

SUSTAINABLE AGRICULTURE

Kerala is positioned at the intersection of different climatic and geomorphologic features. The topography and physical characteristics change distinctly from east to west, starting with the hills to the east, sloping down to the coast, which is covered by coconut groves. Kerala has rich biodiversity and the Kerala stretch of the Western Ghats is one of the world's 34 biodiversity hotspots.

Kerala agriculture is distinct from that of rest of India in terms of resource endowments, land-use and cropping pattern, scale of farming as well as socioeconomic factors. Geographically, the state has a vast coastal line (low lands, 10 %), midlands (42 %) and high lands (48%). The state receives high rainfall (2500 – 3000 mm), yet faces acute shortage of water in summer. The relative humidity favours cultivation of most of the tropical and subtropical crops but at the same time harbors all major pests and diseases. The diversity in soil, climate and socio-economic endowments in the state favours cultivation of a variety of crops, contributing to a rich and varied crop cafeteria spread across its length and breadth. Another specialty of Kerala is abundance of home gardens estimated at around 64 lakh numbers, presenting a combination of crops, livestock, poultry/duckery and aquaculture.

Notwithstanding the above, the growth rate in agriculture is continuously negative for the past many years, owing to a complex array of factors. As per the estimates of the State Planning Board, the present growth rate of agriculture is about –2% leading to continuous increase of non-farmed area. The share of agriculture and allied sectors in GDP decreased from 35 percent in 1980, to about 14 percent in 2016. On one hand, this shows that the economy is growing but more importantly, it reveals that the growth is not balanced. Such a situation can be arrested only if production and productivity is substantially increased and gross expenditure in production substantially reduced, leading to increased net income.

The Task Force on Agriculture development has been constituted by the Kerala State Planning Board by order dated 5th May 2015. The Task Force Report was prepared after detailed discussion of subsector wise key issues, processing of 12th Five Year Plan document, working group reports prepared for 12th Plan, sectoral papers, agricultural development policy, study reports, Perspective Plan 2030, analysis of secondary data and inputs from the departments. The agricultural development policy for the State was approved in 2015.

In order to secure a sustainable path for a prosperous agriculture sector of the State the Perspective Plan 2030 prepared by the State Planning Board, projects a minimum average growth rate of 2 percent per annum. The focus is on increasing competitiveness and productivity in agriculture so as to raise incomes and wellbeing of farmers and bring prosperity, not only for this generation, but for future generation too. The Plan envisages:

Targets

- The average agricultural growth rate will be a minimum of 2 per cent per annum.
- Improved farming efficiency will be achieved despite the expected drop in agricultural area.
- The expenditure allocation towards agricultural research and education to be raised to 1–2 per cent of GSDP of agriculture by 2030.

Mission

- Foster global competitiveness, growth and profitability in the sector in order to attract new investment.
- Build lasting partnerships between public, private and other community stakeholders.
- Increase creation of wealth in agriculture and rural areas.
- Improve investor confidence leading to increased investment in agricultural activities and rural areas.
- Promote sustainable use of agricultural resources.

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Strategic framework

The strategic framework encompasses plantation and non-plantation crops. The strategic framework will have three main pillars:

- (i) Agricultural prosperity
- (ii) Social inclusiveness: Food security, livelihood, rural area development
- (iii) Natural resource conservation

The strategic framework for Kerala Agriculture is developed to promote green economy based on agro-ecology principles that results in improved human well being and social equity while significantly reducing environmental risks and promoting environmental services. The strategic framework is suggested under four pillars with identified focus areas under each pillar.

The strategic pillars and the focus area under each pillar are shown below:

1. Pillar 1 : Raise Agriculture productivity

- Closing the yield gap
- Improved Soil Health Management
- Improved Plant Health Management
- Promote new technologies
- Develop Technology Infrastructure
- Promote innovation

2. Pillar 2: Raise investment in Support Infrastructure

- Soil and water conservation
- Minor irrigation
- Input production infrastructure
- Laboratory net works
- Market/storage/post-harvest

3. Pillar 3 : Strengthening livelihood and assured income

- Revival of the perennial Tree crop systems
- Promote homesteads and Integrated Farming Systems
- Food and Nutrition Security 59
- Mechanisation
- Climate smart agriculture
- Support for low cost credit
- Promote value added agriculture
- Risk management
- Urban agriculture
- Expand social safety nets

4. Pillar 4 : Improve Service delivery

- Prominent and mainstreamed extension system
- Expand Agroservice centres
- Promote social capital development
- HRD and continuing Agriculture education
- Leveraging ICT application.

Some of the existing agricultural policies and programmes targeting to increase agricultural production in Kerala are very relevant in context of climate change. Watershed management programme, soil and water conservation initiatives, rain water harvesting, input availability and efficiency, promoting organic farming and insurance schemes are particularly relevant. Some of the key programmes in the agriculture sector in the states relevant in the context of climate change are given below:

- ❖ **The Kerala Conversion of Paddy Land and Wetland Bill, 2007:** This bill is intended to conserve the paddy land and wetland and to restrict the conversion or reclamation thereof in Kerala.
- ❖ **Insurance Schemes:** A significant contribution made as the part of rice farmer's welfare is the commencement of Kisansree, a programme for providing insurance cover to five lakh farmers in the state
- ❖ **Rashtriya Krishi Vikas Yojana (RKVY):** As per the scheme, the Government of Kerala has to prepare the State and District-level plans in the field of agriculture based on agro-climatic conditions, availability of technology and natural resources.

- ❖ **Training Institute:** Kerala has started an agricultural training institute and identified as a very important input to strengthen the micro level agricultural activities to make it more farmer-friendly and profit oriented.
- ❖ **Formation of Debt relief Commission:** Formation of Debt Relief Commission was much lauded as the state had no model in the country to emulate.
- ❖ **Organic farming:** Kerala has a remarkable share in the organic agriculture. The Department of Agriculture, the State Horticulture Mission (SHM) and the VFPC are the major agencies supporting the organic farming directly in the state apart from NGOs.
- ❖ **Collective farming through Kudumbashree :** Harithashree the lease land farming promoted by the State Poverty Eradication Mission, Kerala, through Kudumbashree, has helped women farmers to stay on in agriculture for their livelihood. The major crops cultivated by the Kudumbashree group is paddy (27 % of area) followed by plantation and vegetables under the lease land farming

Kerala State Organic Farming Policy, Strategy and Action Plan

There is a rich potential for promoting organic farming in Kerala in the light of the fact that intensity of inorganic agriculture here is not that severe compared to that in other States in the country. While the national average consumption of fertilizers and pesticides during 2002-2003 was 90kg/ha and 288g/ha respectively, it was only 60kg/ha and 224g/ha respectively in Kerala. This points to the positive side of agriculture in Kerala in terms of the already low levels of consumption of hazardous chemicals and, therefore, chances of redeeming farmers to organic agriculture are quite high.

The State Department of Agriculture commenced organic farming promotional activities since 2002-03. In the following year, the Department set up a cell for Promotion of Sustainable Agriculture and Organic Farming. It has also launched two brands, namely 'Kerala Organic' and 'Kerala Naturals' to market organic farm produces. Currently, about 7,000 farmers practice organic farming in the State as per NPOP standards, covering a total area of 5750 ha.

Organic Farming Policy, Strategy and Action Plan Vision

Make Kerala's farming sustainable, rewarding, and competitive, ensuring poison-free water, soil and food to every citizen.

Objectives

1. Make farming sustainable, remunerative and respectable.
2. Enhance natural soil fertility and productivity.
3. Ensure soil and water conservation.
4. Ensure agricultural bio-security and food and nutritional security.
5. Create and ensure domestic market for organic products controlled by the farmers.

6. Avoid the use of agrochemicals and other hazardous material and, ensure chemical free water, soil, air and food.
7. Ensure seed, food and sovereignty.
8. Promote biodiversity based ecological farming.
9. Ensure quality control in organic inputs and agricultural produce
10. Enable human health promotion by providing safe agricultural products and commodities
11. Conservation and extension of traditional knowledge related to agriculture.

Strategies and Action Plan

The mission to convert Kerala into an organic State is to be achieved focusing on potential crops and areas in a phased and compact manner with the aim of converting a minimum of 10% of the cultivable land into entirely organic every year and thus achieving the target within five to ten years. On completion of the third year of implementation of the organic farming policy, a Committee of experts comprising representatives of farmers and scientists should make a comprehensive assessment of the farmer's wellbeing, economy and environment and, only after rectifying the drawbacks, if any, can the policy be implemented in rest of the areas.

The strategies

1. Ensure seed sovereignty of the farmers and the State
2. Implementation of organic farming policy in a phased manner
3. Compact Area Group approach in organic farming
4. Strengthen soil and ensure water conservation measures
5. Promote a mixed farming approach for livelihood security and ecological sustainability
6. Conserve and improve agro-biodiversity and undomesticated biodiversity
7. Launch a state-wide intensive campaign on organic farming in the form of a popular movement: "Jaiva Keralam"
8. Ensure availability of quality organic manure to the farmers
9. Ensure farm inputs for organic farming
10. Capacity Building for farmers, implementing officers, agencies, and local self-government members
11. Develop Model Sustainable Organic Farms in the State
12. Ensure and improve the health and wellbeing of the tribal through special tribal agriculture programmes.
13. Establish Producer Companies promoted by organic farmers
14. Establish storage and transportation facilities
15. Promote farm level processing, value addition and encourage the use of organic farm produce in food industry
16. Develop diverse channels for marketing of organic produce
17. Develop a simple certification process in the State for all organic farmers
18. Provide financial incentives for promoting organic farming
19. Encourage the use of renewable energy sources
20. Introduce organic farming in education institutions

21. Reorient Research, Education and Extension
22. Phase out Chemical Pesticides and Fertilizers from the farming sector
23. Integrate the programmes and activities of various departments, local self-governments and organizations
24. Organisational set-up for promotion of organic farming

Agriculture will be prosperous, if it is socially inclusive and environmentally friendly. In coming years, there will be a paradigm shift from subsistence farming to highly knowledge- intensive, competitive farming. Institutions and Innovations for Sustainable Agricultural Growth, argues the need for a paradigm shift from subsistence farming to knowledge-intensive, competitive farming. The focus will be on increasing competitiveness and productivity in agriculture in order to raise the incomes and well-being of stakeholders and bring long-term prosperity. Land zoning is key to this sector, with paddy fields being protected as they are mostly low-lying wetlands. Other measures include forming producer companies, adopting the latest technology and implementing integrated farming techniques.

Sustainable agriculture - Some Promising Technologies / Farming Practices in Kerala

Rice-based Integrated Farming System

Rice fields in the coastal Kerala are typical wetland eco-system with numerous ecological and economic functions. High rainfall coupled with undulating topography of Kerala generates different moisture regimes for crop growth resulting in a wide range of micro-environments. Given the combination of season, and topography, rice in Kerala is grown under a variety of agronomic conditions ranging from totally dry to floating rice under rising flood conditions, from rainfed to irrigated conditions, sandy to clayey soils and saline to acidic soils. Crop diversification has immense potential in rice-based ecosystems. The studies conducted at Cropping Systems Research Centre, Karamana revealed that raising green manure (*dhaincha*), *bhindi* or short duration cassava in paddy fields during summer not only enhanced the profitability and employment but also resulted in a shift of the obnoxious weed flora *Echinochloa crusgalli*. In rice-based diversified cropping systems, one crop of rice followed by two crops of Nendran banana offers high income potential. In such a system, over 10 t/ha crop residues are available for nutrient recycling.

Homestead-based Integrated Farming System (IFS)

Homestead-based integrated farming system (IFS) is one of the most suitable farming systems in Kerala which helps farmers to increase productivity and income in a sustainable manner. Homestead farming satisfies the requirements of sustainability by being productive, ecologically sound, stable, economically viable, and socially acceptable. The productive aspect of homestead farming arises from the fact that home gardens are resource islands that provide a wide variety of goods for domestic consumption, such as food, beverages, construction materials, firewood, and other household supplies. The system has the capacity to sustain crop or pasture production

in the presence of trees, in addition to production from the trees themselves. The different crop or tree species in the home garden satisfy the multifarious needs of the farmer. The produce from trees often provides a substantial proportion of the energy and nutritive requirements of the household's diet. A characteristic of food production in home gardens is that the combination of crops with different production cycles results in a continual supply of edible food. The livestock component, besides providing financial support at times of distress, supports the farmer by providing draught power, milk, meat, and organic manure.

Banana-based Cropping System

An integrated approach in banana farming is a successful intervention demonstrated by KVK, Kozhikode with the objective of enhancing the income of farmers. This technique showed an increase in the yield to the fold of 37 per cent in Kozhikode district of Kerala. Foliar and soil application of a nutrient mixture was done to enhance the production. Foliar application was done at the rate of 5g/l of water from 4 months after planting till bunching at monthly intervals. While soil application with a recommended dosage of 100g/plant was taken up at 2 months and 4 months after planting. These nutrient mixtures for foliar and soil application are obtained from ICAR-IIHR, Bangalore and KAU, Thrissur respectively. Banana based integrated farming approach was implemented in Naduvannur, Ulliyeri, Changaroth, Perambra, Kavilumpara, Cheruvannur and Maruthonkara panchayats during 2012 to 2016. An exclusive license to produce and sell the formulations from ICAR-IIHR, Bengaluru was also obtained. Collaboration with ATMA for scaling up production technologies boosted the prospect of this farming intervention. With a few interventions in the traditional banana based cropping system, plants bunched by 5 ½ months after planting while check plot bunching by 7 months only. Average bunch weight increased to 14 kg from about 10 kg. Average yield in the demonstration plot was 20% higher with 11.6 kg fruits per plant compared to 9.7 kg in check. Bunches matured simultaneously; uniform in size with bright yellow coloured fingers. All these helped the farmers to reduce harvesting and transportation cost due to its even maturity. The economics of banana cultivation also took an upturn with the productivity of Nendran banana in Kozhikode district increasing from 4259 kg/ha of 2011-12 to 5427kg/ha in 2015-16, almost an increase of 27 percent. Income increased from 2.4 lakh/ha to Rs 4 lakh/ha, so is there standard of living.

Open Precision Farming in High-density Planting Banana

With a focus on increasing the area under banana and its productivity, KVK, Ernakulam took the initiative to introduce open precision farming in banana. Open precision farming is a type of high tech farming where the benefit of optimized farming is extracted into the open fields. Generally, precision farming is carried out in poly house cultivation but by bringing this into the open fields for cultivation of banana, the farmers are made aware of the essentiality of applying optimum amount of fertilizers and pesticide formulations. This will help in saving water and other inputs and will result in an efficient farming practice. By the introduction of precision farming technology in the fields of Ernakulam, average production per plant was seen to be 9.3

kg. Also the area under banana cultivation increased from 160 plants to 380 plants per 25 cents. Total yield increased by 116 per cent.

Rice-Fish-Duck-Buffer Integration in Submerged Wetlands

Integrated farming involving poultry and aquaculture has great relevance to the coastal rice lands such as *Kuttanad*, *Kole* and *Pokkali/Kaippad*. The coastal saline soils along the Ernakulam district are referred to as pokkali fields, whereas in the Alappuzha and Kannur districts they are known as Karilands and Kaipad, respectively. The traditional paddy cultivation involving a salt-resistant and tall pokkali variety of paddy, which is practiced during the rainy season from May-June to September-October is followed by shrimp filtration from November to April, in the saline phase. Shrimp filtration is essentially a trapping cum holding system in which water is let into the field through sluice gate during high tide, but when the level reaches the same as outside, the gate is closed trapping valuable fish and shrimp. There are many advantages to this system of integrating traditional farming of paddy and fish/shrimp together. The paddy field provides room for naturally available fish or shrimp juveniles to grow and attain marketable size, providing natural feed for fishes and shrimps while the animal excreta provide nutrients for the ensuing paddy crop. Such a system will not only reverse the present trend of non-utilization and under-utilization of rice field but also make rice farming more attractive, consequent to the increase in productivity and profitability. As buffalo/poultry/duckery also forms an integrated constituent of such a farming system, it can sustain food security. This system of farming could trigger a process of change whereby the income and economic prosperity of people living in these areas will increase leading to economic resurgence.

Vertical Farming for Urban/Peri-urban Households

Integrated intensive vertical farming is an innovative farming system concept which is suitable for land-constrained terrains in the states of Kerala and north-east. A model vertical farming unit developed by the KVK, Kannur and popularly known as „Giggin“s Farm Villa“ is ideal for large scale adoption due to its high comprehensive design and lucrative income prospects. The unit can be set up even on one cent of land. What makes it attractive is its multifaceted nature, wherein farmers can rear goats, hens, rabbits and quails, while also cultivating vegetables, gathering seeds, supplying saplings and catering to production of organic manure.

The pyramidal structure of the farm makes it self-supporting. The farm is like an apartment where animals are grown in different storeys. Adequate micro climate is assured for animals and crops to have a sustainable production of eggs, meat, milk and vegetables. All the components in the vertical farm are in harmony. Waste from one component is used as input for other. The 26 efficiency of the farm depends on how well the components are managed throughout the year. Estimates reveal that Rs.2 lakhs to Rs.2.5 lakhs may be earned a year and the farm will be earning profit by the third year.

The pyramidal structure is further modified as galleries where fodder and high-value crops of the farmer's choice may be grown. Azolla grown on the side ramp provides nutritive feed for animals and poultry. An overhead tank with micro irrigation coupled with recycling of animal urine collected from the farm helps organic production of fodder and high value vegetables. The farm produce may be marketed as organic or safe-to-eat products.