# 3.4 AGRICULTURAL RESEARCH AND EDUCATION

## Introduction

Growth of agriculture and allied sectors is crucial for an overall accelerated performance of the country's economy. In order to achieve balanced nutrition and inclusive growth, considering the trend of diversification of food basket and experience on the factors underlying growth during the past decade, attaining and maintaining a steady growth in cereals, pulses and oilseeds is essential and an accelerated growth of livestock, fishery, forestry and horticulture sub-sectors is also required. Since land is a shrinking resource for agriculture, the pathway for achieving these goals has to be higher productivity per unit of arable land and water.

Research has to be focused more on the society's needs. It has also to take note of changes due to globalization, technological development and growing emphasis on value addition. At the same time, resource and time limitations necessitate prioritizing and optimizing research activities. The thrust areas in which research is to be undertaken, strategies to achieve the targets and specific research programmes such as crop improvement, crop management and crop diversification, crop protection and post harvest technologies required to be achieved are to be prioritised.

Vision Tamil Nadu 2023 envisages the development of eleven marquee projects that will create a huge positive impact and provide significant spin-off benefits. Among the ten signature projects, development of world class institutions of research and knowledge in agriculture is one of the key areas and the Twelfth Five Year Plan will create ways to achieve the same.

To achieve the target of 5.0 percent growth in agricultural and allied sector and to double the farmer's income, research institutions like Tamil Nadu Agricultural University (TNAU), Coimbatore, Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Chennai and Tamil Nadu Fisheries University (TNFU), Nagapattinam are to play a major role.

## I.Agricultural Research and Education

### Tamil Nadu Agricultural University (TNAU), Coimbatore

As the agricultural education and research systems in the State has to face new challenges in the coming years, the education and research systems have to respond effectively to these challenges to produce output that are economically viable and efficient. The processes that lead to these outcome have to be reoriented in a competitive, demand-driven model. The advent of modern information and communication technology revolution should be effectively harnessed to make the education, research and extension activities socially relevant.

The area under agriculture in the State is declining. The breakthrough in agriculture will thus, ultimately have to come from technology with a right vision that places the farmer and his welfare at the centre of action. For this, the State should exploit its comparative advantage in the production of certain crops and should accordingly plan about agricultural research and production strategy. The role of TNAU therefore becomes crucial.

TNAU is a leading agro technology provider of India and its graduates are recognized throughout the world. TNAU has won the Indian Council of Agricultural Research's (ICAR) prestigious Sardar Patel Outstanding ICAR Institution Award in 2010 amidst stiff competition from 97 ICAR institutes and 53 State Agricultural Universities (SAU) in the Nation. TNAU is serving the country through six avenues:

Agricultural Education, Research, Extension, Open and Distance Learning, Agribusiness Development Programmes and Agricultural Policy Support. There are 11 colleges functioning in eight campuses, 36 research stations, 14 Krishi Vigyan Kendras (KVKs) and five Plant Clinic Centres. The University also provides affiliation to six agricultural colleges to offer degree courses and five agricultural institutes to offer diploma courses.

## Achievements and Initiatives taken during the Eleventh Five Year Plan

### Education

The century old campus of TNAU houses more than 3000 students and offers courses from the undergraduate level to the doctorate level. Several innovative programmes like dual degrees and international collaborations have enhanced its stature. ICAR, New Delhi, has provided the Certificate of Accreditation for the education programmes of TNAU from 2001 onwards.

TNAU records the highest employment rate among the 53 SAUs of India. In the scientists recruitment conducted by 'Agricultural Scientists Recruitment Board', a substantial number of the TNAU candidates are being selected. In the past four years, 81 students have cleared Civil Services (Main) examination which is about 40 percent of the candidates from Tamil Nadu.

TNAU is also offering many correspondence courses through the Directorate of Open and Distance Learning. At present, 16 certificate courses in Tamil, three certificate courses in English, seven Post Graduate diplomas and three PG courses are being offered. All the courses have gained wide popularity within a short period of time. A new three year degree programme, 'Bachelor of Farm Technology' in Tamil medium was started in 2010 exclusively for the farmers, as first of its kind in India. A total of 229 farmers have joined in this programme during 2010.

### Research

Research is carried out in all the college campuses and 36 research stations spread all over the seven agro climatic zones of Tamil Nadu. TNAU is now operating 1076 research projects, including 604 external agencies and private agencies funded research projects. During the Eleventh Five Year Plan period, 38 new varieties and hybrids of various crops, 13 new farm implements and 16 management technologies were released for the benefit of the farming community. The University has obtained nine patents and submitted applications for 36 more patents.

The Research Priority Setting, Monitoring and Evaluation Cells are proposed to be strengthened during the Twelfth Five Year Plan for which proposals have been included. The Government of Tamil Nadu extends financial support for establishment and operation of TNAU. Out of the total budget, 58 percent is contributed by the State Government through Plan, Non-plan, NADP and other schemes. The ICAR, GOI and other agency sponsored research programmes besides the University receipts accounted for approximately 42 percent. The financial support by Government to TNAU under plan scheme and NADP including Irigated Agriculture Modernisation and Waterbodies Restoration and Management (IAMWARM) during the Eleventh Five Year Plan period is given in the Table 3.4.1.

**Table 3.4.1: Eleventh Plan Performance - TNAU**

(₹ crore)

| S.No. | Sub-Head | 2007- 2012 | |
|---|---|---|---|
| | | Allotment | Expenditure |
| 1 | State plan | 277.29 | 190.78 |
| 2 | IAMWARM | 123.25 | 36.73 |
| 3 | NADP | 104.56 | 48.90 |
| | Total | 505.10 | 276.41 |

*Source : Tamil Nadu Agricultural University*

## Twelfth Five Year Plan: Goal, Objectives, Strategies and Programmes-TNAU

### Goal

The goal is to help the agricultural sector to be resilient and grow in the midst of adversities and help farmers to increase their income through research.

### Objectives

The objectives of agricultural research and education during the Twelfth Five Year Plan period are:

- To produce graduates capable of multi-tasking and to serve the Nation.
- To evolve varieties/ hybrids and integrated crop production technologies for sustained increase in yield and to meet the end users' expectations interms of quality and food safety.
- To ensure soil and water qualities and enhance output per unit.
- To ensure service provision to enable farmers to take informed decisions based on price and weather advisories.
- To expand the further use of Information, Communication Technology in education, research, coordination, administration and technology delivery.
- To harness research output of frontier sciences to increase value added crop production, storage and processing.
- To investigate climate change, to design mitigation strategies and to supplement disaster management programmes.

### Strategies

Broad strategies envisaged for achieving targeted agricultural growth in Tamil Nadu would cover four categories: a) Agricultural education to cater to the globalising agriculture needs, b) Research for innovative solutions, c) Putting innovative solutions into practice and d) Promoting agribusiness.

#### *Agricultural Education*

New educational programmes and new institutions would be initiated based on the need for developing human resources. There are new developments discernible in the field of agricultural education and the system is to be made as a combination of formal and non-formal with an interdisciplinary orientation. Moreover, collaborative alliances with various institutions in the country and abroad with active participation of the stakeholders will be made. Future programmes will follow the new methods and some of which have already been followed in the University. Education infrastructure would be strengthened so as to improve the learning environment for the youth. To augment the availability of skilled human resource in rural areas, District Agricultural Polytechnics will be established. Besides the above, to increase the employment opportunity in agriculture among rural youth, it is proposed to establish a two year Diploma course in Agriculture at State Agriculture Extension Management Institute (STAMIN), Kudumiyanmalai. Innovation and creativity will be the key features for future development. With this in view, an Innovation Centre for Post Doctoral Research has been proposed as a multidisciplinary institution.

An insect museum has been proposed for identification and description of new insects besides revision of existing taxa and beneficial insects identified will be utilised. Inshort, the museum will serve as a digitalized data repository for all known insects of India.

#### *Research for Innovative Solutions*

An analysis of the commodity share through the modified congruence method was done for Tamil Nadu considering the area and production data for three years (Triennium ending 2009). The harvest values were evaluated at 2008-09 prices. The study results are presented in Table 3.4.2.

**Table 3.4.2: Ranking of Crops for Priority in Resource Allocation**

| Crop/ Group | Weighted share (in %) | Rank | Crop/ Group | Weighted share (in %) | Rank |
|---|---|---|---|---|---|
| Rice | 23.48 | 1 | Mango | 3.13 | 9 |
| Coconut | 9.29 | 2 | Maize | 2.90 | 10 |
| Banana | 9.17 | 3 | Black gram | 2.71 | 11 |
| Sugarcane | 8.59 | 4 | Sorghum | 2.67 | 12 |
| Groundnut | 7.4 | 5 | Green gram | 1.43 | 13 |
| Cotton | 4.6 | 6 | Cashew | 1.16 | 14 |
| Tea | 3.21 | 7 | Turmeric | 0.97 | 15 |
| Tapioca | 3.16 | 8 | | | |

*Source : Tamil Nadu Agricultural University*

*Note : The weighted share is: other cereals (7.88 percent), other pulses (0.72 percent), other oilseeds (1.10 percent), other fruits (2.52 percent), other vegetables (2.22 percent) and other spices (2.09 percent). Besides these, the importance of fodder crops needs to be visualized in the light of growing importance for animal based food and food products. Thus, the research focus and allocation of resources for crops will be determined accordingly.*

Modified congruence method constitutes construction of weighted shares including the value of the produce, the equity captured through area share and foreign exchange earning potential by looking at the share in the total export of agricultural commodities. The expectation is the resource allocation for research to these crops should match the weighted shares for the respective crops. In the above table, for example, the weighted share for rice crop is 23.48 which indicated that approximately 23.5 percent of the resources committed for research should go directly or indirectly to rice research or rice based systems research.

### *Specific Research Thrust Areas*

Crop improvement research on developing new varieties and hybrids would continue to fulfill market needs and also to possess important traits such as drought tolerance, pest and disease resistance and nutrient enrichment especially in nutritional cereals.

- Standardising precision farming technologies for more crops of Tamil Nadu would be given impetus, which will help to increase yield of quality produce and conserve resources.
- Research would be strengthened to develop implements and machinery considering the needs of the farming community, particularly marginal and small farmers besides paying attention to designing gender-friendly implements.
- Research will be taken up to reduce post harvest losses and to enhance

**Box 3.4.1: Precision Farming**

Precision Farming approach includes precise soil preparation, seedling production, crop geometry, micro irrigation, fertigation, integrated pest and disease management and precise post harvest handling of produce. Precision farming increases the yield by 40-200 % and water use efficiency by 300% with almost 30-40 % water savings. Precision farming started as a turn key project by Tamil Nadu Agricultural University on 1000 acres has now spread to more than 81,000 acres across the State. This model experiment has created an interest in the neighbouring States for gross learning of best practices.

*Source: Tamil Nadu Agricultural University*

value addition and emphasis to be given for nutritional cereals so that their consumption level increases.

- Developing bio technology and nanotechnology based solutions for enhancing input use efficiency, productivity, post harvest life, value addition and maintaining resource quality.
- Bio inoculants to augment nutrient availability and to reduce pest incidence
- Rhizosphere engineering to enhance soil plant relationship
- Further intensification of research on climate change and mitigation
- Market research to promote market-led agriculture

### *Marginal and Small Farms Profitability*

Integrated farming systems models for improving the revenue generation of marginal and small farms will be developed. Also, institutional approaches such as group farming and contract farming would be dovetailed to empower farmers in the market.

### *Improving Productivity in Rainfed Areas*

Research and technology transfer initiatives for rainfed areas would be given major emphasis in the Twelfth Five Year Plan including crop improvement, management (especially for nutritional cereals) and improvement in the organic content of soil to achieve marked improvement in the standard of living of marginal and small farmers, particularly in less favoured areas. Organic farming practices will be standardized to help farmers who want to take up organic cultivation.

### *Grape Research*

To bestow research in grapes and for encouraging production and export, a new Grape Research Station will be established at Mallingapuram alias Annamalaiyanpatty, Cumbum valley of Theni district.

## Putting Innovative Solutions into Practice

## Linking Farmers to Markets

High price spread and low farmers' share in consumer rupee for agricultural produce has contributed to the erosion of farm profitability. Farmers must be directly linked to processing units viz., oilseeds to oil mills, tapioca to starch industries, pulses to flour mills, rice to modern rice mills, fruits and vegetables to processing industries, etc., so that they can have a direct link with the industry as in the case of sugar industry or directly linked to consumers through retail outlets (Farmers shandies / organized retailing), through contract farming. This arrangement leads to weave-in a consortium of financial institutions, input suppliers, extension agencies and marketing service providers. Research and outreach programmes will be implemented to develop models for linking farmers to markets. Studies on linking farmers to national markets will also be taken up.

## Market Oriented Agriculture

Greater emphasis needs to be shifted from production technologies, but henceforth the first thing required is the market oriented farm planning and production. Research would be undertaken to formulate market advisories based on the market intelligence and assess its impact and recommendations for larger adoption.

## Targeted Technology Transfer

Special initiatives would be taken up for transfer of critical crop production technologies that would substantially increase yield of identified crops in potential districts. Market linkages would be facilitated by organizing growers and facilitating traders visit to the production areas, interaction among growers and traders, exposure visit for growers to markets and tieing up with appropriate Government agencies for procurement to meet the needs of the Government programmes. Comprehensive technology demonstration in large plots (one acre) in farmers' fields will be continued. Crops cultivated in a large area in each district, which influence a larger dependant population, would be selected for technology transfer.

### Box 3.4.2: Weather Advisory Based Crop Management

The Agro Climate Research Centre at Tamil Nadu Agricultural University in collaboration with the Department of Agriculture has established Automatic Weather Stations (AWS) network in 224 blocks of Tamil Nadu with financial support from NADP during 2008-2010. The Automatic Weather Stations Network provides weather forecast for the next six days and information collected can be viewed at an hourly interval in the website (*www.tawn.tnau.ac.in*). This information helps in day to day management of crops resulting in timely operations and cost savings.

*Source: Tamil Nadu Agricultural University*

## Demonstrating Food Processing Model

Post Harvest Technology Centre at TNAU has designed a viable model for providing custom hiring of processing facility for small famers, traders, entrepreneurs and prospective processors. Such centres would be facilitated and created in the districts to demonstrate the potential of processing in enhancing farmers' revenue.

## Promoting Agribusiness Development

New initiatives would be formulated and implemented to promote rural youth to take up agribusiness ventures such as seed production, farm machinery and implements fabrication, production of bio inputs such as: bio control agents, vermi-compost, providing farm based services, etc., on a PPP mode involving Agriculture Department. This would provide off-farm employment for rural men and women and also contribute for extensive use of bio inputs, which have not been taken up on a large scale by big production establishments.

### Box 3.4.3: DEMIC – Price Forecasting

Tamil Nadu Agricultural University operates Domestic and Export Market Intelligence Cell (DEMIC) through which price forecasts of agricultural produce before sowing and pre harvest are made available to enable the farmers to make rational choices on storage and sales post harvest. In the five year ending 2011, DEMIC made 325 price forecasts of different commodities and results published in English and Tamil dailies. Some of the commodities that are covered include: maize, cotton, turmeric, groundnut, sesame, blackgram, chickpea, coconut, tomato, chillies, onion, coriander and potato.

*Source: Tamil Nadu Agricultural University.*

## Centres of Excellence

Eleven areas were identified in research and education for establishing 'Centres of Excellence' for achieving desired goals by 2023. In agricultural research, Centres of Excellence serve as nodes of research, industry partnership and innovation. It is proposed to establish such Centres in Molecular Breeding, Dryland Agriculture, Soil Health, Precision Farming, Bio-refinery and Farm Machinery.

Fig. 3.4.1: Precision farming

An amount of ₹1184.00 crore is proposed for TNAU as furnished in the Table 3.4.3.

**Table 3.4.3: Twelfth Plan Outlay – TNAU**

(₹ crore)

| S.No. | Schemes | Outlay |
|---|---|---|
| **I** | **Ongoing Schemes including NADP, IAMWARM** | **430.00** |
| **II** | **New Schemes** | |
| 1 | Centre of Excellence in Molecular Breeding at Coimbatore | 7.00 |
| 2 | Centre of Excellence in Soil Health at Trichy | 20.00 |
| 3 | Centre of Excellence in Precision Farming at Periyakulam | 20.00 |
| 4 | Institute of Innovation (Post Doctoral Facility) at Madurai | 20.00 |
| 5 | Centre of Excellence in Dry farming at Chettinadu | 20.00 |
| 6 | Centre of Excellence in Farm Machinery at Kumulur | 20.00 |
| 7 | Pilot Bio-refinery at Coimbatore | 10.00 |
| 8 | Insect Museum at Coimbatore | 10.00 |
| 9 | Farm Women Knowledge Centre at Horticulture College and Research Institute, Trichy | 5.00 |
| 10 | Strengthening of HC & RI, Trichy | 25.00 |
| 11 | Special Res. contingency to staff members | 25.00 |
| 12 | Distance Education – Professional Farmers Degree | 15.00 |
| 13 | Student / Faculty Exchange programme in National and International | 15.00 |
| 14 | NABL accredited Central Instrumentation facility in Colleges (Killikulam, Madurai, Periyakulam, Trichy) | 25.00 |

## Table 3.4.3: Twelfth Plan Outlay – TNAU

(₹ crore)

| S.No. | Schemes | Outlay |
|---|---|---|
| 15 | Strengthening of Biotechnology, Nanotechnology and Information technology facility in teaching institutions | 20.00 |
| 16 | Analytical, Certification and Labelling Centres | 10.00 |
| 17 | Gene and varietal conservation facility at TRRI, Aduthurai | 5.00 |
| 18 | Technology verification, Training and Translational Centre - Kudumianmalai | 5.00 |
| 19 | Establishment of new Research Centres at Tiruvannamalai and Tiruppur districts of Tamil Nadu | 25.00 |
| 20 | Improvement of hostel, sports, gyms and swimming pools at teaching campuses | 40.00 |
| 21 | Establishment of data base of farmer, crop, area, storage capacity and input | 5.00 |
| 22 | Common Student Analytical Facility-Coimbatore | 20.00 |
| 23 | Fencing of Campuses | 30.00 |
| 24 | Improvement of Infrastructure at Forest College, Mettupalayam | 5.00 |
| 25 | Medicinal Plants conservation Centre at Periyakulam and Yercaud | 10.00 |
| 26 | Extension Education – Continuing Education of Dept. Staff | 30.00 |
| 27 | New courses New programmes and Institutes | 10.00 |
| 28 | Disaster Management preparedness | 6.00 |
| 29 | Rhizosphere Engineering, Root pruning and Training with Rhizotron Facility | 10.00 |
| 30 | State Agricultural Education Digital Library support | 15.00 |
| 31 | District Agricultural Polytechnics | 78.00 |
| 32 | Special Human Resource Development – Teaching and Research | 5.00 |
| 33 | Special Human Resource Development - Administration | 1.00 |
| 34 | Community Nursery (two community bore well area in 5 districts) | 10.00 |
| 35 | Agricultural Education :student support and field demonstrations | 48.00 |
| 36 | Quality Seed Production and Supply | 32.00 |
| 37 | Demand Driven Research Support (Competitive Grant) | 95.00 |
| 38 | Diploma course in Agriculture at STAMIN, Kudumiyanmalai | 2.00 |
| | **Total-New scheme** | **754.00** |
| | **Grand Total-TNAU** | **1184.00** |

## II. Animal Husbandry Research and Education - Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Chennai

Livestock play a vital role in the rural economy of our country. Apart from providing food products like milk, egg and meat, livestock sector also generates productive employment and valuable supplementary income to the rural households, majority of whom are small and marginal farmers and landless labourers. This sector contributes to many other socio-economic spin-offs like slowdown of rural-urban migration and empowerment of rural women. It also has strong backward and forward linkages which in turn promote livestock based food processing and leather industries that help in export earnings.

The Tamil Nadu Veterinary and Animal Sciences University was established in the year 1989 with the following objectives:

- To impart quality education to under graduate, post graduate and doctoral students in different fields of veterinary and animal sciences
- To carry out research in livestock and poultry protection and value addition.
- To disseminate knowledge on important technologies to line departments and farming community for the sustenance and growth of livestock and poultry in the State.

TANUVAS is the leading University in the country for promoting veterinary and animal sciences education and is recognized as a potential institution with strong faculty for academics and research in veterinary and animal sciences. The University has six constituent colleges namely, Madras Veterinary College, Chennai, Veterinary College and Research Institute-Namakkal, Orathanadu and Tirunelveli and Institute of Food and Dairy Technology, Koduvalli.

### Box 3.4.4: Mineral Mixture - Milk Production Booster

Thiru K.C.Gopal of Coimbatore district attended a two day training programme on 'Rearing of Milch Animals' by Veterinary University Training and Research Centre (VUTRC). After this refresher skills training, he fed the cows with fodder enriched with mineral mixture @ 40gm/ cow/ day. The impact of this technology were: absence of milk fever after calving, complete shedding of placenta, reduction in premature and still birth calves. Milk output of his farm increased to 70 litres per day. The farmer has appreciated the successful dissemination of technology and suggested for emulating the model across the State.

*Source: Tamil Nadu Veterinary and Animal Sciences University.*

In addition to the six constituent colleges, the TANUVAS has one post graduate Research Institute in Animal Sciences, Institute of Poultry Production and Management, Institute of Animal Nutrition, seven Research Stations, 15 Veterinary University Training and Research Centres, three Krishi Vigyan Kendras and three Farmers Training Centres and two Ethno-Veterinary Herbal Training Centres to take care of research and extension needs of the farming community. The research and developmental logistics provided to the various facets of the veterinary and animal sciences are the hallmark of this University.

### Eleventh Five Year Plan Performance-TANUVAS

During the Eleventh Plan period, 66 plan schemes and 49 non-plan schemes in veterinary faculty, 18 plan schemes in fisheries faculty were in operation resulting in better higher education (908 undergraduates and 418 postgraduates, significant findings in research, technology generation (58 Nos.) and ultimately technology reach to the end users

(7.31 lakh beneficiaries and 3700 extension programmes). Further, improvement in the productivity, sustainability and profitability of the animal husbandry, dairying and fisheries sectors have been done. Apart from these services, clinical facilities have been extended to 3.03 lakh animals through institutional hospitals.

## Technologies with Commercial Potential

At present, 56 technologies developed by the University are having a big potential for commercialization viz:- TANUVAS RUSITEC, TANUVAS inactivated fowl cholera vaccine and inactivated Ranikhet disease virus vaccine, LipL.32 recombinant antigen coated latex agglutination test kit, single radial immuno diffusion test kit and infectious bronchitis virus haemagglutination inhibition test (IBV– HI) kit.

## Twelfth Five Year Plan (2012-17) Goal

The goal is to help the animal husbandry sector to be resilient and to help farmers to increase their income through animal sciences research.

## Objectives

The objectives of animal sciences research and education during the Twelfth Five Year Plan period are:

- To produce graduates capable of multi-tasking in different fields of veterinary and animal sciences.
- To evolve breeds / technologies for sustained increase in yield and to meet the end users' expectations interms of quality and food safety.
- To ensure service provision and to enable farmers to take informed decisions based on prices of different animal products.
- To expand the further use of ICT in education, research, coordination, administration and technology delivery.
- To harness research output of frontier sciences to increase value added animal products, storage and processing.

## Strategies

Broad strategies envisaged for achieving targeted growth in Tamil Nadu would cover four categories: a) Animal sciences education to cater to the globalising

### Box 3.4.5: Oestrus Synchronization Technique for Rescue of Infertile Cows

Oestrus synchronization technique involves use of certain drugs to bring a herd of cows and buffaloes into oestrus at a predetermined time for breeding. Adoption of oestrus synchronization technique in cows and buffaloes is a significant intervention as in Tamil Nadu 30 percent of cattle suffer from reproductive failure, resulting in very long average calving interval of more than two years as against the desired one year. The scheme under NADP has resulted in improved fertility and milk production, reduced calving interval and enhanced economic returns to the farmer. Cost of oestrus synchronization was ₹750 per animal and 18,899 cows and buffaloes in 25 districts were covered and 60.23 percent conception rate in infertile cows and buffaloes was achieved. This technique resulted in increasing milk production by 46.00 lakh litres on annual basis and expected to rescue at least 20-30 percent of cows and buffaloes from going to slaughter as unproductive, thereby effecting a total economic benefit of ₹19.63 crore. Adopting this technique on a large, eg. in 2.00 lakh cows would increase total milk production by 700 lakh litres in a year. This strategy would help to meet the increase in demand for milk and control price increase too.

*Source:Tamil Nadu Veterinary and Animal Sciences University.*

needs, b) Research for innovative solutions, c) Putting innovative solutions into practice and d) Promoting agribusiness with animal husbandry as a base.

An amount of ₹592 crore proposed for TANUVAS for the Twelfth Five Year Plan is given in the Table 3.4.4.

**Table 3.4.4: Twelfth Plan Outlay – TANUVAS**

(₹ crore)

| S.No. | Schemes | Outlay |
|---|---|---|
| **I** | **Ongoing Schemes** | **190.00** |
| **II** | **New Schemes** | |
| 1 | Centre of Excellence in Veterinary Clinical Services | 3.50 |
| 2 | Centre of Excellence in Animal Genetic Resource Conservation | 6.00 |
| 3 | Institute of Animal Reproduction | 10.00 |
| 4 | Establishment of Animal Experimentation Facility (ABSL -2) | 6.00 |
| 5 | Strengthening of VC & RI Campus at Tirunelveli and Orathanadu, IFDT and Koduvalli | 40.00 |
| 6 | Special Res. contingency to each & every staff members | 8.00 |
| 7 | Institute of Distance Education for Skill Development | 9.00 |
| 8 | Student / Faculty Exchange programme in National and International | 9.00 |
| 9 | Stem Cell facility for Veterinary Regenerative Therapy | 10.00 |
| 10 | Nanotechnology facility to augment livestock production and health | 20.00 |
| 11 | Biosafety Level three Laboratories | 10.00 |
| 12 | Genomic research facility | 22.00 |
| 13 | Food safety, quality control, certification and eco-labeling laboratory at IFDT, Koduvalli | 15.00 |
| 14 | Establishment of University Library, digitization and networking of libraries of TANUVAS | 18.00 |
| 15 | Central instrumentation facility for six constituent colleges | 30.00 |
| 16 | Replacement of the old building of MVC, Chennai | 35.00 |
| 17 | Continuing education in veterinary and animal sciences | 8.00 |
| 18 | Establishment of New Veterinary University Training and Research Centres | 18.00 |
| 19 | Research and Development Centre for Ethno-veterinary Practices at VUTRC, Thanjavur | 15.00 |
| 20 | Dairy Science College and Research Institute | 35.00 |

**Table 3.4.4: Twelfth Plan Outlay – TANUVAS (Contd.)**

(₹ crore)

| S.No. | Schemes | Outlay |
|---|---|---|
| 21 | Special contingency grant for transfer of Technology | 5.00 |
| 22 | Strengthening of Institute of Poultry Production and Management, Hosur | 20.00 |
| 23 | Creation of need-based and Location-Specific Centres at the existing University Centres | 24.50 |
| 24 | Pilot project on poultry litter based power plant | 25.00 |
| | **Total- New schemes** | **402.00** |
| | **Grand Total-TANUVAS** | **592.00** |

## III.Fisheries Research and Education - Tamil Nadu Fisheries University (TNFU), Nagapattinam

Tamil Nadu has a coast line of 1076 km and possesses one of the world's well known marine biodiversity regions, Gulf of Mannar. In addition, the State has innumerable number of tanks, reservoirs, village ponds that have been built to harvest water and provide for agriculture and other purposes. These water resources have not only been the source of capture fisheries, but also have been used for culture. With the increasing knowledge on fish as health food, the demand for fish is expected to grow rapidly. In view of all these resource potential and the need of people for quality and nutritious food in adequate quantity, the Government took a major policy decision to establish a separate Fisheries University with an aim to contribute to increased fish availability in the State for local consumption by igniting innovations at all levels. The Tamil Nadu Fisheries University has come into existence on 19th June, 2012.

### Objectives

- To facilitate comprehensive development of fisheries sciences for increased contribution to State's economy and to set bench mark standards through appropriate interventions in fisheries teaching, research and extension
- To impart quality education in different branches of fisheries sciences
- To conduct organised research in frontier areas with the objective of developing cutting edge technologies in fisheries sciences
- To provide extension services to fish farmers, fisher folk, unemployed-youth and entrepreneurs in fisheries sciences
- To set up an aquatic disease diagnosis and surveillance system in the State.

The University has a Fisheries College and Research Institute at Thoothukudi, 4 Fisheries Research and Extension Centres viz:- Tharuvaikulam in Thoothukudi, Madhavaram in Chennai, Parakai in Kanyakumari and Thanjavur, 3 Institutes of Fisheries Technology viz:- Ponneri in Tiruvallur, Nagapattinam and Chennai; a Maritech Research and Extension Centre, Tharuvaikulam in Thoothukudi and a Staff Training Institute at Chennai

### Fisheries Education

*Undergraduate Programme*

B.F.Sc is a four years professional degree programme in fisheries fcience with an intake capacity of 40 students every year. The college has adopted the ICAR – nationwide common syllabus pattern for B.F.Sc. programme from the academic year 2009-10.

*Post graduate Programmes*

M.F.Sc is a two years post graduate degree programme offered in eight disciplines, M.Phil in Climatic Change and Fisheries, Ph.D. programmes are being offered in regular and part time mode in four disciplines.

*Research Areas in Fisheries*

The prominent areas of research in the area of aquaculture are: improving the quality of progeny by developing sperm bank, development of techniques for the culture of fin fish in cages, enhancing the water use efficiency and productivity by bio-floc technology, developing the improved methods of ornamental fish culture and breeding techniques and inventing techniques to prevent and cure fish diseases. Stock assessment of important fishery resources, mapping the fauna and understanding the biology of commercially important and rare species, Coastal area and inland waters monitoring for the major pollutants and waste water management are the focus areas of research. In the area of harvest and post harvest technology, new fishing gears and techniques have been developed. Value addition to fish has been a major focus area and technologies for fish pickle, fish noodles and ready-to-eat products like fish curry, fish puff, fish cutlet and fish burger have been evolved. Quality control wing of fish processing has evolved several rapid techniques for detection of human pathogens.

A separate laboratory for quality monitoring will be built to help the industry. Quality of fish for microbes, nutrients and contaminants will be monitored on regular basis. Development of fish culture production models for the State, economic evaluation of mangroves, role of Self Help Groups in fisheries will be evolved. Fisheries extension is another major activity of the University and research and training centers will be spread throughout the State. Several training programs will be organized on a regular basis to transfer technology and empower people with new skills and information to enable themselves to be innovators.

In this era of globalization and rapidly emerging communication means, building partnership with people and institutions is seen as a cornerstone in bringing benefits to humanity and safeguard environment. Keeping this in view, since 2010-11, a proactive initiative has been undertaken to build partnership with the national and international institutions by entering into Memorandum of Understanding (MoUs).

## Twelfth Five Year Plan

### Goal

The goal is to help the fisheries sector to be resilient and to help fishermen and farmers to increase their income through fisheries research.

### Objectives

The objectives of fisheries research and education during the Twelfth Five Year Plan period are:

- To impart quality education in different branches of fisheries science
- To evolve breeds/technologies for sustained increase in yield and to meet the end users' expectations interms of quality and food safety.
- To harness research output of frontier sciences to increase value added fish products, storage and processing.
- To provide extension services to fish farmers, fisher folk, unemployed youth and entrepreneurs in fisheries sciences.

### Strategies

Broad strategies envisaged for achieving targeted growth in Tamil Nadu would cover four categories: a) Fisheries education to cater to the globalising needs, b) Research for innovative solutions, c) Putting innovative solutions into practice and d) Promoting agribusiness with fisheries as a base.

## Strengthening of Staff Training Institute

At present, staff training institute is located in a rented building and it does not have adequate facilities to train staff on various aspects of fisheries. It is planned to strengthen the staff training institute and it is proposed to enhance the capacity of staff in rapidly emerging areas like climate change, mainstreaming, stock assessment, farmer participatory research, food safety and certification, environmental monitoring, etc.,

## Establishment of Aqua Health Clinic

It is proposed to establish one State level and three regional level state-of- art laboratories for the benefit of aqua farmers with central funding to increase the aquaculture production and export earning.

## Fisheries Technology Institute, Ponneri

Fisheries Technology Institute is being established at Ponneri, Thiruvallur district with a objective to build the capacity of fishermen and fisherwomen on fish culture and development of fisheries. The outlay for the institute has been included in the sub chapter 3.8. Fisheries.

An amount of ₹148 crore proposed for TNFU for the Twelfth Five Year Plan is given in the Table 3.4.5.

**Table 3.4.5: Twelfth Plan Outlay – TNFU**

(₹ crore)

| S.No. | Schemes | Outlay |
|---|---|---|
| **I** | **Ongoing Schemes** | **10.00** |
| **II** | **New Schemes** | |
| 1 | Centre of Excellence in Food Processing | 5.00 |
| 2 | Strengthening FC & RI, Thoothukudi | 5.00 |
| 3 | Special Res. contingency to each & every staff members | 2.00 |
| 4 | Institute of Distance Education for Skill Development | 1.00 |
| 5 | Student / Faculty Exchange programme in National and International | 1.00 |
| 6 | Bio-safety Level Laboratories | 5.00 |
| 7 | Establishment of Fisheries Regional Research Stations and Fisheries Research & Training Centres in different districts of Tamil Nadu | 3.00 |
| 8 | Establishment of Additional Fisheries College in Tamil Nadu | 20.00 |
| 9 | Establishment of University Library, digitization and networking of libraries of Fisheries University | 2.00 |
| 10 | Central instrumentation facility for constituent colleges | 5.00 |
| 11 | Continuing Education in Fisheries sciences | 1.00 |
| 12 | Special contingency grant for transfer of Technology | 1.00 |
| 13 | Creation of need-based and Location-Specific Centres at the existing University Centres | 2.00 |
| 14 | Thrust areas for Fisheries Research and Education | 35.00 |
| 15 | Establishment of Fisheries University at Nagapattinam | 50.00 |
| | **Total - New schemes** | **138.00** |
| | **Grand Total - TNFU** | **148.00** |

## Agricultural Research and Technology Development

Since its establishment, Agricultural Research System (ARS) has made real progress in generating technologies for improving the productivity of crops, forestry, fisheries and livestock. Its performance in terms of returns to investment in agricultural research and development has been rated high (₹ 29 per rupee invested). Impact studies conducted indicate that investments in agricultural research have made more impact on poverty reduction than investments in the road, health and education sectors (IFPRI, 2006). This success has been attributed to the provision of technologies that enhance production and productivity by agricultural research institutions. Despite the above, significant challenges still prevail. Hence, the research system will invest in innovation from the traditional 3F (food, feed, fibre) to 6F (feedstock for industry, fuels, farm-aceuticals). Further, the research concentration will be more on maximising yield per acre, per unit of precipitation, per unit of fertilizer, per hour of work and minimise the cost per unit of production. Thus, ARS needs revamping.

While the ARS has been able to generate a number of technologies, most farmers have not been able to access them and poverty levels still remain unacceptably high. To address this, ARS will be strengthened so that it can generate more technologies further along the value chain, improve its ability to compete in the global knowledge market, coordinate and assure the quality of the services provided by an increasing number of participants and ensure continuity in research capacity for pursuing cutting edge science. The ARS should target the agro climatic zones for accountable technology development and technology as per the suggestions of the State Appraisal Committee (Kannaiyan's Committee, 2009).

### Some of the Key Principles involved are:

- Decentralization of research services and reaching a balance between subsidiary stakeholder involvement and the need to maintain a critical mass of scientists
- Mainstreaming the Integrated Research for Development
- Further enhancement of the quality of the service providing process aimed at improving products and services to farmers
- Developing and maintaining a core strategic programme of advanced science to feed the adaptive research activities at the zonal level. Centres of Excellence will cater to the innovation, patents and knowledge delivery to the site specific problem.

To achieve this objective, activities will be implemented under three components.

### Generation of New Technologies, Practices and Strategies (for improved uptake of technology and knowledge)

Demand driven market oriented and innovation focused research and research programmes on emerging issues of strategic nature (nutrition and climate change)will be undertaken. These components will be supported with the core research activities of Tamil Nadu as well as expanding and introducing Competitive Grants System (CGS). The CGS will finance strategic and zone specific programmes to maintain ongoing research as well as to undertake new work (including activities in climate change, sustainable soil health, precision farming, secondary agriculture and land management). It will also strengthen interaction with key value chain and innovation system stakeholders, notably small scale processors, based on the principles of joint diagnosis and planning, interactive learning and multi-dimensional assessment.

## Strengthening of Demand-driven, Market-oriented and Innovation focused Research

Designing and implementing mechanisms for stakeholder needs identification and response, holding annual priority setting exercises, training stakeholders in demand articulation, designing impact assessments of projects and programmes and developing innovative methods for the diagnosis of constraints and opportunities viz:- Peri-urban agriculture, Urban agriculture, Hydroponics, High-density planting, Protected cultivation, Rhizosphere engineering, Revival of trees, Coastal wind shield, Micro irrigation, Inland fisheries, Location selective breeds, Race animal, Speciality animal, Quality meat, Packaging and cold storage, Dormancy and keeping quality, Nutritional grains, Quality oil, Unit productivity and profitability, Value addition and marketing, Pest and disease surveillance.

## Implementation of Core Strategic Research Programmes

Generate technologies, strategies and practices addressing core national and zonal priorities, Develop Centres of Excellence, Liaise and undertake joint research with other regional Centres of Excellence and share information and research outputs with other Regional Centres of Excellence.

## Initiaing Research Programmes on Emerging Issues of a Strategic Nature (including climate change and nutrition)

Identify, develop and implement projects for emerging issues, provide short maturing and quality seed and cuttings for planting food and cash crops, improve livestock and crops in terms of resistance to drought, disease and pests and in terms of increased yields in a shorter time, develop drought resistant pasture and forage for animals in pastoral areas and develop nutrient dense crops and innovative farming systems for improved household food security and nutrition.

## Non-core Research Priorities Implemented through the Competitive Grant Scheme (CGS)

Prepare and fund research projects through CGS: Allocate funds for the CGS programme; andGenerate technologies, strategies and practices (innovation/patents) from the CGS projects

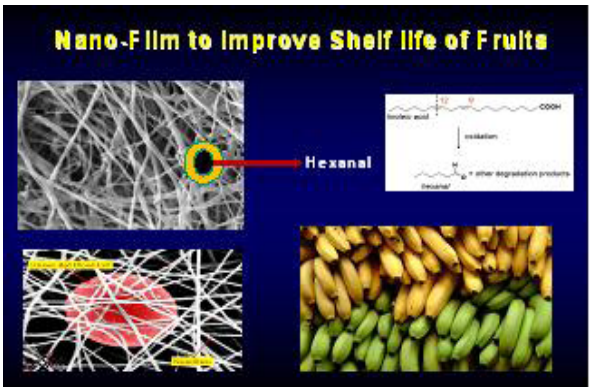


Fig.3.4.2. Nano films

## Monitorable Indicators

The general indicators for monitoring besides specific indicators are given below.

- Higher yield level/ quality of output (grade)
- Higher farm income
- Hybrids and high yielding varieties (HYVs) developed based on end user demand
- Greater proportion of exportable quality of produce
- Adoption of weather based and market information based crop planning by farmers
- Greater provision of market information and market intelligence
- Post harvest management (reduction in post harvest loss and higher shelf life).
- Higher percentage of processing
- Mechanization (types of operations and levels and comparison of labour vs. mechanized operations)

- Promotion of agri business through focused entrepreneurship development (Agri Business Incubator)
- Knowledge empowerment of farmers (Number of farmers graduating and trained)
- Higher use of ICT in technology transfer and agri marketing
- Increasing Water Use Efficiency
- Improving soil health through increased organic matter content and physico-chemical properties of soil.
- Greater number of farmers following soil test based manure and fertilizer application
- Greater number of farmers using Integrated Nutrient & Integrated Pest Management
- Greater number of farmers using technology information systematically
- Increased participation of stakeholders in research planning, execution, transfer of technology (farmer Group/Association, Water User Association, etc).
- The specific benefits and indicators for monitoring are given then and there, where ever necessary.
- Excellence in the academic, research and extension in veterinary and animal sciences will facilitate acccelerated annual compound growth rate of 4 percent in milk, 8 percent in egg and 10 percent in meat.

**Table 3.4.6: Abstract of Total Outlay for Twelfth Plan – Agricultural Research**

(₹ crore)

| S.No. | Institution | On going Schemes | New Schemes | Total |
|---|---|---|---|---|
| 1 | Tamil Nadu Agricultural University | 430.00 | 754.00 | 1184.00 |
| 2 | Tamil Nadu Veterinary and Animal Sciences University | 190.00 | 402.00 | 592.00 |
| 3 | Tamil Nadu Fisheries University | 10.00 | 138.00 | 148.00 |
| | **Total** | **630.00** | **1294.00** | **1924.00** |

Fig.3.4.3: Sustainable Sugarcane Initiatives