GOVERNMENT OF KERALA
KERALA STATE PLANNING BOARD

FOURTEENTH FIVE-YEAR PLAN
(2022-2027)

WORKING GROUP ON
HOW CAN KERALA DOUBLE ITS VEGETABLE PRODUCTION IN THE NEXT FIVE YEARS

REPORT

AGRICULTURE DIVISION
March 2022

FOREWORD

Kerala is the only State in India to formulate and implement Five-Year Plans. The Government of Kerala believes that the planning process is important for promoting economic growth and ensuring social justice in the State. A significant feature of the process of formulation of Plans in the State is its participatory and inclusive nature.

In September 2021, the State Planning Board initiated a programme of consultation and discussion for the formulation of the 14th Five-Year Plan. The State Planning Board constituted 44 Working Groups, with more than 1200 members in order to gain expert opinion on a range of socio-economic issues pertinent to this Plan. The members of the Working Groups represented a wide spectrum of society and include scholars, administrators, social and political activists and other experts. Members of the Working Groups contributed their specialised knowledge in different sectors, best practices in the field, issues of concern, and future strategies required in these sectors. The Report of each Working Group reflects the collective views of the members of the Group and the content of each Report will contribute to the formulation of the 14th Five-Year Plan. The Report has been finalised after several rounds of discussions and consultations held between September to December 2021.

This document is the Report of the Working Group on "How can Kerala double its vegetable production in the next five years?" The Co-Chairpersons of Working Group were Dr.T.Pradeep Kumar and Ms.C.A.Letha IAS. Dr.R.Ramakumar, Member of the State Planning Board co-ordinated the activities of the Working Group. Sri.S.S.Nagesh, Chief, Agriculture Division was the Convenor of the Working Group and Smt.G. C. Roshni, Agronomist, Agriculture Division was Co-Convenor. The terms of reference of the Working Group and its members are in Appendix-1 of the Report

Member Secretary

PREFACE

As part of formulation of the 14th Five Year Plan, the Kerala State Planning Board had constituted working groups of experts in all the major sectors. In Agriculture and Allied Sectors, 6 working groups were constituted viz. Agriculture and Cooperation, Animal Husbandry and Dairy, Inland and Marine Fisheries, Forest and Environment, Water Resources and Regional Packages. To discuss and frame policies in each of these sectors, the working groups were further divided into 28 Expert Sub-Groups (ESG) with specific mandates.

Each Expert Subgroup held at least three meetings beside one focused group meeting before finalising the report. We, the Co-Chairs, place our deep appreciation and gratitude to all the esteemed members of the ESG for their valuable contributions in preparing the report. We are extremely grateful to Dr. V. K. Ramachandran, the Honourable Vice-Chairperson, Kerala State Planning Board, Dr. R. Ramakumar, Member, Kerala State Planning Board Sri. S. S. Nagesh, Chief, Agriculture Division for their consistent guidance and suggestions in preparing the report. The support provided by Dr. C. Anil Kumar, Assistant Director and Smt. Shahida. M. N, Research Assistant in bringing out this report is appreciated. The drafting team put in commendable work in bringing together all the views and opinions of the members. We sincerely hope the recommendations in the report can lead to important changes in the public policy on agricultural development in the State

Dr.T.Pradeep Kumar
Expert Co-Chairperson

Ms. C.A.Letha IAS
Official Co-Chairperson

CONTENTS

HOW CAN KERALA DOUBLE ITS VEGETABLE PRODUCTION IN THE NEXT FIVE YEARS

HIGHLIGHTS

- Domestic production of vegetable is around 15.7 lakh tonnes which meets hardly 40 % of the requirement of Keralites.
- Huge pressure on land and extended homesteads limit the scope of further extension of open cultivation of vegetables in Kerala.
- Suggestions for attaining this possible yet difficult goal involve meticulous planning, re-education, convergence of different departments and organizations, as well as the creative use of technological innovations

EXECUTIVE SUMMARY

Introduction: Diverse climatic conditions that prevail in different parts of Kerala facilitates the cultivation of a variety of vegetable crops that differ in their temperature requirement, cultivation practices, parts used, etc. Huge pressure on land and extended homesteads limits the scope of further extension of open cultivation of vegetables in Kerala. Domestic production of vegetable is around 15.7 lakh tonnes (excluding tapioca) which meets hardly 40 % of the requirement of Keralites. Government of Kerala has made a firm commitment to double the vegetable production during 14th five-year plan period.

Objective: The mandates assigned are

- To assess the progress achieved in increasing area, production, and productivity of vegetables in Kerala over the past five years.
- To suggest a roadmap to double vegetable production in Kerala over the next five years with special focus on increasing productivity and farmer' s income.
- To examine the ways in which the institutions of LSGs, Cooperatives and FPCs can be utilized to participate in vegetable production efforts.
- To suggest ways in which existing systems of vegetable production are modernized and integrated with the different schemes of the Government as well as post-production activities.
- To review the existing procurement and distribution systems, including Government initiatives, and suggest a transparent, technology-driven platform with the active support of LSGs, Cooperatives and FPCs.
- To suggest ways to reform the existing Government schemes to support production.

Progress in increasing area production and productivity of vegetables in Kerala over the past five years: In 2018-19, Kerala could nearly double the area and production of vegetables in comparison with 2015-16 (Table 1). The area under vegetable cultivation increased from 46,500 ha to 82,166 ha with production escalating from 6.3 lakh metric tonnes to 12.1 lakh metric tonnes.

Critical gaps in formulation and implementation of schemes during 13th plan: Several critical issues have been identified through the analysis, and these are listed below

- Lack of integration between agencies, Department of Agriculture, VFPCK, Horticorp, and LSGs in the implementation of vegetable development schemes.
- Inadequate mechanism to assure the quality and supply of seeds, grafted seedlings, bioinputs, limited use of Agromet advisory service, poor adoption of soil test-based fertilizer application.
- Inadequate storage, transport, and marketing support.
- Lack of AEU-based crop production and marketing plan; no production plan or staggered crop production for daily supply to potential markets
- Incomplete database about farmers and local vegetable production. Potential of IOT not exploited.
- No proper support for farmers cultivating on leased land

- Identification of beneficiary and distribution of assistance is based on area and not on production
- Lack of continued support for farmers availing assistance under protected cultivation.
- No convergence mechanism to accommodate social organizations involved in vegetable cultivation.

Suggestions: The suggestions put forth by the committee are listed below.

1. Promote commercial vegetable cultivation in potential AEUs through cluster approach. Adopt location-specific production protocols. The production potential in each AEU should be identified and target-based production should be planned accordingly.
2. More emphasis should be given to the attainment of the physical plan target than the financial plan at the field level. A production plan needs to be formulated for staggered vegetable farming, not only in commercial fields but also in the homesteads and institutions. Explore the feasibility of establishing "market intelligence" centres to provide an idea of the possibility of the potential crop which the farmers can grow in the coming season to fetch maximum price in markets.
3. Promote scientific organic farming that stresses safe-to-eat vegetable, bolstered by 'Eat local' campaigns, responsible branding, kitchen gardens, and recycling.
4. Adopt a comprehensive policy for popularizing hybrids/high yielding varieties. Promote cultivation of market- friendly vegetables among commercial growers after identifying potential AEUs. Monitor the quality of seeds supplied by private agencies.
5. State/District-level seed production plan may be prepared for seed and planting material production and marketing incorporating farmer participation, State farms that promote new nucleus seed, promotion of new varieties, and seed certification.
6. Promote nutrigarden concept in all households and apartments with suitable methods and technological interventions.
7. Popularise rain shelter, low-cost polyhouse, and net-house cultivation of vegetables. Grafted seedlings maybe promoted and training given for their production.
8. Promote soil test-based fertilizer application for commercial farming with a thrust on INM, and augment soil testing labs.
9. Agromet advisory services should be improved and popularised.
10. Popularise open precision farming, mechanization with emphasis on solar pump sets and solar-based fencing to prevent the attack of wild animals in vegetable-growing clusters. Adopt modern techniques like hydroponics, aquaponics, vertical farming in urban and semi urban clusters.
11. Adopt IPM, biocontrol agents, and ecological engineering principles; explore newer low-toxicity pesticides, promote pesticide literacy. Implement crop insurance against the incidence of identified pest and diseases beyond a threshold level.
12. Promote R&D of high-quality hybrids and varieties, pest, and disease resistance. Tropical vegetable research centre should be established to coordinate and prioritize vegetable research.
13. Promote convergence involving DoA, VFPCK, Horticorp, LSGs, and Kudumbashree, and integration of the roles and responsibilities of all the stake holders pooling all the

available resources at various levels of LSGIs

14. Establish a professionally managed, IT-enabled decentralized procurement and marketing system that ensures competitive prices to the producers. FPOs/FPCs and co-operatives should be exploited in procurement, value addition, and marketing of vegetables.
15. More schemes should be devised on FLD for advanced technologies like aeroponics, hydroponics, and vertical farming.
16. Production-linked subsidy and separate assistance may form part of the subsidy schemes. Improve assistance to commercial cultivation of vegetables (cluster) by 25 to 50%. Bring farmers cultivating in lease land also under subsidy regime.
17. Assistance to production of State plan projects may be increased by availing more funds from MIDH/CSS schemes. Promote INM, Agromet bulletins, pesticide literacy and post-harvest management in campaign mode using Krishi paadashala.
18. Procurement and marketing of vegetables should be streamlined by defining clear roles to Horticorp, VFPCK, and DoA. Establish district procurement centres, cold storage facilities, retail outlets, temperature-controlled supply chain facilities, and processing centres.
19. Provide infrastructure support to VFPCK and other farmer markets. FPOs could be tasked with providing logistic support. Development of online sales via Thalir brand is a priority. Modernization of these markets is also necessary.
20. Cafeteria model allocation is suggested to bring more convergence and effectiveness of schemes in output delivery. Out of total outlay, 25 percent is suggested as flexi funds under the optional components. The annual fund requirement is projected as Rs.150 crores. Along with the increase in outlay, the assistance under different components may be revised once in three years to account for inflation. Like LSGD schemes, all the components under the VDP may be approved in April itself like the green book model.
21. Incentives may be provided to traders and farmers for participation in cluster markets as well as a transport support for transporting surplus produce from one market to another in times of glut.
22. A major reform is proposed to provide interest free credit to farmers. More encouragement for promoting lease-land farming is required. In lease-land farming a farmer-friendly certificate system must be introduced to help engage more farmers. Similarly, the upper limit of extending assistance may be increased to 15 acres from the current 5 acres with adequate budget provision.
23. All assistance under VDP may be provided through the AIMS portal, which needs to be revamped, for faster service delivery to beneficiaries. The possibility of developing the AIMS portal for marketing also to be explored and expanded.
24. A certification authority may be formed under the DoA for the certification of organic agriculture. Export potential of ethnic vegetables under organic branding should be explored.
25. Explore the scope of establishing a professional, end-to-end, blockchain-enabled logistics and infrastructure supply chain backbone for agricultural produce (mainly

vegetables/fruits/tuber crops) in Kerala. Promote agri-startups.

Conclusions: Doubling vegetable production in Kerala by the end of the 14th plan period is an attainable yet difficult goal that requires careful planning on different fronts and coordination of different agencies. The situation has been analysed in detail, and concrete suggestions provided.

1. INTRODUCTION

The diverse climatic conditions that prevail in different parts of Kerala facilitates the cultivation of a variety of vegetable crops that differ in their temperature requirement, cultivation practices, parts used, etc. Unlike other Indian States, the absence of a distinct winter climate in Kerala provides an ideal situation for growing summer season crops throughout the year. Cool season vegetables are also grown in Idukki, Wayanad, and the high altitude villages of Palakkad district. Cultivation of bitter gourd, snake gourd, bottle gourd, cucumber, ashgourd, ivy gourd, pumpkin, ridge gourd, cow pea, okra, amaranth, chilli, brinjal, coleus, Colocasia, amorphophallus, potato, garlic, cabbage, carrot etc. are mainly market-oriented. Minor vegetables likes Dolichos beans, chekkurmanis, bird pepper, drumstick, winged bean, curry leaf, clove bean etc. are grown in the home garden mainly for domestic use. Among the twenty-three agro ecological units (AEUs), vegetables can be commercially cultivated in fifteen. Huge pressure on land and extended homesteads limit the scope of further extension of open cultivation of vegetables in Kerala. Domestic production of vegetable is around 15.7 lakh tonnes (excluding tapioca) which meets hardly 40 % of the requirement of Keralites. Neighbouring States still contribute bulk of vegetable requirement and almost 100 % of potato, onion and tomato is from outside. Government of Kerala has made a firm commitment to double the vegetable production during 14th five year plan period. This expert subgroup is assigned with a task of providing a roadmap to double the vegetable production in the next five year plan with simultaneous increase in income of farmers. The mandates assigned are

- To assess the progress achieved in increasing area, production, and productivity of vegetables in Kerala over the past five years.
- To suggest a roadmap to double vegetable production in Kerala over the next five years with special focus on increasing productivity and farmer' s income.
- To examine the ways in which the institutions of LSGs, Cooperatives and FPCs can be utilized to participate in vegetable production efforts.
- To suggest ways in which existing systems of vegetable production are modernized and integrated with the different schemes of the Government as well as post-production activities.
- To review the existing procurement and distribution systems, including Government initiatives, and suggest a transparent, technology-driven platform with the active support of LSGs, Cooperatives and FPCs.
- To suggest ways to reform the existing Government schemes to support production.

2. PROGRESS IN AREA, PRODUCTION AND PRODUCTIVITY OF VEGETABLES IN KERALA

As mentioned in the Kerala Development Report (2021), one of the success stories of the 13th Plan was the achievements in vegetable production. In 2018-19, Kerala could nearly double the area and production of vegetables in comparison with 2015-16 (Table 1). The area under vegetable cultivation increased from 46,500 ha to 82,166 ha with production escalating from 6.3 lakh metric tonnes to 12.1 lakh metric tonnes (GoK, 2021). The data from the Central Statistics Office (CSO) on the crop-wise value of output (VOO) of vegetables in Kerala also validated this growth shift.

Table 1. Area and production of vegetables, Kerala

Year	Area (ha)	Production (lakh MT)
2015-16	46,500	6.3
2016-17	52,83	7.3
2017-18	69,047	10.0
2018-19	82,166	12.1
2019-20	96,313	14.9
2020-21	1,02,000	15.7

Source: DoA and Farmer's Welfare, Government of Kerala

The crop-wise area and production of vegetables in the State in 2018-19 are given in Table 2. Raw banana and plantains, which are commonly used as vegetables in Kerala households, together occupy 19.81% of the total area under vegetables and 33.94% of total vegetable production. Tuber crops such as amorphophallus, Colocasia, sweet potato, and other minor crops occupy 18.20% of the area and constitute 16.66% of total vegetable production. Cool-season vegetables[1] are grown in 4.27% of the total area with vegetables contributing to 4.89% of the total production of vegetables. Cowpea remains the most widely cultivated vegetable crop with an area of 7008 ha (8.53%), with a total production of 77793.80 MT in 2018-19, followed by bitter gourd, snake gourd, and cucumber. The details of the district-wise area are given in Annexure I.

[1]*Potato, carrot, radish, and beetroot are not included. They are classified under cool season vegetables as their commercial cultivation is confined to a small geographical area*

Table 2. Crop-wise Area and Production of Vegetables in Kerala 2018-19

Sl.no	Crop	Area under Vegetable Cultivation		Production of Vegetables	
		Total Area (Ha)	Percentage (%)	Production MT	Percentage (%)
1	Amaranthus	3292.6	4.0	42804.3	3.5
2	Bhindi	3081.0	3.8	27729.0	2.3
3	Brinjal	3292.0	4.0	33315.0	2.8
4	Cowpea	7008.5	8.5	77793.8	6.4
5	Tomato	1171.0	1.4	12881.0	1.1
6	Cucumber	3835.7	4.7	64055.7	5.3
7	Chilly	1205.2	1.5	12951.3	1.1
8	Coccinea	847.0	1.0	9147.6	0.8
9	Ash gourd	2472.7	3.0	24974.1	2.1
10	Bitter gourd	4701.0	5.7	47480.1	3.9
11	Snake gourd	3938.0	4.8	42530.6	3.5
12	Ridge gourd	785.0	1.0	7065.0	0.6
13	Salad cucumber	697.5	0.9	7672.1	0.6
14	Pumpkin	1886.0	2.3	22632.0	1.9
15	Drumstick	365.0	0.4	2244.0	0.2
16	Curry leaf	106.9	0.1	1511.3	0.1
17	Beans	2065.5	2.5	19376.5	1.6
18	Cluster beans	33.2	0.0	249.6	0.0
19	Carrot	811.4	1.0	8873.7	0.7
20	Cabbage	1277.8	1.6	27799.7	2.3
21	Cauliflower	189.4	0.2	2052.0	0.2
22	Beet root	28.1	0.0	530.0	0.0
23	Garlic	677.0	0.8	6176.0	0.5
24	Onion	2.1	0.0	83.0	0.0
25	Small Onion	67.2	0.1	863.2	0.1
26	Lemon	15.2	0.0	561.5	0.1
27	Curry Naranga	40.4	0.1	116.0	0.0
28	Coriander Leaf	4.0	0.0	447.5	0.0
29	Mint leaf	15.1	0.0	245.4	0.0
30	Amla	11.8	0.0	394.0	0.0
31	Capsicum	149.8	0.2	940.9	0.1

32	Bottle gourd	604.2	0.7	5844.9	0.5
33	Citrus	2.5	0.0	10.0	0.0
34	Radish	217.6	0.3	2320.4	0.2
35	Amorphophallus	4777.4	5.8	71689.5	5.9
36	Potato	153.1	0.2	10112.7	0.8
37	Ginger/Turmeric	5882.4	7.2	75410.7	6.2
38	Colocasia	1681.9	2.1	18500.0	1.5
39	Minor tubers	7730.5	9.4	109438.9	9.0
40	Sweet potato	766.2	0.9	2403.0	0.2
41	Banana(raw)	12532.0	15.3	257297.1	21.2
42	Banana Plantain	3746.3	4.6	154306.0	12.7
TOTAL		82166.9	100.0	1212829.0	100.0

Source : Source: DoA and Farmer's Welfare, Government of Kerala

Efforts have been taken to sustain this growth under Subhiksha Keralam, a project launched by the Government of Kerala with the broader objective of attaining food self-reliance by enhancing the area, production, and productivity of food grains, millets, vegetables, fruits, tubers, and pulses in the State, enhancing income of farmers, employment generation, attracting youth and repatriates to agriculture, strengthening animal husbandry and fisheries, and promoting organic farming.

As part of the Subhiksha Keralam project, the Vegetable Development Programme has been formulated to promote vegetable production in the State in a safe-to-eat manner and attain self-sufficiency in the sector. The scheme will be implemented in a mission mode involving all the stakeholders in this sector viz. the Agriculture Development & Farmers Welfare.

It will be implemented in close coordination with the Haritha Keralam Mission with clearly defined physical targets at AEU, Panchayat level and other deliverables. The convergence of vegetable development activities carried out by LSGD, VFPCK, SHM, KAU and Horticorp under the mission is expected to be achieved through the programme. Co-ordination of all PSUs, ATMA, organic farming (GAP, PGS System), marketing, infrastructure programmes shall be ensured for the success of the programme. Along with the commercial cultivation of vegetables (cluster), homestead cultivation will be promoted in all the households in the State for producing safe-to-eat vegetables throughout the State. Institutional cultivation is another thrust area. Productivity increase is given high priority. The proposed activities and corresponding allocation of funds under Vegetable Development Programme 2021-22 are given in table 3

Table 3. Vegetable Development Programme 2021-22

Sl. No.	Components	Amout (in Lakh)
1	Homestead vegetable cultivation including Onam vegetable cultivation (Onathinu oru muram Pachakkari)	1800.00
2	Vegetable Cultivation through institutions	200.00
3	Development of District Clusters	2725.00
4	Block level federated organizations (Block Sangamaithries)	10.00
5	Additional Support to best performing 'A' Graded Clusters	5.00
6	Development support to graded clusters	20.00
7	Technical Support and contractual appointments	50.00
8	Establishment of nurseries	5.00
9	Rain shelter cultivation	500.00
10	Promotion f zero energy cool chamber	0.90
11	Community drip irrigation	19.00
12	promotion of urban clusters, marketing and input centres	850.00
13	Digital documentation	9.00
14	Opertional support	1.10
15	Pesticide Residue Analysis in Vegetables	25.00
16	Support to VFPCK	725.00
17	Subhiksha Keralam-Additional Allocation	500.00
	Total	7445.00

Source: DoA and Farmer's Welfare, Government of Kerala

With an annual subsidy for vegetable farmers fixed as Rs 20,000 per ha, Rs 25,000 per ha, and Rs 30,000 per ha non-pandal, pandal, and cool-season vegetables, respectively, the Government of Kerala offers the highest rates of cash subsidy for vegetable farmers in India, covering most of the farming expenses, including the costs of seeds, planting material, fertilizer, pesticide, and labour costs.

Introduction of Vegetable Base Price Scheme (Table 4) by the Government of Kerala caught nation-wide attention amidst the farmers' protests against the Farm Acts 2020. Kerala became the first State to set base prices for 16 different vegetables & fruits so that if the price falls below the base price, the produce would be procured through Government outlets at

the base price.

Table 4. Vegetable Base Price Scheme of Govt. of Kerala 2020

Sl. No.	Crop	Base Price (Rs./kg)
1	Tapioca	12
2	Nendran	30
	Nendran (Wayanadan)	24
3	Pineapple	15
4	Ash gourd	9
5	Cucumber	8
6	Bitter gourd	30
7	Snake gourd	16
8	Cowpea (Vallipayar)	34
9	Tomato	8
10	Lady' s Finger	20
11	Cabbage	11
12	Carrot	21
13	Potato	20
14	Beans	28
15	Beetroot	21
16	Garlic	139

Source: DoA and Farmer's Welfare, Government of Kerala

The demand for vegetables in Kerala was estimated at 27.1 lakh MT in 2009-10. It is expected that the demand for vegetables will rise to 35.5 lakh MT by 2030 (GoK, 2021). Hence, Kerala needs to aim to double the production of vegetables over the 14th plan period, which requires more allocation of resources. The total allocation of funds for the development of vegetable cultivation from 2012-13 to 2021-22 is given in Table 5. As per the report, the fund allocation for vegetable cultivation development for the year 2020-21 was only 69.47 crore, which dipped from 87 crores in 2018-19. During the current financial year 2021-22, the allocation is only 74.45 Crore for 17 components under vegetable development. Hence, for achieving the target of doubling vegetable production, the funds

allocated for the same need to be increased considerably.

Table 5. Allocation of Funds for Vegetable Development

Sl. No.	Year	Allocation of Funds for Vegetable Development
1	2012-13	48.50
2	2013-14	62.25
3	2014-15	70.00
4	2015-16	70.00
5	2016-17	74.30
6	2017-18	85.00
7	2018-19	87.00
8	2019-20	70.90
9	2020-21	69.47
10	2021-22	74.45

Source: DoA and Farmer's Welfare, Government of Kerala

The cafeteria model has been suggested for the proposed task. The inflation accounting needs to be done periodically to keep pace with the mounting cost of production. It is also suggested that more emphasis should be given to the implementation of the physical plan rather than the financial plan at the field level. A road map for the formulation of a production plan needs to be done for staggered vegetable farming, not only in commercial fields but also in homesteads and institutions. When production increases, there will be a high probability of glut in the marketing of vegetables and an efficient marketing system needs to be developed for handling the produce. Along with other measures, empanelling of the traders needs to be done giving them sufficient incentives to them for the market to function successfully. The data need to be generated and statistically analysed for formulating an efficient marketing plan.

3. ROADMAP TO DOUBLE VEGETABLE PRODUCTION IN KERALA

Doubling vegetable production is a challenge that can be achieved with the participation of all agencies, social and political organisations, and ultimately, the people of Kerala. New innovations and adoption of best practices should be the cornerstone of this programme. Productivity can be enhanced by innovations, integration of technologies and enterprises, adoption of new technology, and overcoming false beliefs.

DAILY REQUIREMENT OF VEGETABLES ACCORDING TO ICMR

According to ICMR guidelines, the daily requirement of vegetables for an adult is stipulated as

- 50 gram leaf vegetables
- 50 gram roots and tubers
- 200 gram other vegetables

Pregnant women require more iron (folic acid), and should consume 50 gram leafy vegetables per day in addition to the quantities mentioned above.

Table 6: Quantity of Vegetables Required For Kerala As Per ICMR Recommendation

Type of Vegetables	Quantity Needed Per Day (Tonnes)	Quantity Needed Per Year (Tonnes)
Leafy vegetables	1,702	6,21,230
Roots and tubers	1,702	6,21,230
Other vegetables	6,808	24,84,920
Total	10,212	37,27,380

Population of Kerala : 34,040,350

Table 7. Gap In Production And Consumption

	Requirement of vegetables (Tonnes)	Gap in production (Tonnes)	Gap percentage wise (Tonnes)
15.70 lakh	37.27 lakh	21.57 lakh	57.87%

The above data has not considered the production of tapioca. Tapioca is cultivated in an area of 61874 ha in 2018-19 with a production of 23.2 lakh tonne (source: www.ecostat.kerala.gov.in). Tapioca is also used for animal feed and industrial purposes. However, approximately 50% is utilized for human consumption. Hence, 11.6 lakh tonne may be added to the vegetable production basket, making the total vegetable production 27.3 lakh tonne. The gap between actual production and consumption will narrow down to 10 lakh tonne. However, actual per capita consumption is low in Kerala, as people mostly prefer a non-vegetarian plate for main meals.

Road map for doubling vegetable production

1. AEU-based production protocol. Formulate schemes for commercial production in potential AEUs
2. Ensure timely availability of high-quality planting materials and quality seeds, ensure coordination between KAU, department seed farm, and VFPCK in vegetable seed production.
3. Selection of suitable varieties and hybrids for each locality and market
4. Address the challenges of weather in vegetable cultivation with the assistance of Agromet Advisory Services
5. Expand irrigation facility to more areas
6. Address issue of high investment for land preparation and other inputs
7. Adoption of scientific nutrient management
8. Adoption of open precision farming in commercial tracts and rain shelter for nutrigardens
9. Protected cultivation in urban and peri urban area, adoption of new growing techniques like hydroponics, aquaponics, vertical farming, and container cultivation.
10. Adoption of integrated packages for pests, disease infestation, and wild animal attack
11. 11. Adoption of modern technology, follow crop calendar, and avoid seasonal surplus of produce
12. Address issue of storage and marketing to ensure income for farmers

AEU-BASED PRODUCTION PROTOCOL

This production protocol aims to facilitate the commercial cultivation of vegetables in AEUs which are established so that the soil type and climatic conditions are more favourable for vegetable cultivation. There are 5 agro-ecological zones and 23 agro-ecological units in Kerala. The agro-ecological zones are coastal plains, midland plains, foothills, high hills, and Palakkad main. Among the 23 AEUS, five are commercial vegetable growing areas and another ten have the potential for commercial farming. The details are given below:

Table 8: Potential Vegetable Growing AEUs

AEU No.	Name of AEU	Area (ha)	% of total area of Kerala	Major Land use
		SOUTHERN ZONE		
8	Southern Laterites	38,727	1.00	Coconut on uplands and rice, tapioca, banana, and vegetables on lowlands are the major crops

9	South Central Laterites	3,65,932	9.42	Mono-cropped rubber and coconut, rice, tapioca, banana, and vegetables on lowlands.
		CENTRAL ZONE		
10	North Central Laterites	1,71,469	4.41	Coconut intercropped with a variety of annual and other perennial crops is on uplands; rice, tapioca, banana and vegetables on lowlands
17	Marayur Hills	28,968	0.75	Forests, temperate fruit trees, potato, sugarcane, temperate vegetables and rice
		NORTHERN ZONE		
11	Northern Laterites	480,257	12.86	Coconut intercropped with a variety of annual and other perennial crops is on uplands; and rice, tapioca, banana and vegetables on lowlands.

Table 9: AEUs that can be converted to potential vegetable growing area

AEU No.	Name of AEU	Area (ha)	% of total area of Kerala	Major Land use
		SOUTHERN ZONE		
1	Southern Coastal Plain	56782	1.46	Coconut plantations on uplands and rice in lowlands
3	Onattukara Sandy Plain	67447	1.74	Coconut plantations on uplands and rice in lowlands
12	Southern Foothills	315893	8.13	Plantations of rubber, coconut, pepper and coffee
		CENTRAL ZONE		
22	Palakkad Central Plain	112957	2.91	Coconut intercropped to a variety of annual and perennial crops is the major land use on uplands and rice in lowlands

23	Palakkad Eastern Plains	47049	1.21	Coconut, arecanut and mango are the major plantation crops. Annual crops include groundnut, cotton, banana, maize, jowar and sugarcane
		NORTHERN ZONE		
2	Northern Coastal Plain	122970	3.16	Coconut plantations on uplands and rice in lowlands are the major land use
13	Northern Foothills	144181	3.71	Plantations of rubber, coconut, pepper and coffee are the major land use
18	Attappady Hills	8872	0.23	Land use is mainly coconut plantations, banana, vegetables, maize and rice
20	Wayanad Central Plateau	74471	1.92	Plantations of coffee, tea, arecanut and pepper are the dominant land use on uplands and rice and banana in lowlands. Forests cover a significant area.
21	Wayanad Eastern Plateau	70325	1.81	Plantations of coffee, tea, coconut, arecanut and pepper are the dominant land use on uplands and rice and banana in lowlands

AEU based varieties - Recommendation

Table 10: Warm Season Vegetables

Crop	Varieties	Agro Ecological Unit
Amaranthus	Red types: Arun, Krishnasree Green types: CO1, CO2, CO3, Renusree	Round the year in potential AEUs (1,2,3,8,9,10,11,12,13, 18,20,21,22,23) except 17. In AEU 17, cultivation during December and January should be avoided
Okra	Green/Light Green fruit types: Pusa Makhmali, Kiran, Salkeerthi Red fruit types: CO1, Aruna Mosaic resistant varieties: Arka Anamika, Susthira, Varsha Upahar	
Yard long bean (cow pea)	Bush Type: Bhagyalakshmi, Pusa Komal, Kasi Kanchan Semi Trailing Type: Kairali, Varun, Anaswara, Kanakamani, Arka Garima Trailing Type: Sarika, Malika, Lola, Vellayani Jyothika, Geetika, KAU Deepika, Arka Mangala	

Table 11: Solanaceous Vegetables

Crop	Varieties	Agro Ecological Unit
Brinjal	Surya, Swetha, Haritha: Bacterial wilt resistant varieties Neelima: F1 Hybrid Having bacterial wilt resistance Ponni	Wilt resistant varieties are recommended for all potential AEUs (1,2,3,8,9,10,11,12,13,17, 18,20,21,22) AEU except plains of eastern part of Palakkad district (AEU 23). In AEU 23, varieties having less resistance to wilt can be cultivated in commercial scale since soil is alkaline in nature.
Chilli	Vellayani Athulya, Keerthi Ujwala, Anugraha: Bacterial wilt resistant varieties	
Tomato	Anagha, Vellayani Vijay, Manulekshmi, Manuprabha, Akshay: Suitable for rain shelter cultivation	Tomato cultivation is recommended during the months of September to February in coastal areas (AEU 1, 2), plains (AEU 8, 9, 10, 11, 22, 23) and valleys near to hilly areas (AEU 12, 13). In hilly regions (AEU 21, 23), tomato cultivation can be done during summer months also. But in AEUs 17, cultivation during December and January should be avoided. Tomato cultivation can also be practiced during rainy season in rain shadow areas (AEU 17) or in protected structures like rain shelters and polyhouse in addition to the recommended season.

Table 12: Cucurbitaceous Vegetables

Crop	Varieties	Agro Ecological Unit
Bitter gourd	Priya, Preethi, Priyanka (Suitable for acidic soils), Arka Harith	Cucurbits can be grown round the year in coastal areas (AEU 1, 2), plains (AEU 8, 9, 10, 11, 22, 23) and valleys near to hilly areas (AEU 12, 13) and in hilly regions (AEU 21, 23). But in AEUs where extreme cool climate is experiencing (AEU 17), cultivation during December and January should be avoided. Virus diseases will be major problem during summer season, and oriental pickling melon is the most tolerant cucurbit against viral diseases and high temperature. Parthenocarpic salad cucumber can be cultivated under polyhouse and rain shelter throughout year except April and May.
Oriental pickling melon	Mudicode, Arunima, Soubhagya, KAU Vishal	
Snake gourd	Kaumudi, Baby, Manusree, Harithasree	
Cucumber	Heera, Subra, Pusa Sheetal, Poinsette, Poona Khira, KPCH 1	
Watermelon	Sugar Baby, Arka Jyoti	
	Seedless F1 Hybrids: Swarna, Shonima	
Bottle gourd	Pusa Summer Prolific, Arka Bahar	
Pumpkin	Ambili, Suvarna, Saras, Sooraj	
Ash gourd	KAU Local, Indu, Tara	

Table 13: Cool Season Vegetables

Crop	Varieties	Agro Ecological Unit
	NS 43, NS 160, NS 183	
Cabbage	September, Pusa Drumhead, Golden Acre, Kaveri, Ganga, Sreeganesh, Pride of India	
Cauliflower	Basant, NS 60, Pusa Meghna	
	Himani, Swati, Pusa Deepali, Early Patna, 74-6-C	During October-February in potential AEUs (1,2,3,8,9,10,11,12,13, 18,20,21,22,23) except 17. In AEU 17, cultivation can be extended to summer season
Carrot	Pusa Kesar, Nantes, Pusa Meghali, Pusa Nayanjyoti F1	
Beetroot	Detroit Dark Red	
Radish	Japanese White, Arka Nishant, Pusa Chetki, Pusa Resmi, Pusa Desi	
Onion	Agrifound Dark Red, Arka Kalyan, Agrifound Light Red, Arka Pragati	
Garlic	Ooty 1, G-50	AEU 17 During October-March
Potato	Kufri Jyoti (Medium Maturity), Kufri Girdhari (Medium maturity, late blight resistant), Kufri Himalini (Medium maturity, Late blight resistant)	AEU 17 During October-April
Beans	Trailing Type - Kentucky Wonder Bush Type - Contender, Premier, VL 1, Arka Komal, Tender Green	During October-Februray in potential AEUs (1,2,3,8,9,10,11,12,13, 18,20,21,22,23) except 17. In AEU 17, cultivation can be extended to summer season
Peas	Bonneville, (Short duration varieties, Suitable for canning)	AEU 17 During October-April

TIMELY SUPPLY OF QUALITY SEED AND PLANTING MATERIAL

Use high-yielding quality planting materials from certified suppliers.

Preference is to be given to pest- and disease-resistant varieties and hybrids from the public sector. Ensure coordination between KAU, department seed production farms, and VFPCK in vegetable seed production. Scientific methods such as seed treatment with bioagents and seed priming should be popularized for improved seed germination. Seed priming is the controlled hydration and drying of seeds which will enhance seed vigour in terms of germination potential and increased stress tolerance, ensure rapid and uniform seedling emergence, impart high level of biotic and abiotic stress resistance, and increase crop yield.

Quality planting material

Since the production from various public sector agencies is unable to meet the demand, private sector players also have a significant role in supplying planting materials. Regulatory measures to ensure the quality of planting materials supplied by private sector agencies are quite inadequate, and some unscrupulous elements exploit the situation causing loss to growers and adversely affecting sustainable farming.

Table 14: Seed requirement of major vegetable crops in Kerala

Sl. No.	Crop	Area (ha)	Seed rate (kg)	Total seed requirement (kg)
1	Amaranthus	3292.6	1.5	4939.0
2	Bhindi	3081.0	7.0	21567.0
3	Brinjal	3292.0	0.4	1218.0
4	Cowpea	7008.5	5.0	35042.3
5	Tomato	1171.0	0.4	468.4
6	Cucumber	3835.7	0.5	1917.8
7	Chilli	1205.2	1.0	1205.2
8	Ash gourd	2472.7	0.8	1854.5
9	Bitter gourd	4701.0	5.0	23505.0
10	Snake gourd	3938.0	3.0	11814.1
11	Ridge gourd	785.0	2.5	1962.5
12	Salad cucumber	697.5	0.5	348.7
13	Pumpkin	1886.0	1.0	1886.0
14	Bottle gourd	604.2	3.0	1812.6

15	Watermelon	100.0	1.0	100.0
		38070		109641.1

The strategies suggested for improving the seed supply chain include:

- Preparing State/district seed production plans for seed and planting material production and marketing, involving/linking various agencies like KAU, VFPCK, Department of Agriculture (DoA), NSC and identified seed companies.
- Strengthening quality control mechanisms
- Promoting farmer-participatory seed production in self-pollinated crops like cow pea
- Improving farms under State DoA by purchasing nucleus seeds of newly evolved varieties from KAU and improving infrastructure facilities of the farms/nurseries for enhancing quantity and quality of planting materials, etc.
- Seed multiplication and popularization of new varieties of vegetables released by KAU
- Establishment of a State Level Seed Certification Agency as envisaged in the Seed Act

Popularise use of seedlings and grafted plants

Vegetable grafting is a technique that is used to improve plant production, reduce disease susceptibility, and increase plant vigour. Biotic and abiotic stresses are capable of markedly reducing the productivity of vegetables. Grafting productive scions onto resistant rootstocks has been a common practice to overcome such stresses to growth. The principal biotic stresses that can be managed by growing grafted plants are bacterial wilt (Ralstonia solanacearum), fusarium wilt (Fusarium oxysporum f. sp. lycopersici), and other diseases caused by Pythium and Verticillium spp. and root-knot nematodes (Meloidogyne spp.). Grafting vegetables on resistant rootstocks is a means of controlling root-knot nematodes and other soil-borne diseases in areas with intensive land use. Grafting is useful for extending the crop-stand in protected structures, as a replacement for methyl bromide applications, or when practising specific low-pesticide or organic production protocols. Raising seedlings under covered condition and transplanting early will save time and be more suited for leased lands.

SELECTION OF SUITABLE VARIETIES AND HYBRIDS

There are many high yielding varieties of KAU and ICAR institutes which are resistant to major pest and diseases

Advantages of hybrid varieties include high yield, early maturity, abiotic stress resistance, disease resistance, uniformity in growth, flowering, and fruiting, superior quality produce, and extended shelf life

Preference must be given to pest- and disease-resistant varieties and hybrids from the public sector. Research should be focused on the development of multipurpose hybrids and low cost hybrid seed production technology to reduce the cost of hybrid seeds.

Table 15: Hybrid vegetable crops from KAU

Sl. No.	Name of the variety/ Hybrid	Crop	Remarks
1	Swarna	Watermelon	First yellow fleshed seedless watermelon hybrid in India. Fruits are seedless, bright yellow flesh (TSS -10.1 o Brix, High in Citrulline 5.1 mg/g, Average fruit weight- 3.18 kg, Average yield -10.2 t/ha, crop varieties.
2	Shonima	Watermelon	Red fleshed seedless watermelon (Triploid hybrid)- High yielding (High TSS (10.6 o Brix), Average fruit weight- 3.95 kg, Average yield -18.26 t/ha).
3	Heera	Salad cucumber	F1 hybrid developed using gynoecious technology. Light green colour fruit(15.5 cm length,0.26kg fruit weight, average yield 73.2 t/ha) .
4	Shubhra	Salad cucumber	F1 hybrid developed using gynoecious technology. Greenish white colour fruit (15.9 cm length,0.275 kg fruit weight, average yield 79.61 t/ha).
5	KPCH-1	Parthenocarpic Salad cucumber	Parthenocarpic hybrid suitable for polyhouse cultivation. High yielding (10 cent polyhouse could yield 5 tonne fruits in a period of 3 month). Produce dark green fruits weighing 220 g with a length of 24 cm and width 15 cm and can be stored up to 1 week at room temperature without any loss in quality. p
6	KRH-1	Ridge gourd	First hybrid in cucurbit using 3 line breeding approach. Long dark green fruits, high yielding 7.1 kg/plant.
7	Neelima	Brinjal	High Yield [65 t/ha], Large, oval to round, glossy violet fruits, Average fruit weight : 176.0 g, Bacterial wilt resistant

Table 16: Public sector hybrids in vegetable crops

Sl.No.	Crop	Available hybrids	Source

		Pusa Hybrid-1, Pusa Hybrid-2, Pusa Hybrid-4, Pusa Hybrid-8, PusaDivya (Kt-4)	IARI, Delhi
1	Tomato	Arka Rakshak, Arka Ananya, Arka Samrat, Arka Shreshta, Arka Vishal, Arka Vardan, Arka Abhijit	IIHR, Bengaluru
		Kashi Abhiman	IIVR, Varanasi
		Rajashree, Phule Hybrid-1	MPKV, Rahuri
2	Brinjal	DBHL-20, Pusa Hybrid-5 (Long), Pusa Hybrid-6 (Round), Pusa Hybrid-9, Pusa Anupama (Kt-4)	IARI, Delhi
		Arka Navneet, Arka Kusumkar	IIHR, Bengaluru
		CH-1, CH-3	PAU, Ludhiana
3	Chilli	Arka Meghana, Arka Harita, Arka Sweta	IIHR, Bengaluru
		Kashi Early, Kashi Surkh	IIVR, Varanasi
4	Sweet pepper	Pusa Deepti, KTCPH-3	IARI
5	Cucumber	Pusa Sanyog	IARI
6	Bitter gourd	Pusa Hybrid-1, Pusa Hybrid-2	IARI, Delhi
		Pusa Hybrid-3	IARI, Delhi
7	Bottle Gourd	Kashi Bahar	IIVR, Varanasi
		Pant Sankar Lauki 1	GBPUAT, Pantnagar

8	Musk melon	Pusa Rasraj	IARI, Delhi
		Punjab Hybrid-1	PAU, Ludhiana
	Pumpkin	Pusa Hybrid-1	IARI, Delhi
10	Watermelon	Arka Jyoti	IIHR, Bengaluru
11	Okra	Kashi Bhairav	IIVR, Varanasi
		HBH-142 (F1 hybrid)	HAU, Hisar
12	Ash gourd	Pusa Shreyali and Pusa Urmi	IARI, Delhi

Table 17. Potential private sector hybrids under open precision farming at KAU, Vellanikkara

Sl. No.	Crop	Hybrid	Company	Salient features	Yield t/ha
1.	Chilli	Sierra	Mahyco	High yielding, dark green long shiny fruits, turns red on maturity, drought & powdery mildew tolerant	23
2.	Tomato	Sivam	Hy veg	High yielding, determinate type with flat round fruits green to red on ripening	73
3.	Brinjal	Green long	Sungro seeds	High yielding, slender, long cylindrical fruits, solitary bearing, light green in colour	27
4.	Cauliflower	C 6041	Syngenta	High yielding, tropical hybrid, semi erect, vigorous plant with creamy white curd	34
5.	Cabbage	NS 183	Namdhari seeds	High yielding, firm round headed hybrid, tropical type, tolerant to black rot and drought	29
6.	Bhindi	Supreme	Hy veg	High yielding, dark green long fruits, with moderate YVMV resistance	43
7.	Ash gourd	Gold	East west seeds	High yielding, vigorous plants with strong vines, cylindrical fruits, rind colour green and white fleshed type	49

Lack of information and lack of timely availability of F1 hybrids developed/identified by KAU and other ICAR institutions is a major constraint. Prohibitive seed prices charged by the private sector as in the case of parthenocarpic hybrids of cucumber need to be curbed. Fresh hybrid seed has to be purchased by farmers every year as they cannot depend on farm-saved seeds. Coordination between agencies for on-farm testing of potential hybrids in major growing pockets like Vattavada and Kanthaloor in Idukki district, and Attappadi

region in Palghat should be ensured. More input and technical skill is required for hybrid cultivation, and imparting training to farmers should be given priority.

ADDRESS THE CHALLENGES OF WEATHER IN VEGETABLE CULTIVATION WITH THE ASSISTANCE OF AGROMET ADVISORY SERVICES

Prolonged drought and severe rainfall severely affect the production potential of vegetable crops. India Meteorological Department (IMD) and Indian Council of Agricultural Research (ICAR) in collaboration with State Agricultural Universities (SAUs), State Departments of Agriculture and other stake holders have been implementing the Gramin Krishi Mausam Sewa (GKMS) scheme in the State of Kerala with the objective of providing crop and location specific weather forecast based Agromet Advisories Services (AAS). Agromet Advisory Bulletins that are prepared based on medium range weather forecasts and disseminated to farmers as a part of this project are helpful to the farming community in arriving at strategic decisions on farming operations with respect to changes in weather. Agrometeorological field units entrusted with the preparation and dissemination of Agromet Advisory Bulletins are located in five agroclimatic zones throughout Kerala under the aegis of KAU. Though these advisory bulletins are prepared and disseminated on every Tuesday and Friday in English as well as in Malayalam, its reach is still limited. Dissemination of these bulletins is done on a real time basis through direct delivery to farmers. They are also displayed on the notice boards of Krishi Bhavans. The bulletins are further uploaded on websites of IMD, KAU, mKisan portal etc. Though different channels were used to improve the dissemination, the outreach of these bulletins is limited. The quality of bulletins is to be further improved by incorporating location specific inputs.

The current Agromet Advisory Services should be strengthened with participation of farmers in each block of selected AEUs. This can be attempted in five districts, viz., Trivandrum, Kottayam, Thrissur, Wayanad, and Kasaragod on a pilot basis. These farmers should be trained to collect and report the different crop stages in relation to time, various weather events, data on pests, and disease outbreak etc. This information will be useful in finetuning location-based crop weather calendars and in improving the quality of Agromet Advisory Bulletins. These lead farmers will play a lead role in disseminating location-specific bulletins prepared at the block level. Moreover, they act as a link between the lab and the land. The present system will be continued effectively using the service of lead farmers. Further, the service of lead farmers will be used for the effective use of Agromet Advisory Bulletins. Regular trainings should be imparted for them to function as climate managers. A monthly honorarium is also recommended for them as an incentive for sparing their valuable time to work on the project. A two-way communication procedure will be developed between the Agromet lab and the farmers and vice versa and this helps in improving the quality of the bulletins and their effective dissemination. Moreover, the knowledge of the farmer acting as the climate manager regarding weather and agriculture will be improved, which in turn help him in achieving a better production.

BRING MORE LAND UNDER IRRIGATION FACILITIES

- Fallow lands or the land where vegetable cultivation is possible should be identified
- Cultivation on leased land should be promoted

- Vegetable cultivation in paddy land in the summer season may be encouraged
- Identify uncultivated barren land and make an arrangement to cultivate it with minimum lease amount through cluster/group approach with the participation of social organisations.
- Popularise drip/trickle irrigation

ADDRESS THE ISSUE OF HIGH INVESTMENT FOR LAND PREPARATION AND OTHER INPUTS

- Ensure mechanization in land preparation and promote the use of solar pump sets.
- Formulate more assistance for leased farmers, as crops grown in pandals require more assistance
- Arrange the distribution of scientifically proven pesticides or botanicals which may be helpful for plant protection and nutrient management
- Subsidy for leased land, other inputs like lime, seed, organic manure and fertilizers, plant protection materials, and equipment are to be provided. Emphasis must be placed on reducing the cost of cultivation through a group approach

ADOPTION OF SCIENTIFIC NUTRIENT MANAGEMENT FOR VEGETABLES

Cultivation of high-yielding varieties of crops and intensive farming exhaust the soil due to their increased productivity, and thus deplete essential nutrients including secondary and micro nutrients causing severe threats to sustainable agriculture. Irrational and excessive application of fertilizers also lead to soil deterioration and decline in the productivity of crops. Soil Test Based Recommendation (STBR) is a widely accepted approach for prescribing fertilizers based on the crop need, taking into consideration the soil variability of different AEUs.

- Soil acidity is a major problem in all AEUs of Kerala. Majority of soils are strongly acidic to moderately acidic, warranting lime application on a regular basis based on pH values as per recommendations
- Deficiency of calcium which is widespread in acidic soils can also be rectified by liming.
- Magnesium deficiency is of common occurrence in the AEUs and hence, application of magnesium sulphate @ 80 kg/ha is recommended
- Application of dolomite powder as liming material can also be resorted to since it will supply Mg in addition to alleviating acidity and supplying Ca.
- The organic matter levels in the majority of soils are between low and medium and hence require the application of recommended dose of organic manure/compost/green manure. N fertilizers need also be applied based on soil test.
- Available P is high in most of the soils, hence application of P fertilizers can be reduced to the extent of 25–50 % of the recommended dose based on the soil P values.
- Available potassium status is medium to high, and K fertilizers have to be applied based on soil test values. Here, soil test values are in the moderate range, and 60–100% of the recommended dose can be applied. Where soil test values are high, only 25 percent of the recommended dose need to be applied.
- Boron is deficient in all AEUs and the application of borax @ 10 kg/ha or 0.5% foliar spray is recommended.

- Zinc deficiency is seen in a limited area where the application of zinc sulphate @ 20 kg/ha is recommended. Foliar application is particularly better under adverse soil conditions.
- Kerala soils typically have high/toxic levels of iron and manganese, which can be managed by liming

Strategies to be adopted

Periodic soil analysis and soil test-based fertilizer recommendation should be the rule as long as intensive agriculture is practiced. Farmers have to be made aware of the importance of periodic soil analysis before the cropping season and taking corrective measures to maintain the crop production capacity of the soil. Soil health cards can be issued to farmers which indicates the native nutritional status, problems pertaining to that particular soil, and fertilizer recommendations including secondary and micronutrients based on the soil nutrient status for the crops (STBR). Soil health cards will also suggest management practices for the observed soil constraints, acidity, alkalinity etc. The analysis of samples can be undertaken by the soil testing laboratories operating in the different campuses and research stations of KAU, district-level Soil Testing Laboratories under the Department of Agricultural Development and Farmers' Welfare, Govt. of Kerala, ICAR institutions, laboratories under Soil Survey Department, etc., with effective coordination by an apex body which can effectively link the activities in a network mode.

Mode of operation

District wise or AEU-wise samples collected from each district should be entrusted with a particular soil testing lab.

Routine analysis can be done at each research station and various campuses under KAU having soil testing labs by providing additional infrastructure facilities, equipment for the analysis of P and K, and supporting staff. Micronutrient analysis can be done at labs equipped with atomic absorption spectrophotometer. With such facilities, approximately 2000 samples can be analysed in each lab in a month with additional staff on temporary basis.

Inductively Coupled Plasma (ICP) spectroscopy can be adopted, but it is very costly and requires in excess of 50 lakh. The ICP can analyse more than 500 samples per day and give analytical results for all nutrients except nitrogen (organic carbon). Three KAU-led labs in each zone should be equipped with ICP and upgraded as referral labs.

Mobile soil testing services and rapid soil testing kits can be utilized for soil testing, but only organic carbon, phosphorus, and potassium can be analysed and hence, recommendations can be given only for N, P, and K. Here, pH indicator papers can be used for determining soil acidity/ alkalinity and thus for lime/gypsum recommendations. Farmers can be given training to use the indicator papers.

The actual analysis of the sample and giving fertiliser recommendations is only part of the soil testing service. To a large extent, the efficacy of this service depends on the care and

effort put forth by extension workers and farmers in the collection and dispatch of samples to the laboratory. The collection of soil samples should be done by trained persons and assigning this task to private agencies who are not familiar with this type of work will result in poor quality samples.

The responsibility of collecting genuine soil samples from the fields can be assigned to Krishi Bhavans and VFPCK of a particular area which can entrust trained farmer organizations or farmer groups or Kudumbashree staff for sample collection. Utilizing farmers' groups will also reduce the cost of sample collection. Farmers can be identified at the Panchayath level and the work can be coordinated by the assigned institution or agency for that area. The collected soil samples from specific areas may be delivered to the local Krishi Bhavans and soil testing lab with the assistance of the panchayat.

ADOPTION OF OPEN PRECISION FARMING

Fertigation

- Prevents nutrient loss
- Reduced quantity of fertilizer
- Effective labour management
- Better root growth
- Prevent soil erosion

Plastic mulching

- Control growth of weeds
- Control temperature of soil
- Conserve moisture
- Control pests
- Produce quality produce

Table 18: Comparison Of Open Precision Field Trials With KAU POP (Control)

Crop	Open Precision best treatment Yield (Kg/plant)	Fertilizer Applied (N:P: K Kg/Ha)	Control (KAU POP) Yield (Kg/plant)	Fertilizer recomm. KAU POP (N:P:K Kg/Ha)	Increase in yield %
Bhindi	2.14	112.5: 46.85:168.75 (125% Ad hoc POP)	1.05	55:35:70	103.8
Ash gourd	9.93	150:75:187.5 (125% Ad hoc POP)	1.36	70:25:25	630
Chilli	1.13	262.5:60:345 (125% Ad hoc POP)	0.56	75:40:25	101.7
Tomato	3.66	105: 48.75:142.5 (75%Ad hoc POP)	1.31	75:40:25	179.4
Cabbage	1.71	263.75: 61.25: 342.5 (125% Ad hoc POP)	0.94	150:100:125	81.9

Cauliflower	1.45	150:60:210 (100% Ad hoc POP) (125% Ad hoc POP)	0.71	150:100:125	95.9

PROTECTED CULTIVATION AGAINST ADVERSE CLIMATIC CONDITIONS

- Cultivation is possible throughout the year
- High yield
- Crop rotation depending on market demand
- Comparatively less pest attack
- Safe to eat or organic produce
- Quality produce
- Effective labour management
- Increased chances for mechanization

However, the adoption of polyhouse cultivation is not widespread in Kerala. This can be attributed to its disadvantages, such as,

- Need for structural modification to suit humid hot climate of Kerala
- Limited choice of crops
- Exotic hybrids not suitable for Kerala polyhouses
- High incidence of sucking pests and diseases due to poor management
- Improper training to farmers on sanitation and crop management
- Lack of group approach
- High initial investment
- Lack of support for maintenance

This can be remedied by popularising rain shelters, low-cost poly houses, and net house cultivation of vegetables. Crops like salad cucumber, yard-long bean, grafted chilli, and cherry tomato can be grown.

Seedlings of vegetable varieties and F1 hybrids suitable for growing in Kerala's conditions may be raised in shade net house nurseries and supplied to growers. Hence, the establishment of shade net house nurseries must be encouraged for the supply of seedlings and grafted seedlings, and such nurseries may be recognized by the State DoA.

INTEGRATED PACKAGES FOR MANAGING PEST AND DISEASE INFESTATION AND ATTACK OF WILD ANIMALS

Adopt integrated pest management (IPM), with emphasis on biological control, endophytes, and ecological engineering and promote pesticide literacy. Develop cost effective management techniques to prevent the entry of wild animals. Implement crop insurance against the incidence of identified pest and diseases beyond a threshold level.

Management of pests and disease infestation

- Promote cultivation of resistant varieties
- Use grafted seedlings
- Prepare and distribute crop calendar

• Improve awareness of plant protection measures through training
• Prepare and distribute bulletins regarding the management of seasonal pests and diseases
• Supply of quality plant protection materials at a subsidized rate

Use of micro organisms

- Use of bio fertilizers increases yield
- Environment friendly
- Effective for pests and disease control
- Enhances growth of vegetable
- Helps to grow quality organic produce

Attack of wild animals

- Measures to protect the cultivated land of farmers at Government level with coordination of forest department and LSGs.
- Subsidy for solar fencing
- Insurance for existing crops

Table 19: Yield loss in vegetables due to insect pests

Crop	Pest	Yield loss (%)
Cucurbits	Fruit fly	30-100
Pumpkin	Fruit fly	28.7-59.2
Bottle gourd	Fruit fly	27.3-49.3
Cucumber	Fruit fly	19.4-22.1
Bitter gourd	Fruit fly	60-80
Cucumber	Fruit fly	20-39
Ivy gourd	Fruit fly	63
Musk melon	Fruit fly	76-100
Snake gourd	Fruit fly	63
Sponge gourd	Fruit fly	50
Tomato	Fruit borer	24-65
Brinjal	Fruit and shoot borer	11-93
Chilli	Thrips	12-90
Chilli	Mites	34
Okra	Fruit borer (Helicoverpa armigera)	22
Okra	Leaf hopper	54-66
Okra	Whitefly	54
Okra	Shoot and fruit borer	23-54
Cabbage	DBM	17-99

Cabbage	Cabbage caterpillar	69
Cabbage	Cabbage leaf webber	28-51
Cabbage	Cabbage borer	30-58
Cow pea	Pod borer	20
Cow pea	Aphid	20-40

Table 20: Cucurbits: yield loss due to diseases in Kerala - (Area: 9894 ha × 2 seasons per year; expected yield = 2.97 lakh t (@15t/ha)

Sl. No	Important diseases	Yield loss (%)	Yield loss ('000 T)	Av. loss in Crores
	I. Cucurbits (Bitter gourd, Snake gourd, Bottle gourd, Little gourd, Ash gourd, Cucumber, Salad cucumber,Pumpkin) (Rs.25/- per kg)			
1	Viral diseases	20-30	59.4-89.1	185.63
2	Wilt diseases (bacterial and fungal)	5-10	14.9-29.7	55.75
3	Downy and powdery mildew diseases	8-10	23.8-29.7	66.88
4	Anthracnose, leaf blight, root rot and fruit rot diseases	10-12	29.7-35.6	81.63
	Total			389.89

Table 21: Vegetable cowpea and beans: yield loss due to diseases in Kerala - (Area: 8748 ha × 2 seasons per year; expected yield = 2.10 lakh t (@12t/ha))

Sl. No	Important diseases	Yield loss (%)	Yield loss ('000 T)	Av. loss in Crores
	II. Vegetable cowpea and beans etc. @ Rs. 30/- per kg)			
1	Wilt diseases (fungal and bacterial)	20-25	42.0-52.5	141.75
2	Viral and phytoplasmal diseases	10-15	21.0-31.5	78.75
3	Anthracnose, leaf blight, root rot and fruit rot diseases	15-20	31.5-42.0	110.25
	Total			330.75

Table 22: Solanaceous vegetables: yield loss due to diseases in Kerala (Area: 3360 ha × 2 seasons per year; expected yield = 0.67 lakh t (@10t/ha))

Sl. No	Important diseases	Yield loss (%)	Yield loss ('000 T)	Av. loss in Crores
	III. Solanaceous vegetables (Brinjal, green chillies, tomato etc. @ Rs. 30/- per kg)			

1	Wilt diseases (bacterial and fungal)	20-25	13.4-16.8	45.30
2	Viral and phytoplasmal diseases	20-30	13.4-20.1	50.25
3	Anthracnose, leaf blight, root rot and fruit rot diseases	15-20	10.1-13.4	35.25
	Total			130.80

Table 23: Bhindi: yield loss due to diseases in Kerala - (Area: 1507 ha × 2 seasons per year; expected yield = 0.36 lakh t (@12t/ha))

Sl. No	Important diseases	Yield loss (%)	Yield loss ('000 T)	Av. loss in Crores
	IV. Bhindi @ Rs. 20/- per kg)			
1	Viral diseases	25-40	9.0-14.4	23.40
2	Leaf spot, leaf blight, powdery mildew, root rot and fruit rot diseases	10-15	3.6-5.4	9.00
	Total			32.40

Table 24: Amaranth: yield loss due to diseases in Kerala - (Area: 2094 ha × 2 seasons per year; expected yield = 0.84 lakh t (@20t/ha))

Sl. No	Important diseases	Yield loss (%)	Yield loss ('000 T)	Av. loss in Crores
	V. Amaranth (red and green) @ Rs. 15/- per kg)			
1	Leaf spot, leaf blight, white rust and root rot diseases	10-25	8.4-21.0	22.05
2	Viral diseases	5	4.2	6.30
	Total			28.35

Table 25: Potato: yield loss due to diseases in Kerala (Area: 516 ha × 1 seasons per year; expected yield = 0.11 lakh t (@20t/ha))

Sl. No	Important diseases	Yield loss (%)	Yield loss ('000 T)	Av. loss in Crores
	VI. Potato @ Rs. 25/- per kg)			
1	Wilt diseases (bacterial and fungal)	20-25	2.2-2.8	6.25
2	Viral and phytoplasmal diseases	20-30	2.2-3.3	6.88

3	Anthracnose, leaf blight, root, and tuber rot diseases	15-20	1.7-2.2	4.88
	Total			18.01

Table 26: Cool season vegetables: yield loss due to diseases in Kerala (Area: 1863 ha × 1 seasons per year; expected yield=0.23 lakh t (@12t/ha))

Sl. No	Important diseases	Yield loss (%)	Yield loss ('000 T)	Av. loss in Crores
	VII. Cool season vegetables (Cabbage, cauliflower, tomato, beet root etc. @ Rs.30/- per kg)			
1	Viral diseases	10-15	2.3-3.5	8.70
2	Club root and wilt diseases (fungal and bacterial)	20-30	4.6-6.9	17.25
3	Downy and powdery mildew diseases	10-15	2.3-3.5	8.70
4	Anthracnose, leaf blight, root & tuber rot and head rot diseases	20-25	4.6-5.8	15.60
	Total			50.25

Table 27: Vegetable crops - yield loss due to diseases in Kerala

Sl. No.	Crops	Yield loss ('000 T)	Loss in Crores
1	Cucurbits (BG, SG, BG LG, AG, Cucumber, Pumpkin etc.)	156	389.89
2	Veg. cowpea and beans	110	330.75
3	Solanaceous vegetables (Brinjal, Green chillies, Tomato, capsicum)	44	130.85
4	Bhindi	16	32.40
5	Amaranth, leafy veg.	19	28.35
6	Potato	07	18.01
7	Cool season vegetables (Cabbage, cauli-flower, carrot, beet root, radish etc.)	17	50.25
Total yield loss		369	980.50

ADOPTION OF MODERN TECHNOLOGY AND PREPARATION OF CROP CALENDAR TO AVOID SURPLUS OF PRODUCE IN MARKET

The potential of modern technologies such as hydroponics, aquaponics, vertical farming, container cultivation etc (See Annexure II for details) should be exploited in appropriate areas. The use of hormones for improving germination, preventing flower drop, enhancing fruit set, and inducing early or delayed harvest need to be exploited for commercial farming.

Effective Use of Farm Machinery

Farm machinery suitable for vegetable cultivation must be promoted. Gender-friendly equipment should be designed, developed, and promoted for all stages from seeding to harvest.

STORAGE AND MARKETING

Post-harvest loss must be minimized. Proper marketing interventions targeting each block, awareness and training is needed.

4. PARTICIPATION OF LSGIs, CO-OPERATIVES, AND FPCs IN VEGETABLE PRODUCTION EFFORTS

ROLE OF LSGIs – EXISTING SCENARIO

1. Watershed-based concept is not being effectively implemented
2. Integrated farming systems (IFS) approach, which is sustainable and gives more income to farmers are not being implemented. Integrated projects that involve agriculture and allied sectors are not conceptualized.
3. Projects for backward and forward linkages of production, procurement, and marketing are not prepared at the LSGD level.
4. LSGIs are not concerned with active participation and involvement of working group members, stakeholders especially bank officials, etc. in project preparation. Many projects are prepared based on the convenience and ease of execution of the implementing officers, and there exists duplication and non-convergence of projects at the level of various LSGIs and between LSGI and Departmental schemes.
5. The problem of providing credit to lease land farmers is not being addressed.
6. The possibilities of utilizing fallow lands for vegetable cultivation is not being actively explored by LSGIs.
7. Despite provisions in the project guidelines for enterprises to provide revolving fund and interest subsidy, there is a paucity of organizations in various LSGISs in the areas of input production, procurement, value addition and product diversification, and marketing. LSGIs have not actively engaged in these sectors.
8. LSGIs have not so far explored the possibilities of giving assistance, support price, and production bonus for organically and safe-to-eat mode of production of vegetables and other produce.

ROLE OF CO-OPERATIVES – EXISTING SCENARIO

1. The huge potential of these institutions in the areas of input supply, ensuring credit needs, procurement of vegetables produced, marketing and value addition, etc. are not exploited at LSGI level.
2. There are no concerted efforts on the part of LSGIs in actively promoting the participation of these institutions in the sectors of agricultural development, increased income generation of farmers, creating employment opportunities for gulf returnees, and youth and local economic development.

ROLE OF FPOs/FPCs – EXISTING SCENARIO

Since these institutions are newly formed, their potential has not been exploited fully in increasing vegetable production in the state.

ROLE OF LSGIs – THE WAY FORWARD

1. Provide assistance and make available seeds/seedlings, manures and fertilizers, plant protection chemicals, etc. to vegetable farmers at a subsidized rate. The grama panchayath should concentrate only on production-oriented activities.
2. Pharmacies for plant-protection chemicals and other inputs should be attached with Krishibhavans similar to the ones associated with Primary Health Centres, Veterinary

Dispensaries, Ayurveda/Homoeo dispensaries, etc.

3. Block panchayath should provide all the required seeds and planting materials with the help of a block-level nursery. Seed multiplication plots of high-yielding and newly released varieties of different crops should be carried out at the block panchayath level, and should be supplied to the beneficiaries of the grama panchayath-level projects.
4. There should be a production plan and marketing plan for vegetable production and this should be prepared at the block panchayath level based on AEZs and AEMUs. Procurement can be made at the block panchayath level.
5. LSGIs should ensure the procurement of locally produced vegetables from eco shops and other farmers' markets under their control for schools and Anganwadis to use in their feeding programmes.
6. Farmers/farmers' groups/SHGs, etc. should be trained in modern technologies for vegetable production. This may be done at the block panchayath level with the strengthening and active participation of Block Level Agricultural Knowledge Centres (BLAKC). Necessary infrastructure facilities may be provided to BLAKCs for conducting trainings.
7. Fallow land suitable for vegetable cultivation should be fully used for the same. Grama panchayaths should take a lead role in ensuring this.
8. There are various agencies and groups involved in vegetable cultivation viz., Farmers, Farmer's groups, member farmers of FPCs, Kudumbashree SHGs, HADA, cluster farmers of VFPCK, Co-operatives, etc. The entire coordination and convergence of these activities should be done at the grama panchayath level only. Projects for providing infrastructural facilities to VFPCK and HORTICORP markets may be taken up by the block and district panchayaths.
9. District panchayaths should fully concentrate on marketing and supply chain activities, infrastructure development, etc.

ROLE OF COOPERATIVES – THE WAY FORWARD

1. Form SHGs of vegetable farmers at the grama panchayath level
2. Provide interest-free loans to farmers, farmers groups/SHGs
3. Provide all the required inputs in kind to farmers, farmers groups/SHGs from the depot of the bank. A portion of the loan may utilized for this and the remaining amount may be released in cash for meeting labour expenses.
4. Procure entire marketable surplus of farmers by fixing a floor price.
5. Set up sales outlets and sell the produce through them, while forming a network of sales outlets of cooperatives, department markets, etc.
6. Procurement of farmers' produce from the production sites to procurement-cum-sales centres through refrigerated reefer vans and ensure the demand and supply at different points.

ROLE OF FPOS/FPCS

- Centralised procurement of inputs and distribution among members.
- Arranging and facilitating credit facilities among groups.
- Conducting trainings for member farmers on improved production technologies,

primary processing, value addition, etc.

- Centralised procurement of produce, value addition, and marketing.
- Setting up of retail outlets in prominent marketplaces.
- Explore the possibilities of online marketing and door delivery of fresh vegetables and processed products.

5. MODERNISING EXISTING SYSTEMS OF VEGETABLE PRODUCTION AND INTEGRATION WITH GOVERNMENT- AND LSGD SCHEMES AND POST-PRODUCTION ACTIVITIES

The existing system of vegetable production should be modernized with an emphasis on INM (integrated nutrient management), IPM, and climate-smart crop production with the assistance of timely information on weather parameters.

INTEGRATED NUTRIENT, PEST, AND DISEASE MANAGEMENT FOR BETTER PRODUCTIVITY AND PROFITABILITY IN VEGETABLES

Most vegetables are seasonal crops which live only for a period of 3–4 months during which they grow, flower, fruit, and die. So, providing the correct quantity of all the required nutrients at the right time is very important. The production potential of newer varieties and hybrids are very high, but to achieve this, the management of the crop should be very scientific.

Limitations of our soil

Kerala is in a high rainfall zone and the soil is deficient in basic elements such as potassium, calcium, magnesium and boron. The iron and aluminium contents are very high, and sometimes reach toxic level. The soils are very acidic with low cation exchange capacity (nutrient holding capacity) and water holding capacity. These limitations can be overcome by the addition of organic matter, soil amendments, and chemical fertilizers. Organic matter releases nutrients only very slowly, and the addition of chemical fertilizers will help address this . Providing foliar nutrients is also beneficial for supplementing with high-quality nutrition.

Integrated Nutrient Management forms the basis of integrated pest and disease management. Losses due to pest and disease is high in vegetables, and organic way of management such as use of homemade botanicals, biological control agents are though useful has lots of limitations in commercial cultivation. Preventive and frequent application are necessary which escalates the cost of cultivation. Fruit flies, internal tissue borers, hoppers, bugs, mites, and nematodes cause considerable economic loss. Downy mildew, bacterial wilt, cucumber mosaic virus, bhindi yellow vein mosaic virus etc., also cause severe loss to farmers. Such losses affect the confidence of the farmer and farmers' groups. For all of them, immediate and effective remedy is scientific use of pesticides. Rather than fuelling chemophobia, the department should impart pesticide literacy to the farmers. Newer pesticides are comparatively less toxic, more selective, cause less environmental hazards and require only very small quantities to be effective. Use of protective clothing, observance of waiting period, and proper disposal of the containers will have to be emphasized. For commercial and semi-commercial scale cultivation, chemical fertilizers and pesticides are essential. They should be used in such a way that farmers, consumers, and the environment is not adversely affected, which is possible by providing pesticide literacy trainings. Integrating different pest management methods in a harmonic manner is essential to achieving long-term results. Judicious crop rotation should be followed to prevent pest outbreaks. GAP (Good Agricultural Practises) with an emphasis on safe-to-eat vegetable production need to be popularized.

EXISTING SCHEMES FOR VEGETABLE DEVELOPMENT AND PRODUCTION

State Plan

Please see the first chapter for details.

Central Schemes

MIDH. The terms of the MIDH scheme are as listed below:

1. Seed production for vegetables: Assistance is given for seed production of both open pollinated and hybrid seeds (both for public sector): In 2021-22, a physical target of 30 hectares was sought and implemented: No target is sought under hybrid seeds
2. Assistance for creation of seed infrastructure: Rs 2 Crores: No target is sought
3. Area expansion: Vegetable production (hybrid) : Target of 1000 ha (Assistance of Rs 50,000 per ha)

Suggestions. Some suggestions pertinent to the scheme are given below.

- In the existing schemes, there is very little focus on productivity improvement, and the current focus is on area expansion.
- More schemes should be devised on FLD for advanced technologies like aeroponics, hydroponics and vertical farming, and for bee keeping : technology may be adapted and tested from research institutes IIHR, KAU, etc. and tested before popularising: after successful field testing during the first three or four seasons, schemes may be devised for assistance to beneficiaries on such technologies
- Production-linked subsidy and separate assistance may form part of subsidy schemes (differential subsidy rates for cucurbits/cool season vegetables/leafy vegetables)
- Expert opinion considers protected cultivation schemes a failure. However, due to poor land availability, new schemes may be devised for protected cultivation with renewed vigour in various years (for installation and cultivation during the initial years and maintenance at regular intervals till stabilisation); a strong component for extension, and good service staff should be present
- Assistance to State plan projects may be increased by availing more funds from MIDH/ CSS schemes
- Separate strategies and schemes for urban and rural homesteads
- Pesticide literacy and post-harvest management in campaign mode using Krishi Paadashala

Improve assistance to Commercial Cultivation of Vegetables (cluster). The terms of the scheme are as listed below:

1. Assistance for permanent Pandal – 50% assistance limited to Rs. 40000/- per ha. (One-time assistance)
2. Assistance for temporary Pandal for lease land cultivators Rs. 10000/- per ha.
3. Assistance for crop cultivation Rs. 30000/- per ha
4. Assistance for machination 1. Pump set - 75% assistance limited to Rs. 10000/- per unit.
5. PP equipment - 75% assistance limited to Rs. 10000/- per unit.
6. Staggered clusters – Rs. 30000/- per ha.
7. Cool season vegetable cultivation (Idukki, Wayanad) - Rs. 30000/- per ha.
8. Intercrop/multiple crop/mixed crop – Rs. 15000/- per ha.
9. Production of traditional seeds by clusters and distribution through eco-shop.

Institutional Cultivation. The provisions are as listed below:

1. Project based cultivation

2. Cultivation of vegetables in small institutions at least 5 per Panchayath (school, Anganavadi, Krishi Bhavan etc.) – Rs. 500/- per cent.
3. Horticultural therapy
4. Homestead Cultivation. The provisions are as listed below.
    1. Terrace garden – 20 clay/high quality plastic pot – total cost Rs.4000/- beneficiary contribution Rs. 1000/-
    2. Irrigation units for terrace cultivation - Family drip – Rs. 7000/- per unit – 25 nos. Wick – Rs. 2500/- per unit – 25 nos.
    3. Rain shelter
    4. Pilot project for vegetable cultivation in all homesteads of 5 corporation area – need based support for residence association based on the project submitted for bringing vegetable cultivation in all homesteads of Corporation area.

Productivity increase

1. Revitalization of clusters - Revolving funds can be given to clusters for payment during procurement from farmers, based on performance and turnover of the cluster
2. Incentive for farmers for bringing the produce to department/VFPCK markets
3. Transportation assistance during excess production period
4. Bio-input centre for clusters
5. Value addition projects for clusters
6. Assistance for innovative technologies for clusters
7. Open precision farming for clusters
8. Need-based support for already established clusters for technology transfer, for farm schools within the clusters
9. Production incentive can be provided for farmers whose output is over and above the average productivity for a particular crop.
10. Implement crop insurance against the incidence of identified pests and diseases that exceed a predetermined level of severity.

6. EXISTING PROCUREMENT AND DISTRIBUTION SYSTEM INCLUDING GOVERNMENT INITIATIVES AND SUGGESTIONS FOR A TRANSPARENT, TECHNOLOGY-DRIVEN PLATFORM

Among the multitude of challenges faced by vegetable growers in the State, the most important challenge faced by them would be finding a market to sell their produce for an assured reasonable price. Unlike paddy, there is no organized mechanism to procure all the fruits and vegetables produced in the State at a fixed procurement price. The perishability of the commodity makes this task highly challenging for any agency involved in the procurement, storage, and distribution of vegetables.

The Kerala State Horticultural Products Development Corporation Limited (Horticorp), with 14 centres and 4 sub centres, is an agency established by the State to procure and distribute fruits and vegetables in the State. However, with the present infrastructure, they can procure approximately twenty thousand metric tonnes of produce worth Rs. 60 crores annually. Vegetable and Fruit Promotion Council Keralam (VFPCK) serves as a facilitating agency that helps the farmers undertake wholesale marketing of their produce through 290 farmers' markets (Swasraya Karshaka Samithis) that are established around major production centres and handles approximately one lakh metric tonnes of produce worth Rs. 300 crores. The DoA owns and operates six wholesale markets in the State. Many eco-shops, weekly markets, and cluster markets were also initiated by the department all over the State to take up the marketing of fruits and vegetables. Cooperative societies and Local Self Government Institutions (LSGI) also operate hundreds of markets. Though there is no single well-established private agency capable of controlling the price of the produce in the State, the marketing of fruits and vegetables in the State is mostly undertaken by these unorganized private players, and hence, their presence influences the price realization in fruit and vegetable commodities. The State intervenes in these markets on festive occasions to regulate the price.

In a nutshell, though there are public, private, and Co-operative markets in the sector, the available marketing infrastructure is inadequate and is not regulated by any specific State-level legislation. Without ensuring adequate marketing infrastructure that could fetch a reasonable price for the produce, any attempt to double the vegetable production would be incapable of meeting the ultimate goal of the initiative, namely, sustainable production, procurement, and distribution of vegetables in the State.

KERALA STATE HORTICULTURAL PRODUCTS DEVELOPMENT CORPORATION LIMITED (HORTICORP)

Kerala State Horticultural Products Development Corporation Limited (Horticorp) is a fully owned Government company under the DoA, Government of Kerala, and was registered with the Registrar of Companies, Kerala in 1989.

Volume handled and turnover

During the financial year 2019-20, Horticorp handled approximately 21336 MT of fruits and vegetables amounting to Rs.59.24 crores, and during the financial year 2017-18, we

handled approximately 19211 MT of fruits and vegetables amounting to Rs.67.95 crores.

Infrastructure, geographical coverage, and governance

Horticorp has 13 District Procurement Centres covering all the districts except Kasaragod, and 4 sub-centres in Chadayamangalam, Harippad, Guruvayoor, and Vadakara. In all these centres, fruits and vegetables are procured from farmers, farmer clusters, Swasraya Karshaka Samithis, and agriculture wholesale markets at reasonable prices. Horticorp procures fruits and vegetables directly from the farmers at rates that are 10 % more than the prevailing wholesale market rates and is committed to buying whatever is produced by the farmers at times of glut. The corporation has a wide marketing network throughout the State for the marketing of fruits and vegetables to cater to customer demands. Horticorp is the only one agency in the Government sector involved in the marketing of fruits and vegetables through the 129 Haritha outlets, 278 franchisee stalls, 25 mobile vending units, and 515 Government and private institutions including old age homes, pre metric hostels, prisons, and correctional homes, hotels, schools, and KTDC at prices 10–30 % lower than the prevailing market prices.

Currently, all the district-level procurement and distribution centres are managed by Assistant Director-level officials of the DoA Development and Farmers Welfare. This will enhance the efficiency of these centres and help to maintain a liaison with other line departments. This will also enhance district-level marketing as well as the eco-shops under various Krishi Bhavans.

Issues and Challenges

The production of vegetables and fruits shows an upward trend owing to the various schemes and measures undertaken by the DoA and allied agencies in this sector. This is a call for Horticorp, in its role as an experienced agency in fruit and vegetable marketing under the state government, to enhance its marketing and distribution network and ensure a fair price for the farmers' produce. However, without adequate storage and processing facilities, Horticorp cannot manage the large quantities of vegetables that are being procured from vegetable clusters, VFPCK Swasraya Karshika samithies, and wholesale markets. Moreover, the excess produce procured during glut would incur a huge loss to the executer and wastage of a huge quantity of vegetables.

From the available statistics (Annexure I), the various fruits and vegetables are selectively cultivated in certain districts. Some vegetables are abundant in some districts, while others might be scarce. Moreover, the production of most fruits and vegetables is seasonal in nature. Certain vegetables that are produced in particular clusters cannot be sold through the outlets already available with Horticorp. On the other hand, the hundreds of eco-shops owned by the department may need specific items from other markets.

By planning a two-fold increase in the production of fruits and vegetables necessitates a shift in cultivation from tuber crops and banana and increasing the productivity of existing crops by achieving a 20% annual augmentation in production. Horticorp should handle approximately 1000 to 20000 metric tonnes every year. The excess produce that accumulates in some districts should be transported and evenly distributed through the Haritha outlets, eco shops, and sales outlet run by the co-operative departments and Kudumbashree under the LSG department.

Prospects and strategies for integration

To coordinate business activities effectively, Horticorp needs more infrastructure and retail business strategies. The wholesale market held by the DoA and VFPCK, and the retail market held by Horticorp and Krishibhavans need to be coordinated to ensure a fair price for the farmer and fresh and healthy fruits and vegetables at a fair price for the consumer. Under these circumstances, a strategic shift in the marketing activities of Horticorp needs to be implemented to cope with the increased production and localized availability of fresh fruits and vegetables. Timely harvest is essential for maintaining quality, and various primary post-harvest operations decrease the spoilage and damage of fruits and vegetables. This will benefit farmers by increasing the price and marketable surplus.

To achieve these ends, the District Procurement Centres and their distribution systems need to be modernized. The following suggestions have been made by Horticorp to facilitate the doubling of farmer's incomes in five years.

1. Hygienically designed and easily cleanable district procurement centres with sufficient storage capacity in each district.
2. Cold storage facilities for highly perishable commodities at Idukki, Palakkad, and Wayanad.
3. Establishment of retail outlets under each LSG unit all over Kerala with the help of LSGI and Primary Co-operative Societies.
4. Temperature-controlled supply chain facilities to link District Procurement Centres with all municipalities and corporations.
5. Establishment of processing centres at production clusters with the help of Primary Co-operative Societies.
6. Temperature-controlled vegetable van to facilitate temperature-controlled supply chain facilities.

VEGETABLE AND FRUIT PROMOTION COUNCIL KERALAM (VFPCK)

Vegetable and Fruit Promotion Council Keralam (VFPCK) is a company constituted under section 25 of the Indian Companies Act, 1956. The activities of the council are governed by a Board of Directors with Agriculture Minister as its chairman. Farmer markets under VFPCK have established a system of institutionalized group marketing which has successfully endured two decades. The Market Intelligence Centre managed by VFPCK collects information on arrivals and prices of commodities in Kerala and neighbouring states, and this information is disseminated through print and visual media and to all SKS. VFPCK also undertakes the brand promotion and establishment of branded retail outlets called Thalir and promotes value addition. Recently, VFPCK has ventured into exporting fresh fruits and vegetables to the Middle East, Singapore, and Europe.

Volume handled and turnover

During 2020-21, all 290 VFPCK SKSs traded a total of 1,16,385 MT of fruits and vegetables worth Rs.216 crores. The total quantity of fruits and vegetables traded and the annual turnover of these markets in the last five years given in table 22.

Table 22. Trading of Fruits and Vegetables through VFPCK Markets: Quantity traded, annual turnover, and average price in the last five years (2015-16 to 2020-21)

Sl. No.	Financial Year	Total Quantity Traded (MT)	Total Turnover (lakh)	Average Price per kg (Rs.)
1	2015-16	102627	230.00	22.41
2	2016-17	100213	280.00	27.94
3	2017-18	100694	306.50	30.44
4	2018-19	82112	246.45	30.01
5	2019-20	92129	274.52	29.80
6	2020-21	116385	215.99	18.56

Recently, VFPCK has exported 42 metric tons of produce including 4 metric tons of vegetables.

Infrastructure, geographical coverage, and governance

There is a network of 290 VFPCK Farmer Markets (Swasraya Karshaka Samithi, SKS) functioning across all 14 districts of Kerala with an annual average of one lakh MT of produce and an annual turnover of Rs. 250–300[2] crores, making it the single largest organized marketing network of farmers' markets in the sector in Kerala. The major fruit crops handled by these markets include different types of bananas such as nendran, njalipoovan, palayanthodan, and robusta, and a considerable quantity of jack, pineapple, and papaya. Through these markets farmers trade an array of vegetable crops such as cowpea, bitter gourd, snake gourd, cucumber, ash gourd, coccinea, brinjal, bhindi, tomato, chilly, yams, and diascorea. Many cool-season vegetables like potato, carrot, cabbage, cauliflower, beetroot, garlic, and coriander leaves are also traded through these markets. These markets are managed by an executive committee constituted by master farmers from the associated self-help groups with VFPCK officials as ex-officio members. These markets are closely monitored, and the accounts are audited monthly by a chartered accountant.

In response to the escalating demand for semi-processed, ready-to-cook, and ready-to-eat food products in Kerala, VFPCK has launched the first outlet for branded vegetables in the State with the brand name Thalir. Apart from this, infrastructure support has been provided to establish a total of 63 eco-shop model outlets (Thalir Green outlets) across the State to support farmers in the production and marketing of safe-to-eat produces. VFPCK has also established two centres for the procurement, processing, and trading of jack fruit at Wayanad & Idukki and a total of seven primary processing centres. The Council also provided infrastructure and techno-managerial support to cut vegetable units, dehydrated ripened banana units, packhouse for banana and vegetables, chips unit, tapioca processing unit, and branded retail franchise outlets called Sasya.

[2]This market system has been in place for the past two decades and had been showing a steady upward trend in growth till 2017-18 when the state witnessed the worst flood in a century. Like other agrarian sectors, the flood has affected the fruit and vegetable sector also, and it was reflected in the drop in quantity and turnover in the following year. Although it picked up the next year in terms of both quantity and value, the year 2020-21 has been disappointing in terms of price realization. Owing to the economic crisis due to the COVID pandemic, there was a sharp decline in the average price realized by the commodities.

Issues and challenges

Even though VFPCK's group marketing concept is considered a replicable model for good participatory marketing, it did not perform with the same efficiency everywhere. The concept of participation implies the existence of a homogenous group. However, on the ground, a group is comprised of individuals with varying views and perceptions, who might respond differently to the same issues. This characteristic of a group could be a strength while solving unforeseen issues in market management but could be counter-productive in some cases. If the marketing committee fails to identify good traders, or exhibits a lack of commitment, it would result in these traders dominating the market, undermining the possibilities of realizing better prices for the commodities. Though the auction system is followed in most VFPCK markets, this tried and tested method for better price realization will not be completely effective in markets where proper grading is not followed.

Traders are not a homogeneous category and vary in their trading behaviour. Unfortunately, even when a Government agency like HORTICORP procures the produce, there is a considerable delay in payment which needs to be addressed. If there is a delay in payments to the farmers, it would affect the timely execution of cultivation activities. This requires constant follow-up and strict monitoring to recover the payment from these traders. Strengthening these markets requires constant monitoring from the facilitators and support from the State. Today, facilitators are overburdened with the tasks of managing 2–4 such markets, and an attempt to double vegetable production might put more pressure on them. Improving staff strength could help in handling the increased inflow of produce.

This model of group marketing has been replicated by various Government agencies. Unfortunately, the number of markets established in some panchayats is not in proportion to the production from that area. These markets established by various agencies target the same farmers, and also seek the same set of traders, resulting in farmers losing their bargaining power and the traders dictating the price. Often, the farmer markets find it difficult to retain their member farmers as they are lured by the other markets or traders with a temporary hike in price, affecting group cohesion. The same farmers enrol as members in multiple organizations with the same objective. This brings in conflicts, questioning the sustainability of those institutions.

Financial support to farmers is channelled through different Government organizations, viz. Krishi Bhavans, VFPCK, other organizations like Sanghamythri. However, the same farmers are given differential financial aid by these organizations for the same activity. This causes a shift in the loyalty of farmers, ultimately affecting the very foundation of farmer collectivization built on trust and commitment. Self-reliance and self-governance were the pillars on which the VFPCK markets have been built and this helped them endure a quarter-century-long journey successfully. All newly established marketing initiatives, except that of VFPCK, are provided with initial capital which once drains out, might fail to keep the interest of the stakeholders and break the system down.

Though traders are an integral part of a marketing system, forming cartels and reducing the price would ultimately make farming less profitable for the growers, forcing them to

leave the profession. Eventually, the traders too will be forced to seek new means for their livelihood while consumers will become more dependent on other States to meet their requirements. The inevitable outcome would be the collapse of all these markets.

Future prospects and strategies for integration

Doubling vegetable production would demand efficient marketing avenues to dispose of the marketable surplus at a reasonable price. If not planned and managed efficiently, this might turn counter-productive with market glut and price fall. In this context, the following steps could be taken for managing the current crisis,

1. The concept of panchayat-wise wholesale markets shall be initiated only where there is sufficient produce and enough growers to run it sustainably. In areas with established VFPCK markets, new markets should be avoided, or merged or integrated with the existing VFPCK market. Beneficiaries in that area may be enrolled in a single market and all the financial supports for fruits and vegetables are to be channelized through it.
2. All Government funds for marketing of the produce should be routed through farmer markets based on the quantity traded and the financial support provided for a particular activity should be made uniform.
3. Except in unavoidable circumstances, HORTICORP shall procure produce from the local farmer markets, and not directly from the individual farmers.
4. The markets may be encouraged to engage in retail tie-ups with HORTICORP, Kudumbashree, Civil supplies, Consumerfed, etc
5. Eco shops should handle only produce with GAP or PGS certificate, procured from wholesale farmer markets under VFPCK or other Government agencies.
6. The members should be incentivized to grade their produce to be traded in a common brand, echoing their uniqueness.
7. Damage to fruits and vegetables caused by careless handling during harvesting, packing, transportation, storage, etc should be avoided. Proper training to farmers and developing a protocol for post-harvest handling will help them get a better price for their produce. Produce should be handled carefully and transported in crates, cartons, and gunny bags having a brand logo.
8. Owing to its perishable nature, fruit and vegetable marketing involves tremendous risk and hence, the markets need to be supported with market intervention to avoid distress sales. Supports like market intervention, base price support, and periodically revised sales promotion incentive are to be provided considering inflation accounting.
9. At the time of glut, excess produce can be pooled district-wise for sale, if needed. The support needed for this, including permission for using the premises of identified spots, transportation support for pooling the produce, support for infrastructure, labour, etc., have to be provided.
10. Risk fund[3], a scheme intended to support farmers at the time of price fall by providing fair price support and exigency, has been welcomed by the farmers. During the FY

[3]*SKS consortium finalizes the base price for the financial year for the major crops in the district based on the cost of cultivation. These prices are reviewed at HQ against MIC data and the base price for each quarter will be finalized. When the price of first-grade produce traded in the SKS falls below the base price the difference between the approved base price and the actual price received by the member farmer will be reimbursed.*

2019-20, Rs. 60.86 lakhs was received as a contribution from GoK and Rs.40.57 lakhs was collected as a beneficiary contribution (1984 beneficiaries). This needs to be continued and revised to support the growers.

11. The base price scheme has been declared for only 16 selected fruits and vegetables and does not include all the major crops of our farmers. The activities of the district level price monitoring committee (DLPMC) which was constituted to declare the market price of produce when it falls below the base price should be more effective for the successful implementation of the scheme. It is imperative to provide timely assistance to the farmers.
12. The committee also fails to declare the base price for all the eligible items under the scheme. Therefore, products that are not included in the base price scheme can be supported with the risk fund scheme.
13. Provision of infrastructure for farmers' markets in the form of land and building would provide an identity for the farmer market, space for the sorting, grading, and marketing of produce, and reduce the expenses of the Samithi in terms of hire charges. The presence of a permanent structure could instil a sense of ownership and pride among the member farmers improving group cohesion and eventually, ensuring sustainability. VFPCK provides the Samithies with land and buildings for trading. Generally, the building consists of a trading hall, an office room, a room for the storage of inputs, and an agro clinic which will provide technical information. Currently, only 126 out of 290 VFPCK markets have their own building. Infrastructural supports need to be provided for the construction of own building for other eligible markets and the fund needs to be allotted for meeting the maintenance expenditure and modernization of the existing buildings.
14. In SKS, marketing of the produce is carried out twice or thrice a week and farmers face difficulty due to a lack of storage facility. A modern cost-efficient storage facility should be provided to reduce post-harvest losses.
15. Support is sought for managing the other projects implemented by VFPCK such as the establishment of Primary Processing Centres, VFPMC, branded retail outlets, and Jack fruit Trading Centre, etc.
16. Value addition can help in ensuring better price for produce, especially during market glut. The value-added product should be procured and supplied by Government agencies and SupplyCo.
17. SKS produce should be branded. Linkages with large supply chains or companies can ensure an assured market for such produce. Geotagging each plot of land and thus maintaining the traceability of the crop output from the farm until it reaches the customer could be undertaken.
18. Among the 300 markets notified as nodal markets in Kerala under the base price scheme, 250 are VFPCK markets. However, only less than 180 SKS are computerized. In some areas, the sales details of many farmers could not be entered into the AIMS portal within the stipulated time due to a lack of infrastructure support like computers and internet facilities. This leads to a delay in entering the sales details of those

farmers into the portal. Infrastructure facilities for technology-driven marketing with computers and high-speed internet have to be supported.

19. Our present accounting software for SKS is V-soft which was developed in-house. It is a modest software and easy to manage, but owing to data security issues, the data is not connected to a single server. Better accounting software like Tally needs to be installed in all SKSs to handle the expected output from the doubling of vegetables.
20. The possibility of integrating VFPCK markets with eNam needs to be explored to facilitate pan-India trade of fruits and vegetable produced in the State. This has to be carefully designed for better price discovery through a transparent auction process based on the quality of produce along with timely online payment.
21. Integration with other institutions needs to be done. Though some of the LSGDs support VFPCK markets in isolated cases, it is not the norm for these LSGDs to provide budgetary allocation for these markets. This must be revisited and activities of VFPCK need to be supported by this well-acclaimed decentralized system of governance.
22. VFPCK has been entrusted to form 70 FPOs to assist the farmers in areas of inputs, production, processing and value addition, market linkages, credit linkages and use of technology, etc. While forming the FPOs, the VFPCK self-help group will act as base level clusters and the VFPCK farmer market can act as FPOs. The activities of VFPCK markets could be integrated with the FPOs.
23. Recently, VFPCK has ventured into exporting and initiated trading of fruits and vegetables to different markets outside India, such as Kuwait, Dubai, Singapore, and UK, under the brand 'Thalir', which needs to be promoted. Plans can be made to export at least 10% of the produce in the SKS with the help of Government support schemes.
24. Support is also being sought for establishing more branded Thalir retail outlets, a north-to-south distribution channel, and a platform for trading organic fruits and vegetables.
25. Continued support is also needed for existing GoK Projects such as the Rebuild Kerala initiative 'Project on strengthening market network in Kerala', procurement, trading & processing of jack fruit by VFPCK, market development activities of VFPCK, bulking points, collection centre, agro clinics, Vipani audit fee, SKS computerisation & maintenance, Vipaninet, MIC charges, support for post-harvest handling and value addition units, pack houses, sales promotion incentive, market intervention support, and common facility centre for farmer markets.

To conclude, if supported with necessary resources, these markets could play a key role in the promotion of vegetable cultivation to achieve the proposed goal of doubling vegetable production in Kerala in the next five years. Hence, providing necessary support to these markets is of paramount importance.

7. REFORMING EXISTING GOVERNMENT SCHEMES TO SUPPORT VEGETABLE PRODUCTION

Reforming existing schemes to improve vegetable production was discussed. The recommendations that evolved from the discussions are summarized below

Cafeteria mode outlay with Flexi Funds

The vegetable development programme is a prestigious programme of the department launched in the first year of the 12th five-year plan. The outlay provided for the scheme for the last 10 years are shown below

Table 23: Annual outlay for vegetable development plan

Year	Outlay provided, Rs. lakhs
2012-13	4850
2013-14	6225
2014-15	7000
2015-16	7000
2016-17	7430
2017-18	8500
2018-19	8700
2019-20	7090
2020-21	6947
2021-22	7445

Source: Dept of Agriculture Development and Farmers' Welfare

To bring more convergence and effectiveness to the schemes that are concerned with output delivery, a cafeteria model allocation is suggested. Department should have flexibility in reallocation between components. All the components could be categorized under two categories, viz., essential and optional. Optional components can be varied depending on the agroecological requirements for timely implementation. Out of total outlay, 25 percent is suggested as flexi funds under optional components. Government of India has already adopted the flexi funds model in schemes.

Substantial Increase in Outlay

In order to double the production more marginal areas have to be brought under vegetable cultivation and the outlay must be more than doubled for meeting the target. The annual fund requirement is projected as Rs.150 crores and Rs.750 crore is projected over the 14th five-year plan period for the modified VDP. More and more marginal lands must be cultivated where incremental output will be less, apart from technologies. Additional funds are required to sustain the production in such land.

Inflation accounting in revision
Along with the increase in outlay, the assistance under different components may be revised once in three years to account for inflation. The practice of using old cost norms must be ended, and the cost of cultivation as well as other requirements must be accounted in the revision of assistance.

Green book model approval
Similar to LSGD schemes, all the components under the VDP may be approved in April itself so that agricultural officers can link with local body schemes for more convergence. Some components are approved quite late and reach the Krishi bhavans after the season. To avoid that, department schemes also may be approved before April end. Necessary administrative systems must be put in place for this.

Physical targets
Scheme monitoring may be implemented with physical targets along with financial targets. Now, more focus is given for financial achievements without looking to physical achievements. More monitoring indicators may be developed for physical targets.

Production planning
Production planning has not been attempted in vegetable production in a realistic manner. A new mode of implementation will be initiated with production planning. But the most important part is an expert group at the district level could be formed with statistical experts to guide the production planning process. Crop specialists as well as statisticians could be engaged in developing the production plan. A small budget provision of 5 lakhs per district is suggested as the requirement for production plan preparation

Incentives in marketing
Incentives may be provided to farmers for marketing in cluster markets, along with transport support for transporting surplus produce in times of glut from one market to another. Suggested funding is about 2 lakhs per cluster with markets, preferably A grade clusters

Trader monitoring and incentivisation
Traders are not registered with markets at present. A new system of registration may be introduced for incentivizing the traders. Traders taking more quantities with maximum price will be incentivized. Norms will be prepared for this. An amount of Rs.25000 per cluster may be earmarked for this purpose

Non-lapsable procurement fund
Issues in marketing and difficulties in getting the amount due to the farmers from the procurement agencies were discussed in detail. Procedural issues often delay the payments for months together. Several farmers in Idukki have reportedly stopped vegetable cultivation due to this issue. To ease the situation, the procedure may be modified so that the amount could be deposited in Treasury itself but may be exempted from all treasury restrictions.

Assured and incentivized procurement price
Assured price is the prerequisite for any production to sustain. A stable incentive procurement price may be introduced along with production increase. The base price is

only a crisis price. An incentivized procurement price is required to attract more farmers into vegetable cultivation.

Storage at decentralized level

Adequate capital investment is suggested for establishing cold storage and connected infrastructure under a professional management. Exact fund requirement may be worked out in subsequent meetings. The funds could be sourced from PACS or GOI. Professional management, networking, logistics etc. are more important in this initiative.

Interest-free credit

A major reform proposed is the establishment of a system to provide interest-free credit to farmers. As a token, an amount of Rs.10 crore is suggested to initiate the scheme.

Protection against wild animals

Human-animal conflict is a serious problem in several areas in the State. A separate budgetary provision may be made to arrange for the protection of crops from wild animals. Boundary protection, technology-based support and compensation are suggested as the components for the scheme. The infrastructure construction, boundary fencing, etc. should be on a participatory manner. An amount of Rs.50 crore may be provided to initiate the project.

Reform in expansion of New technologies:

Often, new technologies are introduced without sufficient background work. Before the introduction of technologies, the required technical documents should be prepared, and training should be provided. Quality monitoring of construction materials including those used in micro irrigation in the field should be provided independently. The beneficiary selection should be reformed and only interested beneficiaries need to be identified. A field report on rain shelters and poly houses may be prepared. New technologies like aquaponics, vertical farming, hydroponics, and aeroponics are to be introduced with all precautions and support systems. Excessively subsidy-oriented technology introduction may be discouraged

Inclusion of pests and diseases in crop insurance

Crop insurance for vegetables to be made more attractive by including protection from pests and diseases. The crop loss due to pests and diseases in vegetables is estimated at 3.6 lakh tonnes. A major reworking of crop insurance scheme is needed to incorporate protection for pests and diseases. An amount of Rs.10 crore may be additionally provided for compensating the modified crop insurance under VDP. Detailed technical parameters could be worked out by an expert team.

Reforms through AIMS Portal

The DoA has decided to strengthen the prestigious AIMS portal. All assistance under VDP may be provided through AIMS portal for faster service delivery to beneficiaries. Private portals are to be approached very carefully considering data security and other related issues. The possibility of developing AIMS portal for marketing must also be explored and expanded. Artificial intelligence and other modern IT technologies should be used under a Government-sponsored mechanism after putting in place the appropriate data security and data ownership agreements.

Faster support response for natural calamities:
Loss due to natural calamities are becoming a repetitive problem. Despite considerable crop loss owing to natural calamities for the last three years, compensation has been delayed in a number of cases. A mechanism may be delivered to provide NC assistance within a stipulated period of one or two months.

Lease land farming
More encouragement is required for promoting lease land farming. Even though leasing is illegal in Kerala, informal lease is widely practiced in food crops like vegetables, rice, and banana. Several problems have been reported in extending assistance to such farmers due to lack of documentation. Typically, the lease agreement is not shared by the landowners or there may be no lease agreement at all. A farmer-friendly certificate system must be introduced to those who cultivate crops on leased land. Moreover, the upper limit of extending assistance may be increased to 15 acres from 5 acres at present. In the base price scheme also, the upper limit of procurement has been enhanced from 5 acres to 15 acres. The same may be applied to lease-land farmers in extending assistance under the VDP.

Expansion of organic farming under certification and traceability
Organic farming practices like certified organic agriculture, safe-to-eat mode of production, Good Agricultural practices, Vrikshyurveda, and BPKP, are finding wide acceptance in Kerala. A certification authority may be formed under the DoA for the certification of organic agriculture. A traceability system must be introduced to ensure higher prices for the farmers. A higher price must also be ensured. A pricing scheme may be worked out to expand organic agriculture. KAU may provide a final package of practices for organic agriculture based on the State-of-the-art, and replace the ad hoc package of practices released more than 10 years ago. A marketing system also may be introduced for organic agriculture under a common brand name. An amount of Rs.15 crore is suggested as a budget support for these new initiatives.

8. REVIEW OF AIMS PORTAL; SCOPE FOR BLOCKCHAIN-ENABLED LOGISTICS AND INFRASTRUCTURE SUPPLY CHAIN BACKBONE FOR AGRICULTURAL PRODUCE; SCOPE FOR AGRI-STARTUP MISSION

Agricultural Information Management System (AIMS) portal is a remarkable initiative by the Government of Kerala to provide many crucial services to the farming community in the State. It is effectively used to serve as a single window for data collection for planning and dissemination of information to a multitude of stakeholders, viz. farmers, policymakers, officials, traders, scholars, and the civil society.

Suggestions:

1. Despite its comparative effectiveness, the design of the AIMS portal needs improvement. The site has been noted to be very slow, particularly during the afternoons even when accessed by trained personnel. Uploads and OTP generation is also tedious. If the site is to be used to its full potential, the server capacity needs to be improved manifold.
2. User-friendliness must be ensured, keeping in mind that the portal targets farmers who may not be highly conversant with computers. AIMS kiosks may be installed at local Krishi Bhavans, VFPCK Markets, and other institutionalized markets with large screens and voice assistance. Short instructional videos, Aadhar-linked population of basic details, drop-down menus with 'other' option for additional information, and user-friendly scanning facilities for photographs and documents must be ensured.
3. The information required should be minimized to what is strictly necessary, and there must be uniform requirements across the State. For instance, the lease land growers in the Malappuram district were exempted from submitting the tax receipts of the owners whereas many other farmers from other districts could not avail of the facility.
4. When applying for claims, the cost of production, potential yield, ceiling, etc, need to be fixed more realistically. For instance, as of now, the potential yield of banana is fixed at 10 tonnes per ha which is far below the yield realized by a good farmer.
5. The market prices of the commodities need to be closely monitored and the declaration of price fall by the District Collector needs to be done without any delay.
6. Submission of details from the bills of an institutional market is mandatory for claiming the base price. It could be simplified by linking the first entry in the market using a unique ID to the claim submission.
7. Presently, claim submission is a long process and this needs to be simplified further. Claim settlement too, is delayed and steps are to be taken to address this issue.
8. Appropriate and legally binding steps need to be taken to bring those farmers who cultivate in lands without title deed (Patta) under the coverage of the AIMS portal. As granting patta depends more on the State than the individual, these farmers who contribute considerably to agriculture, must be brought under the purview of such schemes.
9. An SMS update to the registered farmers is of utmost importance to ensure accountability and transparency. This will help them update themselves about their

stage of registration, application status of various services, submission of further documents, missing information, approvals, sanction, and disbursement of assistance.

10. Once registered, reminders to the members could be sent through SMS with direct links for further actions such as registering their next crop or applying for the base price scheme.
11. After the portal is made user-friendly and accessible to the majority of the farmers, farmers need to be incentivized enough to provide more data on the cost of production, reporting of pests and disease outbreaks, irrigation, harvest details, price realized, reporting price fall, etc. and they should be rewarded for doing so. This is of paramount importance in generating more reliable and updated data to feed into the policy-making process.
12. The same data could be used for providing sales promotion incentives to the growers with additional incentive for mixed cropping and crop rotation, on top of the production incentives.
13. The data thus generated should be made accessible to farmers, policymakers, officials, traders, scholars, and civil society while protecting the privacy of the registered growers. This could pave the way to the preparation of a production plan which could be able to address the issues of crop diversification and market glut, thus making a step further towards attaining the goal of economically viable, ecologically sound, and socially just agriculture.

BLOCKCHAIN-ENABLED LOGISTICS AND INFRASTRUCTURE SUPPLY CHAIN BACKBONE FOR AGRICULTURAL PRODUCE IN KERALA

Introduction

The objectives of this scheme are

1. Assured markets and price realisation for farmers as the driver to increase production, area of cultivation and income of farmers of vegetables, fruits, and tuber crops.
2. Decentralised and assured procurement for every possible region in Kerala, with no farmer left without a procurement centre at their nearest proximity (ward level, at best)
3. Enable all players – Government, LSGs, State marketing agencies, FPOs, PACs, Kudumbashree, farmers, farmer collectives and private vendors, by providing them with a professionally run, regulated and functioning logistics backbone and supply chain system to plug in, register and function as a producer, procurement agency, logistics operator and/or marketing agency.
4. Enable better demand mapping - area, crop, season and quantity wise, and help better crop planning, production and supply so as to avoid market failures either due to insufficiency or glut.

Proposed idea

Instead of State-assisted production support through schemes and subsidies, and a highly inadequate market support through State-run marketing agencies and shops, the proposal is to build, establish, and offer a professional end-to-end, blockchain-enabled logistics and infrastructure supply chain backbone for agricultural produce (mainly vegetables/fruits/

tuber crops) in Kerala. This can have the following core elements from the top end to the bottom end

- A centralised blockchain-enabled information management and control system (IMCS) with a registration and plug in option for producers, procurement agencies, logistics agencies, and end suppliers. Each of these types of users may be provided an app to plug into the system.

- A cold chain transport logistics, with long haul capability for inter district movement and short haul capability for local intra district movement. The cold chain transport logistics can be electric driven as much as is practically possible. All these logistics that may be run by various players should be connected to the IMCS.

- A chain of cold storages established at the block or other appropriate level, and operated by various players, all connected to the IMCS.

- A local chain of smaller storage systems, as need be, at the panchayath level, based on assessment study and growth of production. Such storages may also be run by various players and are also connected to the IMCS.

- Local (at best, ward level) centres/outlets that double as the procurement centre as well as sales outlet, to which registered farmers can go and deliver their produce, their produce checked for quality, weighed and data entered IMCS. These Local centres/shops may be setup and run by any of the above players, including local panchayaths.

Scheme of operations

Presently, we do not have any modern system that looks at agriculture marketing through the entire supply chain perspective. While the DAFW continues to run schemes that promote crop production, it should additionally enable the professional and technical upgradation including expanding the mandate of either the Horticorp or the VFPCK or facilitate a collaborative institution that should build and professionally run a backbone supply chain and IT infrastructure.

The operation of the system may be described simply as below.

1. A farmer, whether they be large, small, marginalised or landless, should be able to register as a producer, if they have marketable surplus, and should be able to predict and enter the expected crop, quantity and approximate periods of supply, in an application like the AIMS that would be part of the IMCS. This leads to an estimate of crops and quantities in a season. Accordingly, the IMCS may designate a local centre to which the farmer can deliver their produce. This may be a centre nearest or most accessible to them, preferably in the ward where they have the farm/home.
2. Local centres are agencies that may be setup by any of the Government, LSGs, any State-owned marketing agencies, FPOs, PACs, Kudumbashree, farmers, farmer collectives and private vendors. They can be the shops already functioning such as Horticorp, VFPCK, Eco shops etc. These are also to be registered with the IMCS and have an app to enter and process procurements and sales data.
3. Once the farmers bring their produce to a designated centre, the personnel in charge of

the local centre checks the quality of the produce, weigh and accept the produce. The data is entered in the app with the register number of the farmer. The farmer gets the payment at the Government fixed rates (MSP/Base price) within the stipulated period. The quantity of produce is added automatically to the block chain. The produce could get sold in their shop itself, and as it is done, the quantity is reduced from the central data base. The produce may also move further up the supply chain.

4. The produce that is available and needs storage would then move out through designated vehicles to one of the various levels of storage, at the panchayath/block levels for further onward supply according to demand.
5. At the demand side, the registered traders or any agency that wishes to procure and sell the produce may register and raise their demands prior itself, and depending on availability, the produce gets organised at the storage/organising yards and the products are delivered to the demand side agencies upon payment.
6. A stock taking and specific sale strategies for items that remain beyond a certain period may then be taken at the Block/ District or State level depending on the nature and quantity of the produce.

Considerations

1. The system needs a professional, technically sound, modern management agency with good HR and trouble shooting skills. Such a team needs to be handpicked, trained, and deployed.
2. Blockchain technology is a time tested one for supply chain management. It has its costs but in terms of building transparency and full chain traceability, adopting this could be critical.
3. Instead of looking for a new institution to run the system, we can upgrade either the Horticorp or the VFPCK, or have a collaborative body that runs the system. Alternatively, it may also be entrusted to a professional agency, which has proven standards and experience.

Way forward

This proposal cannot be fully implemented at a go, and needs very careful evaluation, planning, designing, some restructuring, institution building and execution, preferably with pilot projects and then gradual expansion to the whole State.

Before a DPR is prepared, we may generate a virtual model based on available data for a district and do virtual runs to be convinced of having such a model. This can adopt the blockchain technology so that the software system is also tested. Such a model can be developed with the help of available resources in Kerala, such as engineering students, KAU etc.

The preparation of a DPR with a clear ToR may be entrusted to an agency of repute and experience.

Resources

A well-prepared DPR with estimates and field level time-lined action plans will help raise

resources for this ambitious project. One can look for resources from various sources, including plan funds, infrastructure investment budget through NABARD refinancing, equity contributions from major players in the supply chain or from individual investors, like in the CIAL model, KIIFB borrowings, or even an ambitious attempt at the World Bank fundings.

Endnote

In this era of cutting-edge technology, drones, artificial intelligence and machine learning, etc., one might wonder why these technology barely benefit farms and farmers. Even today, farmers work the earth against all odds including weather and financial constraints, and then wait for an almost non-functional and arbitrary market system, that even if it works, never pays them a remunerative price. Farmers and entrepreneurs need to submit hard copy documents every time they apply for benefits. It is time that we automate such systems, and the best place to start is to make "Ease of Farming and Marketing" as that State policy.

The automation of agriculture offices is a welcome mover, but it is of no use if the services of such automated system does not positively and effectively make life easier for the farmers. It would be apt to allow the process to start at the most needed market access and price realisation, so that even while the income of the farmers improve, the production could be doubled, as is the goal.

SCOPE OF KERALA AGRI START-UP MISSION

An Agri startup mission is primarily geared to address the needs of early starters, innovators, motivated young farmers, and entrepreneurs in the rural and agriculture field. It has the following objectives.

1. To pro-actively scout for, identify, mentor, and incubate individuals/groups, potential Start-ups, with planning, management, technology, training, financial hand holding and other needs to make them evolve into viable and successful rural/agri entrepreneurs.
2. To ensure case-by-case needs assessment and need-based support for potential startups/ entrepreneurs in rural/agri field and facilitate/mentor their growth.
3. To build quality in agri produce, larger reach of organised collective/cooperative production, processing and market support and better realisation of farmer-level income.

Proposed idea

Presently, any person/group entering the field of agriculture with a vision that involves not just farming but the building of their own enterprise around it, must follow the same pattern of rigidly fixed schemes, becoming beneficiaries through the DoA system, approaching and negotiating with finance agencies and banks, meeting serious roadblocks and in the process of building such an enterprise, becoming fatigued. While technology support is available, access is still limited with no professionally managed agency to bridge the gaps.

A one-stop centre, a professionally managed Kerala agri start-up mission, with both centralised and regional expertise, and whose mandate is to identify and enable the growth of agri start-ups and enterprises is the need of the time. This can have the following operations

1. A professional agency, the Kerala agri-start-up mission with regional centres/agencies franchised/directly run, with expertise in agriculture field level enterprise building, planning, management, training, technology linking, financial linking and marketing.
2. The agency can run skills programmes, scouting and identification exercises, incubation and launch pad schemes, mentoring and training programmes, as well as long term support programmes.
3. The agency would handhold the identified group through its incubation and fledgling stages, till it matures to a self-reliant enterprise.

9. SUMMARY

14TH FIVE YEAR PLAN – PROPOSAL FOR VEGETABLES

Critical gaps in formulation and implementation of schemes during 13th plan

- Lack of integration between agencies, DoA, VFPCK, Horticorp, and LSGs in the implementation of vegetable development schemes.
- Inadequate mechanism to assure the quality and supply of seeds, grafted seedlings, bioinputs, limited use of Agromet advisory service, poor adoption of soil test based fertilizer application.
- Inadequate storage, transport, and marketing support.
- Lack of AEU-based crop production and marketing plan; no production plan or staggered crop production for daily supply to potential markets
- Incomplete database about farmers and local vegetable production. Potential of IOT not exploited.
- No proper support for farmers cultivating on leased land
- Identification of beneficiary and distribution of assistance is based on area and not on production
- Lack of continued support for farmers availing assistance under protected cultivation.
- No convergence mechanism to accommodate social organizations involved in vegetable cultivation.

Proposal for Vegetable Sector in Kerala : 14th five year plan

1. Promote commercial vegetable cultivation in potential AEUs (1,2,3,8,9,10,11,12,13, 17,18,20,21,22,23) through cluster approach to increase the production of vegetables from 15.7 lakh tones in 2019-20 to 31.4 lakh tones by end of the 14th Five Year Plan. Adopt location specific production protocol with respect to season of cultivation, soil management, selection of varieties/hybrids, stress management, harvesting and marketing. The production potential in each AEU should be identified and target-based production based on the 15 AEUs should be planned accordingly. The production of vegetables should be targeted according to the potential of each locality, such that there will not be any excess production of a single vegetable which can result in market glut.
2. More emphasis should be given to the attainment of the physical plan target than the financial plan at the field level. A road map for the formulation of a production plan needs to be done for staggered vegetable farming, not only in commercial fields but also in the homesteads and institutions. Explore the feasibility of establishing "market intelligence" centres to provide an idea of the possibility of the potential crop which the farmers can grow in the coming season to fetch maximum price in markets.
3. Promote scientific organic farming that stresses safe-to-eat vegetables. A campaign to "Eat local food" needs to be popularised to ensure the marketing of farmers' produce via responsible branding. Promote kitchen gardens with a thrust on organic farming and waste recycling. Functioning of pesticide residue detection labs in three zones of Kerala should be strengthened for detecting the presence of new pesticide molecules in vegetables.

4. Adopt a comprehensive policy for popularizing hybrids/HYVs with respect to seed source, nutrient schedule, training, pruning, and pest management. Promote cultivation of market- friendly vegetables like seedless watermelon, coleus, hot chilli, beans and cauliflower among commercial growers after identifying potential AEUs. Quality of Seeds marketed by Private seed companies should be regulated. Independent agency should be entrusted for seed testing to ensure quality of seed produced by farmers as well as by different agencies.
5. State/District seed production plan may be prepared for seed and planting material production and marketing involving/linking various agencies including KAU, VFPCK, DoA, NSC, and identified private seed companies. Promote participatory farmer seed production in self pollinated crops like cowpea. Functioning of farms under State DoA may be improved through purchase of nucleus seeds of new varieties, improving infrastructure facilities of the farms/nurseries for enhancing quantity and quality of planting materials etc. Assist seed multiplication and popularization of new varieties of vegetables released by KAU. Establish a State level seed certification agency as envisaged in Seed Act.
6. Promote nutrigarden concept in all households and flats with a stress on rain shelter vegetable production, terrace farming, vertical garden, container cultivation, and promoting Panchamam in nutrigardens with a minimum of five crops, viz, moringa, chilli, curry leaf, cow pea and papaya.
7. Popularise rain shelter, low-cost polyhouse, and net-house cultivation of vegetables so that crops like salad cucumber, yard-long bean, grafted chilli, and cherry tomato can be grown. Establishment of shade net-house nurseries is to be encouraged for the supply of seedlings and grafted seedlings, and such nurseries may be recognized by the State DoA. Grafted seedlings may be used in the case of hybrids and units at the block level may be trained for the production of grafted seedlings.
8. Promote soil test-based fertilizer application for commercial farming with a thrust on INM. Ensure soil testing as a part of all production schemes and promote campaign approach for periodic soil testing with the participation and coordination of all agencies. Establish three referral labs for detailed soil testing. Promote ready-to-use mixtures like Sampoorna, and Ayar.
9. Agromet advisory services should be improved with location-specific bulletins for each AEU and farmers may be selected and involved in data collection and dissemination of weather-based advisory service.
10. Popularise open precision farming, mechanization with emphasis on solar pump sets and solar-based fencing to prevent the attack of wild animals in vegetable-growing clusters. Promote polyhouse vegetable cultivation in appropriate areas with continuous training and assistance to farmers. Adopt modern techniques like hydroponics, aquaponics, vertical farming in urban and semi urban clusters.
11. Adopt IPM, biocontrol agents such as Trichogramma, Trichoderma, Pseudomonas, Piriformospora, new botanicals, neem soap, Pongamia soap, pheromone traps, other types of traps, ecological engineering- promote marigold cultivation once in a year in

commercial growing tracts, adopt non-host plant cultivation, explore newer pesticide molecules with low toxicity, promote pesticide literacy. On-farm production of bioagents should be promoted in each cluster. Implement crop insurance against the incidence of identified pest and diseases beyond a threshold level.

12. Research should be focused on development of high quality hybrids and varieties, pest and disease resistance. Tapping potential of modern technology, addressing the challenge of climate change, conservation of local vegetable gene pool, promoting biological control in stress management, new value addition protocol for popular vegetables. Tropical vegetable research centre should be established to coordinate and prioritize vegetable research.
13. Promote convergence involving DoA, VFPCK, Horticorp, LSGs and Kudumbashree, and integration of the roles and responsibilities of all the stake holders pooling all the available resources at various levels of LSGIs. A three-tier production plan of vegetables involving panchayat-level support for the arrangement of seeds, planting materials, and production inputs, block-level support for procurement as well as marketing and district-level support for value addition of the products should be followed.
14. There should be a professionally managed, IT-enabled decentralized procurement and marketing system, and this should ensure remunerative price to the producers. The huge potential of FPOs/FPCs and co-operatives should be exploited in the next five years in the field of procurement, value addition, and marketing of vegetables. Necessary changes should be incorporated in the project guidelines to achieve these objectives of increasing production, productivity, sustainability, employment generation and income increase of vegetable farmers.
15. More schemes should be devised on FLD for advanced technologies like aeroponics, hydroponics, and vertical farming, bee keeping : technology may be adapted and tested from research institutes before popularising: after successful field testing using schemes during the first three or four seasons, schemes may be devised for assistance to beneficiaries on such technologies
16. Production linked subsidy and separate assistance may form part of the subsidy schemes (differential subsidy rates for cucurbits/cool season vegetables/leafy vegetables). Improve assistance to Commercial Cultivation of Vegetables (cluster) by 25 to 50% from current rate. Bring farmers cultivating in lease land also under subsidy regime.
17. Assistance to production of State plan projects may be increased by availing more funds from MIDH/CSS schemes. Promote INM, Agromet bulletins, Pesticide literacy and post harvest management in campaign mode using Krishi Paadashala
18. Procurement and marketing of vegetables should be streamlined by defining clear roles to Horticorp, VFPCK and DoA. For handling farmer's produce, establish hygienically designed and easily cleanable district procurement with sufficient storage capacity in each district. Install cold storage facilities for highly perishable commodities at Idukki, Palghat, and Wayanad. Establish retail outlets in every LSG all over Kerala with the help of LSGI and Primary Co-operative Societies. Promote temperature-controlled supply chain facilities linked with district procurement centres in all municipalities

and corporations. Establish processing centres at production clusters with the help of Primary Co-operative Societies.

19. Vegetable and Fruit Promotion Council Keralam (VFPCK), with a network of 290 Farmers' Markets (Swasraya Karshaka Samithi, SKS) handles over one lakh MT of produce worth 250–300 crores annually. As group marketing involves bulking the farm produce at a single point, providing infrastructure support to these markets is of paramount importance. Those areas, where there exists an already established VFPCK market, shall be avoided while initiating any new State-funded market, or such markets could be integrated with the existing VFPCK market. Channelling all the financial support for fruits and vegetables through these farmer markets based on the quantity traded would ensure accountability and transparency. VFPCK is primarily involving in wholesale and by providing linkages to other State-organized ventures like Supplyco, Consumerfed, PDS, and mid-day meals, etc., and with logistic support to the council, a substantial share of these produce from the farmers' markets could be distributed to the consumers at a reasonable price. FPOs could be effectively utilized for organizing this. Moreover, it should be a priority to develop the online under the Thalir brand. Though it has initiated export activities, it could be made a profitable venture only if rejections could be managed through branded outlets. Modernization of these markets with computerization and high-speed internet is necessary with the technological change. All these need to be done in a mission mode assessing the realistic quantity of production and demand in the market. To ensure that the farmers continue to take up vegetable cultivation as a profitable and sustainable venture, and to ensure their welfare, the pricing in all platforms involved in the trading of the produce needs to be regulated through State legislation.
20. Cafeteria model allocation is suggested to bring more convergence and effectiveness of schemes in output delivery. All the components could be categorized as either essential or optional. Out of total outlay, 25 percent is suggested as flexi funds under the optional components. More than double the outlay is required for meeting the target of doubling vegetable production. The annual fund requirement is projected as Rs.150 crores. Along with the increase in outlay, the assistance under different components may be revised once in three years to account for inflation. Similar to LSGD schemes, all the components under the VDP may be approved in April itself similar to green book model. A new mode of implementation may be initiated with production planning.
21. Incentives may be provided to farmers for participation in cluster markets as well as a transport support for transporting surplus produce from one market to another in times of glut. A new system of registration of traders may be introduced for incentivizing them. Traders taking more quantities with maximum price may be incentivized. Assured price is the prerequisite for any production to sustain. A stable incentivized procurement price may be introduced along with production increase and the creation of a non-lapsable procurement fund for assured payment for the farmers.
22. A major reform is proposed to provide interest free credit to farmers. A major scheme is suggested for the protection of crop from wild animal attack. Crop insurance for

vegetables to be made more attractive by including pests and diseases also. Often new technologies are introduced without sufficient background work. Before the introduction of technologies, relevant technical documents should be prepared and personnel should be trained. More encouragement for promoting lease-land farming is required. In lease-land farming a farmer-friendly certificate system must be introduced to help engage more farmers. Similarly, the upper limit of extending assistance may be increased to 15 acres from the current 5 acres with adequate budget provision.

23. All assistance under VDP may be provided through the AIMS portal, which needs to be revamped, for faster service delivery to beneficiaries. Private portals are to be approached very carefully considering the data security and other connected issues. The possibility of developing the AIMS portal for marketing also to be explored and expanded.
24. Different modes of organic farming are gaining popularity in the State. A certification authority may be formed under the DoA for the certification of organic agriculture. Export potential of ethnic vegetables under organic branding should be explored.
25. Explore the scope of establishing a professional, end-to-end, blockchain-enabled logistics and infrastructure supply chain backbone for agricultural produce (mainly vegetables/fruits/tuber crops) in Kerala. Promote Agri startups.

10.ANNEXURE 1

AREA UNDER CROPS 2018-19

(Area in Ha)

Vegetables

Sl. No.	District	Drumstick	Amaranthus	Bitter Gourd	Snake Gourd	Ladies Finger	Brinjal	Green Chillies	Bottle Gourd	Little Gourd (Kovai)	Ash Gourd (Kumbalam)	Pumpkin	Cucumber	Cowpea
1	2	15	16	17	18	19	20	21	22	23	24	25	26	27
1	Thiruvananthapuram	2057.73	237.63	81.47	101.81	82.6	80.48	172.19	0.58	61.92	2.92	14.54	135.92	254.62
2	Kollam	1498.08	188.33	126.04	52.45	85.09	120.49	188.4	12.44	153.65	45.64	55.8	20.58	254.11
3	Pathanamthitta	509.97	84.94	102.6	71.09	66.1	88.01	53.79	0.34	139.17	55.36	50.86	31.48	204.64
4	Alappuzha	571.98	297.22	197.8	191.51	125.73	113.19	99.64	1.15	164.77	64.63	76.17	103.05	382.68
5	Kottayam	654.87	120.08	177.03	193.07	104.48	143	103.37	0.58	324.52	49.86	53.54	36.11	474.74
6	Idukki	591.89	80.96	466.03	26.36	52.76	95.11	117.89	0.12	111.59	39.83	70.26	14.39	564.57
7	Ernakulam	588.49	131.01	61.88	106.84	69.36	59.67	48.39	20.55	134.24	70.67	65.2	76.35	891.72
8	Thrissur	1154.43	89.12	108.67	50.32	80.62	66.34	125.98	2.65	61.03	57.61	58.76	35.9	406.88
9	Palakkad	2142.4	138.4	390.6	229.92	352.12	158.73	224.89	21.79	89.56	176.89	259.45	105.47	910.11
10	Malappuram	2499.87	107.5	74.93	50.12	95.89	34.29	49.07	135.05	64.42	154.48	317.75	186.47	708.85
11	Kozhikode	1544.17	111.58	75.24	21.87	47.1	23.71	117.43	6.19	42.81	46.49	52.2	95.14	162.25
12	Wayanad	411.58	57.18	252.24	7.3	10.54	33.37	60.19	2.22	20.69	46.96	109.91	13.99	261.23
13	Kannur	1752.17	212.27	95.07	23.41	87.02	73.21	112.65	1.52	117.05	94.2	80.42	203.82	231.48
14	Kasaragode	668.67	58.25	48.83	15.86	65.52	39.57	72.4	8.54	102.16	25.08	32.17	79.36	95.17
	State Total	**16646.3**	**1914.47**	**2258.43**	**1141.93**	**1324.93**	**1129.17**	**1546.28**	**213.72**	**1587.58**	**930.62**	**1297.03**	**1138.03**	**5803.05**

(Table - 3 Contd…..)

AREA UNDER CROPS 2018-19													
(Area in Ha)													
Sl. No.	District	Tapioca				Tubers							
		Autumn	Winter	Summer	Total	Elephant Foot Yam	Colocasia	Yarn (Kachil)	Sweet Potato	Koorka	Nanakizhangu	Other Tubers	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Thiruvananthapuram	3306.06	3495.3	6236.47	13037.83	313.1	486.75	46.67	11.94	0.96	24.35	99.48	983.25
2	Kollam	2832.59	4383.51	5693.53	12909.63	1005.86	1268.41	414.89	2.09	1.76	56.59	59.42	2809.02
3	Pathanamthltta	684.34	1457.58	2540.51	4682.43	993.07	1128.6	397.32	1.53	1.78	59.01	1.77	2583.08
4	Alappuzha	204.84	552.63	1098.24	1855.71	473.79	580.19	135.02	4.38	2.25	33.91	0.16	1229.7
5	Kottayam	788.35	2207.69	2964.31	5960.35	400.29	395.14	72.63	0.23	0.53	4.18	0	873
6	Idukki	1141.91	2158.48	2661.86	5962.25	552.57	567.02	162.03	4.5	22.84	2.89	10.07	1321.92
7	Ernakulam	999.74	989.45	3032.91	5022.1	214.37	184.43	19.82	3.17	38.61	2.07	0.75	463.22
8	Thrissur	221.2	222.03	533.03	976.26	46.3	140.12	6.39	2.26	167.06	0.06	22.21	384.4
9	Palakkad	437.88	482.46	804.81	1725.15	588.51	378.47	21.63	51.22	648.37	16.42	134.99	1839.61
10	Malappuram	1118.64	1076.6	2743.1	4938.34	497.78	428.98	47.67	44.62	33.99	11.16	68.36	1132.56
11	Kozhikode	221.58	422.46	716	1360.04	185.47	454.95	26.25	10.59	4.8	3.38	56.6	742.04
12	Wayanad	191.8	231.08	800.4	1223.28	737.55	160	48.25	2.8	1.53	0.04	0.3	950.47
13	Kannur	226.77	595.61	978.3	1800.68	116.17	322.78	16.43	19.92	4.52	1.32	53.37	534.51
14	Kasaragod	59.05	216.65	144.41	420.11	32.71	81.32	6.53	51.16	1.51	0	0.81	174.04
State Total		**12434.75**	**18491.53**	**30947.88**	**61874.16**	**6157.54**	**6577.16**	**1421.53**	**210.41**	**930.51**	**215.38**	**508.29**	**16020.82**

ANNEXURE II
New technologies for vegetable crop production

Hydroponics

Hydroponics is a technology for growing plants in nutrient solutions (water and fertilizers) with or without the use of an artificial medium (e.g. sand, gravel, vermiculite, rockwool, peat moss, sawdust) to provide mechanical support. Liquid hydroponic systems have no other supporting medium for the plant roots; aggregate systems have a solid medium of support. Hydroponic systems are further categorized as open (i.e., once the nutrient solution is delivered to the plant roots, it is not reused) or closed (i.e., surplus solution is recovered, replenished, and recycled).

The principal advantages of hydroponics include high crop yield, crop production where no suitable soil exists, more efficient use of water and fertilizers, minimal use of land area, and suitability for mechanization and disease control. A major advantage of hydroponics, as compared with growth of plants in soil, is the isolation of the crop from the underlying soil, which often has problems associated with disease, salinity, or poor structure and drainage. The costly and time consuming tasks of soil sterilization and cultivation are unnecessary in hydroponic systems and a rapid turnaround of crops is readily achieved. Because of its significantly higher costs, successful applications of hydroponic technology are limited to crops of high economic value, to specific regions, and often to specific times of the year when comparable OFA crops are not readily available. Repeated pricing studies have shown that only high-quality, garden-type vegetables viz., tomatoes, cucumbers, and specialty lettuce can provide breakeven or better revenues in hydroponic systems. These vegetables along with eggplant, peppers, melons, strawberries and herbs are grown commercially in hydroponic systems.

Different hydroponic systems

Two different hydroponic systems are used to produce vegetables: the gravel flow, or re-circulating system, and the open bag, or drain to waste system.

In the drain-to-waste (open bag) system, plants are grown in containers and nutrient solution is supplied to plants by means of a dripper, for up to 12 times per day. The number of irrigation cycles per day depends on temperature and the growth stage of plants. The crops in the drain to waste system grow tall and need to be trained and pruned so that they grow upwards as a single stem.

In the gravel flow system, the nutrient solution is re-circulated and the roots of the plants stand in a thin film of nutrient solution all the time. Gravel or sand is used most often as growth medium. A PG project in KAU attempted to standardize the technique of hydroponic cultivation of tomato in a rain shelter. The experiment was laid out with 13 treatments comprising of two hydroponic methods: a) Deep Flow Technique, b) Ebb and Flow Technique; two nutrient solutions: a) Cooper's solution, b) Hoagland's solution and three growing media: a) coco peat, b) expanded clay pellets, c) pebbles and a control where the plants were grown in soil with POP recommendations. The results showed that plants in

soil with POP recommendations showed superiority for plant height, days to first flower appearance, days to first fruit set, days to first harvest, fruits per plant, duration of the crop, number of harvests, yield per plant, and average fruit weight over the hydroponic treatments. Among the hydroponic treatments, F2S1M1, (a combination of Ebb and Flow Technique, Cooper's solution and coco peat) was the best with respect to growth, yield per plant, and benefit-cost ratio . The yield per unit area was also high for this treatment and this was on par with the plants grown in soil. Out of the two nutrient solutions tested, Cooper's solution was significantly better. The growth and yield parameters were significantly influenced by the growing media and were the best in coco peat, followed by pebbles.

Aeroponics. This is a form of hydroponics. Nutrient and water mixture is sprayed in caged roots under dark at certain intervals with the help of sensors. This conserves water, space and is less cumbersome. It demands constant supervision and has disadvantages as listed under hydroponics.

Aquaponics. Involves production of fish and vegetables with same input resource of water and nutrients. Feed is given to the fishes in the pond not to the vegetables or plants grown as hydroponics. Fish pond or tank water is used as hydroponics or aeroponics with or without additional fertigation. This results in effective utilization of fish pond water and its nutrients for production of vegetables/plants simultaneously with added returns on input resources. Plants act as biofilter for the recycled water to fish pond.

VERTICAL FARMING

Vertical farming generally refers to the growing of crops - mostly vegetables, ornamentals, and herbs on stacks of indoor shelves using artificial light and nutrient solutions, without much sunshine and soil. Such farms are not dependent on seasons/controlled environment and have ability to enhance production round the year with little risk of crop failure. Further, they give fresh quality produce without the need for a favourable climate, healthy soil, and high water consumption, and above all, saves on labour, which is a scarce commodity today. Vertical farming has the potential to sustain the ever-increasing world population especially in the urban areas, thus providing food security. Vertical production of mushrooms, hydroponic green fodder, some vegetables and fruits and even poultry birds are either in practice already or at an advanced stage of practice.

Green, living, or bio walls

These are used in ornamental horticulture. These are comprised of a free-standing space or part of a building that is partially or completely covered with attractive vegetation luxuriantly growing in an organic or inorganic medium and in some cases, soil also.

Sky greens – the world's first hydraulic driven vertical farm

The Singapore-based company Sky Greens has developed a revolutionary vertical farming system which is also the world's first low carbon, hydraulic-driven farm. The vegetables are planted on shelves that keep on rotating throughout the day. For garden walls, selection of suitable plants is the single most important factor in its success. Plants thriving well in local climate are the best option. Besides, they should have compact growth providing thick and dense cover. Plants having short growth habit, shallow fibrous root system and longer life

cycle are best suited for this purpose. They also need to be capable of coping both full sun and full shade according to the location.

Important Features of Vertical Farming
Vertical farms enable the producer to:

- Grow food 24 hours a day, 365 days a year
- Protect crops from unpredictable and harmful weather
- Re-use of water collected from the indoor environment
- Provide jobs for residents/communities
- Minimize use of pesticides/fertilizers/ herbicides
- Drastic reduction and dependence on fossil fuels
- Prevent crop loss from storage/shipping/ long transportation
- Stop agricultural runoff, water saving up to 90%

TERRACE GARDENING

Best containers to grow crops
Based on experiments done at IFSRS, KAU with cowpea, bhindi, chilli, brinjal, Amaranthus, and cabbage, it was found that the best container for growing vegetables is plastic sack with 60 cm height and 45 cm diameter capable of holding 20-24 kg potting media. The greater volume of growing media results in better root proliferation and yield when compared to earthen pot, uv stabilized grow bag and polythene bags. Moreover, the small pores of the sack permits better aeration of the potting media and root zone. However, it has a durability of 1-1 ½ years only.

The cost of a good plastic sack ranges from Rs.18-20/-.

Regarding durability, UV stabilized grow bags were found to be durable for 2-2 ½ years and costs only Rs.15 per bag.

Low-cost drip irrigation system

Based on trials with Amaranthus and bhindi it was found that crop yield under drip irrigation was significantly higher than conventional irrigations. The water use was 39 per cent more under conventional irrigation when compared to the low-cost drip system. Water productivity was 80-85 per cent more under the low-cost drip irrigation system. An entire unit of the drip irrigation system, comprising of 100 m length of pipe, connectors filter etc. costs Rs.849/- only and is manufactured by Jain Irrigation Systems (Jain Drip Kit) (IFSRS, 2014).

Ideal growing media for raising crops in pots on terraces

Crop	Best growing media
Amaranthus	Soil: rock dust: cow dung 1:½:1
Cowpea	Soil: rock dust: vermicompost 1: ½:1
Chilli	Soil: rock dust: cow dung 1: ½ :1
Brinjal	Cow dung: coir pith 1:1 (soil less)

Bhindi	Cow dung: coir pith 1:1 (soil less)

The positive effect of rock dust is evident and can be attributed to the micronutrient present in it besides trace amounts of major and secondary nutrients(based on chemical analysis). Hence, it can be considered for use as a substitute for sand which is difficult to obtain. Moreover, rock dust (Rs.2/- per kg) is cheaper than sand.

Foliar fertilization vis-a-vis fertilization as per the package of practices recommendations
In Amaranthus and brinjal, higher yield was obtained by adopting fertilization as per the Package of practices recommendations, while in bhindi and bush cowpea significantly higher yield was obtained with foliar fertilization (19:19:19 @ 5 g litre-1 +0.5 ml Stanowet). Applying of inorganic fertilizers to the soil in the grow bag will leach out along with irrigation water and react with the cement floor of the terrace, which will in the long run damage the terrace. Hence, this practice has to be dispensed with on terraces. It is in this context that, foliar fertilization assumes importance. In foliar fertilization the inorganic fertilizer does not come in contact with the terrace floor and results in reasonably good yield.

APPENDIX-1

PROCEEDINGS OF THE MEMBER SECRETARY

STATE PLANNING BOARD

(Present: Sri. Teeka Ram Meena IAS)

Sub: - Formulation of Fourteenth Five Year Plan (2022-27) – Constitution of Working Group on Agriculture and Cooperation – Revised Proceedings - reg.

Read: 1. Note No. 297/2021/PCD/SPB dated: 27/08/2021
2. Guidelines on Working Groups
3. This Office order of even number dated 08.09.2021

ORDER No. SPB/342/2021-Agri(1) Dated:14.09.2021

As part of the formulation of Fourteenth Five Year Plan, it has been decided to constitute various Working Groups under the priority sectors. Accordingly, the Working Group on **Agriculture and Cooperation sector** is constituted. For the smooth functioning of the Sectoral Working Group (SWG), it is decided to split the Working Groups into Expert Sub Groups (ESG). Hence the Working Group is categorized into eleven Expert Sub Groups as indicated in the proceedings. The names of the members of the SWG are indicated under each ESG. The Working Group shall also take into consideration the guidelines read 2nd above in fulfilling the tasks outlined in the ToR for the Working Group.

1. A PLAN TO IMPROVE THE EFFICIENCY OF WORKING OF KRISHI BHAVANS

Co-chairperson

- Dr C. Bhaskaran, Professor of Agricultural Extension (Retd), Kerala Agricultural University
- Mr T. V. Subash IAS, Director, Agriculture

Members

- Dr P. Jayaraj, Programme Coordinator, KVK, Kannur
- Dr Sreevalsan J. Menon, Associate Director of Extension, Directorate of Extension, KAU
- Mr V. G. Sunil, Assistant Professor, Agricultural Extension, Communication Centre, Kerala Agricultural University
- Mr P. V. Jinraj, Assistant Director, Agmark Laboratory, Thiruvananthapuram
- Ms Asha K. Raj, Assistant Director of Agriculture, Small Farmers Agribusiness Consortium, Thiruvananthapuram
- Mr Kariyam Ravi,115 Journalist colony, NCC Nagar, Peroorkada
- Mr G. K. Manivarnan, Agricultural Officer, Pallikkal Grama Panchayath
- Mr R. Ajith Kumar, Assistant Professor, IIITM-K

- Mr Joy Sebastian, MD, VCONSOL
- Mr Sidharthan A.K, Assistant Director of Agriculture (Q C),Kozhikkodu

Terms of Reference

- To assess the present functioning of Krishi Bhavans in Kerala and suggest how to improve their effectiveness.
- To identify advanced technologies for use in Krishi Bhavans to ensure better delivery of services and their convergence with LSGIs, Cooperatives, FPOs, and KAU.

2. A PLAN TO EXPAND AND MODERNIZE SUPPLY CHAINS IN AGRICULTURE

Co-chairperson

- Dr Poornima Varma, Faculty, Centre for Management in Agriculture, IIM-Ahmedabad
- Dr A. Prema, Professor & Head, Department of Agricultural Economics, College of Horticulture, Vellanikkara, Thrissur

Members

- Ms L. R. Arathi IES, Mission Director, State Horticulture Mission, Kerala
- Dr A. Suresh, Principal Scientist, CIFT, Kochi
- Dr S. Jayasekhar, Senior Scientist, Social Science Division, CPCRI, Kasaragod
- Mr Valsan Panoli, Kerala Karshaka Sangham, Vapushas, Koothuparamba, Kannur
- Mr.V. P. Unnikrishnan, MFH Flat No.2003, Vrindavan Garden, Pattom Palace P O Thiruvananthapuram
- Ms Deepthi S. Nair, Deputy Director, Marketing, Coconut Development Board, Kochi
- Dr S. Asharaf, Professor, IIITMK
- Mr Mathew Abraham, Assistant Director, Marketing, Department of Agriculture
- Dr Sangeetha K. Prathap, Assistant Professor, School of Management Studies, Cochin University of Science and Technology, Kochi.
- Ms Chitra K. Pillai, Assistant Director of Agriculture, Agricultural Urban and Wholesale Market, Maradu
- Mr L. Subhash Babu, Deputy Director (Retd.), Department of Agriculture and Farmer's Welfare
- Mr Joy Sebastian, MD, VCONSOL
- Mr Ashar Thattarath, PGP IIM, Ahmedabad
- Mr Manu K.G, Public Relations Officer, Directorate of AD & FW

Terms of Reference

- To suggest a design of a unified supply chain for farm inputs and outputs with specific reference to aggregation/procurement, storage, and marketing.

- To suggest a framework where LSGIs, Cooperatives and FPCs can be effectively integrated into the unified supply chain.
- To suggest ways to ensure that the supply chains are integrated with the objectives of trade, value addition and processing - domestic and global – as well as agricultural finance institutions.
- To suggest ways in which the private agencies in procurement, trade and marketing are integrated with the supply chains.
- To ensure that the supply chains meet the requirements of *niche* sectors, such as organic farming, in certification and traceability.
- To suggest the major technological changes and infrastructural investments required to equip the State's supply chain systems to meet the needs of the farming community as well as domestic and international trade.

3. HOW CAN KERALA DOUBLE ITS VEGETABLE PRODUCTION IN THE NEXT FIVE YEARS?

Co-chairperson

- Ms C. A. Letha. IAS, Secretary, Agriculture, Government of Kerala
- Dr T. Pradeep Kumar, Director (Planning), Kerala Agricultural University, Thrissur

Members

- Dr P. Rajasekharan, Chairperson, State Agricultural Prices Board
- Mr V. Sivaramakrishnan, CEO, VFPCK
- Mr J Sajeev, Managing Director, Horticorp
- Ms L. R. Arathi IES, Mission Director, State Horticulture Mission
- Dr K. M. Sreekumar, Professor of Entomology, College of Agriculture, Padannakkad
- Mr Sridhar Radhakrishnan, Thirunelly Agri Producer Company (TAPCo)
- Mr Reghulal, Deputy Director of Agriculture (Rtd)
- Dr K. Mini, Deputy Manager, VFPCK, Idukki
- Mr Prakash Puthanmadathil, Assistant Director of Agriculture, Vengara
- Ms S. K. Preeja, Kerala Karshaka Sangham, Pallichal, Nemom, Trivandrum
- Mr R Balachandran, Chithiramangalam, Ulloor Medical CollegePO, Thiruvananthapuram,
- Mr Reji Jacob, Kunnamkotu House, Nediyassala PO, Thodupuzha, Idukki
- Ms Bindu.J, Assistant Engineer, Office of the Assistant Executive Engineer, Malampuzha, Palakkad

Terms of Reference

- To assess the progress achieved in increasing area, production, and productivity of vegetables in Kerala over the past five years.
- To suggest a roadmap to double vegetable production in Kerala over the next five years with special focus on increasing productivity and farmer's income.

- To examine the ways in which the institutions of LSGIs, Cooperatives and FPCs can be utilised to participate in vegetable production efforts.
- To suggest ways in which existing systems of vegetable production are modernised and integrated with the different schemes of the government as well as post-production activities.
- To review the existing procurement and distribution systems, including government initiatives, and suggest a transparent, technology-driven platform with the active support of LSGIs, Cooperatives and FPCs.
- To suggest ways to reform the existing government schemes to support vegetable production.

4. CONSTRAINTS TO TECHNOLOGY ADOPTION AND THE POTENTIAL TO RAISE PRODUCTIVITY IN KERALA AGRICULTURE

Co-chairperson

- Dr C. Chandra Babu, Vice Chancellor, Kerala Agricultural University
- Dr K. C. Bansal, Former Director, National Bureau of Plant Genetic Resources, Indian Council of Agricultural Research (ICAR), New Delhi

Members

- Dr M.N. Sheela, Director, CTCRI, Sreekaryam
- Dr C. Thampan, Principal Scientist, CPCRI, Kasargod
- Dr Madhu Subramonian, Director of Research, KAU
- Dr Jacob John, Professor & Head, Integrated Farming Systems Research Station, Karamana, KAU
- Dr P. Indira Devi, Director of Research (Retd), KAU
- Dr R. Beena, Assistant Professor, College of Agriculture, Vellayani
- Dr Archana Sathyan, Assistant Professor, Agricultural Extension, CoA, Vellayani, KAU
- Dr P. Rajeev, Principal Scientist, IISR
- Adv. Thomas V T, Varacheriyil, Pala PO, Kottayam
- Dr Nishanth K. Raman, Assistant Professor, CoA, Padannakkad, KAU
- Mr Rijish Rajan, CEO, Simplified Enterprises Management, Palakkad
- Dr Thomas Aneesh Johnson, Soil Survey Officer, Office of the Deputy Director and Soil Survey, Thrissur (North)

Terms of reference

- To assess the status of productivity of major crops of Kerala and estimate yield gaps.
- To identify linkages between the adoption and use of modern technology and the gaps in yield in major crops.

- To examine the potential for raising productivity in major crops with the existing technologies.
- To identify gap in the availability of technology and suggest measures to hasten the development of these technologies.
- To suggest measures to improve the research-extension linkages in Kerala's agriculture.
- To suggest a policy framework to transform homesteads into profit centres through the practice of technology-driven agriculture.

5. PREPARATION OF SOIL AND LAND USE PLANS IN LSGIs FOR AGRICULTURAL GROWTH

Co-chairperson

- Dr Srikumar Chattopadhyay, Faculty, GIFT
- Mr S. Subramanian IIS, Director, Soil Survey & Soil Conservation, Trivandrum

Members

- Mr T. Gangadharan, Extension Faculty, KILA, KSSP
- Mr K. S. Hiroshkumar, Scientific Officer, IFSRS, Karamana, KAU
- Mr B. P. Murali, Member, Nagaroor, Kilimanoor Block (KBPA)
- Mr R. Sukhalal, Swararagam,Cherthala South PO, Alappuzha
- Mr A. Nizamudeen, Land Use Commissioner, Kerala State Land Use Board
- Mr K.P. Abdussamad, District Soil Conservation Officer, Kannur
- Mr Anand Vishnu Prakash, Agricultural Officer, Manakkad Krishibhavan, Idukki

Terms of reference

- To critically assess the status of preparation of land use plans by LSGIs in Kerala over the past five years and identify the reasons for the poor performance of LSGIs in this regard.
- To suggest and prepare a guidance note for the effective preparation and development of land use plans, and its integration with watershed plans and agricultural production systems.
- To suggest ways to integrate and converge the objectives and activities of multiple government agencies possessing data on land ownership, land use and agriculture to facilitate regular updating of land use plans prepared by LSGIs.
- To suggest a road map for a State-level people's campaign to complete the preparation of land use plans at the LSGI-level over a period of six months.

6. WATERSHED-BASED PLANNING AND AGRICULTURE: THE POTENTIAL IN KERALA

Co-chairperson

- Dr Ishita Roy IAS, Agriculture Production Commissioner
- Mr I. B. Satheesh, MLA, Kattakada Constituency

Members

- Dr K. K. Sathiyan, Dean, KCAET, Thavanur
- Dr Celine George, Senior Principal Scientist & Head, CWRDM, Manimalakunnu
- Dr Anu Mary C. Philip, Assistant Director, Soil Conservation; IWDMK, Chadayamangalam
- Mr S. U. Sanjeev, Assistant Director of Agriculture (Rtd.)
- Mr U. Janardanan, CEO, Mayyil Rice Producer Company Ltd., Kannur
- Dr A. R. Durga, Assistant Professor, Department of Agricultural Economics, College of Agriculture, Vellayani, KAU
- Mr M. Prakasan Master, Kerala Karshaka Sangham, Pranavam, Azheekode South, Kannur
- Mr T. K. Rajan Master, Nini Nivas, Edachery PO, Kozhikode
- Mr Jo Jose, Assistant Principal Agricultural Officer, PAO Office, Kottayam
- Mr Mohanachandran, Deputy Director (Retd), Kollam

Terms of reference

- To critically assess the status of preparation of watershed plans by LSGIs in Kerala over the past five years and identify the reasons for the poor performance of LSGIs in this regard.
- To suggest and prepare a guidance note for the effective preparation and development of watershed plans, and its integration with land use plans and agricultural production systems with active support of geospatial technologies.
- To suggest ways to integrate and converge the objectives and activities of multiple government agencies possessing data on water, water use, land use and agriculture to facilitate regular updating of watershed plans prepared by LSGIs.
- To suggest a road map for a State-level people's campaign to complete the preparation of watershed plans at the LSGI-level over a specified minimum period.
- To study the different successful models of watershed plans prepared by LSGIs in the State and study the possibilities of replications, and preparation of a set of best practices.
- To provide guidance on linking the existing schemes of the government with a broader watershed-based strategy of development planning.

7. A PROGRAMME TO MODERNIZE AND UPDATE STATISTICAL DATABASES IN AGRICULTURE

Co-chairperson

- Dr Madhura Swaminathan, Professor, Indian Statistical Institute, Bengaluru
- Mr P. V. Babu, Director, Dept of Economics & Statistics

Members

- Dr U. S. Mishra, Professor, Centre for Development Studies, Trivandrum
- Ms L. R. Arathi IES, Mission Director, State Horticulture Mission
- Dr Brigit Joseph, Professor, Dept of Agricultural Statistics, CoA, Vellayani
- Dr K. P. Chandran, Senior Scientist, CPCRI, Kasargod
- Mr T. Paul Lazarus, Assistant Professor, Agricultural Economics, CoA, Vellayani
- Dr Pratheesh Gopinath, Assistant Professor, Agricultural Statistics, CoA, Vellayani
- Mr Deepak Mercy Johnson, Senior Fellow, Indian Statistical Institute, Bangalore
- Mr S. Ajayghosh, Vrindavan, Vadakkan Mainagapally PO, Kollam
- Mr Ramesh P K, TA to Director of Agriculture, Directorate of AD and FW

Terms of reference

- To critically assess the status and robustness of Kerala's statistical databases in agriculture and identify areas of concern.
- To suggest measures to improve the design, collection, analysis and dissemination of statistical data, such as area, production, yield, costs of cultivation, trade, farm harvest prices, wholesale prices, retail prices, market arrivals and so on, related to agriculture.
- To provide a framework for a better use of new technologies to improve the statistical system related to agriculture.
- To suggest ways in which Kerala's statistical system in agriculture should be geared towards meeting the challenges posed by integrated multiple-/inter-cropping based in homesteads and garden lands, apart from wetlands.
- To examine the possibilities of integrating all data on agriculture collected by different agencies in a single electronic platform.

8. A PLAN FOR VALUE ADDITION AND INDUSTRIAL INVESTMENT IN KERALA'S POST-HARVEST AGRICULTURE

Co-chairperson

- Dr K. P. Sudheer, Professor & Head, Department of Agricultural Engineering, College of Horticulture, KAU
- Mr Manu George, Strategist, Agency for the Development of Food Processing Industries in Kerala (ADFIK), KINFRA

Members

- Mr Rajeev Bhushan Prasad, Chief Coconut Development Officer, Coconut Development Board
- Dr E. Jayashree, Senior Scientist, ICAR-Indian Institute of Spices Research (IISR), Kozhikode
- Dr Lijo Thomas, Senior Scientist, ICAR-Indian Institute of Spices Research (IISR), Kozhikode
- Dr M. R. Manikantan, Principal Scientist, Harvest & Post Harvest Technology, CPCRI, Kasargod
- Mr K. K. Rajendrababu, Kunnath Veedu, Alappad PO, Thrissur
- Mr R. Manikuttan,Santhivila, Vandanmedu PO, Idukki,
- Dr V. R. Sinija, Professor & Head, Business Incubation Unit, IIFPT, Thanjavur
- Dr M. S. Sajeev, Principal Scientist & Head Crop Utilization Division, CTCRI, Sreekaryam
- Dr P. R. Geethalakshmi, Assistant Professor, Department of Post-Harvest Technology, College of Agriculture, Vellayani
- Ms K. Thulasi, Kerala Karshaka Sangham, Novelty, Matoor, Kalady, Ernakulam
- Dr P. Nisha, Principal Scientist, CSIR-National Institute for Interdisciplinary Science and Technology, Trivandrum
- Mr Abraham John Tharakan, Chairman, Amalgam Foods
- Mr Madathiveetil Ramesh, Director, Brahma Indic Nutriments Private Limited
- Mr Appu Anitha Muraleedharan, Theeram Agro World
- Ms Mini Srinivasan, Annam Flour and Batter Solutions, Coimbatore
- Mr Ajoy Sukumaran, Assistant Director of Agriculture, Directorate of AD and FW

Terms of reference

- To prepare a roadmap for the development of an entrepreneurship-driven system post-harvest value addition in agriculture while ensuring the generation of employment and skills.
- To suggest measures to effectively integrate the functioning of LSGIs, Cooperative institutions, including FPCs, and line departments towards the development of value chains in post-harvest agriculture.
- To suggest measures to ensure facilities for investment, quality control, traceability, logistics and export, including the necessary arrangements for payment systems.
- To suggest measures to augment Kerala's export of processed products, particularly in high value and *niche* segments.

9. EASE OF ENTREPRENEURSHIP IN AGRICULTURE: REFORMS IN POLICY AND ADMINISTRATION

Co-chairperson

- Mr S. Harikishore IAS, Director, Industries & Commerce Department
- Dr K. J. Joseph, Director, Gulati Institute of Finance and Taxation, Trivandrum

Members

- Dr Binoo P. Bonny, Professor & Head, Department of Agricultural Extension, CoA, Vellanikkara, KAU
- Dr K. P. Sudheer, Professor & Head, Department of Agricultural Engineering, College of Horticulture, KAU
- Mr G Prakash, Joint Director, MSME Institute, Thrissur
- Mr Roshan Kynadi, Agripreneur, Kynadi Plantations
- Mr T. Thulasidasa Menon, Krishnakripa,Thrithalangode PO, Malappuram,
- Mr M. Ramesh, Industry Expert, RABI-KAU Incubation Committee
- Mr Saji George, CEO, BIONEST
- Mr Shan Kadavil, MD, Fresh to Home Foods Private Ltd
- Mr Jamsheed, Agricultural Officer, Kannamangalam, Malappuram

Terms of reference

- To suggest a broad quantitative framework to regularly assess ease of entrepreneurship in agriculture in Kerala.
- To identify the constraints to the flow of entrepreneurial capital into the processing and value addition segments in agriculture.
- To suggest short-term, medium-term, and long-term measures to improve the ease of entrepreneurship in agriculture.
- To suggest legal and administrative measures to be initiated at different levels of governance, including LSGIs, to improve the ease of entrepreneurship in agriculture.

10. HOW CAN KERALA USE THE POWER OF COOPERATION TO RAISE AGRICULTURAL GROWTH?

Co-chairperson

- Mr P B Nooh IAS, RCS, Kerala
- Mr James Mathew, Ex- MLA, Taliparamba

Members

- Dr P. S. Geethakutty, Professor (Retd.), KAU
- Mr Salin Thapasi, Project Leader, SFAC

- Mr Paleri Ramesan, Chairman, ULCCS
- Mr James, Perambra Coconut FPC
- Fr John Choorapuzhayil, Chairman, BIOWIN, Mananthavady, Wayanad
- Dr J. Thomas, PDS Organic Spices, Kuttikanam, Idukki
- Mr G. R Rajeev, Kollam
- Mr Bimalghosh, MD, Aralam Farming Corporation
- Ms Rema K. Nair, Deputy Director of Agriculture (Retd.), Department of Agriculture
- Mr V Ravindran, Senior Manager, Kerala Bank

Terms of reference

- To critically assess the role and position of Cooperative institutions in Kerala's agricultural development pattern.
- To identify weaknesses in the cooperative institutional framework with respect to their contribution to the agricultural production processes.
- To chart out a pathway to effectively leverage Kerala's historical strengths in cooperative action – including both cooperatives and farmer producer companies (FPC) – to improve agricultural growth and farmer's income.
- To critically assess the performance of Kerala's cooperative credit system to finance agricultural activities.
- To suggest measures to modernise the functioning of Cooperatives in the State.
- To suggest measures on how cooperatives can contribute to the development of supply chains and value addition in agriculture.
- To suggest measures to improve coordination across line departments, LSGIs, Cooperatives and FPCs to contribute to agricultural growth.
- To suggest measures for transforming Kerala Bank to support the resource needs of the productive sector of the State.

11. COOPERATIVE BANKING IN KERALA: REVAMPING THE ROLE OF KERALA BANK

Chairperson

- Ms Mini Antony IAS, Secretary, Corporation

Co-Chairperson

- Dr Pallavi Chavan, Director, Reserve Bank of India, Mumbai

Members

- Mr Sasikumar M V,Director, Institute of Co-operative Management, Parasinikkadavu, Kannur
- Mr Jose T Abraham, Additional Private Secretary to the Finance Minister

- Mr K. C. Sahadevan, Chief General Manager, Kerala Bank
- Mr V. Raveendran, Senior Manager, PACS Development Department, Kerala Bank
- Mr Raja Kurup, Board Member, Kadirur PACS, Kannur
- Mr Anoop Kishore, Development Standing Committee Chairman, Wadakkanchery Municipality and District Facilitator of Decentralised plan
- Mr Romio Kattapana, President, Thankamony Service Co-operative Bank
- Mr K.C.S Nambiar, Director, Ancharakandy FSC Bank and Sahakari Coconut Processing facility
- Mr P. R. Sanjeev, Managing Director (Retd.), MILMA
- Mr R K Bhoodes Pillai, Chairman, Federation of Indian Cashew Industries, Former CEPCI
- Mr Sudheer K, Additional Director of Industries and Commerce
- Mr Damodhar, President, Kerala State Small Industries Association

Terms of reference

- To suggest broad measures to deepen and expand the participation of the cooperative sector in the process of economic growth of the State, and to involve youth in the cooperative movement in the State.
- To suggest measures to upgrade the use of technology in the functioning of primary cooperatives, such as the introduction of unified software.
- To suggest measures to improve professionalism in the functioning of cooperative societies in the State.
- To prepare a guidance note on Business Process Reengineering of the Kerala Bank to serve as a key provider of resources to the productive sectors, such as agriculture and MSMEs as well as tourism.

Convener

Sri. S S Nagesh, Chief, Agriculture Division, State Planning Board

Co- Convener

Smt. G C Roshini, Agronomist, State Planning Board

Terms of Reference (General)

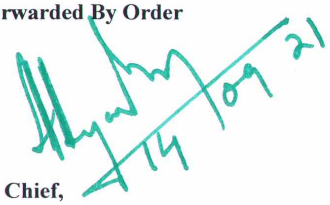
1. The non-official members (and invitees) of the Working Group will be entitled to travelling allowances as per existing government norms. The Class I Officers of GoI will be entitled to TA as per rules if reimbursement is not allowed from Departments.

2. The expenditure towards TA, DA and Honorarium will be met from the following Head of Account of the State Planning Board "3451-00-101-93"- Preparation of Plans and Conduct of Surveys and Studies.

The order read as reference 3 is modified to this extent.

(Sd/-)
Member Secretary

Forwarded By Order



Chief,
Agriculture Division

To

The Members concerned

Copy to

PS to Vice Chairperson
PA to Member Secretary
CA to Member (Dr.Ramakumar.R)
Economic Advisor to VC
Chief, PCD,SPB
Sr. A.O, SPB
The Accountant General, Kerala
Finance Officer, SPB
Publication Officer, SPB
Sub Treasury, Vellayambalam
Accounts Section
File/Stock File