/ha
Cotton	Root rot	Neem cake @ 150kg/ha ST with *T.Viride* 4g/kg Spot drenching of carbendazim (0.1%)

Sesamum	Root rot	Spot drenching of carbendazim (0.1%) Soil application of *P.fluorescens* 2.5kg/ha with 50kg FYM 30 DAS Neem cake 150kg/ha + ST with *T.viride* 4g/kg
	Powdery mildew	Wettable sulphur 2.5kg/ha
Sugarcane	Settrot	1. Select healthy sets for planting. Sets showing red colour at the cut end and hollows should be rejected and burnt 2. Set firie to residues of previous crop to eliminate debris of fungal pathogens 3. The fields which had shown high level of red rot disease, follow crop rotation with rice 4. The setts should be soaked in 0.1% carbendazim or 0.05% Triademefon for 15 minutes 5. Use of resistant varieties CO 62198, CO 7704 COC 8001 CO 8021
	Red rot	

Constraints and problems in managing the crop disease

- Lack of knowledge on the identification of various diseases of the corps under Cauvery Delta Zone
- Lack of knowledge on the impact of disease management practices among the farmers
- Lack of knowledge on the seed qualities and standards of agricultural inputs
- Barrowing knowledge form various private agencies for fungicide usage
- Non availability of bactericides for the management of bacterial diseases in time.

Future thrust

In addition to the major diseases like rice blast, bacterial leaf blight, sheath rot, sheath blight the rice grain discolouruation is become very important one and causing heavy economic loss to the farmers. The marketable quality of the grains become poor and fetches low price and some time it is being rejected by procurement agencies. A number of weak parasites/saprophytes which infect rice seeds at pre and post harvest stages causing sundromer referred to as grain discolouration. The types and magnitude of discolouration vary with the place environmental conditions organisms involved. Environmental factors such as continuous rain, humidity and temperature condusive to fungal and bacterial growth help increase the incidence of grain discolouration. The symptoms may be are spot of any colour (ranging from pale yellowish, brown, gray to block rot lenian to bleached area over glumes or combination of many discrenible patches, lesians or spots. Spots on the glumes or kernel affect both physical and chemical qualities of the grain/seed and also reduce the seed germinability.

Assessment of loss due to rice grain discolouration in the Cauvery Delta Zone

This can be achieved through an intensive survey during the procurement time in various places of Cauvery Delta Zone and also in different fields before harvest.

1. Developing of strategies for production of disease free seeds/grains through newer combination of both botanicals, biocontrol agents and fungicides concentrating research activities to undertake for augmenting disease free seeds/grains producting and productivity of rice.
2. Creating awareness among the farmers and extension workers on managing the grain discolouration by

    i) Enhancing adopting of improved production technology by providing the required technical knowhow.

    ii) Upgrading the technical knowledge and skill of the extension workers and farmers

    iii) Proposal may be sent to the Govt. of Tamil Nadu for creating paddy drying centres in Cauvery Delta Zone.

SOIL AND WATER MANAGEMENT RESEARCH INSTITUTE - THANJAVUR

Constraints and problems of the area in each division

General

i. Definite dates of opening and closing of Mettur dam water for irrigation is not known. This reflects in planning cropping sequence of farmer's choice. This constraint not only affect Kuruvai, Thaladi and Samba rice growing seasons, but has an impact on growing of the summer season crops.

ii. Torrential rains during North East monsoon, hindering both Kuruvai harvest as well as Thaladi transplanting. Also, causes larger patches of low lying lands inundated.

iii. Monocrop of rice in the delta region coupled with unfavorable weather conditions in an year lead to heavy incidence of pests and diseases.

iv. Soils are poor in organic carbon, low in cation exchange capacity and macro nutrients. Organic manures are not frequently applied due to unavailability as well as lack of time for application. Nitrogen losses through leaching and volatalisation occur. Fertilizer management in rice and its follow up crops need standardisation.

v. Kuruvai harvest especially late Kuruvai and planting of Thaladi / Samba overlap, leading to labour shortage. This situation is aggravated by the torrential rains. Lodging and field germination's are not uncommon leading to poor quality grain as well as straw. Lack of means to preserve Kuruvai grain, straw within a short span of time. Quicker method to decompose Kuruvai stubbles needs popularisation.

vi. Bringing down the moisture content to the desired level without loosing grain/seed quality are to be formulated.

vii. Lack of adequate drainage facility in the delta region. The drainage cum irrigation net work in the delta could not drain the excess water in the monsoon season,

resulting in submergence of the crop. Low lying patches of the delta could not be reclaimed and brought to level as it is highly expensive.

viii. Low light intensity prevailing in Samba season results in poor yield. Gene pool of rice is to be screened for greater response to low light intensity.

ix. Prevailing tenancy system and lack of cooperation between owners and tenants and social problems thereon.

x. Labour problem and shortage at peak hours of harvest and transplanting in the delta region. Higher cost of cage wheel puddling on receipt of water in the canals. Minimum wage rate and wage index need to be streamlined depending upon the nature of work. In many cases, timely field operations are not carried out for want of labour.

xi. Standard price policy for the delta grown commodities, especially rice, pulses, cotton, gingelly, groundnut and coconut. Regulated market facilities are to be extended. Timely input supply in kind and cash is to be assured.

xii. Quality seed supply is to be promoted on subsidised basis.

xiii. Contingency cropping sequence is to be worked out in the event of mishaps in routine cultivation.

xiv. New crops suitable to delta region are to be evaluated and adopted in crop rotation.

SPECIFIC CONSTRAINTS

A. NEW DELTA AREA

The farmers of New Delta area go in for more number of garden land crops following a medium duration Samba rice in the rice growing period between August and December. Of late, the farmers of this situation pay more attention to groundnut

cultivation because of the assured returns in terms of market price. Ground water is tapped through bore wells and filter points and groundnut is grown as an irrigated crop either between January to April or between April to June. Bunch type of groundnut with a crop duration of 110 – 120 days occupies major area. The irrigated groundnut is intercropped with onion, castor, redgram and greens at varying densities. Rainfed groundnut sowing coincide with the onset of South West monsoon in the completely rainfed tracts. Under canal irrigated lands groundnut either follows Samba rice or grown before Samba rice. It is also grown under protective irrigation at critical stages of crop growth supplemented by the summer showers. Gingelly and maize are next in importance to groundnut and are rotated in the system according to their suitability. Maize is grown with protective irrigation while gingelly is totally rainfed in most of the pockets. Transplanting of gingelly and maize is also followed under contingency planning. Summer irrigated blackgram sown during April is next in importance in the crop sequence.

Though the situation has a provision to include more number of garden land crops in its rotation, canal water influence has a major say in determining the crops. The opening and closing of the sluices of Mettur dam, time taken by the canal water to reach and soak the soils of this situation and assured alternate irrigation facilities make rice based cropping system either to be with single or double crop of rice. Again, the impact of the canal water in the lands determine the water table and recharge in choosing the alternate crops. Sometimes the preferred crop of this situation, groundnut, suffers on account of excess water due to prolonged seepage or acute shortage of water. More often the crop periods could not be clearly demarked. However, farmers take maximum advantage of well drained and well aerated nature of the soil in growing more crops other than rice. Assured irrigation to the standing crops through complete utilization of ground water is to be geared up. The protective irrigation supplemented through hired water very often results either in surface wetting or excess of what is needed. The major soil series, Madukkur and Pattukkottai are poor in fertilizer status and are to be enriched both for macro and micro nutrients to augment production. The unit size of the farm holding decides the possession of bore well or filter point for supplemental irrigation.

Permanent improvements of the small unit holding with reference to sinking filter points / bore wells, increasing the fertility status and intensive cropping are postponed due to socio-economic problems. Lack of institutional financial support, inadequate finance both at the start of the season as well as at the needed hours of crop growth do not permit adoption of improved farming practices at right time. Sound footing of marketing facilities for garden lands crops needs to be strengthened. Standard price policy for groundnut, coconut, gingelly, maize and blackgram will motivate more farmers to raise crops other than rice and inturn augment production of oilseeds and pulses in the delta region.

B.TAIL END BLOCK

As described earlier, Tail End area is characterised by single rice based cropping system. Only the western boundaries of this situation are double rice crop based. The single crop of rice in the crop rotation is mainly governed by the time taken for the canal water to soak the far eastern land area of this delta region. The total net area cropped and total area in this situation almost equal one another, indicating more prevalence of single Samba rice. Growing of summer crops other than rice is also restricted because of climate, soil and underground water related production constraints. The soils are either too silty or towards more sandy resulting in water holding capacity limitations. The cultivable land area adjacent to sea coast bear bad weather of gale storms and continuous downpour of rains during monsoon season or extreme drought during summer. The underground water tapping has many soil and water related constraints and potential tappings are unfit for agricultural use because of heavy salt content.

In Sirkalai taluk, high yields of rice fallow pulses are obtained. The farmers adopt higher seed rate and ensure uniform population. Besides foliar application of DAP is also practiced. Wherever underground water is available and water being fit for agricultural purpose, groundnut is grown as a cash crop. Rainfed gingelly sowing both in rice fallows and during January and April as summer crop are also practiced. The farmers of this situation usually go in for a single crop of rice followed by one crop other than rice. But for the cropping intensity, growing crops are similar to that of Middle Block. Ill drained

pockets known as Kullankar are seen in Chidambaram, Sirkali and Tharangampadi taluks. Water does not drain out and the excess stagnates in Kullankar soils. These soils are sometimes ameliorated with amendments to alter to a more porous form. Impervious clay fraction accumulate due to various salt deposits. Root penetration is hampered resulting in poor absorption. The soil is poorly aerated and is sticky. They pose problems for the working of implements. Kullankar patches have more problems related to soil. Rice is the principal crop in these patches and very rarely rice fallow pulse or cotton could be rotated. Closer planting, increasing number of seedlings per hill, delay in transplanting beyond September are adopted in Kullankar area. Lack of high yielding rice varieties suitable to ill drained soils is a technical constraints. The gene pool is to be screened to identify the right genotypes which could withstand ill drained soils and continuous submergence with very low environmental interaction.

C. DEEP WATER AREA

Deep water area could raise one crop of rice during monsoon season and one crop other than rice as rice fallow crop. Most, of the cultivable lands stop with deep water rice. The limitations for lesser cropping intensity in this situation are due to heavy monsoonic rains, nature of soils, location of the situation in the far south of the delta region and diffused sunlight during Samba season. Rice crop in this situation is generally not fertilised as per the recommendations. It could not be fertilised in semi dry condition for want of water and in water-logged situation, because of the stagnation. Specific varieties are to be development for this situation which should possess faster grown rate, withstanding water stress as well as water stagnation in different phases of crop growth, interact well under diffused sunlight, dormant nature of the seeds to avoid field germination before harvest and non-shattering type to keep away from the damage of wild birds and excess shedding. Amidst the clutches of the prevailing weather for a particular year coupled with soil properties, the farmers are spared to harvest the available produce. Crop management at all stages of crop growth is difficult and often impracticable to adopt. Thus, growing single crop of rice during monsoon season under submerged state has its own limitations in realising better returns. Raising and strengthening of river bunds, field bunds and main channels, construction and timely

repair of check dams and shutters for quick operations at the time of flash flood, desilting the drainage channels, increasing straight cuts to reduce sea water intrusion, soil reclamation, adequate manuring at initial stage of the crop growth before monsoon season help to certain extent in bringing up the crop growth satisfactory. Timely sowings of rice fallow pulses in all rice area will promote production of pulses, especially blackgram.

D. DRY RICE AREA

Dry Rice area has a number of crop production constraints. As already discussed, rice is the principal crop of this situation. Out of 81.1 per cent of gross cropped area under rice 33.4 and 47.7 per cent are irrigated and upland rice. Crops other than rice could go to a maximum of 9.2 per cent only between January to April month. August to January is the Samba rice season and all cultivable lands remain fallow for a period of more than four months a year. Both irrigated and rainfed rice are grown dry initially.

The production constraints are :

i) Land distribution and soil properties

A sizable proportion of land area (about 25%) is covered under salt swamp, coastal sand, reserve forest and problem soils. Major soil series under this situation are poor in water retention, light textured, low in fertility status with less water holding capacity. Problem soils associated with heavy deposition of inorganic salts are seen distributed.

ii) Unevenness in topography

With alternated low lying patches and soils associated with salinity and alkalinity high and low tide of the sea and marshy swamps are extended along the coast.

iii) Bad weather

Though the situation has an average annual precipitation exceeding 2000 mm, it is a point of hit by thunderstorms, heavy wind currents. Rainfall distribution during summer months is not distributed evenly for raising rainfed crops.

iv) Reach of canal water and location

The situation lie in the south eastern corner of the delta line on both sides by Bay of Bengal. The situation is more towards a point of drain (Tail End). The canal water reach is far delayed upto September even in normal years. Restricted number of tertiaries could cover limited land area under canal irrigation system. There are no check dams, diverts or small reservoirs to control water at times of heavy inundation. Drains and irrigation canals serve the purpose of each other at the time of monsoon rains. Underground recharge is very poor and such sources render water unfit for agricultural purpose. Soil reclamation in this situation is costly.

Though the input and cultivation costs are less, the harvested produce is not that high enough to pay higher dividends. Inadequate application of nutrients at different stages of crop growth limit production in rice. The need for high yielding rice varieties with inbuilt resistance to biotic and abiotic stress conditions is now felt. Prolific built of adventitious root system, ability of the genotypes to respond quickly to water needs and applied nutrients, stiff straw to withstand wind, non-shattering type with least environmental interaction in medium duration group is now aimed specific to this situation. As a long term measure, improving on the canal irrigation system, construction of small storage check dams and regulator vents are to be made. Advancing crop loans, extending crop insurance's, development of input facilities and extending subsidy for semi dry rice cultivation are to be encouraged. Importance of adequate fertilisation either basal or by foliar application, weed management, correction of deficiency syndromes, minimizing harvest and processing losses are to be disseminated for wider adoption.

Production constraints – Horticultural crops

General

1. Clayey soil type and varying soil depth
2. Water source being plenty from Cauvery river between June and February and underground water source being limited in summer

3. Climatic factors; low light intensity and wind hazards
4. Ill drained soils
5. Lack of assured market facility; regulated market in notifying certain horticultural commodities
6. Torrential rains in monsoon seasons

Crop oriented

Banana – ill drained soils; wind injury and crop damage and probing cost; blight (mattaik Katchal); ervinia disease in Nendran banana; salinity in soils; assured market; transport cost; wilt and cucumber mosaic diseases

Mango - land utilisation aspects; off season bearing flower and fruit drop; insect damage; harvest, preservation and market losses due its perishable nature; lack of juice producing firms within the zone limits

Citrus – ill drained soil; die back, rust diseases; micronutrient deficiencies; lack of distribution of quality grafts

Cashew – land utilisation aspects; lack of effective spraying; lack of manuring and irrigation

Tubers – Soil nature; comparatively lesser price for the produce; availability of alternate crops

Betel vine – disturbance in marketing; wilt disease; labourer cost

Vegetables – perishable nature of the produce; drainage problems; availability of alternate crops; lack of underground water tapping; fruit rot in Chillies; climatological factors

Flowers – assured market facility lacking; red spider mite in Jasmine; nematode problem in mullai; lack of quality and productivity clones grafts

Spices and condiments – limitations in extending area; availability of alternate crops; seasonal vagaries

Prospects in the development of horticultural crops in Cauvery Delta Zone

Cashew is an important cash crop in Vallam plateau of Thanjavur taluk and in Orathanad, Vedaranyam, Lalgudi and Kattumannarkoil taluks of the zone. The unit production could be augmented in adopting regular manuring, irrigation and timely control of pests. Likewise, pruning in mango, mass ground spraying against insect pests and propagation of quality saplings of improved mango grafts will augment mango production in the zone. Banana has tremendous value with reference to net return. Integrated approach in cultivation and assured regulated market procedures will enhance its growing in the delta region. Ample opportunities prevail for the area improvement and export of various kinds of flowers especially jasmine of various kinds and nerium. Vegetables are one area where good improvement could be obtained. They are cultivated by small and marginal farmers with limited resources. The crop improvement package could be supplemented and encouraged to obtain higher net returns in unit area besides bringing more area under cultivation. As far as Thanjavur district is concerned cashew in Vallam tract, jack in and around Pattukkottai flowers in Sundaraperumal koil, Vedaranyam and Thanjavur taluks are profitable ventures. Vegetables in Thiruvaiaru and Vedaranyam taluks (especially in Kathirupulam, Karuppanpulam, Ayakkaranpulam) Padugi banana in Kumbakonam and Thiruvidaimarudhur offer still more scope for improvement. Varieties and hybrids suitable to the deltaic region in crops like mango, jack, citrus, banana, cashew, tapioca and vegetables need improvement. The developmental projects aim in unit area improvement and also to bring more area under horticultural crops by encouraging cultivation in cultivable waste lands with supplemental irrigation. The projects are envisaged to completely engage the family labour with less cost of cultivation and regular returns for a standard living. About 7000 ha of cultivable wastes in Thanjavur district could be immediately planned for improvement under horticultural crops besides farm forestry.

PROSPECTS OF AGROBASED INDUSTRIES

Cauvery Delta Zone(CDZ) continuous to be predominantly an agricultural oriented one and no wonder therefore that it has been identified as industrially a backward area. The manufacturing of food products stands the most important industry

due to a large number of rice mills operating in the district. Manufacturing of cotton textiles beverage, tobacco and tobacco products, are other important industrial group worthy of mention here. CDZ has been from early days a flourishing centre of cottage industries and handicrafts alike. Next to handloom comes mat industry. Mats made of korai, screw pine, palm and coconut leaves are much in-demand. The mat weaving is spread over a number of places, but the superior varieties of mats are made in Chakkarapalli, Pakkirithaikkal and Mudukkur. The CDZ is equally well known for its pith articles consisting of beautiful models of Hindu idols, temples, mosques, flower garlands, bouquets, parrots and peacocks. The flower garlands and bouquets are much in demand during Christmas days. Pith is grown on the beds of tanks in the Thanjavur, Thiruvarur, Nagappatinam districts.. The making of musical instruments of jack wood like the veena, the tambura, the violin the mridangam, the tabla and the Kanjara exhibit excellent taste, knowledge and workmanship. The jack wood has special quality for producing musical sounds. Thanjavur and Kumbakonam are known places for the manufacture of musical instruments

The Government has also established industrial training institute at Thanjavur, Nagappatinam to foster and promote small-scale industries in the CDZ. Further, the State Industries Promotion Corporation of Tamil Nadu Limited (SIPCOT) was setup in 1971 as a public limited company wholly owned by the Government of Tamil Nadu with the object of developing medium and major industries in the backward and under developed districts of the State. The District Industries Centre (D.I.C.) also known as Vigorous Extension Agencies were started in 1978 under the National Policy of directing concerted efforts to promote, the development of cottage, rural and small scale industries by ensuring the supply of inputs besides arranging for marketing the finished products. Resuscitating traditional arts and crafts through offering timely financial support is also an important object of the District Industries Centres.

India is the second largest producer of fruits and vegetables in the world. The total fruits and vegetables production in the country is around 110 million tonnes. Out of which, only 1% is processed. Increased agro processing could reduce post harvest losses which are around 25 – 30% of the total produce. Both government of India and NABARD have recognized agro processing sector, as thrust area, Reserve Bank of India

has included agro/food processing activities under priority sector for the purpose of bank lending.

Despite the good potential for exports, not much area has been brought under vegetables, flowers etc. The entire production under horticulture and floriculture crops absorbed by local markets and large-scale commercial ventures are yet to take off in the Cauvery Delta Zone. Concerted efforts by all agencies including financial institution can yield good results. The important export oriented projects for the Cauvery Delta Zone are presented below:

1. Activated Carbon From Coconut Shell Charcoal

Ordinary charcoal has a specific surface area of only 1-2 sq.m/gm, and therefore has very limited ability to absorb substances in the liquid and gaseous phases. Its absorption capacity can be increased to 300-2000 sq.m/gm through activation by removing the tarry material that blocks the surface of the carbon skeleton of charcoal. Charcoal processed in this way is called activated charcoal. Today, more than seventy types of activated carbon and marketed for various applications in the food and chemical industries.

Activated carbon has diverse usage, such as in the purification of iron/gas /liquids, solvent recovery, water/effluent treatment and in the recovery of precious metals (i.e. gold) from ores. The quality ranges mainly from iodine 900 to iodine 1300, with the price quoted at US$1,000 to US$ 1,500n per tonne respectively.

Market

The main markets for activated carbon are the developed countries such as US, France, UK, Australia, Japan, Taiwan, etc. Malaysia, Sri Lanka, Philippines and Indonesia are among the major producers and exporters of coconut shell-based activated carbon.

World market for activated carbon is over 600,000 tonnes per annum and is growing at a high rate since the product relates directly to promoting environmental preservation, which is supported worldwide. In Tamil Nadu VVD & Sons

(manufactures of gingelly and coconut oils) manufacture four grades of activated carbon from coconut shell charcoal with iodine values ranging from 500 to 1000.

Raw Materials

The main direct raw material is coconut shell or coconut shell charcoal, which can be procured from local manufacturers of coconut products such as copra and coconut oil. Gross cost of coconut shell charcoal is estimated at Rs.5 per kg.

Tamil Nadu contributes to 33 percent of India's coconut production. It is the second largest coconut producing state after Kerala, Coimbatore, Thanjavur, Nagapattinam (including Tiruvarur), Dharmapuri,Erode, Madurai, Kanniyakumari and Tirunelveli are the leading coconut producing district in Tamil Nadu.Main indirect law materials consists of polypropylene bags or kraft reinforced paper bags with inner plastic lining. It takes about 10 tonnes of coconut shell charcoal to convert into four tonnes of activated carbon.

1. Spirulina Algae

Spirulina, a microscopic plant is a formation of algae that grows naturally in fresh water. It contains upto 70% protein (on a dry weight basis) and large amount of pro vitamin - A, vitamin - B12 and iron.

It is used in medicinal preparations like vitamin - B12, fluorescent dyes for medical laboratories, as food/pharmaceutical colouring agent etc. It is also used in feed preparations for fish poultry and silk worms to improve the yield from such breeding farms. Spirulina is believed to be ideally suited for the manufacture of face creams, as it has high protein content.

Technology And Process

Spirulina is grown in nutrient enriched open shallow ponds to increase the yield. After attaining desired levels of concentration, part of the grown spirulina is filtered, washed and dried, while the filtrate can be recycled back to the pond. The remaining part of the algae continues to grow in the pond. Regular make up of water level, constant agitation and nutrient supplementation ensure healthy growth of spirulina.

Raw Materials

The major raw materials are the nutrients like sodium bicarbonate, sodium nitrate and potassium sulphate. They are available from indigenous sources.

2. Lemon Processing

(Lemon Oil, Spray Dried Lemon Juice Powder & Citrus Pectin) Products And Their Applications

The products covered under citrus fruit (lemon) processing are lemon oil, spray dried lemon juice powder and citrus pectin. These are import substitution products.

Lemon oil is extracted out of lemon peel (skin) and is used for flavoring of juices and in the manufacture of carbonated beverages, candies, baked foods, cosmetics, soaps & detergents etc. Spray dried lemon juice powder is used for providing lemon flavor in pharmaceutical, processed food (ice cream) beverage and health care products.

Citrus pectin is used as an additive in fruit & Vegetable processing and in pharmaceuticals. It is generally used as a gelling agent in jams, jellies and marmalades. It is also used as a clarifying, thickening, stabilising or foam -forming agent.

Market Aspects

Indusmin Foods Ltd, Mumbai is a recently commissioned unit in the organised sector processing citrus fruits. There are also small-scale units manufacturing lemon products. The demand for lemon oil in India is currently estimated at 125 tpa (tonnes per annum)

The demand for spray dried lemon juice powder is estimated at 400 tonnes per annum a large part of which is met by imports. According to industry reports, around 30 tonnes of pectin (from citrus fruits) is currently being produced in India. The total requirement of pectin for food, pharmaceuticals and miscellaneous sector is estimated at nearly 300 tonnes. The major part of the requirement is met by imports.

Based on the positive signals of growth from the food processing sector, it is expected that the demand for citrus fruit based products would grow at 8 to 10 per cent annum. The demand (tpa)by the year 2000 A.D. is estimated as below

Citrus Pectin -- 315

Spray Dried Lemon Juice Powder -- 475

Lemon Oil -- 160

3. Gherkins/Baby Corn (100% Eou)

GHERKINS

Gherkins a small green cucumber provides gainful employment to small and marginal farmers even while earning good profits for corporate and foreign exchange for the country. The potential for production and export of gherkins has been discovered over the last four to five years, and India's exports are increasing progressively each year. There are now about 9 gherkins processing units in Karnataka, and some in Andhra Pradesh and Tamilnadu as well.

There is no domestic market for these vegetables and the entire produce has to be exported. US (500,000t), Europe (450,000 t) and Japan (220,000 t) are the major markets. Turkey is the largest exporter. It exports nearly 1 million tonnes of gherkins per annum. It contrast India exports are of the order of 40,000 tonnes. Gherkins have to be handpicked from the farm every day , so that they are harvested at their optimal size. This requires about 8 persons per hectare. The processing activity is also labour-intensive. India/Tamil Nadu especially Cauvery Delta Zone has a definite advantage in this field. In fact, the labour costs in India are one-tenth that in Turkey. There is therefore enormous scope for further increasing India's export of gherkins.

Raw Material Procurement

The key to the success of companies processing and exporting gherkins is contract farming. The company has to evolve comprehensive extension programme involving the small growers who produce the crop as specified. Quality seeds (imported), fertilizers, pesticides and finances have to be provided by the company. The entire produce of the farmers is bought back by the company at agreed prices.

The net income for the farmer is around Rs.15,000 per hectare for one season of three months, with an average yield of 4 tonnes per hectare. Gherkins are grown on irrigated lands.

The prices depend on the grades; small ones fetch higher returns. The premium variety with 160+ numbers per kg are procured by processing units at a farm gate price of about Rs.10.50 per kg; the lower grades and their corresponding prices per kg are as follows: 100 - 160 nos./kg - Rs.7.50; 60 - 100 nos./kg - Rs.5.00; 30 -60 nos./kg - Rs.2.00; and 10 - 30 nos./kg - Re.1.

For the corporate sector, production and export of gherkins is quite profitable because the FOB price is around Rs.22000 per tonne against the farm gate price of Rs.9000 per tonne.

BABY CORN

Although baby corn was originally part of the East Asian cuisine its production and market have vastly expanded. Baby corn is now produced commercially in Asia, Africa and Latin America and exported in large quantities to Europe and North America in both fresh and canned forms.

India, and specifically Orathanadu and Peravurani taluk of Cauvery Delta Zone in Tamil Nadu, can exploit this potential by growing processing and exporting baby corn some entrepreneurs engaged in the export of gherkins have begun trying production and export of this product in a small way and initial feedback has been encouraging.

Growing harvesting and preparing baby corn for export requires a great amount of hand labour and a high level of attention and is not well suited to mechanized operations. Therefore, production of baby corn for export has limited to regions with plentiful and inexpensive labour.

However plant geneticists are developing silkless cultivars of sweet corn which will drastically reduce labour costs, because removing silk from baby corn is the most

time consuming process in its production. It is also reported that Thailand which is facing rising labour costs, has been removing silk by means of forced-air machinery.

Raw Materials

Baby corn is sweet corn, harvested just when it begins to develop. Specialized cultivars of sweet corn are employed for its production, although one can produce baby corn from standard varieties as well. Production method for baby corn is generally divided into either production focused on baby corn alone or production that is based on baby corn but also yielding a secondary crop of other corn products. In the latter method, which is commonly adopted in Thailand, the highest quality ears are harvested in immature form as baby corn while lower quality ears are allowed to mature and are sold mainly as animal feed.

Tamil Nadu annually produce about 100,000 tonnes of maize in 60,000 hectares of land. Genetics International Ltd, Delhi secured parental seeds of baby corn from abroad and made the variety suitable for Indian conditions through genetic manipulation. A few progressive farmers near Delhi are making windfall profits by growing baby corn.

Baby corn is sown in small portions of the allocated area at two to three week intervals to ensure phased harvesting almost round the year. The baby corn could be harvested within sixty days of planting, soon after the emergence of silk-like fibre on the ear/cob. About 110,000 to 120,000 corncobs of three to four inches length can be harvested from a one-hectare plot in one crop. The yield in terms of weight is 3 to 4 tonnes. Three crops can be taken in a year.

World Market Scenario

Thailand dominates world trade in both fresh and canned product. It accounts for 80 per cent of world's trade in baby corn. Other countries known to export baby corn include Sri Lanka, Taiwan, China, Zimbabwe, Zambia, Indonesia, South Africa, Nicaragua, Costa Rica, Guatemala and Honduras. The United States alone accounted for about 40 per cent by volume and value. Japan, Germany, Canada, Australia, United Kingdom and Hong Kong accounted for an additional 40 per cent. The US imports fresh

baby corn mainly from Costa Rica while canned corn is procured almost exclusively from Thailand. Pack size of 1.5-kg tins per carton is the industry standard for sale to both processors and the food service industry.

3. Individual Quick-Freezing (Iqf) Vegetables & Marine Products

Preservation of perishable foods is achieved by freezing through a combination of low temperatures and reduced water activity. Freezing is widely applied for different types of fruits vegetables and marine products.

Freezers are divided into different classes like : slow freezers (still air freezers and cold stores); quick freezers (air-blast and plate freezers) and rapid freezers (fluidised bed freezers and cryogenic freezers). Quick freezing is commonly referred to as IQF (i.e.Individual Quick-freezing).IQF is hygienic as the food is blanched and frozen at -40oC where by the biological activity is completely stalled. IQF products are convenient to use, as the they are cleaned, trimmed and cut to a size which can be used for cooking readily. They can be stored for a fairly long period, without losing the color, flavour texture & nutrition contentof the food. IQF is in use since a long in the international market, whereas in India thetechnology is a fairly recent arrival.The technology is being used in India for both domestic the market as well as for exports.There are around 12 IQF shrimp units in the country.At present the frozen vegetables sector has only two major players -NDDB and Delhi-based Jagadamba Foods after Hindustan Lever's Green Valley brand opted out of the market. In the case of NDDB, Mother Dairy's vast network of fresh vegetables outlets across the metros has helped in marketing its Safal brand of frozen vegetables as it has been able to tap its existing retail level cold storage facilities.Jagadamba Foods is estimated to be heading for a turnover of around Rs.120 crores this year.

Raw Materials

Fresh vegetables (okra, beans, peas, spinach, tomato); raw shrimps, cuttle fish and, squid

COMMENT

Frozen vegetables units in the country have not been doing too well. This is mainly due to the absence of a reliable cold chain network. The cold chain involves pre-cooling, cold storage, refrigerated vans and finally freezers at the retail outlets; but the poor infrastructure and transport facilities have hampered expansion. The proposed unit would have to ensure that the necessary system would be in place to take care of its requirement whether it is for the domestic or export markets.

FUTURE THRUST

Sustainable management of soils, water and crops – the basic resources of agriculture, calls for a holistic and visionary perspective in order to plan for the future. The pace of technology introduction and its absorption in recent years has been so rapid, that in the 21st century agriculture in India will be practiced under quite different ecological, technical and socio-economic conditions than in the decades before. Water and not land would be the major constraint in producing enough food at that time but soil management concerns such as physical, chemical and biological degradation would also become increasingly relevant. The UNCED Agenda 21 adopted at the earth summit in Rio de Janeiro called for urgent action on land and environmental issues. It proposed that agricultural development in the future must be sensitive to social needs but at the same time be aware of environmental issues. Thus the slogan for us is to produce and protect.

The current level of rice production is poised around 84 m.t. But, the demand for rice would go up to 95 m.t by 2000 AD and not less than 135-145 m.t to feed the additional 300-350 million people by 2020 AD. This would necessitate adding not less than 2.5 .t of milled rice every year by raising the current level of 2.5 t/ha. to 4.25 m.t of milled rice every year from irrigated ecosystem and from 1.5 to 2.5 t/ha from rainfed ecosystem with no more scope for horizontal expansion in area required to attain and sustain self sufficiency against adds like plateuing of yield levels, depletion of natural resource base, lack of viable technological package for fragile rainfed ecologies, declining cost-benefit ratio entailing farming less remunerative, coming in the way of achieving the targeted production levels.

Irrigated rice yield must be raised from the present level of 5 t ha^{-1} to 8 t ha^{-1} by the year 2020 to secure the targeted production. To reach this yield level, we have to increase the use of N fertilizers by 180% at 33% recovery efficiency and by 87% at 50% recovery efficiency. We can clearly see the importance of promoting the efficient use of N fertilizers to produce the needed rice at minimum economic cost. The same is true for all other inputs.

The projected water demand by 2025 AD for India is 1050 x $10^9 m^3 year^{-1}$, out of which nearly 75% will be utilized for irrigation and the rest for other purposes. Due increasing competition, good quality water will need to be used most judiciously. As the proportion of urban population goes up the demand for better quality water will increase due to better lifestyles. The present per capita availability of water is 2100 m^3 and represents a 'comfortable level'. The population expansion will reduce it to 1700 m^3, the accepted 'scarcity' level by 2030. And in another five to six years it would slump to the 'water shortage level' of 1000 m^3, currently in existence in most middle east countries. The shortages will cover both fresh and recycled waters. So, improved water management will be called for, like provision of more storage and regulation of water during times of water surplus for use in times of water shortages, water conservation by minimizing water losses, increasing food production per unit of water, transferring water to users with higher socio-economic return and reusing saline, sewage and industrial effluent. Short term solutions may in-fact transfer the problem somewhere else in the basin, so regional level management of soil and surface and groundwater resources is called for. Efficient conjunctive management of water resources at regional level will receive the maximum priority.

Of the present ground water development of 13.5 mha-m/year, poor quality waters account for 3.2 mha-m/year. Agriculture is a major user (89%) of good quality water resources. The current demand of first priority users (domestic use, energy, industry) is around 10% of the total water supply of 55.2 mha-m in 1990 and will increase to 22.2% (24.3 mha-m) of the total supply of 105 ha-m in 2025 AD. With increasing competition from industries for good quality water, agriculture will increasingly depend on marginal quality waters for irrigation. We will also have to cope with greater volumes of effluent, toxic solid wastes, sewage waters etc., their effects on

soil and underground water quality and on human and animal health. Problems of water quality will have to be seen in the context of a river basin where water quality deteriorates towards tail end. The existing temporal and spatial variations in water quantity and quality will get further accentuated and, coping strategies including guidelines and standards for reuse / sequential use will need a fresh look.

Cauvery Delta Zone traditionally, cultivate rice, rice fallow pulses, banana, sugarcane, groundnut, gingelly etc. Though the area under these crops are sizeable, the production potential is often lower than State/National levels, for obvious reasons. But, there prevails a good scope in improving productive potential of these crops by adopting production technologies. Even though enough is made in this line, much more are to be covered in increasing yield and quality per unit area. The non-adoption of certain technologies are to be critically evaluated and alternatives are to be advised for follow up. Quality seed supply, input supply in time, timely forecast on pests and disease outbreaks, storage methods and assured marketing will improve the area under different crops of the zone.

The cropping system in Cauvery Delta Zone needs consideration and recasting taking into account the experiences gained in the recent past. Alternate / substitute for Kuruvai and Summer seasons are to be suggested. A profitable rice – based cropping sequences specific for the different situations are to be made available to the farmer. Information on contingency planning should be available so that variations within a year/season can be overcome without overlaps. While suggesting the above, labour, water availability and socio-economic status of the delta farmers are to be borne in mind.

Water management is another area where much attention is needed in the extension side. Tapping underground water for agriculture is getting momentum in the delta zone to supplement water needs. The uncertainty and limited availability of water in the canals created an awareness on the economic use of irrigation water. The delta farmers already started thinking of alternatives in lieu of traditional crops. Water use

efficiency is to be taught through larger demonstrations and preferably taking village as a whole.

Number of pests that were considered important have risen from 3 to 13 during 1965 to 1998 in case of insect pests and to 7 in respect of diseases. Some of the insect pests and diseases like stem borer, gall midge, plant hoppers leaf folder, ear head bug with country wide distribution result in serious losses and are difficult to manage. Other biotic stress like weeds and rodents also pose serious problems in rice production.

Integrated pest management practices for each location should be developed based on the experience of the farmers and utilization of appropriate pest resistant varieties, cultural practices, biorational approaches and chemical control based on pest monitoring. Specific / multiple pest resistance should play an important role. Pests like bacterial leaf blight sheath blight and stem borer for which resistant could not be bred, novel approaches utilizing molecular techniques should be exploited. Application of geographical information system (GIS) for monitoring and predicting pest endemicity should be applied to reduce the yield losses due to pests.

Another factor concerning the economic sustainability of rice production is continuous declining trend in real profitability of rice production. The rate of increase in real cost of production is higher than the rate of increase in farm harvest prices in major rice producing states. The real cost of unit production has declined over the period implying the efficiency of rice production as a result of modern technologies. However, profits are going down due to higher rate of decline in farm harvest prices as compared to rate of decline in cost of production. Thus, farmers are not comfortable to allocate more resources for rice cultivation because of relative low profitability as compared to non-rice crops. There would also be possibility of diverting more resources and land from rice to non-rice crops because of widening gap in the profitability among food and non-food crops. If this trend of declining profitability continued, domestic supply of rice would further be reduced. It is essential to ensure the economic sustainability of rice production on par with alternative farm enterprises. One way of sustaining the real

profitability is to develop cost effective crop management practices to increase input use efficiency so that same or higher output could be achieved with less inputs / lower costs.

Agricultural labour is going to be a major limiting factor for rice cultivation in the future, because of their migration to more profitable non-farm sector with less drudgery of work. Therefore, labour availability is becoming a major constraint in agriculturally progressive regions. If, the present trend of labour scarcity continues, farmers may abandon rice cultivation especially in progressive regions in the years to come as we witnessed a significant reduction in rice area in the state of Kerala wherein rice area has been diverted to other crops and put in non-agricultural use. It could be seen the farm machineries/implements usage in delta is very much restricted. The soil type, weather, labour availability and reach of the land holdings and their adoption to a greater extent in the delta region. Designing and developing suitable farm implements for the delta popularisation of labour and time saving implements lie as the joint responsibilities of the researcher and extension personnel.

Economic growth is often accompanied by adverse effects on the environment. Thus proper planning and management of environmental and natural resource use is critical. Our future programmes will place proper emphasis on introducing appropriate technologies taking into account the farmers' needs, problems and socio-economic conditions. There is need to enhance decision making capability of farmers. For this, comprehensive project evaluation and impact analysis is required and policy issues related to technology transfer in changing economic scenario need to be addressed.

For undertaking new strategic research, human resource development is a very crucial component. Research and research tools will become very sophisticated so training in emerging areas will be needed. Existing scientific and technical manpower requires training in emerging areas. Scientists need specialized training on conceptualizing, planning and resource management. The country has to double its strength of extension personnel by 2020 AD. With liberalization, the skills and incentives to scientists, technicians and other personnel have to be upgraded in order to attract and retain good talent and keep them motivated. Research projects would have to be increasingly of an applied nature and location specific to address a problem in an

interdisciplinary and holistic approach. Effective linkages would be needed with state and voluntary agencies to address the problems. Farmers' fields have to be our laboratories and the farmer our research associate. With the broad-basing of agricultural extension in the coming decades, human resource development will have to play a major role.

Having defined a perspective in consonance with Agenda 21 which calls for a sustainable approach to management of natural resources across eco-environments, the researches on soils, water, crop and socio-economic factors have to be viewed as a part of a large body of research on environmental sciences in continuum. We have to leave the disciplinary, sectorial approach in research and instead adopt a holistic and visionary approach.

STRATEGIES TO OVERCOME CHALLENGES

I. Increase rice production

- Bridging demand and supply of quality seeds
- Increase rice yield from 4.5 t to 8 t/ha through Site Specific Nutrient Management approach
- Increase nitrogen use efficiency through SPAD, LCC
- Development and application of Integrated Pest Management
- Assessment of barriers for the adoption of various rice production technologies through socio economic research and suggest suitable policy measures

II. Increase pulse production

- Collection and preservation of local cultivars of blackgram and greengram
- Breeding of resistant varieties to biotic and abiotic stresses.
- Development of early maturity plant types
- Assessment of nutrient requirements for rice fallow pulses
- Development of IPM rice fallow pulses

III. Popularization of modified drum seeder

IV . Development of rice based Olericulture system

V . Development of rice based Floriculture system

VI . Exploration and introduction of agro based industries in Cauvery Delta Zone

COCONUT RESEARCH STATION, VEPPANKULAM

The details for the cauvery new delta region comprising of Pattukottai, Orathanadu and Peravurani taluks have been collected and furnished hereunder.

1. Geographical distribution of area of each division of the zone

S.No	Particulars	(in Hectares)		
		Pattukkottai	Orathanadu	Peravurani
1.	Total geographical area	71,229	58,574	28,441
2.	Uncultivable waste	1,637	2,680	366
3.	Area used for other purpose	14,642	10,070	7,559
4.	Cultivable waste	1,847	2,680	181
5.	Current fallow	599	1,365	293
6.	Land under trees not included under area sown	472	3106	74
7.	Other fallow	5036	8090	2846
8.	Forest	2664	-	120
9.	Net area sown	44,332	33,217	17,002

2. Rainfall data for 50 years for each division

Taluk	Mean annual rainfall 1 mm	South west monsoon		North East monsoon		Winter		Summer	
		mm	%	mm	%	mm	%	mm	%
Pattukkottai	1025.0	275	26	663	65	20	2	67	7
Orathanadu	1263.0	233	18	753	60	25	2	252	20
Peravurani	1006.0	242	24	685	68	11	1	68	7

3. Different soil type available in the region

Three types of soils are available in this region. They are Pattukkottai series, Madhukkur series and Peravurani series

Name of the series	Area	Percentage
1. Madhukkur series	1,10,573	73.4%
2. Pattukkottai series	33,424	22.2%
3. Peravurani series	6,672	4.4%
Total	1,50,669	100.0

4. Crop cultivated in the region

S.No.	Name of crop	Area (Ha)	Popular varieties	Yield kg/ha
1.	Paddy	90,329	ADT 36, ADT 39, ADT 43, CR 1009	5,000 kgs
2.	Maize	19	Ganga 5, Col	3,500 kgs
3.	Blackgram	5,729	T9, ADT 3, ADT 5	800 kgs
4.	Groundnut	5,659	TMV 2, TMV 7 and JL 24	3,000 kgs
5.	Gingelly	5,040	TMV 3, TMV 5, TMV 6	400 kgs
6.	Coconut	22,047	ECT, VHC 1, VHC 2	13,000 Nuts/Yr
7.	Oilpalm	510	Tenera	-
8.	Sugarcane	1,221	COC 671, COC 658, CO 62174	120 tons
9.	Soybean	1,349	Co 1	1200 kgs
10.	Banana	131	Poovan, Mondhan	12 tons/yr
11.	Mango	664	Bangalore, Neelam and Local	10 tons/yr
12.	Vegetables	268	Brinjal, Chillies, Bhendi local	5 tons/yr
13.	Flowers	6	Jasmine, rose, Crosandra	200 kgs/yr
14.	Other crops	160	Palmyrah, Eucalyptus, Casurina	-

5. Constraints and problems of the area in each division

Pattukkottai

1. Non availability of water to raise kuruvai paddy and samba nursery
2. Labour saving implement for planting and weeding in paddy
3. Non availability of adequate quantities of paddy and pulses seeds in time during season
4. Non availability of combind harvester in paddy for smaller holdings
5. Lack of support price for the Agricultural produce
6. Effective and efficient pest control methods in coconut

Orathanadu

1. Non availability of adequate water for kuruvai paddy in canal
2. Labour saving implements for planting and weeding in paddy
3. Non availability of adequate quantities of quality seeds of paddyu, pulses varieties
4. Non availability of combined harvester in paddy for smaller holdings
5. Non availability of trashing floors
6. Lack of support price for the agricultural produce

Peravurani

1. Non availability of water to raise kuruvai paddy and samba nursery
2. Non availability of quality seeds of paddy and pulses
3. Labour saving implements for planting and weeding in paddy
4. Non availability of combined harvesters in paddy for smaller holding
5. Lack of support price for the Agricultural produce
6. Effective and efficient pest and disease control packages for coconut
7. Technologies so far developed ie. varieties, management, plant protection and other items developed in this station

ACHIEVEMENTS

CROP BREEDING

High yielding coconut hybrids/varieties

VHC 1 : Tall x Dwarf hybrid released in 1982 (ECT X MGD)

Features: Early flowering (4 years), average yield of 115 nuts/palm/year with high copra outturn (142 g/nut) with 69% oil content

VHC 2 : Tall x Dwarf hybrid released in 1988 (ECT X MYD)

Features: Average yield – 142 nuts/palm/year, High copra weight (146 g/nut) with 70% oil content and reduced bunch buckling and leaf drooping

VPM 3: Tall Variety released in 1994 (Selection from Andaman Ordinary)

Features: Drought tolerant, average yield – 92 nuts/palm/year, High copra weight (176 g/nut) with 70% oil content

VHC 3 : Tall x Dwarf hybrid released in 2000 (ECT x MOD)

Features: Average yield – 156 nuts/palm/year. High copra weight (162 g/nut) with 70.2% oil content

Seed nuts and seedlings production

About 20,000 quality seednuts and 30,000 seedlings of promising coconut varieties and hybrids are being supplied to the farmers, agriculture department and research stations every year.

CROP MANAGEMENT

Agronomy

- A spacing of 7.5 x 7.5 m is optimum for higher nut yield per unit area
- 0.56: 0.32: 1.20 kg NPK/palm/year gives higher nut yield in ECT
- 1.0: 0.25: 2.0 kg NPK/palm/year gives higher nut yield in hybrid
- Banana (Poovan) is the most profitable intercrop in coconut (C:B ratio 1:4.2) where intercropped at 2.5 x 2.5 x 5.0 m spacing
- Turmeric, pine apple, tapioca, mango, curry leaf and pulses are also suitable intercrops
- Drip irrigation at 100% Ec level increases nut yield. Basin irrigation is also effective
- Slow release fertilizer (NP tablets) is more effective

CROP PHYSIOLOGY

- One kg micronutrient mixture (developed by Agriculture Department) per palm per year in soil increases the nut yield
- Spraying of 1 ml of NAA in 2 litres of water at 30 days after the opening of inflorescence increases the setting percentage
- 200 g borax + 3 kg potash reduces barennuts

CROP PROTECTION

Agricultural Entomology

- Application of 10% BHC (50 g) + sand (50 g) or carbofuran 25 g + sand 100 g in the crown of coconut reduces the rhinoceros attack. Crown application of 50 g neem seed kernel powder + 100 g sand is also effective
- Root feeding of 10 ml monocrotophos + 10 ml water controls the red palm weevil

Coconut eriophyid mite

- Population of mites more in 5 month old nuts
- Mites enter into bracts on 34 days after fertilization
- Palmyrah fruits act as alternate host for mites
- In dwarf, nuts of all colours infested by mite
- In tall varieties green coloured nuts infested more than bronze coloured nuts
- Genotype screening revealed Lakshadweep ordinary and Cochin China recorded least damage
- Mite damage was least in palms receiving neem cake 2 kg + bone meal 0.5 kg + mill ash 4 kg/year.
- Increased dose of potassium (2 kg K2O)
- Growing of high density multiple intercrops lowers mite damage

- Spot application of Triazophos 5 ml/lit or carbosulfan 2 ml/lit reduced the mite population and 3 kg MOP recorded least mite damage
- Fish oil rosin soap 4% either alone or combined with Fusarium sp (10^6/ml) significantly reduced the mite population
- TNAU Agro biocide root feeding gave 75% population reduction after 45 days
- Placing of 3-4 bits of bromodialone cakes controls rodent effectively

Plant Pathology

- Incidence of Thanjavur wilt (Basal Stem Rot) of coconut caused by (Ganoderma lucidum) was reported from the district in 1952.
- Soil temperature positively correlated with severity of Thanjavur wilt. Regular irrigation during summer reduces soil temperature.
- Application of 5 kg neem cake/palm/year reduces Thanjavur wilt
- Banana intercropping in wilt affected gardens contains the wilt disease
- Neera tapping in diseased palms for 6 months reduces the disease incidence
- Root feeding of 1.3 g aureofungin-sol + 0.5 g copper sulphate or 2 ml tridemorph in 100 ml of water combined with soil drenching of 40 litres of 1% Bordeaux mixture effectively controls wilt
- Soil application of 500 g each of $CaSo_4$ + MgSo4 also controls wilt
- Application of 500 g inoculum of Trichoderma harzianum in 50 kg FYM checks the disease
- Application of 200 g Azotobacter or phosphobacteria in 10 kg FYM reduces the wilt disease
- Chemodiagnostic method EDITA and TTC tests are useful for early detection of Thanjavur wilt
- A new hybrid coconut (ECT x Wilt tolerant ECT) is identified as wilt tolerant
- Root feeding of 2.0 g Thiophanate – methyl or carbendazim in 100 ml of water reduces the leaf blight incidence

Prospects of Agrobased industries

- Seed industry : to produce quality seeds of cereals, pulses, oilseeds and vegetables
- Seedlings and sapling nursery : to produce seedlings of coconut, grafts of choice varieties of mango, sapota, pomegranate, citrus, guava, Amla, ber, jack and other fruit trees rooted cuttings of ornamental plants and cut flowers
- Coconut based industries : such as coconut dry powder, confectioneries, oil refineries, coir industry, coirpith decomposing industry. Coir mate industry, tender coconut soft dring industry

- Essential oil industry, cutflowers industry
- Modern rice mill, rice bran oil industry, basmati rice export industry
- Fruit processing industry, packing and export, jam making industry
- Cashew processing and export industry

Suggestion to alluviate the problems and constraints and improvement of Agricultural productivity and production

1. Effective and efficient utilization of ground water potential for crops like paddy, pulses and coconut
2. Extensive use of drip irrigation system in coconut to save water
3. Establishment of seed village for production and supply of quality seeds in paddy, pulses and oilseeds
4. Extensive use of mechanical implements for sowing, harvest and thrashing to save labour
5. Popularisation of coconut intercropping for additional benefit to the farmers per unit area
6. Effective utilisation of Agricultural biproducts for various purposes
7. Effective implementation of integrated pests & disease management techniques in coconut

FUTURE THRUST

1. Development of hybrids/varieties in coconut for drought tolerance, pests and disease resistance
2. Development of variety in coconut for tender coconut
3. Developing coconut intercropping technology with high cost benefit ratio
4. Developing suitable micronutrient mixture for improving coconut yield
5. Developing integrated management practices for eriophyid mite control
6. Developing molecular tools for the early diagnosis of basal stem rot disease of coconut
7. Identification of new effective antogonists for the biological control of basal stem rot disease in coconut

AGRICULTURAL RESEARCH STATION -PATTUKKOTTAI

The details for the Cauvery new delta region comprising of Pattukkottai, Orathanadu and Peravurani taluks have been collected and furnished hereunder.

1. Geographical distribution of area of each division of the zone

S.No	Particulars	Pattukkottai	Orathanadu (in heactares)	Peravurani
1	Total geographical area	7129	59574	28441
2	Uncultivable waste	1637	2680	336
3	Area used for other purpose	14642	10070	7559
4	Cultivable waste	1847	2680	181
5	Current fallow	599	1365	293
6	Land under trees not included under area sown	472	3106	74
7	Other fallow	5036	8090	2846
8	Forest	2664	-	120
9	Net area sown	44332	33217	17002

2. Rainfall data for 50 years for each division

Taluk	Mean annual rainfall	Southwest Monsoon		Noth east monsoon		Winter		Summer	
	mm	mm	%	mm	%	mm	%	mm	%
Pattukkottai	1025.0	275	26	663	65	20	2	67	7
Orathanadu	1263.0	233	18	753	60	25	0	252	20
Peravurani	1006.0	242	24	685	68	11	1	68	7

Different soil type available in the region

Three types of soils are available in this region. They are Pattukkottai series, Madhukkur series and Peravurani series

S.No.	Name of the series	Area	Percentage
1	Madhukkur series	110573	73.4%
2	Pattukkotai series	33424	22.2%
3	Peravurani series	6672	4.4%
	Total	**150669**	**100.0%**

3. **Crop cultivated in the region**

S.No.	Name of crop	Area (Ha)	Popular Varieties	Yield kg/ha
1	Paddy	90329	ADT36, ADT39, ADT43, CR 1009, Ganga 5, Co1	5000 kgs
2	Maize	19	T9, ADT 3, ADT 51	3500 kgs
3	Blackgram	5729	T9, ADT 3, ADT 5	800kgs
4	Groundnut	5659	TMV 2, TMV 7 and JL 24	3000kgs
5	Gingelly	5040	TMV 3, TMV 5, TMV 6	400 kgs
6	Coconut	22047	ECT, VHC 1, VHC 2	13000 Nuts/yr
7	Oil palm	510	Tenera	-
8	Sugarcane	1221	Coc 671, Coc 658, Co 62174	120 tons
9	Soybean	1349	Co1	1200 kgs
10	Banana	131	Poovan,Mondhan	12tons/yr
11	Mango	664	Bangalora, Neelam & Local	10 tons/yr
12	Vegetables	268	Brinjal,Chillies,Bhendi,local	5 tons/yr
13	Flowers	6	Jasmine, rose, crosandra	200kgs/yr
14	Other crops	160	Palmayra,eucalyptus, cassurina	-

Constraints and problem in New detaic region

1. Non availability of water to raise kuruvai paddy
2. Scarsity of Agricultural labourers
3. Labour saving implements for planting and weeding in paddy
4. Non availability of adequate quantities of paddy & pulses seeds in time during seasons
5. Non availability of combined harvester in paddy for small holdings

6. Lack of support price for the Agricultural produce
7. High labour cost, High cost of cultivation, Poor soil condition, high fertilizer and pesticide cost
8. Lack of marketing facilities, transport problems, fluctuation in prices of Agricultural commadities
9. Effective & efficient Pest control methods in coconut
10. YMV, LCV attack in pulses
11. Post harvest storage and Pest Problems in agricultural produce
12. Training required for know how of new technologies
13. Rat damage in field and stored produces
14. Yield maximisation technologies required on Pulses and groundnut

4. Technologies so far developed i.e. varieties, management, plant production and other items developed in this station

i) **Crop Breeding**

Breeding YMV resistant Blackgram

- A promising blackgram culture viz., PBG 4 (T9XDU2) with an yield potential of 1464 kg/ha is in the final stages of evaluation. The yield increase over ADT 3 is 35 percent

- About fifty cultures derived through hybridization utilizing resistant and high yielding varieties are under preliminary trials

Multilocation trials

This is one of the centre for the multilocation trials for promising pre-release cultures of all pulses, soybean, groundnut, gingelly, maize and vegetable crops.

Breeder seed production

Nucleus, breeder and TFL seeds are being produced for the following crop varieties

Crop	Variety	
	Nucleus seeds	Breeder seeds
Rice		ADT 36 and ADT 38
Blackgram		ADT 5
Greengram		ADT 3
Groundnut	VRI 2	

ii) Crop Management

Integrated Farming

IFS involving poultry viz., broilers and layers and substituting ruling rice with maize to some extent (mmet the poultry feed) is found to be remunerative

- Tellichery goat was profitable when small area is raised with CO 1 Cumbu Napier grass for grazing

Nutrient Management

Groundnut

Application of NPK in the ratio of 17.5: 35: 52.5 and 17.5 : 35 : 70kg/ha for Ist and IInd crop of groundnut, respectively, followed by application of gypsum @ 200kg at 45^{th} days after sowing was highly productive

Blackgram

Composted coirpith @ 7.5 tonnes/ha + recommended dose of NPK (25;50:0KG/HA) (Increased blackgram yield)

Soybean

Seed treatment with Rhizobium UASB 117 culture reduced N input cost

Rice

Application of N at 30, 45, 30 and 15 kg/ha (basal, tillering, panicle initiation and flowering phase, Respectively), entire P (40kg/ha) as basal and K in two equal splits (20kg/ha each) at basal and panicle initiation was optimum for getting higher yield in Kharif and Rabi rice

- Enriched composted coirpith with Zinc sul
- phate @ 25kg/ha enhanced rice as well as succeeding groudnut/blackgram yields

Weed Control

Anilophos @ 600 ml/ha effectively controlled wetland weeds
Metalachlor @ 1.00 kg ai/ha was effective in controlling weeds in soybean
Pretilachlor @ 0.3kg ai/ha applied on 3 DAS to direct seeded rice + one handweeding on 30 DAS controlled the weeds and enhanced rice yield

Seed rate for direct seeding

A seed rate of 100kg/ha was optimum to obtain better yield under direct seeded rice

5. Prospects of Agrobased Industries

- Seed Industry : to produce quality seeds of cereals, pulses, oilseeds and vegetables
- Seedling & sapling nursery : to produce seedlings of coconut, grafts of choice varieties of Mango, sapota, pomegrnate, citrus, guava, Amla, ber, jack and other fruit trees. Rooted cutting of ornamental plants and cut flowers
- Coconut based Industries such as coconut dry powder, confectionaries, oil refineries, coir industry, Coir mat industry, tender coconut soft drink industry
- Essential oil industry
- Modern rice mill & Rice bran oil Industry
- Fruit processing industry, packing & export, jam making industry
- Cashew processing & export industry

6. Suggestion to alluviate the problems and constraints and improvement of Agriculture productivity and production

- To alluviate the labour scarsity labour saving implements may be made available to farmers
- Development of machinaries like combined planter, harvester suitable for small holdings
- Improving irrigation facilities by way of deep borwells
- Electric power supply to motor pumpset may be given on priority basis for irrigation purpose
- Technology transfer for water use efficiency to improve the yield and minimise the water loss
- Remuneration price may be fixed by the government for all the agricultural produce
- Marketing facilities may be created provided where ever necessary
- Agro based industries viz. rice bran oil industries, fruit processing, coconut based industries such as descicated coconut powder, oil refineries, confectionaries, coir mat industry etc.may developed
- Technology transfer through training and mass media contact etc.

7. Future thrust

1. Introduction of horticultual crop in the Cauvery new delta region
2. Developing suitable and remunerative inter crop in coconut garden
3. Development of Agrobased industries
4. Concentration on pulse production and its management techniques
5. Production and distribution of quality seeds, saplings to the farmers
6. Development of post harvest technology and value added products

JOINT DIRECTOR OFAGRICULTURE – CUDDALORE

Geographical distribution of area of each division of the zone-

Particulars	Chidambaram (ha)	Kattumannar Koil (ha)
Total geographical area	64882	48223
Uncultivable waste	1278	2203
Area used for other purposes	10690	7855
Cultivable waste	753	403
Current fallow	3270	1851
Land under trees not included under area sown	6543	3545
Other fallow lands	2394	2136
Forests	70	-
Permanent pasture and other grazing lands	10	177
Cropping intensity	159%	162%

Rainfall data for 10 years from each division

Taluk	Mean annual rainfall	South west monsoon		North east monsoon		Winter		Summer	
		mm	%	mm	%	mm	%	mm	%
Chidambaram	1475	228	15	1181	80	24	1.0	73	4
Kattumannar koil	1591	313	19	1147	72	26	1.0	87	6

Soil series in Chidambaram taluk

Name of the series	Symbol	Area	Percentage
Kondal	Knd	34984.96	63.62
Valuthalakudi	Vld	11312.64	20.57
Adanur	And	4026.88	7.33
Padugai	Pdg	3563.52	6.48
Thiruvengadu	Tvg	936.96	1.70
Valuthalakudi & Thiruvengadu	Vld + Tvg	166.40	0.30

Kattumannar Koil Taluk

Name of the series	Symbol	Area	Percentage
Kondal	Knd	20633.60	51.71
Madukkur	Mdk	11276.80	28.26
Pattukkottai	Pkt	4025.60	12.08
Vallam	Vlm	1367.04	3.43
Padugai	Pdg	378.88	0.95
Pattukkottai and Madukkur	Pkt + Mdk	1423.36	3.57
		39905.28	100.00

JOINT DIRECTOR OF AGRICULTURE, NAGAPATTINAM

Different soil types in the region

Series	Area (in ha)
Adanur	43550
Kalathur	35226
Nedumbalam	28404
Kevalur	21002
Kondal	13877
Sigar	8126
Padugai	22250
Kallivayal	13109
Kogur	6038
Thiruvenkadu	5846
Aalathur	554
Melkadu	27091
Valuthalakkudi	24062
Sethi	6143
Nagapattinam	4053

Crops cultivated in the region

S.No.	Name of crop	Area (Ha)	Popular varieties	Yield kg/ha
1.	Paddy	1,84,003	ADT 36, ADT 43, ADT 38, CR 1009	5302
2.	Blackgram	56,578	ADT 3	280
3.	Greengram	20,821	ADT 3	200
4.	Cotton	1,283	MCU 7	2350 kg (kapas)
5.	Groundnut	3,327	JL 24, VRI 2	1200
6.	Gingelly	1,030	TMV 3	425
7.	Soybean	129	Co 1	1000
8.	Coconut	3,116	ECT, Hybrid	20,000 Nuts/yr
9.	Oilpalm	15	Hybrid	-
10.	Sugarcane	3639	CoC 8201 CoC 777 CoC 778	125 tons
11.	Other crops	10	Casurina	-

Rainfall

Taluk	Mean Annual rainfall	South west monsoon		North East monsoon		Winter		Summer	
		mm	%	mm	%	mm	%	mm	%
Sirkali	1277	204	16	997	78	38	3	38	3
Mayiladuthurai	1210	218	18	920	76	48	4	24	2
Tharangampadi	1155	196	17	878	76	46	4	35	3
Veddaranyam	1250	175	14	1013	81	25	2	38	3
Nagapattinam	1280	205	16	986	77	51	4	38	3
Thirukovali	1310	197	15	1022	78	52	4	38	3

Constraints and problems

Nagapattinam district agriculture is mainly oriented with different irrigation system viz., cauvery and vennar whereas cauvery is substituted by filter points and advanced cultivation in all aspects whereas Vennar and Vettar system only with Mettur water and some times inundation by flood and excess water as well as water scarcity also. Soil is also facing problems like saline and alkaline. Paddy in all respect of pulses to some extent (60,000 ha) and cotton about 1,500 ha are the crops cultivated. Cauvery water availability not at correct time due to location of district at the tail end region of cauvery

1. **Future thrust**

Introducing mechanisation like power thrasher, combined harvester by more demonstration

2. **Prospects of agrobased industries**

No specific agrobased industries except one sugar factory in Mayiladuthurai, Thalainayar and very few coir industries

3. **Suggestion to alleviate the problem**

1) Soil reclamation to problem locations by using appropriate ameleorants can be programme as 5 year plan
2) Horticultural crops got scope in sandy loam of Vedaranyam – Velanganni belt whereas mango's are extensively cultivated
3) Dry and waste land available in condusive to cultivate cashew crop in a special DPAP programme can be launched

Geographical distribution of each division of the zone (in ha)

S.No	Particulars	Sirkali	Mayiladu thurai	Tharan gampadi	Vedara nyam	Nagapa ttinam	Thiru kuvali	Keva lur
1.	Total geographical area	46587	43128	27673	74805	40857	21581	2745 8
2.	Uncultivable waste	202	-	580	29152	87	3580	-
3.	Area used for other purpose	8958	10602	3853	7626	7049	3909	5184
4.	Cultivable waste	397	56	294	1275	821	165	2003
5.	Current fallow	1715	1757	704	116	730	68	535
6.	Land under trees not included under area sown	2193	726	534	4983	327	790	875
7.	Other fallow	5120	3037	4520	270	408	108	911
8.	Grass	146	180	154	281	304	54	85
9.	Forest	1102	-	-	3531	-	-	-
10.	Net area sown	26754	26770	17034	27571	31131	12907	1786 5

JOINT DIRECTOR OF AGRICULTURE, TIRUVARUR

Particulars of rice area (in hac)

1) Total area under rice cultivation : 1,73,600
2) Irrigated area : 1,73,600
3) Area planted upto 28th November, 2000 : 1,72,798

Rice varieties under cultivation

S.No.	Name of the variety	% of coverage to total area			
		Kuruvai	Samba	Thaladi	Total
1.	TKM 9	6%	-	-	6
2.	IR 50	1%	-	-	1
3.	ADT 36	4%	1.5	0.5	6
4.	Co 47	1%	-	0.5	1.5
5.	ADT 43	4%	-	-	4
6.	ADT 42	1%	0.5	3	4.5
7.	ASD 18	2%	-	-	2
8.	ASD 16	0.5%	-	-	0.5
9.	Savithiri	-	28	2	30
10.	ADT 38	-	13	6	19
11.	ADT 39	-	7	3	10
12.	ASD 19	-	4	2	6
13.	White Ponni	-	2	0.5	2.5
14.	Trichy 1	-	2	0.5	2.5
15.	ADT 44	-	1	-	1
16.	Co 43	-	3	0.5	3.5

4. Seed source : For 17% area certified seed is distributed through department of Agriculture

5. General constraints : Enclosed

6. No. of pesticide dealers in the district : 323

7. Farmers requirement : Enclosed

8. Availability of P.P. equipment : Adequate

9. Rainfall during the year : Normal

10. General climatic conditions :

Kuruvai : Bright sunshine during the whole kuruvai season gave all time record yield in the district viz., 6241 kgs/hac

Samba : Widespread rain during north-east monsoon with adequate interval helps samba, thaladi crops, except some low-lying pockets

Pest and disease incidence is low in kuruvai, samba and thaladi seasons

Land use (See status report – stations table)

Land use pattern – Tiruvarur District (Block wise)

S. No	Particulars	Tiru varur	T.T. Poondi	M.Pet	M. Gudi	Kottur	Needa	V.Man	K. Vasal	K. Chery	Nanni lam	Total
1.	Forest	-	-	2452	-	-	-	-	-	-	-	2452
2.	Barren and uncultivatable	-	-	113	-	-	-	-	-	-	-	113
3.	Used for non agri purpose	3207	2670	2476	5919	4332	5738	2206	2927	3202	3511	36688
4.	Cultivable waste	735	272	48	531	272	338	244	122	127	159	3048
5.	Permanent pasture	27	80	138	36	141	142	16	-	-	86	766
6.	Area under trees	51	46	105	607	242	308	216	275	182	74	2106
7.	Current fallows	372	163	12	614	219	1343	1922	793	557	136	6131
8.	Other fallows	542	96	20	775	281	281	298	87	120	754	3454
9.	Net area cultivated	9843	5802	15271	18280	20362	16562	15422	14569	13859	15415	155385
	Total	14777	19129	20635	26862	26749	24712	20324	18773	18047	20135	210143

Rainfall pattern in Tiruvarur District

S.No	Month	Normal rainfall (mm)	Yearwise rainfall (mm)							
			1994	1995	1996	1997	1998	1999	2000	2000 (cumu lative)
1.	January	48.26	12.00	46.86	18.09	20.40	21.86	8.90	193.00	-
2.	February	42.66	97.20	2.03	-	-	22.86	70.00	89.00	282.00
3.	March	16.05	0.50	14.98	-	2.60	-	6.30	33.00	315.00
4.	April	12.76	6.90	6.30	52.28	41.90	-	44.35	44.60	359.00
5.	May	35.35	17.40	110.70	13.50	60.20	98.08	41.87	34.30	393.90
6.	June	26.31	0.88	31.90	105.20	35.00	8.00	32.00 31.00	5.20	399.10
7.	July	72.74	22.70	49.71	11.10	148.00	60.00	127.50	20.10	419.20
8.	August	93.12	17.30	26.19	157.52	27.40	230.21	72.10	49.20	468.40
9.	September	151.48	14.52	75.38	143.69	85.42	70.10	325.01	141.27	609.67
10.	October	205.65	121.27	206.72	109.00	176.32	71.77	337.43	111.8	721.6
11.	November	350.54	457.79	283.75	424.00	605.66	331.28	101.00	344.0	1065.55
12.	December	175.28	106.89	40.36	668.59	366.84	386.00	1197.46	196.20	1092.28
	Total	1230.20	874.45	866.88	1702.97	1509.14	1280.16		1262.0	1262.0

Crops cultivated in the region (Hectare)

Crop	Tiruvarur	Nannilam	Kudavasal	Valankaiman	Mannargudi	Needamangalam	T.T.Poondi	Total	Remarks
Blackgram	1475	4045	560	3410	15890	2995	4592	32967	Upto December Normal area 70000 ha
Greengram	2360	2563	349	2123	4740	225	674	13034	
Groundnut	-	-	-	-	550	24	-	574	
Gingelly	-	-	27	-	315	-	-	342	
Banana	15	45	128	108	-	23	21	340	
Tapioca	-	-	-	-	45	2	-	47	
Paddy-kuruvai	818	3048	4536	4128	9778	6118	6212	34638	
Samba	8452	11260	18756	9523	30655	9677	20950	109273	
Thaladi	790	3048	4486	3846	7800	5962	6066	31998	
S.cane planted	17	439	210	423	124	124	-	1387	
Ratoon	45	210	410	44	96	96	25	916	
Oilpalm	-	-	27	14	15	14	-	72	
Coconut	210	1150	1090	710	406	830	230	4626	

10 years average rainfall (mm)
Talukwise

Tiruvarur	**Nannilam**	**Kudavasal**	**Valankaiman**	**Mannargudi**	**Needamangalam**	**T.T.Poondi**
1197	1110	1022	1105	1298	936	1190

FUTURE TRUST

- Installation of food processing industry
- Increasing the production of fine grian rice in this district
- Small scale industry to supply rice products like flour in packets
- Green algae blocking the irrigation channel should be removed without using chemicals and without contaminating the ecosystem

Normal area (unit Hac)

S.No.	Block	Kuruvai	Samba	Thaladi	Total
1)	Thiruvarur	1560	8096	904	10560
2)	Nannilam	3200	11920	2190	17310
3)	Kodavasal	2116	8580	2116	12812
4)	Koradacheri	1951	9670	1951	13572
5)	Mannargudi	4204	12619	3415	20238
6)	Kottur	6215	18035	3800	28050
7)	Needamangalam	6200	9563	5643	21406
8)	Thiruthuraipoondi	3225	9984	2920	16129
9)	Methupet	3148	10830	2556	16534
10)	Valangaiman	4040	9520	3429	16989
	Total	35859	108817	28924	173600

ARANTHANGI - (Particulars From NPRC- Vamban)

1. Geographical distribution:

Land use pattern (ha)

-	Forests	473
-	Uncultivable waste land	-
-	Landput to non Agrl. use	14736
-	Cultivable waste	725
-	Permanent pastures or other grazing lands	166
-	Trees and grooves	1729
-	Current fallows	133
-	Other fallows	5732
-	Net area sown	24782
-	Total	48476

Forests Resources – Aranthangi

Reserve forest (ha)	473
Area under Agroforestry (ha)	437
Area under Social forestry	237

Wetland (Panchayat – Govt. Land) – Aranthangi

Salty land	0.59
Shifting cultivable land	52.89
Degraded forest	263.44
Total Extend	216.92

2. Rainfall pattern (in mm)

Southern West Monsoon	
June	76.3
July	86.83
August	98.76
September	116.53
Total	**378.42**
North East Monsoon	
October	284.69
November	206.39
December	101.68
Total	**492.76**

Winter		
January		31.89
February		6.56
	Total	**38.45**
Summer		
March		7.2
April		20.8
May		37.47
	Total	**65.47**

3. Soil type

i) Soil type : Red loam
Black clay

ii) Soil series : Pattukkottai, Madukkur

iii) Soil characteristics : Acidic to Neutral
Slightly alkaline
EC – Normal

4. Crops cultivated

Crop	**Area (ha)**	**Production (MT)**
Paddy (Irrigation)	13000	39026
Millets Irrigation	50	500
dry	105	
Pulses Irrigation	110	90
dry	350	
Groundnut Irrigation	1000	11622
dry	4265	
Gingelly Irrigation	100	281
dry	990	
Sugarcane Irrigation	20	2600
dry	-	
Coconut	695	NR
Vegetables	103	NR
Fruit crops	4260	NR
Trees	437	NR

5. Constrains and problems

Since majority of the paddy growing area in this division lies both in river bed as well as rainfed areas. In river bed the main problems encountered is non receipt of water in time due to the tail end region of the cauvery delta. While in rainfed areas the system of cultivation is both in semi dry and dry conditions even though very good rainfall is received, the water in storage tanks are insufficient due to poor storage, coupled with inadequate feeding channels. Further the soils are saline and alkaline in nature, the crops selected should be tolerant to saline and alkaline conditions.

6. Technologies Developed

Improved varieties like ADT 38, ADT 39, ADT 43, rice were adopted to these area. Improved management practices like summer ploughing, moisture conservation practices, application of herbicides and latest plant protection measures are being adopted by farmers.

7. Prospects of Agro based Industries

Wide scope for establishment of agro based industries like fruit proceesing units, cold storage, fish processing will be promising.

8. Suggestions to alluviate the problems and constraints and improvement of Agricultural productivity and production

Varieties with high yield potential under saline and alkaline soil conditions are to be evolved. Mechanization is another promising area. Organic manuring to alluviate the soil crusting, alkaline problems is essential. Improving the storage capacity of the irrigation tanks by desilting and maintaining the feeding channels.

9. Future thrust

- Development of new varieties
- Technologies to supress the saline alkaline problems
- Introduction of integrated farming system
- Fish cultivation
- Adoption of alternate cropping system

TIRUCHIRAPALLI DISTRICT- AREAS

Particulars	Trichy	Musiri	Thuraiur	Lalgudi	Total Districts
Forest	180	1737	28837	2609	41675
	(0.27)	(1.39)	(35.67)	(3.48)	(9.46)
Uncultivable	1387	2812	10718	2358	18702
waste	(1.99)	(2.32)	(13.26)	(2.39)	(4.25)
Land put to run	14332	16294	8288	16442	71511
agrluse	(20.45)	(19.22)	(10.25)	(16.62)	(16.23)
Cultivable	4432	3337	3036	2842	28340
wastes	(6.38)	(2.83)	(3.75)	(3.08)	(16.23)
Permanent	105	227	3492	2345	6357
posture	(0.16)	(0.25)	(4.32)	(2.65)	(6.44)
Land under trees	569	287	4355	650	5983
	(0.82)	(0.32)	(5.39)	(0.52)	(1.45)
Cusient fallows	7962	14617	8055	9569	58331
	(11.26)	(16.11)	(9.16)	(10.38)	(1.36)
Other fallows	7561	4089	1961	4432	20372
	(10.9)	(4.10)	(2.43)	(4.25)	(13.24)
Net area sown	33245	50688	12100	55400	189141
	(47.82)	(53.46)	(14.91)	(56.63)	(4.63)
Total geographi-	37803	80869	80842	97647	440412
culorer	(100)	(100)	(100)	(100)	(100)

KULITHALAI TALUK

Particulars	**Area in ha**
1Total geographical area	129447.93
2 Uncultivable waste	1446.60
3Area used for purpose	16727.40
4Cultivable waste	14055.20
5 Current fallow	7402.00
6 Land under trees	1052.00
7 Area under fallow	1253.68
8 Forest area	5802.75
9 Net area zone	63948.90

The figures in parenthesis sofer to the percentage of land uses to the geographicAl extent of a particular taluk.

Average rainfall (mm) for 50 years of taluks of Trichy Disticts.

Taluks of Trichy Dt.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec.	Total
Trichy	14.4	7.8	7.8	32.9	50.5	18.6	53.5	78.5	175.8	167.2	105.3	77.7	742.0
Manaparai	15.8	19.7	19.1	44.3	67.7	37.1	63.3	109.4	131.4	205.8	113.3	80.3	907.2
Musiri	12.3	5.1	9.4	31.6	36.7	18.2	58.6	65.4	106.1	201.4	104.2	47.6	716.6
Turaiyur	7.2	6.8	20.4	40.0	72.3	19.3	42.8	79.6	129.0	228.9	100.2	49.4	790.9
Lalgudi	17.7	11.8	10.1	30.5	61.9	18.4	52.7	83.3	128.1	136.4	110.0	71.1	792.0
Kulithalai	8.98	6.02	6.41	24.08	52.55	35.9	35.38	51.0	115.33	171.09	138.55	59.22	704.41

Different soil types in different taluks Trichy Districts

Trichy	Black, ver deep Fine (soils with high clay content)
Manapparai	Miscellaneous land type
Musiri	Coarse loamy Red soil Moderately deep
Thuraiyur	Fine (soils with high clay content) Black soil, Moderately deep.
Lalgudi	Fine loamy mixed allurium Black soil very deep.
Kulithalai	Clay loam, sandy loam and red soil

Different crops cultivated in different Taluks of Trichy Districts

Crops	Trichy	Musiri	Thuraiyur	Lalgudi	Total (District)
Rice	20780	10410	11540	23890	73090
Pulses	5770	11770	1680	8250	33090
Oilseeds	680	9600	1270	7400	30350
Millets	450	22750	7240	22420	65000
Sugarcane	511	1010	140	5440	7490
Others	3690	9340	95	7450	34250
Total	31880	64880	31410	74850	243270

Animal Population in Numbers.

Cattle	17599	108388	70774	43623	68604
Sheep	10835	61381	44062	27758	42072
Goat	12865	49362	67193	25808	63034
Poultry	248420	141526	177450	52777	123425
Duck	1370		-	-	-
Others	2132	-	7274	-	1431

Talukwise Crops grown (Area in ha)

Crop/Season	Trichy	Musiri	Thuraiyur	Lalgudi	Total
Rice	900	350	1000	6100	7000
Kuruvai					
Samba	17500	6250	8350	12750	50350
Thaladi	900	-	1000	6100	2150
Navarai	1200	650	900	50	3000
Total	20500	7250	11250	25000	70000
Millets					
Cholam I	50	785	275	20	1930
RF	200	20515	6655	13620	53650
Cumbu					
I	5	760	240	120	1925
RF	35	2775	1060	3665	8265
Rog I	-	-	10	10	85

RF	20	-	30	20	170
Others RF	20	10	1205	2150	4105
Total area in millets I	55	1545	525	150	3940
RF	275	23300	8950	19435	64260
Total	330	24845	9475	19585	68200
Pulses Red gram I	0	55	10	0	65
RF	40	1005	500	1605	3360
Total	40	1060	510	1605	3425
Black gram I	0	870	830	1065	3295
RF	6500	600	220	5755	13925
Total	6500	1470	1050	6820	17220
Green gram I	15	90	10	0	260
RF	780	520	225	1080	2900
Total	795	610	235	1080	3160
Hooses grain RF	60	170	235	305	2155
Bengal grain RF	0	20	75	0	95
Other RF	0	1530	800	905	3145
Total	15	1015	850	1065	3620
RF	7380	3845	2055	9650	26380
Total	7395	4860	2905	10715	30000
Pulses					
Sugarcane	390	225	330	1770	2885
Ratoon	90	300	190	1730	2415
Total	480	525	520	3500	5300
Cotton Ir	0	50	50	0	830
RF	515	250	550	4580	7385
Total	575	300	600	4580	8215
Banana	3800	2715	400	4135	11060
Oilseeds	125	2480	2050	710	7795
G.Nut I					
RF	185	6890	2940	2120	18215
Total	310	9370	2990	2830	26060
Gingelly I	360	550	800	0	2115
RF	175	0	35	3260	4420
Total	535	550	835	3860	6535
Castor I	0	0	0	0	20
RF	0	500	200	475	1235
Total		500	200	475	1255
Sunflower I	10	390	1300	30	1785
RF	10	840	455	480	1855
Total	20	1230	1755	570	3640
Total Oilawws	495	3420	4150	740	11715

I					
RF	370	8230	1630	6935	25775
Total	865	11650	5780	7675	37490

KULITHALAI TALUK cropwise area and yield

Crop\variety		Area in ha	Yield in kg
1Paddy	co43,ADT39,IR20,white ponni	8915	7640
2 Sorghum	K3	6091	576
3 Cumbu	WCC75	2855	260
4 Red gram	SA1	2466	450
5 Black gram	T9	171	320
6 Green gram	KM2	19	375
7 Sugarcane	COC 85061,COC 671,COSI 95071	2279	110000
8 Banana	Rasthali,Nendran,Poovan	4034	
9 Ground nut	TMV7	2580	2800
10 Sunflower	KBSH1	188	2240
11 Gingelly	TMV3	2276	248
12 Oil palm	Tenera	12	16000
13 Cotton	LRA5166	236	1750

Varieties and their productivity in the District.

Crop/Varieties	Area in %	Productivity t/ha
Rice White ponni	55%	5.25
ASD 19	20%	6.00
ADT 39	20%	6.25
Others	5%	5.50
Kuruvai ADT 36	45%	6.40
ADT 43	40%	6.90
ASD 18	10%	6.50
Others	5%	5.80
Millets Cholam local I	10%	3.000
RF	90%	1.000
Cumbu ICMV 221-I	70%	2.5
RF	60%	1.2
X7 I	30%	3.0
RF	40%	1.5
Ragi Trichy-1	70%	3.5
Co.13	30%	2.8
Cotton LRA 5166	40%	6.9
Anjali	20%	7.2
RCH	30%	6.9

Others	10%	5.0
Redgram SA1	90%	656kg
Others	10%	500kg
Blackgram ADT 3	90%	700kg
T-9	10%	600kg
Greem gram KM 2	90%	900kg
Others	10%	700kg
Oilseeds		
Sunflower Mixkola	80%	2.0 t/ha
Hybrid	20%	3.0 t/ha
Ground nut TMV 7	80%	3.0 t
VRI 2	20%	3.0 t
RF		1.2 t/ha
Gingelly TMV 3	70%	700 kg/ha
TMV 4	20%	750 kg/ha
TMV 6	10%	650 kg/ha
Banana		
Poovan	30%	20kg/bunch
Rasthali	30%	15kg/bunch
Nendran	20%	14kg/bunch
Others	10%	

Channalwise irrigated Ayacut area in Trichy District.

Name of the Channels	Ayacut ha	Dishcharge cusec
1. Uyyakondon	12108	710
2. NKHLC	6102	400
3. KHLC	2517	410
4. Ramavatholai	612	79
5. Puthu vatholai	1250	80
6. Srirangam Nattu vaikkol	1348	170
7. Peruvalai	7800	500
8. Main Ayyanvaikol	7207	450
9. New Ayyanvaikol	716	39
10. Pullambodi	2542	500
11. Kottuputhur	1760	150
12. North Bank	4160	260

Total area irrigated through these canels 53,000 ha

Agro industries in Trichy District.

Coir and Coir product industries	4
Straw boand industries	1
Chewing tobacco industries	1
Cotton ginning industries	4

Modern rice mills	60
Sugar factory	1
Oil centes	58
Sogo industries	2
Mat industries	60
Puff mills	17

CONSTRAINTS

1. Major disease out break in Rice and banana ie., blast in white ponni
   Panama wilt in Banana
2. Labour problem
3. Low price for the produces.
4.Mechanised harvest for paddy and mat korai

SUGARCANE RESEARCH STATION, SIRUGAMANI

1. GEOGRAPHICAL DISTRIBUTION

Extent	: 24.93 ha
Location	: Trichy-Karur main Road (21 km from Trichy)
Latitude	: 10’56’N
Longitude	: 78’26’E
Altitude	: 78-18m MSL
Average Rainfall	: 600.3mm
Soil	: Sandy loam to Clayey loam

Objectives:

Sugarcane:

- To tackle the problems in sugarcane cultivation in wetland under flow irrigation.
- To evolve high yielding, good quality sugarcane varieties which are resistant to early drought and late water logging, saline and alkaline conditions, red rot, smut and internode borer.
- To develop an integrated nutrient management practices with special emphasis on soil-plant-health care.

Banana:

- To standardise the agro techniques for wetland banana cultivation in cauvery delta zone.
- Crop improvement programmes to evolve cultivars for dwarfism, resistance to pest and diseases.
- Post shoot application of plant growth regulators and micronutrients.
- Development of integrated control measures for the insect pest, nematodes and diseases of banana.

Betelvine:

- Germplasm collection, maintenance, evaluation, cataloging and hybridisation.
- To evolve suitable crop management practices to improve yield and quality.
- To develop integrated management strategies for pest and diseases.

Oilpalm:

- Evaluation of high yielding hybrid combinations and development of suitable agro techniques for high yield.

2.DIFFERENT SOIL TYPES AVAILABLE IN THE REGION

1.Clay loam
2. Red soil
3.Loamy soils
4. Gravels
5.Heavy clay

3. DIFFERENT CROPS CULTIVATED

1. Paddy
2.banana
3.Sugarcane
4. Betelvine
5.Oil palm
6.Vegetables
7.Flower crops
8.Coconut
9. Pulses
10.Korai
11.Groundnut
12.Gingelly
13.Sunflower

Paddy	11,450
Kuruvai	200
Samba	10,500
Thalady	350
Navarai	400
Cholam (I)	1300
Cholam(R)	18400
Cumbu (I)	1800
Cumbu ®	5750
Maize	
Samai	2000
Thinai	400

Total	27150

Redgram	5000
Blackgram	350
Greengram	150
Horsegram	2000

Sugarcane	2450
Ratoon	1400
Groundnut	1500
Gingelly	1500

Castor

Oilseeds	3100 (I)
	6980 ®

Total	10080

Banana	4000
Chillies	900
Korai	

4. CONSRAINTS AND PROBLEMS

The post harvest technology for preserving the flower and fruit produces for storage and long distance transport is the need of the hour.

5. TECHNOLOGIES SO FAR DEVELOPED

A. CROP IMPROVEMENT

High yielding varieties play a major role in increasing the production of cane per unit area. Hence increasing and stabilising the yield and quality level of sugarcane continues to be the major objective of sugarcane breeders to satisfy internal and external market.

The breeding division of this station was entrusted with the work of evolving high yielding and high quality sugarcane varieties for Cauvery Delta Zone where an unique situation of early drought and late water logging prevails. This objective was fulfilled with the release of five varieties. These varieties are able to suit stress conditions besides catering to the needs of the growers and sugar industries.

Varietal improvement.

The basic method of breeding was interspecific hybridisation to produce high yielding and high quality varieties with desirable agronomic traits coupled with resistance to major pests and diseases. A crossing procedure known as “Nobilisation” is generally followed to improve the yield and quality.

Varieties released from Sugarcane Research Station, Sirugamani.

CoSi.776

This variety was released during 1977. This is a cross progeny of Co.419 and Co.775. It is a thick, purplish green cane with profuse spines on the sheath. It is a mid late maturing type with good yield of 120 t/ha and 11 per cent of sucrose. It is an erect and vigorous growing cane which can perform well even under saline-alkaline soils. It is moderately resistant to top borer and can do fairly well under drought conditions.

CoSi.86071

It was released during 1986. This is a hybrid obtained by crossing Co.775 and Co.842. It is a quick growing erect variety and belonging to mid late maturity group. It can tolerate early drought and late water logging It is a medium thick yellowish purplish cane. The yield potential of this variety is 132 t/ha in plant crop and 120 t/ha in ratoon crop. It contains 12 per cent of sucrose. This variety does well even under saline patches. It is moderately resistant to red rot, smut and top borer.

CoSi.95071

This was released during 1995. The parents of this variety are CoC.671 and MS 6847. It is a tall growing greenish cane with non lodging and non flowering characters. This high yielding clone is suited to areas where early drought and late water logging exists. On an average, it produces 142 t of cane per hectare with 12.2 per cent of commercial cane sugar. It is a good ratooner. Besides high yielding, it is moderately resistant to red rot.

CoSi.96071

It is a general cross derivative of Co.82061. It is suitable for early season plantings of entire Tamil Nadu. This variety produces an average cane yield of 147 t/ha with 11.9 per cent of sucrose. The per cent increase over CoC.671 and CoC.92061 in case of cane yield was 22.2 and 11 per cent respectively and it was 17.7 and 8.1 per cent in the case of sugar yield. Moderate resistance for alkalinity is an advantageous feature of this variety.

CoSi.98071

It is a cross derivative of BO91 and Co.67198. This variety is recommended for mid/late seasons of deltoic regions of Tamil Nadu. It produces an average cane yield of 144.7 t/ha per hectare which is 15.4, 13.0 and 9.0 per cent higher than that of popular check varieties viz., Co.6304, CoC.93076 and CoSi.86071 respectively. The sugar yield of CoSi.98071 is 25.5, 20.4 and 12.7 per cent increase over the standard varieties Co.6304, CoG.93076 and CoSi.86071 respectively.

Besides high yielding, this variety is moderately resistant to red rot, smut and scale insects whereas the check, varieties Co.6304 and CoG.93076 are susceptible. This variety can be grown under high pH conditions also.

Sugarcane:

1) Five varieties were released, three for early (Cosi.86071, Cosi.95071 and Cosi.96071) and two for mid/late seasons (CoSi.776 & CoSi.98071).
2) The cropping sequence of sugarcane - sugarcane ratoon - blackgram - paddy was more beneficial.
3) .Modified system of planting soybean as intercrop on the sides of the ridges was found to be beneficial as it has not reduced the cane yield.
4) Intercropping daincha on one side of the ridge and incorporation on 60th day of cane planting increased the cane yield by 12.15 t/ha.
5) Forming deep ridges and furrows, pre-emergence application of 2.5 kg/ha atrazine and one hand weeding are effective in weed management.
6) A 45cm deep trench at every 2m interval is the best under water logged conditons.
7) Integration of 210kg N as neem coated urea + 25t pressmud + 10kg each of Azospirillum and Phosphobacteria/ha recorded higher yields.
8) To combat drought, trash mulching combined with 12.5 kg Kaoline spray/ha or deep trenching with Urea + Potash spray at 2.5% can be practiced.
9) 25% additional N for ratoon, 5-10 days after stubble shaving increased cane and sugar yield.
10) Trash mulching, frequent irrigation, daincha intercropping, release of egg parasitoid *Trichogramma chilonis* and application of NSKE 5% effectively reduced the internode borer incidence.
11) Cane planted during February and September was succptible to smut and Co.449, CoC.771 and Co.6304 are resistant. Aerated Steam treatment of setts at 54'C for 6 hours followed by treatment with 0.1% Carbendazim reduce the incidence.
11) The nematodes can be controlled by either marigold or daincha incorporation in combination with pressmud (25 t/ha or Neemcake (2 t/ha).
12) Application of Borax @ 62.5 kg/ha 100 days after planting can reduce the loss in CCS from 2.95% to 0.89% when harvest is delayed by 3 months.
13) Addition of 1:40 dilution of distillery effluent increased cane and sugar yield and improved the soil organic matter.

ii) BANANA

1) Germplasm garden with 116 types are maintained.
2) Application of Borax @ 50g/plant during 3rd month and spraying of 0.5% Boric acid during 4th and 6th month reduced lumpiness in Rasthali.
3) Application of 200g gypsum at 2nd month after planting at 20 days interval five times followed by copious irrigation will alleviate the salt stress.
4) Karpooravalli is relatively tolerant to flooding injury. Foliar spray of urea 1% with 2% Potash is advocated to combat flooding injury.
5) Application of pressmud @ 15 t/ha or neem cake @ 1.5 t/ha was found to reduce the root-knot and spiral nematode infestation and increased yield.
1) Fusarium wilt can be controlled by application of 60mg capsules of *Pseudomonas* during 2,4 and 6th month after planting by placing it in the corm at 45° angle.

Betelvine:

1) Germplasm collection of 44 clones is maintained and SGM1 is the variety released during 1994.
2) Basal application of 100 kg P_2O_5/ha and 50kg K_2O/ha every year and 100 kg N/ha in the form of Neem coated urea or 150 kg N/ha as FYM + Urea in 4 splits combined with 2kg Azospirillum + three rounds of triacontanol 500 ppm at 30 days interval from fifth month registered higher productivity.
3) Bamboo basket lined with fresh plantain leaves under hollow packing recorded lowest spoilage.
4) Application of Bordeaux mixture (0.25%) as pre-monsoon drenching once followed by application of *Trichoderma* at monthly interval + field sanitation were effective against all diseases.
5) Wettable sulphur 0.50% or dicofol 0.05% or Ethion 0.05 % against mite and chlor phyriphos 0.05% or neem oil 2% or endosulfan 0.04% against scale insects are effective.
6) Drenching with dichlorvos 0.05 % (once in 30 days) or NSKE 5% or neem oil 2% at biweekly interval effectively checked the stem borer and weevil in Agathi.
7) Quarterly application of *Paecilomyces lilacinus* inoculated neem cake @ 500 kg/ha for each application controlled the nematodes effectively

Oilpalm:

1) Intercropping oilpalm with Rasthali banana followed by its ratoon was found to be profitable.
2) Application of NPK at 1200:600:1200 g/palm upto four years was found to give good yield.

6.PROSPECTS OF AGRO BASED INDUSTRIES

The area in and around SRS, Sirugamani is dominated by the polyclonal cultivation of banana and many farmers at present pose problem to market the bunches. The establishment of a mini agro based industries for chips making, banana pulp, powder and banana juice will be useful venture. The prospects for the initiation for such agro industries is very bright.

6. SUGGESTIONS TO ALLEVIATE THE PROBLEMS AND CONSTRAINTS AND IMPROVEMENT OF AGRICULTURAL PRODUCTIVITY

1. The technology development and transfer to marginal and small farmers do not reach at the expected level and even if reaches, the adoption percentage is low due to the constraints of financial implications. hence it is suggested that training on advenced package of practices with the avenues for financial support have to be given in one and the same training programmes.

2. Establishment of cold storage units for minimising the post harvest losses.

3. Establishment of Plant Clinic Centres at each Block level

4. Starting selp help groups

7. FUTURE THRUST

1.Development of high yielding high quality sugarcane varieties with red rot resistance
2.Studies on the micro propagation of promising sugarcane varieties and mass production programmes
3.Development of ecofriendly pest and disease management practices
4.Development of Post- shoot hormone mix for improving bunch grade in banana
5. *In vitro* screening and induction of salt tolerance in banana
6. Develoment of Agrotechniques for irrigated oil palm plantation.
7.Development of integrated disease and pest management strategies for betelvine

ANBILDHARMALINGAM AGRICULTUAL COLLEGE & RESEARCH INSTITUTE – TRICHY

Technologies so far Developed

1. TRY-1 Ragi (suitable for problem soil area)
2. TRY-1 Rice (Medium duration, Rice ; Suitable for Samba in problem soil area)
3. TRY-R-2 (Short Duration Rice ; Suitable for Kuruvai and Navarai in problem soil area)
4. Developed package of practices for problem soil management.

Constraints

1. Blast disease out break in Rice (particularly in white ponni) Wilt disease in Banana
2. Problems on Soil and Water
   a. Sodic soil + Saline water
   b. Sodic soil + Normal water
   c. Normal soil + Saline water
   d. Sodic soil + Sodic water

3. Labour problem (especially during transplanting, weeding and harvesting stages)
4. Low price for the produce

Suggestions to overcome problems

- Popularising direct seedling in Paddy
- Use of Drum Seeder for Direct Seedling
- Popularising IPM in the district
- Exploring the possibilities for starting banana- based industries
- Popularising TRY-1 and TRY-R-2 Rice varieties to increase rice productivity in problem soil area
- Evolving new varieties of major crops viz., paddy, sugarcane, banana, etc., suitable to the district
- Evolving varieties of different crops suitable for alkaline soil

Future Thrust

- Starting Post Gradutate programmes
- Evoving hybrid rice suitable for Trichy district
- Strengthening research on problem soil management