TAMILNADU RICE RESEAERCH INSTITUTE, TNAU, ADUTHURAI

MANDATE

- To meet the research requirements of the region with the help of existing Agricultural Colleges and Research centres

  To perform lead function for rice and rice based cropping systems

- To coordinate the research programme of all the stations of the state on rice and rice based cropping systems

- To serve as testing and verification centre for the technologies developed at other stations and applicable to the region

ON-GOING RESEARCH SCHEMES

I. Plan

01. Scheme for the Production of breeder seed in paddy

02. National Agricultural Research Project at Cauvery Delta Zone, Aduthurai (NARP I)

03. Scheme for upgradation ofTNRRI and reorganisation of the set up of Directorate of Research

04. Scheme for commercial exploitation of heterosis in rice

ll. ICARPARTLY FINANCED

05. AICRIP on rice

06. AICRIP on Palms

07. AICRIP on Jute and Allied fibres

III. ICARFULLY FINANCED

08. Research-cum-Demonstration scheme of oilpalm genotypes under varied environments

IV. GO I SCHEMES

09. NCl\1RWF- Starting of Experimental Agro meteorological Advisory Services

NATP

10. Technologies for skimming and recharging fresh water over saline ground water regions

11. Land use planning for management of agricultural resources under Mission Mode Programme

V. INTERNATIONAL AGENCIES

12. IRRI-MEGA Project: Development of research methods to quantify the relationship between soil quality and productivity - Reversing trends of declining productivity in intensive irrigated rice systems (IRRI)

13. Pilot HAM Radio on reaching farmers with new knowledge and technologies through interactive communication in selected villages of Cauvery Delta Zone

VI. VENTURE CAPITAL SCHEMES

14. Hybrid rice seed production in ADTRH 1 and CORH 2

15. Production of biocontrol agents viz., Pseudomonas, Trichoderma and mass production of

Past Accomplishments of TRRI

Agricultural Botany

Development of high yielding extra early, early, medium and long duration rice and blackgram, greengram, soybean and cotton varieties for rice fallow conditions, heterotic rice breeding, maintenance and utilization of germplasm, evalution of Jute and Mesta, nucleus and breeder seed production were the main function.

A total of 42 rice varieties was released and 14 rice varieties introduced from Tamil Nadu Rice Research Institute, Aduthurai. In earlier years, local varieties were purified and about 22 pureline selections were released. Then about 20 rice varieties were evolved by hybridization and two rices were obtained as spontaneous mutants (ADT 15 and ADT 41).

The release of ADT 27 (NORIN 8/GEB 24) during 1964-65 through Indica and Japonica hybridization programme was the major break through in increasing the rice productivity and paved way towards the green revolution in Tamil Nadu.

Among the rice varieties developed ADT 36, ADT 37 and ADT 42 (short duration), ADT 38 and ADT 39 (medium duration) and introduced rice varieties like IR 50 and IR 64 (short duration), Improved White Ponni (medium duration) CR 1009 (Ponmani) (long duration) are very well accepted by the farmers and still popularly cultivated in a larger area.

Improvement of quality rices of scented and non scented types was also taken up at TRRI, Aduthurai for export purposes and a variety ADT 41 was released next to ADT 32. Subsequently, a promising rice culture AD 93013 (IR 50 x Improved White Ponni) was also released. It is a medium slender non scented quality rice with yielding ability of 5.6 t/ha. In the development of crop varieties .for rice fallow conditions, this Institute has developed 5 blackgram varieties (ADT 1 to ADT 5), 3 greengram varieties (ADT 1 to ADT 3) one soybean variety (ADT 1) and one cotton variety (ADT 1).

BREEDER SEED PRODUCTION

This institute is vested with the responsibility of supplying nucleus and breeder seeds of rice, pulses and cotton released from this institute to the State Seed Farms and needy seed growers. Besides, quality truthful seeds of the aforesaid crops under cultivation are produced and supplied to the farmers.

AGRONOMY

Development of seed treatment techniques, new cultivation practices for direct seeded and transplanted rices, weed and water management, cropping pattern and farming system are the main objectives.

Technologies for seed treatment, seed rate, time of sowing, nursery management, age of seedlings, planting techniques, green manure and fertilizer management were developed. After the introduction of fertilizer responsive varieties research on optimization of fertilizers and their splits for Kuruvai, Thaladi and Samba rices was also started. DAP for nursery, use of optimu, seed rate, age of seedlings and spacings for short, medium and long duration rices and application of herbicides were also studied and the results popularised among the farmers. Techniques for super seedling production (Dapag) and Sathupai nursery were also developed from this station.

Studies on crop management, herbicides for direct seeded and semi dry rice, ways for maximising grain yields, alternate cropping and cropping pattern both in the new delta and old delta, summer ploughing and water management were given importance at later stages and results disseminated.

Eradication of Ipomoea by post emergence spray of 2,4-D sodium salt (0.2%) spray with 1 % urea and 1 ml of soap solution perlitre of water is an outstanding achievement of this institute. The technique was followed in Thanjavur and Nagapattinam districts through a Government scheme at a cost of RS.3.08 crores by the Department of Agriculture and Ipomoed controlled later it was extended to Pudukkottai, Trichy, Karur, Perambalur and Cuddalore districts.

SOIL SCIENCE

Research programmes were intensified from 1962 on use of organic manures, chemical fertilizers and their effect on the soil, laying out permanent manurial experiment to evaluate the effect of organic and inorganics in the soil and crop yield, foliar spraying

of fertilizers and useful results were brought out. Maurial schedules for rice and rice fallow crops were formulated. Soil test crop response studies and micronutrient studies inn rice were also carried out.

Studies were conducted on major soil series of Thanjavur district (Madukkur, Adanur, Paadugal and Silty clay soil (Kullanker area) and fertilizer requirements were also assessed for them individually.

Application of rice husk for ill drained soil, ferrous sulphate for iron defecient soil, application of zinc sulphate enriched coir pith compost or FYM, optimization of NPK for hybrid and rice varieties, and foliar sprayings of NPK were the findings disseminated to the farmers. Application of urea coated with gypsum and neem cake 5:4: 1 ratio, DAP as a P source, use of phospho bacterium for solubilization of soil P,K fertilizer savings through addition of Azolla or coir pith compost, DAP spray for rice fallow pulses, application ofNPK for rice fallow gingelly were the outstanding results of TRRl commonly followed by farmers.

Under IRRI collaborated Mega Project, the significance of measuring soil nutrients supplying capacity on field specific basis has been stressed. Site specific approach in determining optimum fertilizer requiurement and SSNM based recommendation must replace the blanket regional recommendations for sustainable rice productivity in Cauvery Delta Zone.

CROP PHYSIOLOGY

Screening rices for photo and thermo-sensititvity, studies on physiological parameters and manipulation of yields, mitigatory options for Thaladi rice, nutrio physiological aspects of rice, and rice fallow crops were the main objectives.

Spray of methanoll 5%, or 2% root extract of Eichornia and GA increase rice yield, improved photosynthetic capacity and the panicle exsertion and reduced the spiklet sterility in Samba and Thaladi crops. Spray of Kinetin 20ppm at heading stage, 2% tender coconut water or 5% Arappu leaf extract, dipping the seedlings in CuS04 (5%) and 1% CuS04 spray also increased the Thaladi rice yield. Application of 500 kg/ha of river sand or 500 kg/ha of lime hastened the root activity of Thaladi rice and decomposition of Kuruvai stubbles respectively. Foliar spray of muriate potash for inducing drought tolerance, 2% DAP spray to increase the rice fallow crop yields and 1 % muriate potash and 100ppm salicylic acid spray to increase the rice fallow pulses and soybean yield were some useful findings for large scale adoption. Methanal (5%) spray increased rice-fallow cotton yield.

Mitigatory options for high temperature induced future climates were found to be use of temperature tolerant varieties and adjusting the planting dates. Hypothetical plant types were also simulated for suiting the future climate change. Role of soil CO2 for enhancing rice productivity owing to green manuring is elucidated.

The SP AD chlorophyll meter based N application is known to save considerable amount of N fertilizer with increased grain yield in Kuruvai, Samba and Thaladi seasons inrespective of soil series in CDZ. Cultures/varieties with higher NUB were also screened and identified.

SEED TECHNOLOGY

This is a recently started department currently concentrating the research on seed hardening, seed dormancy, seed deterioration and physiological deterioration.

AGRICULTURAL MICROBIOLOGY

This is also a new field of study concentrating on efficient use of bio fertilizers like Azolla, and BGA and their effects on rice yield. It also imparts training on biofertilizer application and production.

AGRICULTURAL ENTOMOLOGY

Screening rice varieties for major pests, epidemiology of insects, evaluation of plant protection on rodents and insects 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. TKM 6 (Yellow stemborer) ADT 36 and (brown plant hopper), IR 50, CR 1009 and improved White Ponni (moderately resistant to GLH) and AB 2057 and 2045 blackgrams (leatborer and pod borer) 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.

The research on Entomology was strengthened in the year 1962. Results generated from the studies on rice pests, their eco system, management of the rodents with zinc phosphide bowtraps, alumimium phosphide, manual killing of rats during summer, specific period of pest occurrence, ecological investigation, integrated pest management, bio control and botanicals in pest manangement and light trap catches were made available for adoption by the farmers.

GLH was identified as the vector to transmit the RTD, Yellow stemborer damage in thaladi rice; white fly damage in cotton, incidences of aphids, jassids, thrips, prodenia, American bollworm in the irrigated cotton; prodenia, leaf beetle, thrips and white flies in pulses, and leaf beetle and leaf miner damages in soybean were also studieid and results disseminated to the farmers. Results on influence of plant density, fertilizers and irrigation levels on the incidence of pests were also transferred to farmers.

BIOCONTROL

Predators like *(Cyrtorhinus lividipennis,* spiders (especially *Pardosa pseudoannulata)* the frog *(Rana tigirina)* and parasitoids *(Platy gaster oryzae, Telenomus* sp. and *Tetrasticus* sp.) were found to playa major role in the management of many rice pests. Spraying biocides like Delfin and Dipel (Bacillus thuringiensis) reduced leaf folder and white backed plant hopper in rice.

Botanicals in Pest Management

Neem seed kernel extract 5% (NSKE) and neem oil 3% spray controlled effectively the BPH and GLH, while NSKE 5% and Palmarosa oil 2% checked leaf folder. NSKE 5% spray had effective control on *Galurucid* beetle in pulses and NSKE 5% and Nochi 5% spray controlled carryover of storage pest S. *cerealella.*

PLANT PATHOLOGY

Evaluation of cultures, varieties and germplasm accessions of rice against major diseases, epidemiological studies, management of major diseases through chemical, botanicals and biocontrol agents and imparting training on oyster mushroom production are the major objectives.

Investigations on pathological aspects started in the year 1962, which mainly concentrated on rice diseases and factors influencing disease onset. Top priority was given for bacterial leaf blight and blast resistant varieties of rice through a scheme "Scheme for the evaluation of blight and blast resistant strains since" 1971.Improved White Ponni, IR 50, IR 54, ADT 36, DV 85, lET 4141 and IR 22 were identified as resistant to these diseases. The study also indicated the various pathotypes existing at different places.DV 85, lET 4141 and BJl were resistant to Indian isolate ofBLB.

Blast can be managed by wet seed treatment with tricyclazole, pyroquilon or carbendazim. Spraying a virulent heat killed cells of Xanthomonas oryzae pv oryza or Streptomycin sulphate + chlorotetracyline + copper oxychloride or nickel nitrate or nickel chloride or water extract of cowdung or neem oil 3% or NSKE 5% helps to manage bacterial leaf blight. Split application of potash is also useful for controlling the disease.

PRODUCTION ORIENTED SURVEY

The scientists of AICRIP conduct Production Oriented Survey every year to record the rice varieties grown, crop management practices, incidence of pests and 'diseases etc. in different rice growing areas of Tamil Nadu.

AGRICULTURAL ENGINEERING

This department was started to develop implements for direct seeded rice, transplanted and harvester for rice. Research is in progress on mechanisation of rice farming.

SOCIAL SCIENCE

a) AGRICULTURAL ECONOMICS

One rupees investment in kuruvai and thaladi seasons resulted a profit of Rs. 0.61 to RS.0.74 respectivley. The yield gap in rice cultivation is 1425 to 1745 kg/ha in kuruvai and 913 to 1701 kg/ha in thaladi season. High yielding rice varieites occupied 99.,7% and 99.1 % in kuruvai and thaladi season respectively.

Poor seed setting and pest infestation are major constraints in soybean.

The wilt disease is the major production constriant in banana (Rasthali) in Cauvery Delta Zone. Wide fluctuation in market price and non-existence of marketing facility are the major constraints in banana marketing.

Pest (caterpillar) and disease (viral) excessive drought during flowering and premature flower and pod shedding are production constriants in rice fallow pulses.

b) EXTENSION ACTIVITIES

Technical informations for cultivation of all crops needed for the month are discussed under' Training and Visit' system programme during the Zonal Meetings for Thanjavur, Nagapattinam and Tiruvarur districts and messages given. Special lectures delivered to the extension staff, farmers on various aspects of crop production in rice and rice based cropping system. Training is imparted to the Agricultural Research Scientists. Rice Scientist Meet and Regional Research Extension Council are being conducted periodically. Crop fields are visited frequently to assess the field damage by biotic and a biotic stresses. Field survey is conducted during the periods of heavy rains and cyclone and suitable remedial measures suggested. Conducting Farmers' Day, Field Day, ortganised skilled demonstrations, participating AIR, TV programme, releasing popular articles both in English and Tamil in Dailies and Periodicals are the regular extension activities of this institute for the benefit of the farming community.

Two villages nearby the institute are selected and adopted for dissemination of technologies under village adoption programme. Farmers' seminars were organised on Rice fallow crops and summer crops package technologies.

Agro-Meteorology

The Tamil Nadu Rice Research Institute, Aduthurai is having an Automatic Weather Station and in collaboration with IMD, Pune, it forecast the climatic changes, rainfall etc. A weather station established long back in this station is fully equiped with all latest and sophisticated meteorological equipments. Based on the meteorological observations recorded, the incidence of pest and disease and other crop management practices are forecast to the farmers.

OILP ALM

To popularise the oilpalm cultivation and to increase the palm oil production in Tamil Nadu, an oilpalm research was also started at the Tamil Nadu Rice Research Institute, Aduthurai during 1989 with the help of AICARP to study the oilpalm adaptability, and to assess the nutrient and irrigation requirement.

The II project viz., GxE interaction studies were initiated with hybrids (Tenera) received from Costa Ricc.a, Palode and Ivory Coast.

The studies so far carriedout indicated that trees which do not receive irrigation, produce more number of male inflorescences to the tune of 50 to 60% which will affect the fruit yield considerably. The water requirement of trees varies based on climatic and soil conditions. I year, II year and III year old trees need 30, 75 and 100 litres/dayl tree. According to the transpiration rate, a tree will require an average of 180 to 200 *litresl* day. Since, the palm tree is a monoecious, it requires pollination from the male inflorescence and it is usually promoted by a weevil called *Elaeidobius kamerunicus* and the yield was increased from 20-56%.

SIMULATION STUDIES

To assess the probable performances of new genotypes in different environments, pre-testing of genotypes to develop a hypothetical plant types, to predict the effective weed and the N fertilizer management, to estimate the changes in the nature and its effect on the potential yield to simulate the effect of CO2 concentration and temperature rise in atmosphere and its relation to rice yield, to characterise different agro-ecological regions of rice growing, to manage the leaf folder, stemborer and BLB disease the simulation studies were taken up at TRRI under the auspices of *IRRI/SARP* programme.

Accomplishments during the last five years

Crop varieties evolved

ADT 43 (IR 50 *I* Improved White Ponni)

It is semidwarf (87 cm) maturing in 110 days. It yielded on an average 5953 kg/ha with 6.0, 6.2 and 6.5% increase over IR 50, ADT 36 and ASD 18 respectively. In addition to the higher productivity and early duration, it possesses hightillering ability,

higher N use efficiency and medium slender white rice, finer than Improved White Ponni. It contains high amylose content (> 25%) with good linear elongation (1. 72 times) and high volume expansion ratio (4.6) after cooking. It is resistant to GLH and field tolerant to SB and GM. It is suitable for growing in the first crop season (Sornavari/Kar/Kuruvai) of Tamil Nadu except Kanyakumari and Tuticorin districts.

ADTRH 1 (IR 58025 A / IR 66 R)

It is a semidwarf (105 cm) hybrid, maturing in 115 days with a duration range of 110 to 123 days. It yielded on an average 6396 kg/ha with 16.8 and 15.2% increase over CORH 1 (MGR) and ASD 18 respectively. In addition to its higher productivity and short duration, it possesses high tillering ability, long panicles with high grain number and long slender white rice with high amylose content (25.2%) and mild aroma on cooking. It is moderately resistant to SB and LF under field condition. It is suitable for growing in the first crop season (Sornavari/Kar/Kuruvai) throughout Tamil Nadu.

ADT 44 - A LONG DURATION RICE SUITABLE FOR SAMBA SEASON

ADT 44 (AD 97178) is a selection from OR 1128-7-Sl (lET 14099-IR 56 / OR 142-99). It is a medium tall (112.7 cm) variety with a maturity duration of 145 - 150 days and average duration of 148 days. At Tamil Nadu Rice Research Institute, Aduthurai during samba season it recorded a mean grain yield of 4873 kg/ha in 147 days with 16.7% increase over CR 1009 (4176 kg/ha). The culture recorded the highest yield of 5975 kg/ha in the manurial trial under 150:60:60 NPK kg/ha which was found to be the optimum dose for samba season.

The biological yield was 14.3 t/ha (6.0 t of grain and 8.3 t of straw) and its potential yield was 15.8 t/ha. Its mean performance in different trials was 6214 kg/ha which was 4.8 and 13.0% higher yield than that of CR 1009 (5929 kg/ha) and ADT 40 (4160 kg/ha) respectively. It is resistant to Green Leaf Hopper and blast, with field resistance to stemborer and brown spot and field tolerance to leaf folder. It is suitable for growing in the samba season (August 15th to September 10th sowing) of Tamil Nadu.

ADT(R) 45

Released in January 2001. ADT (R) 45 is a short duration (105-115 days) rice variety tested as AD 95010 (lET 15924), a hybrid derivative of the cross IR 50/ADT 37. It has recorded the mean grain yield of6137 kg/ha with 13.8, 67.2 and 15.2 per cent yield increase over the check varieties ADT 36 (5391 kg/ha), ADT 43 (5780 kg/ha) and ASD 18 (5325 kg/ha) respectively in the station, Multilocation, ART and Large Scale Demonstration trials conducted from 1994-2000. It has compact dense panicle, more 1000 grain weight (17.5g) and synchronized maturity of tillers than ADT 43. The rice is

white, medium slender with acceptable grain quality. It has head rice recovery of 65.3%, protein, 8.83% and amylose, 23.20%. ADT(R) 45 has resistance to gallmidge(Biotype I) and moderate resistance to stemborer and brown plant hopper. It is suitable for cultivation during Sornavari/karlkuruvai in wet transplanted condition as well as direct seeded condition in the entire state of Tamil Nadu.

ADT(R) 46

The medium duration rice culture AD 94010 (ADT 38 x CO 45) suitable for thaladi and late samba season of Tamil Nadu was released as ADTR 46 by the Honourable Minister for Agriculture, Government of Tamil Nadu during the Farmers Day Celebration at Tamil Nadu Agricultural University Coimbatore from 03.01.2002 07.01.2002. The highlights of the culture are higher productivity (6.2 t/ha), semi dwarf, non lodging habit, long slender white rice with 1000 grain weight of 23.8 g. It contains 9.08% crude protein with 30% amylose. It is resistant to stemborer, and leaf folder under field conditions showing high milling and head rice recovery with acceptable cooking and organoleptic properties (TRRI, Aduthurai)

Technologies developed and included in the Crop Production Guide I passed on to ART 10FT:

CROP IMPROVEMENT

. AD 92215 (BG 380-2 I ADT 38)

It is a medium duration (13 0-13 5 days) culture suitable for cultivation during thaladi season. In the trials conducted at Research stations, it recorded a mean grain yield of 4533 kg/ha. In Adaptive Research Trials conducted during 1998-99, results were received from 47 locations of 11 districts and this culture has recorded a mean grain yield of 5840 kg/ha, the yield increase being 9.1 % over ADT 38. It was tested under ART during 99-2000. It has resistance to stemborer and moderate resistance to leaf folder, brown spot and blast. The rice is medium slender and white in colour.

. AD 94010 (ADT 38 I CO 45)

This culture with a mean grain yield of 5684 kg/ha in 134 days and 18.8% yield increase over ADT 38 was evaluated under ART during 1999-2000. It is resistant to stemborer and moderately resistant to leaf folder and sheath rot. The rice is white and medium slender.

. AD 94016 (CO 45 / ASD 15)

This medium duration culture (130 - 135 days) has recorded an average grain yield of 5.6 t/ha with yield increase of 17.0% over ADT 38. The rice is medium slender, white. This culture is resistant to stemborer, leaf folder and moderately resistant to sheath rot, blast and brown spot. It was evaluated under ART during 1999-2000.

. Two extra early rice cultures *viz.,* AD 95128 (IET 11412/IR 64) and AD 95134 (IET 11413 / IR 64) recorded higher grain yield of 4.6 and 4.4 t/ha in 100 days respectively, the yield increase being 13.0% and 8.0% over the check MDU 5. These two cultures were under evaluation in J\1L T - Extra early and also AICRIP IVT - VE during 1999 - 2000.

. One short duration culture AD 95010 (IR 50 / ADT 37) with a grain yield of 4.6 t/ha and 6.4% and 3.0% yield increase over ASD 20 and ADT 43 respectively was tested in J\1LT I during 1999-2000. It has a duration of III days.

· One culture AD 95106 (IR 50 / Improved White Ponni) of mid early duration (119 days) recorded 4.3 t/ha grain yield which was 10.6% increase over ASD 16. This culture was evaluated in MLT II during 1999-2000.

· Four medium duration cultures with a maturity range of 132-135 days *viz.,* AD 92215, AD 94010, AD 94016 and AD 95319 were evaluated in MLT III during 19992000. Among them, AD 94010 (ADT 38 / CO 45) recorded the highest yield of 5.6 t/ha with 12.5% increased yield over the best check CO 43. The next best entry AD 94016 (CO 45/ ASD 15) registered 5.4 t/ha and 7.3% yield increase over CO 43. The other two entries *viz.,* AD 95319 and AD 92215 (BG 380-2 / ADT 38) recorded 5.2 and 5.1 t/ha with yield increase of 4.5 % and 2.2% respectively over CO 43.

. In the long duration group, three cultures *viz.,* AD 97178, AD 97191 and AD 98306 were evaluated during 1999-2000 in J\1LT IV. Of these, AD 97191 (CR 1009 / Pankaj) with 152 days duration recorded 5.3 t/ha with 9.6% yield increase over ADT 40, while AD 97178 was released as ADT 44 during January 1999.

. Among two quality rice cultures *viz.,* AD 98208 and AD 98307 evaluated in MLTQuality Rice Early during 1999-2000, AD 98208 (AD 93015 / lET 14583) recorded higher yield of 4.8 t/ha, the increase being 14.4% over ADT 41.

Pulses

Blackgram

. ADB 2003 (London 1/ ADT 5)

This culture matures in 70 days and has recorded a mean grain yield of 778 kg/ha with 25% and 20% yield improvement over ADT 3 and ADT 4 respectively. It was evaluated in ART during 1999-2000.

. ADB 2045 (ADT 3 / AB 863)

This culture matures in 70 days under rice fallow conditions. It recorded a mean grain yield of 703 kg/ha with 20.5 and 22.5% increase over ADT 3 and ADT 4 respectively. It was under evaluation in MLT during 1999-2000.

II. CROP MANAGEMENT

AGRONOMY

In rice, application of herbicide, Anilophos 18 EC @ 0.60 kg ai/ha and cinmethalin 10 EC @ 0.75 kg ai/ha was found to be promising with better weed control in rice with increased grain yield.

Maximum benefit cost ratio of 3.26 was obtained with the plating method of broadcasting of rice seedlings followed by random planting (3.14).

For rice fallow blackgram, sowing during January second fortnight recorded significantly more grain yield. Foliar spray of 2% DAP twice at 25th and 40th day after sowing yielded more grains.

Sowing of rice-fallow soybean during January second fortnight was found to be optimum in maximizing the grain yield which was on par with February first fortnight sowing. Among the varieties tested, performance of CO 1 was found superior over ADT 1.

In gingelly, application of recommended NPK (40:20:20 kg/ha) with NAA 30 ppm foliar spray on 25 and 40th day of sowing gave higher seed yield.

In oilpalm, basin method of irrigation (60 to 240 litres of water/palm/day depending upon the evaporation demand) produced more female inflorescences with the maximum fruit bunch weight. While, the trees without irrigation produced more of male inflorescences with dried leaves giving sickly appearance. Also, basin method of irrigation with fertilizer dose of 1200:600:2700 g NPK/Palm/year. has produced more number of female inflorescence (15/Palm/year) and increased bunch weight.

The weed flora found in Jute fields were *Echinochloa colorum, Eclipta alba, Boerheavia diffusa, Cynodon dectylon* and *Cyperus rotundus.* Application of fluchloralin @ 1.0 kg/ha followed by one hand weeding and two Wheel hoeing favoured growth and fibre yields in jute.

In a study on the response of rice hybrid to Nitrogen application, it was found that rice hybrid responded to N application upto 150 kg/ha level. Among the hybrids tested, Pro Agro 6201 and ADTRH 1 were found to be promising. However, their yield potential was only comparable with ruling varieties ADT 36 and ADT 42.

Field experiment on the age of seedling and plant population on the yield of rice hybrid ADTRH 1 indicated that the grain yield was comparable between 25 and 30 day old seedlings. There was significant reduction in grain yield when being 30 day old seedlings were planted. A closer spacing of 15 x 10 cm (66 hills/sq.m) registered higher grain yield followed by 20 x 10 cm spacing (55 hills/sq.m).

Field experiments were conducted to find out the influence of various age of seedlings under various methods of planting. Varieties ASD 16, ADT 42 and ADT 43 were evaluated. The results showed that younger seedlings (15 and 20 day old) performed much better under seedling broadcast technique in the varieties ASD 16 and ADT 42. There was about 2/3rd labour sowing under seedling broadcast method and the yield was also comparable with line planting technique.

Weed management studies in Jute revealed that application of Fluchloralin at 1.00 kg/ha followed by hand weeding at 4 weeks stage with two wheel hoeing at 3 and 5 weeks after sowing with urea top dressing yield significantly more fibre yield than other treatments.

Yield maximization studies in transplanted rice revealed that application of 150:60:60 kg NPK/ha + FYM 10 t/ha + ZnS04 25 kg/ha + Azolla 1 t/ha + foliar spray of 2% DAP and 1 % KCl at panicle initiation and booting stages significantly increased the panicle number/m2 (500), panicle weight (2.95 g) and grain yield (7240 kg/ha) followed by combination of above agronomic techniques without foliar spray of 2% DAP and 1 % KCl (6980 kg/ha).

Nutrient response study in selected hybrid indicated that application of NPK at 150:80:50 kg/ha resulted in higher grain yield (5860 kg/ha). Among the hybrids evaluated, ADTRH 1 out yielded other varieties/hybrids by recording a grain yield of 5500 kg/ha. The standard variety ADT 43 registered a grain yield of 4960 kg/ha. The interaction effect showed that ADTRH 1 at 150:80:50 kg NPK/ha recorded a grain yield of 6230 kg/ha.

Studies on the weed control for transplanted rice revealed that hand weeding twice significantly recorded lesser weed bio-mass (10.24 g/m2), higher weed control index (85 per cent), higher panicle number (512/m2) higher panicle weight (3. 16g) and higher grain yield (6100 kg/ha) followed by the herbicides oxadiargyl, butachlor, anilophos + trichlopyr (2 doses), whip Reis and Ethoxysulfuron. All the herbicides reduced the weed bio-mass over unweeded check.

Weed control studies in direct sown rice under puddled condition showed that application of butachlor + Safener @ 1. 0 kg/ha recorded significantly lesser weed DMP (18.2g/m2), higher panicle number (424/m2), panicle weight (2.5g) and grain yield (4760 kg/ha) and this was followed by higher and lower doses of rice guard @ 0.375 + 0.015, rice guard 0.250 + 0.010 kg/ha and hand weeding twice. They were on par with each other.

Under transplanted condition Butachlor (1.25 kg/ha) followed by 2, 4-D Na salt on 25th DAT, reduced significantly the relative density of broad leaved population and recorded higher grain yield (5100 kg/ha). For direct seeded rice under puddled condition pretilachlor + Safener (0.4 kg/ha) followed by one hand weeding on 35 DAS significantly reduced the relative density of broad leaved weeds and grasses and recorded higher grain yield of 5060 kg/ha. Shift in weed flora from broad leaved weeds and grasses to sedges was also observed.

Direct seeding of sprouted seeds through broadcasting, using herbicide 6 DAS followed by one hand weeding at maximum tillering stage with recommended dose of NPK (125:50:50 kg/ha) and ZnSo4 (25 kg/ha) N applied in three splits (50% basal, 25% tillering and 25% PI) P and ZnSo4 , 75% K as basal and 25% K at PI was the optimum management practices for direct sown rice under puddled condition (5668 kg/ha). The grain yield (5796 kg/ha) obtained under transplanted crop with the same package was comparable with direct sown crop.

For the pre-release culture AD 97178 (OR 1128) 1st August sown crop (transplanted on 1 st September) and 15th August sown crop (transplanted on 15th September) recorded higher grain yield with 175 kg of applied N/ha. August 1 st and 15th sown crops were comparable in terms of grain yields.

Application of fluchloralin @ 1.0 kg/ha followed by light hand weeding at 4 weeks stage with two wheel hoeing at 3 and 5 weeks after sowing + urea top dressing 1Iz at 3 weeks + *Yz* at 5 weeks after sowing recorded significantly more plant height, stem girth, green yield, fibre yield and B/c ratio than other treatments in both the jute varieties JRO 524 and JRC 7447. This treatment also recorded significantly less weed dry weight than other treatments. The result revealed that application of poultry manure @ 1 t/ha recorded significantly more fibre yield (15.67 q/ha) than other treatments followed by application of poultry manure @ 2 t/ha and recommended dose ofN. The treatments had no significant effect on plant height and basal diameter.

Soybean

The experimental results showed that the sowings taken !n the third week of January has recorded significantly higher number of pods followed by fourth week sowing. Among the varieties tested PI has recorded significantly higher number of pods

(20.9). The yield data clearly indicated that January third week sowing recorded significantly higher seed yield (701.7 kg/ha) followed by fourth week sowing (674.9 kg/ha). After the second week of February, the yield of soybean was found to be reduced drastically because of dry weather prevailed during the crop growth period. Among the varieties tested, PK 472 has recorded significantly higher seed yield (647.6 kg/ha) followed by PI (672.4 kg/ha). The interaction was also found significant. Maximum yield of 795.7 kg/ha was recorded by January third week sowing with PK 472 variety.

Among the varieties tried ADT 43, sown in direct broadcasting at 200 kg/ha seed rate with 24 hours soaking and 24 hours incubation period has given the maximum grain yield of 4821 kg/ha. Soaking and incubation beyond 24 hours was found to be not advisable.

In clay loamy soils at TRRI, Aduthurai, the grain yield differences were not significant among the hybrids viz., KRH 2, PHB 71, ADTHR 1. The nutrient combination ofN150 + P 60 + K 80 kg/ha recorded maximum grain yield (6.6 t/ha) and out yielded all other nutrient combinations. At all levels of Nitrogen, addition of K gave significantly higher grain yield over Ko indicating the importance of K nutrient for enhancing the grain yield.

Pro-Agro 6201 produced significantly higher grain yield of 6.31 t/ha, while PHB 71 produced an yield of 5.82 t/ha next to Pro Agro hybrid. The check varieties ADT 36 and ADT 43 recorded an yield of 5.08 and 5.01 tlha respectively.

Direct seeding method using drum seeder during Kuruvai gave grain yield ranging from 4.20 to 7.25 t/ha in different locations with the mean yield of 5.10 t/ha. The mean yield obtained for broadcasting and transplanting were 4.60 and 4.80 t/ha
respectively. Similarly in Samba season, drum seeding recorded higher mean yield of 5.13 t/ha followed by broadcasting (4.53 t/ha) and transplanting (4.83 t/ha).

The variety ADT 38 produced the maximum grain yield (7.67 t/ha), panicle number *(558/m2)* and panicle weight (3.18 g) in treatments receiving recommended fertiliser dose 150:60:60 kg/ha NPK + FYM @ 12.5 tlha + ZnS04 25 kg/ha + Azolla 1 t/ha at 10 days after transplanting. The percentage increase in grain yield in improved treatment over recommended fertilizer dose is 45.3.

Hand weeding twice (6.08 t/ha), Acetachlor @ 0.15 kg ai/ha (6.15 tlha) Rice guard @ 0.312 + 0.012 kg/ha (6.03 tlha) and butachlor @ 1.5 kg/ha (5.99 t/ha) recorded significantly higher grain yield as compared to control by reducing weed flora. These treatments also recorded lesser weed biomass, higher panicle number/m2 and panicle weight over other treatments.

Drum seeding at the seed rate of 80 kg/ha under puddled condition has registered the maximum grain yield of 3306 kg/ha. Irrespective of seed rates, pre-emergence application of butachlor at 8 DAS followed by one hand weeding 35 DAS has effectively controlled the weeds and recorded the higher yield of 3838 kg/ha. Combination of above two treatments has recorded 4133 kg/ha of grain yield. Regarding benefit/cost ratio, the maximum of 2.46 has been recorded in drum seeding + pre emergence application of butachlor. The B/C ratio was the least in control plot recording 1.66.

SOIL SCIENCE

In rice, application of NPK alongwith organic manure and gypsum recorded higher grain yield in Kuruvai and Thaladi seasons of 1996-97 suggesting the need for the combined application of organic manure and gypsum for sustained productivity in CDZ.

In a study on three rice crop sequence, it is indicated that the applied PK inputs were superfluous showing the native soil P and K was already sufficient to meet the crop demand. Trends of grain yield in -F plots was found as a reasonable index of indigenous soil N supply (INS). It is also suggested to have a site specific N management for increasing the rice productivity in CDZ.

The pre-release rice culture OR 1128 was evaluated for NPK fertilizer requirement. It requires 150:60:60 kg N:P205:K20/ha to produce higher grain yield of 5.98 t/ha during samba season in cauvery delta.

In a study on the addition of straw as a K source for rice, the application of 50 kg K20/ha as muriate of potash registered the highest grain yield (5.20 t/ha) during kuruvai in var. ADT 42, which is on par with 50 kg and 75 kg K20/ha supplied in the form of straw (5.02 and 5.15 t/ha of grains). During thaladi, the application of 60 kg K20/ha as muriate of potash recorded the highest grain yield of 5.29 t/ha, which is on par with 75 kg K20/ha supplied in the form of straw (5.27 t/ha).

The test verification of various N fertiliser recommendations showed that significantly higher grain yield of 5.24 t/ha was obtained in the treatment with the simulation model based MANAGE-N (168 kg N/ha) at Tamil Nadu Rice Research Institute, Aduthurai farm. In the on-farm trials conducted in 4 locations, the MANAGEN based application resulted in higher grain yield (6.11 t/ha) in one location only. While the use of controlled release N fertilizer (CRN Urea) recorded higher grain yields in remaining three centers. The yield difference between MANAGE-N and CRN Urea applied treatments ranged trom 140 to 540 kg ha-l only.

The continued application of NPK alongwith organic manure and gypsum registered higher grain yield recording 37.5% increase in kuruvai 98 and 25.6% increase in thaladi (1998-99) seasons over the NPK application alone. This results suggest the need for combined application of organic manure (6.25 t/ha green manure in kuruvai and

12.5 t FYM/ha in thaladi) with chemical fertilizers (125:50:50 kg NPK/ha in kuruvai and 150:60:60 kg NPK/ha in thaladi) besides 500 kg gypsum/ha for sustainable rice productivity.

Studies on organic farming in rice revealed that basal application of poultry manure @ t ha-1 alongwith BGA 40 kg ha-1, Azospirillum and Phosphobacteria 8 kg ha1 and top dressing of groundnut oil cake @ 100 kg ha-1 on 30 DAT recorded significantly higher rice grain (6244 kg ha-1) yield compared to recommended inorganic fertilizers application (5021 kg ha-1). Among the organic manures tried poultry manure exhibited its overriding superiority over green manure, pressmud and composted coirpith treatments involving addition of organics recorded higher organic carbon and available P content compared to treatments involving addition of inorganics alone.

Application of N based on simulation model MANAGE-N or soil test crop response (STCR) or controlled released N fertilizer (CRN 3c) to rice can increase the grain yield considerably during Kuruvai season.

Application of recommended dose of K (blanket K) either in the form of MOP or in the form of paddy straw is effective in increasing the grain yield to a considerably extent both in kuruvai and Thaladi season. In Thaladi season. In Thaladi season,
increased dose of straw @ 90 kg/ha is required to produce grain yields as that of recommended K (60 kg KzO/ha) in the form of MOP.

Continued application of recommended dose ofNPK (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.

Application of well decomposed poultry manure @ 5 t/ha along with four times recommended biofertilizer and 100 kg groundnut oil cake on 30 DAT recorded significantly higher grain yield compared to recommended inorganic fertilizer application both in kuruvai and thaladi seasons.

Continued application of recommended dose of NPK (125:50:50 and 150:60:60 kg/ha in kuruvai and thaladi respectively) along with organic manurre (6.25 t/ha GM in kuruvai and 12.5 t/ha FYM in thaladi) and gypsum @ 500 kg/ha in both seasons registered consistently; the highest grain yield.

The newly released rice variety ADT 45 requires 125:50:50 kg N : PzOs:KzO per hectare to produce the highest grain yield; of 6.01 t/ha during kuruvai season in Cauvery Delta Zone (CDZ).

Site Specific Nutrient Management (SSNM) always recorded higher grain yield with higher N use efficiency than in Farmers Fertiliser Practice (FFP), since the SSNM accounts the soil nutrient supplying capacity. Further, the grain yield in SSNM plots with line planting was higher than that in random planting which indicated the importance of maintaining adequate plant population in rice fields for getting increased grain yield.

Rice straw incorporation @ 4000 and 4700 kg/ha in kuruvai and thaladi seasons respectively manifested similar grain yields as that of recommended dose of chemical K fertiliser indicating that the straw could be utilised to supplement the fertiliser K to an extent of 50 and 60 kg K20/ha for kuruvai and thaladi seasons, respectively.

Foliar spraying of I % Monopotasium phosphate at the end of tillering and panicle initiation stages along with recommended levels of NPK (Soil application) has consistently recorded higher grain yields in all the three seasons viz., kuruvai, samba, thaladi (irrespective of varieties) than the conventional soil application ofNPK alone.

Application of poultry manure @ 5 t/ha + 4 times recommended dose of Azospirillum and phosphobacteria + 40 kg BGA/1000 kg Azolla (kuruvai/thaladi) + 100 kg oil cake at 30/50 DAT registered highest grain yield in both seasons.

AGRL. **MICROBIOLOGY**

Combined application of weedicides, Thiobencarb (1.2 lit./ha) + 2,4 DEE (1.5 lit./ha) reduced the methane emission and increased the dissolved oxygen content in the rice fields.

Application of Azolla (500 kg/ha) emitted lesser methane.

In rice, yield increase was spectacular when phospho-bacteria was combined with *AzaspirUlum* with the half dose of recommended P level.

Combined application of *AzaspirUlum* and *Azalia* saved basal N application with increased grain yield in rice.

In rice-fallow cotton, application of Azospirillum through seed treatment and soil application at the time of first earthing up was beneficial.

Phosphobacteria solubilizes the insoluble rock phosphate more rapidly than the soluble super phospate. The solubilization of phosphorus was observed to be high in the treatment applied with 50% of Rock phosphate and phosphobacteria by recording 36.3, 37.5 and 26.0 kg/ha and the control recorded lOA, 12.5 and lOA kg/ha on 30, 60 and 90 DAT respectively on an average.

The combined application of azospirillum and phosphobacteria with half doses of N&P (through seed treatment, soil application at the time of I earthing up (30 DAS) and II earthing up (50 DAS) resulted in the higher kapas yield of 1.52 t/ha in the rice fallow cotton, whereas the uninoculated control registered 1.02 t/ha only.

The combined inoculation of Azospirillum and phospho bacteria through seed treatment, soil application at the time of I earthing up (30 DAS) and II earthing up (50 DAS) with half doses of nitrogen and phosphorus recorded higher kapas yield of 1.52 t/ha and the control registered 1.02 t/ha in the rice fallow cotton.

Zinc solubilizing and silica solubilizing bacteria were isolated from the Cauvery delta. Application of these bacteria will lend a scope for utilizing the cheap source of zinc and silica reserve in the soil.

The phenol accumulation in the continuous irrigated low land rice system was analysed and it varied from 19.80 to 27.43 mg phenol/g of soil in the long term fertility experiment.

Inoculation of zinc solubilizing bacteria with half dose of phosphatic fertilizer recorded higher grain yield of 5.84 and 5.53 t/ha, whereas the control (uninoculated) recorded 4.89 and 4.63 t/ha during the kuruvai seasons of the years 1999 and 2000 respectivel y.

Studies on the interaction of different Azolla cultures and rice varieties indicated that ADT 44 inoculated with Azolla hybrid TNAU 1 recorded higher growth parameters and grain yield of 6.12 t/ha than other interactions.

Association of mycorrhizal fungi with wetland rice roots was identified and the percent, of association is low. Screening, mass multiplying and application to rice fields would be more useful in mobilizing the unavailable phosphorus.

CROP PHYSIOLOGY

Foliar spray of 5% *Arappu* leaf powder extract at panicle initiation and flag leaf stages is beneficial in mitigating the lowlight effect of Thaladi season with more yield, thus resulted in higher cost-benefit ratio of3.31 than the unsprayed control.

The N application strategy monitored with the SP AD Chlorophyll Meter saved 19.0, 35.3 and 43.3 % of N fertilizer and the grain yield of 14.2, 20.9 and 11.9% more yield than the recommended N levels during Kuruvai, Samba and Thaladi seasons of 1996-97.

Regarding the soil series, padugai soils showed phenomenal response (23.5% more yield in comparison with recommended N) followed by Kalathur (+ 16.5%) and Adanur (+ 11. 7%) series. Therefore, irrespective of the soil series and seasons, considerable savings in the applied N and increased yield could be achieved when monitored with the SP AD Chlorophyll Meter.

An optimum SP AD threshold value for increasing Nitrogen Use Efficiency (NUB) and enhancing grain yield was 35.0 for Kuruvai and Thaladi seasons and 37.0 for Samba season.

Corresponding values of Leaf Colour Scale index were found to be 3.25,3.75 and 3.25 (in the grade of **1-7** of IRRI -CREMNET) .for reaching the optimum SP AD value of 35, 37 and 35 during Kuruvai, Samba and Thaladi seasons respectively for higher grain yield and NUB. Thus, the Leaf Colour Scale serves as an alternative for the SP AD meter to be well utilized in monitoring the N application and its optimization in the farmers' fields.

Higher grain yield in ADT 39 rice was obtained in Thaladi (1996-97) season with 4% sand mixing (rich source of natural silicon). Total dry matter accumulation (TDMA) and Harvest Index (HI) are the causal factors for the increased yield.

Kuruvai rice yield can be maximized (by more than 27%) with the spray of 5% *Arappu* leaf extract given during panicle initiation and flag leaf stages along with other maximization inputs.

SOCIAL SCIENCES

AGRICULTURAL ECONOMICS

Rice

Farmers of CDZ were using higher seed rate (107 to 118 kg/ha) irrespective of seasons and lower level of fertilizer than the recommended level. Hence, adoption of the above two technologies at recommended level would help the farmers to obtain increased profit than the present level.

Coconut: Adoption level of management practices such as application of fertilizers in two doses in a year, irrigation in the interval of ten days throughout the year except during the rainy season and other cultural practices such as green manuring, earthing up etc. attributed for variation in the yield level in the range of 11,000 - 32,400 nuts/ha/year.

Banana: Major production and marketing constraints identified were:

- Availability of quality suckers
- Inadequate water supply
- Exploitation of farmers by commission agents through collusive agreement with traders

Educational attainment and adoption of technologies were found to be directly related and the awareness of technologies was also high acording to the level of education. Ten percent of the farmers applied fertilizers based on blanket/soil testing recommendations and the rest applied on their own experience or at the advise of adjacent farmer. Fertilizer application based on soil test recommendation had given higher yield than fertilizer applied on their own experience. The partial factor productivity indicated that on an average one kg ofN had given 47.69 kg and 48.76 kg of grain during 1997-98 thaladi and Kuruvai 1998 respectively. It indicated that productivity increased form 42.62 kg (Thaladi 1994-95) to 47.69 kg (Thaladi 1997-98). Similarly, the productivity per kg of nitrogen for kuruvai also increased from 38.77 kg in 1995 to 48.76 kg in 1998.

AGRICULTURAL EXTENSION

RICE

Agriculture in Cauvery Delta Zone especially old delta region has made gains in productivity as measured by the indices of Total Factor productivity (TFP). These gains varied by period but TFP has increased in the old delta region.

In Kuruvai seasons TFP indices (Base period Kuruvai'95) showed on increasing trend upto Kuruvai'97 (1.28), followed by slight decrease in Kuruvai'98 and then increased in Kuruvai'99. The TFP indices shown an increasing trend upto kuruvai'97. This is mainly due to the decrease in the use of inputs namely labour and fertilizers. BY comparing Kuruvai'97 and 98, a slight decrease was noticed, the increased use of machine labour and hired labour in the production process and at the same time the decrease of output was the important reasons for the decline. In comparing Kuruvai'98 and 99, the increase in TFP indices was mainly attributed by increased output.

In Thalaidi seasons TFP indices (base period Thaladi '94) showed decreasing trend in Thaladi'95 but the following years showed increasing trend. The increasing trend in Thaladi'97 was mainly due to the variation in the fertilizer use namely decrease in the use of fertilizers and hired labour and the increased use of seeds and machine labour were also noticed in that season. But the net effect was increasing trend. A slight decrease in TFP in Thaladi'98 was noticed, this was mainly due to the increased production and also increased use of inputs especially family labour.

Comparing the value share of inputs in both season over the season and years leads to a conclusion that fertilizer and hired labour accounted nearly 80 per cent and remaining 20 per cent accounted by other inputs namely seeds, pesticides, exchange labour and machineries.

To increase TFP in Old delta region of Cauvery delta zone, the policy must be addressed to increase the efficiency of these inputs namely fetilizer and labour.

In Old delta region the nitrogen application was varied from 83 to 148 kg/ha in kuruvai and 77 to 135 kg/ha in Thaladi seasons.

Farmers of Old delta regions of Cauvery delta zone applied less then 25 kg/ha of Phosphorus in both seasons. This level is below the blanket recommendations. The reduced phosphorus application by farmers because of their experience indicated that lowering phosphorus did not resulted in any significant yield loss. Even this level of P appication was mainly due to the application of complex or mixed fertilizers at basal. There is no difference in application of P between seasons.

In the case of Potassium, farmers applied less than 50 kg/ha. Potassium application was reduced over the years in both seasons. In Kuruvai'95 it was 52.92 kg/ha and was reduced to 29.49 kg/ha in Kuruvai 99. Similarly it was 42.09 kg/ha in Thaladi'94 and 24.62 kg/ha in Thaladi'99.

RICE **FALLOW** PULSES

In blacks gram cultivation 51. 66 and 75.00 per cent of small and large farmers have adopted high yielding variety. In the case of green gram it was 36.67 and 72.00 per cent for the above farming categories.

The farmers invariably used higher seed rate than the recommended dosage of 20 kg/ha. The seed rate used by farmers was 12.50 to 31.25 per cent higher than the recommended dosage. Allowance for germination, own seed and long term practice were the reasons attributed by the farmers for high seed rate. In rice fallow Pulses 43.33 pereent and 57.50 per cent of small and large farmers respectively have adopted the the DAP spray. The correct dosage was adopted by 11.54 and 21.74 per cent of adopters is small and large farming categories. Small farmer group constituted large share i.e.,
56.67 per cent of non-adopters. Lack of proper water supply during the later phase of crop for facilitating the DAP spray was perceived as an important reason for nonadoption by small farmers.

Among the various production costs, the human labour component constituted a major share in cost of cultivation ofrice fallow pulses, it was 47.79 and 46.90 per cent in small and large farms respectively. The cost of cultivation was 4.72 per cent higher in case of large farmers as compared to small farmers and it could be due to higher fertilizer

usage by large farmers. Among the various production constraints the incidence of pest and diseases was ranked as serious problem and the next one was excessive drought during flowering and pod filling.

In the study area, 91.67 and 72.50 per cent of small and large farmers sold their rice fallow pulses only through village traders. Non of the farmers sold their produce through regulated market. The reason stated by large farmers was the long distance between farm gate and regulated market and unconomic quantity of produce by small farmers.

The price spread in black gram marketing have indicated that producer's share in consumer rupee was 60.18 percent. The marketing costs and market margins accounted for 39.81 per cent. Whereas, in the case of green gram, the producer's share in consumer's rupee was 61.23 per cent and the rest 38.12 per cent accounted for cost of marketing and margin for intermediaries in the channel marketing.

COCONUT

The input-output ratio of Coconut farms in Mayiladuthurai taluk was worked out for progressive and poor maintained farms and it was recorded as 2.37 and 2.27 respectively for the above categories of farm. **In** the actual production, a mean difference of 15, 455 nuts / annum was recorded between progressive and maintained farms. The per hectare cost of cultivation was Rs.16,462 and Rs.lO, 159 respectively. Accordingly the returns over variable cost was Rs.46,400 and Rs.12,906 respectively for the above two production environments.

BANANA

The price spreed and producer's share in consumer's rupee were calculated for Poovan variety of Banana in Kulithalai and Lalgudi taluks. The producer's share in Peak season in Kulithalai and Lalgudi were **41.** 89 and **41.** 70 per cent respectively. The figures for lean season were 48.93 and 48.67 respectively for the above regions. The price spread in Kulithalai ranged from 51. 07 per cent and 58.19 per cent during lean and peak seasons respectively and price spread in Lalgudi ranged from 51.33 per cent to 58.19 per cent respectively. It indicated that **41** to 48 per cent share of consumer's rupee were siphaned off by the intermedianes in banana marketing. Price escalation of lean seasons was also favourable to intermedianes. Reduction in share of the consumer rupee during the lean season is a clear indicator of above fact.

SUGARCANE

The per kg cost of J aggery extraction was worked out to Rs.ll. 3 5. The inputed value of sugarcane accounted for 67.93 % of the total cost of Jaggery extraction. The per kg income derived from jaggery extraction was worked out to Rs.ll.43. Hence, the input-output ratio of Jaggery extraction units in Thiruvidaimaruthur taluk was worked out to 1: 1. 0 1.

ID. CROP PROTECTION

AGRICULTURAL ENTOMOLOGY (1996-97)

The rice accessions, BR 1086 and IR 10196 were resistant to leaf folder.

The F2 segregants resistant to GLH were TNAU 90045/ADT 39, CO 43/Xinshai, CO 45/Gangui, ADT 38/V.No. 2109, White Ponni/IR20, ADT 38/TNAU 91045, ADT 39/IR 72, ADT 39/Draksha, ADT 39/ARC 10660, CO 43/White Ponni and ADT 38/TNAU 9013.

In rice, the chemical decis 2.8 EC (25 g a.i./ha) caused resurgence of BPH when applied on 20, 40, 60 and 75 days after planting.

Five per cent NSKE was as effective as 0.1% D.D.V.P. in reducing the stored pest, *Sitotroga* damage.

Combined application of nimbecidine + monocrotophos was effective in controlling stemborer in rice.

For containing stemborer damage in rice, application of botanicals viz., 0.3% neemazal, 0.5% econeem or 0.5% fortune aza were effective.

Stemborer damage was lesser in the pheromone baited traps.

Nimbecidine (1 %) spray was safe and less toxic to the predatory spiders and coccinellids from five days after treatment.

In rice-fallow crops, 0.05% palmarosa oil or 5% NSKE were found effective for leaf beetle damage in blackgram, beetle in soybean and thrips in cotton.

In blackgram, the accessions, AB 2027, 2057 and 2045 were promising for leaf beetle and pod borer damages.

The activity of pollinating weevil and male flower production was higher in oilpalm garden during January to April.

In oilpalm, rhinoceros beetle damage could be effectively controlled by the balanced application ofNPK @ 1200:600:2700 g per palm/year.

1997-98 A. Host-Plant Resistance:

The l\1LT and ART cultures screened at Aduthurai against yellow stemborer and leaf folder under field conditions showed that the cultures, AD 95010, IET 14129, AS 94158, ASRH 14, AS 96142/1, AS 96007, AS 96256, AS 96115, AS 96006, AS 96136,

AS 96095, AS 93165, AS 93183 and AS 95035 had damage score of 1 against stemborer whereas the cultures TNAU 94241, SATVI 2118, lET 14084, AS 94158, AS 96005, AS 95109, lET 14728 and AS 95035 had a damage score of 1 against leaf folder.

Among the 183 NSN 1 cultures received from DRR, Hyderbad, lET 14829, 14833, 14834, 14806, 14867, 14350, 14359, 14584, 14935, 14965, 14657, and 14338 were found to be free from gallmidge attack. In the MRST cultures, KAUM 46-8-1, RGL 3265, RP 3746-26738, RNR 9891, HKRH 1002, 1003 RI 086, MRH 520, TNRH 16 and KMRH 3 were free from leaf folder damage under field conditions.

B. Ecology:

At Aduthurai pheromone mediate traps caught YSB male moths ranging from 1 to II/trap during Kuruvai season. The field infestation during this period ranged from 2.9 to 10.5% deadhearts. During thaladi season 1 to 32 moths/trap were caught and the field infestation during this period ranged from 4.1 to 9.8% deadhearts as against 2.0 to 12.2% recorded in control plots. The stemborer damage was low in the pheromone mediated mass trapped field and pheromone + insecticide treated fields compared to the control.

The light trap catches at Aduthurai, showed that Yellow stemborer was prevalent throughout the year with peak activity (32798 and 9900) during 4th week of December and 1st week of January 1998. The GLH (1484) and BPH (23080 and 161040) reached their peak activity during 1st and 2nd week of January respectively which was coincided with a maximum temperature of 29.5°C and minimum temperature of 21.5°C with RH 91 % and sun shine 4.4h.

The distance required to naturalize the effect of light trap (125 W mercury vapour) in the line of invasion of YSB was found to be 20 m and in the line of spread it was 10 ill. The spread from the line of invasion do not extend beyond the light-source. As the line of invasion is quite variable from place to place, a distance of 20 m in all directions from light-trap might be necessary to mitigate the effect of light on infestation of nearby crop by the insect.

The light trap catches of YSB was correlated with field incidence of YSB (damage percentage of dead hearts and white ears). The result showed that the field incidence is related to the ratio of female moths caught in the light trap. The correlation coefficient obtained was 0.531 which is highly significant (t=4.11 at P = 0.01). The regression equation obtained was Y = 26.15 + 17.74 X). Male moths caught failed to show any relationship) (FO. 000 13; n=31) with the field incidence. Similarly it was observed that an unit increase in the light catch of BPH accounted for an increment of 9
BPH per 10 hills in the field. The regression equation obtained based on 31 weeks of observations was Y=5753 + 9 X and the corresponding correlation coefficient was 0.513 (t=3.86 at P=O.OI).

C. Integrated Pest Management:

The NBPP (Need based pest control plot) besides supporting more spider predators (4.36/10 hills during Kuruvai; 3.25/10 hills during Samba) compared to SBPP (Schedule based pest control plot), also effected optimum control of pests (YSB, LF) and gave higher economic yields, 2407.41 kg/ha and 2988.89 kg/ha during kuruvai and Samba respectively. The natural biocontrol plot (NBCP) though recorded higher spider population (4.2/10 hills during Kuruvai; 3.85/10 hills during Samba), effecting considerable check on phytophages gave significantly inferior yields (2199.07 kg/ha and 2355.56 kg/ha) during Kuruvai and Samba respectively. Further, NBPP (based on ETL) resulted in a favourable balance between pest and natural enemy complex which had an additive effect on the maintenance of stemborer, leaf folder and gallmidge in CO 43 rice at below threshold levels and thereby resulted in increased grain yield (5825), compared to SBPP (5500 kg) and NBCP (4650 kg/ha).

The natural biocontrol was compared with schedule based and need based protection. the stemborer and leaffolder damages were higher in natural biocontrol plots. But higher level of stem borer egg parasitism (43%) and leaffolder larval parasitism (40%) and spider population (28.7 /25 plants) was observed in natural biocontrol plots. The grain yield recorded was higher (2604 kg/ha) in need based protection plots which was on par with schedule- based protection plots (2890 kg/ha). The cost benefit ratio worked out was 1: 1.40 far natural biocontrol, 1: 1.96 for need based protection and 1: 1.95 for schedule based protection.

When the number ofmirid bugs exceeds 70/10 hills on 20 DAT, it was found that need based plant protection had no advantage over no protection against BPH which signifies the total effectiveness of the natural biocontrol agents.

The effect of application of preemergence herbicides, butachlor (1.25 and 2.5 kg/ha) anilofos (0.4 and 0.8 kg/ha) either alone or in combination with 2,4 Ethyl ester 0.5 kg/ha on the population of aquatic predatory insects and spider was studied in low land rice ecosystem. The results of the field trial revealed that none of the above treatments had any adverse effect on the population of spider, hydrometrids, back swimmers and valids, as observed from 7 days after herbicide application.

At Aduthurai observations were made in 15 onfarm trials on the pest scenario in different fertilizer schedules of the Mega Project. The results indicated that the stemborer incidence was positively correlated with N applied as feritlizer. The effect of N was independent of P and K. The r value is highly significant (0.3297; n=75) and the regression equation is Y =3.316+0.041 X. Similarly increased N in the form of fertilizer, with or without P and K, significantly increased the leaf folder incidence (26.67% to 28.19%). The N gradient regression equation obtained is Y= 1.468 + 0.1536 x. The leaf folder damage did not significantly affected the yield as the correlations between the leaf folder damage and yield was not significant. However, stemborer showed a negative influence on yield in the different fertilizer variants. The increase in N showed increased

damage and the yield levels were reduced accordingly. Potash did not reduce the incidence and NK plots showed a high regression coefficient of 154.15 compared to 123.92 in FFP, 128.53 in NP and 131.82 in SSNM. Possibly balanced nutrition, as in SSNM and P application might compensate the loss due to stemborer to certain extent. This is evidenced, as seed in the value of intercepts which gives an idea of yielding potential when the independent variables are at zero level. The NP and SSNM plots recorded 7670.5 and 7782.7 kg respectively when stem borer incidence was nil while the NK plot gave 7582.8 kg.

D. Insecticide Evaluation:

Out of the 12 insecticides tested under lET trials of AICRIP, Carbofuran 3 G and Chlorpyriphos lOG at 1 kg ai/ha, were effective against stem borer and gallmidge recording 1.51 - 1.80% WE at harvest when compared to 15.97% in control, besides recording higher grain yields. Mitac 20 EC @ 300 g ai/ha was effective against leaf folder followed by RH 2485 (Methofenozide 22.9 EC) @ 100 g ai/ha; Carbofuran and Silafluofen 20 EC @ 100 g ai/ha was effective against BPH. In the BTL experiment also Dursban 10 Gat 1.00 and 1.5 kg ai/ha was as effective as carbofuran 3 Gat 1.00 kg ai/ha in reducing the dead heart and white ear damage caused by the stemborer besides registering higher grain yield on par with carbofuran 3 G @ 1.00 kg ai/ha. These insecticides also showed no adverse effect on the spider population at the stated test concentrations.

1998-99 *Host Plant Resistance Yellow stem borer (YSB)*

TheMLT cultures, CB 95066, CB 97083, Salivahana, ASD 19, AS 93128, TNRH 31, TM 91039, ADT 38, lET 1722, ADT 44, (AD 92215, AD 94010, IR 64, TNAU 94241 and TNAU 93154) were found resistat under natural infestation at Aduthurai with a damage score of 1. Out of the 100 MRST cultures tested for YSB resistance twelve viz., VL 90 - 1619, VL -91 -1762, IR- 2809 -26 -3 -3, KARUM 61 - 6 - 1 - 1 -1, RI096516 -1-1, R1618 - 133 -4 -4 -1, lET 14935, JGL 546, MTO 11694, MTU -EP - 1243 8 and SKL 63 -3 -3 -16 -22 -32, were showing moderate resistance.

Brown Plant hopper resistance

At Aduthurai, the cultures/varieties viz., AS 95035, CB 95066, ASD 16, ADT 44, lET 14080, AD 95106, ASD 8, AS 94104, IR 64, CB 94247, AD 95010 and ASD 19 were found resistance with a damage score of 1 under field conditions. Among the 34 PHS cultures received from DRR, Hyderabad, eight cultures M39-40-1, M45-20-1, M616-1-1-1, M38-4-2, RGL 9993, RP2894-43366, RP 2932-43293 and RP3472-43606 were found to be moderately resistant. Two extra early cultures AD 98004 and AD 98005 were moderately resistant to BPH with a score 3 under assured pest load.

Leaffolder Resistance

The culture lET 16120 was showing leaffolder resistance under field conditions at Aduthurai farm.

Gall midge Resistance

Among the 183 entries (National Screening nursery I) tested under field conditions at Aduthurai three cultures viz., lET 15177, lET 15178 and lET 15179 were showing resistant reactions.

Pests abundance

Monitoring of stemborer at Aduthurai through light trap that showed the pest occurs throughout the year. The peak activity, however, was observed during the second week of January and February (1767 and 1770 moths/day).

The GLH activity monitored at Aduthurai showed a peak occurrence during first week of September. The peak activity ofBPH (1,62,893 and 12,353 nos) was during the first fortnight of October.

Simulation of leaffolder damage

The crop is able to compensate upto 20 per cent damage during the vegitative phase terminating at panicle initiation. Beyond 30 days any damage exceeding the minimum compensatory level of 10% results in economic grain loss. In another trial, the results surprisingly showed that even complete removal of flag leaf did not result in yield loss.

Yield loss due to insect pests

The grain yield estimates revealed that the loss due to sucking pests was much less (4.25%) compared to the loss caused by both internal and external feeding lepidopterans (6.35%). Among th chewers, the internal feeder (YSB) accounts for greater loss (6.0770) compared to the least loss (0.2870) accountable for leaffolders. The chewers and suckers together caused a loss of 12.20%.

Economic threshold for use of parasitoids and botanicals

The results of the trials conducted at Aduthurai, showed that the current ETL has to be reduced for the release of parasitoids and spraying of botanicals as they are slow acting. Both the use of 25 and 50% of current ETL was superior and showed parity among them. Significant control of YSB/LF, higher grain yield and high cost benefit for the lower ETL was observed.

Use of botanicals~

At Aduthurai, 10% leaf extract of Arrappu *(Albizia amara)* was superior in controlling YSB and leaffolder and gave high grain yield. The efficacy was comparable to monocrotophos.

IPM

Use of Azolla was found to increase the activity of Lycosids. The temporal succession of spiders to cover different growth phases of the crop as well as ideal nitch-sharing in the rice ecosystem was observed to sustain the predator - pest balance thus, preventing escalation of pests.

IPM technologies for Hybrid rice, ADTRH 1

The results of the three years 9 1996,97 and 98) trials with the ADTRH 1 showed that stembore and leaffolder management through biocotrol agent was significant in minimising the damage due to both the pests. *Trichogramma* were released 30 and 37 days after transplanting for checking the stemborer. The parasitoid effectively checked the pest and therefore the damage as deadhearts was lesser than the ETL compared to 18 per cent in the check.

The leaffolder damage was checked by the introduction of *Trichogramma chilonis* twice on 37 and 44 days after transplanting coupled with a spray of neem seed kernal extract 5% on 55th day after transplanting as a need based spray. The treatments were effective in reducing the damage due to leaffolder (lesser than 5%) compared to the check in which the damage ranged from 12.5 to 20%. The grain yield was also higher (6.0-6.25 t/ha) compared to the yield in the control plots (5.5-5.9 tlha).

Insecticidal evaluation

Kanodane 6G and Dursban lOG were found to be equal in their efficacy against stemborer, with phosphomidan and carbofuran. Actara 25 WG at 25g ai/ha was found superior to chlorpyriphos at 500g ai/ha against the leaffolder. Chlorphyriphos, Mitac 25EC, Evisect 50 sp, fipronil OAG and karate 5EC were found effective against leaffolder.

Safety of insecticideslweedicides to natural enemies

In the rice ecosystem, use of recommended weedicides such as butachlor, anilofos, 2,4-D Na salt had no adverse effect on the aqatic predators.

Toxicology

The BPH population at Aduthurai is susceptible to pho sphamid an. The LD 50 and LD 90 of ph os ph amid an to the 4th instar BPH were 0.0162 + 0.0084 mg and 0.1736 + 0.0962 mg respectively.

2000-01

HOST PLANT RESISTANTCE

The accessions *viz.,* AD 95157, AD 97230, ASD 8, AS 95111, CB 96073, KR 95019, TNRH 21, ASD 19, ASD 20 and MDU 5 were found field resistant to leaf folder. MLT cultures *viz.,* AD 98208 and AS 94170 have recorded a stem borer damage score of 1 (1-5 % white ear) as against 9 (>25% white ear) in ASD 19 and lET 14080.

BOTANICAL PEST CONTROL

Plant products *viz.,* neem oil, mahua oil and NSKE 5% were found to be safe to the natural enemies in rice ecosystem and the insecticides *viz.,* monocrotophos, chlorpyriphos, phosphamidon and quinalphos were toxic to the predators *viz.,* spiders and coccinellids.

BIO-CONTROL

Application of Azolla @ 2t/ha on 10 and 20 DAT resulted in higher number of natural enemy population *viz.,* coccinellids, spiders, braconids and reduced incidence pests *viz.* stem borer and leaf folder.

INTEGRATED PEST MANAGEMENT (IPM)

Site Specific Nutrient Management (SSNM) with IPM (avoidance of chemical pesticides upto 30 DAT and releases of *Trichogrammajaponicum* at 5cc/ha on 28,35 & 42 DAT) was superior in containing the stem borer damage at vegetative and maturity stages of the crop both in kuruvai and thaladi seasons as against the Farmers Fertilizer Practice (FFP) and Site Specific Nutrient Management with need based plant protection.

Application of Nand K @ 100 and 50kg/ha basally and on 20 DAT recorded lower incidence of stem borer and leafhoppers coupled with enhanced natural enemy activity and higher grain yield than the applications of Nand K on 40 and 60 DAT in both the samba and thaladi seasons.

INSECTICIDE EVALUATION

Need based application of profenophos 50EC @ 375 gm a.i./ha significantly reduced stem borer damage and resulted in higher grain yield on par with the standard insecticide monocrotophos 36 SL @ 360 gm a.i./ha. The cost benefit ratio in profenophos 50 EC @ 375 gm a.i./ha was 1:1.95 while in monocrotophos 36 SL 360 gm a.i./ha it was 1:2.04. Application of carbo fur an @ 1 kg a.i./ha + monocrotophos @ 0.5 kg a.i./ha at 15, 45 and 75 DAT recorded the highest yield of 4862 kg/ha and lesser incidence of stem borer and leaf folder.

PLANT PATHOLOGY (1996-97)

Of the 2419 rice accessions screened against blast and bacterial leaf blight, about 1703 accessions were resistant to blast, while 517 were resistant to bacterial leaf blight. Accessions numbering 393 were resistant to both blast and BLB.

Foliar application of *Pseudomonas fluorescence (500* g/ha) at booting and flowering contained the sheath rot and grain discoloration effectively with higher grain yield.

Growing susceptible variety, viz., IR 50 showed higher disease intensity when compared to susceptible variety, treated with fungicide/biocontrol agent.

One spraying with Contaf 5 EC 1.0, *2.0* or *4.0* ml/l or Edifenphos I ml/l immediately after noticing the symptoms significantly reduced leaf blast incidence with. increased grain yield.

1998-99

Host Plant Resistance

Among *2200* cultures screened against BLB and blast, INRC 13695, 13718 and 13832 were found to be moderately resistant to both BLB and blast under natural as well as artificial conditions.

In the artificial screening of entries against BLB, out of 403 tested, 2 cultures viz., Ajaya and IR64 were identified as resistant to BLB.

In the field monitoring of *Xanthomonas oryzae* p.v. Oryzae out of differentials tested under arttificial conditions, 5 cultures viz., BJl, DV 85, Cempeselak, IR 64 and lET 8585 were resistant to BLB (Grade 3).

Disease Management

In the integrated management of blast disease, growing resistant variety without any disease management practice had no disease incidence. This was followed by growing susceptible variety (IR 50) with fungicidal spray of carbendazim *0.05%* (1.34 grade) and IR 50 with P. fluorescens application (1.61 grade) as against 4.93 grade in check. In the moderately susceptible variety (ASD 17) fungicidal spray recorded lesser incidence of 1.56 grade followed by *P fluorescens* application (1.81 grade) while the check recorded 4.16 grade.

In the management of sheath rot and grain discolouration of rice, two spraying of *Pfluorescens* @ lkg/ha at booting and 15 days later effectively. Checked the sheath rot (13.1 %) and grain discolouration (11. 3 %) and also recorded significantly higher yield (7833 kg/ha)

Application ofN (75% of recommended dose) in three split doses on 40,55 and 75 DAS through neem coated urea (Urea:Gypsum:Neemcake 5:4:1) combined with application of P. fluorescens (ST+NA+FS) significantly reduced sheath rot and grain discolouration and recorded increased yield compared to control.

STCR recommendation of fertilizer application, gypsum application (500 kg/ha); ZnS04 application (25 kg/ha) foliar spray of DAP (2%), Kcl (1%) and cowdung water extract (20%) recorded less incidence ofBLB which is on par with chemical control.

2000-01

Host Plant Resistance

Under NSN 1 (AlCRIP trial) 207 accessions were screened and the following 3 accessions *viz.,* lET 16774 (RP 3644-36-15-8-4), lET 16837 (EXPH-8), lET 16928 were resistant to blast (grade 1) under artificial inoculated condition as against grade 8 in TNI. For sheath rot under artificial condition Jeragasalal was resistant with grade-I.

The lines BG1165-2, IR.69734-5-1-2, IR 71605-2-1-5-3, IR 71005-2-1-5-2-1, IR.50 and IR.62 were found to be moderately resistant to the disease (grade 3-5). The other four lines were susceptible to the disease.

For BLB disease, 98 cultures in germplasm, 72 cultures in NSN 1, 15 cultures in NHRT and 23 cultures in DSN trial were found to be moderately resistant to the disease (grade 3-5). None of the cultures were found to be resistant to the disease.

Management of diseases

For the management of blast and sheath blight disease among the six fungicides tested Contaf 5 EC and Tilt recorded lowest blast incidence of 37.43 and 37.71 per cent disease index respectively as against 69.03 per cent in control. With regard to sheath blight Contaf 5 EC and Tilt 25 EC recorded 18.55 and 24.69 PDI as against 35.93 PDI in check.

Spraying of botanicals Achook 5ml/lit or Neem gold 20 mIll in rice crop were found to be effective in containing the sheath blight disease next to the carbendazim and propiconazole fungicides. These botanicals recorded lower disease severity of 39.6 and 41.1 per cent and higher grain yield of 5317 and 5150 kg/ha respectively as compared to 45.9% disease severity and 4767 kg/ha yield in control.

Spraying of neem oil 3% TNAU formulation + 0.2% glycerol or neem oil 3% TNAU formulation + 0.2% activated clay found to reduce the disease severity of sheath rot under field condition both in kuruvai and thaladi seasons by registering 0.51% and 0.58% respectively as against check 1.88% and 1.33% respectively.

The Site Specific Nutrient Management (SSNM) adopted with IPM and line / random planting recorded significantly lesser disease incidence like brown spot, sheath blight, bacterial leaf blight and grain discolouration when compared to SSNM (check) and farmers fertilizer practice (FFP) in all stages of the crop growth.