

Agricultural Extension and Advisory Systems in Tamil Nadu

Working paper 3

MANAGE Centre for Agricultural Extension Innovations,
Reforms and Agripreneurship



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About the publication

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Foreword

Extension system has been a beacon of Indian agriculture right from the 1950s with the initiation of the Community Development Programme and National Extension Service. Subsequently, the extension support system ushered in in the 1960s on High Yielding Varieties and improved farm practices (Green Revolution) had demonstrated the extension capacity of India to the world. This has also made the country self-sufficient in food grain production. Subsequently, there evolved several extension models and state-specific extension systems to cater to the varying needs. Tamil Nadu, with its vast network of line departments (agriculture and allied departments), private and NGOs has made a number of extension initiatives, which helped the state to be a leader in food grain production, integrated horticultural growth, livestock management and fisheries development. However, the changes in climate, the priority of the people, demand of the market (national and global), value/supply chain, the behaviour of consumers, etc., demand a tailor-made extension system that suits both domestic and global needs. Therefore, it is imperative to understand the present extension systems and innovations of the state, while keeping the view on the needs of farmers and global demand.

This working paper has analysed the extension systems of the line departments, ATMA, Private Extension and NGOs and analysed the strengths and challenges of each stakeholder in carrying out the extension. Particularly, the good extension practices such as Collective Farming, Uzhavan Mobile App (Farmers' App), Agripreneurship, Micro Irrigation Management Information System" (MIMIS), Livestock Extension on Wheels, Village level Custom Hiring Centres, international exposure visits of fisheries personnel among others are worth replicating. While, the challenges such as low budgetary provision for the extension, inadequate manpower, overlapping of works, inadequate convergence (ATMA), inadequate follow up of the recommended technologies, their performance analysis etc., needs re-examination by the state. Nevertheless, the state has pioneered several extension reforms, time once again demands the best course of actions and policy frameworks that will transcend the extension reformations needed for the state at present and henceforth. The study has also come up with specific recommendations, which may provide an insight for the state to revamp and strengthen the extension systems by duly co-developing suitable strategies. This will translate into high productivity (agriculture and allied sectors), enhanced supply chain, better economic gain (for both farmers and state), and enhanced agricultural prosperity of the state globally.

(G. Jayalakshmi)

MANAGE, Hyderabad
29. 07. 2020



Dr. Saravanan Raj
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Preface

Technological advancement and good practices per se will not improve agriculture, while they are inseparable parts in agricultural/ farming systems. The technology should be the ones that meet the needs of farmers, locality of the farming system, demand of the market and the expectation of the traders, consumers, enabling policy environment. This is where extension systems continue to play a greater role among agricultural innovation systems stakeholders. However, the changing needs of farmers and ever-changing climate not only require sustainable technologies but also good extension strategies, models, approaches, networks, partnerships, mobilising in groups and working with the systems approach. Therefore, every time, there is an opportunity for a specific “extension approach” to bring desirable changes in each farmer in terms of knowledge, skill and capacity, also to adapt to the changing times.

The state, Tamil Nadu, is proven to be one among the best states in the country in terms of evolving the best-fit extension models based on local conditions such as group approach (collective farming), ICT based advisory services (Uzhavan App), cluster approach (block wise CHC), allied extension (Animal Mobile Medical Ambulance), market led extension (e-NAM), entrepreneurship etc., along with its regular training and capacity building programmes. However, the key attributes relating to better farming by every farmer remain ignored, even as the socio economic status of most of the marginal and small farmers. It is, therefore, to analyse the challenges of extension advisory systems in the state in terms of reaching out to every farmer and of catering to the specific needs of them, this study was carried out. Findings of the study elucidate several replicable extension models for other states and the process of their success criteria, it has also analysed challenges of the extension advisory systems that need the attention of development professionals and policymakers.

The constraints such as the low budget for agriculture (most of which go in the form of subsidy), widening extension worker to farmers ratio (1:1834), growing absentee landlordism, lack of convergence between extension (line departments) and research systems, non-availability of location specific, lack of market facilities, limited farm support services and inadequate rural infrastructure, etc. deter the extension systems to reach their fullest capacity. Also, the challenges such inadequate manpower, low budget and lack of independence in ATMA, coupled with increased desk works, lack of time for field visits, reducing knowledge of scientific agriculture among extension professionals, subsidy/input based extension services of every line department have failed to reflect the demand of the agrarian community in the state. Henceforth, the findings of the study are vital for the policymakers of agriculture in the state to make necessary amendments. As agriculture being the state subject, the state needs to reorient its agricultural extension policy in a way that it will not only address the challenges of extension systems, but also replace its present extension approaches with community based sustainable extension approach with special emphasis on promoting rural innovations, incubation and agri-business.

(Saravanan Raj)

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29. 07. 2020

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Abstract

Extension is a lifeline of agricultural growth and farmers livelihood, thus to understand the status of agricultural extension and advisory systems in Tamil Nadu, a field level study was undertaken during 2017-18. The study revealed that the extension services namely technology transfer, demonstrations on modern technologies, trainings on improved agricultural practices accompanied by capacity building on IPM/ICM and Agro Eco System Analysis (AESA)/ in agricultural crops and horticultural crops respectively are an integral part of the activities of the line departments. However, these extension services are less effective in addressing every farmer's need regarding awareness/knowledge, technology, information, innovation and advisory service. However, the extension advisory systems of KVKs, ATMA, private and third sectors (Tirunelveli Social Service Society, CREATE, Ayakudi Guava Producers Company Limited, Velliangiri Farmer Producer Company Ltd (VFPCL), entrepreneurs etc.,) have been delivering exceptional agro advisory services to the farming community in Tamil Nadu. It is also evident that, the farmers depend mostly on private dealers for inputs like fertilisers, pesticides, herbicides and so forth and 68.6 % of the information need of the farmers come from input dealers in Tamil Nadu. The study sheds light on emerging issues in crop production, value chain management and marketing, knowledge management, ICTs, human resource management, agriprenurship and agri-business, gender inclusion, extension and pluralism, subsidies, insurance, policies and schemes and so on. The study elucidates suitable recommendations coupled with policy implications for organising extension in Tamil Nadu so as to transform and revitalise the agricultural extension and advisory systems in the state, which will pave a road map for effective extension systems.

Executive summary

In a rapidly changing climate, farm resource, cropping pattern, irrigation water availability, value chain management, consumers' preference, supply and demand and in Tamil Nadu, each farmer's need for awareness/knowledge, technology, information, innovation, advisory service and among others differs significantly. Recent evolution in extension has changed the focus of extension stakeholders (Public, private and third sectors) from technology transfer to agri business, which has put the agricultural extension as an essential part in development of farm sectors and livelihood of farmers in the state. Agricultural extension system helps in linking the farmers with all of its stakeholders so as to enable the farmers to sustain the farm productivity, sustainability, marketing and income. In this circumstance, MANAGE has taken a grass root level research to understand the status of Agricultural Extension and Advisory Systems of public, private and third sectors (NGOs, producers organisations, input dealers and entrepreneurs) in the state of Tamil Nadu along with the present challenges in agriculture and allied sectors so as to transform the extension systems of the state.

The major stakeholders of extension system in the state are the Department of Agriculture (DoA), the Department of Horticulture and Plantation Crops (DoH), the Department of Agricultural Engineering (DoAE), the Department of Agricultural Marketing and Agri-Business, the Department of Animal Husbandry, the Department of Fisheries, Department of Sericulture, the Agricultural Technology Management Agency (ATMA), the NABARD and supportive extension like the Tamil Nadu Agricultural University (TNAU), the Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), the Tamil Nadu Fisheries University (TNFU), Krishi Vigyan Kendra (KVK), the Farmer Producer Company, the Non-Governmental Organisation (NGO) and private extension players namely agricultural input companies.

With major extension activities carried out by the Department of Agriculture (DoA), the other line departments have been helping the state extension systems with their coordinated agro advisory services in reaching out to the farmers and catering to the needs of them. The Department of Agriculture focuses on crop production along with supply of inputs for crop production. The department of Horticulture and Plantation Crops involves in increasing area under horticultural crops and value chain management of vegetables and fruits, the Departments such as Fisheries, Animal Husbandry and Sericulture, concentrate on both production and marketing of fishes, livestock and silkworms respectively. Moreover, the activities of the line departments encompass skill development trainings, demonstrations, Farm Field Schools, Adoptive Research Trials, entrepreneurial development and Transfer of Technology with both extension to farmers contact and ICTs. Similarly, private and third sectors extension services include capacity/skill building of farmers on modern/innovative crop production technologies, value added services on value chain management and marketing of farm produces, ICTs based customised advisory services pertinent to weather information, crop production practices and post-harvest management. The major findings of the study are,

Public Extension

- The State Agricultural Extension Management Institute (STAMIN) and Farmers Facilitation Centre (FFC) and Water Management Training Centre (WMTC) are key public institutes, which impart skill and capacities of the extension functionaries and farmers in the state through periodical trainings and capacity/skill development programmes on latest technologies and agricultural innovations. STAMIN, FFC provide trainings to not less than 0.25 lakh extension functionaries/farmers/youth/entrepreneurs every year, 0.29 lakh were benefited from the trainings of STAMIN and FFC during 2016-17. WMTC trained about 1100 field level extension functionaries during 2016-17.
- KVKs-TNAU organised about 991 OFT, FLD, on and off campus trainings, campaigns, pre and post seasonal trainings, etc., during 2016-17, which benefited 0.32 lakh farmers/youth/farm women/household women and among others, these extension activities helped farmers to get awareness and knowledge on Integrated Crop Management (ICM) in agricultural/horticultural crops, precision farming, Integrated Pest Management (IPM), value addition technologies etc

Agricultural Technology Management Agency (ATMA)

- ATMA's extension activities such as within district trainings, within district exposure visits, Farm Field School (FFS), demonstrations, interstate exposure visits, within state exposure visits, Kala Jatha together with ICTs based information dissemination are vital in educating farmers. It has been observed that not less than 250 extensions and agro advisory services are carried out every year in each district of Tamil Nadu, which benefit about 25 000 farmers from each district, i.e. more than 75,00000 (75 lakh) farmers in the state.
- ATMA's role in instilling awareness/knowledge on sheep and goat rearing, inclusion of fisheries into farming, low cost livestock-feed formulation, modern post-harvest technologies and water conservation techniques is successful in improving the productivity of farm and income of the farmers. importantly, portable Pico Projector is effective in dissemination of the modern technologies/good practices by the field extension functionaries among farmers.

NABARD

- NABARD helps the line departments, KVKs, NGOs, FPCs, Farmers Clubs, Self Help Groups, Private Sectors, TNAU, TANUVS, TNFUs, etc., with the finance and funds, with which the public, private and third sectors perform various extension advisories and agro services in the state of Tamil Nadu. Moreover, NABARD has its own role in formation of Farmers Producer Organisation, Farmers Clubs, SHGs, etc., which improve the farmers access to credit, farm inputs/machineries, technology, extension services and market.

Private Extension

- Private extension plays a crucial role in extension and agro advisory services in Tamil Nadu. The

organisations such as UPASI, Parry's corner, Dhan foundation, Hatsun Agro products, Sustainable Agro Alliance limited have been providing trainings and capacity building programmes among farmers/farm women/rural youth/ on modern crop production technologies, organic farming, value chain management, water conservation technologies, watershed programmes, Integrated crop management, etc. Similarly, NGOs such as CREATE, TSSS, ThiaMan, VK-NARDEP provide awareness campaigns, trainings, skill improvement programmes on organic farming, nutrition/ terrace gardening, etc. The Centre for Indian Knowledge System (CIKS) is exclusively working in creating awareness, skill and capacity of the farmers/household women/rural youth on community gardening across the state of Tamil Nadu.

- The MSSRF-Tamil Nadu organises Plant Clinics programmes (on camp live extension services) in each village of Tamil Nadu, which provide need based agro advisory services to the farmers on the basis of real time demand. The Cereal Systems Initiative for South Asia has trained and skilled more than 0.25 lakh paddy growers on modern rice farming technologies like laser land levelling, direct seeding of rice, mechanical transplanting of rice and among others hitherto.

ICTs

- WhatsApp based reporting has helped the extension functionaries to update the higher official about the status of scheme and its success within short span of time, it is a cutting-edge ICT technology as it improved the efficiency of time, space and extension activity. Moreover, WhatsApp reporting has brought transparency among extension functionaries in carrying out the field extension activities and implementation of schemes at the grass root level.
- Similarly, Agriculture Management and Information System (AGRI-MIS) of the state has a data base of 68 lakh farmers, which helps the line departments to identify the knowledge/capacity gap of each farmer and to develop extension strategies such as trainings, capacity building programmes, agriprenurship, etc.
- e-Extension initiatives of TANU such as TNAU Agritech portal, multi video conferencing facility and 12 Android mobile based expert Apps help farmers, researchers, extension functionaries, general information seekers and other from across the state. 6000 people visit the agritech portal on a daily basis thereof accessing 700-920 pages every day.
- The recent ICT initiatives of indiagriline (EID Parry), mKRISHI (TCS), Onefarm (Ekgaon technologies), Farm Field (SAAL), Reuters Market Light (Thomson Reuters), mASK provide customized/ personalised agro advisory services to the farming community across Tamil Nadu.
- CSISA provides trainings and demonstrations to paddy growers so as to create awareness and knowledge in use the Nutrient Manger for Rice (NMR) for site specific nutrition application in Tamil Nadu, more than 0.25 lakh farmers have been trained to use NMR so far in Tamil Nadu.

Agirpreneurs' extension

- Agirpreneurs have established various agri business models on vegetable nursery, online sale of organic produce, organic farming, traditional seeds, collective farming, social media, agri clinics,

value addition, veterinary, Integrated Farming System (IFS), etc., which help in maximizing the farm income, value chain management and marketing thereof improving the livelihood of farmers. Save Our Rice is an awareness campaign programme organised by the NGO CREATE across the state of Tamil Nadu, which helped around 0.37 lakh farmers to adopt traditional rice varieties and conserve them under community seed preservation and multiplication through seed production by farmers.

Farmers Producer Groups

- Farmers Producer Groups are a gamut of entire extension services in Tamil Nadu. The Farmers groups such as the Velliangiri Uzhavar Producer Company, the Ayakudi Guava Producers Company Limited, the Erode Precision Farm Producer Group etc., provide trainings/capacity buildings programmes, knowledge and awareness among the members and non-members farmers on various farm technologies to maximise the crop productivity. Besides, networking of farmers groups with the public institutes like Krishi Vigyan Kendra, the Department of Agriculture, the Department of Horticulture and Plantation Crops, the Department of Marketing and Agri-Business and private players/NGOs help them to organise awareness campaigns, exposure visits, Farm Field School (FFS) and hands on trainings on innovative farm technologies (nursery, bio-fertilisers, etc.)

Major recommendations emerged from the study

- Though the state provides skill and capacity improvement trainings to the extension functionaries through STAMIN, Water Management Training Centre, 22 Farmers Facilitation Centre (FFC) and the National Institute of Agricultural Extension Management (MANAGE), the extension functionaries of the state need reinvigorated trainings and capacity buildings on recent and advanced crop varieties, fertilisers, plant protective measures, farmer friendly farm machineries and post-harvest technologies as the changing cropping pattern and vagaries climate require advanced crop production advisory services. It is also evident that the farmers are increasingly depend on private dealers for crop management as the input dealers were found to have provided the latest technologies and advisory services to the farmers.
- Extension functionaries require more business skills along with knowledge and capacity on technical, organizational, managerial and communication so as to develop farmers as agripreneurs rather than mere producers.
- Agripreneurship and agri business are the two major evolutionary extension in agriculture, yet the knowledge of extension functionaries in the field agripreneurship needs to be enhanced so as to help them to provide agripreneurship trainings to the rural youth/unskilled labourers/migrating farmers, which will help the rural youth/farmers to venture into profitable agribusiness and provide employment opportunities to the resource poor agricultural labourers, household women, etc.,
- Extension functionaries' awareness/knowledge on market performance of new technology has been insufficient. It has been observed that, when the improved variety like TKM 13 was introduced as an alternate to the biotic and abiotic susceptible BPT 5201, the demand of TKM 13

among the traders and consumers was low due to preference of BPT 5201. Therefore, knowledge of marketing value of each technology and variety is necessary for extension professional working closely with the farmers before introducing them in the field.

- Though agro-tourism is an emerging area in the field of agriculture, extension functionaries have nascent exposure and knowledge pertinent to agro tourism in Tamil Nadu. So, extension functionaries need to be exposed and trained to promote agro tourism in the state of Tamil Nadu, which will help them to invigorate agricultural development in the state.
- Tamil Nadu has an abundant opportunity in small scale food processing industries. Extension functionaries' skill and knowledge in production of bio-fertilisers, organic manures, vermicompost, cow dung-based manures are limited owing to increased schemes-based extension activities coupled with increased work burden. Therefore, more trainings could be done to increase the extension functionaries' capacity on these organic input production methods in association with the NGOs/FPCs which are involving in organic farming.
- Trainings and awareness about value chain management of agricultural commodity are often a neglected area in extension advisory systems as most of the scheme-based extension services focus on modern crop production technologies and good crop management practices. In this context, the state government should focus on value chain management and training the field level functionaries to improve the farmers' Knowledge, Awareness and Skill (KAS) in value chain management of various agricultural commodities.
- Knowledge, skill and capacity of the extension functionaries on value addition technologies and practices are limited as schemes concentrating on crop production seldom focus on technologies for value addition and marketing. Therefore, extension functionaries are to be trained to demonstrate various commercially proven technologies to enhance the knowledge and awareness of the farmers in value addition.
- The shift in cropping pattern from agricultural crops to horticultural crops is predominant due to dwindling water resources, climate change and migration. If the corrective measures are not taken within time bound, then the shift toward horticulture may lead to unsustainability in the state. In this circumstance, there is an immense need for skilling the extension functionaries in developing efficient extension strategic plan in block level with the focus on technology, new farm practice, new cropping pattern so as to promote sustainable agriculture in Tamil Nadu.
- The third sectors like NGOs have become a major extension services provider in the state, thus the line departments should provide more opportunities for NGOs in terms of participation in the development of schemes/need assessment of farmers, collaborative demonstrations in Transfer of Technologies, trainings and capacity building on value chain analysis and development of entrepreneurs, etc. Convergence of line departments with NGOs is required in creation of awareness of schemes, assessment of location specific technologies, transfer of demand driven technologies and so on.

Tamil Nadu – An overview

Origin

Tamil Nadu is one of the oldest civilisations in the world with its beginning traces back to 5000 BCE i.e. the period of 'Lemuria continent or 'Kumarik Kandan', which was a part of Africa and Australian continent and the state represents the Dravidian Culture (Chidambaram, n.d.). Therefore, Tamil Nadu is believed to be the cradle of human origin. Sangam age is the golden period of Tamil Nadu as it sheds light on the earlier life of polity, culture, geography and agriculture of the state. The governing of the state had begun in 200 BCE and lasted till 300 CE. The early rulers of the ancient Tamil Nadu were the Pandyas, Cheras and Cholas kingdoms and the British empire was the last to leave the state with the mark of Independent India in the year 1947 (<https://goo.gl/dwskr3>). The name Tamil Nadu means the land of Tamils. The state was renamed as Tamil Nadu on 14 January, 1969 from Madras state by C. N. Annadurai, then the Chief Minister (CM) of Tamil Nadu.



Figure 1.1. Map showing the geopolitical location of Tamil Nadu in India

Geography

Tamil Nadu is the 11th largest state by area with the total area of 130 058 Sq.km, which is 3.96 % of the total land area of the country. 7th largest populous state in India. Tamil Nadu is located in the southern peninsula of Indian Subcontinent; the district Kanyakumari in Tamil Nadu marks the southernmost tip of the country. The state is situated in 8o05' and 13 o35' N latitude and 76015' and 80o20' E longitude. Tamil Nadu is bordered by the Union Territory of Puducherry in the East; the states like God's own country (Kerala) in the west, One state, Many worlds (Karnataka) in the north west, Andhra Pradesh in the North, the Bay of Bengal in the east, the Gulf of Mannar and the Palk strait in the southeast and the state shares its border with the vast Indian ocean in the south. Cape comorin is the southernmost tip, which is the confluence point of three major seas namely the Indian Ocean, the Bay of Bengal and the Arabian Sea.

The physiography of Tamil Nadu is divided into five major regions viz., the Kurinji/mountainous region, the Mullai/ forest region, the Palai/arid region, the Marudham/the fertile plains and the Neidhal/coastal region. The Western Ghats and Eastern Ghats are the two major mountainous ranges in the state of Tamil Nadu, both of which meet at the Nilgiri hills. The Udhagamandalam, Kodaikanal, Kothagiri and Yercaud are the famous hill stations. Palani hills and Courtallam are home to medicinal plants.

Tamil Nadu is also an abode of flora and fauna in the country with more than 3000 plant species spread across the state. The blooming of Kurinji flower in Kodaikanal hill once every 12 years is the natural gift of the state. A few KMs stretch of arid and semi-arid like red soil in the districts Tuticorin and Tirunelveli are one of the unique features of Tamil Nadu, which is locally called Theri soil by the inhabitants of Sothern Tamil Nadu.

The state has the third largest coastline (906.9 Km), which stretches from Kanyakumari to Chennai in the eastern side of the state. The rivers such as Cauvery (475 miles), Palar (182 miles), Thamiraparani (70 miles), Ponniyar (200 miles), Vellar (134 miles) and other small rives make the state highly fertile and favourable for agriculture.

Fact sheet of Tamil Nadu

- With 6.89 lakhs registered Micro small and Medium Enterprises (MSMEs), Tamil Nadu accounts for largest number of MSMEs (15.07 %) in the country.
- It is 100 % electrified state in the country and with the total installed capacity of 10,480 MW renewable energy (solar, wind etc.), Tamil Nadu is leader in this sector, which is 28 per cent higher than any other state in the country.
- With 23.72 % (30 850 Sq. Km) forest and tree cover, the state is resolved to achieve 33 % of the forest cover mandated by the National Forest Policy, 1996.
- 2nd largest GDP contributor in the country with the per cent share of 8.4 %.
- Tamil Nadu is the 2nd GST contributor in the country with 10 % share.

Economy

The prosperity of Tamil Nadu state's economy comes from agriculture, industries (automobiles & auto components, engineering, pharmaceuticals, garments, textile products, leather products, chemicals, plastics, etc.), service and tourism sectors. Tamil Nadu is the 2nd largest and 4th largest GST contributor and exporter of goods & services respectively in the country with the per cent share of 11.5 to the total exports of the country. The state is one of the 100 % electrified states in the country. (Economic survey, 2017-18). The state ranked top position in the country with regard to domestic and foreign tourist arrivals in 2014 and 2015 (GoTN-Tourism Policy Note, 2017-18). The state has 3 major ports (V. O. Chidambaranar Port Trust Tuticorin district, Chennai Port Trust-Chennai and Kamarajar Port, Tiruvallur district), the proposed one in Enayam, 23 minor ports, 7 air ports and well-connected road and rail network, with which Tamil Nadu has become one of the transport hubs in the country (IBEF, 2018).

Culture

Tamil Philosopher Kaniyan Poongunranar's saying "Every place is our village and every person is our family" is an epitome of Tamil Culture and traditional hospitality of Tamils. Tamil language is claimed to be one of the oldest languages in the world with its beginning dating back to 2500 years and it is spoken by 78 million people worldwide (Graves, 2018 and Seelinger, 2018). Tamil Nadu is also home to rich heritage of Dance (Bharathanatyam, Poikkal Kuthirai Attam, Karakattam etc.), festivals (Pongal, Karthikai Deepam etc.). Temples (Brihadeshwara temple, Ramanathaswamy, Meenakshi Temple, etc.), Cuisine (Rice, Sambar, Idly, coconut chutney etc.) and handicrafts (Paintings of Tanjore, Pottery, Woodcarving, Stone Carving and so on). The state encompasses several oldest art and literature like Thirukkural and Tholkappiyam; the Aimperumkappiyaṅka! are seevakasinthamani, valaiyapathi, kundalakesi, silappathikaram and manimekalai are said to be the great five epics of Tamil Literature. The harmonious coexistence of Hinduism, Christianity, Islam, Jainism and other religious groups stands out to be a prototype for unity in diversity of the state (Arunasalam, 2014).

Chennai is known as the ***Detroit of Tamil Nadu*** thanks to the presence of several automobile production industries.

Coimbatore is called the Manchester of South India as it homes to several small, medium and large-scale textile industries.

Tiruppur is dubbed as Dollar city/Knitwear capital of the country due its garment industries.

IBEF, 2018 and Kumar, 2008

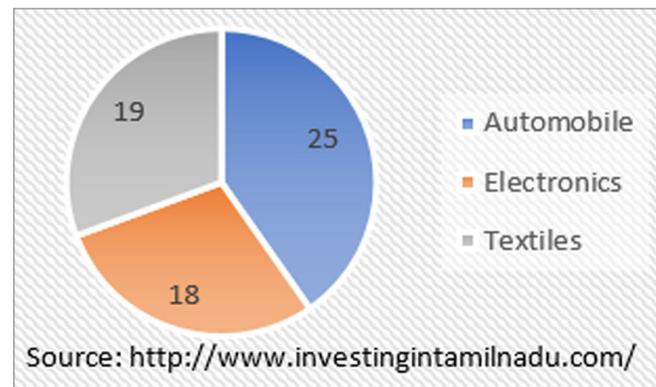


Figure 1.2. % share of industrial production to the country's total output

Demography

Total population of the state is 7.21 crores, of which 50.13 % male and 49.87 % are male and female respectively, the sex ratio of the state fairly performs well with the 995 females for 1000 males. The rural and urban population of the state is 3.72 and 3.49 crores respectively. Population density of the state is 555 per Sq. Km. Tamil Nadu is one of the fastest growing urbanised states in the country with 48.45 % its people living in urban areas. (Census of India, 2011).

Administration

The state has 32 administrative districts with Chennai its official capital. The state is further divided into 285 taluks, 385 blocks and 17 680 revenue villages for decentralised democracy (Annexure 1). The executive head of the state is Governor, who is assisted by the Council of Minister with the Chief Minister (CM) is its head. The CM of the state is elected on the basis of the election to the state legislative assembly. I.e. CM is elected for the tenure of five years through the majority of the state Legislative Assembly. The district administration is vested in district collector, who either selected through union or state public service commission's competitive exams. Similarly, the local administration of the state is vested in concerned public servants. High court is the highest judiciary authority in the state, which look into both civil and criminal cases of the state.

Agriculture

Tamil Nadu is divided into seven agro climatic zones namely (i) North Eastern Zone, (ii) North Western Zone, (iii) Western Zone, (iv) Cauvery Delta Zone, (v) Southern Zone (vi), High Rainfall Zone and (vii) Hilly Zone. The Cauvery delta zone is considered to be granary of Tamil Nadu. The net cultivated area of the state to the total geographical area is 37.08 per cent (48.33 Lakh ha). 80.35 % of the net cultivated area is under food crops followed by oil seeds, sugarcane and cotton (GoTN-Agriculture Policy Note, 2017-18). The major cereal crops of the state are paddy, pulses, oil seeds and cotton and other coarse cereals (GoTN, Statistical Hand book of Tamil Nadu, 2016). The area under horticulture is 14.76 lakh ha. With the 2.95 lakh ha of fruit crops and 3.14 lakh ha of vegetables, Tamil Nadu contributes 6 % in area under horticulture and 7 % in terms of horticultural production in the country (GoTN-Agriculture Policy Note, 2017-18). The total operational land holders of the state are 81.18 lakh, which are operating 64.88 lakh ha of cultivable lands. 61 % of the operational area belongs to 92 % of marginal and small farmers in the state. The average size of the land holding in the state is 0.8 ha whereas the country's average is 1.15 ha (GoTN-Agriculture Policy Note, 2017-18). Of the

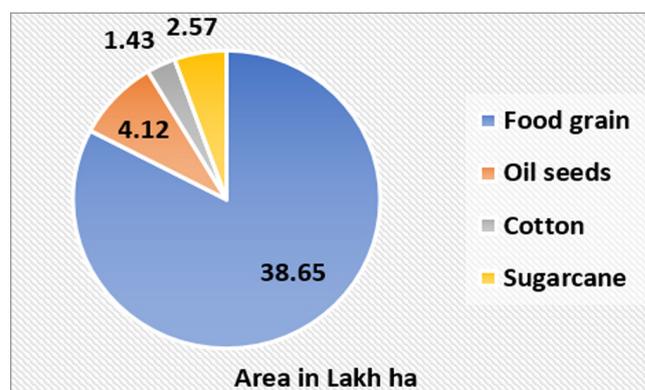


Figure 1.3. Area under major Agricultural crops in Tamil Nadu

total workers of 329 lakh, 42.25 lakh people (12.84 %) are cultivators and 96.06 lakh people (29.2 %) are agricultural labourers, thus nearly 42.04 % of the population is engaged in agriculture, of which 54.9 % is female (Census of India, 2011).

Tamil Nadu ranks 1st in productivity of maize, cumbu/pearl millet groundnut and total oil seeds in the country. In terms of productivity of rice and coconut, Tamil Nadu ranks 2nd in the country (Figure 1.6). In terms of productivity of sugarcane (93 MT/ha), Tamil Nadu ranks 3rd in India (GoTN-Agriculture Policy Note, 2017-18). The state ranks 1st in terms of area under banana, tapioca, cocoa and flowers in the country (Figure 1.4). Similarly, in terms of Production of major horticultural crops in Tamil Nadu production of banana, tapioca, plantation and loose flowers, Tamil Nadu occupies first in the country (Figure 1.5). Tamil Nadu state is also third largest fruit producer in the state next after to Uttar Pradesh and Maharashtra states (GoTN-Agriculture Policy Note, 2017-18). The state occupies significant place in vegetable production in the country with the tomato, onion, brinjal etc., being the major vegetables in the state of Tamil Nadu.

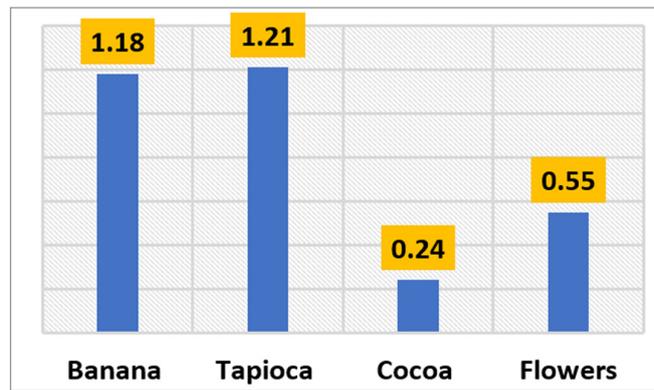


Figure 1.4. Area under major horticultural crops in Tamil Nadu

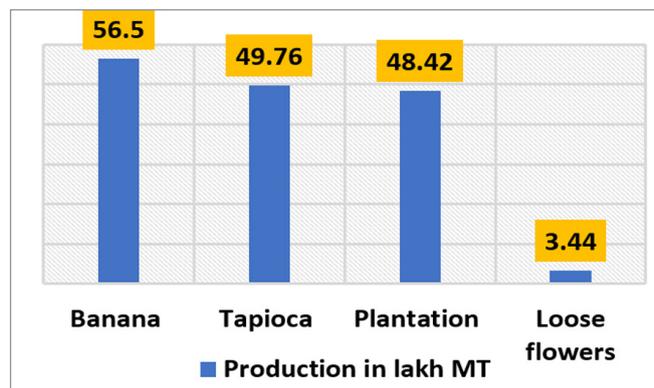


Figure 1.5. Production of major horticultural crops in Tamil Nadu

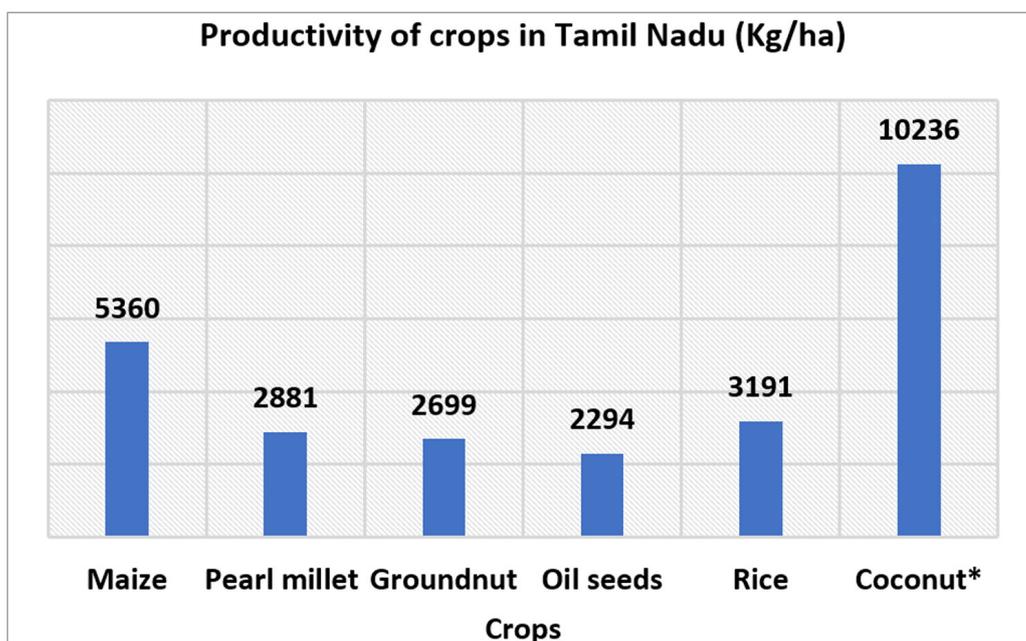


Figure 1.6. Productivity of crops in Tamil Nadu (*Coconut nuts/ha)

Agricultural extension and advisory systems in Tamil Nadu

Extension in Tamil Nadu was started with the Community Development Programme (CDP) in the early phase of 1950s and Intensive Area Development Programme (IADP) in the early 1960 and 70s. Of later, with the changed cropping pattern and needs of the farmers owing to the Green Revolution, the extension intervention was strengthened with the aid of World Bank in the form of Training and Visit System (T & V), which played a timely role in transfer of new technologies. But, it was during 1990s the state government's Tamil Nadu Agricultural Development Project (TNADP) integrated agriculture with its allied sectors namely Horticulture, Animal Husbandry, Fisheries, Sericulture and Forestry

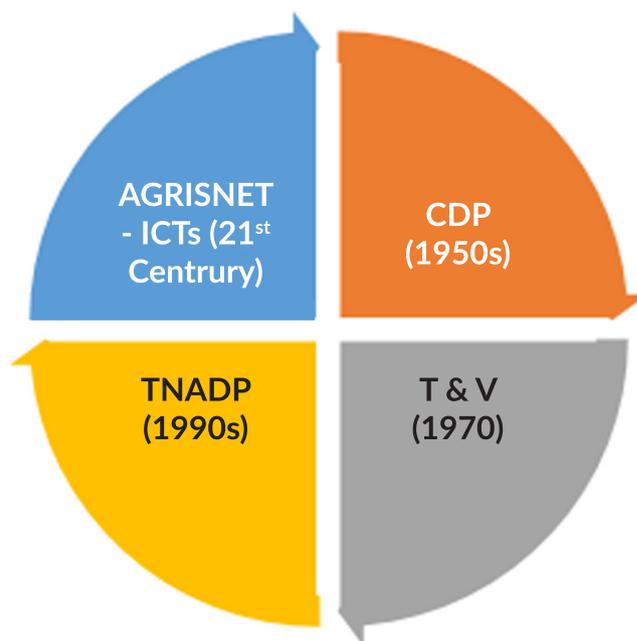


Figure 1.7. Evolution of Extension systems in Tamil Nadu

under one umbrella of the Broad-Based Extension System. With the dawn of 21st century, the state government stepped into its own Agricultural Information and Services Network (AGRISNET) to connect extension officers with all the farmers online. With this web-based information, another ICT based intervention Farm Crop Management System (FCMS) was initiated by the state government to map the resources/factors of crop production in the farms so as to enable the farmers to cultivate crops with respect to the available resources in consultation with the extension officers. (<https://goo.gl/SJqYCr>). Besides, the Department of Agriculture has been working at the grass root level to meet the growing need of the farmers and to provide sustainable technologies, farming support, revamping sustainability in farming, and confront the declining trend of land holding, (Agricultural trend in Tamil Nadu <https://goo.gl/2QYrNc>).

At the present time, ATMA is closely working with all the line departments in carrying out the extension and advisory services needed by the farmers. ATMA works on following extension activities namely demonstration, farm school, within district training, intra and inter-state exposure visit, Kalajatha, exhibition, farmers award, dissemination of information on print, electronic media and local media. All of these extension activities of ATMA cover latest technologies in agriculture, horticulture, animal husbandry, fisheries, sericulture and agricultural marketing. Thus, the ATMA's convergence with the allied departments has improved the effectiveness of the extension systems in the state.

Methodology

Multisectors viz., the Department of Agriculture, the Department of Horticulture and Plantation Crops, the Department of Agricultural Engineering, the Department of Agricultural Marketing and

Agri-Business, the Department of Animal Husbandry, the Department of Sericulture and supportive extension like the Krishi Vigyan Kendra (KVK), the Farmer Producer Company and the Non-Governmental Organisation (NGOs) were reviewed. Review of existing studies, annual reports, annual publication, policy documents, literature etc., both quantitatively and qualitatively has been carried out to analyse the strength and challenges in the agricultural sectors and value chain management. Community forum was organised to triangulate and validate the reports of the sectors besides, interviews with practitioner/stakeholders of agricultural extension and advisory system in Tamil Nadu coupled with the review of ICTs and Social media based Agricultural Extension and Advisory System (AEAS) were carried out so as to understand the effectiveness of the agricultural extension systems and capacity gaps in Tamil Nadu.

Research design

Ex post facto combined with concept/policy analysis, summative evaluation of extension designs was followed to assess the status of agricultural extension and advisory systems along with value chain management in Tamil Nadu.

Sampling location

A total of 7 districts from the total of 32 districts was selected from each of the agro-climatic zones of Tamil Nadu. For this purpose, four criteria were followed, they are (i) Total gross cropped area (ii) Total net irrigated area (iii) Total food crop area and (iv) Cropping intensity. The selected districts for the study were Villupuram from North Eastern Zone, Salem from North Western Zone, Coimbatore from Western Zone, Thiruvarur from Cauvery Delta Zone, Tirunelveli from Southern Zone, Kanayakumari from High Rain fall Zone and Nilgiri from Hilly Zone (Annexure 2).



Figure 1.8. Tamil Nadu map showing the selected districts for the study

Data collection

Secondary data from books, reports, accounts, annual reports, policies, documents, research articles, case studies/success stories, blogs, newspapers reports, websites, portals were collected. Primary data were collected using qualitative methods such as Focus Group Discussion (FGD), Individual interview,

open ended questionnaire, document data, technology performance data and observation data. The extension functionaries of the state were selected on the basis of purposive sampling (critical case and targeted sampling) so as to extrapolate the status of agricultural extension and advisory systems in the state of Tamil Nadu. The extension activities of public, private and third sector (NGOs, FPOs etc.) of Tamil Nadu were also analysed.

Selection criteria of sampling districts for the study

The district was selected against four criteria viz., (i) Total gross cropped area (ii) Total net irrigated area (iii) Total food crop area and (iv) Cropping intensity) + or - one criteria. I.e. when the district of each agro climatic zone fulfilled at least two/three of the four selected criteria, the district has been selected as the representative district of the agro climatic zone for the study. Moreover, the first three criteria were assigned with the weight score of 0.5 and the fourth criteria with 0.25, so to avoid the selection conflict i.e. when two/more than two districts fulfill the selected criteria in the same agro climatic zone, then the weight score was followed to eliminate the conflicting district. In this context, In the North Eastern Zone, though Cuddalore, Tiruvannamalai and Villupuram districts have fulfilled the two of the four enlisted criteria, the district villupuram was selected on the basis of the weight score assigned to the criteria 4/cropping intensity i.e. 0.25.

Challenges in agriculture in Tamil Nadu and their implication for organizing extension

Identification of right challenges in agriculture/allied sectors plays a vital role in formulating effective extension strategies and policies. Though challenges faced by farmers have been addressed with the schemes/programmes of the government over a period of time, the conditions of farmers have remained the same. In this context, the study has identified the emerging challenges in agriculture and elucidated the causes of challenges comprehensively so as to transform the extension systems in the state of Tamil Nadu.

Emerging challenges in agriculture in Tamil Nadu

Declining phase of agriculture in Tamil Nadu

- In Tamil Nadu, agriculture is in declining phase due to multipronged challenges. Net sown area of the state reduced at 0.68 % per annum (NDDDB, 2014). At present, the per cent share of net sown area is 37.08 (48.33 lakh ha) to the total geographical area (130.05 lakh ha) of the state while the net sown area was about 47.20 % in 1970s (GoTN, 2017-18 and Ramasamy et al, 2005).
- Contribution of agriculture to the state GDP reduced to 7 % during 2016-17 from 15 % during 2002-03 (GoTN-Agriculture Policy Note, 2005-06).
- Increasing trend of fallow lands is not uncommon in Tamil Nadu as a result of bio-physical (erosion,

soil texture and available nitrogen) and socio-economic condition namely size of land holdings and fragmentation of lands (Dharumarajan et al, 2017). Fallow lands (Both current and other fallow lands) increased to 21 % (27.32 lakh ha) during 2016-17 from 17.63 % (22.93 lakh ha) during 1990-91.

- Presently, area and production of oil seeds are 4.08 lakh ha and 9.73 lakh MT respectively (2013-14) as against the area of 8.64 lakh ha and production of 13.91 lakh MT during 2004-05 (GoTN-Agriculture Policy Note, 2005-06 and GoTN-Agriculture Policy Note, 2015-16). Diminishing trend of area and production of oil seeds might be attributed to high concentration on food grain production and lack of field level research/extension to study the advanced technologies required by the oilseed crops.
- Despite being the annual average rainfall (921 mm) of the state is lower than the country's annual rainfall i.e. 1200 mm, the state has been witnessing a decline in annual rainfall reception in the past decade on account of changing climate, reduced vegetation globally, increased anthropogenic induced global warming etc. To add to the situation even worse, the annual rainfall of the state was at its epic low in 2016 as the state received only 168.30 mm from North East Monsoon as against the normal rainfall of 440 mm, which had been considered to be the worst monsoon failure in Tamil Nadu nearly after 141 years (GoTN-Agriculture Policy, 2017-18).
- Farmers leaving agriculture show an increasing trend, nearly 8.67 lakh farmers have left agriculture in Tamil Nadu in the last decade (PTI, 2014).
- Subsidy system of the schemes has failed to capitalise the fiscal resource needed for the resource poor farmers because of their inaccessibility to most of the benefits of schemes. Moreover, the high ceiling rate of lands, lack of collateral records and inadequate documents have posed deterrents in obtaining the subsidy given in the schemes. Even after, 70 years of independence, the livelihood status of the marginal and small farmers remained unchanged owing to the subsidy led schemes.

Historically, farm prices have been kept suppressed to keep industrial wages low. This meant monopoly procurement laws and intermediation through the Agriculture Produce Market Committee (APMC). But, that has been compensated by providing the farmers with highly subsidized inputs-water, electricity, fertilisers, credit and seeds. But, this did not benefit the really needy, subsistence farmers.

*Ajit Ranada, Editorial,
The Hindu (dated March, 22, 2018)*

The Tamil Nadu government informed the Supreme Court that suicide of farmers is integrally linked to problems and deficiencies in the farming sector as the target of various schemes did not benefit the farmers. It was reported that, 606 and 200 farmers suicided in 2015 and during 2016-17 respectively.

Venkatesan, "Tamil Nadu admits farmer suicides, sees link to agricultural problems", 2017, Madhav - India Today, 2017 and Mahapatra, 2017

Increased table work and reduced extension services

- The ratio of the farmers to extension worker is inadequate in the state i.e. 2500:1, which results in incompetency in assessment of the farmers' need, transfer of technologies and information dissemination right from weather forecast to market demand. Furthermore, increased paper works and less extension activities along with amplified financial accountability pertinent to each scheme were found to have affected the extension system of the state; attending more meetings such as meetings with collector about collective farming, micro irrigation, insurance, 20-point programme, bankers meet, mass contact programme and ad hoc meetings deters the extension functions of the state as well as these meetings are held almost four to five times a week. All of which, led to inadequate time for technical supervision of farm activities and attending to farmers' necessity (Mr. Senthemizhselvan, JDA, Personal communication, March, 2018 and Ravindran et al, 2007).
- The works based on schemes mostly aim at increasing the area and production of agricultural/horticultural crops, which consequently give rise to compulsive pressure among extension functionaries in achievement of the physical and financial target encompassed in each scheme viz., National Agriculture Development Programme (NADP), National Mission on Sustainable Agriculture (NMSA), Seed Village Scheme (SVS), Pradhan Mantri Fasal Bhima Yojana (PMFBY), Pradhan Mantri Krishi Sinchai Yojana (PMKSY), National Food Security Mission (NFSM) to name but a few. However, the mission mode approach of the schemes has failed to deliver the need of the farming community and solve the emerging issues in farming sectors. Moreover, the target fixed under each scheme is not based on the real field situation (Ravindran et al, 2007). It is also evident from the reduced share of food grains production of Tamil Nadu to the country's total. The state contributed around 7 % of food grain production in the country during 1965-66 yet the state share reduced to 5 % presently (Viswanathan, 2017).
- The agricultural extension system in Tamil Nadu is still organised around a modified Training and Visit (T & V) system and the focus is mostly on major food crops (World Band, 2004). On the other hand, ATMA has been functioning just as an extension support system of the line departments. However, these universal extension systems seldom result in catering to the demand of the different categories of farmers in the state as cropping pattern, farm resources, educational level, farm income, information access, extension person contact of these farm categories (Marginal,

In Tamil Nadu, the ratio of extension worker to farmers is 1:2500.

Shareef et al, 2012

I have shifted my six of ten acres of paddy area to Casuarina in 2012-13 owing to labour and water scarcity. I irrigate Casuarina once in 20 days, thus I am able to save not only water but also wages spent on irrigation. Besides, traders buy the poles (Casuarina poles) at 3.5 to 4 lakhs per acre since it has more market value in paper mills.

(Mr. K. Tamilvanan, Samathakuppam village, Melmalayanur block of Villupuram district)

small and medium and big farmers) differ markedly.

- Time available for providing crop based advisory services/location specific extension is also less, as most of the time extension functionaries involve in selection of the beneficiaries needed for achieving the target of the schemes; which is coupled with the lack of technical officers at the grass root level has also affected the extension services markedly (Ravindran et al, 2007).

Shift in cropping pattern and system of the state

- Cropping pattern/system has been changing due to unpredictable climate, unwillingness of youth to take up toilsome agriculture, migration of rural men and youth in search of better job opportunities in the urban and towns.
- Farmers are shifting from laborious /water intensive food crops to non-food crops/ less water intensive crops and horticultural crops. E.g. Farmers in Villupuram district have been shifting to Casuarina from Paddy and Sugarcane; In Coimbatore district, 67.35 % of the area was shifted to horticultural crops, of which 39.48 % and 14.20 % of the area was shifted to Coconut and Banana crops from Pulses, Sugarcane and Cotton respectively (Vincent, 2017), despite that the officials are unwilling to take up a research in the shift in cropping pattern, as it could alter the current funding pattern of the state.

Increase in cost of cultivation of and increased use of inputs in agricultural crops, depleting groundwater level, increased demand of vegetables among city dwellers, schemes and subsidies available for horticultural crops influenced farmers to shift their cropping pattern from agricultural crops to horticultural crops in the state.

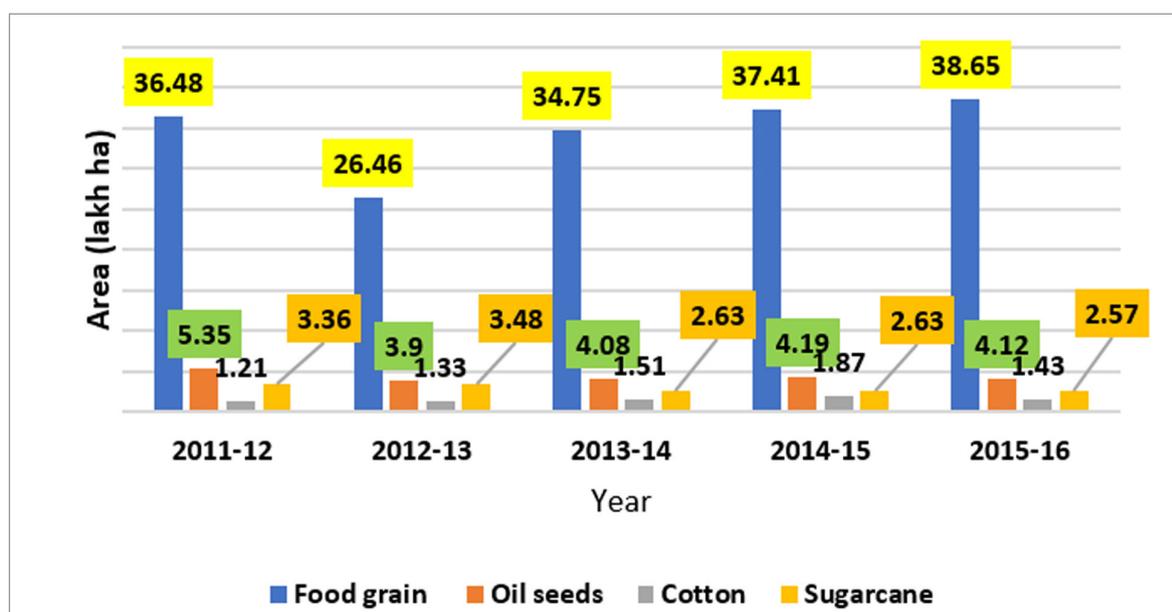


Figure 1.9. Trend in Area of major agricultural crops between 2011-12 to 2015-16 in Tamil Nadu

Cropping pattern in the state of Tamil Nadu

- The area under food grain area increased from 36.48 lakh ha during 2011-12 to 38.65 lakh ha during 2015-16 (Figure 1.9). It might be attributed to the financial assistance/grants given by the state and central government in increasing the area under food grains through various schemes like National Agriculture Development Programme (NADP), National Mission on Sustainable Agriculture, Seed Village Programme, Tamil Nadu State Seed Multiplication Scheme (TANSEDA) and extension support of various central and state institutes like Krishi Vigyan Kendra (KVK), research station of Tamil Nadu Agricultural University (TNAU). Besides, extension and agro advisory services of the third sector like Farmers Producer Organisations (FPOs), Community Based Organisations (CBOs), Non-Governmental Organizations and private sectors have significant role relating to increasing area under food crops. However, areas under oil seeds and sugarcane have reduced in the last five years from 5.35 and 3.36 lakh ha to 4.12 and 2.57 lakh ha respectively. It might be due to reducing ground water, erratic rainfall, lack of new/location specific technologies in the past years.
- Labour wages have increased sharply in the state. E.g. the wages (in case of Male) for harvesting one tonnes of Sugarcane is about 450-550 INR on normal days (Kharif and Rabi) and in summer, it goes up to 800-900 INR/tonnes (Mr. Devanathan, Deputy Director, Farmers Training Centre (FTC), Personal Communication, March, 2018).
- However, the average wage rate for male labourer was 62.2 INR in Kharif 1999-2000 (World Bank, 2004). Moreover, though men and women farmer engage in the same farm operation, inequality in wage rate is widening, men earn 162 times higher wages than women for the similar kind of field work (Fatima et al, 2017). Both the increased wage rate and shortage in labourer have led to rapid mechanisation in the state. But, three factors pose impediments in fulfilment of 100 %mechanisation in the state namely (i) inadequate funds (i.e. the funds allocated for the purchase of farm machineries and implements at subsidised rate of 40 % to an eligible farmer are inadequate to meet the rising demand) (ii) red tapism in procuring the farm implements and (iii) expensive farm machineries.
- Moreover, crop production has become very expensive owing to lack of cost effective farm machineries/implements in the government sectors/depot as well as functioning of fewer Custom Hiring Centres (CHCs) in the state of Tamil Nadu are incompetent to support the farmers' demand and reduce the cost of production. Similarly, lack of awareness in technology dissemination and knowledge on use of new farm machineries/implement like rotavators, laser leveller, power weeders, power threshers etc., were found among the farmers in the state (NABARD, 2016-17).
- Only 225 CHCs have been set up throughout the state in the past two years (Senthil Kumar and Naik, 2016). The state government in its budget speech declared that 1 106 CHCs have been set

The state government of Tamil Nadu has proposed to develop 385 CHCs in 385 Block with the cost of 25 lakhs for each CHC. Of the total cost of establishment 40 % is borne by the state and 60 % by the entrepreneurs/farmers/group.

up throughout the state since 2014-15 (GoTN-Budget Speech, 2018-19). However, investment in mechanisation of farming focuses on big machineries in Tamil Nadu, thus affecting the farm women as they prefer to have small farm machineries/equipment (Fatima et al, 2017).

Lack of real ground data and fool proof

- Absence of valid data/real time data with respect to the area of crops is a serious concern as these data are mostly used for fixing the physical target like area coverage, production and distribution of seeds of food grains, distribution of inputs, fertilisers and so on (Senthemilselvan, JDA, Personal communication, March, 2018).
- Lack of proof of farmers such as land records, Chitta and Adangal impedes the target-based distribution of bio-fertilisers, pulse wonder, micro nutrient mixtures, power weeder, pheromone trap, plant protection chemicals, power tiller, transplanter, conoweeder, etc.

Poor quality of inputs and discrepancy in distribution

- Farmers depend mostly on private dealers for inputs like fertilisers, pesticides, herbicides and so forth and 68.6 % of the information need of the farmers come from input dealers (Babu et al, 2012) as the technical officers' knowledge and skill on recommending right inputs and fertilisers have been reduced owing to more scheme-based report works, non-updating of knowledge on present time fertilisers, pesticides, fungicides, etc. on the one hand and lack of field exposure on the other hand (M. Sugumar, JDA, Personal communication, February, 2018).
- A few of the varieties distributed under public extension system are not competitive to that of private varieties; farmers have not received quality plant protection chemicals and machinery from the public extension system (Ravindran et al, 2007). Moreover, these seeds/inputs are distributed under different schemes like NADP, NMSA, Seed Village Schemes, which affect the crop led distribution and production. Besides, these inputs are not available on time hence, the lower level technical officers are coerced to distribute the seeds to the farmers for the achievement of the target (Focus Group Discussion, February, 2018 and Ravindran et al, 2007).

Farmers prefer to purchase inputs (Seeds, fertilisers, pesticides, etc.) from input shops and private dealers rather than from state depots operated by the Department of Agriculture (DoA) owing to the pervasive extension approach followed by private agencies in sale of their inputs at competitive advantage than public extension.

Scarce incentives of public sectors have led to poor investment on capacity building of extension staff pertaining to up-to-date knowledge.

Birner and Anderson, 2007

Land ownership and farmers rights including women farmers

- Tamil Nadu do not recognise the sharecroppers as “tenants” (Panagariya, n.d.). 10 % of rich land holders own 55 % of the arable lands of the state (Fatima et al, 2017).
- Absentee landlordism, leased-in lands and fragmentation of lands have been growing in Tamil Nadu. It is also evident that Tamil Nadu has about 13.56 % of the operated lands under leased in, (Mani, 2016). Besides, there is no legal ban on leasing (NITI AAYOG, 2016). In this context, farmers who have no legal rights to lands are not eligible to avail the benefits of schemes and thereof subsidies. It may in long run impact livelihood security of the resource poor/marginalised farmers in the state.
- Legal recognition of land ownership is obligatory for any benefit of schemes and policies, most of the women in Tamil Nadu have been ignored to the entitlement of schemes as they lack land ownership rights. However, 37 % of the work force of agriculture is constituted by women in the state. On an average, they spend about 3 300 hours in the field in a season as against 1 800 hours by men. All the more, farm women are responsible for 80-90 % of the food production, 90 % of dairy production and maintenance of milch animals & poultry in the state (Fatima et al, 2017).

Fisheries sectors and implication

- Fisheries Policy Note (2016-17) highlighted that the lack of both quality and low-cost seeds cum feeds is the constraint for the inland fisheries. Although the State Agriculture Plan has shed the light on the need for the infrastructure/stock keeping and fish seed hatcheries through private involvement and SHGs, there have been dearth of extension strategies and technology backup to support the private players/NGOs/FPCs/

Tamil Nadu has 3.83 lakh ha of inland water resources, which includes 78 Nos of reservoirs (0.62 lakh ha), major & minor irrigation tanks (2.65 lakh ha), ponds, rivers, back water (0.56 lakh ha, etc., moreover, the state has 2.28 lakh inland fisher population. Inland fish production was 2.42 lakh tonnes in 2015-16. The state has 51 shrimp hatcheries.

GoTN, Policy Note, 2016-17

- Agirpreneurs to venture into fish seed/feed enterprises so far (State Agriculture Plan, 2009).
- Even after nearly a decade from the recommendation, inland fisheries suffer from lack of seeds/fingerlings and pellet/mash seeds, though some of the hatcheries/seed production and rearing centre are owned by private players (229 Nos of private players are in the state, GoTN, Policy Note, 2016-17), the price of seeds/fingerlings is unaffordable by marginal and small farmers. Scattered location of these fish hatcheries is unlikely to motivate the inland farmers to integrate fisheries with farming. E.g. farmers in Villupuram district have to move to not less than 200 KMs (Himalayan Fish Farm Aqua Tech-Thiruvavarur) in case they need to purchase fish seeds. Similarly, lack of perennial water bodies and droughts deters the farmers to take up fisheries enterprise.
- The schemes concentrating on ornamental fish farms and backyard hatcheries need to be backed with the proper extension intervention so as to educate the farmers on fish production

and integrated marketing of fishes. The lackadaisical approach in fulfilment of physical target of providing ornamental fisheries to any of the household could affect the long-term benefits of ornamental fisheries as the beneficiaries abandon the ornamental fisheries farm once the subsidy of the government is withdrawn.

- Moreover, the present fisheries staff strength is only 1 687 (GoTN, Policy Note-Fisheries, 2016-17), which includes Additional Directors of fisheries, joint Directors of Fisheries, Inspectors of Fisheries to name a few. The present strength of staffs may not be adequate to support the growing demand of the fish seeds and capacity need of the farmers concerning modern fisheries rearing technologies/seed/breed farms/hatcheries units.
- Lack of trainings, demonstrations, contact between fisher folks and extension personnel, extension staff, untrained extension professionals along with improper running of fisheries cooperative societies have been considered to be the major constraints in providing fisheries extension services in the state (Arivukkarasu, 2011).
- Inadequate marketing channel is also a major challenge in the fisheries sectors and inefficient funds to promote trainings, demonstrations and capacity building programmes in the field of fisheries are an impediment to the development of inland fisherfolk's knowledge and awareness on latest technologies and modern rearing practices, despite the extension/technological awareness taken by the Tamil Nadu Fisheries University/National Fisheries Development Board in imparting trainings on modern fish production technologies coupled with value addition technologies.

Looming water crisis and irrigation management

- 75 % of the state's water is consumed by the agriculture (World Bank, 2004) and net irrigated area reduced to 0.59 % (1.63 lakh ha) in 2016 when compared to 2006 (2.88 lakh ha). At present, net sown area under irrigation is 56.56 % (27.25 lakh ha) of which 43.69 % (11.91 lakh ha) of the irrigation source is met from open wells (GoTN, 2008 and 2016). However,

“Salinity problem has increased due to rapid depletion of ground water, which leads to sea water intrusion thereby affecting the productivity of crops like pulses in the recent past”

*J. Ayyanar a farmer from
Villupuram district*

water scarcity has become more acute in the recent days owing to unseasonal rainfall, over exploitation of available ground water and gradually increasing farmers' dependency on ground water resource, it is also evident from the increased depth of 600-1000 ft bore wells (World Bank, 2004). It has been estimated that, 36 %, 9 %, 17 % and 3 % of the blocks were over exploited, critical, semi-critical and salinity affected respectively (NDDB, 2014). Moreover, per capita availability of water is 1700m³ in the state, which is considered to be “Stress Level” (Department of Land Resources, n.d.).

Livestock

- The per cent share of bovine population reduced to 27 in 2012 (19th livestock census) when compared to 18th livestock census, 2007; number of milch animal population (in-milk and dry, cows and buffaloes) declined from 4.5 million in 2012 from 5.1 million in 2007 (NDDDB, 2014). The state shares about 5.3 % (7 million tonnes) of the country's milk production, of which 90 % of the milk is from cow (NDDDB, 2014). However, per capita milk availability is only 266 grams per day, which is little lower than the country's per capita i.e. 302 grams per day; per capita egg availability 214 Nos. Egg production was about 14.12 million in 2013-14 and 4.64 lakh tonnes (NDDDB, 2014 and GoTN-Policy Note, 2017-18).
- Encroachment of the grasslands (Mandhai and Maichel nilam) in villages has significantly impacted the availability of fodder to sheep/goats/cattle (K. Ramachandran, Deputy Director (Animal Husbandry), Personal Communication, February, 2018). Similarly, prolonged drought in many parts of Tamil Nadu has resulted in loss of pasture lands, as a consequence, both production and productivity of livestock have become meagre (G. Prema, Regional Joint Director of Animal Husbandry, Personal Communication, January, 2018).
- Existing value addition in milk processing industries and marketing of the products is inadequate to improve the welfare of the livestock keepers in the state owing to inadequate awareness on technologies/infrastructure/technology park related to milk processing and inaccessibility to milk value chain/marketing channels.
- The extension functionaries of the state Departments of Animal Husbandry have not been exposed to different extension and teaching methods due to lack of budget, infrastructure, low priority of veterinary extension in comparison to other veterinary services in Tamil Nadu. Budgetary allocation for extension activities was also less, which was only 1 % (Ravikumar and Chander, 2011).
- Most of the veterinary services are associated with clinical services of animals. Therefore, veterinary doctors seldom pay attention to the livestock keepers/farmers' activities like adding value to the milk, exposure needs of farmers in knowing the commercialised milk processing technologies and so on.
- Non-encouraging value addition coupled with inadequate capital for investment in food processing sectors obscures the farmers in getting a remunerative income.

Drip irrigation and unrealistic outcome: Though drip irrigation is promoted as a sustainable solution to the increasing water paucity. The pipes and valve given under the scheme is seldom suitable to the cropping pattern of the small and marginal farmers of the state. Besides, during high rainfall, farmers prefer to alter the cropping pattern, in this circumstance, farmers uninstall the drip pipes.

Marketing and trading

- Both lack of market facilities and traders for new varieties such as CO 51 and TKM 13 rice varieties constraint the farmers in leaving the ruling variety such as BPT 5204 notwithstanding

its susceptibility to pests and diseases (M. Senthil Kumar, DoEE, TNAU, Personal communication, March, 2018). Transfer of location specific and farmers driven technologies have affected the production adversely due to lack of research evidence and farmers driven feedback system in the state, the bottom up approach of extension is mostly on paper but on real ground, the nature of extension is still a top down approach.

- Fluctuating price and volatile market demand of the agricultural produce are continued to be the chief farm distresses and may also be so in the coming days as the regulation of production has become difficult owing to the fragmented land holdings of the state. Market price instability is a persistent problem. E.g. Market price fluctuation of cassava is severe due to mass production of the crop in the same season, which has been persistent since 2005 (Linder et al, 2017). Besides, awareness about modern technologies on cassava value addition is an added constraint. According to P. Manivel (A farmer from Salem district) a total of 140 by-products can be prepared from Cassava by farmers themselves. However, lack of awareness and trainings on new technologies relating to cassava value addition are the biggest challenges to the cassava farmers. Limited attempt in diversifying the value chain of cassava reduces farmers share in consumer price (Linder et al, 2017) as the majority of the cassava growers still depend on sago industries for the sale of cassava.
- Direct marketing of the farm produce by farmers is a severe setback as the farmers are to compete with the other competitors and traders who have firmly been established in the market structure. Likewise, consumers' preference and changing eating behaviour pose challenges in marketing of the farm produce (Dhakshan and Rajandran, 2017).

Value addition

- Although Tamil Nadu accounts for 14 % (5, 161 Nos) of food processing industries in the country, these commercial industries might not be able to support the growing production of fruits (61. 81 lakh tonnes) and vegetables (65.59 lakh tonnes) in the state (Gol, 2016-17).
- Insufficient funds and extension interventions to involve farmers in value chain management are the major constraints in the state. Besides, supply of farm produce like banana, mango and other fruits is yet to be bolstered in the state of Tamil Nadu even with around 2.98 lakh ha of area under fruit crops (MOSPI, 2017).

CO 45 is the slender type of rice variety but the farmers in need of thick type rice variety. Similarly, in case of CR 1009 is the long duration variety but farmers in need of short duration variety without the yield sacrifice that they get in CR 1009

Source NILERD, 2015

35 %, 25 % and 5 % of the food processing industries are in milk, bakery and meat respectively. Processing of vegetables and fruits will give new varieties to farmers, minimise the yield losses and higher profit to the food processors.

(Vandhana, 2014)

Lack of farmers driven and location specific technologies

- Technology transfer (in case of new varieties) and demonstrations are not in sync with the preference of farmers and consumers, despite that the new varieties are less vulnerable to biotic and abiotic stress. Especially in case of ADT 47, ADT 49, ADT 50, CO 51 (Paddy varieties); K 12 and CO 30 (Sorghum); LRG 41 (Red gram); VBN 5, VBN 6, VBN 7, MDU 1; (Black gram); VRI (GN) 6, K 9 (Groundnut) to name a few, farmers prefer to cultivate BPT 5201 over CO 51 due to high market demand of BPT 5201.
- It can also be evinced from the record that 18.33% of the farmers expressed that the demonstrations have not covered all the crops, which they grow (Ravindran et al, 2007). Promotion of Polyhouse in the state has also been weakening due to multipronged challenges. The average temperature of the state is increasing at a rate of 1oC, the state is now in need of the fully automated protected cultivation for shifting to high value commercial crops Cloves, Nutmeg, Pepper, Anthurium and so forth (Mrs. Jaya Jasmine Ph.D., Professor, Personal communication, January, 2018). On the other hand, lack of participatory trainings and demonstration on maintenance of Polyhouse were found to have discouraged the farmers in adoption of Polyhouse even with the subsidy for instalment of Polyhouse.
- Promotion of crops, which are not suitable for a specific locality and ecological condition of the state poses tremendous pressure to field level extension functionaries as they involve in canvassing the farmers in achieving the area coverage of crop e.g. Oil palm.
- Most of the technologies promoted by the state government have not reached the marginal and small farmers, thus these technologies/subsidies/benefits have failed to save the farmers from their farm distresses.

Farmers blame “Tamilnadu Rice Research station” for not releasing a new variety for the last 10 years, which they cite for their lack of interest in agriculture.

Lack of pluralistic agricultural extension

- Though pluralistic extension is widely recognised as a strategy to increase the quality delivery of extension and advisory services, inadequate funds and efforts were earmarked and undertaken respectively under any scheme for the effective utilisation of pluralistic extension, except the 10% of funds allocated to NGOs/private dealers for conducting identified trainings/demonstration under the aegis of ATMA.
- Inadequate funds to revitalise the social entrepreneurship/certified extension professionals may also hamper the pluralistic extension in coming days.

Ineffective extension approach

- The scope of mechanisms followed to profile the farmers as to whom (farmers) the trainings/exposure visits given on certain technologies/management techniques is limited. e.g. Solar

Light Trap/Solar Drier. Unless there is a provision to strengthen the beneficiaries list pertinent to the trainings/exposure visits/demonstrations/farm schools, it may lead to the selection of the same beneficiaries repeatedly. In such a case, benefits of these hard-core extension activities may not reach the poorest of poor farmers. Moreover, most of the trainings and meetings are conducted to achieve the target furnished under the schemes. E.g. Total physical target of Farm Field School and Demonstration were 14 and 27 respectively in Villupuram district during 2017-18, which included demonstration on Solar Light Trap and Farm Field School (FFS) on ICM in Pulses.

Most of the trainings, meetings, demonstrations, Farm Field Schools (FFS) exposure visits etc., have been done for the official record and achieving the target of the scheme. Officials have limited time to evaluate, whether the benefits were reached the rightful farmers or not owing to increased desktop work/document work.

Crop insurance and future perspective

- The reimbursement of the insurance is made only when the crop loss is occurred due to natural calamities. Besides, it is given on area approach not on individualistic approach. The crop insurance is also not given if the crop loss occurs due to wild animals' attacks or severe outbreak of diseases in a pocket of farms.
- Case of Nilgiris district, only Banana, Potato and Tapioca are covered under the Pradhan Mantri Fasal Bhima Yojana (PMFBY), the major crops such as Carrot, Garlic and Ginger have not been covered notwithstanding these later crops Carrot

Farmers were generally not aware of the crop insurance scheme and the way of reimbursement of money, which they deposit in the bank owing to the communication gap between the insurance company and farmers. Further, delay in settlement of claims, complex procedure and high premium have affected the enrolling into crop insurance scheme. Wide variation has been found to exist between actual and crop cutting experiment yield.

Mani et al, 2012

covers about 45.96 per cent (2554.96 ha) of the total Vegetable areas and Garlic & Ginger cover about 25.18 per cent (676.63 ha) of the total Spices and Condiments areas in Nilgiris district.

ICTs

- Use of ICT is still in its nascent stage: Of the 1200 farmers who have registered Mobile Multimedia Agricultural Advisory services, only 243 farmers have used MAAS. Moreover, the queries mostly asked by the farmers are 60 % related to pest and diseases and 32 % crop cultivation practices (Muthiah et al, 2013). Only 10 000 farmers are said to have registered to Dynamic Market Information (DMI), which is a joint venture of TNAU and Centre for Development of Advanced Computing (C-DAC), Hyderabad (Belakeri, et al, 2017). It is clear that farmers still have a major

problem with the plant protection. Only, 10 507 farmers have registered in e-Velanmai initiative of TNAU (Karthikeyan, n.d.) In this light, a customised individual farm-based ICT is to be created along with the necessary updating as and when the change in cropping pattern and system occurs.

- The use of SMS portal, daily messaging services through various Apps of the state and central government like Kissan Suvidha App, e-Kalpa, agri tech portal is yet to find a place in dissemination of farmers' crop and demand driven information. Only 11.66 % of the farmers used the ICTs for agricultural information (Shanthasheela and Sindhuja, 2015). However, use of mobile phones was found to be high among farmers for accessing agricultural information like plant protection, market information and weather-related quarries.
- The extension functionaries use WhatsApp for providing certain information on pest and diseases of the crops when infected plant parts sent by the farmers to the concerned officer. The farmers who use WhatsApp were found to have basic literacy in use of mobile phones/smart phones, the marginal and small farmers yet to make use of these sophisticated/modern technologies as their literacy level is less.

Capital formation for off-farm investment

- Capital flow for investment on and off farm activities is still a concern for marginal farmers and Small (M/SF): Most of the marginal and small farmers have limited access to credit/loan facilities from formal sector/nationalised bank/cooperative banks due to lack of assets which the medium and big farmers have. Most importantly, dependency of these M/SF on informal sector/external sources has increased (Mahendra Dev, 2014 and Yogeshwari, 2013). Despite the fact that, these M/SFs contribute 51.7 % of the crop output in the state (Mahendra Dev, 2014).

Indebtedness of the marginal and small farmers

- Money spend on consumption by marginal and small farmers exceeds their income. For example, MF spends around 2285 INR/month for consumption from his meagre monthly income of 1739 INR; similarly, SF spends around 3187 INR/month yet the monthly income is only 2244 INR (Mahendra Dev, 2014).
- 74.5 % of the farmers households are indebted in Tamil Nadu, which is more than all India level (48.6 %).
- Moreover, in the state of Tamil Nadu, meagre holding (0.41 ha) of marginal and small farmers is a serious concern as these fragmented land holdings could not allow the M/SF to meet the collateral requirement needed for the formal sector loans. Therefore, debt burden is more on these farmers. Conversely, large farmers have better access to formal sector loans owing to high land holdings. Hence, these farmers have less indebtedness (Yogeshwari, 2013).
- It would be even higher in the time of crop failure, as the invested loan in the production of crops pass on to next cropping season with added interest (Yogeshwari, 2013).

Hunger and post-harvest management in the state of Tamil Nadu

- Lack of Post-Harvest Techniques (PHT) is an added constraint in the state, most of the farmers are not equipped to take up PHT like preserving and cooling, dehydrating/drying, packaging, labelling etc.,
- Inadequate policy framework for integrating farming with poverty of the state is a hurdle in equating the food requirement and food production. Menon et al, 2009 put that, hunger in Tamil Nadu is in alarming state. It may be that imbalance in the distribution the food items, vicious poverty cycle, unplanned urbanisation among many other factors. Furthermore, the post-harvest losses of Fruits and Vegetables (F & V) of the state are about 8 100 crores (Business Standard, 2014) i.e. a loss of 8907.04 INR per capita of the state (2011, Census). In Tamil Nadu, the aggregate post-harvest loss of horticultural crops is 22.08 % as cited by Anonymous source, 2002 in IIHR, 2013-14.
- Similarly, post-harvest loss in Cavendish and Robusta varieties of banana is about 9-15 %; unmarketable Kharif onion bulb is said to be 12 % and 5 % of post-harvest loss of kharif onion is due to spoilage, which is maximum for any other state in the country; (IIHR 2013-14). Post-harvest loss of sorghum, Black gram and cashew is 3.76 %, 2.37 % and 7.72 % respectively in the Eastern coastal and Ghats regions of Tamil Nadu (Jha et al, 2015).

KVKs

- Inefficient convergence between line departments and KVKs: According to Dr.P.Kumaravadivelu-KVK, Avinashilingam (Coimbatore), Line departments use only 10-30 % of the KVKs potential in one hand and only 40 % of the farmers use the fullest potential of the KVKs on the other hand. Therefore, efficient convergence and coordination need to be streamlined by the central and state government to utilize the potential of KVKs. A policy should be formulated to study and replicate the technology/management techniques/production techniques/marketing chain by line departments, which were assessed and verified by the KVKs for the concerned region. For example, TMV 7 is the ruling variety of Groundnut in Coimbatore (KVK-Avinashilingam, Annual Report-2015-16). However, CO 6 has been assessed as the alternate technology through OFT to TMV 7 on account that the high yield of CO 6 (18.40 Qtl/ha) when compared to TMV 7, which yields only about 17.27 Qtl/ha. On other hand, Benefit Cost ratio of TMV is 1.73 whereas CO 6 is 2.01. Therefore, line departments may involve not only popularizing CO 6 Groundnut variety among farmers but also seed production and marketing chain of the CO 6 in large scale. Similarly, NIPHM fertiliser schedule has been found to improve the productivity of the curry leaf over current practice of the farmers. Therefore, effective convergence between KVK and Line departments is a viable option in redeeming the farmers from farm multiple farm distresses in coming days.

Implication for organising extension

Concerted efforts to bring back the fallow lands

- As the fallow lands show an increasing trend, necessary steps like afforestation, agro-forestry, plantation crops etc., may be promoted. In this context, community afforestation programmes such as community nursery on Casuarina, Teak, Pongamia, Eucalyptus, Subabul and so on need to be strengthened. The need of the credit for establishing nursery, capacity for maintenance and production of nursery need to be imparted among the community.
- Collaboration needs to be made with educational institutes, voluntary organisations, grass root institutes, etc., for mobilising mass for the establishment of agro-forestry with the available resources, the state department of agriculture, forestry and horticulture may function as technical supporters in establishment of quality agro-forestry nursery and ready reckoner in establishing and maintaining agro-forestry across the state.

Contract farming may be strengthened with both public and private paper mills for the production of pulp wood plantation and Panchayat level institutes may be strengthened both financially and technically to promote agro-forestry in the waste and fallow lands in the state of Tamil Nadu against the backdrop of increasing fallow lands.

NABARD, 2016-17

Focusing beyond papers and arithmetic for automation of every farm at low cost technology

- Given that the dynamic nature of the climate linked farming, farmers should have to apply fertilisers and pesticides periodically in the hope of getting the yield at any cost. As a result, the cost of production has increased and fertility of the soil has reduced. In the same way, the departments have been supplying all sort of inputs to the farmers at subsidised cost to ensure the targeted production. This is where the farmers are to be linked with technology, thus to help them to use crop production measures on a demand basis. E.g. a customised user/farmer friendly digital technology connected with the cropping pattern and resources of a farm needs to be developed, therefore to alert the farmer regard to the farm resources; their use. It would ensure the sensible use of inputs like fertilisers, plant protection measure, water, etc., and minimising the cost of production.
- In Tamil Nadu, promotion of DSSIFER 2010 computer software across every farm must needs

Farmers persuaded to use excess chemical fertilizers, but the decision on fertilizer use requires knowledge of the expected crop yield response to nutrient application, which is a function of crop nutrient needs, supply of nutrients from indigenous sources, and the short and long-term fate of fertilizer applied

Dobermann et al, 2003

to be encompassed as a policy implication. The computer software “DSSIFER” needs to be used as a smart tool for enhanced fertiliser use efficiency and crop productivity (Sellamuthu et al, n.d.).

- Awareness, knowledge and capacities among both the extension functionaries and farmers in use and importance of NUTMON-Toolbox along with a policy backing to encourage the NUTMON-Toolbox in the farm level are inevitable. It has been developed to monitor the nutrient flows and stock as a user-friendly Decision Support System in tropical soils of Tamil Nadu. (Surendran et al, 2005).
- The automation of every farm at low cost technology could be a proven way in the coming days. However, it could be done only if the state is resolved to allocate a huge fund of budget towards farming and divert its notion from subsidy led agriculture as well as outsource/provide more man power/human resources/trained extension professionals.

DSSIFER 2010 Decision Support System for Integrated Fertiliser Recommendation has been developed to generate crop, site and situation specific balanced fertiliser prescriptions for responsive yield targets of 27 various crops in the state of Tamil Nadu.

(<https://goo.gl/cVcoJv>) (Sellamuthu et al, n.d.)

Capacity and skill improvement for customised crop production technologies

- Capacity of the farmers needs to be improved constantly through cluster trainings on different crops, modern management practices, cost effective and emerging technologies so as to manage crop effectively amid changing climate/depleting resources. The farmers of all categories in particular marginal and small farmers are to be adequately trained to use digital based crop production guide TN-AGRISNET/Farm Crop Management System and e-Velanmai of TNAU. It may help the farmers to manage the farm resources effectively amid dwindling farm resources.
- The number of Farmers Friend of ATMA may be increased to meet the ICTs based solution sought by the illiterate farmers in the state.

Periodical research and extension on yield gap analysis and awareness programmes

- There must be an awareness programme on a daily basis at farm level in educating farming community in attaining the potential yield of the crops amid the available resources. It may enable the farmers to rope in to get the potential yield as against the current yield.

Reorienting extension and advisory services based on shift in cropping pattern

- Extension officials should involve in studying of the changing cropping pattern across the state so as to educate the farmers about the need for the sustainable agriculture. Besides, the study could serve as a mean of delivering crop-based extension and advisory services to the farming community.
- Extension coupled with conclusive research is to be done to revise and restructure the strategic

extension plan based on each block's cropping pattern followed by different categories of farmers. Besides, the strategic extension should suit the prevailing ecological conditions, farm resources and value chain management.

- Equity distribution of benefits of schemes should be concomitant with the present cropping pattern and resources of the farm but, should not be on the basis of General farmers and Scheduled Caste farmers as this system volatilises the benefits reaching the resource poor and marginal farmers in the state.

Village level crop portal or e-village for enhanced information access

- The present TN-AGRISNET, FCMS and CSC are to be strengthened along with a creation and updating of crop portal at every village, which would bring positive impact on preparation of Strategic Research and Extension Plan (SREP) and implementation of crop/resource-based schemes/policies thereby resolving the agrarian distress faced by the farming community in the state of Tamil Nadu.
- e-village with a curator/technician will also help the farmers to access solution for most of their problems and up-date the cropping pattern/system of the farm periodically in the e-village/crop portal. Moreover, every farmer's seed need, fertilisers, plant protective measures, farm machineries are compulsory to be up dated in the crop portal before the onset of cropping season. It will be of immense help in knowing the farmers demand and fixing appropriate target in the schemes.

Need for invigorated capacity and skills in operation of farm machineries and implements

- Extension system could involve experts to improve the capacity and skill of farmers on various pre-harvest and during harvest machineries and implements. More precisely, farm women may be trained to operate gender friendly machineries and implements. Likewise, Custom Hiring Centre (CHC) may be established on the basis of Public Private Partnership as in the case of the government of Karnataka, Andhra Pradesh and Punjab (Yes Bank-GAA/OAV-FICCI, 2016).

Participatory Rural Appraisal (PRA) for validating the land records and synergetic integration

- A long-term extension policy and expert team should be streamlined to validate, verify and computerise the Chitta and Adangal of all farmers, it may ease the line department in ensuring the proper dissemination of Schemes' benefits to rightful farmers/owners.
- Coordination between Village Administrative Officers (VAO), Revenue Officers (Ros), Statistical Officers (SOs), AOs and other concerned officers should be strengthened to improve the transparency in Crop Cutting Experiment (CCE)/Crop Estimation Survey (CES) since, CCE is the base line for the fixation of target of the schemes. It may lead to synergy between the different

public administration, which are working for the welfare of the people in particular farming community.

- Crop Cutting Experiment should also include the cropping pattern followed by different category of farmers like marginal farmers, small farmers, medium and big farmers, it may improve the earmark of funds exclusively for these marginalised sections of the farming community.

Public Private Partnership for integrated delivery of farm inputs at time and affordable price

- In spite of the fact that the private extension is not a substitute for the public extension as it focuses on a particular farming groups and specific farm services (Glendenning et al, 2011), Public Private Partnership (PPP) with input/farm machinery companies must needs to be strengthened and revitalised to legalise and regulate the inputs supply on demand basis. The present data base of 68 lakh farmers covered under AGRI-MIS should be strengthened to cover the rest of the farmers (15 lakh farmers approximately) in the state so as to deliver the customised services to them.
- Moreover, capacity building and updating of the grass root extension functionaries on newly released seeds, fertilisers, pesticides, fungicides, etc., of both private and public are to be done periodically. It may help them to improve their knowledge on current availability of inputs in the market and cross validate the efficiency of private inputs to that of inputs released by the public sectors e.g. Tami Nadu Agricultural University (TNAU), Indian Council of Agricultural Research (ICAR) etc..
- The state may strengthen and promote its existing Primary Agriculture Cooperative Banks (PACB) led Agriclincs and Mini Soil Testing Laboratory and Agri-Clinics & Agri-Business (AC&ABC) centres respectively across every village/identified cluster to supply the crop production and protection inputs at subsidized rate as the 16 % of the farmers have not accessed the AC&ABC and 70 % of the farmers expressed that, there is no need for AC&ABC (Glendenning et al, 2011). In this context, more capacity building and trainings should be provided to eligible agricultural graduates for increased knowledge and awareness on crop production and protection technologies. It would help AC&ABC to provide inputs based on the appropriate tests and diagnostic results and make the services available at affordable rate to farmers.
- As both the demand and need of each farmer vary significantly, more agricultural professionals/ graduated youth/skilled youth in the village need to be trained to provide the services required by the farming community in and out of time.
- As FPOs and NGOs are continually providing extension services along with marketing opportunity to farmers in the state e.g. Velliangiri FPO Ltd, ThaiMaan FPO, VK-NARDEP NGO, Dhan foundation, TSSS, etc., Emancipatory approach is to be followed to integrate all well-

VK-Nardep (NGO, Kanyakumari) provides about 3000 technical advisory services every year on organic farming, terrace gardening, bio-gas production, fish amino making and so on.

functioning NGOs and FPOs for the greater inclusion and exclusive agricultural extension systems in the state.

Inclusion of Innovative intervention of Information and Communication Technology (ICT)

- Delivery of extension services with the help Pico projector needs constant updating of new technologies and location specific knowledge, in its absence farmers may not adopt whatsoever diffused to them as a latest technology.
- Trainings/capacity building programmes need to be organised to increase the knowledge and skills of the farmers pertaining to innovative ICTs intervention of both public and private ICTs. Integration of public and private ICTs platform (mKRISHI, EASY KRISHI,) may offer personalised agro-advisory services to the farmers in time (table 1.15).
- An extension officer may specially be appointed to advise the farmers who are illiterate with all ICT means like CropIn (a mobile based ICT platform) for monitoring and management of pest and diseases, FCMS for resource led crop production, Kisan Suvidha for weather forecast and market access and so on. These measures could bring down the cost of production and help the farmers to realise remunerative income in the near future.

Affordable PHT and adequate trainings in handling of PHT for increased welfare of the agrarian society

- An inventory of post-harvest technologies/techniques have been coming in the country like Groundnut Decorticator, Pedal operated Maize Dehusker Sheller, Chilli Seed Extractor, Banana Comb Cutter, Banana Fibre Extractor, Women Friendly Rotatory Arecanut Dehusker, Cassava Chipping Machine, Rice Flaking Machine to name just a few. Therefore, the state government should promote these PHTs for increased value of the farm produce along with production of high value crops for better income. It may pave a road map to the state in improved post-harvest management and reduced post-harvest loss of farm produces.
- Extension functionaries and professionals should adequately be skilled to train the farmers/household women/rural youth in operation of the PHTs, cold/supply chain management and logistics of food and non-food produce.
- More awareness and opportunities of technologies available for food processing (fruits and vegetables) need to be popularised through mass media and disruptive technologies. The value addition in banana/banana fibre for different produces should be promoted on a large scale in Tamil Nadu as banana fibre can be used as a promising raw material in packaging and textile industries (Vigneswaran et al, 2015).
- Public extension could cooperate with corporate and third sectors like NGOs, FPOs, SHGs, FCG, etc., for venturing into small scale adoption of food processing technologies, Besides, funds may be mobilised through NABARD/ATMA for inculcating the capacity/skills needed for the food processors/village youth/household women. A joint venture could be taken by the

DoA and the Indian Institute of Food Processing Technologies (IIFPT), Thanjavur for promoting agri-entrepreneurs for greater mobilisation of skilled employees in food processing industries. Backward linkages may be created to encourage farmers to grow crops which have extant of scope and demand.

- Field level extension functionaries' skills and capacity in the field of food processing technologies need to be improved so as to encourage farmers to adopt food processing/ post-harvest management technologies, which could enhance the value-added F & V products and reduce the post-harvest losses of the fruits and vegetables.
- These steps would possibly pave a way for infusing technology and revamp extension mechanism for post-harvest management of crops. Eventually, adding value to both the public extension and livelihood of farmers.
- Similarly, a new paradigm shift in scheme, innovative technology and extension approach is necessary to improve value addition and value chain of the livestock produce. Cluster trainings coupled with multi-media (videos, short films, audio and animated videos) may be organised to instil capacity and skills among migrating farmers/youth/women on milk produce, value addition in cow dung (preparation of vermicompost, dried cow dung, bio-gas, etc.).

A distinct statutory extension mechanism for marginal and small farmers

- A separate farm extension professionals/functionary should be made for marginal and small farmers, it would pave a way for finding the real farm issues/challenges of these 92 % of the small and marginal farmers in the state.
- The extension worker to farmers ratio (1:2500) should be increased so as to meet the demand of each farmer in time.

Inclusive extension for landless cultivators and farm labourers

- With the growing of absentee landlordism, adequate measures should be taken to benefit the cultivators of the lands effectively. Provision should be made to the central and state government schemes so as to include the farmers/labourers/landless cultivators within the beneficiary domain of every scheme. These measures may protect the landless farmers/agricultural labourers and improve their livelihood status.

Cluster level Entrepreneurship Development Programme (EDP) in fisheries

- Private investment and agriculture ventures would be strengthened in the field of fisheries and fish production. Progressive farmers/household women and village youth from every identified cluster may be trained to venture into seeds/fingerlings production enterprises and preparation of pellet & mash feeds for greater availability of feeds for fisheries management. In the same way, the tender could be given to private hatcheries and fisheries to start their outlet in the fisheries cluster of every district. Social and community capacity may be inculcated among the rural youth/

women/retired teachers/volunteers to involve in maintenance of farm ponds/community ponds dug under NFDB/NADP/MGNREGA and so on.

Linking extension with corporates and consumers

- The state government should identify the Corporate Social Responsibility (CSR) funds for the establishment of PHT units at every cluster areas/villages. In this context, capacity/skill should be inculcated through trainings among identified farmers to improve the quality of their produce through preserving/cooling, dehydrating/drying, packaging, labelling, etc., Additionally, direct linkages between producers and consumers are to be strengthened to abolish the middlemen and commission agents totally.
- Branding and social advertisement of farm produce should be promoted to improve the value of farm produces. For this to happen, farmers need a continuous training on good practices of agriculture and importance of branding. A separate extension mechanism is necessarily to be established at every district/block for branding of farm produces besides, promotion of the brands through social advertisement among the rural and urban consumers, which will help the farmers to realise direct income from farm produce.

Community of Practices (CoP) to combat water crisis

- Community trainings on integrated watershed development seem to be a proven solution to combat the depleting water resources and failure of monsoon. Cluster approach as followed in TN-IAMWARM would be created on the basis of volunteerism and social commitment. In this context, extension should identify the potential farmers/community/youth/women to instil the community spirit among them, it may be one among many ways of saving water from present water crisis.
- Farmers' choice of shift from high water intensive crops such as sugarcane, paddy, cotton, banana etc., to less water intensive crops like pulses, millets, vegetables, etc., as a solution to save water crisis should be supported with proper policy mechanism and sustainable approach, in its absence the shift in cropping pattern may disintegrate the sustainability of agriculture and agro ecosystem and its diversity.
- Holding a hand on increasing the food crop production needs diversion toward the support of farmers initiative/shift in cropping pattern/inclusive farming, it may be done with the help of incentives and infrastructure for those crops, which the farmers prefer to adopt in due course as

Nevertheless, the micro irrigation is promoted across arid and semi-arid regions, there is no conclusive evidence that the micro irrigation has led to reduction of evapotranspiration of crops. The most ignored remarks by policies and schemes. However, the long-term solution is possible with the promotion of less water intensive crops, water markets and virtual water trades. Micro irrigation is not an alternative to these alternatives in terms of saving fresh water.

Harsha, 2017

an alternative to food crops. The farmers suffer not because of their choice, but because of the stringent policies that still support the top down technologies like varieties which are less than 10 years old against the backdrop of ruling varieties, promotion of oil palm despite that the water requirement of this crops is high, increasing the area under Polyhouse notwithstanding its location and eco-system suitability.

Water trade and extension

- Virtual water connection has become a central part of farming. Policies and schemes should involve in long term solution to the water crisis. The present scheme for saving water in the form of Pradhan Mantri Fasal Bhima Yojana may also be lost if the water crisis becomes severe. In this condition, even the water available for drip irrigation will be worn out. Therefore, early attempt in inception of virtual trading of water from the water rich area to water paucity areas is inevitable for policy makers.

As a cropping pattern decides the adoption and suitability of drip irrigation, widespread adoption of drip irrigation may be promoted in the areas where the shift in cropping pattern observed towards Coconut and Banana.

Kumar and Palanisami, 2010

Social advertisement of modern technologies and practices

- Before advocating any variety to farmers, consumer awareness should be made through social advertisement, disruptive technologies like social media and electronic media about the importance of the new variety over other older one. E.g. the state departments should create a mass awareness among the consumers about why TKM 13 and CO 51 are relatively better when compared to ruling variety BPT 5201, unless this happens, traders will never incline to pay remunerative price to the new varieties as the older one (BPT 5201) is continued be the market leader in the state.

Market driven crop diversification through effective extension

- As cited in the World Bank report-2004, increasing the agricultural diversification will not compromise Tamil Nadu's food security owing to the systematic Public Distribution System, effective markets and targeted nutrition programmes of the state.
- In this backdrop, extension system of the state should strength its focus on Integrated Farming System (IFS) coupled with market demand of the produce in diversification of crops for year-round income to the farming community. 3 Cs viz., Cost effective technologies, credit and capital for investment could be made available at the individual farm level for unceasing higher farm returns to the farmers. Moreover, ecology specific farming system and crop production/management practices are to be made aware among the resource poor farmers through extension advisory services.

Modified Farmers Field School for farm resource-based technology transfer

- Farmers' Field School approach, will have more farmers' demand-based extension services, reducing the use of pesticides for environmental and health benefits by farmers, increased on farm productivity and improved knowledge gain among farmers (Davis, 2012 and Birner and Anderson, 2007). Field School should seek to involve more technical officers/extension functionaries right from need assessment of the farmers to market demand along with technical advisory and market intelligence. It may help the farmers to realise better income in real time.

Monitoring and evaluation (M & E) from field to fork

- Monitoring and evaluation of the system should be strengthened at the grass root level where the farmers have direct link with the extension functionaries. M & E should assess the efficiency of public varieties distributed and their adoption rate by different farmers; revitalised extension strategy is necessary to assess the location specificity of the technology and good agricultural practices disseminated by the public extension besides, an expert team may be made to analyse the utilisation and efficiency of the farm inputs given under public system at subsidised rate.
- M & E is also imperative in assessment of extension and advisory services delivered by ATMA to various farmers on different cross cutting technologies like Solar Light Trap, Solar Pump Sets, Solar Driers etc. It may bring the status and nature of impact of trainings, exposure visits, demonstrations, Farmer Field School (FFS), meetings etc., provided under ATMA in terms of income generation, livelihood security and farm productivity.

Restructuring the policy framework for agricultural extension

- Policy of agriculture and extension should reflect the needs of every stakeholder involved in this sector not merely the farmers. The subsidy led production of food crops may be substituted with market led extension so as to promote Out of Farm (OoF) enterprises in the coming days such as strengthening of agro-tourism, post-harvest management of farm produce, value added farm produce etc.,
- Similarly, linking consumers with producers, production based on consumer demand, creation of rural agritech park and social marketing of farm produces would be yardstick measures in improving the marketability of the farm produces.

Revamping agriculture through fisheries and livestock extension

- With growing unemployment rate (3.8 %) <https://goo.gl/1Hr8iB>) in the state and migration of rural youth/farmers/women in search of remunerative jobs in urban areas and towns, integration of the fisheries and livestock sectors into farming should be identified as a solution to the aforesaid problems. Fisheries development programmes may be strengthened to improve the skill and capacity of the youth/farmers/women in the areas of fish seeds production/shrimp

hatcheries/ fish seeds-based enterprises.

- By doing so, the availability of seeds and feeds may be increased. The unemployed youth of the rural/women/interested farmers may be provided with the educational tour to major hatcheries of fishes/production technologies/rearing and maintenance of fishes at low cost. Similarly, progressive farmers/rural youth/Community Extension Worker (CEW) at least 1 for 500 farmers/livestock keepers may be promoted as the extension agents to identify the issues faced by the farmers. It may be done on a contractual pay so as to facilitate an effective livestock extension in the state.

Documentation of farm level innovations and Indigenous technologies followed by farmers

- Assessment, verification and validation of farm innovation/indigenous practices in agriculture need to be done by the extension functionaries for greater transfer of locality specific technologies and encourage farmers to farmers extension on large scale. Time and again, farmers are proven to be the major innovators as they manage their farms effectively by adjusting to the fickle climate and fluctuating market scenario. Both an extension mechanism and a policy support for documentation of successful innovations/good farm practices in the farm level are imperatives to understand the innovativeness of the farmers be it crop production technologies or management practices or harvesting technologies or post-harvest management practices or value chain management.

Extension and Advisory Systems in Tamil Nadu

Department of Agriculture (DoA)

- The State Department of Agriculture was established in 1882 as a result of the recommendations of Indian Famine Commission. In 1904, the department became an independent unit with the Director of Agriculture as the high-level authority. The Department of Agriculture is continued to be the major implementor of the central and state schemes viz., National Agricultural Development Programme (NADP), Pradhan Mantri Krishi Sinchai Yojana (PMKSY), Pradhan Mantri Fasal Bhīma Yojana (PMFMY), Soil Health Card (SHC), Seed Village Scheme, National Mission on Sustainable Agriculture (NMSA), National Food Security Mission; Mission on Dry Land Agriculture (MSDA), TNASEDA Seed Multiplication Scheme, and Collective Farming.

Role and responsibility of DoA

- Department of Agriculture (here after only DoA) is involving in production and distribution of certified seeds of all food grains and making them available to farmers at subsidised rate. Mostly, the DoA concentrates on production and distribution of those varieties with not more than 10 years old. E.g. CO 51, TKM 13 would be produced and distributed to the farmers not the BPT 5204, which has its presence since 1990s.

- Besides, the inputs ranging from quality seeds to protective chemicals are sold at subsidised rate under various schemes. The Agricultural Officers/Assistant Agricultural Officers (hereafter, extension functionaries) involve in Crop Estimation Survey/Crop Cutting Experiment for establishing area, production and productivity.
- Extension and advisory services: Field visits and demonstrations by the extension functionaries are continued to be major extension activities of the DoA coupled with providing technical advices, new schemes; their benefits, new technology through regional newspapers (The Dina malar, Dina Thanthi, Dinakaran, Tamil Hindu etc.), television channels, All India Radio (AIR).
- The state government has provided tablet and Pico projector to all the field level extension functionaries to transfer the technology at faster pace. Most of the extension functionaries focus on dissemination of latest technologies and management practices System of Rice Intensification (SRI), System of Pulse Intensification (SPI), System of Millet Intensification (SMI), Sustainable Sugarcane Initiative (SSI), precision farming, Integrated Farming System (IFS), Micro Irrigation, Dry Land Farming, community nursery, organic farming, farm diversification and sustainable farming to increase the production and productivity. To attain this, the DoA has committed to ensure two-fold strategies one is to make availability of quality seeds/seed materials and quality inputs at subsidised rate at farmers door step and the other one is strengthening the extension like trainings, capacity building on modern agricultural technologies and use of disruptive technologies like FCMS, Touch Screen Kiosks and other ICTs.
- Farmers Interest Group (FIG), Farmer Producer Group (FPG) and Farmers Producer Organisation (FPO) are created throughout the state under the Collective Farming Scheme, then again, each FPG will become an eligible group to the corpus fund of five lakh, which can be used for the purchase of farm machineries/farm implements such as combine harvester, tractor, mini tractor with rotavator, power tiller, paddy transplanter, power sprayer, drum seeder to name just a few.

Area coverage of improved technologies and farming practices is as followed SRI (5.81 lakh ha), machine planting of paddy (1.72 lakh ha), direct sowing of paddy (5.15 lakh ah), SPI (1.25 lakh ha), SSI (0.4 lakh ha), Precision Farming (0.02 lakh ha), IFS (0.01 lakh model for dry, wet and garden lands), micro irrigation (0.07 lakh ha), 3.25 hybrid coconut seedlings were distributed under CDB and 4.99 lakh seedlings distributed under NADP.

Source: Agriculture, 2016-17

In Tamil Nadu, extension personnel have visited 976 operational holdings and covered 606 hectares of area in 2012.

Sajesh, and Suresh, 2016

Table 1.1. Major extension functionaries and their roles in department of agriculture

S. no.	Extension functionaries	Roles	Present challenges
1	Joint Director of Agriculture (JDA)	Implementation officer of the central and state scheme in the district level and presiding officer in the meetings with collector about collective farming, Farmers Grievance Day, Micro Irrigation, Insurance, 20-point programme, bankers meet, Mass Contact Programme (MCP) and other ad hoc meetings.	Attending meetings has increased. Time for field visits/supervision of the field works of subordinates severely affected due to increased paper works
2.	Deputy director of Agriculture (DDA)	Programme and scheme implementing officer mostly involves in assisting JDA in administration.	Refer JDA's challenges
3.	Assistant Director of Agricultural (ADA)	Programme and scheme implementing officer in the block level and inspects the activities of AOs and AAOs, ATMA extension activities in the block level.	Many of the ADA posts are vacant. Lack of time in conduct of meetings, trainings, demonstrations, field days, market extension etc., due to increased paper/office work
4.	Agricultural Officer (AO)	AOs involve in core extension activities like transfer of technology, conducting Adoptive Research Trials, Minikilt trials, block level meetings, field visits, collection and analysis of soil samples, analysis of pesticides et., delivery of on and off-farm advisory services to farmers on the basis of need.	Additional charge for vacant AOs in the districts. AO is in-charge of several works like collection of soil samples, coverage of farmers under insurance, analysis of pesticides etc., led to inefficiency in attending farmers' need
5.	Assistant Agricultural Officer (AAO)	AAOs mostly assist the AO in conducting meetings, trainings, demonstration, identification of beneficiaries for various benefits, collection of soil sample, dissemination farm advisory services	Inadequate filling of sanctioned AAOs in the state. I.e. 6 AAOs in each block. Ad Hoc activities affect the regular extension of the state

Source: Personal Communication with Devanathan, DD, FTC and M. Senthemizhselvan, JDA and Focus Group Discussion with ADAs, AOs.

Salient features of DoA and its impact

- The state received “Krishi Karman award” four times in a period of five years for its record in food grain production during 2011-12 and 2015-16, pulse production during 2013-14, coarse cereal production during 2014-15 from the central government. The state achieved its ever record of food grain production of 113.69 lakh tonnes during 2015-16, which is 43 % more than the food grain production during the year 2010-11.
- The state received various awards like State Agriculture Leadership Award (2013), Food Production Programme Leadership Award (2015), Global Agriculture Leadership Award (2016-Agriculture Today). National Gold Award for e-Governance in 2014-15 by Gol.
- The state has extended 100 % subsidy support to marginal and small farmers concerning to the schemes of both the central and state government in the entire country and 75 % of subsidy to other farmers.
- As of now, agriculture consumes around 20 % of the power supply of the state (GoTN-Agriculture Policy Note, 2017-18). Besides, the power supplied to farmers is not charged on the ground of reducing the cost of crop production, it incurs huge loss of exchequer to the government. Therefore, both the publicity and popularisation of solar pump sets for irrigation, solar power lights trap for Integrated Pest Management and solar driers to make quality dry produce have been done in full swing under the state Solar Energy Policy. It would in long run help the farmers to reduce the coal-based power consumption and improve the renewable energy of the state.
- Networking for collective farming: 2000 Farmers Producer Groups (FPGs) were formed under collective farming in 2016-17, each FPG has the members of not less than 100 farmers. The state government has proposed to cover 40 lakh farmers within a period of five years, which is nearly 50 % of the farm families of the state. Each FPG is entitled to receive 5 lakhs corpus funds, which may be used to purchase farm machineries and implements. By doing so, the fragmented land holders/farmers with less access to credit and loans may be benefited.
- Certified seeds for quality output: Tamil Nadu State Seed Development Agency (TANSEDA) has been involving in production of certified seeds and distribution of quality agricultural seeds to the farming community with the objective of achieving the Seed Replacement Ratio of 33 % in self-pollinated crops (paddy, pulses and groundnut), of 50 % in cross pollinated crops (cotton, cholam/Jowar and cumbu/Bajra) and of 100% in hybrids.

The state government has 41 State Seed Farms (SSF) with the area of 4180.18 acre for production of quality of seeds and demonstration of latest technologies for making awareness among farmers. It has 16, 37 and 63 major, small and mini seed processing units, which process 30 000 MT seeds procured from the SSF and farmers every year. The state owns 23 Coconut Nursery centres and 16 Coconut Crossing Centres for production and distribution of quality coconut seedlings to the farmers as a part of rejuvenating aged orchards and replantation of coconut coupled with establishment of new orchards.

GoTN, Agriculture Policy Note, 2017-18

- In 2016-17, 18206, 314, 3658, 2282 and 28 MT of paddy, millets, pulses and oil seeds and cotton were procured and around 85 % of them distributed to 5.20 lakh farmers as a part of replacing the seeds with quality seeds. Periodical propaganda and demonstration have been conducted by the extension functionaries at the grass root level about the production strategies of seeds and their maintenance. In the same way, awareness meetings are conducted among the farmers about the need of replacing seeds with the quality seeds.
- About 66.7 lakh soil health cards have been distributed under the scheme of Soil Health Cards. It may help the farmers in application of site specific and need based fertilisers. Besides, the steps may further reduce the need of complex fertilisers as the Soil Health Cards hold good for straight fertilisers, and therefore, reduce the cost of production of crops.
- Crop based eco-diversity: Every year the DoA envisages to distribute 250 MT of green manure seeds, 525 MT of Blue Green Algae, 500 MT of Azolla and 5000 Nos of Pluerotus Kits, these measures certainly help in increasing the organic matter and nitrogen content of the farms, therefore, support the farmers to get more productive soil and protecting the eco-system of the farms.
- Capacities and skill of the farmers and extension functionaries are met by the 22 Farmers Facilitation Centres (FFC), Water Management Training Centres (WMTC), Madurai, the State Agricultural Extension Management Institute (STAMIN), Pudukkottai. Every year, more or less 29000 Nos of farmers/youth/convenor/farm women are trained on farm management practices and technologies by FFC and STAMIN WMTC imparts trainings to 180 field functionaries and 900 farmers annually on irrigation management technologies and water use efficiency.
- STAMIN provided skill improvement trainings to 1100 Nos of field level extension functionaries so as to cater the need of up-to-date farm knowledge and latest technologies during 2016-17. To improve the direct interface between farmers/farmers groups and extension functionaries, 1918 Assistant Agricultural Officers (AAOs) along with 385 and 770 Block Technology Manage (BTM) and Assistant Technology Managers (ATM) visit 12 620 village panchayats in 385 blocks. Each AAO visits 8 segments every fortnight and the Assistant Agriculture Officer visits the field 3 times a week. The supervision is done by both Deputy Director of Agriculture and Joint Director of Agriculture by visiting the field level officers 2 times a week.
- 880 Amma Facilitation centres (AFC) are empowered to help farmers about the latest technologies and linking them with the wide range of market and network services. Importantly, these AFCs provide crop advisory services to the farmers as well.
- The stocking godowns of the centre distribute critical inputs, farm implements, plant protection equipment. In the recent past, 146 of these AFCs have been upgraded to Integrated Agricultural Extension Centres (GoTN, Agriculture Policy Note, 2017-18).

Table 1.2: Inputs management in Tamil Nadu

S. no.	Unit	Total	Production /analysis (2016-17)	Feature
1.	Fertilisers Control Laboratory	14	17500 samples	Analyse the fertiliser samples for the quality fertiliser recommendation to the farmers.
2.	Micro Nutrient Mixture Production Centre (MNMPC)	1	2357 MT	MNMPC has an annual production capacity of 2400 MT and analyses about 14 different Micro Nutrient Mixtures.
3.	Bio-Fertiliser Production Unit	22	3000 MT	These Bio-fertilisers units analyses the quality of bio-fertilisers so as to recommend standard fertilisers for crop production.
4.	Liquid Bio-Fertiliser Unit	12	6,00,000 litres	
5.	Organic Fertiliser Testing Laboratory (OFTL)	2	1400 Samples	These OFTLs analyse about 1400 samples of vermicompost, city compost and de-oil cakes every year.
6.	Pesticide Testing Laboratory (PTL)	15	21433 Samples analysed in 2016-17	PTLs analyse the pesticides drawn from 147 and 13 321 pesticide manufacturing units and private outlets respectively.
7.	Central Control Laboratory (CCL)	1	NA	CCL provides capacity needs of analysts through trainings.
8.	Soil Testing Laboratory (STL)	31	11.46 soil samples	STLs provide awareness among farmers about the soil testing and analyse the soil samples drawn from farmers field for improving the fertiliser management.
9.	Mobile Soil Testing Laboratory	16		
10.	Bio Control Lab	10	-	-
11.	Integrated Pest Management Centre	2	-	-
12.	Seed Testing Laboratory	33	-	-

- ICTs for enhanced delivery of farm services: with the development of Agricultural Management and Information System (AGRI-MIS), the state government has made an exemplary work of establishing the farmers data base, the AGRI-MIS has the data base of 68 lakh farmers in the state as of 2018. The state has customised the Kissan Suvudha App in Tamil language so as to make the App farmers friendly, which provides information on weather forecast, sale outlets of seeds, fertilizers, pesticides and farm machineries, market prices, crop protection, farm advisories and Kisan call centre. ICT initiatives such as ARS (Agriculture Reporting System), e-Kalpa, Bhuvan, nutrient flash cards, FCMS and TN-AGRISNET, are being used by the extension professionals/

field level extension services providers to deliver extension advisory services to the farmers in time.

- 3.636 crores of rupees have been disbursed as compensation to the farmers under Pradhan Mantri Fasal Bhima Yojana (PMFBY) during 2016-18, which benefited around 10.15 lakh farmers in the state (GoTN, 2018-19-Budget Speech).

TN-Agriculture Resources Information System Network (TN-AGRISNET) is an ICT platform, which is set to collect 82 lakh farm families of the Tamil Nadu through online as a data base. It complements the extension functionaries in dissemination of information about weather, soil health & status, welfare schemes, inputs and its price, crop wise technologies, market trends, videos related to new farm technologies and schemes etc., TN is the awardee of Specific Sectoral Award-Gold for its e-Governance initiative by Gol.

Challenges

Crop production

- Input dealers have earned the trustworthiness more than the extension functionaries of line departments among the farmers as a result of non-updating of recent and advanced fertilisers and plant protective chemicals. Therefore, farmers have drifted to input shops directly for the know-how/scientific advisory of the plant protection measures. It has not only helped the private players to sell their plant protective measures at higher cost but also use of high active ingredient for the want of immediate result, which has led to loss of soil fertility and health over a period of time.
- Presently, inputs (seeds, fertilisers, pesticides, etc.) are to be supplied by the extension functionaries of the Department of Agriculture to farmers, which affects the extension systems of the state as the extension functionaries have merely become record keepers and accountants of balance sheet regarding the quantity of inputs supplied and finance and subsidy, as a result of which extension functionaries are not able to focus on capacity/information need of the farmers, farming systems research/extension besides, linking farmers with research and extension in Tamil Nadu.
- Crop Cutting Experiment (CCE) and its implication: When 2 Kgs of Maize sample is taken from 5X5X5 plot of the village in which the AO works, the weight of the Maize after 1 week of drying is said to be about to be 900 Kgs scientifically. However, the AOs or grass root level extension functionaries are duty-bound by the top-level management to show the weight of the 2 Kgs Maize sample around 1300 Kgs. It leads to generation of counterfeit data regarding productivity and production of the crop in the block, district and state as a whole. (the example cited above is the experience of the one of the AOs from Tamil Nadu name and block is not disclosed). Whereas,

Poor advertisement of stock position about inputs and deficiency of inputs at the time of supply are the major challenges faced by the extension functionaries of DoA.

Parthasarathi, 2009

the same village wherein the Crop Cutting Experiment has been done in Maize crop, the top-level management reinforces AOs to manipulate the data of the yield of Maize to zero so as to misappropriate the funds of Pradhan Mantri Fasal Bhima Yojana (PMFBY).

Policies and schemes

- Most of the time farmers avail the schemes for want of subsidies yet farmers may not use/continue the technologies/benefits received under schemes. For example, farmers who adopt micro irrigation through Pradhan Mantri Krishi Sinchai Yojana (PMKSY) in the current year, may uninstall the system in the succeeding year owing to good rainfall or logging of irrigation system or absence of immediate services for micro irrigation. However, there is no evidence as to what extent, the farmers have discontinued the micro irrigation due to disenchantment. It might be that lack of systematic evaluation by the officials among the beneficiaries who have adopted micro irrigation over a period of time under PMKSY. If the particular scheme is not on the basis of the ecological or conditions of the location, then the concerned JDAs/AOs/AAOs should be given with rights to null and void the scheme on the basis of its irrelevancy.

Extension functionaries have become an agent rather than a change agent in convincing farmers in adoption of top-down technology for want of achieving the physical target of the scheme, this mission mode transfer of technology often consider the location specificity and need of the farmers.

ICTs

- WhatsApp based reporting has helped the extension functionaries to update the higher official about the status of scheme and its success within short span of time, it is a cutting-edge ICT technology as it has improved the efficiency in terms of time, space and extension activity. Moreover, WhatsApp reporting has brought transparency among the field extension functionaries and implementation of schemes at the grass root level. However, the untimeliness in reporting through WhatsApp has increased, thus the untimeliness of reporting should be streamlined to improve the use of new media tool appropriately and effectively.

Subsidies and insurance

- Subsidies and insurance encourage farmers to adopt technologies, which are unaffordable by farming community. However, the subsidy led agriculture has changed the extension systems/approaches from education of farmers to canvassing of farmer. As a consequence, extension campaign, participatory awareness creation, education and farming systems research and integrated extension approach in farming are still in its nascent stage i.e. right from field to fork.

The subsidy given to the farmers have not been reaching the farmers properly

Parthasarathi, 2009

Human Resource Management

- A total of 2 006 technical officers, functions in directorate of agriculture, which includes 420 Assistant Directors of Agriculture (ADAs) 1088 Agricultural Officers (AOs), 337 Deputy Agricultural Officers (DAOs), 125 DDAs, 31 JDAs and 5 Additional Directors of Agriculture. And total field functionaries of 2829 AAOs and Agricultural Seed Officers (ASOs) are pervasively working closely with the farmers. However, the proposed strength is inadequate to support the 83 lakh farm families of the state. i.e. each of the functionary (excluding Additional Director of Agriculture) is to meet 3243.79 farmers in a year.
- Analyses of pesticides, bio-fertilisers, organic fertilisers etc., are being done by AOs as a part of Quality Control. It has led to more work burden on them. For example, a fixed analysis of 100-150 pesticide samples, 100-150 bio-fertilisers sample on a monthly basis is difficult for AOs who are in turn charge of schemes work, collection of soil samples, conduct of Adoptive Research Trials, Mini-Kit Trials, etc.,
- Most of the cash books, bill books, stock book of stock verification and TANSEDA are maintained additionally by AOs. In many cases one AO is given with the maintenance of two centre pertinent to stock verification and TANSEDA.

Case of Coimbatore district

In Coimbatore district, 1/4th (21.56 %) of the AOs, 61.11 per cent of the Assistant Seed Officers (ASOs), 16.66 per cent of the Deputy Agricultural Officers (DAOs), 21.25 per cent of the AAOs, 50 per cent of the Depot Manger Grade 2, 25 per cent of Depot Manage Grade 3, 71.42 per cent of the Sales Assistant, 64.70 per cent of Office Assistant, 28.12 per cent of the Night Watchmen, 75 per cent of the Assistant Draughting Officers, cent per cent of Mazdoor and Skilled Assistant Grade 2 posts are vacant against the sanctioned posts (Joint Director of Agriculture, Coimbatore, 2018).

Department of Horticulture and Plantation Crops

Department of Horticulture and Plantation Crops was separated from Department of Agriculture in the year 1979 and has its own extension mechanism from 2015 onwards. The department aims at providing crop production materials and advisory services for the improvement of horticultural production. The schemes such as Integrated Horticulture Development Programme (IHDP), Pradhan Mantri Krishi Sinchai Yojana (PMKSY), National Horticulture Mission (NHM). The National Mission on Sustainable Horticulture (Rainfed Area Development Programme), Paramparagat Krishi Vikas Yojana (PKVY) are the major centrally sponsored schemes. The state schemes of the Department of Horticulture and Plantation Crops include collective farming and Peri Metro Vegetable Cluster Development Programme. These schemes are operated with mission mode approach due to fixed physical and financial target.

Tamil Nadu contributes about 7 % of horticulture production in the country and has the area share of 6 % to the total horticultural area in the country

GoTN-Agriculture Policy Note, 2017-18

Salient features and its impact

- The area under horticulture crops has been increasing in the state of Tamil Nadu as the value and export market of the crops continue to perform well. At present (2016-17), the state has 2.95 lakh ha of land area under fruits and 3.14 lakh area under vegetable crops, 1.15 lakh ha of spices and condiments, 7.15 lakh ha of plantation crops, 0.11 lakh ha of medicinal and aromatic plants and 0.26 lakh ha of flowers (GoTN-Agriculture Policy Note, 2017-18).

The state has the highest area under banana (1.18 lakh ha) in the county. The area of other crops such as tapioca (1.21 lakh ha), cocoa (0.24 lakh ha), flowers (0.55 lakh ha). Additionally, 3 thousand ha of grapes, 6.35 lakh ha of plantation and 4 thousand ha of pepper are in the state.

GoTN-Agriculture Policy Note, 2017-18

- The production of fruits and vegetables is 60.08 and 88.83 lakh MT respectively. The total area of the horticultural crops is set to increase from the present 14.76 lakh ha to 15.67 lakh ha in 2017-18. Even the production is set to increase from 174.94 lakh MT to 188.22 lakh MT (GoTN-Agriculture Policy Note, 2017-18).
- The area under horticultural crops increased from 10.01 lakh ha during 2011-12 to 14.76 lakh ha during 2016-17. The average Annual Growth Rate (2011-12 to 2016-17) of area under horticultural crops is 7.76 %. Both internal and external factors are said to be the reasons for increased area under horticultural crops. The external factors include, increased demand of horticultural produce in the urban areas, changing lifestyle and food habits of the urban dwellers, increasing Purchasing Power Parity (PPP), schemes of the government such as National Horticulture Mission (NHM) and Mission Integrated Development of Horticulture (MIDH). The internal factors include, less management of orchards when compared to agricultural crops, profitability of the crops, favorable

situation for horticultural production, higher Benefit Cost Ratio (BCR) of horticultural crops than agricultural crops and wider spacing of crops e.g. Coconut and Banana.

- Micro irrigation for enhanced productivity and minimised water use: Around 3.46 lakh acres of lands brought under micro irrigation, which benefited 1.45 lakh marginal and small farmers in the past five years. In addition to this, 0.86 lakh ha of lands were laid with micro irrigation under TN-IAMEARM project, which benefited 0.33 lakh farmers across the state.

Trend of Horticultural area in the state of Tamil Nadu

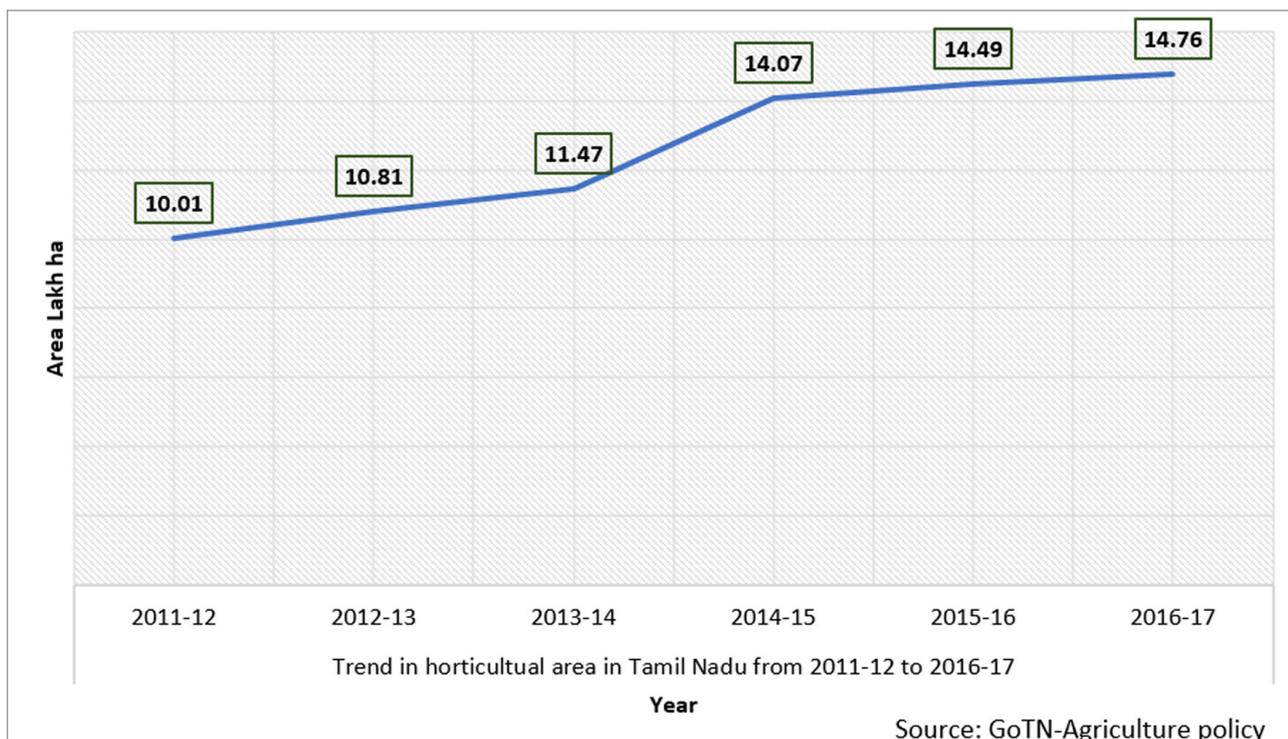


Figure 1.10. Trend of Horticultural area between 2011-12 and 2016-17 in Tamil Nadu

Table 1.3. Schemes and development activities of department of horticulture and plantation crops

S. no.	Schemes	Features	Budget Spent (Crore)	Area increased lakh ha (between)
1.	Integrated Horticulture Development Scheme (IHDS)	Hybrid vegetable seeds and quality planting materials are distributed at 40% subsidy in total cost of cultivation through this scheme by State Government. This scheme is implemented with the main objective of area expansion of horticultural crops in 9 non-National Horticulture Mission districts namely, Karur, Kancheepuram, Namakkal, Nagapattinam, Thiruvavur, Tiruvannamalai, Tiruvallur, Tuticorin and Virudhunagar.	24.99	0.96 (between 2011-12 to 2015-16)
2.	TN-IAMP (IAMWARM-II) Project (Tamil Nadu Irrigated Agriculture Modernization Project- Horticulture)	The main objective of the programme is to accelerate crop diversification to horticulture crops especially vegetables, through promotion of hi-tech cultivation and water conservation technologies in the proposed sub-basins.	77.47 (2006-07 to 2014-15) 210.00 from 2017-18 to 2023-2024	0.49 (61 sub basins) 0.45 (proposed increase in area)
3.	National AYUSH Mission - Medicinal Plants (NAM-MP)	Assistance of 30% and 50% in the cost of cultivation is extended for growing medicinal plant species such as Marunthukoorkan (Coleus), Kanvalikilangu (Gloriosa), Nelli (Amla), Thippili (Indian long Pepper), Avuri (Senna), Nithyakalyani (Periwinkle), Thulasi (Ocimum), Vembu (Neem), Manathakkali (Black night shade) etc.,	2.53 (2016-17)	960 ha
4.	Paramparagat Krishi Vikas Yojana (PKVY)-NMSA	Organic farming, certification by Participatory Guarantee System (PGS) and marketing the produces in local markets are encouraged in this scheme by cluster approach.	3.60 and 51 clusters (2015-16)	2550 acre under organic cultivation
5.	Rainfed area development (RAD)-NMSA	It aims to promote Integrated Farming System (IFS) with emphasis on multitier cropping, rotational cropping, inter-cropping, mixed-cropping practices etc., to enable farmers in maximizing farm returns for sustaining livelihood and mitigate climate related issues	11.17 (2016-17)	21 districts

6.	Perimetro Vegetable Cluster Development Programme	Perimetro Programme is implemented with an objective of reducing the gap between producer and consumer and to ensure supply of safe and quality vegetables at low price to urban population and higher income to farmers.	56.02 2016-17	6 clusters
7.	National Agricultural Development Programme (NADP)	Promotion of Precision farming, area expansion of Horticulture crops, pandal cultivation, protected cultivation, Banana bunch sleeves etc,	231.48 (2011-12 and 2015-16)	Component basis
8.	National Horticulture Mission	To encourage horticulture crops cultivation among farmers. Area expansion of high remunerative horticulture crops such as Vegetables, Fruits, Spices and Condiments, Flowers and Plantation crops is being promoted with adoption of high tech cultivation practices.	359.23 (2011-12 and 2015-16)	1.48 lakh ha (new gardens)

Source: GoTN-Agriculture Policy plan, 2017-18

- Increased area under horticultural crops through NHM, concerted efforts have been taken in all the 22 NHM operating districts to enhance the horticultural activities. Between 2011-12 and 2015-16, the area increase of horticulture was 1.48 lakh ha owing to rejuvenation and replantation of senile plantation (0.2 lakh ha), establishment of mushroom units (4 Nos), creation of water resources (7 Nos), protected cultivation (06 lakh ha), promotion of Integrated Pest Management (0.01 lakh ha), establishment of bee keeping structures (0.25 lakh Nos). On the other hand, NHM has supported the creation of 219 Nos of pack houses, 292 Nos of low cost onion storage structures and 2 Nos of cold storage and integrated cold storage units in Tamil Nadu.
- The state has established two Centres of Excellence, which include Centre of Excellence for Cut flowers at Thally, Krishnagiri district and Centre of Excellence

The state owns 56 State Horticulture farms with the area of 2 538.16 acres, 13 parks, of which 5 are in Nilgiris district, 4 are in Salem district, one is in Chennai, one is in Tirunelveli and one is in Ramnad and the other one is in Dindigul.

GoTN-Agriculture Policy plan, 2017-18

Four Horticulture Training Centres are with the state viz., Madhavaram in Tiruvallur district, Kudumianmalai in Pudukkottai district, Thally in Krishnagiri district and Ooty in The Nilgiris district. These training centres entrusted to provide training in Hi-tech cultivation of Horticulture crops is imparted to farmers. On an average, not less than 3000 farmers are trained on modern and high-tech cultivation.

GoTN-Agriculture Policy plan, 2017-18

for Vegetables at Reddiyarchatram, Dindigul district under NHM with the technical support from Israel.

- The state has resolved to establish two more centres namely, Centre of Excellence for Hill vegetables in Nanjanadu in Nilgiris district and Centre of Excellence for Tropical fruits in Trichy under NHM.
- NADP has made an outstanding contribution in the field of horticulture in the past five years (2011-12 to 2015-16), which includes increased area under precision farming (0.1 lakh ha), bower (Pandhal) cultivation of vegetables (0.01 lakh ha), protected cultivation of 29 ha. Besides, distribution of 88 Nos of Turmeric broilers, 8,688 Nos of Tapioca sett cutters, modernization of State Horticulture Farms, establishment of new State Horticulture Farms and training to farmers etc., under Perimetro Vegetable Cluster Development Programme the state ensured the supply of fresh and quality vegetables to the consumers of urban population meanwhile increasing the remunerative return to the producers. Perimetro Vegetable Cluster Development Programme is operated in 6 clusters namely Chennai, Coimbatore, Trichy, Madurai, Salem and East Coastal districts.

Human Resource Management

- 2610 and 1223 technical and non-technical staffs are functioning respectively in the DoH. Of the total technical staff, 62.56 % are Assistant Horticultural Officers followed by 15.47 % Horticultural Officers and 15.24 % are Assistant Directors of Horticulture, 4.71 % are Deputy Horticultural Officers and the remnant per cent are Additional Directors of Horticulture (2 Nos), Joint Directors of Horticulture (6 Nos) and deputy Directors of Horticulture (39 Nos).

Department of Agricultural Engineering

In Tamil Nadu, agricultural Engineering formed in the year 1946 under the Grow More Food Programme. The Agricultural Engineering Department was started functioning as a separate department since 1981.

Roles and responsibilities

- Agricultural Mechanization, Soil and Water Conservation, Water Management, Green Energy

Case of Kanyakumari district

Allocated man power is insufficient to cater the need of the farmers, as most of the farmers shift to horticultural crops to conserve and better use dwindling farm resources including water due to climate change more man power is needed. For example, Absence of 80 per cent Assistant Director of Horticulture (ADH), 8.33 per cent of Horticultural Officers (HOs), 86.84 per cent of Assistant Horticultural Officers (AHOs) in Kanyakumari is the major constraint on account of more than 50 per cent (54.66 %) of the area under horticultural crops (includes coconut) to the total net cultivated area. It affects the efficiency in identification of right farmers and conduct of trainings/ demonstration of technologies such as bee hives/colonies.

Initiatives in Agriculture, Infrastructure development are the major role of the Department of Agricultural Engineering (GoTN-Agriculture Policy plan, 2017-18).

- The strengths of land development machinery were 81 Bulldozers, 132 Tractors, 63 Laser Levellers, 7 Paddy 184 transplanters and 48 Paddy combine harvesters during 2017-18, for hiring out to farmers at nominal hire charges so as to support the farmers in laborious field works like land levelling, land shaping, ploughing, paddy transplanting and harvesting etc., Bull dozers and Tractors are also used for relief works during the periods of flood and natural calamities (GoTN-Agriculture Policy plan, 2017-18).
- Minor irrigation machineries such as 24 Rotary Drills, 7 Percussion Drills, 22 Mini Drills, 42 hand Boring Sets, 7 Long Hole equipment and 29 Rock Blasting Units are also hired out to the farmers at reasonable price, which enable the farmers to overcome the labour shortage and improve the crop production. To popularize the innovative agricultural machinery/implement, the Department of Engineering has been conducting exhibition and demonstration training among the farmers. Besides, farmers have been educated on the economical use of irrigation water, growing importance of agricultural machineries to increase the agricultural production and to improve the living standards of farming community.

In 2016-17, 26 Rotavators, 12 Balers and 10 Ridge moulders were purchased (Rs.85.83 Lakh) to help the farmers in hiring of these farm machineries

GoTN-Agriculture Policy plan, 2017-18

A total of 30 numbers of Agricultural Engineering Extension Centre for Agricultural Engineering Department at the cost of Rs.75 Lakh under NABARD – RIDF assistance from 2017-18 onwards

GoTN-Agriculture Policy plan, 2017-18

Human Resource Management

A total staff strength of 4015 number is in the Department of Agricultural Engineering, which includes 11 Superintending Engineers at regional level, 31 Executive Engineers at district level, 5 Executive Engineers for special schemes, 125 Assistant Executive Engineers at revenue division level and for special schemes and 3,836 other staff in the department.

Table 1.4. Schemes and Developmental activities of department of agricultural engineering

S. no.	Schemes	Salient features	Budget (Crore)	Achievement (2016-17)
1.	NADP	Agricultural machinery and implements of different types and models which are empanelled/approved by Agricultural Engineering Department are distributed to the farmers. The subsidy is about 50 percent for small, marginal, scheduled caste, scheduled tribes and women farmers and about 40 percent subsidy assistance for other farmers/the maximum subsidy amount fixed by Government whichever is less. The machineries are Power tiller, Paddy transplanter, Garden land and Wet land, Brush cutter, Multicrop thresher provided to farmers.	12.65	3,516 numbers of Agricultural machinery and implements.
2.	Sub Mission on Agricultural Mechanization (SMAM)	Agricultural machinery and implements have been distributed to the farmers with the subsidy assistance.	22.51	2,832 Nos of farmers benefited.
3.	Distribution of Post-Harvest Technology and Management machinery (PHTM)	Self Help Group (SHG), User Groups (UG) of farmers, Entrepreneurs, FPOs and Co-operative Societies were formed to distribute the Post-Harvest Technology and Management machinery under National Agriculture Development Programme to individual farmers and to encourage the food processing and value addition of farm produced among the farmers/women/youth/skilled labourers.		
4.	Block Level Custom Hiring Centres (CHC)	The subsidy assistance for establishing Custom Hiring Centre at block level is 40 percent of the total unit cost of Rs.25 Lakh or a maximum amount of Rs.10 Lakh per centre and the 60 percent balance amount of Rs.15 Lakh per centre will be the beneficiary group or entrepreneurs' contribution as per Sub Mission on Agricultural Mechanization's guidelines issued by Government of India.	41.92	175 Custom Hiring Centres under NADP and 245 under SMAM And 5 Sugarcane based CHC under NADP.

5.	Special Area Development Programme	To provide special attention to hill areas and to the forest fringe villages of Western Ghats areas. It has been envisaged to include the following conservation measures, eco-restoration, eco-protection and eco-development and conservation by adopting integrated watershed approach in a holistic manner for sustainable livelihood and enhancing agricultural productivity.	75 crores to 2015-16 all line departments	
6.	River Valley Project	It has been implemented in South Pennaiyar and Mettur catchments in Dharmapuri, Krishnagiri and Erode districts under the NADP since 2013-14. Soil and water conservation measures such as Contour bunding, Land development activities, Drainage line treatments, Silt detention structures, Water harvesting structures, Support to farm production system, etc.,	₹28.4 (2013-14 onward) and 4.50 2017-18	21 764 ha covered and 2 022 Nos of water structures established.
7.	Water harvesting Structures through Rainfed Area Development	Rainwater harvesting structures are constructed under Rainfed Area Development as part of National Mission for Sustainable Agriculture (NMSA).	2.85	65 check dams constructed.
8.	Creation of Water harvesting Structures under PMKSY	To create more water structures as a remedy to drought and reducing water source.	12.25 (2016-17)	389 water harvesting structures.
9.	World Bank Aided Tamil Nadu Irrigated Agriculture Modernization Project (TNIAMP)	₹15 Crore has been kept to take up the construction of farm ponds in the 66 sub-basin areas as a supplementary source of additional irrigation.	2017-18 to 2023-24	
10.	Command Area Development and Water Management Programme in Canal and Tank commands	Command Area Development and Water Management has been envisaged to reduce the loss of water in the field channels of canal and tank irrigated areas and to ensure equitable distribution of water among head reach and tail end farmers by adoption of rotational water supply system. 2015-16 onwards, the programme has been called PMKSY. Construction of concrete field	44.38 crores from 1980-81	9.41 lakh ha covered in 36 command areas. 2014 Water User Associations have been formed

		channels, Creation of Infrastructure for Micro Irrigation, Construction of diversion box with shutters and Construction of cart track crossing are being executed by the Agricultural Engineering Department under the PMKSY.		under this programme.
11.	Green Energy Initiatives in Agriculture	In order to promote utilization of solar energy in agriculture sector by the farmers, the Government has been providing subsidy assistance to the farmers for installation of solar powered pumping systems and solar driers since 2013-14.	₹80.77 Crore.	2 293 Nos of 5 HP, AC solar Pumps were installed. 5.73 thousand ha covered so far 132 solar dries installed in 2016-17.

Department of Agriculture Marketing and Agribusiness

Agriculture marketing covers agriculture activities like assessment of demand and supply for farm-inputs, most efficient agronomic practices, post-harvest handling of farm products including transportation of products from farm gate to processing industries and ultimate consumers, shaping of public policies and programmes related to pricing, handling, purchase and sale of agricultural products (GoTN-Agriculture Policy Note, 2017-18).

Roles and responsibilities

- The major roles and responsibilities of the Department of Agriculture Marketing and Agribusiness include, formation and promotion of Farmer Producer Organization (FPO) to improve the socio-economic status of farmers, promotion of Commodity Groups for creation of market linkages, creating infrastructure facilities for Postharvest Management and Marketing of farm produce, creating marketing opportunities through Regulated Markets, Farmers Markets, Specialized Market Complexes to farmers, minimizing post-harvest losses and enhancing shelf-life through storage godowns, cold storages, ripening chambers, drying yards, etc. creation of infrastructure for value addition and processing through Public Private Partnership (PPP) mode, dissemination of market information, ensuring quality assurance for unadulterated food products through Agmark laboratories Capacity building programmes to impart skills on post-harvest management and processing, value addition, grading to the farmers. (GoTN-Agriculture Policy Note, 2017-18).

Salient Features

- The state has 23 Market Committees and 278 Regulated Markets (2017-18) for better regulation of buying and selling of agricultural produce. Services such as storage godowns, transaction sheds, pledge loan, etc., are provided in the regulated markets. Fees are not collected from farmers for the services rendered. 1 % of the sale value of the produce is collected as market fee from Traders. It was estimated that, during 2016-17, about 31.74 lakh MT of agricultural produce were sold by farmers and Rs.119 Crore was collected as market fee (GoTN-Agriculture Policy Note, 2017-18).
- Market Information: Dissemination of market related information like daily price and arrival information of agricultural produce is given through www.agmarknet.gov.in, which helps the farmers to aware of the daily market information and supports the decision making regarding sale of farm produce by farmers.
- e-National Agriculture Market: The state has promised to make 15 Regulated Markets to e-NAM by availing financial assistance from Government of India under Agriculture Technology Infrastructure Fund (ATIF) in 2017-18.
- Supply chain management: The Department is implementing the project Supply Chain Management of fruits, vegetables and other perishables with a total financial outlay of Rs.398.75 Crore to reduce post-harvest losses with appropriate systems, to connect farmers with major market centres, processors and consumers, to convert surplus production into value added products, to provide uninterrupted supply of quality fruits.
- Farmers' market/ Uzhavar Sandhais: 179 Uzhavar Sandhais are functioning in Tamil Nadu (2017-18). During 2016-17, on an average of 2410 MT. of vegetables, fruits worth of Rs.6.79 crore sold by 9,015 farmers, 4.02 lakh consumers were benefitted per day through Farmers' markets.
- Agmark Grading: AGMARK standards cover quality guidelines for 213 different commodities. In Tamil Nadu, there are 30 State Agmark Grading Laboratories in 19 districts and 1 Principal Agmark Grading Laboratory at Chennai. In 2016-17, 21.53 lakh quintals of food products were graded through these laboratories.
- Food Processing Incubation cum Training Centre: Food Processing Incubation cum Training Centre

e-Trading for turmeric was introduced in Perundurai market of Erode district under e-National Agriculture Market. Further 38 markets (30 regulated markets and 8 Cooperative markets) will be brought under e-National Agriculture Market in the state by 2018-19

GoTN, 2018-19-Budget Speech

The Farmers' Markets / Uzhavar Sandhais function with the objective of ensuring fair price to the Farmers' produce without the interference of intermediaries and supply of fresh fruits and vegetables to the consumers at a reasonable price.

Agmark is a quality certification mark on agricultural products in India. AGMARK is legally enforced by the Agricultural Produce (Grading and Marking) Act of 1937 (and amended in 1986) by Directorate of Marketing and Inspection, Government of India.

was established at Kinathukadavu, Coimbatore district and at Srirangam, Trichy district. Tamil Nadu Agricultural University has been identified as the resource for imparting training to agri entrepreneurs. TNAU is conducting value addition trainings at both centres since May 2017.

Human Resource Development

The Department of Agricultural Marketing and Agri-Business has about 1,310 department staffs and 1,631 Market Committee staff in the State, which include Assistant Agricultural Officers (635 Nos), Agricultural Officers (172 Nos), Deputy Agricultural Officers (52 Nos), Deputy Directors of Agri-business (29 Nos) and Joint Directors of Agriculture (3 Nos). In marketing committee, 345 Supervisors, 196 superintendents, 21 secretaries, 9 engineering supervisors and 1060 other non-technical staffs are functioning across the state.

Table 1.5. Schemes and developments activities department of agricultural marketing and agri-business

S. no.	Schemes and development activities	Salient features	Budget	Benefits
1.	TN-IAMWARM-I Project (2007-08 to 2013-14)	TN-IAMWARM-I Project helped in creation of post-harvest infrastructures such as Agri Business Centre, Drying yard, Collection Centre, Storage shed, Storage-cum-drying yard, pack house and distribution of Post-harvest equipment to commodity groups functioning across the state of Tamil Nadu.	NA	6577 commodity groups were formed. 1.73 lakh farmers benefited.
2.	e-Learning centre (2016-17)	e-learning centres have been created to disseminate information regarding post-harvest management and marketing through exhibits, audio visual aids, kiosk (touch screen), documentaries on various agricultural marketing interventions and latest developments in agri business sector under NADP.	7 crores	10 e-Learning centres across 10 districts.
3.	Agro Marketing Intelligence and Business Promotion Centre	Agro Marketing Intelligence and Business Promotion Centre (AMI & BPC) was established at Trichy to render market information in coordination with TNAU. Market information and intelligence services are being disseminated through mobile SMS to the registered farmers and staff of the Department.	43 lakhs	22.50 lakh farmers have registered in this.

Animal Husbandry

Modern Veterinary aid in India started by British East India Company in 1977. Of late, Civil Veterinary Department was inaugurated as a separate department in 1892 and in 1948 the Head of the Department was designated as the Director of Animal Husbandry. Animal husbandry contributes 4.34% GSDP in the state's agriculture and the agriculture and allied activities' contribution is 36.26%. The value of this sector increased from Rs.11535.23 crore in 2006-07 to Rs.47659.71 crore in 2015-16. The estimated milk production, which was 54.74 lakh Metric Tonnes (LMT) during 2005-06 in Tamil Nadu and increased to 75.56 LMT during 2016-17 (GoTN-Animal Husbandry Policy Note, 2017-18).

Tamil Nadu share of cattle, buffalo, sheep, goat, pigs and (other horses, donkeys and ponies) population to the total of India is 4.62, 0.72, 7.36, 6.02, 1.79 and 3.74 % respectively. The total livestock population of the state to the country's total is 4.44 %

*GoTN-Animal Husbandry Policy
Note, 2017-18*

Roles and responsibilities

- Activities such as upgradation of local stock of cattle and buffaloes by Artificial Insemination using exotic and cross bred semen for cattle and Murrah semen for buffaloes are integral parts of the Department of Animal Husbandry in the state.
- Conservation and propagation of indigenous breeds of livestock in their native tracts are set to improve the traditional value of the livestock. Similarly, augmenting the production potentialities of livestock and poultry is indispensable part of the department which increases the production of milk, egg and meat across the state.
- The state provides necessary and timely modern veterinary assistance and health cover to the livestock and poultry through the Department of Animal Husbandry, which ensures livestock health by preventing major livestock diseases. The department has been entrusted to Implement various central and state Government schemes for the upliftment of economic status of rural poor/marginal farmers/household women and to protect human health by detection and control of major zoonotic diseases of animals. Besides, the extension activities of the department include creating awareness among public on modern animal husbandry technologies/practices, conducting training on basic/latest animal husbandry practices among the farmers/livestock

In 2013, the department was awarded with the "Best Practices Award" for improvement of quality delivery system ensuring good governance by the Hon'ble Chief Minister of Tamil Nadu.

GoTN-Animal Husbandry Policy Note

Livestock farms (13 Nos) situated across the state maintain cattle breeds of Crossbred Jersey, Crossbred Holstein Friesian, Tharparkar, Sahiwal, Umblachery; Sheep breed of Ramnad White, Mecheri, Madras Red, Vembur; Goat breed of Kanni Adu, Salem Black, Tellichery, Jamunapari etc..

keepers, organising health camps in every village etc., in the state. It is also responsible to deliver the effective health services to the animals across the state in time, thus to improve the production and productivity of the animals. For this purpose, veterinary graduates and para veterinarians are functioning across the state.

Salient features

- Tamil Nadu is the 2nd largest producer of eggs (4400 million/annum) and 4th largest producer of broiler (250 million broiler/annum) in the country. Infrastructure and veterinary services have increased, vaccination has significantly increased from 3 lakhs in 1992-93 to 20 lakhs vaccination in 2013-14. 45 lakhs of Artificial Insemination were done by the public while private conducted around 17 lakh artificial insemination (NDDB, 2014).
- Tamil Nadu ranks 1st in Poultry, 4th in Sheep, 7th in Goats, 13th in Cattle and 14th in Buffalo population in the country.
- Animal welfare: Cattle Breeding and Fodder Development Units (CBFD) are in all the 31 districts of the state except in Chennai. These Units supply breeding inputs viz., liquid Nitrogen and Frozen semen straws to the Artificial Insemination centres and ensure the distribution of fodder seeds; their development activities. In order to improve the health of the animals, during 2016-17 and 2017-18, the department spent about INR 32.62 and 33.23 crores respectively in purchase of general medicines, Mineral Mixture, Intensive Health Cover, etc., these funds are allocated to all the centres and institutions function under the department every year.
- Monitoring of Avian Influenza: Monitoring of slaughter houses for hygienic meat production is a key activity of the department. Weekly visits to bird sanctuaries and water bodies for rare mortality of birds and inspection of wet markets of poultry are undertaken by the 24 Animal Disease Intelligence

Infrastructure of Animal Husbandry in the state

2 804 veterinary institutions, i.e. 6 veterinary polyclinics, 22 veterinary clinician centers, 139 veterinary hospitals, 2 581veterinary dispensaries and 56 mobile veterinary units and 24 Animal Diseases Intelligence units (ADIU), 2 Poultry Disease Diagnostic Laboratories (PDDL) and one Central Referral Laboratory (CRL); 8 Livestock farms, 3 sheep farms, 1 poultry farm and 1 Fodder Seed Production Farm (<https://goo.gl/78BGqp>)

*GoTN-Animal Husbandry Policy
Note, 2017-18*

Most of the dairy farmers in Namakkal district (Tamil Nadu) have accessed public departments as a preferred source of training and advisory services due to professional competency of extension personnel and cost-free nature of the extension services. However, dairy farmers perceive that the training and advisory services provided by the dairy co-operatives have been more effective in terms of knowledge and skill, staff attitude, infrastructure, flexibility, infrastructure and need basis.

Karthikeyan et al, 2018

Units functioning across the state. To protect the poultry from sudden diseases and to provide healthy broilers to the consumers, the Poultry Disease Diagnostic Laboratory (PDDL) situated at Andagalurgate, Namakkal District undertakes timely inspections and diagnosis of unusual activities of the poultry. Institute of Veterinary Preventive Medicine, Ranipet (IVPM) is undertaking the Investigation of Food Mouth Disease (FMD) outbreaks, virus typing and sero-monitoring of vaccinated animals under FMD Control Programme. And, produces vaccines and biologicals for various livestock diseases.

Rajapalayam, Kombai, Chippiparai and Kanni are the native dog breeds of the state.

In 1989, Tamil Nadu Veterinary and Animal Sciences University (TANUVAS). It offers 336 and 119 B.V.Sc., and M.V.Sc., respectively every year www.tanuvas.tn.nic.in

- Nano Heal and Nano Dermal Cream, Improved meat type Japanese quail, Progesterone impregnated intravaginal sponges for synchronizing estrus in cattle and buffalo, Surgical Scrub Kit are the technologies developed by TANUVAS.
- TANUVAS is also resolved to perform both clinical and laboratory services in its part, the following table discusses the services done by TANUVAS during 2014-15 and 2015-16.

Table 1.6. Clinical and laboratory services of department of animal husbandry

S. no.	Services/Year	2015-16	2016-17
1.	Clinical Services	1.88 lakh animals were treated as out-patient cases (4255 and 663 large and small animals were treated.	1,96,666 animals were treated as out-patient cases (3,830 large animals and 1,053.
2.	Laboratory Services	3 121 mycotoxins, pesticides and drug residues were analysed, 61,577 tests for proximate, mineral, adulterants, contaminants and mycotoxins in feed, feed ingredients, and vitamin concentration were done and 3,143 human and 3,252 animal serum samples were screened by Microscopic Agglutination Test (MAT) for detection of leptospiral antibodies.	59122 tests for proximate, mineral, adulterants, contaminants and mycotoxins in feed, feed ingredients and vitamin concentration and 2,207 human and 1,216 animal serum samples from suspected cases were screened by Microscopic Agglutination Test (MAT) for detection of leptospiral antibodies were done.

Table 1.7. Extension activities by department of animal husbandry and TNAUVAS

S.No.	Extension	2015-17	Components	Impact/benefits
1.	On-campus training	2010	Dairy farming, sheep & goat farming, poultry farming, pig farming, milk and milk products and feed and fodder cultivation.	1.22 lakh beneficiaries
2.	Off-campus training	1693		
3.	Training programme	255	Fodder development, Pudhu Vazhvu and Poultry development.	11675 beneficiaries
4.	Skill development	84 courses	22 PG Diploma, 15 Skill development and 10 self-employment courses on knowledge and skills on latest technologies in veterinary field.	*9813 beneficiaries
Total		3958		143488

**Students/rural youth/women/farmers*

Table 1.8. Schemes and Development activities of department of animal husbandry

S. no.	Schemes and development activities	Salient features	Beneficiaries/impact
1.	Free distribution of milch cows and goats / sheep (2011-16)	Milch Cows are given to Village Panchayats where there have been limited/less numbers of Milk Cooperative Societies. After the distribution of Milch Cows, Milk Cooperative Societies are established and milk is procured from beneficiaries. Mostly, the beneficiaries are women under free distribution of milch cows and goats / sheep scheme since the scheme is envisaged to promote the livelihood and to improve the participation of women in economic activities.	63 488 women beneficiaries 63 488 Milch Cows. 66 lakh litres of milk are being produced daily through these milch cows and 1,21,636 calves worth Rs.60.81 crore were born.
2.	Free distribution of goats/sheep (2011-16)	Each beneficiary is provided with 1 male and 3 female goat / sheep which are around 6-8 months of age. Beneficiary is woman aged below 60 years. 30 % of beneficiaries of the scheme should be SCs/STs and the beneficiary should be of landless agricultural labourers.	7 22 152 women beneficiaries and 28 88 608 sheep/goat 59.07 lakh kids worth Rs. 1,476 crores have been obtained from the goats distributed.

3.	Scheme for poultry development (SPD)	The Government of Tamil Nadu launched the Scheme for Poultry Development during 2012-13 at an outlay of Rs.22.35 crore to develop poultry industry in non-poultry backward regions. At least 33% of the beneficiaries should necessarily belong to SC / ST Communities.	NA
4..	Establishment of broiler farm (2012-13 to 2016-17)	Rs.122.35 crore has been spent to establish broiler farms across the state.	2,747 Broiler farms, have been established in 25 Districts till 2017.
5..	Native Chicken Rearing	Identified beneficiaries are encouraged to rear native chicken under the Scheme. A flock size of 250 / 500 birds can be profitably reared and marketed by the farmers. A sum of Rs. 44,850 is given to a beneficiary with 25 % subsidy from the state government.	15,554 Native chicken farms established till 2017.
6.	State Fodder Development Scheme (SFDS)	To reduce gap between the demand and supply of feed and fodder, efficient utilization of available resources, the Government is implementing State Fodder Development Scheme since 2011-12 at a total outlay of Rs.140 crore. 30 % should be SCs and STs beneficiaries. It aims at improving the fodder need of the animals by means of improved distribution of fodder seeds, azolla cultivation, distribution of rain guns to effectively use water resources	2.27 lakh acres of farmers lands have been brought under the cultivation of fodder; production of 164 MT of fodder has been ensured by this. 12,703 Chaff cutters were also given to farmers. 20,958 Azolla units were 10,483. Rainguns were installed.
7.	Foot and Mouth Disease Control Programme (FMD-CP)	Foot and Mouth Disease Control Programme funded jointly by the State and Central Government is being implemented in all Districts of Tamil Nadu to contain and prevent the occurrence of foot and mouth disease. So far, 12 rounds of FMD vaccination have been carried out in the State.	In 2016-17 alone 93,83,197 and 93,86,018 nos cows and buffaloes respectively were vaccinated.
8.	National Livestock Mission (NLM)	It has been implemented for animal insurance and other developmental activities of animal welfare and rural backyard poultry development scheme is also implemented through NLM.	2 lakh animals were insured 3,120 beneficiaries were provided with 4 weeks old 20 birds.

9.	Livestock Protection Scheme (Kalnadai Padhukappu Thittam)	Veterinary health camps are conducted at farmers' door step to provide total health cover to livestock and poultry in remote villages where veterinary facilities are inadequate.	5,500 special camps/year.
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**Free Distribution of Milch Cows and Goats / Sheep Scheme have yielded approximately 7 Lakh Metric Tonne of manure worth Rs.112.14 crore.*

Department of fisheries

11 lakh fisher folks live in 608 villages of 13 coastal districts in Tamil Nadu. With 1076 KMs of coastal line, Tamil Nadu ranks 2nd in terms of longest coastal line in the country next to Gujarat state. The fish production of the state attained to 6.97 lakh tonnes thus placing the state 5th largest producer of the fish in the country. 0.93 lakh MT fish products were exported and earned foreign exchange of 5.30 thousand crores during 2014-15. On the whole, the Gross State Domestic Share of fisheries is 0.7 % to the state. Tamil Nadu is endowed with 3.83 lakh ha. of effective water spread area. The water spread comprises of long seasonal / short seasonal irrigation water resources. Tamil Nadu being a water starved State, has water in most of these water bodies for a short period of 4-5 months only. The inland fisher population is about 2.27 lakh. Inland fisheries have gained popularity and emerged as an important source of livelihood for fisherfolk / fish farmers in Tamil Nadu. About 5,000 ha of ponds and tanks are being utilised. Short seasonal fish species such as Amur Carp, Genetically Improved and Farmed Tilapia (GIFT), Jayanthi Rohu, Pangasius sp., etc or fresh water aquaculture under the programme of District Fish Farmers Development Agency (DFFDA) have been promoted among the inland farmers and fishermen. 7 100 acres of area under coastal aquaculture i.e. shrimp production. Free (SPF) Shrimp, Litopenaeus vannamei. So far, 1,694 shrimp farms have been registered (GoTN-Fisheries policy Note, 2015-16).

Roles and responsibilities

- The Department of Fisheries has been entrusted to protect the traditional fishing rights of the fishermen and ensure the safety of the fishermen while fishing at sea and provide social security to the fishers through various relief schemes. The major activities of the Department of Fisheries include, improving the standard of living of the fishers by implementing several welfare schemes, developing / strengthening the infrastructural facilities for hygienic handling and processing of fish and thereby promoting domestic and overseas market. Conserving fishery resources by enforcing statutory regulations such as mesh regulation, preventing use of destructive gears, stock enhancement and establishing artificial fish habitats is also a part of the Department of Fisheries.
- The department ensures the management of fishery resources by offering diversified fishing options to the fishermen to exploit offshore/ deep sea resources especially, Tuna by providing financial assistance for deep sea fishing and establishing Mid-Sea Fish Processing Unit. Moreover, the department promotes the sustainable eco-friendly aquaculture practices / capture and foreign

exchange earnings through export and strengthens the Fisheries Co-operatives functioning across the state.

Salient features

- In light of volatile nature of water bodies and farm ponds, the state government has introduced fast growing fish species, such as Amur Carp, Genetically Improved and Farmed Tilapia (GIFT), 'Jayanthi Rohu' and Pangasius in short seasonal water bodies in place of common carp. To do this, adoption of cage farming, improvement of fish seed farms/banks, advancement of hatcheries technologies and feed mills have been intensively promoted by the state government.
- Fish seed production / Fish seed rearing centres: There are 33 fish seed rearing centres functioning under the control of the Fisheries Department and 5 fish seed rearing centres under the control of Tamil Nadu Fisheries Development Corporation (TNFDC). In addition to this, 4 fish seed production centres have been established at Poondi in Tiruvallur District, Thirukampuliyur at Karur District, Thattankulam in Thanjavur District and Chittar in Kanniyakur District which are expected to function to its full potential in the coming days. All of these fish farms have the capacity of producing 21 crore fingerlings every year. These fish seed farms enable the state government to reduce demand of the fish seeds to 25 crores from the present demand of 40 crores.
- The TN-IAMWARM project has helped the Department of Fisheries to train the inland fishermen folks on 99 Intensive fish cultures in ponds, GIF Tilapia culture, cage culture, Intensive Pangasius culture, Integrated fish culture and hygienic fish marketing. For this purpose, 10 Officials were deputed to Vietnam and 9 officials were deputed to China for overseas training programme during 2013-14. These trainings resulted in improvement of knowledge and skill of the fishermen folks/farmers in modern fish culture activities.
- NADP has been helpful in development of quality brood stock devoid of disease and fishing nets

An amount of Rs.58.43 lakh was released to establish a 'Magur' hatchery at Kancheepuram district so as to meet the demand of 'Magur' seeds in the state

Tamil Nadu Fisheries University (TNFU) offers UG degree of B.F.Sc. to 80 students, of M.F.Sc., to 19 students and 9 Ph.D., every year since 2012 and 4 certificate courses on Aquaculture, Freshwater Fish Farming Technology, Ornamental Fish Farming Technology and Harvest and Postharvest Technology.

<http://www.tnfu.ac.in>

TNFU has developed 18 fisheries technologies Pond culture of cobia, Indoor live feed culture techniques for Daphnia sp, developed a RT-PCR assay for the detection of viable Salmonella by targeting mRNA of invA gene to name a few. Two patents for its credit Designing and fabrication of inland raceways for intensive rearing of ornamental fishes and Mass production of Daphnia magna (live feed) in organic medium for ornamental fish feeding.

are provided to inland fishermen at 50 % subsidy in upgradation of fishing efficiency. During 2013-14, fishing nets were provided to 1063 inland fishermen.

- Demonstration for cage culture: Cage culture demonstration is given frequently to farmers/lessee/ fishermen cooperative society members with an objective to enhance their income through fish culture. 1.33 crores have been spent till 2015-16 to demonstrate the cage culture in the panchayat tanks, village tanks and irrigation tank among the farmers/fishermen/etc.

Human Resource Management

A total of 1686 posts is sanctioned, which includes 3 Joint Directors of Fisheries, 7 Deputy Directors Fisheries and 49 Assistant Directors of Fisheries function across the state to ensure the administration and developmental activities of fisheries in the state. 85 vacancies of various posts like Inspectors of Fisheries, Sub-Inspectors of Fisheries may be filled to ensure the timely delivery of fisheries services and advisory to the fishermen community.

Table 1.9. Schemes and development activities of department of fisheries

S. no.	Schemes and development activities	Salient features	Beneficiaries/impact
1.	National Savings-cum-Relief Scheme (NFSRS) for Marine Fishermen.	Funds are provided to the fishermen folk during lean season of fishing.	2 700 Rs/fisherman in 2014-15, 1.94 fishermen folk has been benefited.
2.	Savings-cum-Relief Scheme for Marine Fisherwomen.	Funds are provided to the fishermen folk during lean season of fishing.	1.76 lakh marine fishermen.
3.	Financial assistance of Rs. 2,000/- to Marine Fishermen Families during Fishing ban period.	Funds of 2000 Rs/head is given to the fishermen families.	1.49 fishermen families benefited in 2014-15.
4.	Group Accident Insurance Scheme for Fisherfolk.	In the event of death, the legal heir of fisherman was given Rs.1,00,000/-and in the event of permanent and partial disability the fisherman was given Rs.1,00,000/- and Rs. 50,000/- respectively.	1.13 crores have been settled to 119 claims so far.
5.	Motorisation of Traditional Crafts.	Motors provided to fishermen at subsidised cost.	635 fishermen benefited so far.
6.	Providing Wireless Communication facilities to ensure Sea safety.	It helps in warning the fishermen about the weather situation and thereof forecast.	18,400 Nos of individual wireless operating license have been filed with WPC. For procurement of 5 watt and 25-watt VHF end user equipment.

7.	Ornamental fish hubs by rural women.	It is envisioned to create ornamental fish hubs with 25 units of backyard ornamental rearing units in each district, five ornamental fish marketing units with a modified vehicle for transportation of live ornamental fishes at a total cost of Rs 2.13 crore, besides providing ornamental fish culture training to the beneficiaries at free of cost.	NA
8.	Tamil Nadu Irrigated Agriculture Modernisation and Water Bodies Restoration and Management (TN IAMWARM) project 2007-08 to 2014-15.	Aquaculture in farm ponds, fish seed rearing in cages, construction of earthen fish seed rearing farms, improving the existing Government fish seed rearing farms, cage farming, promoting ornamental fish culture and setting up of fish kiosks for fish marketing are being undertaken.	15 masonry fish seed banks, 109 earthen fish seed banks, 4 fish seed breeding and production centres, 49 ornamental fish culture units and 35 modern fish kiosks have been established. So far 831 farm ponds have been stocked with fish fingerlings and brought under fish culture. The productivity of the irrigation tanks 200 Kgs/ha/annum from 100 Kgs/ha/annum and farm pond productivity increased to 4.50 MT per ha.

Department of sericulture

A separate department for Sericulture was started in 1979. A total of 0.43 lakh acres (43935.75 acres) of lands was under mulberry cultivation in the state as of March, 2017. The total mulberry farmers of the state are 23 873. Additionally, 7640 acres of lands were brought into mulberry cultivation during 2016-17. The target for 2017-18 was about 7500 acres. During 2016-17, with the production of 1914 metric tonnes, the state has become a topper in the Bivoltine cocoon producer in the country (GoTN-Sericulture Policy Note, 2017-18).

Roles and responsibilities

- The major role of the Department of Sericulture is to attain self-sufficiency and to become a bivoltine Sericulture State; transfer latest Sericulture technologies to all of its stakeholder so as to create avenue for employment in rural / semi urban bases. Promotion of high yielding mulberry

varieties such as V 1 and M 1 is its priority; To ensure the capacity need of sericulture farmers, skill improvement programmes/trainings on the latest technologies are conducted; the state supports the sericulture farmers with subsidy in cultivation of mulberry crops, instalment of drip irrigation, establishment of cocoon sheds/silk reeling centre. The sericulture department ensures the supply and procurement of improved silk warm rearing equipment and zero-defect silkworm eggs; It facilitates marketing of cocoons and silk yarn through the government cocoon markets (20 Nos) and establishment of Chawkie rearing centres throughout the state with the objective of attaining more productivity of cocoons.

- The Directorate of Sericulture formulates and implement various schemes for development of Sericulture sector in the State (GoTN-Sericulture Policy Note, 2017-18).

Salient features

- The state owns 19 seed farms with an acre of 1907.58, these farms ensure the supply of 60. 50 lakh number of cocoon seeds every year.
- 11 state grainages and 3 National Silkworm Seed Organisation (NSSO) grainages with the production capacity of 100.50 lakh function across the state to ensure the production of zero defect silkworm laying, which are supplied to the farmers.
- Multi Graded Cold Storage units have been established at Krishanagiri and Hosur in Krihsnagiri district to preserve the silkworm eggs of 40 lakhs.
- 105 technical service centres are spread across the state to provide extension advisory services and technical assistance to the farmers about mulberry cultivation, garden maintenance, silkworm rearing and crop protection measures. The services are offered in the following three ways namely In-person, through telephone answering and field visits. These services are offered by the field level technical officers viz., 837 Nos of Junior Inspectors of Sericulture, 179 Nos of Assistant Inspectors of Sericulture and 67 Nos of Inspectors of Sericulture.
- 31 state silk farms with 280.18 acre are resolved to ensure the demonstration and training need of the sericulture farmers periodically. Moreover, these farms supply the quality mulberry saplings and chawkie silkworm to the farmers. These trainings centres have provided 6178 trainings, 1.35 lakhs of Chawkie (7 days old silkworm larva). The rearing of Chawkie is done by the four state Chawkie rearing centres along with 135 private chawkie rearing centres. 20 government cocoon markets help the farmers to sell their cocoons to traders (Reelers) at fixed price through open auction, which is facilitated by the staff of the Department of Sericulture.

90 % of the farmers practice production of bivoltine eggs (Two generation in a year) in Tamil Nadu.

(GoTN-Sericulture Policy Note, 2017-18).

Government Anna Silk Exchange, Kancheepuram is the major silk exchange board in Tamil Nadu since 1991, which facilitates in procurement of raw silk produced by the reelers through open auction system

(GoTN-Sericulture Policy Note, 2017-18)

- 8 Nos of Multiend Reeling Units and 3 Twisting Units help in post-cocoon practices. 93 cottage basin reeling units, 33 Multiend Reeling Units, 25 Charka Reeling Units are also maintained by the private players to ensure the self-sufficient production of silkworm fibre and yarn. Moreover, entrepreneurs are trained to establish reeling units. For this purpose, the state government extends its support to the private players and entrepreneurs. The cocoon productivity of the state is 78 Kgs/100 silkworms laying, which is more than the national average of 58 Kgs/100 silkworms laying.

Human Resource Development

Department of Sericulture has a total strength of 1453 technical and non-technical staffs, of which 57.60 % (837 Nos) are Junior Inspectors of Sericulture, 12.31 % (179 Nos) are Assistant Inspectors of Sericulture, 4.61 % (67 Nos) are Inspectors of Sericulture and the remnant are Director (1 Nos), Joint Directors (4 Nos), Deputy Directors (10 Nos) and Assistant Directors (27 Nos). 22.57 % of non-technical staff are working across the district and state sericulture department (GoTN-Sericulture Policy Note, 2017-18).

Major activities of the Agriculture and allied departments (An analysis of three year data from annual reports of 2017-18, 2018-19, & 2019-20)

Background

The number of operational landholders in the State is 79.38 Lakh who operating cultivable land of 59.73 Lakh Hectare. Small and Marginal holders account for 93% of the total holdings operating 62% of the area occupied. The remaining 38% of the total landholdings are occupied by 7% of medium and big farmers. The average size of landholding is around 0.75 ha, it is slightly lower than the national average (1.08 ha) (GoTN, 2019). Around 64 % of the farmlands are irrigated by wells and borewells, followed by 22 % of the land area are irrigated by canals, 14% of the land area irrigated from tanks and a negligible per cent (0.08%) by other sources.

Budget and agriculture

Agriculture also receives less budget, compared to other sectors, for example, it received only 6.4 %, 6.3 % and 6.1 % of the total budget during 2018-19, 2019-20 and 2020-21, respectively.

It was observed that, in Tamil Nadu, the sustainable action plan for Climate change in Agriculture, Climate resilient farming system, Integrated farming system, Collective Farming, Mission on Sustainable Dryland Agriculture, Micro irrigation, procurement of pulses through NAFED, Risk insurance, Organic farming, etc., are the major policy framework for transforming agriculture as a business and thereby increasing the income of farmers.

Major technologies and practices in agriculture	Major extension institution
Direct sowing of Paddy, Machine Transplanting of Paddy, System of Pulses Intensification, Redgram, transplantation, Promotion of Coarse and Nutricereals and popularisation of high yielding varieties, Extra Long Staple cotton production, Sustainable Sugarcane Initiative (SSI), Bio-control agents, Integrated Pest Management technologies, Biofertilizers (Azospirillum, Rhizobium and Phosphobacteria), Micro Nutrient mixtures, Soil Health Card; water conservation technologies and practices: Micro Irrigation, Percolation ponds, farm ponds, community ponds, check dams, Village ponds	Integrated Agricultural Extension Centers (IAEC), Farmers Training Centres, Water Management Training Centre (WMTC), State Agricultural Extension Management Institute (STAMIN) and State Agricultural Management and Extension Training Institute (SAMETI),

Crop insurance and compensation

The state plays a pioneering role in crop insurance. The state disbursed an amount of Rs.5,348 crores as compensation claims to 21.75 lakh farmers for the year 2016-17, 2017-18 and 2018-19 under Pradhan Mantri Fasal Bima Yojana (PMFBY). This has brought the state to first among all Indian states in terms of disbursement of maximum amount as crop compensation to farmers.

Cyclone Gaja and revamping agriculture, horticulture and livestock

It was enumerated by the department of agriculture that around 19,720 Ha. of Agricultural Crops such as Paddy, Millets, and Pulses was damaged. Also, 23,645 ha of horticultural crops such as Banana, Cashew, Mango, Vegetables, Jack, Acid lime, Garlic, Tamarind and Flowers were affected. The loss of agriculture, in particular, coconut was heavily damaged due to Gaja cyclone. It was found that around 35,268 ha of coconut garden were affected and caused damage to 51.67 lakh coconut trees. The agriculture department distributed 35 lakh Tall coconut seedlings at free of cost for replanting. This was possible because the department of agriculture has brought about 43.26 lakh coconut seed nuts raised them in the government Farms. Also, the department has promoted the intercropping of millets such as maize, ragi and kudhiraivali, pulses and oilseeds in cyclone-affected areas. The state has also allotted Rs.53.71 Crore under State Disaster Relief Fund (SDRF) and State funds towards the relief assistance. Relief assistance was provided to 195 fully damaged mechanized fishing boats, 1429 partially damaged mechanized fishing boats, 1051 fully damaged FRP vallams, 2942 partially damaged FRP vallams, 6157 engines and 10648 fishing nets to resume their fishing activities. (GoTN, 2019). The major affected districts were Pudukkottai, Nagapattinam, Thanjavur, Tiruvarur, Cuddalore, Tiruchirapalli, Dindigul, Theni, Karur, Sivagangai Madurai and Ariyalur.

Fall Armyworm in Maize and roadmap to the pest management

In July 2018, Fall Armyworm (FAW) devastated maize crop and caused a considerable loss to the farmers. However, the regular extension advisory services such as field visits of extension personnel,

university scientists etc., to the affected fields have enabled the farmers to mitigate the effects of Fall Armyworm to a certain extent. This apart, special workshop cum training was organised by the state with the participation of scientists from TNAU, experts from the Government of India, KVKs and Officers from the Department of Agriculture. The major outcome of the workshop was the IPM strategies for the control of pest (FAW), and therefore, the field extension personnel were trained to provide advisory services on IPM to farmers at a regular interval, and thereby managing the crops against Fall Armyworm. The pest has affected the maize crop of around 14 districts in the state, namely Perambalur, Ariyalur, Cuddalore, Vellore, Villupuram, Trichy, Dindigul, Madurai, Virudhunagar, Thoothukudi, Tirunelveli, Coimbatore, Tiruppur and Salem Districts.

The major awards conferred to farmers

“Bharat Ratna Dr. M.G.R. Traditional Rice variety conservator Award” (every year), for those farmers who conserve and grow traditional paddy varieties and Paddy Special Award for System of Rice Intensification (every year) awarded to a farmer who obtains the highest yield of paddy under SRI.

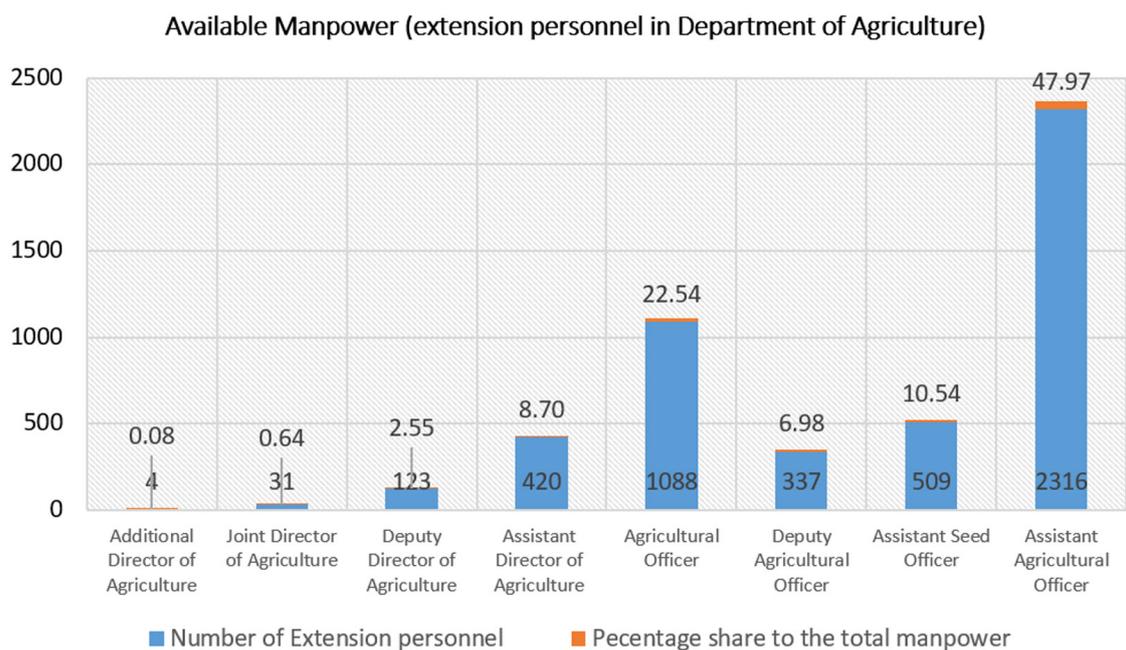
Major schemes of agriculture and their importance

Sr. no.	Major schemes of agriculture and their importance	Extension activities and impact
1.	Mission on Sustainable Dryland Agriculture (MSDA) Improving the production and productivity of Millets, Pulses, Oilseeds and Cotton in 25 Lakh acres of drylands; Summer ploughing, Agronomic interventions, Establishment of water harvesting structures, Creation of value addition units, value addition machinery and Custom Hiring Centres, Animal Husbandry activities, distribution of fruit seedlings	Farmers Club, Capacity Building, Entry Point Activities Expected beneficiaries 10 lakh farmers
2.	Rainfed Area Development (NMSA) Promotion of cropping System along with Border Crop, Tree Sylvi-pastoral system, Permanent Vermicompost units, Apiary units	Demonstration, Farm Schools among others; Safeguard farmers against the weather extremes
3.	Paramparagat Krishi Vikas Yojana (PKVY) Promotes Pesticide Residue Analysis, packing, labelling and branding of organic produce, Value addition, infrastructure creation, Brand building, participation	Capacity building, Exposure visit, conducting trade fairs and exhibitions; organic certification
4.	Sub-Mission on Seeds and Planting Material (SMSP) Enhancing productivity and climate resilience of irrigated agriculture, improve water management and increase market opportunities for farmers and agro-entrepreneurs	Capacity building, Exposure visit; 66 selected sub-basin areas

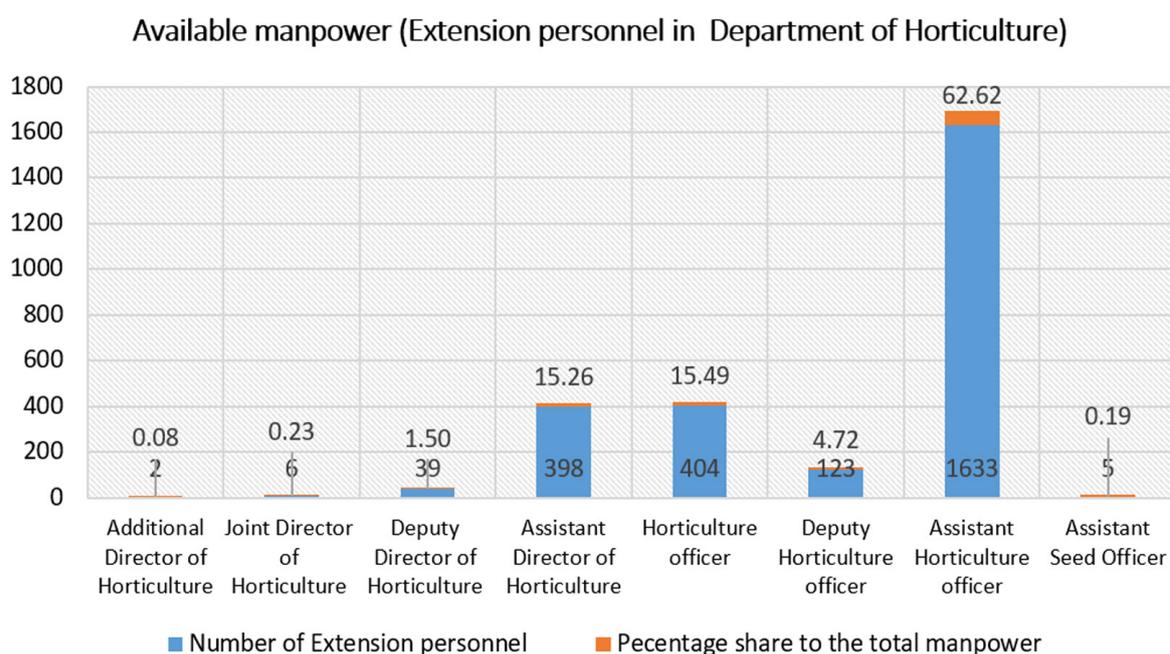
Major extension centres in the state

S.No.	Major extension institution	Numbers
1.	Integrated Agricultural Extension Centres (IAEC)	155
2.	Main Agricultural Centres	383, including 155 IAEC
3.	Uzhavar Maiyam (Farmer Centre)	10
4.	Sub Agricultural Extension Centres	497

Available manpower in Department of Agriculture



Available manpower in the department of horticulture



In Tamil Nadu, as per 2011 census, out of 7.21 million population (72,147,030), there are around 4.2 million (4,248,457) cultivators, which is around 6% of the total population. Further, 9.6 million (9,606,547 /13.31%) of the total population are agricultural labourers. However, with the manpower of 4828, that too, only 2316 of AAOs are considered to be directly connected with the field visits, the manpower is largely less to meet the varied requirements of the farmers. Therefore, though the available manpower in the department of agriculture to farmers is calculated to be 1: 879 (including all JDAs, DDAs etc.), yet only AAOs are found to be mainly involved in field extension, thus the ratio widens to 1:1834. The reports of the department of agriculture illustrate that even in 2016, the agricultural extension manpower (4838 Nos) to farmers was found to be more or less the same. It is therefore, there is a need for the state to reduce the widening gap of the extension to farmer ratio, which will help in effectively delivering the advisory services, also considering the changing climate and its influence in agriculture, there is a need for more personalised extension service as never before. In Horticulture as well, the ratio of field extension personnel to farmer is very high with 1:2601. As the state has a wider area in horticulture and most of the farmers are shifting towards horticulture, there is a need for shortening the widening ratio of field extension officer (horticulture) to farmer, as to promote sustainable horticulture development in the state.

Ratio of extension personnel (field extension personnel) to farmers

S.No.	Departments	Available manpower	Manpower (Field Officers - AAOs/AHOs)	No of cultivators	Extension personnel to farmers ratio
1.	Agriculture	4828	2316 (AAOs)	4,248,457	1:1834
2.	Horticulture	2610	1633 (AHOs)		1:2601

Status of ATMA: Support to State Extension Programmes for Extension Reforms Scheme (SSEPERS)

The major role of ATMA (SSEPERS), is to foster convergence among all the line departments and coordinate the extension advisory services in a phased and effective manner (GoTN, 2019). ATMA is considered to be a major decentralised body in the extension advisory system (in the state) as it involves in bottom-up extension approach, providing personalised extension services to farmers at scale and enhances the participation of all the stakeholders, including farmers.

ATMA carries out five-pronged extension advisory services in the state, (i) for extension functionaries ATMA conducts training, facilitate the documentation of success stories; organise exposure visit of extension functionaries to progressive states, also, ATMA directly participates in Developing Strategic Research & Extension Plan. (ii) On farmers front, the extension of ATMA includes training to farmers, organizing demonstrations (Agriculture and Allied departments), conducting exposure visit of farmers, organising/coordinating district level exhibition and Kisan melas, disseminating farm information through printed leaflets, local advertisements, display board, Kalajatha, IT network; facilitating farmer scientist interactions/joint visits by scientists & extension workers, organising field days, farm schools and Kisan Goshtis. (iii) On research front, extension services of ATMA include

assessment, refinement, validation and adoption of frontline technologies and researchable issues through KVKs and other local research centres. (iv) At an administrative level, major advisories of ATMA are the conduct of administrative and district /block farm advisory committee meeting. (v) On Support system front ATMA's support to district level Training Institutions, farmer friend, and Certified Farm Advisor, Specialist and Functionary Support (Block Technology Manager, Assistant Technology Manager, Computer Programmer, Accountant) are leveraging extension system in the state. ATMA conducted 9618 training to farmers benefiting 3,80,840 during 2018-19.

Also, the fund is allocated to train the Rural Youth on Operation and Maintenance of Agricultural Machinery and Implements, Solar powered pumping system and Micro Irrigation System at village level. Each year, the rural youth is trained to be a better farmer machinery service provider to farmers, in turn, it enhances the employment opportunities to the number of unemployed in the villages.

ATMA is considered to be the critical juncture in bridging the gap of knowledge, skill, and capacity of farmers, as well as extension personnel. Importantly, the roles of ATMA in the dissemination of innovative technologies are integral to the extension system. However, during 2017-18, ATMA received only 0.33 % (Rs. 41.75 Crore) out of Rs.12, 400 allocated for agriculture. Similarly, during 2018-19, out of Rs. 13,968 allocated for agriculture and allied sectors, only Rs. 58.31 crore (0.4%) was allocated to ATMA to carry out its extension services. ATMA receives a dismal amount of funds, which is well below 0.5 % of the total budget allotted for agriculture. ATMA being the state's vital source for reinvigorating the extension system, the funds allocated for ATMA perhaps, are insufficient every time. Therefore, there is a need for a substantial increase in the allocation of funds to ATMA. The other major challenges faced by ATMA are lack of manpower, which is coupled with temporary staff like ATMs and BTMs is a major bottleneck for ATMA. Several studies show that the lack of sufficient manpower poses threat for ATMA to carry out its extension effectively. In a recent study by Sangeetha et al, 2019 illustrate that the frequent changes in ATMs and BTMs and insecurity about the jobs were the major factors that led to the inefficiency in extension services provided by ATMA. Moreover, it was observed that many times, ATMs and BTMs are loaded with scheme related activities, including Crop Cutting Experiment, which is otherwise done by the extension personnel of the department of agriculture. There is also an overlapping of job responsibilities among the extension functionaries (AAOs/ATMs/BTMs). ATMA in its all prospects is dubbed as a local governance body in extension system. Therefore, the policymakers must provide more autonomous and independency to ATMA and allocate considerable funds (maybe 2% of the total outlay of agriculture) to ATMA for creating a technical cum permanent manpower structure, which will result in more freedom, enhanced convergence, enhanced participation of all stakeholders, including farmers and thereby strengthening the bottom-up extension.

S.No.	Extension activities	2017-18		2018-19		2019-20	
		Physical progress (Nos)	Financial progress (Cr)	Physical progress (Nos)	Financial progress (Cr)	Physical progress (Nos)	Financial progress (Cr)
1.	Farmers in Training	267198		570913		129867	
2.	Demonstration	8946		4321		16665	
3.	Exposure Visit	1681		1173		1747	
4.	Farmers in Exposure Visit	39803	8.06	4079	22.93	19211	7.50
5.	Farmer Friends	2586		68		30	
6.	Farm Schools	1068		496		174	

Source: https://extensionreforms.dacnet.nic.in/DashBoard_Statusatma.aspx

Agricultural Technology Management Agency (ATMA)

ATMA is resolved to deliver effective extension services to farmers. ATMA forays on convergence approach with line departments, NGOs, State Agricultural Universities, Tamil Nadu Veterinary and Animal Sciences University and so on. ATMA extension activities carried out in the state of Tamil Nadu are as given in the figure 1.11.

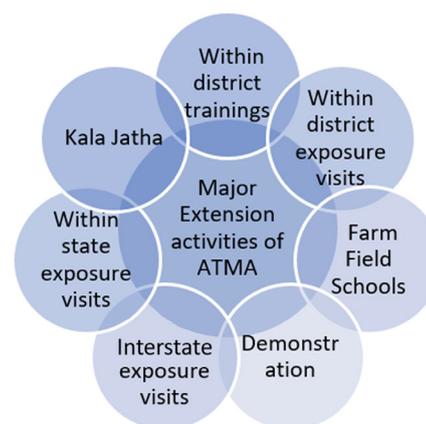


Figure 1.11. Extension activities of ATMA

Salient features of ATMA

ATMA seeks to provide trainings, demonstrations, Farm Field School (FFS), etc., on latest technologies such as Integrated Crop Management (ICM) in paddy, pulses, oil seeds, maize, sugarcane, etc., mushroom cultivation, value addition, roof top gardening, hybrid cultivation, organic farming, solar light traps, solar pumps, System of Rice Intensification (SRI), azolla cultivation, sheep and goat rearing, inland composite fish culture, mulberry production, low cost feed formulation for livestock, post-harvest management, micro irrigation, etc.,

Table 1.10. Case of salem and villupuram districts (ATMA extension activities during 2017-18)

S.No.	Extension activities and beneficiary per activity	Villupuram	Beneficiary	Salem	Beneficiary
1.	Within district training (40 Nos/training)	221	8840	96	3840
2.	Within district exposure visit (50 Nos/Visit)	22	1100	44	2200
3.	Within state exposure visit (50 Nos/visit)	6	300	12	600
4.	Interstate exposure visit (20 Nos/Visit)	2	40	2	40
5.	Demonstration (40 Nos/demo)	73	2920	27	1080

6.	Kala Jatha (no limit since street play)	20	-	22	-
7.	Farm Field School (40 Nos/FFS)	16	640	14	560
Total		360	13840	217	8320

Source: O/o. JDA, Annual Reports-2017-18, Salem and Villupuram

- Kala Jatha/street play is an innovative extension method, which has been used by the Block Technology Manager (BTM) and Agriculture Technology Manager (ATM) to disseminate the information on latest agricultural and allied sectors technologies among farmers. For this purpose, ATMA allocates funds to any of the reliable NGO in the district and the script for the play is narrated and given to the NGO. It is held in every block regularly to provide information on latest technologies and various schemes of the government.
- Use of Pico projector is another novel initiative in transfer of technology to the farmers. Field level extension functionaries are provided with Pico projectors, the portable nature of the projector helps the field level extension functionaries to carry it with them wherever they go.

Challenges

- Lack of independent project director for ATMA affects the Automatic extension services of ATMA as the Joint Director of Agriculture is the project director of ATMA. Moreover, Director of Farmers Training Centre (FTC) is the Deputy Project Director of ATMA in some districts e.g. Tirunelveli, Kanyakumari and Villupuram districts to name just three districts. Therefore, the coexistence of ATMA with Department of Agriculture and FTC affects the efficiency of extension system in the state.
- Infrastructure facilities for ATMA are insufficient. In many cases, ATMA functions in a separate room allocated in the Department of Agriculture (DoA) in the district level e.g. Coimbatore, Thiruvarur, Villupuram, Salem districts to name a few.
- Prevalent of usurpation of ATM's and BTM's duties is higher in the state of Tamil Nadu. As JDA is the Project Director of ATMA, it has been reported that many of the ATMs and BTMs have been utilised by the DoA to carry out the Crop Cutting Experiment (CCE), which is otherwise the duties of AOs/AOs functioning across the state. However, lack of official records keeps the usurpation aside. The unreported meddling of the DoA with ATMs and BTMs affect their job responsibility enormously.
- Poor content and knowledge management are lacunas of ATMA in Tamil Nadu. ATMA has emerged as the backbone of line departments in transfer of technologies, providing trainings, demonstrations, participatory farming system extension, exposure visits, awareness on latest schemes/subsidies/ insurance etc., as it is evident that, all the extension activities of the line departments of the state are provided through ATMA. Contrariwise, none of the ATMA functioning under Joint Director of Agriculture has documented neither impact/benefits of trainings/exposure visits/demonstrations nor the adoption of practices/technologies (organic farming technologies/practices, ICM in Paddy, Pulses, Millets, value addition in Millets, Solar Light Traps and so forth) demonstrated by ATMA among the beneficiaries across the state. It might be because, there is limited expertise

in ATMA to research and document the adoption of technologies by the farmers and thereof, impact. Moreover, the available man power like BTMs and ATMs in the blocks are rather expected to deliver the target-based trainings/ exposure visits/demonstrations than document the further penetration of the technologies at the grass root level.

- Political nepotism in the selection of beneficiaries was found to be inevitable in Tamil Nadu. In as much as, the selection of beneficiaries has been influenced by the politics of the state. In this backdrop, the benefits are not reaching to the needful farmers.
- As most of the Farmer Friends are relatives of influential political parties/president of the panchayat therefore, it has led to the deterioration of the concept of Farmers Friends in many of the villages.
- Non-timely availability of the funds: Most of the time, the funds are released at the end of the financial year thereby, it affects the efficient functions of extension systems at grass root level. Release of adequate funds at the time of need may help the official of ATMA to manoeuvre effectively.
- As far ATMA, in most of the districts of Tamil Nadu, the monitoring and evaluation by third party has not been taken place. It may be due to poor penetration of the benefits to the intended farmers and ineffective trickle down of extension activities among the marginalised farmers in the state.

Krishi Vigyan Kendra (KVK)

The KVK scheme is 100% financed by the Govt. of India and the KVKs are sanctioned to Agricultural Universities, ICAR institutes, related Government Departments and Non-Government Organizations (NGOs) working in Agriculture. KVK, is an integral part of the National Agricultural Research System (NARS), aims at assessment of location specific technology modules in agriculture and allied enterprises, through technology assessment, refinement and demonstrations.

KVKs have been functioning as Knowledge

and Resource Centre of agricultural technology supporting initiatives of public, private and voluntary sector for improving the agricultural economy of the district and are linking the NARS with extension system and farmers.

Avinashilingam KVK-Coimbatore supports about 50 SHGs located in Annur, Karamadai and Periyanaickenpalayam blocks; 6 FPOs located in the blocks of Annur, Karamadai, Periyanaickenpalayam, Pollachi, Sulthanpet, Sulur and kinathukadavu and it has established 25 Farmers Clubs (FCs) These groups have better access to the inputs, farm technologies, farm machineries etc. in one hand and have direct contact regarding trainings, demonstration, farmers meet, field days, exposure visits, field tour, entrepreneurship, agri-business school conducted/organised by KVK-Avinashilingam.

Assessment of technologies and extension

Assessment of technologies for location specificity is the major activity of the KVK and it is done by means of fixed Front Line Demonstration and On-Farm Testing (Table 1.11). Besides, both on and off campus trainings on various Post-harvest technologies value addition and marketing of millets,

Integrated Pest Management, Integrated Crop Management, hi tech farming in Vegetable cultivation, organic farming, farm mechanization (Castor thresher, groundnut stripper and seed cum fertiliser drill) crop diversification, Integrated Farming System (IFS) are conducted. KVKs are forerunner in ensuring the horizontal spread of improved technologies thereby improving the crop production and livelihood status of the farmers in the state.

Case of KVKs of TNAU

Convergence of KVKs – A perspective analysis

In theory, KVK has a convergence with the various public and private institutions, and also its linkages with NGOs and other development organisations are great strengths to the extension system of KVKs. KVKs (under TNAU) were found to have the convergence with the following agencies viz., ICAR institutes, Agriculture Skill Council of India (ASCI), India Meteorological Department (IMD), MANAGE, NAARM, NABARD, RBI, State Planning Commission, All India Radio (AIR), Press, SAUs, Colleges, line departments and other private organisations. However, in practice, there is very little importance given to convergence by KVKs, mostly because, they have their specific target and strive to achieve them within the stipulated time. It is believed that, line departments and ATMA have a major stake with KVKs in need assessment, identification of beneficiaries and participation in field days, exposure visits and upscaling successful technologies for a wider use and to tap the maximum benefits, however, the degree of convergence (expected level) varies from place to place and time to time. It was observed that the line departments' convergence with KVKs takes place in terms of demonstration of new varieties, on farm trials, training and few other areas. As evinced throughout in this report, several varieties which were assessed to be better alternatives to the existing varieties by KVKs have not been scaled up by the line departments (at desirable level). For example, TKM 13 (rice variety) has been successfully experimented by KVKs in multiple locations in the state and found to be a better alternative to BPT 5201 (the old rice variety), yet the adoption rate of TKM 13 is negligible. It is because the line departments have little to no time to focus on upscaling and promotion of such new varieties and other innovations. Moreover, there is considerable gap in knowledge about the benefits of TKM 13 among the farmers and traders/consumers. Several schemes and programmes are also implemented through convergence by KVKs. Some of the key schemes are Seed Hubs Projects, Attracting and Retaining Rural Youth in Agriculture (ARYA), Swachh Bharat Abhiyan & Swachhta Hi Sewa, Pradhan Mantri Fasal Beema Yojana (PMFBY), National Innovations on Climate Resilient Agriculture (NICRA) and the like. Under this scheme convergence, several sustainable agricultural practices and agricultural innovations are demonstrated to farmers at cluster level. For example, KVKs which are implementing NICRA have prioritised their extension towards Climate Smart Agriculture (CSA). Some of them are canal de-silting, introduction of CSA varieties (e.g. flood tolerant variety CR 1009 sub1), creation of fodder banks and CHCs. Thus, the scheme convergence among KVKs proves to be effective in bringing a desirable change in farming community. However, the success of the scheme convergence in terms of adoption of new technology, generation of employment opportunities and increase in productivity as well as income needs to be studied for further convergence and upscaling.

Achievement of KVKs during 2016-2019

Fourteen KVKs are linked to TNAU in the state and are considered to be a single window to the farmers. During 2016-19, these KVKs have organised about 1593 OFTs, 5,692 demonstrations, 2,377 farmers training covering 64,835 farmers, 100 vocational training to youth/women covering 5,070 youth/women and 680 sponsored training to farmers with the beneficiaries of 32,044. Also, Exhibitions/melas /field days / Special Programmes conducted by these 14 KVKs were about 891, which benefited around 2,62,939 people including farmers, youth, women etc. Popularisation of 65 new varieties of TNAU/ICAR were the significant achievement of the KVKs-TNAU in the same period. The promotion of 251 production and management technologies of agriculture, horticulture, agro-forestry, animal husbandry, fisheries, poultry etc were believed to have a positive influence on the productivity of crops and income of farmers. Besides, KVKs are involved in the production of seeds of different crops (mostly newly released crop varieties) and distribution of them to farmers on a need and demand basis. This helps the farmers to buy quality seeds at affordable prices.

Ref: Senthil Kumar, M., (2019). Krishi Vigyan Kendras (KVKs) - An effective linkage and co-ordination model of extension. Presented in the TANUVAS-MANAGE International Seminar on 'Innovative Extension Management for uplifting Livelihood of Farmers-Status, Initiatives and Way Forward' during June 27-28, 2019 at TANUVAS, Chennai.

Multi media

Books, booklets, pamphlets, folders, leaflets and newspaper notices are frequently published by the KVKs on the subject matter of Rice -Seed to Value Addition, Sustainable Sugarcane Initiative, (SSI) Rice-Integrated Pest Management and Organic Agriculture, Importance of Soil testing and Soil collection methods, Roof top nutrition garden, Bamboo Cultivation Techniques, Biological disease control by Pseudomonas Fluorescent, Nutraceutical Drink for Immune Booster, Use of ICT in Agriculture, Farm mechanization in agriculture; all the more cultivation practices of rice, pulses, millets, fodder etc, are published every year to ensure the farmers' awareness and knowledge are up-to-date .

Salient Features

- KVKs are forerunner in ensuring the horizontal spread of improved technologies: Front Line Demonstrations play an influencing role in changing the adoption behaviour of farmers toward improved technologies. For example, TPS 5 (Rice variety), Bhendi hybrid CO 4, Sorghum K - 12, were demonstrated to farmers through FLDs for their higher productivity as against their low yielding counterpart ASD 16 (rice variety), Bhendi local race, Sorghum local race respectively. Scientific button mushroom production and organic cultivation were

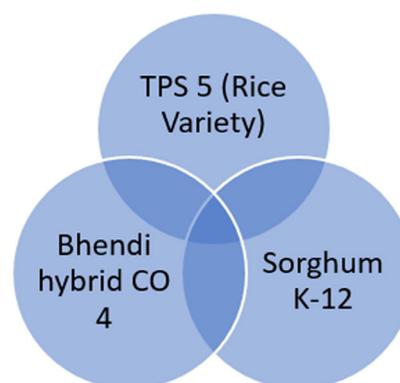


Figure 1.12. Latest technologies disseminated by the KVKs in Tamil Nadu

also promoted among farmers to establish small scale business by KVK-Tindivanam (Villupuram district). Besides, large proportionate farmers have adopted these demonstrated technologies. Table shows that the KVKs involved in the FLDs of aforesaid technologies.

- Inclusive approach: As KVK has fully been devoted to furnish the extension activities, it made comprehensive impact on farmers lives by means of conducting various training programmes, demonstrations, campaigning, camps for animal health on and off campus training on roof-top gardening, farm machineries, Integrated Pest Management (IPM), Integrated Crop management (ICM) in paddy and pulses, vegetables, etc., These extension approaches cover general farmers, Scheduled Castes (SCs), Scheduled Tribes (STs) farm/household women and youth.
- Branding for improving the marketing of the agricultural produce: Avinashilingam KVK, Coimbatore has created around 18 brands such as “Avinash”, “Tribal Treasures” “GTREE Agri products” “Sri Sai” “Ezhil” to name a few. The products include Wheat flour, Turmeric powder, Ginger candy, chillies powder, curry leaf powder, banana stem candy, natural mosquito repellent, Fertimix (Cotton special and maize special) etc., Besides, the brand has been developed for individual farmer, two Self-Help Groups (SHGs), tribal group (Irula tribes of Western Ghats), KVK has a role of only facilitation in branding done.

Man power

One programme Coordinator and six Subject Matter Specialists have been appointed to carry out the fixed target of Front Line Demonstration,

On-Farm Testing, trainings and ad hoc extension programmes such as awareness on soil day, international pulse year, etc., on the whole, technical advisory services are provided to farmers both in person and through telephone.

1.64 % and 21.58 % of scientists and technical staff respectively are vacant against the sanctioned posts (NILERD, 2015)

Table 1.11. Salient achievements of KVKs of TNAU in 2016-17

S.No.	Features	No	Area coverage	Beneficiaries
1.	On-Farm Testing (OFT)	117	285	498
2.	Front Line Demonstrations (FLDs)*	363	793 Locations	2237
3.	On-campus and Off-campus training programmes*	481	-	16667
4.	Vocational training programmes	30	-	2867
5.	Soil Health Day Campaign	NA	-	2173
6.	Kuruvai (Kharif) and Samba / Thaladi (Rabi) pre-season training campaigns	NA	NA	7,900
Total		991	-	32 342

Source: GoTN-Agriculture Policy Note, 2017-18

*specifies the area coverage is not mandatory

Velliangiri Farmer Producer Company (VFPC)

Velliangiri Farmer Producer Company Ltd (VFPCCL) was established in 2013 and registered as the company in the same year of establishment. It is located at Pooluvapatti, Thodamuthur block (Coimbatore district). Until March-2018, the VFPCCL had around 1063 farmers as members, of them 73 per cent are marginal and small farmers and the remnant 27 per cent are medium and big farmers.

Roles and responsibilities

- It involves in aggregation of fresh coconut from members, grading, selling of fresh coconut according to market demand. It produces and sells Copra to Oil Mills located in Kangeyam (Tirupur district) and Produces Coconut oil by traditional method. Besides, it procures vegetables from its members.
- It sells inputs like fertilisers, pesticides, fungicides, bio-fertilisers at reasonable price to the farmers. for example, it sells bio-fertilisers such as Pseudomonas, Azospirillum, Phosphobacteria, Tricoderma viride and Vesicular-arbuscular mycorrhiza (VAM) at the price of only 200 Rs/Litre and 45-60 Rs/Kg (in case of powder). The other fertilisers like urea is sold at 284 Rs/50 Kg, MOP is at 460 Rs/50 Kg.
- Technical services related to crop production are given frequently to the farmers on demand basis.

Salient features

- The VFPCCL has given 50 Nos of on-campus trainings (Isha Vidya School, Coimbatore) on Organic farming, Azolla cultivation, zeba water absorbent technique (<http://www.zeba.com/index.php>), new Syngenta tomato seeds (Tomato seeds-3152), Kitchen garden, rainwater harvesting structure.

Majority of the Farmers Organisations have undergone trainings of the public departments' in precision farming, drip irrigation, SRI, IPM etc., most of the members of Farmers Organisations contact DoA for participating in trainings, demonstrations and knowing the latest technologies as well as getting farm inputs

Parthasarathi, 2009

- Off-campus trainings on vegetables and coconut in Tamil Nadu Agricultural University (TNAU) and a special training on Nalla keerai with the help of Nall Keerai Producer Company, Pakkam (Chennai).
- Nearly 40 farmers were exposed to Mr. R. Sathiskumar's coconut field, Vadakadu village (Pudukkottai district) to understand "pepper" as an intercrop in coconut; visits to Ayakudi Guava cultivation area and visit to Central Plantation Crop Research Institute (CPCRI) were undertaken to understand the knowledge on latest technologies in farming in particular fruit and coconut farming.
- ICTs: WhatsApp-Velliangiri Uzhavar Producer Company disseminates the messages of market status of coconut, vegetables, etc., on a daily basis. Besides, it is used as the medium for communicating plant production measures on a quarry basis. The solution to the quarries is given by Mr. R. Sathish Kumar, B.Sc., (Agri), who is the resource person cum consultant for the farmers

who are the members in Velliangiri Uzhavar Producer Company. Programme schedule, place and date of the meetings, trainings etc., are also given through WhatsApp.

- Successful farmers: Velliangiri FPC has made several successful farmers since its inception 2013. Mr. S. K. Velusamy and Mr. Jayaveeran have made exemplary contributions in the field of azolla cultivation and organic coconut farming respectively. These farmers' fields serve as the model farms in the state of Tamil Nadu and several farmers have followed the similar farms at their fields owing to the success of both Mr. S. K. Velusamy and Mr. Jayaveeran. The other two FPCs (Table 1.12).

An extension model for community innovation, incubation and mentoring - A case of Agri-Entrepreneurs' Service Centre (AESC) of KVK-MYRADA, Erode

Today, agriculture is beginning to be called agri-business and the present-day farmers are increasingly becoming entrepreneurs, not just producers. To nurture this entrepreneurship among budding and evolving farmers, an ICAR KVK (MYRADA) at Erode has established an Agri-Entrepreneurs' Service Centre (AESC) to provide hand holding support to farmers in the field of agri enterprises/ventures. The decades of experiences that were gained by KVK-MYRADA in agricultural and allied sector extension have helped KVK to identify that the skill sets of farmers are integral to high productivity and income. Thus, AESC established by KVK has its major focus on skilling farmers through enhancing existing skills (along with knowledge and capacity), exploring potential skills, and introducing new skills for developing farmers as agri-entrepreneurs. Also, it provides a range of extension services (such as training, mentoring, exposure visits (to successful entrepreneurs), education on bankable projects and extension linkages with resource institutes/departments / regulatory bodies) for farmers to learn and develop innovative farm enterprises concerning organic farming, honeybee keeping, poultry, livestock management, mushroom cultivation, product quality improvement, storage and shelf-life, packaging, value addition and marketing. This KVK is also involved in the documentation of the successful entrepreneurs who were trained by it and popularise them among others through telecast, broadcast and publication. Therefore, these "venturesome entrepreneurs" can inspire other farmers to learn and leverage the new enterprises practised by them, while, KVK can continue its support services through AESC to these new entrants on entrepreneurship until they become inspiration to others.

Personal Communication: Dr Alagesan, P (25th July, 2020) (<http://myradakvk.org/>)

Community Managed Resource Centres (CMRCs) of KVK-MYRADA - A Community extension system for sustainability

Community approach is an undisputable extension model in agriculture to date. Several community based organisations are functioning across the state. However, the one which was promoted by KVK-MYRADA, Erode namely Community Managed Resource Centre (CMRC) is highly successful in Tamil Nadu. About 7 CMRCs with 71 CRPs (Community Resource Persons) have been promoted by this KVK until now and these CMRC have benefited around 5904 members in Erode district. The extension advisories CMRC include providing continuous information to its members, technology and services relating to farm innovation, animal welfare, financial supports, and marketing supports among others. Moreover, CMRC's extension supports such as skilling/building the capacity of farmers on value addition, linking with research institutions/line departments, the formation of commodity-based groups, mobile SMS services, provision of quality input and its management etc, are continued to help farmers not only increase the productivity and income but also enhance the sustainability of the agro-ecosystem that largely benefit the upcoming generation. The two main features of this CMRC are the identification of innovative farmers and farm innovations. The innovations identified by CMRCs of KVK have eased the agricultural (during and post) operations. Organic liquid manure preparation, Turmeric Harvester, Groundnut pod stripper etc are a few innovations that were identified by KVK through CMRCs to date. Replicating this extension model, therefore, at scale would help the state to cover a large number of farmers effectively and customising the extension services that are based at the need and demand of the farmers from time to time.

Personal Communication: Dr Alagesan, P (25th July, 2020) (<http://myradakvk.org/>)

Table 1.12. Farmers Producer Companies and their activities

S.No.	Particulars	AGFPCL	EPFPC Ltd
1.	Origin	In 2009, the Ayakudi Guava Producers Company Limited (AGFPCL) was started as the registered under the Small farmers Agri-Business Consortium (SFAC).	In 2008, Erode Precision Farm Producer Company Ltd (EPFPCL) was started as the registered society under SFAC.
2.	Place/ headquarter	No. 7, Santhaipeetai, Dindigul Main Road, Ayakudi, Palani (Tamil Nadu).	Hospital road, sivagiri, Kodumudi taluk of Erode district (Tamil Nadu).
3.	Members	A total of 750 guava growers (100 women members) from 25 villages of five blocks of Dindigul district and 25 Self-Help Groups/Farmers Interest Groups has the stake with AGFPCL Ltd.	A total of 250 farmers is having a stake in the EPFPC Ltd.
4.	Roles and responsibility	Improving value addition and marketing linkage of Guava for higher profitability to its members.	Providing fertilizers, pesticides, fungicides, weedicides, plant growth promoters and bio inputs and sale of Zero-toxic cereals, millets, honey, jaggary, desi cow milk, butter, pulses, oilseeds, value added products of pomegranate and millets are being sold to public.

5.	Innovation and technologies	Supply of quality planting material, high density and ultra-high-density planting, management practices for nematode-wilt complex menace etc. Supply of organic and inorganic fertilizers, plant protection chemicals, micro-nutrients, bio-formulations, farm implements through wholesale prices to the producer members. TNAU is the main partner in providing aforesaid inputs.	Dr. E. Vadivel helped the EPFPCL for bringing 10 thousand seedlings of Pomegranate from M/s Jain Company as an alternate crop to turmeric in the Sivagiri area of Erode district. 10 thousand seedlings were planted by 20 farmers. each of the farmer has planted about one acres of land with Pomegranate. Precise grading and packaging of Pomegranate in boxes are helpful to the members to fetch higher price in the markets.
6.	Extension activities	The company has appointed an agricultural professional as a part of delivering agro advisory services to the Guava growers on a demand basis, he visits the guava orchard of the member of AGFPC Ltd and provides advisory services based on the observation. Furthermore, he contacts with the scientists of the TNAU for rendering scientific recommendation to the existing problems in the Guava crop. Off-campus training is provided on the basis of need. Similarly, members of AGFPC Ltd are sent to relevant on-campus trainings at TNAU to discuss the issues related to maintenance of Guava orchard.	Regular study tour to Andhra Pradesh, Karnataka and Maharashtra to get in depth knowledge of Grapes, Guava and Pomegranate and exposure visits are arranged to Kerala, Andhra Pradesh to learn good practices in farming. Capacity Building Trainings on a paid basis are being offered on the topics like establishment of FPO to the interested groups of 20 from many districts; Crisis management in the FPOs promoted already; Book keeping in tune with Registrar of Companies; Business plan development for new FPOs. Workshop are conducted on Nematode management, Biodynamic farming, Organic farming and Advances in plant protection.
7.	Networking	Ayakudi Guava market is one of the biggest markets wherein the Guava growers directly linked with the consumers. Moreover, for technical advices related to pre-harvest and post-harvest practices, the AGFPC Ltd has established a strong network with the scientists of TNAU. It further helps them in introducing latest Guava production technologies to their members at affordable price.	Carnation mother plants have been imported from Italy for supply to needy clients including State Department of Horticulture. Scientists of Indian Institute of Horticulture-Bangalore and Tamil Nadu Agricultural University-Coimbatore are invited for focus group discussion on various topics. Experts from different organizations like IIHR, TNAU and M/s Jain irrigation are invited to diagnose the pest and diseases of pomegranate and to get immediate solutions on a monthly basis.

8.	Marketing and promotion	AGFPC Ltd members sell their organically prepared beverages of Guava, Jamun, Amla and powders of Jamun and Amla seeds, organically produced honey, millets-based products in their organic outlet called 'Unnadam' established by AGFPC Ltd. The most important feature is that the Guava growers are directly linked with the consumers and guava fruits are procured from members and marketed to nearby markets. Members sell their guava directly to the consumers in the markets. On an average 10 tonnes of guava are sold every day. On festival times, it goes up to 40 tonnes a day.	Collective cultivation and sale of Pomegranate at higher price is the major marketing activities of EPFPCL. EPFPCL functions as a resource institution to promote FPOs in Tamil Nadu and assigned 5 FPOs on Pulses and Millets to be promoted in Salem, Namakkal, Erode, Tiruppur and Thiruvavar districts. It has Agri-Input Shops, Kissan Seva Kendra and Zero-Toxic Agri Produce Sale Centre. Besides, establishment of processing industry for agriculture and horticulture produces, Krishi Business Kendra for paid services, adoption of supply chain management practices among farmers are underway. the EPFPCL provides training programme on establishment of FPC to the interested farmers on a payment basis.
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Source: Venkattakumar et al, 2017 and Erode precision farm producer company Ltd, 2014 and Sankri and Ponnusamy, 2015

NGOs in Tamil Nadu

NGOs organise several trainings programmes, demonstrations and exposure visits with the view of uplifting the farming community. For this reason, NGOs began to be called third sector in the field of agricultural extension. In this context, three NGOs have been selected

from Tamil Nadu to understand the roles of this sector in agriculture in the state of Tamil Nadu. The major activities carried out by each of the NGO are given in the nutshell as followed (Table 1.13).



Table 1.13. Major extension activities of Non-Governmental Organisations

S.No.	Component	*TSSS	CREATE	VK-NARDEP
1.	Headquarter	Tirunelveli	Thiruvavarur	Kanyakumari
2.	Place of operation	Tirunelveli and Tuticorin.	Throughout Tamil Nadu.	Throughout Tamil Nadu and parts of India.
3.	Membership	19000 Female and 1000 Male.	37 000 farmers.	Mainly provides demonstration to all farmers.

4.	Roles and responsibility	Production and procurement of organic produce.	Production, procurement and popularisation of traditional rice varieties of Tamil Nadu.	Popularisation of food/nutrition gardening and promotion of organic farming.
5.	Techniques and technologies	Organic farming techniques like Ganajeevamirtham, Jeevamirtham mix, Nimastram, Agniastram, Fish amino making etc.,	Traditional rice varieties like Kattuyanam, Poongkar, Karunguruvai Kuzhiyadichan, Kudavaalai, Gauvuni, Mappillai Samba, Samba Mosanam, Arupatham Kuruvai; their production technologies.	Cow dung-based plant, Terrace gardening, production of NPK manure, community/traditional water harvesting, Organic farming, Azolla, Bio-gas Bio-Fertilisers production, natural pest repellent, Fish amino makings.
6.	Major extension activities	Awareness campaign on major international days, trainings and demonstration on latest organic production technologies and community led watershed programme.	Awareness meetings on traditional rice varieties; trainings, exposure visits, demonstration, etc.,	Demonstration, trainings and Field visits related to Azolla cultivation, Bio-gas production, bio-fertilisers production, terrace gardening, organic farming etc.,
7.	Publication	Velan Vithai, which is a monthly magazine published on organic farming practices and technologies.	Only folders, pamphlets, brochures are circulated.	Folders, pamphlets, brochures are circulated.
8.	Virtual media	Website create by TSSS provides information about various topics of interest including organic farming (http://www.tsssindia.org/).	A website has been created so as to host a hub of activities and information related to traditional rice varieties of Tamil Nadu (https://neljayaraman.com).	The official website of VK-NARDEP provides online videos, information about developmental activities including organic farming (http://www.vknardep.org/).

9.	Networking	Department of Horticulture is the major partner of TSSS in provision of quality planting materials to the farmers.	ThaiMann (Mother Soil) FPC has been created with 1000 farmers to promote the production and procurement of seeds of traditional rice varieties and partnership has been made with KVK-Thiruvarur in conduct of trainings.	ATMA-Kanyakumari NABARD are the major partners. Department of Science and Technology (DST) and Department of Bio-Technology (DBT) are the partners in providing funds/grants.
10.	Marketing	Sells the organic produce of its members in market outlet provided at TSSS on a daily basis.	Procures seeds of traditional rice varieties from its members and redistributes to the farmers on demand basis.	It sells the Bio-fertilisers, Azolla, Bio-gas and natural pest repellent to the farmers at affordable price.

*TSSS-Tirunelveli Social Service Society

National Bank for Agriculture and Rural Development (NABARD)

NABARD mostly plays a financial supportive role in carrying out the extension and agro advisory services. It supports all the line departments, promising NGOs and KVKs, agirpreneurs and other organisation having the role of promoting agriculture and farmers welfare. It also involved in creation of its own farmers club, Self-Help Group (SHG) and Farmer Producer Company.

Roles and Responsibilities

- Subsidy and funds are granted to veterinary colleges for training in poultry rearing practice, grants to TNAU for conducting TNAU Jasmine production and latest technologies in Jasmine cultivation under the scheme of Capacity Building for Adoption of Technologies (CAT). In the scheme linked to Provision of subsidy to commercial banks, Subsidy for goatery, diary, poultry, storage godowns, organic farming, milk processing unit and chilling unit are distributed to identified farmers. In order to identify the thrust areas in agriculture and allied sectors such as innovative production technologies, good practices, value chain, processing technologies, etc., Discussion is prompted among the line department of agriculture. It has been done with the help of Potential Linked Plan (PLP) of NABARD.
- More importantly, trainings on community led watershed development, ways and means of

NABARD has formed seven FPOs in Tirunelveli district; one FPO in Thiruvarur; 5 FPOs in Coimbatore district, 7 FPOs in Villupuram district. Similarly, 400 and 84, 150, 300 Farmer Clubs (FCs) have been formed in Tirunelveli, Thiruvarur, Coimbatore, Villupuram districts respectively till 2017-18.

improving tribal livelihood, discovering opportunities for Medium, Small, micro enterprises, field visits, etc., are promoted by Residential capacity and awareness programme. By doing so, nearly 30 farmers/tribes from each district are motivated to develop the entrepreneurial capacity, skills, mental cognition etc., By and by, these schemes lead to the overall development/livelihood status of the farmers.

Tamil Nadu Agricultural University

Tamil Nadu Agricultural University (TNAU) was established in the year 1868 at Saidapet, Chennai, in 1906 it was relocated to Coimbatore. It has 13 Under Graduate programmes, 40 Post Graduate programmes, 26 Doctoral degree programmes. It has 11 campuses, 36 research centres and 14 Farm Science Centres/Krishi Vigyan Kendra (KVK). Education, research and Extension are the three-fold activities of TNAU.

Roles and Responsibilities

- The major extension activity undertaken by the University is Front Line Extension, i.e. dissemination of proven technologies, management techniques, standardised crop production and protection practices/techniques to all the line departments of the state, (Department of Agriculture, Department of Horticulture and Plantation Crops, Department of Agricultural Engineering, Department of Agricultural Marketing and Agri-Business, Department of Animal Husbandry, Department of Sericulture) and Krishi Vigyan Kendra (KVK). TNAU has released 819 new crop varieties 165 agricultural implements and 1,527 management technologies, of which 12 crop varieties in 2016-17. These technologies are disseminated to the aforesaid technologies in the Scientific Workers Conference (SWC) held every year with the line departments. Besides, Crop Production guide is released as the source material for all the proven technologies. Periodical refresher trainings are given to all technical officers of the line departments and KVK and are conducted either in research station or KVK or SAMETI.
- Monthly Zonal Work Shop is organised as the platform to discuss the upcoming extension works, field problems, existing farming situation, farming issues and solutions for the same. All the more, TNAU distributes the breeder and foundation seeds of all new varieties and hybrids to the departments to multiply and meet the certified seed requirement of the state. Besides, these breeder and foundation seeds are also distributed to the research stations, KVKs to produce the certified seeds so as to meet the seed requirement of the farmers from across the state. In case of advisory services, field visits, field day, publications, video and audio messages, farmers scientists' interaction, diagnostic field visits etc., are undertaken by the scientists working in all the 36 research stations, 11 campuses, 14 KVKs. Extension programmes such as farmers mela, meetings, fair, display of technologies, grievance day meetings, are all assisted by the Directorate of Extension Education (DoEE)-TNAU.

TNAU participated in CODISSIA Agricultural fair - 2016. The stalls and demonstrations on various technologies were organized, which benefited 25 000 visitors including farmers

e-Extension initiative of the TNAU was taken up during 2008-09 with the funding support of NADP, with which TNAU Agritech Portal (<http://agritech.tnau.ac.in>) was established, which consists of more than nine lakh pages and the content can be accessed in both the English and Tamil. The portal has about 900 success stories in the form of videos, besides, the portal links the line departments under one roof and encompasses the information relating to farmers' groups, farmers' federations, image based nutritional disorder, information on post-harvest management, value addition market intelligence and schemes of the government. Around 6000 people visit the about 700-920 pages every day and spend about 15-17.50 minutes. About 40 lakhs users have visited the portal so far. Multi video conferencing facility is the another notable initiative of the e-Extension (<http://vcon.tnau.ac.in>), it connects about 59 sub centres of TNAU and with the unique log in ID, members can establish video conferencing, which allows the users to use online presentation, on-line chart etc. Similarly, expert system for crop (Paddy, Sugarcane, Ragi, Coconut and Banana) and animal enterprises (Cow, Goat, Poultry) have been developed in multilingual (English, Tamil, Malayalam and Kannada). It comprises of Decision Support System, Crop Doctor and Information System, importantly, which can be used off-line mode and are available on google play store.

(<https://goo.gl/26u927>). Tamil Nadu Agricultural Weather Network (<http://tawn.tnau.ac.in>), wherein automatic weather stations located in 385 blocks of the state help in disseminating the weather report to all the registered farmers. 700 AOs who have specially trained for this purpose, send messages to all of their clients on a daily basis.

TNAU, 2013 and GoTN-Agriculture-Policy Note, 2017-18

- Memorandum of Understandings (MoUs) are frequently been made with the National Institute for Agricultural Extension Management (MANAGE), the National Bank for Agriculture and Rural Development (NABARD), the Indian Council of Agricultural Research (ICAR) cum ICAR based research stations such as the Central Plantation Crop Research Institute (CPCRI), the Central Tuber Crop Research Institute, the Indian Institute of Horticulture Research to name a few, corporates and all government organisation in fulfilling the capacity and knowledge gap of extension functionaries in the state.
- By and large, Rural Agriculture Work Experience (RAWEX) is the major extension programme for Under graduate students to get exposure on the farming situation and status of farmers in the country. In the same way, student and faculty research is done in researchable areas of agricultural extension and advisory services in the state.
- TNAU also participates in all the agricultural related mela/fair/expo conducted by Coimbatore District Small Industries Association (CODISSIA), The Federation of Indian Chambers of Commerce and Industry (FICCI), Pasumai Vikadan, to name but a few. On the whole, TNAU is the major partner in preparation of Strategic Research Extension Plan (SREP) in the state.

Salient Features

- During the year 2016-17, 584 passed out after successfully completing diploma course and 503 students were newly admitted. In Under-Graduate programme, 1,453 passed out successfully and 2,879 students (1,366 in constituent colleges and 1,513 in affiliated colleges) were newly

admitted. In Post-Graduate degree programme, 494 passed out and 464 new students were newly admitted. Doctoral programmes, 108 students passed out successfully and 178 students were newly admitted. During 2016-17, totally, 193 students were placed in various industries namely; Agro Industry (61), Seed Industry (2), Food Industry (9), NGO / Government (30), Plantation (1), Banking (81) and other institutions (9) (GoTN-Agriculture Policy Note, 2017-18).

- Open and Distance Learning: Under Open and Distance Learning mode, 24 certificate courses and three Masters' degree programme are offered. For farmers, one Bachelor of Farm Technology (B.F. Tech) and one Master of Farm Technology (M.F. Tech) 232 programmes are made available (GoTN-Agriculture Policy Note, 2017-18).

Awards of TNAU

1. **Plaque of appreciation by Cereal systems initiatives for South Asia (coordinated by CIMMYT, Mexico)** given to Soil and Water Management Research Institute, Thanjavur for its commitment in improving the lives of small and marginal farmers in Cauvery Delta
2. **Skoch-Order-of-Merit** (Top 100 projects in India) for Block Level Weather Forecast awarded to the Agro Climatic Research Centre, TNAU, Coimbatore
3. **Skoch- Order - of - Merit** (Top 100 projects in India) for the Value Chain on Industrial Agroforestry scheme in Tamil Nadu to Forest College and Research Institute, Mettupalayam by the Skoch Group, New Delhi
4. **Mahindra Samridhi India Agri** award for 2016 for popularising Millet processing technology in India to Post Harvest Technology Centre, TNAU, Coimbatore.
5. In 2017-18, TNAU-KVK, Dharmapuri awarded as the best KVK in the country (GoTN-Agriculture Policy Note, 2017-18)

- National Institutional Ranking Framework (NIRF) ranked TNAU as the No. 1 State Agricultural University Again, TNAU ranked as a No.1 State Agricultural University by Career 360 in 2016. The QS ranked Tamil Nadu Agricultural University in the 130-140th position in 2016 among the academic institutions in BRICS countries.
- Agricultural Technology Information Centre (ATIC): A single window delivery system of technology and inputs. The centre sells inputs like seeds, planting materials, bio-fertilisers, crop boosters and technical books for the benefit of farmers.
- ICTs and TNAU: Education Media Centre, the TNAU produced 125 video programmes and 278 video shows were conducted and 317 video lessons were sold during 2016-17. Android App based expert system: A total of 12 Android Apps related to paddy, sugarcane, ragi, coconut, banana and for animal husbandry enterprises like cow and buffalo, goat rearing and poultry, which were uploaded in the Google Play Store and mgov App Store for the benefit of farmers. The Apps are available both in English and Tamil languages. Kissan Call Centre (KCC) is under the management of TNAU. During the year 2016- 17, 23,000 calls were answered. Domestic and Export Market Intelligence Cell (DEMIC), TNAU, during 2016-17, depending upon the crop, 23 advisories on pre-sowing and 39 advisories on pre-harvesting were sent to about 4 lakh farmers.

- Farmers Facility Centre: First-hand information about the technologies and renders analytical services with regard to soil and water and diagnostic services of plant samples. It coordinates the scientist-farmer interaction. On an average, 230 farmers visit the centre for getting farm advisory services besides, analysing the soil and water every month.
- Uzhavarin Valarum Velanmai: Uzhavarin Valarum Velanmai is the monthly Tamil Magazine published by TNAU, which has a subscriber base of 12,865. It was started in the year 1975.
- TNAU – Information and Training Centre, Chennai: 65 training programmes were conducted on 31 varied topics such as; roof gardening, kitchen gardening, fruits and vegetable processing, indoor plants, mushroom cultivation, vermicomposting, organic farming, etc., which benefited around 2 231 participants.
- The Agro Climate Research Centre: During 2016-17, totally 102 bulletins each with four advisories were prepared and 102 SMS were sent to 8.68 lakh farmers per time (Totally 8.85 crore) on 6 topics viz., agricultural crops, horticultural crops, plantation crops, cattle and small ruminants, poultry and other birds and extreme weather events (GoTN-Agriculture Policy, 2017-18).
- Agri-Business Development: More than 100 incubatees were enrolled with this Directorate of Agri Business Development and 25 technologies have been commercialized by TNAU Agri-Business Development. Some of the commercialised technologies are TNAU Coconut tonic, TNAU Panchagavya, TNAU strains of Pseudomonas and Trichoderma, TNAU Master Trap and Ready to cook Mix Food from Pearl millet, technology for maize hybrid seed production for COH (M) 8 and sugarcane juice bottling to name just a few.
- Intellectual Property Rights: Tamil Nadu Agricultural University has obtained 7 patents and 59 findings have been field for obtaining patent. Tamil Nadu Agricultural University has also registered 64 crop varieties under Protection of Plant Varieties and Farmers Rights (PPV&FR) as extant varieties.

Tamil Nadu Agricultural University through the Domestic and Export Market Intelligence Cell (DEMIC) forecasts local market prices of agricultural produces before sowing and before the harvest seasons. The market advisories are disseminated both in print and electronic media. Price forecasting is done for 24 crops /produces.

Human Resource Development

Out of the total sanctioned posts of 1396, Directors / Deans (46), Professors (423), Associate Professors (74) and Assistant Professors (635) were positioned. Steps are taken to fill up 218 vacant positions so as to strengthen the agricultural education, research and extension in the state.

Innovative extension systems and services Department of Agriculture, Allied Departments and Tamil Nadu Agricultural University (TNAU)

Department of Agriculture

Collective farming: The state has innovated Collective Farming as a way of enhancing group farming and collective marketing. Up until 2019, around 2,000 Farmer Producer Groups (FPGs) purchased about 7,729 Farm Machineries with a corpus fund of Rs.100 crore in the state (GoTN, 2018, 2019). In addition to collective farming, FPOs are being promoted by the state to enhance the marketable surplus capacity of farmers, while reducing the cost of production. The state had about 500 FPOs as of now (GoTN, 2019-20). Of them, 130 belong to the Tamil Nadu Small Farmers Agri Business Consortium, 170 were promoted by the National Bank for Agriculture Rural Development (NABARD), 11 of them were promoted by the Small Farmers Agri Business Consortium. Also, the Department of Horticulture and Plantation Crops has encouraged the formation of 15 FPOs, as well as 174 FPOs, was promoted by farmers themselves. According to the national paper published by NABARD (2018-19), the country has about 5000 FPOs (including FPCs). Thus, the state accounts for 10 % of the total FPOs in the country. This signifies the extension efforts of the state in fostering considerable reforms in agriculture right from the supply of inputs to sale of the final output to markets.

Uzhavan Mobile App: Uzhavan Mobile application, a farmer-friendly mobile technology, launched in 2018. The essential advisory services of the app include the availability of stock of seeds, fertilisers, and farm machinery (both public and private). This apart, the algorithm led AI enables the farmers to know about the premium of crop insurance, notified crops and areas, as well as farmers, can know the place of visit of AAOs and AHOs in advance. Meanwhile, the information on instantaneous identification of Pest/Diseases and remedial measures, market price, weather status and FPOs is of vital importance to farmers in resolving the farm problems effectively. The app was developed both in Tamil and English, thus, the farmers face little to no difficulties in accessing the contents/services in the app. As far as the reach, 4.5 lakh farmers have downloaded the app so far. This can be downloadable from Google Play Store (<https://play.google.com/store/apps/details?id=agri.tnagri&hl=en>).

e-NAM, an e-trading platform to facilitate farmers, traders, buyers, exporters and processors to trade commodities at national level. Until, 2018-19, around 23 markets were linked to e-NAM. During 2018-19, Around 15.65 lakh quintals of agricultural products were sold through these 23 e-NAM markets and the value was calculated to be 277.24 crores. The major feature of the platform is that the sale amount of the produce is directly transferred to the farmers. Data signifies that during 2018-19 alone, around 48.50 crores was sent to the accounts of 12, 511 farmers (GoTN, 2018 and 2019-20). As the state is planning to cover all the markets in the state under the e-NAM, it would benefit a number of farmers in future and ease the trading.

Reinvigorated field visit systems: The state has a vast network of Assistant Agricultural Officers (AAO) and they are entrusted to make a fixed schedule of field visits regularly i.e. 1,918 AAOs will

visit 12,620 village Panchayats in 385 blocks and each AAO visits 8 segments (villages) once in a fortnight to meet the farmers. However, there is a substantial difference between conception and reality when it comes to field visits. There is hardly any time for AAOs to visit the field and provide advises to farmers regularly on innovative and novel technologies of crop production. They are often engaged in achieving the target of different schemes and programmes (both central and state), which prevent them in participating in the much-needed extension activities right from the need assessment of farmers to providing personalised farm advisory. Therefore, the state may have to revisit the field visit systems of the department of agriculture and tailor the extension system that facilitates both the bottom-up approach and farmer-friendly extension system.

Front Line Demonstration (FLDs), the other conventional and rather proven extension advisory of the state is FLDs, the department of agriculture is focusing on the promotion of improved crop management practices (Integrated Crop Management, intercropping, High-Density Planting in cotton) through FLDs.

Department of Horticulture

Artificial intelligent (AI) based benefit transfer: Micro Irrigation Management Information System” (MIMIS), launched in 2017-18, an AI-led innovative system which enables the farmers to easily register their details in MIMIS for Micro Irrigation scheme. This ICT enabled registration has led to higher registration rates and enhanced

transparency in the provision of micro irrigation facilities to farmers. The department of horticulture aims to bring almost all areas under wells and tube wells irrigation into micro irrigation. Thus, the MIMIS may provide an opportunity for the horticulture department to map the farms with/without micro irrigation and thereby delineating the benefits to the needed. These phased measures pave a way for conserving water and reducing the effects of climate change on crops in the long run.



Micro Irrigation Management Information System” (MIMIS)

TNAU

In Tamil Nadu, farmers, graduates, and other interested personnel are being supported to become agripreneurs by the Technology Business Incubator at Directorate of Agri-Business Development (DABD), TNAU, Coimbatore. Also, to upscale the entrepreneurship in the state, a number of Agri-Business Incubation Forums were established, some of them are, Madurai Agri-Business Incubation Forum; Periyakulam Horticulture Business Incubation Forum; Killikulam Agri-Business Incubation Forum; Tiruchirappalli Agri Business Incubation Forum, and Mettupalayam Agroforestry Business Incubation forum. Around 100, 33 incubatees were enrolled to become nurture between farmers and

technology during 2017-18, 2018-19 respectively. Also, about 45 technologies were commercialized (TNAU Coconut tonic, TNAU Panchagavya, TNAU Millet Dehusker, TNAU strains of Pseudomonas, Sugarcane Juice Bottling TNAU Master Trap and Ready to cook Mix Food from Pearl millets are a few to name) by these agribusiness forums.

The technological backstopping: In addition to this, the SAU introduces several new technologies/crop production practices (e.g. Rice ADT 53, Rice VGD 1, Little Millet ATL 1, Greengram VBN 4, Groundnut BSR 2, Bottle gourd PLR 2, Banana Kaveri Saba to name a few) farm machinery (Turmeric washer, Turmeric boiler etc.,) etc. and are provided to the line departments for front line demonstration and subsequent upscale. These departments, in turn, create awareness and knowledge on the novel technologies/practices/farm machinery among farmers. Agricultural Technology Information Centre (ATIC), at TNAU, Coimbatore one of the few centres which seek to deliver the agro-inputs such as seeds, planting material, bio-fertilisers, crop boosters with the technical backstopping. Also, the centre provides technical guides/books/materials in the local language (Tamil) for the benefit of farmers.

Kisan Call Centre (KCC): Advisory at hand, farmers can get the farm advisory at any time (7 AM to 10 PM) by just dialling to the Toll-Free number (1551 or 1800-180-1551). KCC functioning at TNAU is an example for the mobile-based farm advisory in the state. Every year, farmers calling to KCC is increasing. However, during 2018-19, around 2.14 lakh calls were answered, which is lesser than the calls answered during 2013-14. It might be attributed to the increase in access of farmers to the field level extension functionaries and other farm advisories.

S.No.	Year	Number of calls answered
1.	2018-19	2,14,762
2.	2017-18	2,51,015
3.	2016-17	23,000
4.	2015-16	1072 per day
4.	2014-15	790 per day (2.88 lakhs)
5.	2013-2014	3.23 lakhs

Department of Animal Husbandry

Animal husbandry departments as well play a major role in enhancing the livestock extension system in the state. The continuous extension and clinical services of the department have led the state to become a major milk, meat and egg producer in the country with 4.39 %, 7.88% and 18.29 % respectively of the total share. About 46% of the agricultural output/GDP of agriculture is from the livestock sector in the state (GoTN, 2019).



Livestock extension on wheels: In recent past, the most innovative extension model of animal husbandry has been the introduction of Animal Mobile Medical Ambulance (AMMA)/livestock extension on wheels, by which the extension and clinical services are taken to the remotest corner of the state and at farmers doorstep at any time. For the benefit of farmers, the Toll-Free number (“1962”) has been given. As farmers call the number, the mobile ambulance, which is at near to the farmers, goes to the place and solves the issues immediately.

Institutional livestock extension: The advanced and innovative livestock extension system is the establishment of Animal Disease Intelligence Units (ADIU) at district level (the state has 28 ADIUs in 28 districts except for a few districts). Major advisory of these units include disease forecasting, resolving outbreaks, conducting awareness camps, distribution of vaccines and monitoring vaccination feed and fodder, also serum collection of disease relating to Foot and Mouth Disease (FMD), Peste-des-petits ruminants (PPR) etc. also, livestock professionals have extensively involved in containment of FMD through the National Disease Control Programme for Foot and Mouth Disease and Brucellosis (NADCP-2019-20).

Livestock extension (scheme based) also includes creation of awareness/knowledge on health optimisation of livestock under the scheme of Mission on Sustainable Dryland Agriculture (MSDA); promotion of IFS, organising the special camps on deworming, vaccination, castration under the scheme of Livestock Protection Scheme (Kalnadai Padhukappu Thittam/KPT), promoting entrepreneurship on innovative techniques of preservation, processing and value addition of the livestock products and world-class facilities for students under Advanced Institute for Integrated Research on Livestock and Animal Sciences (launched in 2019 at Salem).

Training the farmers on the overall health of the animals is the most important extension service of the department of animal husbandry, through which the state ensures the production and productivity of the livestock. The livestock extension/service units such as veterinary sub-centre (825 at remote village level), veterinary dispensaries (2721 at panchayat level), veterinary hospitals (147 at block headquarters level), clinical centres (16 at district level) and veterinary polyclinics (14 at municipal corporation level) provide round the clock livestock extension advisory and clinical services (Deworming, vaccination, treatment of diseases, breeding, conservation of indigenous breeds of cattle etc.).

Notably, the state has shown considerable interest in enhancing the livestock extension system and advisory services. Even while, most of the extension services delivered by the veterinary personnel are co-existent with the supply of inputs/top down approach. This shows that there is a gap between core extension services and input supply based extension. The former one is dealing with solving the problems of farmers by veterinary personnel, the later one is relating to the top down approach, where the extension personnel are involved in the achievement of the targeted supply of inputs at a given point of time. Rangnekar, 2014 argues that the livestock departments are engaged mostly in the delivery of clinical advises and breeding of animals, also they rarely conduct “on-farm trials” of livestock technologies. On the other hand, the on-farm trials of KVKs are highly skewed towards crop production technologies than livestock. It is, therefore, the state may strengthen livestock extension

system with more focus on knowledge extension, better advisory services, efficient on-farm trials, better demonstration units., while equally keeping the eye on robust clinical cum breeding services. The other major challenge for livestock extension in the state is the limited budgetary allocation. Though the state recognises the importance of livestock in the state economy and its contribution to the state as well as national GDP of agriculture, the state allocated only 1,678.2697 crores during 2020-21. Given the vast number of livestock system and its upward growing curve needs special attention of the policymakers. Undeniably, most of the budget allotted for livestock would go for clinical services and improvement of infrastructure, it is impending for the state to allocate more budget to animal husbandry that will enhance the livestock extension systems and propel the state beyond clinical/ breeding services. NABARD, and IFMR, 2017 report that in Tamil Nadu, the sampled farmers were reported to have low income from livestock, also they argue that the farmers earn not more than 10 % of the income from the livestock within agriculture (NABARD and IFMR, 2017). It can be attributed to inadequate extension advisory services and knowledge management of the department for livestock farmers. Several reports suggest that diversification toward livestock, poultry and nonfarm activities can bring an additional source of income to farmers. In addition to this, the livestock sector also paves a way for value addition. However, the success is highly dependent on the overhauling of the livestock extension system with farm/farmer specific training, livestock information and demonstration/on-farm trials of innovative livestock technologies.

Tamil Nadu Veterinary and Animal Sciences University (TANUVAS-1999) provides quality education to the students on livestock research, knowledge and extension. The university and its constituent colleges have a capacity of 500 students. Also, the universities and constituent colleges have made a breakthrough in livestock research and made tremendous progress on state-of-the-art technologies which include Bovine Masti Cure Plus; Nano-Herbal Methicone Lotion; Nano Sarcoid Cream; AMS Green Tea Beads for Coccidia and AMS Beads for Coccidia; Solar tick trap with pheromone impregnated vapour patch and value-added milk products like Ghee residue Candy with orange peel, Milk protein etc. This apart, about 24 Veterinary University Training and Research Centres (VUTRC), 03 KVKs and 03 FTCs of TANUVAS provided around 2090 training, benefiting 70507 farmers across the state.

Department of Fisheries

The other major allied department which is making headway in the state is the department of fisheries. As the fish and value-added fisheries products are gaining important dietary orientation among the consumers, the fisheries department for its part has intensified the fisheries extension services to both marine fishermen community and inland farmers. The department has about 1797 fisheries personnel to look after the extension services, which include marine and engineering wings. The state's major aim is to provide several relief measures and advisories/information to the marine fishermen families as the state has one of the largest fishermen population depending on marine for its livelihood. The department has also been promoting inland fisheries through its District Fish Farmers Development Agencies located at all districts. These agencies provide regular training and extension advisory to the farmers on fish nurseries and hatcheries. Importantly, the state is involved in the production of fish

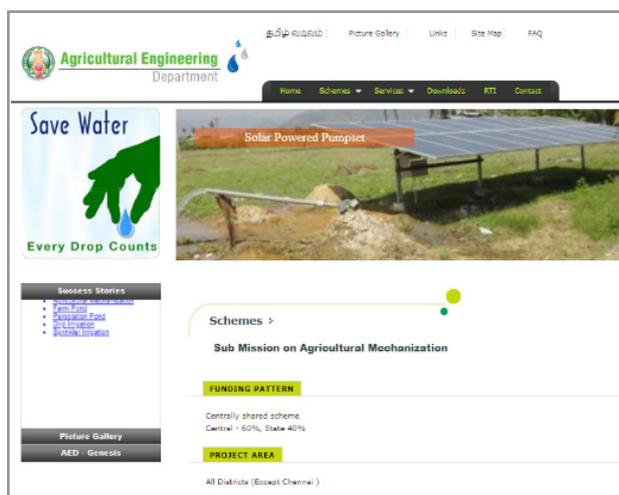
seeds from its 37 Fish Seed Rearing Centres and stocking it for the assured supply, whenever and wherever necessary.

International exposure visits for fisheries extension personnel: The state conducts international exposure visits for fisheries extension personnel to enhance their knowledge on advanced and innovative fisheries technologies. During 2019-20, around 25 personnel were sent to the fisheries institutes of Philippines and Thailand to learn about the latest and advanced fisheries production technologies (i.e. South East Asian Fisheries Development Center (SEAFDEC), Department of Fisheries, Royal Government of Thailand and Asian Institute of Technology). The gain in knowledge on fisheries may help the department to pilot test the new fisheries technologies at small scale, subsequently, these technologies can be scaled up based on the success.

All the more, the state has 1431 Fishermen Cooperative Societies with the membership of 7,17,204 fishermen. These societies are mostly involved in providing welfare supports to fishermen at all levels. Tamil Nadu Dr J Jayalalithaa Fisheries University at Nagapattinam (2012) provides education on fisheries to 400 students every year on average. This will ensure the creation of a cadre of skilled and competent manpower in fisheries. The fisheries Universities and constituent colleges also invest in research and development of fisheries technologies.

Department of Agricultural Engineering

Institutional extension and farm machinery services: Block wise custom hiring centres, the state has been establishing block-wise Custom Hiring Centres as of 2018-19, there were about 451 CHCs available in the state. Also, the state has 11 sugarcane-based CHCs for enabling the sugarcane farmer to carry out the timely agronomic activities including harvest. In addition to this, village-level CHCs were established in the low farm power districts, wherein around seven to eight members are encouraged to establish CHCs with 80 % (i.e. 8 lakhs) of assistance from the state under National Agriculture Development Programme (NADP) and Sub Mission on Agricultural Mechanisation (SMAM) and the remaining amount is borne by the farmers. As of 2018, they had about 738 village-level CHCs. The departments provide agricultural machinery and implements like Tractor, Power Tiller, Rotavator, Paddy Transplanter, Tractor and Power Tiller driven implements, Power Weeder, Chaff Cutter, Brush Cutter, Multi Crop Thresher, Baler, Shredder and Combine Harvester etc., are distributed under Sub Mission on Agricultural Mechanization (SMAM) to the individual farmers. The subsidy assistance of 50% to SC, ST, Small, Marginal and Women farmers and 40% to other farmers or the maximum permissible subsidy amount fixed by Government of India whichever is less is given for the distribution of agricultural machinery.



Tamil Nadu Irrigated Agriculture Modernisation Project (TN-IAMP)

The project is being supported by the World Bank, with this project, the state seeks to modernise the irrigation infrastructure, improve water use efficiency, enhance yields and productivity of agriculture with climate resilient production systems, promote diversification towards high value crops, and strengthen the institutional reforms through Participatory Irrigation Management (PIM) and Water Users Association (WUA). Funds are also diverted to renovate the 66 sub-basins in the state. The project benefits each stakeholder in agriculture and allied sectors, be it farmers, water users associations, farmer producer organisations and agribusiness entrepreneurs. The benefit will be enlarged to cover 5.43 lakh ha of farmlands. Activities are carried out under the following components namely, Demonstration of Improved Production Technology/IPT (like SRI in Paddy), Farm Field School on other crop production practices, Awareness on subsidy based farm mechanisation, Knowledge and Training on the overall development of agriculture and allied departments. These activities are carried out by the AAOs, DAOs/AOs/DoA and JDA at the village, block and district level respectively. Similarly, for the horticulture sector, AHOs, HOs/DHOs/ADHs and JDH/DDH are said to have participated in the promotion of horticulture based cropping system/improved technologies (hybrid vegetables, High Density Planting in fruits etc.,). Activities concerning animal husbandry department are the development of dairy interest groups, increasing the area under fodder cultivation, demonstration of various health improvement techniques (calf management, mastitis control, artificial insemination etc.).

Generic Issues in extension provision

Human Resources and Capacity Development

- A total of 2 006 technical officers functions in Tamil Nadu, which includes 1088 Agricultural Officers (AOs), 2829 Assistant Agricultural Officers (AAOs) and Agricultural Seed Officers (ASO) and these officers are closely working with farmers in transfer of technologies, providing trainings, demonstrations, undertaking diagnostic filed visits, organising field days, village/farm meetings, Farm Field Schools (FFS) etc., However, the provided strength is inadequate to meet the need of 83 lakh farm families in Tamil Nadu i.e. each of the extension functionary needs to meet 3243.79 farmers/year if the extension functionaries are to know the farm data/each farmer's demand. Moreover, study shows that the high farmers to extension worker (2500:1) in Tamil Nadu results in incompetency among the extension functionaries to cater to the growing farmers' need and demand.
- Lack of training and development of extension personnel pertaining to solving the existing farm

40% additional man power with vibrant capacity enhancement mechanism is needed for effective fishery extension services.

Kumar, 2010.

90% of the time, Agricultural Officers (AOs) seldom visit the village, that is under his/her jurisdiction. If the farmers go in group to the agriculture department, which is better as the voice of them is heard.

Prabhu, 2017

problems faced by the marginal section of the farming community (marginal and small farmers) may force the farmers to depend more on private dealers and external agents for solution, which in turn leads to ineffective management of farm resources and crop production as the private dealers mostly orient toward profit of the business rather than the progress of the farmers.

- Lack of periodical trainings and capacity development of extension personnel pertaining to changed cropping pattern, marketing demand, consumer awareness on organic foods, value addition, food processing have led to the incongruity between the extension/advisory services disseminated and information/ guidance required for the production of crops.
- The present strengths of AAOs i.e. 6 AAOs in each block (2310/385 blocks) in Tamil Nadu are inadequate as each block has about not less than 35 revenue villages in Tamil Nadu that the each AAO has to visit 5 villages and covering 45 farmers/village (approx.) every year. In this circumstance, provision of AAO on the basis of revenue villages (17 680) in Tamil Nadu may not only bring adequacy in man power requirement in the state of Tamil Nadu but also provide customised extension services to the farmers on demand basis.
- Although schemes have led to the increased area under food crops and production to some extent, the overall outlook of the state agriculture has been deteriorating. The extension functionaries are mostly involved in coverage of area targeted in the scheme rather than assessing the capacity need of the farmers and changed cropping system of the state.
- Additional extension functionaries are imperative to support the changing need of the farmers and consumers. Even there is lack of evidence and research to show the number of extension functionaries and experts needed for the proper functioning of extension system in the state. It has been said that, more of extension activities and advisory services provided to the farmers go undocumented owing to lack of separate wing and extension expert in research station, line departments etc.,

Private extension and its impact

Table 1.14. Agro extension services of private players in Tamil Nadu

S. No.	Private extension players	Impact
1.	UPASI	Free advisory services to small farmers and also free analytical services are provided to Tea Technology, Pesticide Residue, Pathologyfarmers on. Quality upgradation programme implemented by UPASI benefited 0.43 lakh small tea growers, which enhanced the quality of tea thereby giving increased income to farmers as cited by Ramu et al in Hansra, 2005
2.	Parry's corner	It is resolved to provide farm and financial inputs needed by the sugarcane growers in the state. EID Parry has 5 plants in Tamil Nadu situated at Nellikuppam in Cuddalore district, Pugalur in Karur district, Pudukottai in Pudukottai district, Pettavaithallai in Trichy district and Puducherry.

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|----|----------------------|---|
| 3. | Dhan Foundation | Dhan foundation has so far covered 104 watersheds and 0.75 lakh ha of lands and 5000 farm ponds for improving water needed for the irrigation of crops and drinking water ponds in 300 drought prone villages, with which 1.2 lakh people have access to drinking water as of now |
| 4. | Hatsun Agro Products | It procures close to 2 million litres milk on a daily basis from more than 3 lakh farmers over 8,000 villages and provides awareness and knowledge to milk producers on modern milking technologies, fodder production practices and feeding of livestock. |
| 5. | SAAL | Sustainable Agro Alliance Limited (SAAL), a Madurai based agricultural organisation has been working to connect the agirpreneurs with farmers in the pesticide free vegetable value chain. SAAL has been training the young agricultural professional/agirpreneurs in the subject of organic farming. Almost, several agirpreneurs have been trained to advocate the farmers about the organic vegetable farming and venture into the organic vegetable value chain management. Each of the agirpreneur will have to train farmers about the value chain management after the training. These trained agirpreneurs of SAAL provide seed to seed advisory services about organic farming and involve in market facilitation of organic products of those farmers with whom they have established their extension advisory services. Besides, SAAL has developed an App Farm Field, which allows the farmers to provide expected yield of the vegetables to the buyers. Thus, the buyers could pre-order their required amount of vegetables from multiple farmers using the data available on the Farm Field App (Ware, 2015). This Farm Field App has about 458 farmers data base and the information on farm area, production estimation and rates for procurement and sale. Agirpreneurs are involved in collection of data and upload them in the Farm Field App for synchronisation so as to provide real time data to the stakeholders (Sustainable Agro Alliance, https://goo.gl/qz4iVJ) |
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Gender

- Though agriculture has 7 % of GDP in Tamil Nadu, 90 % of its contribution come from women. However, recognition and direct benefits to these major contributors of the state agriculture are meagre. The provision for women participation is not more than 20 % under any extension activity of the DoA, ATMA and other line departments be it training or demonstration, exposure visit or other. However, KVKs follow more gender inclusive approach be it trainings on value addition, nutrition gardening, production of vermicompost, cultivation of ornamental crops, cultivation of high value crops. E.g. KVK-Thirupathisaram covered 78.24 % of women in one of its training. However, when it comes to crop production and protection, men are the regular beneficiaries be it trainings, demonstration/exposure visits/Farm Field School.
- 770 Amma farm women groups have been formed to empower and engage women in Group oriented agricultural activities from production to marketing of agricultural produces.

Less exposure to the outside world was the bottle neck of women to access the information in Tamil Nadu.

- NABARD has committed to the uplifting of women through Micro Entrepreneurship Development Programme (MEDP) in Goatery, dairy, vermicompost, food processing, value addition, Beautification, etc. In the same way, Self-Help Groups are formed to benefit the women across the state. Trainings and capacity building of women on operation of farm machineries and implements are yet to find a place in the state. It may be that the lack of women friendly machineries and implements. These entrepreneurship-oriented trainings and capacity development may help in promotion of more women entrepreneurs in the state.

Partnership and Collaboration

- Collaboration has been seen in the form of calling a resource person for speaking on a particular subject matter. Let's say, if the trainings and demonstration are given by the DoA in Integrated Crop Management (ICM) in pulses, then they call a Subject Matter Specialist from adjacent KVK/ Research Station/TNAU/TNAU-affiliated colleges/other ICAR institutes. There has been no special partnership made to address the issues such as dwindling water resources, shift in cropping pattern, fluctuating market price of the farm produces, though schemes such as PMKSY is being implemented by the DoA and DoH&PC, the role of the Department of Engineering has limited scope, despite that the micro irrigation is more of an engineering subject.
- Lack of collaboration with private players: Private companies have been playing a conspicuous role in dissemination of technologies and inputs be it crop management techniques or practices or varieties. In this context, a joint venture could be made with identified private companies in assessment of the location specific technologies/customised crop production inputs, marketing demand of the farm produce coupled with consumer preference.
- Besides, there is a limited provision by the government to make use of private companies be it agri-business ventures or start-ups in agriculture or establishment of farmer friendly agri-clinics and agribusiness centres or others. Though ATMA has a 10 % stake with the NGO, which is mostly a smaller amount than the requirement, as the farming sector in the state of Tamil Nadu is dynamically changing. Therefore, an effective policy for collective involvement of apt private players in promotion of technologies/marketing of produce/value addition of the farm produce possibly will help the farmers to realise increased returns.

ICTs and Social Media

- FCMS/Touch Screen Kiosks/ implemented by the state government may not lead to productive impact unless, the ICTs are used to amalgamate farmers with extension personnel widely. Officials use WhatsApp to some extent to support the farmers in management of pest and diseases yet fraction of users is very less as majority of

Farm Crop Management System (FCMS) is a data base of every individual farm resources of land, water and cropping pattern. The data base is made based on the consultation of extension agent with the concerned farmer. This will help the farmers to identify the productivity gap and ways to improve crop production.

For further information <https://goo.gl/zehALs>

the farmers have less knowledge on use of new media tools like WhatsApp and Facebook. As modern ICTs tools have become inexpensive, expert teams need to be employed in use of WhatsApp or other ICTs interventions of various corporate sectors at every village for the benefit of the farmers, which will result in customised delivery of extension services to the needful/resource deprived farmers.

- With the increased use of ICTs in the field of agriculture and allied sectors, Agricultural engineering has proposed to make an app based on Ola and Uber model. It is likely to be released in the end of 2018. The App will help the farmers to locate the nearest custom hiring centre and availability of each of the machinery and implement. Besides, hiring charges will be mentioned along with the contact details of the custom hiring centre. Therefore, farmers could save much of their time.
- Horticulture Research Station and its ICT initiative: Garman Krishi Masaum Seva was introduced in 2014. The special project has been entrusted to analyse the weather data frequently for the benefit of the farmers. Moreover, the cultivation practices like fertiliser application, water management in crops and best practices related to pest and disease management are sent with the view of making awareness among the farmers about the weather information for crop productions. As far the extension strategies, farmers SMS portal is used for sending advisory messages to all the 516 registered farmers across the state. Most of the farmers are also informed through All India Radio (AIR). Moreover, a tie has been made with the reliance foundation to send the messages to the farmers who are the members of reliance mobiles. In this way, a total of 1000 farmer is covered under the Garman Krishi Masaum Seva.
- HRS, Kanyakumari has telecasted and broadcasted around 12 and 30 programmes through Makkal TV (Man Vasana) and All India Radio (AIR) respectively on advanced technologies on pepper, ginger, clove, nutmeg, cinnamon etc., in the state. These ICTs mean of dissemination of information are said to cover more farmers within short time and provide valuable advisories in management of crops and adoption of agricultural technologies.
- Use of ICT has been high among NABARD as NABARD has its own web portals namely Krishak Sarathi (<http://www.krishaksarathi.com/>) and e-Shakti (<https://eshakti.nabard.org/>) for farmers club and Self-Help Group respectively. These groups make use of the portals any time to know the activities of NABARD respect to farmer's club and SHGs. NABARD uploads all of its technological intervention in the portals for the benefit of the farmers.

Garman Krishi Masaum Seva is the project operated by HRS in view of safeguarding the crop production and protection through advance weather advisory services. AIR plays a vital role in broadcast of weather related crop advisory services to the farmers every Tuesday and Friday. The information on crop weather advisory is given to all blocks of Kanyakumari district.

NABARD itself created a web portal namely Krishak Sarathi and e-Shakti for farmers club and Self-Help Group respectively.

Table 1.15. Recent ICT initiatives in the state of Tamil Nadu

S.No.	Private players	ICT initiative	Salient features	Impact
1.	EID Parry	Indiagrilline.com and its physical portal is set up in the name of Parry's Corner across the state of Tamil Nadu	It includes, A Cane Management System software which provides information related to crop production and post-harvest techniques of sugarcane. The farming calendar of sugarcane is also an added feature of the initiative. Besides, the parry's corners provide inputs to sugarcane growers. corDECT (Digitally Enhance Cordless Technology) Wireless Local Loop technology is used to provide better connectivity at low cost.	16 Parry's corners have been setup on a franchise mode, wherein an entrepreneur/ youth/or any other operator is solely responsible for the operation of the kiosk. The farm information related to other agricultural crops like Paddy, Banana and groundnut is also provided. It has been observed that even the kiosk operator can earn about 800-2000 INR per month by means of providing computer education, mailing, Desktop Publishing and Xerox charges (Bowonder and Yadav n.d.).
2.	TCS	mKRISHI	It provides SMS, Voice message and photo based advisory services to farmers through mobile phones and enables two-way communication between farmers and experts and Interactive Voice Response (IVR) therefore, farmers have better access to information on microclimate, fertilizer dose, market information. The mKRISHI® provides a variety of personalized information; the critical difference of mKRISHI is that the experts can respond to farmers' queries (Singh, 2014).	88.33 % of the farmers of Kancheepuram district expressed that the services of mKRISHI is easily adoptable to the local field condition. mKRISHI played a vital role in changing the farming scenario of Tamil Nadu as the mKRISHI provides appropriate technology, market and input information. As a consequence, the yield and of the crops and income of the farmers increased (Singh 2014). Besides, farmers realised increased production, better income and access to credit, farm inputs and market. All the more, mKRISHI helped the farmers to involve in demand led diversification (FAO, 2017).

3.	Ekgaon Technologies	Onefarm (A mobile based SMS technology)	A farmer can subscribe agro advisory services for a crop cycle of four to five months by paying INR 150. The advisory services are personalised, localised, specialised and provided on a various subject of agriculture, which includes seeds treatment, weed, pest and fungus treatment, schedule for fertilisers and agro-chemicals. Moreover, the advisories are customised based on individual farmer's field nutrients availability (Mustaquim, 2015 and Manisha, 2017).	Each farmer's data base has been created along with the Site Specific Nutrient Management System. Ekgaon Technologies, a Delhi-based company, provides farm advisory to the 3,00,000 farmers in Tamil Nadu, Madhya Pradesh and Chhattisgarh (Mustaquim, 2015 and Manisha, 2017).
4.	Thomson Reuters	Reuters Market Light (RML)	It is an SMS based agro advisory services and provides highly customized and localized agricultural related information services to the registered farmers. The SMS includes localized weather forecasts, crop advisory, proximate market data and crop prices along with relevant policy and national and international news. RML functions throughout the state but with the high presence in Erode district (Anbarasan, and Bhardwaj, 2015).	86.6 per cent of the farmers had willingness to pay to the extension services offered by the RML. The value-added services of the mobile phone companies may perhaps provide increased income to the farmers. The SMS of the RML has significantly influenced the farmers' cultivation practices in the state of Tamil Nadu (Anbarasan, and Bhardwaj, 2015).
5.	Umadikar et al, 2013 (Research scholars from	mASK	Personalized Dashboard for every farmer with Crop and Advisory Timeline. mASK system is a personalized dashboard, developed for every farmer who has registered in the system. A call-centred approach is provided thereby the farmer's dashboard with the crops, time of sowing, spacing etc., will be displayed to the expert as soon as the farmer called in to the system with a query,	It Contains 50 farmer profile, farm and current crop details. Current crop details cover the plot/crop soil test report, seed variety, age of crop, spacing, seed treatment, nutrient history, pesticide history and weedicide history. After the use of mASK, the farmers observed that the reduced cost of production, increased yield and reduced pest and disease (Umadikar et al, 2014).

by utilizing the Caller Line Identification (CLI) – in other words, the unique mobile number. It has an in-built feature of crop history timeline, therefore, the farmer's history of cropping pattern will be displayed to the expert, when he gets the call from a concerned farmer, which would enable the experts to provide advisory services aptly (Umadikar et al, 2014).

6.	CICR-ICAR*	e-Kapas	<p>“e-Kapas network” has been established for effective knowledge transfer among cotton cultivating farmers in the state of Tamil Nadu. It disseminates cotton technologies through regular voice SMS alerts in local language to the cotton growers registered with e-Kapas network (Rani et al n.d.).</p>	<p>In Tamil Nadu, 7406 farmers had registered with e-Kapas network from major cotton growing districts. Majority of them believed that mobile phones significantly reduced their costs for accessing information on cotton technologies and provided them a chance to use the ICT based extension service (Rani et al n.d.).</p>
7.	CSISA	The Nutrient Manger for Rice (NMR)	<p>It is an ICT based decision making tool, which gives real time site specific fertilisers recommendation. It was introduced by CSISA (Cereals System Initiative for South Asia) in the Cauvery Delta Zone of Tamil Nadu. This tool provides guidelines based on the need of the farmers and condition of the paddy fields. It works on the basis of the compiled data which was previously provided by the farmers about his/her field situations, crops and so on (CSISA, 2015).</p>	<p>This tool saves around 4500 INR per ha of paddy field, hence reducing the cost of production of paddy as the fertiliser is the second largest consumer of cost of production of paddy. With the use of NMR, farmers would save about, 15-20 % of Nitrogen, 36-42 % of Phosphorous and 28 % of Potassium when compared to the recommendation of state fertiliser (CSISA, 2015).</p>

*The Central Institute for Cotton Research (CICR)

Agripreneurship and innovative extension intervention in Tamil Nadu

Agripreneurship has been growing in the state of Tamil Nadu and several farmers have initiated their own businesses in agriculture and allied sectors with the help of national institute like MANAGE, line departments, NOGs, private players etc. These agribusinesses are benefiting the rural livelihood, improving farm income, generating employment opportunities and retaining interest of farmers (Table 1.16).

Table 1.16. Agripreneurs and innovative extension interventions in Tamil Nadu

S.No.	Agripreneurs	Innovation and networking site	Salient features	Impact
1.	Mrs. S. Sellapponnu (B.Tech Agri.Eng)	VKS Agri-Clinic, Sivagangai district	It provides year-round agriculture consultancy services and soil testing laboratory facilities to more than 3000 farmers, which covers about 250 villages in Sivagangai district of Tamil Nadu. Besides, Mrs. S. Sellapponnu herself takes a field visits to provide crop based consultancy to farmers for enhanced farm return.	VKS Agri-Clinic has provided employment opportunities to 6 persons and the store houses established at Kadapuliur and Panruti towns of Tamil Nadu help in storing the farm produces like Cashew nut, Groundnut, Paddy and Coriander. These warehouses benefit around 80-100 farmers.
2.	Ms. J. Umamaheshwari, B.E. in Agriculture	Rich Masala, Podanur, Coimbatore district	It manufactures masala items like turmeric, chilli and coriander powder along with value added products from minor millets and moringa leaves. It purchases the raw produce from 100 farmers in 50 villages in turn the producers are the buyers of the masala. Thereby, it created win-win situation for producer and manufacture.	It employs about six women, which includes women with differently abled.
3.	Mr. S. Natarajan (B.Sc., Agriculture)	Natarajan Agri-Clinics and Agri-Business centre. Madurai district.	It is resolved to solve the urban nutrition need and food security through urban gardening. It is ensured by the supply of vegetable saplings and organic inputs (Vermicompost, bio-fertilisers and pesticides). About 5000 farmers have	More than 500 clientele get regular consultancy on good management

			been covered from the three districts of Tamil Nadu namely Madurai, Dindigul and Sivagangai.	practices of urban farming from Mr. S. Natarajan.
4.	Mr. Balaji B.Tech (Horticulture)	B&B Organics and online organic food sale mart. It is working throughout Tamil Nadu and based at Trichy	It trades organic fruits, vegetables, spice, rice, pulses, millets, oilseeds etc., on www.bnborganics.com , Sandhaikadai.in and also through Amazon.in . it covers about 50 farmers.	8 persons are employed so far. The organic food items are also exported to Middle East.
5.	Shri. S. Innasimuthu	Green Madurai firm, Madurai district	Home gardening consultancy to more than 1500 residential houses, 180 corporates and 480 progressive farmers of Madurai, Dindigul, Virudhunagar and Erode districts of Tamil Nadu. Landscape services were provided to 40 educational institutes on a voluntary basis. The aim of the firm is to transform Madurai as green city of the state.	Generated direct and indirect employment opportunities to 100 persons and 450 persons respectively.
6.	Mr.K.Vinoth	Mushroom production in 500 sq.m. room. Kottikuppam village, Villupuram district, Tamil Nadu	Mr. K. Vinoth is able to make around 10 lakhs from 100 bags in 500 sq.m. mushroom farming. He gets his spawn needed for the production of oyster mushroom from the Department of Horticulture and the other materials like compost from the farm itself, which helps him to use the available farm resources.	Mr.K.Vinoth generated employment opportunity to 2 women of the village and provides advisory services to 54 farmers in seven villages the consultancy services would be covering more farmers in coming days, thereby, helping the farmers to get additional and remunerative income from mushroom production.

7.	Dr. S. Sujitha	Vet Care, Kallakurichi, Villupuram Tamil Nadu	Dr. S. Sujitha has established a vet clinic and consultancy service centre at Kallakurichi. This vet clinic caters to the need of the livestock keepers of 20 villages located in Kallakurichi Taluk of Tamil Nadu. More than 300 farmers have benefited from the Vet Care and 200 farmers regularly get advisory on selection of milch breed, feed and fodder management, timely vaccination, animal health management etc.,	With this Vet Care consultancy and laboratory services, Dr. S. Sujitha gets around 5 lakhs income per year.
8.	Mr. T. V. Satish	Vijaya Shree Nursery, Harur, Dharmapuri, Tamil Nadu	Mr. T. V. Satish ventured into a vegetable nursery production with the loan of 5 lakhs from the Indian Bank. Today, the nursery supplies saplings of major vegetables like tomato, chilli, brinjal, cabbage, cauliflower, okra and all gourds (Bitter gourd, snake gourd, bottle gourd, etc.,). More than 1000 farmers from 5 districts of Tamil Nadu got sapling from this nursery.	Employment opportunities were given to 10 skilled and 30 unskilled labourers from the surrounding villages for the production, maintenance and sale of saplings to the incoming farmers. He earns about annual amount of 1 crore.
9.	Mr. P. Manivel (Diploma in EEE)	Integrated Farming System (IFS). This IFS farm is located in Valapadi block of Salem district	IFS is becoming thrust area in farming as of now, as IFS ensures the year-round income. He has educated about 50 neighbouring farmers about practicing IFS amid scarce water. Besides, he has been giving trainings, awareness and knowledge about the need for value addition in rice to the farmers.	He is the model farmer in the field of IFS and he was invited at Krishi Unnati Mela, IARI, 2018 as a speaker.
10.	P. Tamilselvi	Direct marketing for increased farm returns Kodayampalayam village, Anthiyur block	P. Tamilselvi involves in production of mushroom, red banana and poultry unit, small flock of goats and ducks along with cattle farm. The direct marketing is the	P. Tamilselvi's farm earns her an annual profit of nearly 13 lakhs and guides other farmers in Integrated Farming System (IFS) and

			key for p. Tamilselvi. She sells one banana at the rate of 8-10 INR instead of 2 INR due to direct marketing. Moreover, she produces mushroom from 600 beds and sell them directly to the consumers . KVK, MYRADA, Erode has given necessary skills to P. Tamilselvi in production of mushroom and IFS (Prabu, 2018).	mushroom production. Mrs. Tamil selvi is called mushroom lady in Erode.
11.	M. Kumar	Organic farming, Mugaiyur village, Villupuram	M. Kumar has been involving in organic farming for 20 years from now. He has provided awareness and capacity/ skill to 100 of his own neighbor farmers in organic farming technologies. His involvement in result demonstration about the organic farming helped him to earn credibility among neighbouring farmers since he believes that seeing is believing to the conventional farmers (Gilon, 2017).	Organic farming helped the farmers to minimise the farm input use maximise the output along with the conservation of soil and nature.
12.	Parameshwaran	Conservation and multiplication of native seeds. Kuttiyagoundanpudur Village, Oddanchathram Taluk, Dindigul district	Parameshwaran was the 24 years old youngster who has discontinued his aeronautical engineering degree in pursuit of conserving his father's farm lands. After contacting successful farmers, Parameshwaran has ventured into collection of native seed varieties and multiplication of these seeds for supply. Initially, he collected around 20 native seed varieties and now he owns around 150 native seed varieties and multiplies them with the help of his father and supplies them to needful farmers.	Training and virtual communication to all the interested stakeholders on establishment of terrace gardening, kitchen gardening is his strength. Besides, he charges 1500 INR per training per person pertinent to terrace gardening. He has his own Facebook page https://www.facebook.com/F.CROWN.AMBASSADOR so as to keep his stakeholders informed of latest technologies, new techniques in terrace gardening,

			He provides method and result demonstrations/ awareness, trainings, exposure among the household women/youth to purchase native seeds and cultivate them on the terrace/kitchen yard.	trainings related information and so on.
13.	Madhu Balan, Agricultural Officer (AO)	Social media for societal impact (Vivasayam Karkalam community page-Facebook page)	Madhu Balan, Agricultural Officer from Dharmapuri district of Tamil Nadu helps the interested people of all walks of life in entering into agriculture. He uses the Facebook page (https://www.facebook.com/vivasayamkarkalam/) as a mean of reaching the mass. He provides seed to seed information about farming and updates successful stories of the farmers from across the state, thus simulating the interest among thousands of farmers/youth/ professionals. More than farming information, he gives information on sources of seeds, inputs and other farm needs, which helped people to access farming at their ease. (Prabu, 2015).	Presently, the pages of his Facebook are being browsed by agricultural graduates, young farmers, professionals of other sectors. This Facebook page has members of more than 14 336 people from across the country as on 28.04.2018.
14.	Tribal farmers	Amrita SeRVe Organic Rice, Sadivayal, Coimbatore district, Tamil Nadu	Amritha SeRVe, a self-reliant village project of the Mata Amritanandamayi Math. Amritha SeRVe motivated 20 tribal farmers of Sadivayal to form a farmer's club, with which they have opened a bank account. These farmers were then collectively involved in cultivation Bhavani rice variety purchased TNAU on 35 acres of lands. The production aspects like field preparation, water	

			<p>budgeting, application of cow dung and urine were done collectively. This collective approach on organic rice cultivation helped the farmers to get 28 INR per kg of paddy in the place of mere 9-13 INR per Kg of paddy previously due to application of chemical fertilisers. Each of the farmer of the club has received about 19 thousand INR per acre (Prabu, 2017).</p>	<p>Collective farming reduced the cost of cultivation and helped in increasing the yield double fold.</p>
15.	CSISA		<p>CSISA (Cereal System Initiative for South Asia) with the help of International Rice Research Institute (IRRI), Philippines has made awareness and knowledge among 0.25 lakh rice farmers on several rice production technologies and management practices such as laser land levelling, mechanised dry direct seeding of rice, mechanical transplanting of rice, site specific nutrient management etc., on more than 70 acres of lands across Tamil Nadu (CSISA, 2015).</p>	<p>These technologies reduced the cost of production of rice and increased the income of the farmers in n Thanjavur, Thiruvavur and Nagapattinam districts of the Cauvery Delta and the neighbouring districts of Ramana-thapuram and Sivagangai of Tamil Nadu. CSISA has benefited about 25 thousand farmers in the last five years. Moreover, TNAU and Department of Agriculture (DoA)-Tamil Nadu help in facilitating the availability of direct seeds drill at subsidy rate to the farmers (CSISA, 2015).</p>
16	MSSRF	Plant clinics	<p>Plant clinics are the programme which are conducted at the village level to provide practical agro advisory and recommendations to farmers on various problems of farming. Trained professionals are appointed as plant doctors to provide advisory services to farmers. Farmers are informed in advance about the date, time and place of plant clinic</p>	<p>Since Plant Clinics Programme inception from 2012 in Thiruvaiyaru in Thanjavur district, Tamil Nadu, which has catered to the need of the farmers across the district. As of now, this unique programme covers about 40 villages in the state of Tamil Nadu, Maharashtra and Union Territory of Pondicherry</p>

sessions whenever it is scheduled to be held in a particular village; the residents are informed about it through the Village Knowledge Workers, Farmers Association Members, progressive farmers and Plant doctors and through voice SMS (Vedavalli, 2017).

(Vedavalli, 2017).

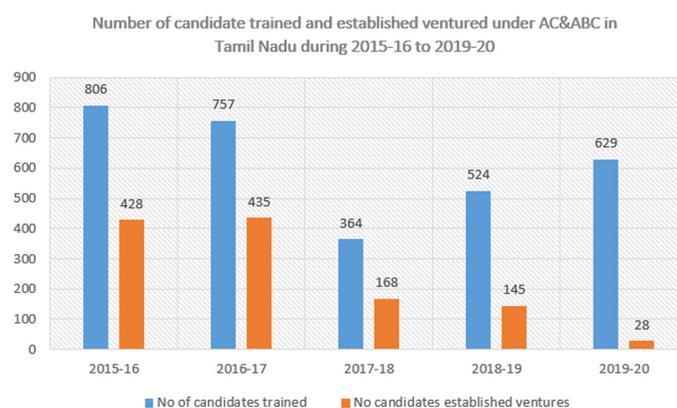
Status of AC&ABC and DAESI in Tamil Nadu

Agri Clinics and Agri Business (AC&ABC)

AC&ABC has been tapping the expertise of the graduates of agriculture since its inception (2002), also imparts training in different aspects of agriculture, horticulture, sericulture, veterinary sciences, forestry, dairy, poultry farming, and fisheries. The trained candidates play a central role in complementing the public extension; providing reliable advisory services to farming communities on new technologies, good practice of agriculture and allied sectors as well as fostering the

farm specific extension services to a large number of farmers. The programme is being implemented by MANAGE with the help of SAMETI at state level and NTIs at district as well as cluster levels. The NTIs implementing AC&ABC training in the state are Annamalai University, Annanagar, Chennai; Voluntary Association for People Service (VAPS), Madurai; Agricultural Graduates Consultancy and Services Society (AGCASS), Erode; Roever KVK Krishi Vigyan Kendra, Perambalur just to name a few.

As on June 1, 2020, out of 72,136 trained candidates, around 7764 candidates (10.78 %) were from Tamil Nadu, while, only less than 50 % (3689/47.51%) of the trained candidates have established any ventures. Of the trained candidates, around 38 % of them ventured into agri-clinics/agri clinics and agribusiness centres, while the all India figure for this stood at 39.87%. The state stands at 3rd ranks with 3689 trained candidates establishing any of the ventures listed in below table between 2002 and 2020. The states Maharashtra and Uttar Pradesh stand at 1st and 2nd respectively with 8155 and 7152 trained candidates establishing within the same period. During 2019-20, of the total candidates trained (629), in the state under AC&ABC, most of them have established dairy/poultry/piggery/goatary. Therefore, there is an enormous scope for the state to facilitate the creation of more agri ventures by



Number of candidate trained and established ventures under AC&ABC in Tamil Nadu (2019-20 Agri-venture establishment data is not updated due to COVID 19)

the trained candidates of AC&ABC. Also, a vast majority of the trained candidates' interest in agri venture is mostly skewed towards agri-clinics and agribusiness, followed by dairy Poultry/Piggery/Goatary. Hence, the state may focus on the neglected areas of agri ventures that are having high value for both farmers and trainee. For example, providing a much needed impetus for the agri ventures such as Bio-fertilizer production and Marketing, Soil Testing Laboratory, Tissue Culture, Organic Production/ Food Chain, etc., might not only help in generating high income to the agripreneurs but also play a role in enhancing the sustained income of farmers.

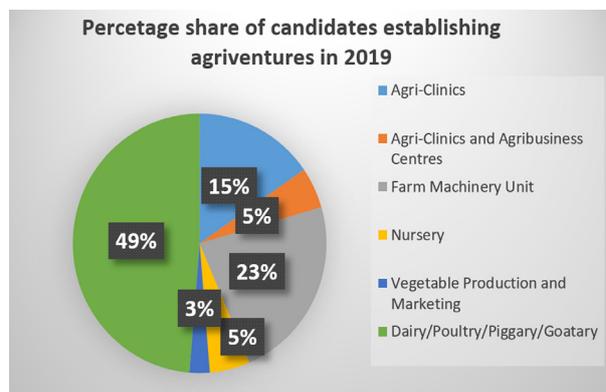


Table 1.17. Agri-venture establishment by trained candidates in Tamil Nadu during 2002-2020

S.No.	Name of the Ventures	Total ventures established in India	Total no. of candidates established in Tamil Nadu	% share to the all India total
1.	Agri-Clinics	4638	744	16.4
2.	Agri-Clinics and Agribusiness Centres	7979	663	8.31
3.	Agro-Eco Tourism	17	1	5.88
4.	Animal Feed Unit	59	5	8.47
5.	Bio-fertilizer production and Marketing	166	15	9.04
6.	Contract Farming	111	21	18.92
7.	Cultivation of Medicinal Plants	114	10	8.77
8.	Direct Mkt.	171	9	5.26
9.	Farm Machinery Unit	815	99	12.15
10.	Fisheries Development	398	45	11.31
11.	Floriculture	111	15	13.51
12.	Horticulture Clinic	179	29	16.20
13.	Landscaping + Nursery	114	25	21.93
14.	Nursery	591	105	17.77
15.	Organic Production/ Food Chain	117	16	13.68
16.	Pesticides Production and Marketing	59	2	3.39
17.	Value Addition	451	37	8.20
18.	Fishery clinic	17	6	35.29
19.	Seed Processing and Marketing	380	34	8.95
20.	Soil Testing Laboratory	110	25	22.73
21.	Tissue Culture Unit	28	2	7.14

22.	Vegetable Production and Marketing	423	34	8.04
23.	Vermicomposting/ Organic manure	541	47	8.69
24.	Veterinary Clinics	940	163	17.34
25.	Crop Production	319	17	5.33
26.	Dairy/Poultry/Piggary/ Goatary	9500	1462	15.39
27.	Rural Godown	58	3	5.17
28.	Production & Marketing of Bio-Control Agent	30	2	6.67
29.	Agriculture Journalism	18	0	0.00
30.	Sericulture	63	10	15.87
31.	Mashroom Cultivation	134	41	30.60
32.	Apiary	104	2	1.92
Total		28755	3689	12.83

The low establishment of different ventures might be attributed to the availability of loan as it is a critical part of establishing AC&ABC centres, taking up high value commercial ventures as well. Non-granting of loans to the trained candidates was the major factor that deters them to establish ventures immediately after the training. Henceforth, the state government may allocate a considerable amount of funds to commercial banks to provide loans to the trained candidates of AC&ABC, similar to the loan facilities available for farmers at nominal interest. Also, the government may think of providing interest free loans to these candidates, which may translate into the establishment of a large number of AC&ABC in the state. More importantly, every year 600-700 students pass out from TNAU alone, and the number is likely to grow even higher as a number of the opening of private agricultural colleges is increasing year on year. On the other hand, during 2018-19, only 26 % (178) of the graduated students were placed in different industries namely agro, food industries, NGOs and other sectors. Most of them go for banking and finance sectors for the reason of job security. Gender inclusiveness in agriculture is growing at an increasing rate, however, data show that only 16% (1110) of the trained candidates of AC&ABC were women as of 2018-19. Therefore, there is an ample opportunity for the state to train more agricultural graduates under AC&ABC and make them better entrepreneurs and self-employed, including female. However, the success of this is dependent on the candidates' access to more loan facilities, venture capital/seed capital and gender inclusiveness. Hence, the government needs to reorient its policy framework that would largely benefit the AC&ABC trained Candidates in getting the loan. Consequently, it will help in developing the core competencies of the agricultural graduates and utilising their knowledge and capacity for the benefit of scientific farming by every farmer.

Diploma in Agricultural Extension Services for Input Dealers (DAESI)

DAESI launched during 2002-2003 intending to train the input dealers on scientific agriculture and thereby transform them as para extension professional cadre for the benefit of farmers. Tamil Nadu was a part of DAESI since the pilot test of it by MANAGE in 2002-2003, since then the state has actively been implementing the programme. At state and district level, SAMETI and NTIs respectively, are its major implementing partners. The trained dealers are found to have involved in the exhibition of several new farm technologies such as rooftop garden model, drip irrigation; charts of pest and disease management practices among others. Also, they go for frequent field visits at a fixed time regularly. The state has trained around 919 candidates (about 24 DAESI batches) as of March 2020. However, it is only a fraction of (3.17%) the share, when compared to the total trained candidates (28,986) across the country. Another 160 input dealers are likely to complete the training in 2020-21, while the pan India figure is 20,920. The states such as Karnataka and Andhra Pradesh (which started the programme along with Tamil Nadu) have trained about and 6344 (22%) and 4151 (14%) input dealers respectively in the same period (31st March 2020). Apart from DAESI, TNAU through its ODL (Open and Distance Learning) has been offering a one-year Diploma course in Agri-Inputs since 2019- 2020. According to several study reports, in Tamil Nadu, for most of the farmers, input dealers are the major source of agricultural information (68%) (Glendenning et al, 2010, 2011; Babu et al, 2012 and Rasheed, n.d.). It is imperative, therefore, for the state to increase the number of DAESI training by covering all the input dealers in a short time possible. There is also a need for the assessment of the total untrained and prospective input dealers in the state, as the state has several unidentified input dealers. The department of agriculture/ATMA functioning in every district needs to map the practising as well as prospective input dealers to include them under DAESI in forthcoming days. Also, SAMETI and respective extension/line departments can publish the list of DAESI trained candidates with their contacts/address in their respective websites, the state needs to include these trained dealers in its Uzhavan App as well, for the farmer to easily access them and get reliable/scientific information on the crop production and management.

Number of input dealers trained under DAESI during 2015 to 2020 in Tamil Nadu



“After DAESI, the dealers started recommending pest and disease control measures scientifically, previously they used to advise “blind fold recommendation”; also they visit farms one or two times a week to observe the field conditions, what is more significant of trained dealers is that they are now able to attract more farmers owing to their responsive extension services that matches the need of the farmers”-

Mr. S Manoharan, Assistant Director of Agriculture (ADA) and Former DAESI coordinator, STAMIN, Tamil Nadu.

Urban Agriculture in Tamil Nadu

Ensuring urban food security in the state of Tamil Nadu has become crucial as the urban population is continued to be booming. In 2014, Do-It-Yourself (DIY) kit was introduced by the government of Tamil Nadu to promote urban gardening in order to ensure the growing need of fresh and nutritious food of urbanites. By doing so, urbanites can meet their own vegetables and green diet requirement. Presently, the scheme covers the following cities namely Chennai, Coimbatore, Trichy and Madurai. The Do-It-Yourself (DIY) kit consists of polythene bags, coconut coir bricks (that absorb water and to be used instead of sand,) seedlings of brinjal, tomato, chillies, and cuttings of plants of ladies' finger, broad beans and three varieties of greens

viz., Araikeerai, 'Mullaikeerai, Palakeerai, coriander and radish. The kit also contains Azospirillum (200g), Phospho bacteria (200g), pseudomonas (100g), Trichoderma (100g) and fertilizer 18:18:18 (1 Kg) and azadirachtin (100mg). The state government has been supplying the kits to more than 1 lakh urban families living across the four cities Chennai, Coimbatore, Trichy and Madurai. Each kit's cost is 500 INR and a person can buy as many as kits needed (MSSRF, 2017).

Besides, the Centre for Indian Knowledge System (CIKS) is promoting organic farming and kitchen gardening in Tamil Nadu. The CIKS provides awareness/knowledge and skill among the farmers/household women in establishment of community garden, backyard garden, nutrition garden etc.,. Importantly, it promotes home gardens with the aim of conserving indigenous vegetable varieties and medicinal plants. Several documentations were made by the CIKS regarding home gardens especially the case studies of Mr. N. Rajaraman, Sirkazhi taluk of Nagapattinam District pertaining to vegetable seeds production and distribution to fellow residents and farmers through Seed Exchange Programme, Community Kitchen Garden of a group of women from "Ponni Iyarkai Vivasaya Magalir Kuzhu" (Ponni Natural Farming Women's Group) in the Aadhamangalam village of Nagapattinam district. In Vedharanyam Cluster, Nagapattinam district, the impact felt by the home or community gardens as followed. 95 % of the respondents were aware about the reduction of expenses incurred on vegetable purchase, 84 % cited access to fresh vegetables, 37 % for the additional income from sale of the vegetables, 37 % cited that these were free of chemicals, 21 % for its nutritional benefits and 11 % reduction in health-related expenses. About 90% of them shared seeds and vegetables with their neighbours (Subhashini et al, 2013).

In community gardening, the entire plot is divided into a number of small manageable size beds but the ownership of the land may belong to only one person. All the farming activities are managed by the concerned member of the plot starting from bed preparation to harvesting which includes, sowing, watering, manuring, weeding, spraying and harvesting were done by the members of the group. The yield from this plot was shared equally among all the members of the group and excess vegetables were sold locally

(<https://goo.gl/mX3rrc>).

Table 1.18. Food processing industries and opportunities in Tamil Nadu

S.No.	Industry	Products	Why food processing
1.	Turmeric Processing	Turmeric powder	Tamil Nadu occupies about 6% of the total area under spices and condiments in India. Tamil Nadu is one of the largest producers of this spice in the country
2.	Fruit Processing	Fruit pulp, jam, squash, concentrate, mango jelly (using the system of Ultra High-Density plantation)	Tamil Nadu is one of the leading states in fruit production. Occupies 1st rank in Banana production
3.	Sago & Starch Processing	Starch & sago, wet sago starch, sago flour processing, sago trunks are cut into shorter and processed, coating starch paper and organic glue alternative for PVA based glue	0.87 lakh ha of the area under Tapioca cultivation in Tamil Nadu
4.	Fish Processing	Canned and tinned fish, ready to retail processed Seafood	Tamil Nadu is one of the leading producers of marine and inland fisheries in the country
5.	Rice Processing	Edible rice free of husks, stones and other foreign material, rice bran, rice bran oil, rice flour and hull, rice starch, broken rice, brewers rice and rough rice	With the rice production of above 70 lakh MT, Tamil Nadu state has the ample opportunity for rice processing
6.	Cashew Processing	Raw cashew nuts, salted cashew nuts, paste, cashew curries and cashew nut shell liquids	0.89 lakh ha of area are under Cashew plantation in Tamil Nadu

Source: MoFPI (2017) and GoTN-Agriculture Policy Note, 2017

Enabling Environment

- Even now, most of the policies are production led agriculture rather market led agriculture. Schemes like NADP/NMSA/NMSA have been implemented to increase the area and production of food crops but the time has come to motivate the farmers toward market led production and integrate farming with other systems like fisheries, poultry, animal husbandry, mushroom, horticulture etc., so as to give a better access to remunerative income to the farmers. Integrated Farming System may not only help the farmers to get the income throughout the year but also lead

Policy environment is needed to support both production and remunerative income to the farmers

G. Chandrashekhar, (*The Hindu, BusinessLine-dated, April, 5, 2018*).

On an average, Tamil Nadu KVKs cover about 3254 farmers and 38 villages every year.

NILERD, 2015

to sustainable agriculture in the long run.

- The KVKs ensure the horizontal spread of the improved technologies/farm practices to farmers in large scale. In the same way, NGOs, FPCs and input dealers have been following an integrated approach like the trainings cum demonstration/capacity building programme cum awareness programme in sensitising the farmers/farm women/village youth on modern technologies and good practices in agriculture; NGOs/FPCs/private dealers also provide quality seed/planting materials/fertilisers, plant protective chemicals and bio-fertilisers at subsidised rate so as to ensure the maximum output from minimum inputs.
- ATMA is not able to exercise its independent power in the state as it is considered to be a mere extension scheme under the DoA. Most of the extension, demonstration, Farmers Field School etc., conducted are just for paper work and fulfilment of the target. The JDA is the Project Director of the ATMA and the Deputy Director (DD), FTC is Deputy Project Director of ATMA, therefore in many cases, the Agricultural Technology Managers (ATMs)/Block Technology Managers (BTMs) are extensively used for the works of the DoA be it data entry or field level extension work or assisting the AOs/AOs in conduct of trainings, meetings, demonstrations, Crop Cutting Experiment etc.,
- Interwoven extension system with political system: There prevails notable political fiefdoms in selection of Farmers Friend (FF), beneficiaries for subsidy, exposure visits/inter-state exposure visits and so on. In many instances, selection of Farmer Friend (FF) has been influenced by the political system owing to the monetary value of the Farmer Friend (i.e 6000 INR per annum), thus it affects the transparency in extension as said by one of the Deputy Directors of Farmer Training Centre. In this backdrop, a transparent system may be identified in selection of FF by the farmers such as (outside the current politics), Kudavolai method of selecting the intended FF, voting system, etc.,
- Agri business and value-added services: Periodical trainings on income generating enterprises/ activities viz., mushroom production, vermicompost, value addition in food grains by KVKs across the state are promising, these extension interventions of the KVKs have benefited farmers, household women, youth/other interested candidates.

Increased autonomy of ATMA gives a considerable independence from the general public administration, which is a key for ATMA to function independently as a registered society and venture into any partnership with private/NGO/other public institute

Birner and Anderson, 2007

Political interest capture crept into public sector extension system. Large farmers have more political influence than small and marginal holders, therefore, politicians incentivise the public administration to serve the interest of the large farmers

Birner and Anderson, 2007

Successful extension interventions

- Branding for improving the marketing of the agricultural produce: Avinashilingam KVK, Coimbatore has created around 18 brands such as “Avinash”, “Tribal Treasures” “GTREE Agri products” “Sri Sai” “Ezhil” to name a few. The products include wheat flour, turmeric powder, ginger candy, chillies powder, curry leaf powder, banana stem candy, natural mosquito repellent, fertimix (Cotton special and maize special) etc., Besides, the brand has been developed for individual farmer, two Self-Help Groups (SHGs), tribal group (Irula tribes of Western Ghats), KVK, Avinashilingam is pioneer in the state in providing trainings and creating awareness among the beneficiaries about the branding of farm produce and its value in the marketing.
- Cluster approach for improving the value of the produce: KVK-Avinashilingam (Coimbatore district) has helped in establishment of small scale food processing units through cluster modules such as Self-Help Groups, farmers group, small groups etc., with the help of these approaches, farmers are motivated to venture into processing of their produce for value addition. E.g. Amma pannai mahalir group from Iddikarai village of Coimbatore district.
- Location specific technology and KVKs: KVKs across the state have involved in demonstration, training, awareness making among farmers on location specific technologies, which led to increased adoption rate; in particular, TPS 5 (rice variety), Bhendi hybrid CO 4, Sorghum K – 12 have widely been adopted by the farmers as these varieties have not only superseded the yields of the previous varieties but also strong consumer base. KVKs’ efforts prove that, the extension is an essential part of agriculture in bringing desired changes in farmers’ knowledge, attitude and skill (KAS) pertaining to new technologies and innovative farm practices.
- A success of an NGO “CREATE”: Save Our Rice (Namadhu Nallai Kappom) is the programme, which has taken up extensive training, meetings and awareness campaigns as methodologies to address the issues and importance of traditional rice varieties viz., Kattuyanam (best suited for flood condition), Poongkar (suited for saline soil), Karunguruvai (best for making biriyani), Kuzhiyadichan (for alkaline soil), Kudavaalai, Gauvuni, Mappillai Samba (for high energy), Samba Mosanam (best suited for making flat rice), Arupatham Kuruvai (short duration variety (60 days). Since 2004, hundreds of thousands of programmes have been undertaken by CREATE to spread awareness about the value of the traditional rice varieties in Tamil Nadu and across the country,

Mr. Pradeep was a trained entrepreneur in honey bee by HRS. Now he runs his own FPO on honey bee and employing many farmers in the production pure and quality honey.

According to Mr. Manivel, selling 75 Kgs/ sack of Paddy, a farmer could get hardly 1400 Rs/Sack, but if the same is processed to rice in the mill, he may get about 2400 Rs/Sack of 50 Kgs. Besides, he can also sell the rice barn at reasonable price. Thereby, earning additional money to his savings. For this reason, farmers are to be motivated to go for milling of paddy always so as to the real price for his year-round “toilsome” in the fields.

Mr. P. Manivel (A progressive farmer, Valapadi Block of Salem district).

by which 0.37 lakh farmers have adopted traditional rice varieties in Tamil Nadu as well as these farmers involve in seed production of these traditional rice varieties at present so as to meet the growing seed demand.

- FPCs such as Velliangiri Farmers Producer Company Ltd and ThaiMan have impacted the lives of coconut growers and traditional rice growers respectively in the state of Tamil Nadu. Both of these FPCs have been forerunner in use of extension system such as spreading awareness on modern technologies, low cost farm level practices, extensive trainings. Exposure visits are organised by these FPCs to various successful farms across the state to impart the skill and capacities of their members to inculcate good agricultural practices and adopt improved crop production technologies.
- Women led agriculture: NGO, TSSS (Tirunelveli Social Service Society) has envisaged the need for women led agriculture for stabilised utilisation of farm resources and increased household income. Evidently, of the 20000 farmers in TSSS, 19000 are women members. These women farmers were in turn grouped to form Self-Help Group. All the extension programme, capacity building programme, entrepreneurship development programmes are given to these women frequently in order to make them as independent traders and business farmers and keep them updated about the new farm technologies, market scenario/information, value chain management, etc.,
- Nutrition security of the household is addressed: VK-NARDEP is an NGO located at Kanyakumari, which has been extensively creating awareness/knowledge among the household women/members about the terrace gardening in the state with the objective of ensuring the nutrition need of each household. Until now (2017-18) around 1500 Terrace gardening has been established throughout India, of which 75.00 per cent of them established in Tamil Nadu. Moreover, trainings and skill development programmes are organised to instill knowledge among women on preparation of kitchen waster and bio-gas in the household itself, therefore ensuring the inputs requirement of the terrace gardening.
- Model farms more farm returns: Mr. Manivel (Valapadi block of Salem district) and Mr. Velusamy' (Thondamuthur block of Coimbatore district) farms are the model farms for IFS and Azolla cultivation respectively. The former one was developed by the own interest of farmer with the help of YouTube videos on IFS but the later one was developed by the training provided by the Velliangiri FPC. Both of them stand for unique farm models and adoptable by the marginal/small farmers/resource poor farmers in the state.
- Social commitment for adding value to the farmers' lives: Mr. Manivel Although having a background of Diploma in EEE (Electrical & Electronics Engineering), he turned to change the lives of his village farmers of Valapadi block in Salem district. He motivated around 50 farmers as of 2017 to go for value addition in paddy. He provides consultancy and advisory services to the paddy farmers about importance of milling of rice and value-added returns from rice.
- Ensuring the welfare of tribes for inclusive growth: Trainings are frequently provided to the Kani tribes of the Western Ghats by the HRS, Kanyakumari on value addition of banana, pineapple and pepper. As these tribes mostly live in the distant forest areas, they seldom go out for mainland works, which resulted in poor standard of life. Therefore, to improve the livelihood of this tribes, a constant training is ensured to skill them to market their farm produce with added values thereby

improving their livelihood standard.

- **Contract farming:** Nearly one lakh sugarcane farmers are contracted by EID parry to meet the steady demand of the sugar in the state. It provides extension and advisory services to all of its contract farmers on a regular interval. Trainings are frequently given on scientific cultivation of sugarcane, soil health, ratoon management, water conservation, drip irrigation Sustainable Sugarcane Initiative (SSI) and mechanization. Furthermore, it arranges credit facilities and insurance to the small farmers and labourers and promotes Namadu Parry Mayyams/Our Parry Centre (NPM/OPC) or rural outlets with the aim of fostering entrepreneurship among farmers. These NPM serve as value-added service hubs to the rural farmers in availing demand based agro advisory services. EID parry has established 82 NPMs across five units and NPMs are supported by more than 300 agri-service providers, these NPMs are responsible for providing both consultancy services on scientific production of sugarcane and sugarcane machineries for improving the mechanisation of sugarcane farming across the state (<https://goo.gl/xr7EXX>)
- **Precision farming** in the state has been successful in improving the production and income of the farm families. The examples are as followed.

Table 1.19. Precision farming in Tamil Nadu

S.No.	Farmer	Mr. Manoharan	Mr. R. Velappan
1.	General profile	Age 35 years and total land holdings 3.5 acres. Education level: High school.	Age 55 years and total land holdings 6.80 acres. Education level: middle school.
2.	Location	Semmanahalli Village, Dharmapuri.	Semmanahalli village, Dharmapuri district.
3.	Crops cultivated	Radish 1.5 acres and Papaya 2 acres.	2 acres of Papaya and 2 acres of Guava.
4.	Duration of crops	Radish 3 months crop and Papaya 2 years crop.	Papaya 2 years and Guava has a yielding period of 2-10 years.
5.	Cost of Cultivation	40 000 INR/1.5 acres of Radish and 70 000 INR/ 2 acres of Papaya.	70 000 INR/ 2 acres of papaya and 1.50 lakh/2 acres of Guava.
6.	Productivity	300 bags of Radish (50 KGs/bag) and 40 tonnes of Papaya.	40 tonnes of Papaya and 50-100 Kgs of Guava per plant.
7.	Revenue	1.1 lakh for radish and 4 lakhs for Papaya.	4 lakhs for Papaya and 4.95 lakhs for Guava.
8.	Extension	He has been trained in various centres like Krishi Vigyan Kendra (KVK) Paparapatti, Dharmapuri district, farmer producers' organisation, Dharmapuri, Regional Research Institute (RRI), Krishnagiri and Tamil Nadu Agricultural University (TNAU), Coimbatore on	Mr. Velappan has been trained about precision farming in KVK, Paparapatti, Dharmapuri and TNAU.

8.		various methods of precision technology and farm management.	
9.	Information source	Neighbour progressive farmer, TNAU and local agro input dealers.	Neighbour progressive farmer, TNAU and local agro input dealers.
10	Innovative precision farming technologies adopted	Precision technology like drip irrigation, bio-fertilizer, soil management and overall input management practices.	Drip irrigation, bio-fertilizers and vermicompost.
11.	Factors responsible for adoption of precision farming	Subsidy.	Subsidy
12.	Impact	Precision farming helps in management of overall inputs of farms hence increases the yield.	Reduced use of fertilizers will reduce cost of cultivation hence the yield and revenue are increasing.

Source: Ramamoorthy, 2016

Value chain management in Tamil Nadu – An Overview

The farm-market linkages in agriculture value chain management are dominated by several brokers and intermediates, which result in slow and inefficient market movement of agriculture products, inflated price spreads and post-harvest losses (Madhumitha, 2015). About 95 per cent of the sale of fresh produce, importantly horticultural produces occur through traditional value chain. The various stakeholders of the agriculture value chain, namely the farmers, wholesalers, processors and retailers work more in isolation rather than in an integrated/coordinated manner. The value chain management suffers largely from planned demand forecasting, production planning, market information (Madhumitha, 2015).

Value chain management in cashew nut in Tamil Nadu

60 % of the cashew nut growers have adopted the value chain of Farmer - village trader - wholesaler – processor – trader channel of value chain management; 26.55 % of them followed Farmer - cooperative marketing society; 10 % of them Farmer - commission agent – wholesaler – processor value chain management channel and 3.75 % of them adopted the Farmer – processor value chain management channel (Sundarvaradarajan and Jahanmohan (2002) in the study “Marketing Cost, Margin, Price Spread and Marketing Efficiency of Cashew in Tamil Nadu as cited by Madhumitha, 2015).

Value chain management in vegetables in Tamil Nadu

The value chain management of Carrot was studied by Madhumitha, 2015 in Nilgiris, Tamil Nadu. 57 % of the carrot farmers have followed the marketing channel of Farmer - Pre-harvest Contractor (PHCs) - Wholesaler - Retailer - Consumer, the reason for the farmers following this channel is that the cleaning process was labour intensive and added to the costs of the farmer. So, farmers sell the carrot crops to pre-harvest contractor. Moreover, these pre-harvest contractors' own carrot cleaning machines. PHCs are more in Nilgiris, therefore, these PHCs establish a firm contract with the carrot farmers, sometimes they pay some amount in advance to the farmers with whom they have contract agreement. However, PHC's marketing cost of carrot is 205 INR per quintal of carrot, which includes post-harvest practices like cleaning, sorting, packaging, transport, weighing and loading & unloading, which is followed by the retailers' share of marketing cost is about 200 INR per quintal of carrot and wholesalers marketing cost of carrot per quintal is about 190 INR. In total, the marketing cost of carrot per quintal in this marketing channel is about 2630 INR. The producer share in consumer rupee is 58.74 % (1530 INR per quintal of carrot). On the other hand, 33 % of the farmers follow the marketing channel of Farmer- Wholesaler - Retailer - Consumer, in which the producer share of consumer price is 71.45 % (1650 INR per quintal of carrot). Thus, the total carrot price per quintal is only 2575 INR per quintal of carrot. The carrot farmers who have sufficient water facilities follow this marketing channels, then the cleaned carrots are brought to the markets and sold in an open auction. These farmers often handle small quantity of carrots. The third and final marketing channel followed by the carrot farmers is the direct sale of carrot to the consumers. This sale takes place in Farmers' markets/Uzhavar Sandhai. However, only 10 % of the carrot farmers use Farmers' market due to lack of transportation/bus services, allowance of traders to buy vegetables from farmers' market is a problem to consumers, lack of cold storage facilities in case the farmers are not able to sell the carrots in a single day. Moreover, co-existence of wholesale vegetable markets and Farmers' market in most of the places (Madhumitha, 2015). However, the producer share in consumer price in this channel is 88.53 % (1970 INR per quintal).

Thus, the total price of the carrot per quintal in this channel is only 2225 INR. So, the government should take necessary steps to upgrade the Farmers market across the state. All the farmers market should be established with the mini cold storage facilities, high technologies for complex needs to be established to attract more consumers. Besides, the farmers market should follow strategies like consumer-friendly trade/marketing as followed in Super markets/wholesale markets of the state. Similarly, value chain management of potato in Nilgiris has three marketing channels. 63 % of the potato farmers follow, Farmer - Wholesaler - Retailer - Consumer value chain management channel for the sale of potatoes since the single harvest of potatoes produces bulk quantity, so farmers sell them to wholesalers directly. Moreover, Nilgiri Cooperative Marketing Society (NCMS) is the largest wholesale procurer of potatoes, and NCMS pays a handsome amount to the farmers thus farmers prefer to sell potatoes to NCMS. 27 % of the potato farmers follow the marketing channel of Farmer - Retailer - Consumer and 10% of the potato farmers have adopted the marketing channel of Farmer - Consumer i.e. Farmers' market/Uzhavar Sandhais. In potato value chain management also, in channel

one farmer gets less share in consumer price rupee i.e. 1915 of 2800 INR per quintal of potato but in the channel II and III, farmers get 2100 of 2655 INR per quintal of potato and 2350 of 2635 INR per quintal of potato respectively.

Farmers (both carrot and potato farmers) face constraints such as fluctuating price, inadequate institutional credit to support the working capital, lack of storage facilities, exploitive nature of the middle man, high transport cost, high market fee, lack of post-harvest techniques viz., cleaning, sorting, packaging, etc., (Madhumitha, 2015).

In case of Tomato value chain, three value chain channels have been existing, the channels are as followed.

- i. Producer - Village trader - Commission agent/Wholesaler - Retailer – Consumer
- ii. Producer - Commission agent/Wholesaler – Consumer
- iii. Producer – Consumer

Though the channel three is the most efficient system in terms of higher farmer's share in consumer rupee, this channel has been used by a small proportion of farmers. The channels I and II are used by 90 % of the farmers as the disposal of the tomato has found to be easier in these two channels but the farmer's share in consumer rupee is lesser in these channels owing to the presence of too many intermediaries. In case of producer-village trader-wholesaler-retailer consumer supply channel, the marketing costs incurred by village trader, wholesaler and retailer were found to be Rs. 37.42/Qtl, Rs. 12.67/Qtl, and Rs. 22.41/Qtl, respectively. However, the farmers didn't have significant marketing costs when selling directly to village traders. In producer-wholesaler-retailer-consumer supply chain, the marketing cost incurred by producer was Rs. 37.36/Qtl while the marketing costs of wholesaler and retailers remain the same. The producer's share in consumer's rupee was found to be Rs. 38.31/Qtl under producer-village trader-wholesaler-retailer-consumer and it was Rs. 54.50/Qtl in the case of inclusion of another intermediary, i.e. village traders (Siva and Swaminathan, 2015). The price spread was found to be at 61.69% and 45.5% in the case of Channel I and Channel II respectively. The higher price spread may be due to price fluctuation and perishable nature of tomato. On the other hand, the value chain of tomato suffers from lack of postharvest facilities like cold storage. Besides, farmers perceive that the 25 % of the tomato is lost due to lack of proper post-harvest management system and capacity/skills needed for the same and higher transportation cost is found to affect the tomato farmer's share in consumer (Siva and Swaminathan, 2015).

The major actors in chillies value chains are said to be input suppliers to farmers (including manufacturers, wholesalers and retailers), farmers, village traders, commission agents, wholesalers and retailers. Input retailers operated small shops in the villages/ local market. Non-contract farmers sell their chillies to commission agents or village traders who either sold to another intermediary or sold directly to a wholesaler. These commission agents are located in market place and they support the farmers with finance in cultivation of chillies. In the sale of chillies by farmers to the commission agents, farmers have to pay a commission charges of transport cost, packing cost and weighing

charges. Processing firm largely buy chillies from commission agents in market itself. On the other hand, some of the processing industries have direct contract farming with the farmers, in this case the processing firms guide the farmers in purchase of quality seed materials, certified seeds and safe plant protective chemicals along with extension advisory is provided in the subject of seed treatment, nursery management, method of harvesting and drying and Good Agricultural Practices for chillies cultivation.

Policy implication for improving the value chain in vegetables

Cold chain management is the blessing in disguise for the perishable vegetables as the cold storage facilities are less in the state. Given the perishable nature of the vegetables, cluster based cold chain management is to be encouraged among farmers, the capacity needed for the post-harvest management of vegetables could be instilled frequently to avoid the post-harvest loss of vegetables. More mechanism needs to be established so as to motivate the farmers to sell vegetables directly to the consumers without the involvement of intermediaries particularly village traders and commission agents. Besides, these vegetables growers' awareness on processing of vegetables and value addition is the key in stabilising the vegetable farmers' livelihood. Cottage industries on vegetable value addition can be a solution in improvement of sustainable income to the farmers in case of mass production of vegetables. For this purpose, KVKs/line departments/department of Agricultural Marketing and Agri-Business must train the farmers/household women to get involved in home-based production of value added vegetable products. moreover, collective approach is to be encouraged among these household women in making and marketing of value added vegetable products. vegetable cluster-based cottage industries may function as a viable solution in enhancing the linkage of farmers with the consumers. The financial need of the industry may be routed through NABARD/nationalised bank/Co-operative banks. Unless, a strong mechanism is created to address the involvement of intermediaries in the value chain of vegetables, farmers could not cope with the production distress of vegetables and market inefficiency in procurement of vegetables at fixed rate. The right measure may lead to increase in farmer's share in consumer rupee in the coming days. Most of the farmers are forced to sell their vegetables at low price to the traders/middle men owing to the lack of cold chain management. Cluster based attractive packaging facilities for both raw and processed vegetables should be established and entrepreneurs/youth/household women and others may be trained in processing of vegetables and packaging of the vegetables.

Value chain management in Tapioca in Tamil Nadu

The value of tapioca is added in the starch and sago processing industries. The value-added products of tapioca include sago, starch, alcohol, animal feed and wafers. 650 to 700 sago/starch processing industries are located in Namakkal and Salem districts of Tamil Nadu respectively. The value chain of tapioca starts from the procurement of raw roots (tapioca) from farmers and processing them into starch/sago/wafers and sell them to the final consumers. Tapioca value chain markets include six different channels. They are as followed. The typical value chain of the tapioca includes logistics, firm

operations like (starch/sago/wafers making), marketing and channel value chain. 75 % of the farmers sell the tapioca to the commission agents and 25 % sell the tapioca to the processors, of which 15 % of the farmers sell the tapioca to the starch processors and 10 % to the sago processors. The SAGOSERVE and Wholesalers constitute about 65 % and 35 % of marketing of sago respectively. Wafers processors distribute their wafers to retailers however, most of the wafers are marketed through wholesalers. Moreover, the constraints such as monsoon failure, price fluctuation, shortage of labour availability, high input cost, non-availability of quality planting materials and wastages of tubers during harvest may affect the producers' share in consumer price and impact the value chain of tapioca. Similarly, non-availability of cold storage facilities for tapioca, lack of tuber supply throughout the year and poor drying facilities during rainy season may affect the value chain of tapioca (Komaravel, 2013).

- i. Farmers – Commission agent – Wholesalers – Retailers - consumers (in which the raw tubers are sold to the consumers directly for consumption).
- ii. Farmers – Commission agent – Sago processor – Sago serve – Wholesaler – Retailer - Consumers (in which the sago is sold by the processing industries to the consumers).
- iii. Farmer – Commission agent – Starch processor – wholesaler – industrial consumer – industrial consumers like pharmaceuticals, textile industries etc., (in which starch is sold by the processing industries to the consumers through various intermediaries).
- iv. Farmer – Starch Processor – Sago Serve – Wholesaler – Industrial consumer
- v. Starch processor – sago processor - Wholesalers – Retailers – Consumer
- vi. Starch processor – Wafers processor - Wholesalers – Retailers – Consumer

Table 2.1. Value chain channels of tapioca and their salient features

S. No.	Value chain channel	Salient features
1.	Channel 1	Farmer receives about 305 INR per 73 Kg of bag, which is 72.22 of the farmer's share in consumer rupee/price. A farmer spends around 30 INR as a marketing cost per 73 Kg of bag, in this process farmer involves in cleaning, handling and transportation of tapioca. Similarly, the marketing cost borne by the commission agent, wholesaler, retailer for one bag is 10 INR, 10 INR and 10 INR respectively. Thus, the total price for 73 Kgs of a tapioca bag is 335 INR. And, the bag is sold to the consumer at the rate of 350 INR. Hence, the price spread of 73 kgs of a tuber bag is 45 INR.
2.	Channel II	A farmer receives about 1948.80 INR for 409 Kgs of tuber i.e. 4.70 per Kg of tuber. The commission agents sell the tubers to processors. The processing and marketing of tuber into sago accounts for 27.79 % of the consumer price. Likewise, wholesalers and retailers' share in consumer price is about 3.50 and 1.32 % respectively. The price spread is about 1.70 INR per Kg of raw tuber. Thus, the price paid by the consumer for 409 Kgs of tuber is 2649.04 INR

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3. Channel III In this channel, farmer gets around 1660.80 INR for 346 Kgs of tuber i.e 4.80 INR per Kg of tuber. The farmer's share of consumer price is 80.14 %. In this channel the tuber is sold to the processors by commission agents and the output starch is sold to wholesalers, wholesalers sale it to retailers and reaches the consumer at the price of 2072.27 per 90 kgs of starch.
 4. Channel IV The channel IV is similar to that of the channel III except the commission agents. In which the starch is sold to the consumers and the farmer's share of consumer price is 77.61 % (1695.40 INR per 346 Kgs of tuber).
 5. Channel V Channel V starts with the starch processors and characterised by the presence of Sago processors, Wholesalers, retailers and consumers. In this channel the starch processor gets about 2265.67 INR per 104.72 Kgs of starch i.e. 21.63 Kgs of starch. Then the sago processors, processes the starch into sago. Then the sago is sold to the wholesalers. The wholesalers sell the sago to retailers and then to consumers. The consumer pays about 2534.67 INR per 90 Kgs of Sago. The price spread is calculated to be 269.00 INR for 90 Kgs of Sago production and distribution
 6. Channel VI In this channel, the starch processors sell the starch to the wafers processors. Then the usual value chain players involve in the marketing channel i.e Wholesalers, Retailers and consumers. In this channel, the starch processors receive about 250 INR for 25 Kgs of Wet starch. The wet starch is processed by the wafers processors and marketed to the wholesalers, the processing and marketing cost including the value added to the starch by wafers processors is about 46.15 % of the consumers' price. In this channel, the wafers processors get the highest profit margin i.e. 5.77 % for 14.4 Kgs of wafers. The consumer pays around 520 INR for 14.4 kgs of wafers. The price spread from starch processors to the consumers is about 270 INR.
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(Komaravel, 2013).

Policy implication for value chain management in Tapioca

Price fluctuation is the biggest threat to the tapioca growers of the state as the planting season and harvesting of the crops occur almost same throughout the state. Therefore, demand led production of Tapioca and regulation of the production could be a solution in increasing the producers' price in consumers rupee. More importantly, eliminating the commission agents/traders from the supply chain of tapioca may help the farmers to realise the higher share in consumer rupee and benefit the farmers directly from the starch/sago processors. For this reason, the government intervention in logistics of the tapioca to the processing industries is needed to tackle the issue. On the other hand, improving the cluster based infrastructure facilities for establishment of small scale vermicelli, fried snacks, chips, cassava flour, cassava rava, cassava pasta etc., could improve the income of the farmers. In this context, institutional support (Department of Agriculture/Department of Agriculture and Agri-Business/KVK/Central Tuber Crops Research Institute (CTCRI) for trainings, capacity building and skill in the value addition of cassava is imperative and the focus of the state should be reoriented toward training the village youth/household women/unemployed graduates in setting up and production of

value added products of Cassava. The funds for infrastructure and technologies may be routed through NABARD. Agri business hub should be established to provide technical guidance on value addition on demand basis. Besides, grading/branding of the value-added products of cassava pertinent to each cluster will possibly pave the way for increased demand among the consumers.

Value chain management in fruits in Tamil Nadu

Banana

Tamil Nadu is the leading producer of banana in the country with the production of 5.65 million tonnes to the total production of 29.72 million tonnes. The most famous value chain management in banana is, Farmers - Post Harvest Contractors- Commission agents - Traders/Wholesalers - Retailers - Customer (BVC I) in the state of Tamil Nadu. Another Banana Value Chain Management II (BVC II) is about the involvement of state of art technology in which banana is harvested at farm then the selected banana bunches go through following steps, which include quality criteria check, dehand, wash, size and grade, packing unitisation, pre-cooling (13oC and 95 % RH), buffer store await transport, ripening rooms and open retail at market. The cost margin of Cultivar. var. Grand Naine in BVC I is 13 INR per bunch at farm gate and 25 INR per bunch at retail market and in BVC II (Cultivar. var. Grand Naine) is 18 INR per bunch at farm gate and 27.50 INR at retail market. In this way, the farmer share in consumer price is slightly higher in BVC II i.e. 65.45 % when compared to 52 % in BVC I. In BVC I, mostly face to face communication takes place between farmers and wholesale traders/ commission agents, whereas in BVC II Mostly by phone between farmers and agent. Farmers often visit the wholesale markets and some retailers.

Similarly, in BVC I, the price of banana is fixed based on weight of the banana bunch. On the other hand, in BVC II, Agent pays farmers based on bargaining results between him and buyers (farmers as price takers) (Pauline and Ajjan, 2014). Besides, 81 % of the banana farmers in Tamil Nadu participates in buyer - seller meets organised by the government institutes like Horticultural Department, TNAU, Financial institutions and Farmers Associations.

Table 2.2. Value chain management in banana and its component

S.No.	Value chain management in Banana	Components/impact
1.	Farmers – Pre-Harvest Contractors/Local traders – Commission agents – processors - Whole sealers – Retailers – consumers (It is a traditional value chain management in banana)	<ul style="list-style-type: none"> i. open auction in the market, which is done either once or twice a week in a fixed time. ii. Bananas are graded at each level based on subjective assessment of parameters such as bunch weight, maturity, finger length, and cosmetic appearance iii. Wholesalers ripen the fruit, either with smokes or carbide, and wrap fragile and high value banana bunches with dry banana leaves before transporting them to destination markets to the retailers. Retailers sell the fruits to consumers iv. As traditional value chain management involved a complex of intermediaries, it leads to 25-30 % of post-harvest loss of banana. v. Farmers’ share in consumer price is 42.11 per cent to 62.50 per cent (Farmers’ selling price of each banana bunch in case of Grand Naine is 12 INR)
2.	State-of-Art value Chain in Theni district (Banana farmer – Agent with ripening facility – Retailers – Consumers. (In case of Stat of Art Value Chain, the technical support is offered” by TNAU and Michigan State University, Precision farming project support extended by the Government of Tamil Nadu, National Research Centre of Banana, Trichy, M/s. Jain Irrigation Systems Ltd., for tissue culture plants of banana, M/s Nadar and Ebrahim, Philippines for fruit care activities. Credit support was offered by Canara Bank, Indian Bank, Tamil Nadu Mercantile Bank, Federal Bank, Housing Development Finance Corporation (HDFC). Institutional support was provided by Ministry of Food Processing Industries, State Department of Horticulture, Government of Tamil Nadu, National Horticulture Mission, Expansion of National Mission on Micro-irrigation and Theni District Banana Farmers and Traders Association.	<ul style="list-style-type: none"> i. The State-of-Art value chain’s objectives are to reduce the post-harvest losses and wastage of banana, to provide export grade banana to cater domestic markets and to facilitate export to Middle East and European countries. II. Propagation exclusively through tissue culture plants, thereby facilitating uniform growth and untested for viruses, uniform maturity and harvest, disease resistance, less water requirement and higher second crop quality. iii. Capacity building of farmers (Skills, knowledge and technology transfer) iv. Nylon rope harvesting with no damage of fingers V. Plastic crates for collection and transport vi. It forms a National Model “Farmers’ Corporate” - to link farmers (Cold chain infrastructure and market) and Traceability (Identity of banana and its origin) vii. Net income increased to Rs 3,00,000 – 4,00,000/ ha depending on fruit care and improved cultivation practises viii. Farmers’ share in consumer price is 60 % (Farmer’ selling price of each banana bunch in case of Grand Naine is 18 INR)

3. Processed banana value chain	i. The essential nature of processed banana value chain is that making banana fruits into any of the following products they are Banana fig, sauce, sweet chutney, jam, fibre from pseudo stem sheath, flower pickle, fruit pickle, stem pickle, biscuits, Ready To Serve (RTS), banana enzyme clarified beverage, flour, baby food, health drink, flour soup mix using dried banana flower, flour, squash, blended juice, central candy, peel pickle, sip up
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Pauline, 2014

Other than the banana value chain given in the table, the following marketing channels are also found in the banana value chain management. They are as following

- i. Producer – Local traders – Commission agent – Wholesaler – Retailer – Consumer
- ii. Producer - Wholesaler – Retailer – Consumer
- iii. Producer – Commission agent – Processor – Consumer

Mango

Processed fruits account for only 1-2 % of mango production. The processing is mostly done by farmers/ farm families for household need or local retailers/markets. A small scale commercial processing unit process the fruits for national and international export yet the fraction of export of the processed fruits is very low. Farmers' association like Self Help Groups (SHGs), Farmers Interest Groups (FIGs), producer association and co-operatives helped in maximising the output from minimised inputs. AMUL, Mahabanana, Mahagrapes are the notable examples.

Policy implication for fruits value chain management

Value chain management in Mango needs a policy backup most importantly, in value addition of the mango. Given the scope of fruit processing industries in Tamil Nadu, cluster-based technology backup must need to be given to farmers on a collective approach. Need of extension machinery and technical experts on development of skills in operating the processing technologies are to be addressed frequently and on a demand basis. Direct marketing of processed food items by farmers themselves could be a key in motivating the farmers in involvement in fruit processing for value added marketing. On the whole, entrepreneurs need to be supported with the help of funds and technical knowledge in establishment of cluster based/home based small scale processing industries. Social marketing for such value-added fruit produces may be done with the help of institutions like Department of Agriculture/Department of Agricultural Marketing and Agri-Business/Krishi Vigyan Kendra (KVK)/State Agricultural University (SAU) and third sectors (NGOs, Farmers Groups, Self-Help Groups etc.,). Consumer awareness on farmers based value added fruit produces would persuade the consumer to purchase the value added foods directly from the farmers.

Value chain management in flowers in Tamil Nadu

The value chain management in Rose takes place between farmers and traders with the pre-trade agreement at fixed price. As a result, there is no commission in marketing of Rose flowers. Moreover, the transportation of Rose flowers is shared among the farmers hence, reducing the transportation cost of the Rose flowers to the markets. However, transportation cost of marketing of Rose flowers is about 41 % of the total marketing margin. Therefore, farmers of Tamil Nadu are not involved in value chain management in Rose flowers (Kaviarasan et al, 2015). So, the state government may encourage the value chain management in rose and other flowers crop so as to enhance the income of flower growers. Likewise, extension and advisory services in production and post-harvest management of flowers crop are to be encouraged among the flower growers.

Policy implication for value chain management in flowers

Flowers demand has been increasing, most of the flowers value chain suffer lack of cold chain management and non-awareness on attractive packaging and designing coupled with marketing. Extension channels for value chain management in flowers is imperative as most of the farmers lack scientific knowledge on handling and packaging of flowers be it cut flowers or loose flowers. Besides, Department of Horticulture/Department of Agricultural Marketing and Agri-Business/KVK should have to involve in orienting farmers about the value of packaged flowers in the domestic and international markets. Cluster based cold chain, logistics and packaging infrastructure would improve the value chain management in flowers in particular among the small and marginal farmers in the state of Tamil Nadu. It may be done with the help of NABARD/Nationalised Banks/Co-operative banks etc., Besides, a policy mechanism to drive effective value chain management in flower producers is indeed the need of the hour as it could encourage the farmers to get higher share in consumer price and strive to eliminate the middle men/intermediaries and the logistics management in value chain management in flowers.

Value chain management in organic farming

According to Press Information Bureau-Gol, 2015, Tamil Nadu share of certified organic farms to the national total is about 0.5 % (3640.07 ha). In Tamil Nadu Lack of technically expertise equipment, High cost for cold storage warehousing, lack of supply of packaging materials and Practicing old method of processing methods are considered to be the impediment in value chain management of organic produces. Besides, the following shortage of organic products due to seasonal change, uncertain storage facility for long time, lack of power supply for refrigeration, faulty choice of products and process, conflicts between stakeholders, non-fertile organic eco system, diversification of taste and preference, accelerated globalisation and trade restrictions. 40% of the organisation faces problems in conversion of input into finished product i.e. processing. Only 46% of the organisations uses supply chain professionals to normalize their supply chain. High price variability in raw material is the problem in the existing supply chain structure (Chandrakala and Devi, 2016).

Policy implication for value chain management in organic produce

Funds for establishment of infrastructure such as cold storage facilities/cluster-based packaging warehouses and extension and advisory services for processing and value addition of organic produce regarding ready to serve, ready to eat etc., among the organic farmers. Entrepreneurship skills among the youth/household women in value addition of organic foods and direct marketing of them to the consumers.

Value addition in milk and milk products in Tamil Nadu

Milk sectors are found to be involved in more value addition produces viz., toned milk, standardized milk, full cream milk and ghee, butter and SMP (skimmed milk powder). The milk procurement (milk collection, transportation, chilling and reception) cost of milk for cooperative societies is calculated to be 1.23 INR per litre whereas private players spend around 1.09 INR in procurement of 1 litre of milk. Total cost of value chains of various milk products per litre or Kg for cooperative societies and private companies is as followed (Babu and Verma, 2010).

Table 2.3. Value chain management in milk Rs per litre or Kg

S.No.	Particulars	Toned milk	Standardised Milk	Full cream milk	Butter	Ghee	SMP	Khoa	Ice cream	Milk peda	Mysorepa
1.	Co-operative societies	15.21	19.28	19.43	144.59	175.91	151.39	169.41	-	108.59	-
2.	Private companies	15.52	19.46	21.24	143.81	176.12	149.24	-	96.32	-	156.24

Babu and Verma, 2010

Table 2.4. Value addition of cooperative societies and private companies One unit is either 1 litre or 1 Kg

S.No.	Milk products	Cooperative societies		Private players	
		Value added (Rs) /unit	Selling price (Rs)/unit	Value added (Rs)/unit	Selling price (Rs) /unit
1.	Tone milk	5.26	16.50	5.54	17.50
2.	Standardised milk	6.99	21.00	6.63	22.00
3.	Full cream milk	6.92	22.00	6.46	23.50
4.	Butter	52.97	165.00	61.06	170.00
5.	Ghee	84.78	210.00	81.63	205.00
6.	SMP	71.37	170.00	59.28	163.00
7.	Khoa	85.50	180.00	-	-
8.	Ice cream	75.07	115.00	-	-
9.	Milk peda	-	-	61.38	110.00
10.	Mysorepa	-	-	76.44	172.00

Babu and Verma, 2010

In the private dairy plant, ice cream (55.80%), Mysorepa (44.44%) and ghee (39.82%) secured the top three ranks in terms of value addition. Except full cream milk (27.49%), all other dairy products had added more than 30 per cent of the value to the product (Babu and Verma, 2010). The value addition is found to give more profit to the farmers and help in getting more income to the dairy farmers in Tamil Nadu. In this context, the government of Tamil Nadu may encourage more value addition plants across the cluster area of dairy. Moreover, farmers may be motivated to take up value addition of milk collectively. More credit and institutional support are needed to set up dairy milk processing industries even on a small scale. In this view, the Department of Agriculture and Animal Husbandry may collaborate with NABARD for the credit and financial mobilisation for the establishment of small scale dairy value addition hub/centres. The capacity need of the dairy farmers and cooperative societies may periodically be given by the institutions and experts.

Policy implication for milk and milk products

Milk sector is playing a pivotal role yet establishment of even more co-operative milk processing industries and farmers led milk processing small scale sectors may improve the economic conditions of the milk producers in the state of Tamil Nadu. Farmers could even be motivated in the domain of packaging of milk and direct marketing of it to their clients at higher price.

Value chain management in tea in Tamil Nadu

INDCO, Cooperatives, Self-Help Groups (SHG), TANTEA Estates and Primary Producer Societies (PPS) are involved in Tea value chain management in the state of Tamil Nadu. INDCO cooperative sets itself on the co-operative principles of economic participation and equity. SHGs focus on financial inclusion of women. TANTEA identifies it's with corporate philosophy of professional management and profit. PPSs aim at giving a collective voice to the STGs at various levels (Mansingh et al, 2012). Buyers and retailers are the vital players in the tea value chain with their control over blending and packaging. Majority of the price of tea is accounted for by the non-producers – shippers, blenders, packers, own

BLFs pay about 2-3 INR per Kg of medium-standard tea leaves to the suppliers/small holders/SHGs so as to maintain the quality of the leaves. The price may be even higher for premium quality leaves i.e. "fine leaves". More frequently, BLFs provide awareness about quality production of tea among the farmers. BLFs often make a direct link with the tea growers/Small Tea Growers (STGs)/SHGs in procurement of quality tea leaves. It helped them to bypass the auction and agents involved in procurement of bulk tea leaves.

Larsen, 2016

brands and point of sale functionaries. Small tea growers form the vital chunk of tea value chain. Value chain of the Small Tea Growers (STGs) is as followed, the STGs sell tea leaves to agents/societies/INDCO factories, agents and societies in turn sell them to estate factories/Bought Leaf Factory and from these players, the tea goes to CTTA/private sale/Tea serve/buyers. On the other hand, Bought Leaf Factory (BLF) in Nilgiris intake 50 % of the green leaf needed for the tea manufacturing from its

own estate. However, remaining 50 % from the small tea growers (Larsen, 2016). TEASERVE is one of the auction platform created by the state government to benefit the farmers in marketing of the “made tea”.

INDOCOSERVE helped the STGs to come into every step of tea value chain management thereby reducing the marketing barriers of these STGs in the state of Tamil Nadu. SHGs and STGs have established and supported by UPASI-KVK in value chain management of tea. These groups have established better linkage system with the tea processing industries. Many cases, these groups procure the fresh tea leaves and supply them to BLFs (Mansingh and Johnson, 2012). On an average, the producer’s share of consumers price is about 40.26 % i.e. when 4 Kgs of tea leaves are sold at the rate of 60 INR at the producer point and sold at 148.60 at the consumer end. The cost of production born by the producer is INR 20 for four kgs of leaves. The net price received by the producer is Rs. 40 for four kgs of leaves. The expenses borne by the processor, wholesaler and retailer are about 16, 19.85 and 8.75 INR respectively (Prakash and Paramasivam, 2013). The presence of the branded tea manufacturers like Unilever and Tata Tetley brought a sustainable and increased tea production and income to the Small Tea Growers (STGs) in the state of Tamil Nadu (especially in Nilgiris).

Table 2.5. Actors and their role in the tea chain management system

S.No.	Actor	Roles and responsibilities
1.	Agent	Agents collect the green leaf from STGS and transport to the processing factory. Mostly the agents are the trusted member of the community of tea growers. Sometimes, the STGs themselves act as an agent. Many a times, agents have the upper hand in the fixation of the price of the green leaves.
2.	Processing Factories	Bought Leaf Factory (BLF), Estate Factory and Industrial Co-operative (INDCO) Factories are the three major tea processing factories in the state. These factories procure green leaves from the farmers and agents and make them into tea
3.	Auctions	Tea produced by the small holders in the Nilgiris reaches the buyers/retailers through auction as well as private sale. Nilgiri tea is sold at the Auction centre located in Coonoor called also called the Coonoor Tea Trades' Association (CTTA) auction started in 1963 and TEASERVE or the Tea Manufacturer's' Service Industrial Co-operative Society Limited started in 2003. On the other hand, the tea produced at estates is sold privately to the retailers and brands.

Source: Mansingh and Johnson, 2012.

Tea board and its role in tea chain management

The Tea Board is resolved to make provisions for the small tea growers, which enable them in production of quality tea. During the 9th plan period the Tea Board introduced the ‘Small Growers Development Scheme’ which provide STGs training on modern aspects of tea cultivation, study tours and field visits. This scheme was modified and continued in the later plans. In the successive plans the Tea Board developed various schemes for the benefit of the small growers (Mansingh and Johnson, 2012).

Table 2.6. Schemes of tea board and their salient features

S.No.	Schemes of the Tea Board	Salient features
1.	Tea Plantation Development Scheme	The scheme envisaged to improve the productivity improvement through replanting/replacement planting, rejuvenation pruning and consolidation through infilling of vacancies, creation of irrigation facilities, special focus on small tea gardens for enhancing productivity and quality, new planting in small growers' sector in traditional and non-traditional areas, setting up of tea producers societies etc.,
2.	Quality Upgradation & Product Diversification Scheme	It provides for extending financial support to the tea industry by means of subsidy in modernisation of tea factories. It is done by means of replacement of old and worn out machineries, installation of additional machineries, changing the product mix enabling the tea manufacturing factories. Besides, packaging units for obtaining quality assurance certificates such as HACCP and ISO have also been given importance. Awareness programmes have been conducted to improve the awareness among farmers in quality production of tea plantation. UPASI has been acted as the implementing agency of the Tea Board schemes.

Source: Mansingh and Johnson, 2012.

Opportunities in value addition of organic produces

In the field of production, 42 % value addition can be done in organic produces, 64 % of the population use imported packaging materials for organic produces. Improvement in processing and tracking or tracing of products is the main technical improvement in the cold chain management of organic produces (Chandrakala and Devi, 2016).

Value addition of rice in Tamil Nadu

Value addition of rice includes preparation of brown rice, puffed rice, flaked rice, ready-to-eat foods and extruded foods. There are different forms of rice processed in Tamil Nadu and most of the consumers preferred single boiled rice. Paddy processing units processed different forms of rice namely raw rice, steam rice, single boiled and double boiled rice. Husk, Bran and Broken were the by-products. Modern paddy processing units were more efficient in processing of paddy into rice and most of the units in Southern Tamil Nadu processed all forms of rice. Single boiled rice is preferred form of rice among the consumers in Southern Tamil Nadu. The market for single boiled rice is almost saturated and there are many players in the market. (Indumathi et al, 2015). Polishing of rice helps in adding the value to the rice thereby increasing the price of the rice per quintal.

Policy implication for rice value chain management

Given the fact of innumerable value added products (Parched rice, puffed rice, etc.), cluster-based technology park/cottage industries are to be established for rice value addition and entrepreneurs are

to be trained in processing of rice based value products. A link between farmers, the entrepreneurs and the technology park could improve the access of procurement of rice. A marketing linkage is also imperative in establishing a credible marketing facility for the value added products of farmers. The Department of Agricultural Marketing and Agri-Business should involve in social marketing and making consumer awareness, which would lead to improved income and farmers' livelihood.

Value chain management in pulses

In Tamil Nadu, 16 major, 2 medium and 63 mini pulse processing units with the capacity of 1000 MT/year, 500 MT/year and 200 MT/year respectively were established (Singh, n.d.). 100 small and large-scale manufacturers are involved in roasted gram manufacturing. A small percentage of the total chickpeas production about 10% is roasted called the "roasted gram". The Chick pea is processed in various stages to obtain roasted gram. This process requires time and skill. The roasted gram can be used for various purposes and taste is also found to be high (Yogan and Manohar, 2015).

Policy implication for value chain management in pulses

Cluster based cluster milling hub/technology park/small scale processing industries coupled with the packaging hub is needed as the selling of raw pulses affects the producers share of consumer rupee. As the demand of the packaged pulses/pulse flour picks up well in the markets, farmers/youth/household women's skill and capacity on processing/packaging of pulses need to be improved through trainings/capacity building programme. Department of Agriculture/Agricultural Technology Management Agency (ATMA)/Krishi Vigyan Kendra (KVK)/Department of Agricultural Marketing and Agri-Business should increase the funds for training the farmers in value addition of pulses along with the trainings on production. Moreover, a branding value for each of the cluster is necessary to improve the marketing value of the pulses. On the other hand, collective logistic management, identification of potential markets including super/virtual markets for marketing of the pulses may improve the producer's share in the consumer price. In the similar way, the value addition may eliminate the distress sale of pulses at the time of surplus production of pulses thus sustaining the income of the pulse producers throughout the year. The quality assurance of the value-added pulses needs to be done with the help of FSSAI (Food Safety and Standards Authority of India) and AGMARK of the state. These measures may improve the income of the farmers and a viable solution to the fluctuating price of the pulses year after year.

Value chain management in fisheries sector in Tamil Nadu

Fish value Chain in Tamil Nadu is as followed. There are two channels exist for Sardine fishes and two channels for Seer fishes. In the fish value chain, the fishermen's share of consume rupee in all the channels is nearer/above 70 %. In case of sardine fishes, the consumer pays about 25 and 26 INR per Kg of fishes in the channels of I and II respectively. In case of Seer fishers, the consumer pays about 140 and 145 INR per Kg of fishers in the channels of I and II respectively (Kumar et al, 2008).

Table 2.7. Value chain in fishes

S.No.	Value chain of fishes	Exiting channels	Fishermen share in consumer rupee (Rs/Kg)	Consumer's price (Rs/Kg)
1.	Sardine	i. Fishermen – Retailer – Customer ii. Fishermen – Vendor – customer	i. 17.84 (71.36 %) ii. 17.84 (68.62 %)	i. 25 ii. 26
2.	Seer	i. Fishermen – Wholesaler – Customer ii. Fishermen – Retailer – Customer	i. 103.71 (74.08 %) ii. 103.71 (71.52 %)	i. 140 ii. 145

Kumar et al, 2008

Value addition in the state of Tamil Nadu

A total of 25 home scale processing units was established by farm women trained at KVK in the district of Kancheepuram. Out of which, 7 units on fruit products such as Squash, Jam, 6 units on vegetable pickles, 3 units on milk products, 5 units on masala powder preparation and 4 units on cereal products. These units sell 60 % of their products at the value of 500 – 1000 INR directly to consumers. Remaining 40% sell through hired stages that valued more than Rs1000. KVK, Kancheepuram establish marketing linkages with these units through various stages like conducting and participating exhibitions/fairs, awareness meetings, sale in the farmers mandies. KVK is also providing marketing facilities as arranging weekly bazaar within the premises of KVK. Further, NABARD came forward to assist these units to start Rural Mart at Potheri near KVK.

Extension and advisory system in the development of value addition

KVK Kancheepuram has been working closely with farm women in the establishment of SHGs as well as technological/technical support for establishing home scale processing units through various processes including technology standardization, awareness creation, technical and enterprise training, initiating and nurturing income generation activities, trainings on processing technologies and so on.

Impact

These small-scale value addition units helped the farm women to earn addition income from off farm activities and created employment opportunities to the rural household women. Besides, the farm women have become major market players as they involve in direct selling of the value-added produces.

Scaling up

In order to reach more farmers and household women the same home-based value addition units as followed by KVK-Kancheepuram may be set up across the villages with the financial assistance from NABARD and technical support from KVKs and line departments. Besides, the department of Agricultural Marketing and Agri-business may take up the social advertisement, mela and agri market mela for the promotion of the value added produces so as to assure the farm/household women with the year-round income for the better living and livelihood.

Public Private Partnership (PPP) and value chain management

There were three value chain of the PPP studied namely value chain of Farmers Association, FPO and NGO. The farmers who have been the members of PPP value chain got improved yield and repaired their houses, enhanced the infrastructure of the dwelling place, purchased home appliances, which include fans, refrigerator, washing machines, vehicle, etc.,

Value chain channel of Farmers Association

Farmer - Local trader - Wholesaler - Retailer - Consumer or Farmer - Wholesaler - Retailer - Consumer

Value chain of FPO

Farmers - Primary wholesaler - Secondary wholesaler - processor /Trader - Retailer - Consumer

Value chain of NGO

Farmers - Primary wholesaler - Secondary wholesaler and traders - Retailer - Consumer



Table 2.8. Value chain channels of public private partnership

S.No.	Particulars	Salient feature
1.	Farmers association value chain	80 % of the farmers attempted the marketing of produces. In this value chain, millet farmers involved in grading and packing at farm levels and pack them in the suggested gunny bags. The packed millets are sold to the wholesalers/local traders. Importantly, the grading and packing of the millets fetch higher price to the farmers, besides, helping them to overcome the involvement of middle man in the marketing.
2.	FPO pattern of value chain	60 % of the farmers involved in this value chain for the avail of better price for the value-added produces. In this channel, the farmers involve in grading, dehulling and packing at farm levels. The grading methods of the Department of Agricultural Marketing and Agri-Business are followed by the millet farmers. In this value chain farmers get addition of 8 INR per Kg of millet than market price
3.	NGO pattern of value chain	65.78 % of the farmers involved in this value chain to get the better price for their value added produces. The farmers of this value chain pattern involve in grading, dehulling, roasting and packing. In this model, the NGO has established a contract farming with the millet farmers. The packed millets are sold to the wholesalers (primary or secondary). These wholesaler sales the packed millets to the processors for the further value addition. These NOGs further involve in roasting of millets, which helped them to realise the better price in the markets. The farmers are in turn provided with the better price and without delay. Moreover, the price received per kg of millet is more than the market price in this model.

Summary

Department of Agriculture (DoA)

The Department of Agriculture (DoA) plays a major part in promotion of agriculture and improving the livelihood of the farm families in the state. The DoA helped the state to achieve increased area under SRI (5.81 lakh ha), machine planting of paddy (1.72 lakh ha), SSI (0.4 lakh ha) and food grain production of more than 100 lakh MT helped to receive the much coveted Krishi Karman Award from the Government of India for four times in five years (2011-12-2015-16). It is entrusted to ensure the demand of seeds, inputs, latest technologies, etc., for effective crop production in the state as well. The DoA provides demonstrations, capacity/skill development trainings, Farm Field Schools, Kala Jatha etc., through STAMIN, FFC, ATMA, WMTC and personal agro advisory services provided by the AOs/AAOs/ATMs/BTMs etc., to the farmers form a major extension service in the state. Nearly 2000 Farmers Producers Groups were developed during 2016-17 with the aim of collective purchase of farm inputs and sale of farm produces, these farmers' groups help the farmers to realise reduced cost of crop production and increased farm returns. TN-AGRISNET, FCMS, Pico projectors helped the extension functionaries to disseminate information at faster pace, these virtual extension advisory services help the farmers to decide on crop management and marketing of farm produce in real time basis.

Department of Horticulture and Plantation Crops

The Department of Horticulture and Plantation Crops' extension efforts and the support of central and state's government schemes helped Tamil Nadu to achieve increased area (14.76 lakh ha) in horticulture until 2016-17. Production of horticultural crops is 188.22 lakh MT (2016-17) in the state, with which the state government shares about 7 % of the country's horticultural production. Moreover, awareness campaign and demonstrations of the department made among farmers have enabled the state to be forerunner in coverage of micro irrigation with 3.46 lakh acres (9.48 %) of horticultural area under micro irrigation in the past five years (2011-12-2016-17). The schemes like NHM, NADP, RAD, etc., have brought significant achievements in IPM in horticulture, protected cultivation and bee keeping with the area of 0.01, 0.06 and 0.25 lakh ha respectively. Above and beyond, the Department of Horticulture and Plantation Crops' contribution in organic farming of horticultural crops (2550 acres), high tech vegetable cultivation in the sub basins (0.49 lakh ha), increased area under hybrid vegetables (0.96 lakh ha) have been noteworthy achievements in the state of Tamil Nadu in the last one decade (2007-2017).

Department of Agricultural Engineering

The Department of Agricultural Engineering is enabling the state to achieve 100 % mechanisation in the field of agriculture, its extension and advisory systems cover soil and water conservation measures, Green Energy initiatives, supporting the field work with suitable/cost effective machineries like land levelers, land shapers, paddy transplanters, combine harvester, rotavators, balers, ridge moulders, rotary drillers, mini drills, percussion drills along with others. The agricultural engineering has established 1 106 CHCs since 2013, which are located in Block level so as to enable the farmers to make use of the farm machineries/implements at ease. Significant achievements like 2 022 Nos water structures, 65 check dams, 389 water harvesting structures, 2 014 water user associations, 132 Nos of solar driers were made during 2016-17, these contributions are likely to cater to the water resource of the farms amid declining water resource across the state.

Department of Agricultural Marketing and Agri-Business

The Department of Agricultural Marketing and Agri-Business supports 23 Market Committees, 278 Regulated Markets, 179 Uzhavar Sandhais, 30 State Agmark Grading Laboratories, Food Processing Incubation and Trainings centres functioning across the state. Contributions of the Department of Agricultural Marketing and Agri-Business encompasses, creation of 6577 commodity groups (1.73 lakh farmers), 10 e-Learning Centres, establishment of Agmark standards for 213 commodities, sale of 2410 MT of vegetables and fruits (during 2016-17) etc.,

Department of Animal Husbandry

The farmers and farm/household women were benefited through the treatment of 3.87 lakh animals (both big and small animal) by the Department of Animal Husbandry during 2015-17. 11.09 lakh

women farmers have benefited from free distribution of milch cows/goats/sheep in the last five years (2011-16), the economic worth of the free distribution of 0.63 lakh milch cows includes 66 liters of milk/day and production of 1.21 lakh calves were born valuing 60.81 crores of INR and the beneficiaries have realised 1.46 crores of INR from 59.07 lakh kids of Goats/sheep in the last five years (2011-16). Similarly, increased area under fodder cultivation (2.27 lakh ha), broiler farms (2 747 Nos), native chicken farms (15 554 Nos) and azolla units (20 958 Nos) are all noteworthy contributions of the department. Similarly, distribution of chaff cutters (12 703 Nos), treatment of cows (93 lakhs) and buffaloes (93.63 lakhs) and insurance of 2 lakh animals against Foot and Mouth Disease benefited the farmers during 2016-17. The Department of Animal Husbandry organises about 5 500 special livestock camps every year across the villages in Tamil Nadu. Extension methodologies such as skill development trainings, on and off campus trainings totaling 3 598 during 2015-17 benefited 1.43 farmers/farm women/youth/graduates/skilled labourers and many others in the state.

Department of Fisheries

The department has endeavored to achieve 0.7 % of the Gross State Domestic Share (GSDP) with the production of 6.97 lakh tonnes of fishes. Extension services like trainings and demonstrations have made awareness/knowledge among inland fish farmers/fisher folk community on intensive fish culture, intensive Pangasius, hygienic fish marketing, hatcheries development including Magur hatchery, thereby helping the state to achieve a significant place in the Indian fisheries sectors. Moreover, provision of wireless communication facilities to 18 400 Nos of coaster fisher folk and motorisation of traditional crafts (635 Nos) help the fishermen to be well informed of the weather situations and deep-sea fishing respectively.

Department of Sericulture

The department of sericulture has brought about 0.43 lakh acres of farm lands under sericulture with 23 873 farm families practice sericulture across the state. Each year about 0.07 acres of lands are brought under sericulture with the schemes like increasing area under sericulture and Catalytic Development Programme (CDP). The state's 105 technical service centres located across the state ensure the farmers' need of sericulture information relating the schemes of the government, rearing silk worms and marketing etc., every year the state supplies about 60.50 lakh Number of cocoon seeds required by the sericulture farmers in the state.

ATMA

ATMA encompasses a variety of extension activities, which includes within district trainings, within district exposure visits, Farm Field School (FFS), demonstrations, interstate exposure visits, within state exposure visits, Kala Jatha together with ICTs based information dissemination. It has been observed that not less than 250 extensions and agro advisory services are carried out every year in each district of Tamil Nadu, which benefit about 25 000 farmers from each district, i.e. more than

75 lakhs of farmers in the state. ATMA imparts awareness, knowledge and skill/capacity among the farmers on Integrated Crops Management (ICM) in various agricultural/horticultural crops, value added enterprises like mushroom production, small scale food processing technologies, System of Rice Intensification (SRI) and use of solar lights and pumps as a part of renewable energy.

ATMA's role in instilling awareness/knowledge on sheep and goat rearing, inclusion of fisheries into farming, low cost livestock-feed formulation, modern post-harvest technologies and water conservation techniques is helpful in improving the productivity of farm and income of the farmers. Importantly, the Pico Projector is a disruptive technology, which is helpful among the field level extension functionaries of ATMA to disseminate the modern technologies in farming and allied sectors. However, content management and impact evaluation of farm technologies disseminated among the farmers are relatively insufficient, therefore, necessary documentation support and funds need to be provided to ATMA in order to understand the impact of technology disseminated under ATMA in the state. Irregularity in third party evaluation affects the impact of the ATMA at grass root level and among farmers. The Farmer Friend (FF) is helpful in disseminating latest information and crop production technologies to the farmers yet there prevails considerable incapable FF in Tamil Nadu, which is not only affecting the resource of FF but also depriving the benefits of farmers. Political interference in selection of FF could be avoided so as to make eligible candidate as FF. Although the ATMA instills knowledge and capacity of FF through trainings/skill development programmes, exposure visits, etc., on various farm technologies, these are not in conjunction with the present need of the farmers and farm practices. Therefore, farmers' demand driven trainings, exposure visits, skill and knowledge need to be inculcated among FF to disseminate rightful and location-based technologies. For this purpose, FF along with field level extension functionaries needs to assess the farm resources, cropping pattern, funding sources, extension agents contact, credit availability, scientific orientation, information source and inputs availability and so on, these enumerations of each farmer's need may lead to development of quality and value-added extension services by ATMA in the state of Tamil Nadu.

National bank for Agriculture and Rural Development (NABARD)

NABRD helps the line departments, KVKs, NGOs, FPCs, Farmers Clubs, Self Help Groups, Private Sectors, TNAU, TANUVS, TNFUs, etc., with the finance and funds, with which the public, private and third sectors perform various extension advisories and agro services in the state of Tamil Nadu. Moreover, NABARD has its own role in formation of Farmers producers Organisation, Farmers Clubs, SHGs, etc., in improvement of livelihood of the farm families and rural sectors.

Krishi Vigyan Kendra (KVK)

KVKs in Tamil Nadu plays a crucial role in assessment of location specific technologies and dissemination of proven technologies. KVKs-TNAU organised 991 extension activities (On-Farm Testing, Front Line Demonstration, On and Off campus trainings, vocational trainings and awareness campaigns during 2016-17) benefiting 0.32 lakh farmers/youth/farm women/household women and

among others. KVKs have been forerunner in terms of making awareness and knowledge on advanced farm technologies on Integrated Crop Management (ICM) in agricultural/horticultural crops, precision farming, Integrated Pest Management (IPM), value addition technologies, hi-tech horticulture production, organic farming technologies/traditional, farm techniques, mechanisation of farming, nutrition gardening and value chain management of farm produces in particular millets and promotion of awareness about ICTs in agriculture, entrepreneurship in agriculture, value added enterprises like food processing, mushroom production, value addition in rice, pulses, millets and other. The extension activities of KVKs include trainings, capacity building programmes and skill development regarding fodder production, livestock maintenance, fisheries production, poultry, piggery, duckery, etc., which help the farmers to integrate their farming and to gain remunerative income.

KVKs have also been helpful in making awareness among the farmers about the formation of farmers producer groups, farmers clubs, agri-business school across the state of Tamil Nadu, which integrate the farmers in collective purchase of farm inputs and supply of farm produces in the market. Front Line Demonstrations (FLDs), awareness campaigns, knowledge development programmes and so on help the farmers to replace ineffective crop variety with the productive crop variety e.g. TPS 5 rice variety, Bhendi Hybrid CO 4 and Sorghum K-12 to name just a few. Women led agriculture is promoted by KVS across the state with trainings on various household entrepreneurial start-ups like value addition, packaging, labelling, branding and marketing of the farm produce so as to make agriculture a profitable venture as well as to reduce the involvement of commission agents in the value chain of agricultural commodity. On such example is the SHG named Amma Pannai Mahalir group (Mother farm women group) from Coimbatore district of Tamil Nadu, which ventured into processing of their own farm produces so as to add marketing value of the produce. This has been helping them to get additional income and better livelihood. KVKs also support FPOs/FPCs, Self-help Groups, entrepreneurs with trainings, capacity and skill development programmes on advanced crop production technologies, value addition of farm produces and marketing strategies.

Farmers Producers Company (FPC)

Farmers Producers Companies have distinct role with their activities ranging from supporting farmers with inputs for crop production and inventory for marketing of the farm produces. FPCs provide the inputs at lower cost so as to allow the farmers to realise reduced cost of cultivation and higher returns per unit. These FPCs play a vital role in extension and advisory services, their extension strategies include demonstrations on latest/modern technologies like use of Zeba Water Absorbent, production of quality bio fertilisers and trainings on value addition and market linkages. FPCs provides advisory services to the farmers by networking with technical advisors, scientists of agriculture and allied sectors for good agricultural practices and involvement of farmers directly in value chain management of farm produces.

Non-Government Organisation (NGO)

NGOs such as CREATE, TSSS and VK-NARDEP play an inevitable role in Transfer of Technologies and

providing agro advisory services to the farming community, these three NGOs together cover about more than 50 thousand farmers with 40 % of them are women in the state of Tamil Nadu. These NGOs have created knowledge network among their stakeholder about organic farming, traditional rice varieties and nutrition/terrace gardening. These NGOs support the farmers by providing information source from pre-field preparation to post-harvest management of farm produces.

Tamil Nadu Agricultural University (TNAU)

TNAU functions as a technological backstopping of the line departments, private and third sectors in the field of agriculture and allied sectors. TNAU and its research stations such as the Rice Research Station, the Horticulture Research Station, the Groundnut Research Station, the Oilseed Research Station and so on have been developing improved crop varieties and good management practices for both crop production and post-harvest management of farm produces. TNAU has developed 64 crop varieties under Protection of Plant Varieties and Farmers Rights (PPV & FR) including 7 patents and 59 findings. Widespread extension services of TNAU encompass publication of Uzhavarin Valarum Velanmai magazine (12 865 subscribers till 2016-17), mobile advisory services through Kissan Call Centre (0.23 lakh call-answers during 2016-17), production of videos lessons, programmes capsule (720 Nos till 2016-17), weather information as SMS to 8.86 lakh farmers in the state, pre-sowing and pre-harvesting advisory services to about 4 lakh farmers during 2016-17.

Conclusion

Agricultural Extension and advisory systems have undergone several evolutionary phases and innovative changes in the state of Tamil Nadu with the introduction of Community Development programme since 1950s. The production of crops has fraught with several challenges in the state of Tamil Nadu, with the changing face of socio-economic conditions, natural resources, technology, value chain management, supply and demand of farm produces, rural and urban set up, even then the extension systems of the state namely public, private and third sector have enabled the farm sectors to apt to the changing environment. However, recent challenges show that the innovative extension methodologies such as participatory farm extension, agri-business mode of reinventing farm enterprises, demonstrative results, ICTs based farm advisory services have been shown with less success ratio than the anticipated. In this context, the study has focused its attention to bring recent challenges in agriculture and allied sectors so as to make agriculture productive, competitive and sustainable in the state and recommendations for effective implementation of agricultural extension and advisory systems in Tamil Nadu with the aim of reaching every stakeholder viz., public institutions/institutes, private agro advisory services providers, Non-Government Organisations (NGOs), Farmer Producer Organisations (FPOs), input dealers, market traders, value chain actors and farmers in agricultural extension.

Major findings of the study and recommendation

Public Extension

- The State Agricultural Extension Management Institute (STAMIN) and Farmers Facilitation Centre (FFC) and Water Management Training Centre (WMTC) are the major role players in providing skill and capacities of the extension functionaries and farmers in the state through periodical trainings and capacity/skill development programmes on latest technologies and agricultural innovations. STAMIN, FFC provide trainings to not less than 0.25 lakh farmers every year, 0.29 lakh were benefited from the trainings of STMAIN and FFC during 2016-17. WMTC trained about 1100 field level extension functionaries during 2016-17.
- The state government promoted 2000 Farmers Producer Groups (FPGs) benefiting more than 2 lakh farmers across Tamil Nadu during 2016-17, these FPGs encourage collective farming and marketing among the farmers in the state.
- KVKs-TNAU's extension activities (OFT, FLD, on and off campus trainings, campaigns, pre and post seasonal trainings, etc.,) were 991 Nos during 2016-17 with the beneficiaries of 0.32 lakh farmers/youth/farm women/household women and among others, these extension activities helped the farmers to get awareness and knowledge on Integrated Crop Management (ICM) in agricultural/horticultural crops, precision farming, Integrated Pest Management (IPM), value addition technologies, hi-tech horticulture production, organic farming technologies/traditional, farm techniques, mechanisation of farming, nutrition gardening and value chain management of farm produces in particular millets and promotion of awareness about ICTs in agriculture, entrepreneurship in agriculture, value added enterprises like food processing, mushroom production, value addition in rice, pulses, millets and other.

Agricultural Technology Management Agency (ATMA)

- ATMA encompasses a variety of extension activities such as within district trainings, within district exposure visits, Farm Field School (FFS), demonstrations, interstate exposure visits, within state exposure visits, Kala Jatha together with ICTs based information dissemination. It has been observed that not less than 250 extensions and agro advisory services are carried out every year in each district of Tamil Nadu, which benefit about 25 000 farmers from each district, i.e. more than 75 lakhs of farmers in the state.
- ATMA imparts awareness, knowledge and skill/capacity among the farmers on Integrated Crops Management (ICM) in various agricultural/horticultural crops, value added enterprises like mushroom production, small scale food processing technologies, System of Rice Intensification (SRI) and use of solar lights and pumps as a part of renewable energy.
- ATMA's role in instilling awareness/knowledge on sheep and goat rearing, inclusion of fisheries into farming, low cost livestock-feed formulation, modern post-harvest technologies and water conservation techniques is helpful in improving the productivity of farm and income of the farmers. Importantly, the Pico Projector is a disruptive technology, which is helpful to field level

extension functionaries of ATMA to disseminate the modern technologies in farming and allied sectors. However, content management and evaluation of farm technologies disseminated among the farmers are relatively insufficient, therefore, necessary documentation support and funds need to be provided to ATMA to understand the impact of technology disseminated under ATMA in the state.

- Irregularity in third party evaluation affects the impact of the ATMA at grass root level and among farmers. The Farmer Friend (FF) is helpful in disseminating latest information and crop production technologies to the farmers yet there prevails considerable incapable FF in Tamil Nadu, which is not only affecting the resource of FF but also depriving the benefits of farmers. On the other hand, political interference in selection of FF could be avoided so as to make eligible candidate as FF.
- Although the ATMA instills knowledge and capacity of FF through trainings/skill development programmes, exposure visits, etc., on various farm technologies, these are not in conjunction with the present need of the farmers and farm practices. Therefore, farmers' demand driven trainings, exposure visits, skill and knowledge need to be inculcated among FF to disseminate rightful and location-based technologies. For this purpose, FF along with field level extension functionaries needs to assess the farm resources, cropping pattern, funding sources, extension agents contact, credit availability, scientific orientation, information source and inputs availability and so on, these enumerations of each farmer's need may lead to the development of quality and value-added extension services by ATMA in the state of Tamil Nadu.

NABARD

- NABARD helps the line departments, KVKs, NGOs, FPCs, Farmers Clubs, Self Help Groups, Private Sectors, TNAU, TANUVS, TNFUs, etc., with the finance and funds, with which the public, private and third sectors perform various extension advisories and agro services in the state of Tamil Nadu. Moreover, NABARD has its own role in formation of Farmers producers Organisation, Farmers Clubs, SHGs, etc., in improvement of livelihood of the farm families and rural sectors.
- Capacity Building for Adoption of Technologies (CAT) is given to farmers with the help of KVKs/line departments, NGOs, FPOs, private companies, TNAU, TANUVAS, etc., the CAT includes goatery, dairy, poultry, organic farming, value chain management in milk, food crops and vegetables etc.
- NABARD is training the farmers/youth/household women etc., on small/medium scale industries (food processing, value addition and packaging sectors) so as to improve the livelihood of rural household youth/women/farmers.

Private extension

- Private extension plays a crucial role in extension and agro advisory services in Tamil Nadu. The organisations such as UPASI, Parry's corner, Dhan foundation, Hatsun Agro products, Sustainable Agro Alliance limited have been providing trainings and capacity building programmes among farmers/farm women/rural youth/ on modern crop production technologies, organic farming, value chain management, water conservation technologies, watershed programmes,

Integrated crop management, food processing technologies coupled with value addition, branding and conservation of traditional crop varieties in Tamil Nadu. Similarly, NGOs such as CREATE, TSSS, ThiaMan, VK-NARDEP provide awareness campaigns, trainings, skill improvement programmes on organic farming, nutrition/terrace gardening, etc.,

- The Centre for Indian Knowledge System (CIKS) is exclusively working in creating awareness and developing skill/capacity among the farmers/household women/rural youth on community gardening across the state of Tamil Nadu. Ponni Iyarki Vivasaya Magalir Kuzhu (Ponni Natural Farming Women's Group) is a community garden promoted by the CIKS spreads knowledge and awareness among other farmers about the importance and working of community garden in Tamil Nadu. Furthermore, CIKS documents several indigenous vegetables varieties and medicinal plants of Tamil Nadu. Besides, trainings are provided to farmers in seed production of rare and indigenous crop varieties, thereby conserving these indigenous crop varieties to the next generation.
- MSSRF-Tamil Nadu organises Plant Clinics programmes (on camp live extension services) in each village of Tamil Nadu, which provide need based agro advisory services to farmers. The trained professionals are appointed as crop doctors. These plant clinics function throughout the state with the coverage of more than 40 villages so far.
- The Cereal Systems Initiative for South Asia trained and skilled more than 0.25 lakh farmers on modern rice farming technologies like laser land levelling, direct seeding of rice, mechanical transplanting of rice and among others.
- Similarly, agripreneurs have established various agri business models on vegetable nursery, sale of organics food items online on demand basis, organic farming, `traditional seeds, collective farming, social media, plant clinics, value addition, veterinary, Integrated Farming System (IFS), etc., in Tamil Nadu, which help in increasing the farm income, improving the value chain management and marketing thereof, improving the livelihood of the farmers in the state. Save Our Rice is an awareness campaign programme organised by the NGO CREATE across the state of Tamil Nadu, which helped around 0.37 lakh farmers to adopt traditional rice varieties and conserve them under community seed preservation and multiply through seed production by farmers.

Farmers in Tamil Nadu expressed that, they have not been able to meet the field level extension functionaries, which delays the utilization of the government schemes, these delays perhaps best attributed to the inadequate man power in the state Department of Agriculture

Parthasarathi, 2009

Farmers Producer Groups

- Farmers Producer Companies (FPCs) are a gamut of entire extension activity in Tamil Nadu. The farmers groups such as the Velliangiri Uzhavar Producer Company, the Ayakudi Guava Producers Company Limited, the Erode Precision Farm Producer Group etc., provide trainings for improving the farmers' capacity knowledge and awareness on latest technologies and management practices thereby increasing the farm sustainability and livelihood of farmers.
- Networking of farmers groups with the public institutes like Krishi Vigyan Kendra, the Department

of Agriculture, the Department of Horticulture and Plantation Crops, the Department of Marketing and Agri-Business and private players and NGOs helps FPOs to organise awareness campaigns, exposure visits, on innovative farm technologies like nursery technologies, bio-fertilisers, azolla farming, Integrated Farming System (IFS), intercropping, precision farming, post-harvest management, value addition, agri-business and so on. Farmers groups follow group approach for Collective marketing of farm produces thereby increasing the on-farm income of farmers.

ICTs

- WhatsApp based reporting has helped the extension functionaries to update the higher official about the status of scheme and its success within short span of time, it is a cutting-edge ICT technology as it has improved the efficiency of time, space and extension activity. Moreover, WhatsApp reporting has brought transparency among field extension functionaries and implementation of schemes at the grass root level. However, the untimeliness in reporting of scheme-based progress through WhatsApp poses work burden among the field level officers, this untimeliness may be streamlined to improve the use of new media tool appropriately and effectively.
- Similarly, Agriculture Management and Information System (AGRI-MIS) of the state has a data base of 68 lakh farmers, which help the line departments to identify the extension need of each farmer and develop extension strategies such as trainings, capacity buildings, agripreneurship, etc.
- e-Extension initiatives of TANU such as TNAU Agritech portal, multi video conferencing facility and 12 Android mobile based expert Apps help farmers, researchers, extension functionaries, general information seekers and other from across the state. 6000 people visit the agritech portal on a daily basis thereof accessing 700-920 pages every day.
- ARS (Agriculture Reporting System), e-Kalpa Bhuvan, Farm Crop Management System (FCMS), TNAU-Agri tech portal and TN-AGRISNET help the extension functionaries to provide real time recommendation and advisory services to the farmers in the state of Tamil Nadu.
- The ICTs such as indiagriline (EID Parry), mKRISHI (TCS), Onefarm (Ekgaon technologies), Farm Field (SAAL), Reuters Market Light (Thomson Reuters), mASK provide customized agro advisory services to the farming community across Tamil Nadu.
- CSISA provides trainings and skill development of farmers so as to create awareness and knowledge in use the Nutrient Manager for Rice (NMR) for site specific nutrition application in Tamil Nadu, more than 0.25 lakh farmers have been trained to use NMR so far in Tamil Nadu.
- The use of ICT has been high among NABARD as NABARD has its own web portals namely Krishak Sarathi (<http://www.krishaksarathi.com/>) and e-Shakti (<https://eshakti.nabard.org/>) for farmers club and Self-Help Group respectively. These groups make use of the portals any time to know the activities of NABARD respect to farmer's club and SHGs.

Knowledge management

- The impact of the technologies disseminated under public systems is limited as the present systems

focus on target-based dissemination of farm technologies be it crop production technologies or farm machineries or post-harvest management technologies. Therefore, adequate trainings and capacity need to be improved among the extension functionaries to document the impact of farm technologies ranging from crop production to post-harvest management, which will facilitate in understanding the status of each technology's impact on crop production, income generation, gender inclusion and farmers' livelihood.

- Though TN-AGRISNET, FCMS and AGRI-MIS have the repository of farmers data base and farm resources, these ICT tools have limited access to the changing cropping pattern of the state besides, farmers are unaware of the use of these ICTs in production of crops due to inadequate extension systems to educate the farmers about FCMS and AGRI-MIS, lack of knowledge on new media, insufficient technical experts to provide instant solutions to farmers and so on. Therefore, creation of e-crop portal in each village with a curator/technical expert will help the farmers to access e-agriculture and get instantaneous solutions to their farm problems. Besides, the e-crop portal should encompass each farmers data base including farmers' cropping pattern, inputs (fertiliser) need, farm machineries need and other, thereby enabling the extension functionaries to spread appropriated advisory services to farmers in real time basis.

Man Power

- A total of 2 006 technical officers functions in Tamil Nadu, which includes 1088 Agricultural Officers (AOs), 2829 Assistant Agricultural Officers (AAOs) and Agricultural Seed Officers (ASO) and these officers are closely working with farmers in transfer of technologies, providing trainings, demonstrations, undertaking diagnostic filed visits, organising field days, village meetings Farm Field Schools (FFS) etc., However, the sanctioned man power is inadequate to meet the need of 83 lakh farm families in Tamil Nadu i.e. each of the extension functionary needs to meet 3243.79 farmers/year if the extension functionaries are to know the farm data and each farmer's demand.
- The present strengths of AAOs i.e. 6 AAOs in each block (2310/385 blocks) in Tamil Nadu are inadequate as each block has about not less than 35 revenue villages in Tamil Nadu that the each AAO has to visit 5 villages and 45 farmers/village (approx.) every year. In this circumstance, provision of AAO on the basis of revenue villages (17 680) in Tamil Nadu may not only bring adequacy in man power requirement in the state of Tamil Nadu but also provide customised extension services to the farmers on demand basis.
- The studies show that the high farmers to extension worker (2500:1) in Tamil Nadu, which result in incompetency among the extension functionaries to cater to the growing farmers' need and demand. On the other hand, most of the extension functionaries involve in soil sample collection, production of bio-fertilisers, trading of farm inputs etc. Besides, the state consists of 2610 technical officers to help horticulture

Farmers in Tamil Nadu expressed that, they have not been able to meet the field level extension functionaries, which delays the utilization of the government schemes, these delays perhaps best attributed to the inadequate man power in the state Department of Agriculture

Parthasarathi, 2009

farmers, of the total technical officers in Horticulture, 62.56 % are Assistant Horticultural Officers (AHO), 15.47 are Horticultural Officers (HO) and the rest of them include Assistant Director of Horticulture, Deputy Directors of Horticulture and Joint Directors of Horticulture yet need more man power to promote sustainable horticulture development.

- Even in fisheries, of the 1686 technical officer posts, more than 5 % of the post are vacant as against the sanctioned that too most of the posts are Inspector of Fisheries, Sub-Inspector of Fisheries etc., therefore, the vacancies affect the field level fisheries extension in Tamil Nadu.

Post-harvest management and Marketing

- Extension functionaries and professionals should adequately be skilled to train the farmers/household women/rural youth in operation of the PHTs, cold/supply chain management and logistics of food and non-food produce.
- More awareness and opportunities of technologies available for food processing (fruits and vegetables) need to be popularised through mass media and disruptive technologies. The value addition in banana/banana fibre for different produces should be promoted on a large scale in Tamil Nadu as banana fibre can be used as a promising raw material in packaging and textile industries.
- The state government should identify the Corporate Social Responsibility (CSR) funds for the establishment of PHT units at every cluster area/village. In this context, trainings/capacity needs/skill should be inculcated among all farmers to improve the quality of their produce through preserving/cooling, dehydrating/drying, packaging, labelling, etc.
- Similarly, a new paradigm shift in scheme, innovative technology and extension approach is necessary to improve value addition and value chain of the livestock produce, fruits and vegetables and food grains. Cluster trainings coupled with multi-media (videos, short films, audio and animated videos) may be organised to instil capacity and skills among migrating farmers/youth/women on milk produce, value addition in cow dung (preparation of vermicompost, dried cow dung, bio-gas, etc.).
- Direct marketing of farm produce by farmers is still a setback in Tamil Nadu owing to the firmly established traders/commission agents in the markets. Likewise, lack of awareness among farmers about the consumers preference and market demand poses hurdle in direct marketing of farm produces. Therefore, extension functionaries including KVKs officials/Subject Matter Specialists should focus in increasing the awareness/knowledge of farmers about demand and supply of each produce in the markets, similarly the state should facilitate more consumers and farmers meet so as to establish a strong coordination between consumers and farmers in production and sale of farm produces, rural technology park with adequate infrastructure is to be created in each village for directly linked with farmers.
- Farmers' knowledge, awareness and skill should be enhanced pertaining to existing market channels, value chain and value addition on various farm commodities frequently by the extension functionaries. Similarly, the state needs a supportive extension coupled with trained professional to improve the awareness and capacity/skill of the farmers in handling value addition technologies

related to each farm produce, which will help the farmers to familiarise with value addition of farm produces and marketing.

- Information related to demand and supply of perishable produce, food grains and other essential commodities should be made available to farmers at cost effective manner in prior to the season of planting and crop production.
- Branding of farm produce is an emerging area in agriculture, hence awareness and knowledge must need to be improved among the farmers about branding of farm produces and promotion of social marketing among the potential consumers for the advertisement of farm brands. The state could adopt the model of KVK-Avinashilingam in promoting branding of farm produces.

Agri business and entrepreneurship

- The state is the forerunner in agri business due to its commercial advantage agricultural commodities, strong consumer base, export potential of farm produces, quality of farm output etc. However, the state has to impart invigorated capacity and skill among the graduated agricultural youths to set up more Agri-Clinics and Agri Business Centres across every village in the state so as to facilitate the extension services at the door step of the farmers.
- Private extension coupled with value-added advisory service needs a policy back up and funding support in the field of fisheries and fish production. Progressive farmers/household women and village youth from every identified cluster may be trained to venture into seeds/fingerlings production enterprises and preparation of pellet & mash feeds for greater availability of feeds for fisheries management. Social and community capacity may be inculcated among the rural youth/women/retired teachers/volunteers to involve in maintenance of farm ponds/community ponds dug under NFDB/NADP/MGNREGA, which will help them in fisheries production.

Major Capacity gap and extension strategies

- Though the state provides skill and capacity improvement trainings to the extension functionaries through STAMIN, Water Management Training Centre, 22 Farmers Facilitation Centre (FFC) and the trainings and capacity development programmes provided by the National Institute of Agricultural Extension Management includes field level extension functionaries from the state, the extension functionaries of the state need reinvigorated trainings and capacity buildings on recent and advanced crop varieties, fertilisers, plant protective measures, farmer friendly farm machineries and post-harvest technologies as the changing cropping pattern and vagaries climate require advanced crop production advisory services. It is also evident that the farmers are increasingly depend on private dealers for crop management as the input dealers were found to provide latest technologies and advisory services to the farmers.
- Agripreneurship and agri business are the two major evolutionary extension systems in agriculture, yet the knowledge of extension functionaries in the field agripreneurship needs to be enhanced so as to help them to provide agripreneurship trainings to the rural youth, which will help the rural youth to venture into profitable agribusiness and provide employment opportunities to the

resource poor agricultural labourers, household women, etc.,

- Extension functionaries' awareness/knowledge on market performance of new technology has been insufficient. It has been observed that, when the improved variety like TKM 13 was introduced as an alternate to the biotic and abiotic susceptible BPT 5201, the demand of TKM 13 among the traders and consumers was very high due to preference of BPT 5201. Therefore, knowledge and awareness of marketing value of each technology and variety are necessary for extension professional working closely with the farmers.
- Though agro-tourism is an emerging area in the field of agriculture, extension functionaries have nascent exposure and knowledge pertinent to agro tourism in Tamil Nadu. So, extension functionaries need to be exposed and trained adequately to promote agro tourism in the state of Tamil Nadu.
- Tamil Nadu has an abundant opportunity in small scale food processing industries. Extension functionaries' skill and knowledge in production of bio-fertilisers, organic manures, vermicompost, cow dung-based manures are limited owing to increased scheme-based extension activities coupled with increased work burden. Therefore, more trainings can be done to increase the extension functionaries' capacity on these organic input production methods in association with the NGOs/FPCs, which are involving in organic farming.
- Trainings and awareness about value chain management of agricultural commodity are often a neglected area in extension advisory systems as most of the scheme-based extension services focus on modern crop production technologies and good crop management practices. In this context, the state government should focus on value chain management and training the field level functionaries to improve the farmers' Knowledge, Awareness and Skill (KAS) in value chain management of various agricultural commodities.
- Knowledge and skill in value addition technologies and practices among the extension functionaries are limited as schemes fixed on crop production seldom focus on technologies for value addition and marketing. Therefore, extension functionaries are to be trained to demonstrate various commercially proven technologies to enhance the knowledge and awareness of the farmers in value addition.
- The shift in cropping pattern from agricultural crops to horticultural crops is predominant due to dwindling water resources, climate change and migration, the extension functionaries are to be trained to make agricultural extension strategic plan in block level with the focus on technology, new farm practice, new cropping pattern so as to promote sustainable agriculture in Tamil Nadu.
- The fallow lands increased to 21 % during 2016-17, farmers leaving current fallow lands have increased too in the last one decade owing to the change of bio-physical and socio-economic conditions. Awareness and knowledge on low water intensive crops with high output should be made among extension functionaries and farmers periodically. Awareness campaign about plantation crops and promoting agro-forestry needs a policy cum financial support coupled with trained extension functionaries to educate the farmers about the scientific way of converting fallow lands into agro-forestry and plantation crops. Knowledge should be instilled among farmers by the field level extension functionaries to make use of fallow on a community basis/Community of Practice (CoP).

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Annexure 1

Administrative units in Tamil Nadu (As on 2018)

Sl. No.	Administrative unit	Total
1	Districts	32
2	Revenue Division	82
3	Taluks	285
4	Firkas	1 349
5	Revenue villages	17 680
6	Municipal corporation	10
7	Municipalities	125
8	Block (panchayat union)	385
9	Town panchayat	561
10	Village Panchayat	12 618
11	Lok Sabha constituency	39
12	Assembly constituency	234

(Source: <http://ecostat.tripura.gov.in/At-A-Glance-2015-16.pdf>)

Annexure 2

Representative districts for the study

S. No.	District	Criteria 1 Gross cropped area (0.5) (000 ha)	Criteria 2 Net irrigated area (0.5) (000 ha)	Criteria 3 Field crop area (0.5) (000 ha)	Criteria 4 Cropping intensity (0.25) (per cent)	Rank
I North Eastern zone						
1	Kancheipuram	149.00	130.70	118.8	106.4	
2	Thiruvallur	149.40	91.80	149.9	132.10	
3	Cuddalore	264.40	150.60	235.00	122.8	
4	Vellore	216.80	99.60	126.00	108.00	
5.	Villupuram	380.00	245.00	168.43	111.00	I
6.	Tiruvannamalai	266.90	147.70	245.20	121.4	
7.	Vellore	216.80	99.6	126.00	109.8	
II North Western Zone						
8.	Dharmapuri	187.10	65.7	82.20	117.7	
9.	Krishnagiri	198.60	52.0	164.70	104.5	
10.	Salem	224.90	98.80	189.30	109.7	I
11.	Namakkal	198.50	65.70	125.10	119.20	
III. Western Zone						
12.	Erode	310.70	166.10	144.10	105.4	
13.	Coimbatore	330.60	175.40	65.4	105.7	I
14.	Tiruppur	201.90	119.30	92.90	103.00	
15.	Theni	119.80	57.90	57.40	106.1	
16.	Karur	96.10	94.40	73.30	101.8	
17.	Dindigul	246.80	99.40	123.50	103.30	
18.	Perambalur	223.50	67.50	78.30	104.9	
19.	Ariyalur	128.60	39.80	74.10	103.00	
IV Cauvery Delta Zone						
20.	Thanjavur	252.10	166.9	234.60	129.9	
21.	Nagapattinam	269.70	128.80	266.10	175.90	
22.	Tiruvarur	274.00	149.60	246.50	176.50	I
23.	Trichy	191.60	108.8	135.30	104.9	
24.	Pudukkottai	158.50	107.50	23.69	101.40	
V Southern Zone						

25.	Madurai	153.50	86.00	110.20	106.4	
26.	Sivagangai	113.70	79.70	90.40	100.00	
27.	Ramanathapuram	190.00	69.70	139.60	100.20	
28.	Virudhunagar	140.90	59.30	77.50	102.60	
29.	Tirunelveli	208.50	118.40	130.50	119.10	I
30.	Thoothukudi	176.60	40.10	110.00	104.00	
VI High Rain Fall Zone						
31.	Kanyakumari	92.60	27.10	20.30	115.40	I
VII Hilly Zone						
32.	Nilgiris	79.30	0.70	1.30	100.00	I

(Tamil Nadu contingency plan, 2011)

Annexure 3

Land utilization pattern in Tamil Nadu Area in lakh

S.No.	Particulars	1990-91	2000-2001	2014-15
1.	Total geographical area	130.90	129.19	130.33
2.	Cultivable waste	2.90	3.52	3.25
3.	Current Fallow	12.49	11.34	9.98
4.	Other fallow	10.44	12.28	17.17
5.	Net area sown	55.78	53.03	47.13
6.	Cultivable area (2+3+4+5)	81.61	80.17	77.53
7.	Area sown more than once	10.53	10.34	11.83
8.	Gross cropped area (5+7)	66.32	63.28	58.96
9.	Cropping intensity (8/5*100)	118.19	119.5	125.1
10.	Land put to non-agricultural purpose	18.35	19.85	21.89
11.	Ratio of net sown area to available cultivable area	68.34	66.15	60.78

Source: Krishnan, 2017 and Statistical Handbook of Tamil Nadu, 2016

Sl.No.	Net cropped area	2016-17		2017-18	
		Area (in lakh ha)	% (Total Geo area)	Area (in lakh ha)	% (Total Geo area)
1.	Forest area	21.57	16.55	21.57	16.55
2.	Net Cropped Area	48.33	37.08	46.39	35.59
3.	Area under Misc. Tree crops	2.34	1.79	2.26	1.73
4.	Permanent Pastures	1.08	0.83	1.07	0.82
5.	Current fallow	9.89	7.59	9.92	7.61
6.	Other fallows	17.29	13.27	19.33	14.84
7.	Culturable Waste	3.24	2.49	3.20	2.46
8.	Land put to non- agricultural use	22.01	16.89	22.01	16.89
9.	Barren and Unculturable land	4.58	3.51	4.58	3.51
10.	Total Geographical Area	130.33	100.00	130.33	100.00
11.	Cropping Intensity (%)	126		124	-

GoTN, 2017-18 and 2018-19

Annexure 4

Area under major food grain crop in Tamil Nadu Area in lakh

S.No.	Major food crops	2011-12	2012-13	2013-14	2014-15	2015-16	AAGR
1.	Rice	20.16	14.93	17.26	18.30	20.37	0.25
2.	Millet	8.00	6.42	9.33	9.71	9.01	28.15
3.	Pulses	8.32	5.11	8.16	9.40	9.27	2.70
4.	Oil seeds	5.35	3.90	4.08	4.19	4.12	-6.53
5.	Cotton	1.21	1.33	1.51	1.87	1.43	4.17
6.	Sugarcane	3.36	3.48	2.63	2.63	2.57	-6.70

Source: Agriculture policies of Department of Agriculture
AAGR-Average Annual Growth Rate

Annexure 5

Production of major food grain crops in Tamil Nadu Production lakh MT

S.No.	Major food crops	2011-12	2012-13	2013-14	2014-15	2015-16	AAGR
1.	Rice	74.59	40.50	71.15	79.14	73.51	-0.36
2.	Millet	23.24	13.42	32.73	40.58	34.21	9.66
3.	Pulses	3.69	2.13	6.14	7.24	5.85	11.52
4.	Total food grains	101.52	56.05	110.02	126.96	113.57	2.80
5.	Oil seeds	11.14	8.16	9.61	9.73	NA	-4.51
6.	Cotton	3.82	2.55	4.17	6.28	NA	16.57
7.	Sugarcane	385.76	340.14	324.54	244.63	NA	-15.18

Source: Agriculture policies of Department of Agriculture
AAGR-Average Annual Growth Rate

Annexure 6

Area under horticultural crops in Tamil Nadu Area in lakh ha

S.No.	Horticultural crops	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	AARR
1.	Fruits	2.87	3.10	3.29	2.86	2.94	2.95	0.54
2.	Vegetables	2.54	2.74	2.90	2.85	2.93	3.14	4.24
3.	Spices and condiments	1.65	1.78	1.89	1.13	1.16	1.15	-7.22
4.	Plantation crops	2.55	2.75	2.92	6.85	7.06	7.15	20.62
5.	Flowers	0.26	0.29	0.31	0.13	0.14	0.11	-17.20
6.	Medicinal and aromatic plants	0.14	0.15	0.16	0.25	0.26	0.26	12.38
	Total	10.01	10.81	11.47	14.07	14.49	14.76	17.77

Source: Agriculture policies of Department of Agriculture
AAGR-Average Annual Growth Rate

Annexure 7

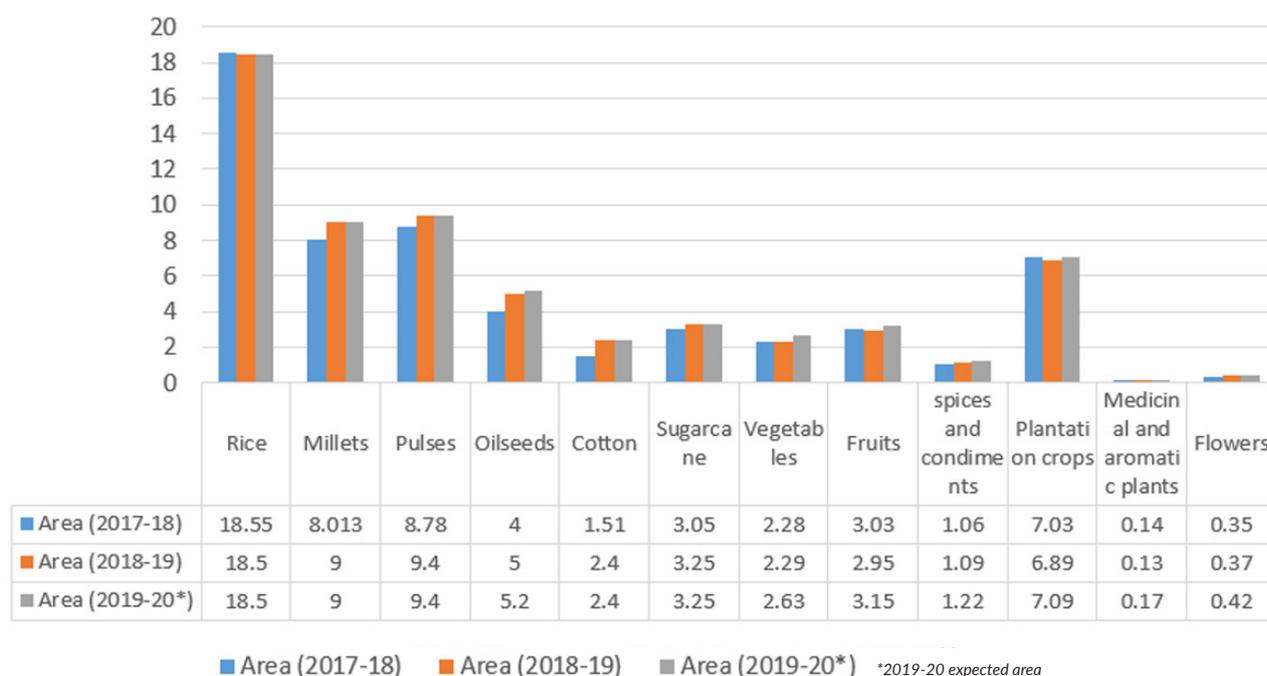
Production of horticultural crops in Tamil Nadu Production Lakh MT

S.No.	Horticultural crops	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	AAGR
1.	Fruits	58.77	67.00	73.70	59.63	62.61	60.08	0.44
2.	Vegetables	69.27	78.96	86.79	75.16	78.92	88.83	4.97
3.	Spices and condiments	10.05	11.46	12.60	7.82	8.21	8.23	-3.99
4.	Plantation crops	10.50	11.97	13.16	12.83	13.48	13.00	4.27
5.	Flowers	2.74	3.12	3.44	2.2	2.31	1.39	-13.57
6.	Medicinal and aromatic plants	1.29	1.47	1.62	3.36	3.52	3.41	19.44
Total		152.62	173.98	191.31	161.00	169.05	174.94	-

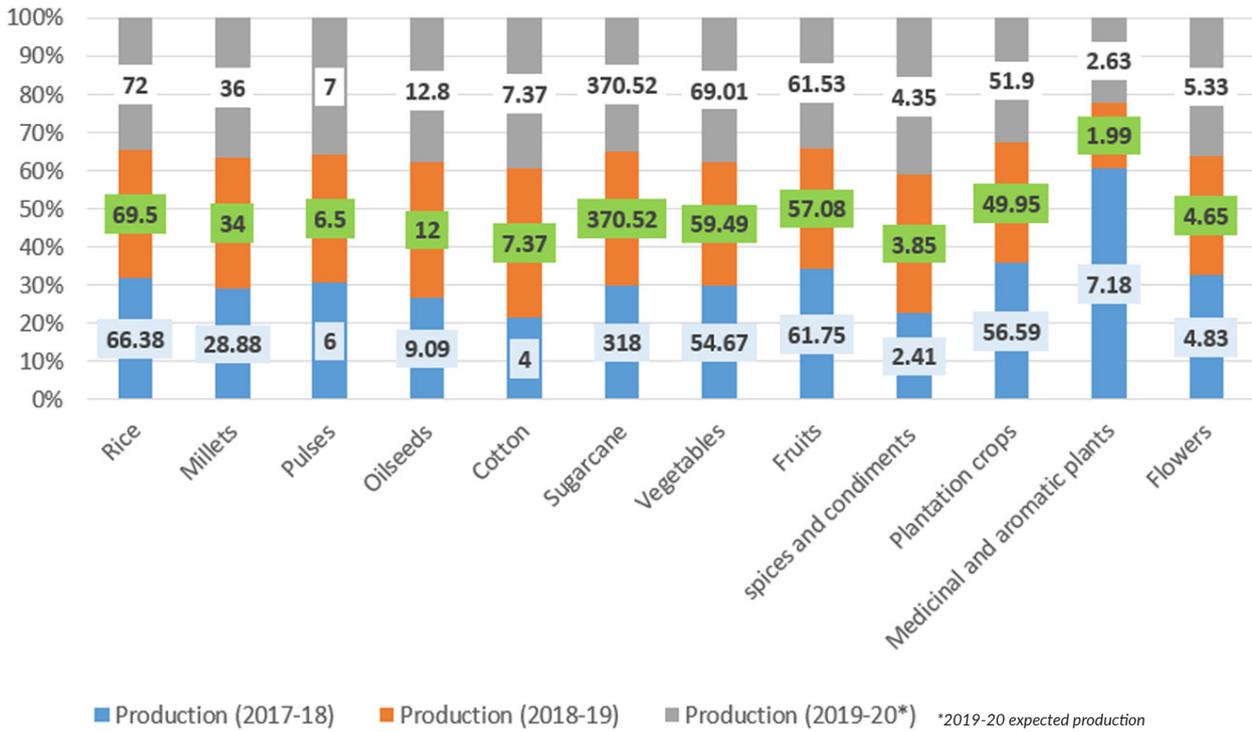
Source: Agriculture policies of Department of Agriculture
AAGR-Average Annual Growth Rate

Area and production of agriculture and horticulture crops

Area of agriculture and horticulture crops during 2017-18, 2018-19 and 2019-20 (in lakh ha)



Production of agriculture and horticulture crps during 2017-18, 2018-19 and 2019-20
(in Million MT)



Annexure 8

Water sources and net irrigated area

S.No.	Irrigation Source	No of availability	Net irrigated area (lakh ha)	Per cent share
1.	Canal	2239	6.72	23.72
2.	Tank	41127	4.38	15.45
3.	Well	1869723	17.20	60.72
4.	Other		0.03	0.11
Total			28.33	100.00

Source: Agriculture policies of Department of Agriculture
AAGR-Average Annual Growth Rate

Annexure 9

The status of the livestock in Tamil Nadu (20th Livestock Census, June 2019)

Sl.No.	Livestock	Livestock population in Tamil Nadu (in million)	Livestock Population in India (in million)	% share to the all India total
1.	Cattle	95.18 (95,18,660)	193.46 (19,34,62,871)	4.92
2.	Bovine	10.03 (1,00,37,455)	303.75 (30,37,58424)	3.30
3.	Sheep	4.50 (45,00,491)	74.26 (7,42,60,615)	6.60
4.	Goats	9.8 (9888746)	148.88 (14,88,84,786)	6.64
5.	Poultry (including backyard)	120.78 (12,07,81,100)	851.80 (85,18,09,931)	14.18

Annexure 10

Resource persons contacted during survey

S.No.	Departments	Contact detail
1.	Department of Agriculture	<p>Mr. P. Pandian (JDA), 19, Santhai Street, Nagercoil, Tamil Nadu. Phone: 04652-277122, Mail.ID. pdatmakany@gmail.com</p> <p>Mr. Senthemizhselvan, Mobile No. 9442326331, Near old bus stand, Salem, 636 001</p> <p>Mr. Ramesh, AO, O/o. JDA, Near old bus stand, Salem, 636 001</p> <p>Mrs. Hema, Deputy Agricultural Officer, Mobile No. 7397753316, #inside Collectorate building, Tiruvarur-610 001</p> <p>Mr. S. Karpagaraj Kumar, Agricultural Officer (AO), Nirubar colony, Tirunelveli-2, Phone: 04622-572514, Mob: 9942982578. Mail.ID: jda_tirunelveli@yahoo.in</p> <p>Mr. M. Sugumar, JDA, Thadagam Road G.C.T. (Post), Coimbatore 641 013, Phone: 0422-2432739 Mail ID: agricbe@tn.nic.in</p> <p>Mr. C. Ethiraj, AO (State Scheme), Mobile No. 9500610512, Collectorate complex, Villupuram district, Tamilnadu. 605602</p>
2.	Department of Horticulture and Plantation Crops	<p>M. Ashok Macrin, Deputy Director of Horticulture (DDH), 19, Santhai Street, Nagercoil, Tamil Nadu.</p> <p>Mr. Aruputham (Deputy Director of Horticulture (DDH), NGO B Colony, Tirunelveli, Phone: 0462-2552632. Mail. ID: ddhtirunelveli@yahoo.com</p> <p>Mr. M. Prakash, HO, Mobile No. 8778013019, #Kuranguchavadi, Omalur Main Rd, Narasothipatti, Salem-636 304</p> <p>Thiru. Sivasubramanian Samraj, JDA, Horticulture House, PostBox no -72, Vijayanagarm, Udthagamandalam -643001 Ph: (0423) 2444056 Fax: (0423) 2444085</p> <p>Mrs. Sathya, Assistant Director of Horticulture, Mobile No. 9400567619, Deputy Director of Horticulture8,Thadagam Road,GCT post,Coimbatore-641013. Office contact. 0422-2453578</p> <p>Mr. A.E. Suresh Kumar, B.Sc., (Hort), Deputy Director of Horticulture, 3rd floor, # 217, Collectorate office additional building, Tiruvarur. Mob: 9443847142</p>

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3. Department of Animal Husbandry
 Dr. Joseph Chandran, B.V.Sc., Regional Joint Director, Collectorate Campus, Kanyakumari. Mob: 9445001195.
 Dr.K. Ramachandran, B.V. Sc., Deputy Director, Mobile No. 9842299488, #Near town hall, Veterinary hospital, Coimbatore, 641 001
 Dr. R. Manoharan, B.V.Sc., Regional Joint Director of Animal Husbandry, Near Tiruvarur Bus Stand, Tiruvarur Mob: 9443133650. Mail.ID: vid-fayan2005@yahoo.com
 Dr. G. Prema, i/c. Regional Joint Directorate of Animal Husbandry, Mobile No: 9445001117, Collectorate Complex, Tirunelveli.
4. Department of Fisheries
 J. Mary Sophia, Inspector of Fisheries, ADF, Vadasery, Nagercoil, Tamil Nadu. Mob: 04652-227460. Mob: 9840670443. Mail. ID: ddrkumari@gmail.com
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