

ABOUT THE COURSE

In recent times agricultural sector in Kerala confronts an array of issues which is indubitably a matter of contemplate especially in view of livelihood and sustainability of the sector in the State. The youth moving away from agriculture to other comparatively more remunerative fields poses serious threats on the agrarian future of the State. An asymmetric socio-economic regime with undue importance on consumerism is detrimental to the State in long run. A paradigm shift in this regard, especially placing the agricultural sector in the upfront of the present socio-economic structure of the society requires concerted effort. The revised educational curriculum in its essence holds this perception. It comprehensively covers the basic agricultural aspects by giving emphasis to Agri Field Techniques, Crop Production Technology, Applied Agriculture and Post Harvest Technology.

Even though we made tremendous improvement in production and productivity of agricultural crops, about 30 to 40% of fruits and vegetables are lost due to poor postharvest handling. Huge post harvest losses and lack of secondary agriculture are major threats to our economic, social and nutritional security. 'Secondary agriculture' is adding value to the basic agro commodities to allow farmers to get better returns from their harvest, create new jobs in rural sector to grow rural economy which is entirely based on agriculture. For the prosperity of our nation, a successful transition from primary agriculture to secondary agriculture creating new jobs and building wealth is inevitable which all developed countries have succeeded in this regard. Agro processing industries have the potential to generate directly significant employment in production activities and also indirect employment through its forward and backward linkages. Thus secondary agriculture provides ample scope for new job opportunities in all steps of value addition throughout the supply chain right from production, harvesting, post harvest handling practices, packaging, labelling, marketing, storage, primary processing and product development through secondary processing. This will provide better returns to farmers and creation of employment with off spin benefits of reduction of post harvest losses and food and nutritional security.

The renewed curriculum touches upon all the important aspects of agricultural technologies in a structured and phased manner while giving sharp focus towards the downstream of the value chain on value addition and business opportunities. The revised course structure comprehensively covers the basic agricultural aspects by giving emphasis to Post harvest and Processing Technology. The course is designed in such a way to train the students in the above aspects to satisfy the new employment opportunities associated with secondary agriculture and also become successful entrepreneurs.

Objectives

- ◆ To create awareness of post harvest techniques of major crops in Kerala
- ◆ To develop skills on primary processing and secondary processing of Agricultural products
- ◆ To make them understand cold chain management of perishables
- ◆ To make them aware of postharvest technology of flowers
- ◆ To get acquainted with establishment of processing units as per FSSAI
- ◆ To enable the learner to handle processing equipments
- ◆ To develop skills and competencies among students to be successful entrepreneur
- ◆ To enhance self support capabilities
- ◆ To develop capacity building in association with SHM, VFPCCK, CTCRI, APEDA
- ◆ To utilize talents and skills of students in Development of innovative consumer demanding products
- ◆ To develop skill in grading, packing, storage and marketing of agricultural products
- ◆ To make them understand how to assist in Quality control and food safety measures
- ◆ To familiarise the opportunities in domestic and export trade
- ◆ To generate awareness on the realities of employment market in the community.

Job Roles (Career Path)

Government / Semi Government	Private Sector	Self Employment
<ul style="list-style-type: none"> • Assistant Agricultural Officer. • Agriculture Assistant KLDB • Agri Extension Assistant • Supply Chain Field Assistant • Seed processing Worker • Quality seed grower • Green house fitter • Floriculturist (open and protected cultivation) • Gardener • Laboratory Technical Assistant in VHSE • Vocational Instructor in VHSE • Work superintendent in Department of Agriculture • All other posts where basic qualification required is plus two • Field or Farm technician (IISR) • Field Assistant and Farm supervisor (Farming corporation) • Farm Technical Assistant (Plantation corporation Limited) • Field Assistant (LEADS) • Field Assistant (CTCRI) • Field Assistant (FSRS) • Field Assistant (VFPCCK) • Field Assistant (KAU) • Technical Assistant (KVK) 	<ul style="list-style-type: none"> • Food sample collector • Post harvest technician • Technician in Processing industries • Technician in repair & maintenance of Processing Equipments • Field Representative (Fertiliser and Pesticide companies) • Assistants in Agriculture based media programmes • Gardeners / Farm supervisors • Assistants in crop health clinics • Agri Extension service provider • Harvesting machine operator • Supply chain field assistant • Micro irrigation technician 	<p><u>Production sector</u></p> <ul style="list-style-type: none"> • Private nursery • Mushroom cultivation and spawn production • Vermicomposting • Coir pith composting • Azolla cultivation • Organic manure production • Bio fertilizer production • Seed production and processing unit • Hiring of agricultural implements • Repair of agricultural implements • Apiculture • Protected cultivation <p><u>Service sector</u></p> <ul style="list-style-type: none"> • Training on above sectors • Agro-clinics • Agricultural consultancy • Irrigation services • Harvest services • Other farm services • Agro Service Centers

SUBJECT APPROACH

The vocationalisation of education in India has been launched with the vision and concept of Mahatma Gandhi's dream on Basic Education. The Centrally Sponsored Scheme of Vocationalisation of Secondary Education provides for diversification of educational opportunities so as to enhance individual employability, reduce the mismatch between demand and supply of skilled manpower and provides an alternative for those pursuing higher education. The scheme of vocational education was revised with the dire need at present for high skilled human resource to sustain the high growth rate of Indian economy and increased possibilities of international demand of skilled manpower, changes in technologies and financial markets, the growing international competition and increasing demand from various segments of population for job-oriented education.

India is an agricultural country and Kerala being one of its most populated states depend mainly on development of agriculture. Since the achievement of statehood in 1956, Kerala has been exploring all the potential possibilities to promote agriculture and thereby achieving self sufficiency in food and employment generation. In recent times agricultural sector in Kerala confronts an array of issues which is indubitably a matter of contemplate especially in view of the livelihood and sustainability of the sector in the State. The youth moving away from agriculture to other comparatively more remunerative fields poses a serious threat on the agrarian future of the State. An asymmetric socio-economic reign with undue importance on consumerism is detrimental to the state in long run. A paradigm shift in this regard especially placing the agricultural sector in the upfront of the present socio-economic structure of the society requires concerted effort. As a matter of fact there is a need to restructure and realign the sub segments of agricultural sector like production sphere, marketing arena, value chain and educational spectrum. The revised course structure of agriculture science and processing technology comprehensively covers the basic agricultural aspects by giving emphasis to agrifield techniques and crop production technology. The purposeful emphasis on agricultural processing and applied agriculture assumes significance in this context. It touches upon all the important aspects of agricultural technologies in a structured and phased manner while giving sharp focus toward the downstream end of the value chain on value addition and business opportunities. The upgradation in structural value chain is the manifestation of entrepreneurship and this is only possible through imbibing the courage to climb up the ladder by breaking away from the conventional pathways in agricultural sector. Agroprocessing industries have the potential to generate directly significant employment in production activities and also indirect employment

through its forward and backward linkages.

This employment will be in rural areas where these industries have to be located near the source of raw materials, especially perishable agricultural products. These industries would help in reducing post-harvest losses and wastes as well as in using byproducts more efficiently. This can increase farmers' income by getting them better prices and also consumer welfare by increasing the availability of agricultural consumer goods. The available vast potential in our country could be sufficiently exploited.

The revised course structure comprehensively covers the basic agricultural aspects by giving emphasis to post harvest and Processing Technology. The course is designed in such a way to train the students in the above aspects and to become successful entrepreneurs.

Objectives

- ◆ To generate general as well as specific awareness about the various agricultural sectors and activities.
- ◆ To create a pool of efficient as well as empowered personnel in agroprocessing sector.
- ◆ To create well trained technicians with supervisory and management skills in handling supply chains.
- ◆ To supply efficient personnel in establishing and maintaining agriclinics for the farming community.
- ◆ To create skilled technicians in the area of Green House technology.
- ◆ To create skilled personnels in the area of landscaping and garden management.
- ◆ To supply skilled personnel in the development of innovative consumer demanding products.
- ◆ To provide skilled technicians to handle agro-processing equipments.
- ◆ To create efficient and skilled technicians in the field of specialized techniques.
- ◆ To develop skilled personnel in grading, packing, storage and marketing of agricultural products.
- ◆ To create a dedicated work force in subsidiary enterprises like nursery business, mushroom technology and Apiculture.
- ◆ To provide skilled personnel in assisting Quality control and food safety measures.

- ◆ To train personnel to implement projects for maximizing value addition.

The Kerala School Curriculum has been revised in the year 2013- 14 in tune with the recommendations in Children's Right to Free and Compulsory Education- Kerala Rules and Provisions-2011. The characteristics of Kerala School Curriculum -2013 can be summarized as it is child centered, process related, activity oriented and value based. It lays stress on the learning outcomes at the cognitive, process, attitudinal and value domains. The teacher has the freedom to employ logical and variegated learning strategies during the transaction process. It gives importance to ensuring the learning outcomes to all learners. Based on these learning outcomes continuous and comprehensive evaluation is recommended. The curriculum also lays emphasis on the code of professional ethics for teachers.

With regard to learning process the following points are given importance.

1. The learners relate their previous knowledge to the knowledge they newly construct.
2. Knowledge construction has to be at the individual and community levels.
3. The differential needs of the learners are to be addressed by selecting and adapting learning activities.
4. Learning and assessment are complimentary to each other.
5. Learning process should aim at the all round development of the learner.

With all the above ends in view, the learning strategies are so designed and to be implemented. The learning activities proposed are diversified in their nature but is ensured to engage all learners both the gifted as well as the slow pace learners. Projects, experiments, discussions, panel discussions, debate, survey, assignments, seminars, interviews, exhibitions, multimedia presentations, formulations, constructions and so on are the strategies proposed for transacting the learning outcomes in a learner centered experiential manner.

For example, while transacting LO s related to Mushroom cultivation the teacher can employ demonstration by herself followed by the practice of the learners. The learners inturn will impart this training in field level avenues like Kudumbasree units, adopted villages making the learning socially productive.

Another example that can be cited is Terrace Farming. This activity can be taken up as a group project. The learners will be sensitized with the need of producing pesticide free vegetables and also make the people

aware of its importance. For this survey will be conducted to analyse the status and explore the possibilities of terrace farming. Under the leadership of the teachers, the beneficiaries selected will be oriented with the harmful effects of using vegetables with the pesticide residue and there by inculcating the need of cultivating pesticide free vegetables. Seedlings needed for terrace farming will be produced in the school. Then the learners in group take up the responsibilities to do the terrace farming in the selected houses. Continuous follow up and monitoring will also be done by the learners till its harvest. A detailed project report will be prepared by the students after completing the project and this report will be considered for their Practical Evaluation. The students will acquire skills to solve social issues and they develop a positive attitude as social citizens.

The teacher has the freedom to employ any suitable strategy to transact a particular content area, provided he/she should ensure that the prescribed learning outcome is achieved by all the learners. Each learning activity should be designed in such a way that there is provision for continuous assessment to promote better learning. There should be slots for assessment as learning and assessment for learning. The learning evidences or learning products should be clearly specified while framing the activities. Teacher should have a thorough planning to explore the maximum possibilities of variegated learning resources especially ICT materials for making the learning more effective. There should also be provision for catering the academic needs of all children (gifted as well as CWSN). The parents and society have a crucial role in promoting the level of learning of all children. For this, the teacher should explore all possibilities for utilizing the resources of the community for enhancing better learning of all children.

INFRASTRUCTURE

The revised VHSE curriculum in ASPT demands well equipped and sophisticated infrastructural facilities in order to transact it in a most effective manner which is detailed below

- ❖ Resource repositories including interactive multimedia with smart class rooms should be made available in each course.
- ❖ Sufficient number of Laptops and accessories should be made available for teachers as well as students.
- ❖ Facilities for online referencing for students should be ensured.
- ❖ A well equipped processing unit with necessary processing equipments and utensils can be provided.
- ❖ Cut vegetable packing unit may be established for regular supply of pesticide- free cut vegetables.
- ❖ PTC sales counter unit may also be established in each school.

- ❖ Cultivable land, Irrigation facilities and drainage facilities are needed.
- ❖ As mechanization is essential in modern era, small farm machineries may be made available.
- ❖ Soil Health Clinic and Consultation Soil Centers can be established in each school.
- ❖ Agri KIOSK centers with touch screen facilities can be established in each school as a part of farmer service.
- ❖ Poly house unit, Mist chamber, Rain Shelter, Micro irrigation unit, Mushroom house, Vermi compost unit, Azolla Unit, Biocontrol Lab etc. can be established.
- ❖ Softwares like E - crop doctor for diagnosis of pest and diseases & KAU Fertulator for Fertiliser calculation can be made available
- ❖ Essential plant protection chemicals, fertilizers, manures, chemicals and materials needed for preservation can be made available
- ❖ Essential materials, tools and implements for cultivation practices, plant propagation, seedling production, plant protection and all other activities for the efficient functioning of PTC may be provided.
- ❖ A well equipped library with print rich references, periodicals, leaflets, pamphlets, journals etc. can be made available.
- ❖ Updated IT Resources can be ensured in schools at easy access of students and teachers.
- ❖ Store room and work sheds can be provided.

ASSESSMENT

The course exclusively focus on assessment as learning, assessment for learning, assessment of learning as envisaged in the school curriculum. Continuous Assessment is given due importance as it promotes learning and ensures the achievement of the prescribed learning outcomes by all the students.

I. **The continuous assessment areas are detailed as follows**

1. Process assessment
2. Portfolio assessment
3. Unit assessment

II. **Practical evaluation is also proposed**

- ◆ Indoor practical works in labs
- ◆ Field visit
- ◆ Visits in production cum training centres

- ◆ On the job training
- ◆ Case studies
- ◆ Demonstration

Practical record and vocational diary are considered as the records for practical evaluation.

III. Internship Evaluation

The vocational competence as well as the socio-emotional skills of the students is also to be evaluated and considered for certification.

IV. Theory examination

Theory examination is also suggested as part of TE. It can be done through written examination with items of testing higher order mental processes as well as depth of conceptual understanding.

SYLLABUS

MODULE - 1

AGRI FIELD TECHNIQUES

1. Introductory Agriculture

Agriculture-definition, branches, milestones in agriculture development in India, Major crops in India and Kerala, Area, production and productivity of major crops in Kerala, Important Agricultural Institutions- teaching and research institutions, extension centres, agri based government and semi government organisations.

2. Agrometeorology

Meteorology-agricultural meteorology-definition, weather and climate, microclimate, meteorological observatory and instruments to measure weather elements, automated weather stations, weather forecasting, Crop seasons in India and Kerala, Monsoons in Kerala

3. Soil health management

Soil profile, physical properties-soil structure and texture, Soils of Kerala-problem soils of Kerala , Soil acidity- liming materials, soil alkalinity and its amelioration, Soil erosion-definition, types of erosion-water erosion- Wind erosion- Soil and water conservation-agronomic measures- mulching, contour farming, strip cropping, alley cropping, multitier cropping, mixed cropping, intercropping, crop rotation, grass/fodder cultivation, cover cropping, zero tillage, biofencing/vegetative fencing. Engineering measures- Percolation pits/ soak pits, contour bunding, making basins around trees, trenches, bench terracing, check dams, gabions, inward and outward terracing, brushwood check dams, gabion checkdams, artificial water holding structures and renovation of existing bunds, weirs, sidewalls,

geotextiles. Soil pollution- causes, practices to maintain soil health, Soil quality monitoring- Soil health card, Remote Sensing and GIS.

Tillage-definition and objectives, types and effects of tillage in soil- zero tillage, minimum tillage, primary and secondary tillage implements, and small farm machinery

Plant Nutrition- Essential elements-macro and micro, Functions, Deficiency and toxicity symptoms of N, P, K. Manures and fertilizers-classification, Organic manures- bulky and concentrated- FYM, compost, different composting methods, green manuring. Chemical fertilizers-straight, complex, mixed fertilizers, biofertilizers- examples and use. Integrated Nutrient Management, Methods of fertilizer application, Calculation of fertilizer requirement, KAU Fertulator, Soil fertility evaluation- soil testing, plant tissue analysis-DRIS methods, critical levels in plants, rapid tissue test, indicator plants, biological methods of soil fertility evaluation, Soil based plant nutrient management information system. Organic farming and sustainable agriculture- Component of organic farming and their role in sustainable crop production, nutrient management in organic farming, disease and pest management in organic farming.

4. Irrigation technology

Irrigation-definition, methods of irrigation- surface, subsurface, micro irrigation, special methods (drip, sprinkler, mist, bubbler, pivot), fertigation, chemigation, quality of irrigation water and its management, drainage- importance in crop production, Rainwater harvesting-techniques and structures-ferrocement tank, percolation pits(emerging innovative models)

5. Plant propagation techniques

Types of propagation-sexual propagation-seed- definition, qualities of good seed, classes of seed, sowing methods, seed propagation- seed bed preparation, hybrid seed propagation, vegetable seedling production, portray seedling production. Seed testing- methods of testing germination percentage. Asexual propagation methods - cutting, layering, budding, grafting, tissue culture, vegetable grafting

6. Crop Pest management

Pest-definition, classification with examples, plant disease-common symptoms and pathogens, weeds-uses and harmful effects, dryland and wetland weeds, Plant protection methods, Biopharmacy, plant protection chemicals and different formulations (emphasis to new generation pesticides), plant protection equipments, weed management, E- Crop Doctor, Crop diagnostic centres.

MODULE – 2**CROP PRODUCTION TECHNOLOGY****1. Agronomic classification of crops:**

Cereals - Pulses - Millets - Oil seeds - Tuber crops - Fruits - Vegetables - Spices and Condiments - Plantation crops - Medicinal and aromatic plants - Fibre crops - Sugar crops - Fodder crops - Narcotic crops - Green Manure crops.

2. Farming system

Concept and different types of farming system with examples

Their merits and demerits - Monocropping - Crop rotation - Inter cropping - Mixed cropping - Ratoon cropping - Multi-tier cropping - Relay cropping - Mixed farming - Homestead farming.

Integrated Farming System-Concepts -Goals - Components -Mushroom, Vermiconpost, Azolla, Livestock, Poultry, Aquaculture, Biogas Plant - Advantages and disadvantages - Success Stories.

3. Crop production Technology of Field crops**RICE**

Climatic requirements - Soil - Season - Varieties (Include Recent varieties and Geographic indexing) - Seed rate - Seed Treatment - Nursery preparation - Wet - Dry - Dapog - Spacing - Fertilizer Recommendation - Common weeds in Rice fields - *Kole, Pokkali, Kaipad* cultivation - Transplanting - IPDM- System of Rice Intensification(SRI) technique - Scope of farm Mechanization in rice cultivation and Post Harvest Handling-Value addition-Current Trends in Rice production(For additional information only)

TAPIOCA

Climatic requirements - Soil - Varieties - Propagation - Mini sett propagation technique - Preparation of Land - Season and Planting - Manuring - Irrigation -Intercropping - Value addition - Pests and Diseases - Biopesticide from Tapioca. Current trends in Tapioca production (For additional information only).

FODDER CROPS

Guinea grass - Hybrid Napier - Congo Signal Grass - Subabul - Agathi - Stylo - Mention Silo, Silage, Haylage-Planting material-Fertilizer recommendations-Harvesting -Yield-varieties.

4. Crop production Technology of Vegetables

Solanaceous vegetables.

Brinjal – Tomato – Chilli, Varieties -Seed rate -Spacing - Manuring - Pest and Diseases

Cucurbitaceous vegetables

Bitter gourd – Snake gourd - Bottle gourd – Ash gourd – Pumpkin – gherkins, Varieties -Seed rate -Spacing - Manuring - Pest and Diseases

Cool Season vegetables

Carrot – Cabbage – Cauliflower, Varieties - Seed rate- Spacing - Manuring - Pest and Diseases.

Amaranthus, Bhindi, Cow pea

Varieties - Seed rate- Spacing - Manuring -Pest and Diseases

Kitchen garden, Terrace Cultivation

Current Trends in Vegetable Cultivation (for additional information only)

5. Crop production Technology of Plantation crops

COCONUT

Scientific name -Soil -Site selection -Important Cultivars /Hybrids - Coconut Nursery Techniques (Mother palm selection, seed nut storage, Coconut nursery preparation and seedling selection) - Cultivation practices - Land Preparation - Planting - Spacing - Planting systems - Time of Planting - Irrigation – different techniques – drip irrigation-Weeding - Intercropping - Drought management - Husk burial - Mulching - Cover crops and green manure crops - Manuring. Plant protection - Pests – Rhinoceros beetle, Redpalm weevil, Black headed Caterpillar, Eriophid mite, Nut crinkler. Diseases-Bud rot, Stembleeding, Rootwilt, Tanjore wilt - Management with special emphasis on Biocontrol. Value addition - Different products made out of coconut-Current trends in coconut cultivation(for additional information only)

b. RUBBER

Scientific name - Soil - Site selection - Important varieties/Clones - Nursery - Cultivation practices - Land Preparation - Planting clones – Planting distance, Pitting and refilling, Type of planting - Cover cropping and Mulching – Manuring - Weeding - Use of rainguard - Tapping -Plant protection - Pests, Diseases -Abnormal leaf fall, Powdery mildew, Pink disease-Value addition - Different products made out of Rubber -Current trends in Rubber and allied industries (for additional information only)

PEPPER

Scientific name - Soil- Site selection - Important Varieties - Selection Of mother plants - Raising rooted cuttings - Cultivation practices - Land Preparation - Planting vines- Spacing - Planting methods - Time of Planting - Irrigation - Weeding-Under planting - Manuring-Bush pepper. Plant protection - Pests - Pollu beetle, Marginal gall thrips - Diseases - Quick wilt, Anthracnose, Slow decline. Value addition - Different products made out of Pepper - Current trends (for additional information only)

6. Crop production Technology of Fruits**BANANA**

Scientific name - Soil - Site selection - Important Varieties - Sucker selection and preparation of suckers for planting - Cultivation practices - Land Preparation - Planting suckers - Spacing - time of Planting - Irrigation - Weeding - Intercropping - Manuring - Tissue culture techniques in Banana - Leaf Banana cultivation. Plant protection - Pests - Pseudostem weevil, Rhizome weevil, Aphids, mealy bugs, skipper butterfly- Diseases Bunchy top, Banana bract mosaic (Kokkan) - Sigatoka - Rhizome rot-Panama wilt. Value addition- Different products made out of Banana current trends in banana cultivation (for additional information only)

MANGO

Scientific name - Soil - Season - Site selection - Propagation - Important Varieties - Cultivation practices - Land Preparation - Planting - Spacing - Time of Planting - Irrigation - Weeding - Intercropping - Manuring - High Density Planting in Mango. Plant protection - Pests - Stem borer, Mango Hopper, Nut weevil, Fruit fly - Diseases - Powdery mildew, Anthracnose, Die back - Physiological disorders - Value addition - Different products made out of Mango - Current trends in Mango cultivation (for additional information only)

PINE APPLE

Scientific name - Soil - Site selection - Important Varieties - Sucker selection and preparation of suckers for planting - Cultivation practices - Land Preparation - planting suckers - Spacing - Time of Planting - Irrigation - Weeding - Flowering induction - Manuring - Plant protection - Pests - Mealy bug - Diseases - Leaf spot - Value addition - Different products made out of Pineapple.

7. Crop Production Technology of Flowers

ANTHURIUM

Varieties - Propagation - Planting and Potting media preparation - Fertilizer recommendation - Inter cultural Operation - Plant Protection - Harvesting.

ORCHID

Varieties - Propagation- Planting and Potting media preparation- Manuring - Intercultural Operation - Plant Protection - Harvesting.

ROSE

Classification -Varieties-Propagation - Planting and Potting mixture preparation - Manuring - Pruning- Plant protection -Harvesting - Packing and Marketing - Value added product - Rose oil.

JASMINE

Soil - Climate- Important Cultivars and varieties - Propagation - Rooting Hormone - Land preparation - Spacing - Manuring - Irrigation - Pruning - Intercultural operation - Weed control - Pest and diseases - Value added products - Jasmine oil.

8. Importance of Medicinal Plants in Kerala

Introduction - Common medicinal plants cultivated in Kerala with their common name, parts used, scope of medicinal plant cultivation in Ayurveda.

LEARNING OUTCOMES

After the completion of two modules, the learner will be able to;

- 1.1.1 define agriculture and enumerate its branches and explain the milestones in Agriculture development in India.
- 1.1.2 explain the major crops in India and Kerala and calculate the production and productivity of cultivated crops of Kerala.
- 1.1.3 enlist the important Agricultural Teaching and Research Institutions, Extension centers, and Commercial Agri- based government and semi government organisations.
- 1.2.1 define Agricultural meteorology, distinguish between weather and climate.
- 1.2.2 realise the use of meteorological observatories, handle the instruments to measure weather elements.
- 1.2.3 get acquainted with the Automated Weather Stations .
- 1.2.4 establish the relationship between weather forecasting and cultivation of crops.

- 1.2.5 analyse the rainfall data and identifies the monsoon seasons in Kerala, relate it with agricultural seasons and prepare the crop calendar.
- 1.3.1 explain soil profiles with relevant diagrams and experience soil structure and texture.
- 1.3.2 mention soils of Kerala and suggests crops suitable for each type of soil.
- 1.3.3 explore and explain the problem soils in Kerala and their reclamation.
- 1.3.4 analyse soil acidity, soil alkalinity and apply remedial measures such as liming and amelioration respectively.
- 1.3.5 observe, make and present reports on the types of soil erosion and practise agronomic and engineering measures of soil and water conservation.
- 1.3.6 explore and make reports on the causes of soil pollution, check factors affecting soil health hazards and apply measures to maintain soil health and interpret the information in a Soil Health Card.
- 1.3.7 familiarise remote sensing, GIS and its application.
- 1.3.8 define Tillage and its types and share its objectives, and effects of tillage in soil and classify tillage implements into primary and secondary and operate them.
- 1.3.9 describe small farm machinery and practise them in needy contexts.
- 1.3.10 explain plant nutrition, enlist the essential macro and micro elements, the functions, deficiency and toxicity symptoms of N,P, K.
- 1.3.11 classify manures and fertilizers and identify the need of Integrated Nutrient Management.
- 1.3.12 calculate Fertilizer Requirement using scientific methods, using soft wares like Fertulator and practise different methods of fertilizer application
- 1.3.13 prepare soil samples for testing, interpret the results and give recommendations based on the result.
- 1.3.14 apply different methods for soil fertility evaluation such as soil testing, plant tissue analysis by DRIS method, critical level in plants, rapid tissue test, indicator plants and biological method.

- 1.3.15 explain and prepare notes on soil based Plant Nutrient Management Information System, recognize the need of organic farming and its role in sustainable crop production, nutrient management, disease and pest management.
- 1.3.16 realize the need and significance of sustainable agriculture.
- 1.4.1 define irrigation, methods of irrigation such as surface, sub-surface, micro-irrigation, and detail special methods such as drip, sprinkler, mist, bubbler and pivot.
- 1.4.2 explain fertigation, chemigation and recognizes quality of irrigation water and its management, drainage and its importance in crop production.
- 1.4.3 describe rain water harvesting techniques and structures-ferrocement tank, percolation pits and other emerging innovative models.
- 1.5.1 identify types of propagation define seed and enumerate the qualities of good seed, classes of seed, sowing methods.
- 1.5.2 practise sexual propagation in plants, seed-bed preparation, vegetable seedling production, prostrate seedling production.
- 1.5.3 practise seed testing- methods of testing germination percentage.
- 1.5.4 practise asexual propagation methods in plants- cutting, layering, budding, grafting, tissue culture and vegetable grafting.
- 1.6.1 define pests, classify pests, describes plant diseases, their common symptoms and pathogens, weeds- uses and harmful effects, dry land and wet land weeds.
- 1.6.2 explain plant protection methods, Biopharmacy, plant protection chemicals and their formulation and enlist pesticides in use with emphasis on new generation and banned pesticides.
- 1.6.3 identify plant protection equipments, weed management, E-crop doctor and visit crop diagnostic centres.
- 2.1.1 explain different agronomic classes of crops and list out their examples
- 2.2.1 define different farming systems, their merits and demerits, with emphasis on IFS
- 2.2.2 explain mono cropping, crop rotation, intercropping, mixed cropping, ratoon cropping, multi tier cropping, relay cropping, mixed farming and home stead farming.

- 2.2.3 define IFS and share its goals and components, advantages and disadvantages of different IFS models.
- 2.3.1 describe the climatic requirements, suitable soil and season for rice cultivation.
- 2.3.2 explain the varieties of rice, recently released varieties and geographic indexing.
- 2.3.3 identify and prepare notes on seed rate, seed treatment, nursery preparation (advanced and recently developed techniques) transplanting and spacing.
- 2.3.4 describe and suggest fertilizer recommendation for effective rice cultivation.
- 2.3.5 list out common weeds in rice fields, insect pests, diseases and their management.
- 2.3.6 identify and prepare notes on *Kole*, *Pokkali*, and *Kaippad* cultivation of rice.
- 2.3.7 describe SRI (System of Rice Intensification Technique)
- 2.3.8 explore and explain scope of farm mechanization in rice cultivation and post harvest handling
- 2.3.9 list out the important rice research stations in Kerala and make notes on current trends in rice production.
- 2.3.10 describe the varieties, climatic requirements, suitable soil and season for tapioca cultivation.
- 2.3.11 identify and explain propagation and mini set tapioca propagation techniques.
- 2.3.12 explain the process of preparation of land, describe the season and planting, manuring and irrigation, inter cropping related to tapioca cultivation.
- 2.3.13 list out insect pests, diseases and their management in tapioca and enlist the bio pesticides made from tapioca.
- 2.3.14 familiarise with the current trends in tapioca production.
- 2.3.15 enlist fodder crops such as Guinea Grass, Hybrid Napier, Congo Signal Grass, Subabul, Agathi and Stylo with reference to important varieties , planting material, planting methods, fertilizer recommendations, harvesting and yield.
- 2.3.16 mention techniques of fodder preservation-Silo, Silage and Haylage.
- 2.4.1 identify and prepare chart on Solanaceous vegetables such as brinjal, tomato, chilli, in terms of their varieties, seed rate, spacing, manuring, pests and diseases.

- 2.4.2 identify and prepare chart on Cucurbitaceous vegetables such as bitter gourd, snake gourd, bottle gourd, ash gourd, pumpkins and gherkins in terms of varieties, seed rate, spacing, manuring, pests and diseases.
- 2.4.3 identify and prepare chart on cool season vegetables such as carrot, cabbage, cauliflower in terms of their varieties, seed rate, spacing, manuring, pests and diseases.
- 2.4.4 identify and prepare chart on amaranthus, bhindi, cowpea in terms of their varieties, seed rate, spacing, manuring, pests and diseases.
- 2.4.5 practise kitchen gardening and terrace cultivation.
- 2.4.6 familiarize the current trends in vegetable cultivation and its value addition.
- 2.5.1 identify and explain the scientific name of coconut, soil suitable for coconut crop production and site selection.
- 2.5.2 list out important coconut cultivars, hybrids and coconut nursery techniques.
- 2.5.3 explain the cultivation practices of coconut in terms of land preparation, planting seedlings, spacing, planting systems, time of planting, irrigation, weeding, manuring and intercropping.
- 2.5.4 explain the techniques for drought management such as husk burial, mulching, and use of cover crops and green manure crops.
- 2.5.5 explain plant protection of coconut plants- identify pests, diseases and explain their management with special emphasis on biocontrol.
- 2.5.6 familiarize the current trends in coconut cultivation and its value addition.
- 2.5.7 identify and explain the scientific name of rubber, soil suitable for rubber crop production and site selection.
- 2.5.8 enlist the important varieties, clones of rubber and their nursery.
- 2.5.9 explain the cultivation practices of rubber in terms of land preparation, planting clones, cover cropping and mulching, weeding, manuring, use of rain guard and tapping.
- 2.5.10 explain plant protection of rubber- identify pests, diseases with special emphasis on abnormal leaf fall, powdery mildew, pink disease.

- 2.5.11 familiarise the current trends in rubber and allied industries, different products and their value addition.
- 2.5.12 state the scientific name of pepper and explain soil suitable for pepper crop production and site selection.
- 2.5.13 list out important varieties of pepper, describes the selection of mother plants, and raising rooted cuttings.
- 2.5.14 explain the cultivation practices of pepper in terms of land preparation, planting vines, spacing, planting methods, time of planting, irrigation, weeding, manuring and underplanting.
- 2.5.15 practise bush pepper propagation.
- 2.5.16 explain plant protection of pepper, lists out its pests and diseases.
- 2.5.17 familiarize the current trends in pepper cultivation and list out different products made out of pepper and its value addition.
- 2.6.1 identify the scientific name of banana, soil suitable for banana crop production and site selection.
- 2.6.2 list out the important varieties of banana.
- 2.6.3 describe sucker selection and preparation of suckers for planting in banana.
- 2.6.4 explain the cultivation practices of banana in terms of land preparation, planting, spacing, time of planting, irrigation, weeding, manuring and intercropping.
- 2.6.5 familiarise the tissue culture techniques in banana and leaf banana cultivation.
- 2.6.6 explain the plant protection of banana, its pests and diseases.
- 2.6.7 list out different products made out of banana and its value addition.
- 2.6.8 familiarize with the scientific name of mango, soil suitable for mango crop cultivation, season and site selection.
- 2.6.9 list out the important varieties of mango and their propagation.
- 2.6.10 familiarize with the cultivation practices of mango in terms of land preparation, planting, spacing, time of planting, irrigation, weeding, manuring and intercropping.
- 2.6.11 familiarize with the high density planting in mango.
- 2.6.12 familiarize with plant protection in Mango and list pest and diseases.

- 2.6.13 familiarize with the current trends in mango cultivation and list out different products made out of mango and its value addition.
- 2.6.14 familiarize with the scientific name of pine apple, soil suitable for pine apple cultivation and site selection.
- 2.6.15 list out the important varieties of pine apple and explain sucker selection and preparation of suckers for planting.
- 2.6.16 familiarize with the cultivation practices of pine apple in terms of land preparation, planting, spacing, time of planting, irrigation, weeding, manuring and flowering induction.
- 2.6.17 familiarize with the plant protection of pine apple, and list pests and diseases.
- 2.6.18 list out different products made out of pine apple and its value addition.
- 2.7.1 describe the varieties of Anthurium, and its propagation methods, planting and potting media preparation, fertilizer recommendation, intercultural operation, plant protection, harvesting.
- 2.7.2 describe the varieties of orchid, and its propagation, planting and potting media preparation manuring, intercultural operation, plant protection, harvesting.
- 2.7.3 familiarize with the classification varieties of rose, its propagation methods planting and potting mixture preparation, manuring, pruning, plant protection, harvesting, packing and marketing, value added products and rose oil.
- 2.7.4 familiarize with the cultivars, varieties propagation of jasmine, rooting hormones, land preparation, spacing, manuring, irrigation, pruning, inter cultural operation, weed control, pests, diseases, yield and value added products and Jasmine oil.
- 2.8.1 familiarize with the importance of medicinal plants in Kerala, list them out with their common name, parts used and scope of medicinal plants in Ayurveda.

Scheme of Work

Sl. No.	Month	Unit Name	Periods	No. Unit Weight
1	June	Introductory Agriculture Agrometerology	16 18	
2.	July	Soil Health Management	80	
3.	August	Soil Health Management Irrigation Technology Plant Propagation Technique	4 42 26	
4.	September	Plant Propagation Technique Crop Pest Management	54 26	
5.	October	Crop Pest Management Agronomic Classification of Crops	74 6	
6.	November	Agronomic Classification of Crops Farming System Crop production Technology of field crops	1 16 63	
7.	December	Crop production Technology of field crop Crop production Technology of Vegetables	17 51	
8.	January	Crop production Technology of Vegetable Crop production Technology Plantation crops Crop production Technology of fruit crops	9 65 6	
9.	February	Crop production Technology of fruit crops Crop production Technology of flowers	34 46	
10	March	Crop production Technology of flowers Importance of Medicinal Plants in Kerala	14 12	

COURSE STRUCTURE

This course consists of 4 modules such as:

Sl.No	Name of Module	Total periods
1	Agri Field Techniques	340
2	Crop Production Technology	340
3	Applied Agriculture	340
4	Post harvest Technology	340

CLASS ROOM ACTIVITIES

- ◆ Seminar
- ◆ Group discussion
- ◆ Quiz
- ◆ Preparation of Posters and Charts
- ◆ Project and workshops
- ◆ Exhibitions
- ◆ Multimedia presentation
- ◆ Panel discussion
- ◆ Interview with invited experts/ farmers in the classroom
- ◆ Workshop
- ◆ Role play
- ◆ General discussion
- ◆ Brainstorming
- ◆ Debate
- ◆ Slide show
- ◆ Assignment
- ◆ Animated CDs

PRACTICAL ACTIVITIES

- ◆ Indoor practical work in labs and outside field
- ◆ Field visits
- ◆ Production cum training centre
- ◆ On the job training
- ◆ Interaction with successful farmers at the farm site
- ◆ Curriculum oriented case studies
- ◆ Demonstration

ON THE JOB TRAINING

OJT refers to that component of vocational curricula which takes place in a real job situation under the supervision of an expert or in-plant supervisor. It provides participation in the actual production of goods and services. It prepares the student psychologically in developing entrepreneurship qualities.

It helps in continuous evaluation of the student's work and knowledge. The student is exposed to the latest technology and equipments. The student finds the real feelings in taking instructions from the supervisor. It provides the student overall exposure and the use of material and machinery. It leads to increased production of goods and services to the employers at less cost.

Time : End of each module

Duration : 15 days per year

List of possible OJT Centres

GENERAL

- ◆ Various institutions under Kerala Agricultural University (Colleges, research stations)
- ◆ Krishi Vigyan Kendras (KVKs)
- ◆ Krishi Bhavans
- ◆ Central Government Institutions like CTCRI, CPCRI, IISR etc.
- ◆ VFPCCK centres
- ◆ State Horticulture Mission
- ◆ Master Farmer's Fields
- ◆ Various Commodity Boards, Government of Kerala
- ◆ District Seed Farms
- ◆ Extension Training Centres
- ◆ Various NGOs like Thanal, PASSS, Mithra Niketan, MSSRF
- ◆ Various Private Nurseries (Atmanilayam Nursery Gardens Cheruvarakkonam, Kuzhippallam Botanical Gardens Nellimoodu, Beena Nursery Vithura, Dreamland Garden Mukkoodu, kollam).
- ◆ Regional Agricultural Training and Testing Centres
- ◆ Agro service centres
- ◆ Soil testing labs
- ◆ Safal markets
- ◆ HORTICROP
- ◆ Private Retail Malls

District wise OJT Centers

1. Thiruvananthapuram

- Jawaharlal Nehru Tropical Botanical Garden and Research Institute (JNTBGRI), Palode
- Biotechnology and Model Floriculture Centre (BMFC), Kazhakkuttom
- Rubber Board
- Various NGOs like Thanal, PASSS, Mithra Niketan
- Various Private Nurseries (Atmanilayam Nursery Gardens Cheruvarakkonam, Kuzhippallam Botanical Gardens Nellimoodu, Beena Nursery Vithura)
- VFPCCK - Thiruvananthapuram
- RATTC - Vellayani

2. Kollam

- KVK Sadanandapuram, Kottarakkara
- FSRS Sadanandapuram, Kottarakkara
- District Seed Farm, Kottukkal, Anchal
- State Seed Farm, Kottarakkara
- Cashew Farm, Kottarakkara
- Extensiion Training Centre (ETC), Kottarakkara
- Agro Industries, Neduvathoor, Kottarakkara
- Institute of Watershed Development Management Kerala (IWDMK), Chadayamangalam
- Agro Fruits, Elambal, Punalur
- Dreamland Garden, Mukkoodu, Kollam
- Soil Testing Lab, Kureepuzha
- Kripa Mushroom Farm, Kulakkada
- Biogas Training Centre, KNNMVHSS (AC & ABC), Pavithreswaram, Puthur.

3. Pathanamthitta

- Pazhakulam Agroservice Society (PASS), Adoor
- State Seed Farm, Munnalam, Adoor
- Sugarcane Breeding Farm, Kadakkad, Pandalam
- Bodhana Social Service Society, Thiruvalla
- KVK, Thelliyoor, Pathanamthitta
- Seed Farm, Pandalam

4. Alappuzha

- CPCRI, Kayamkulam
- Rice Research Station (RRS), Monkombu
- Seed Farm, Veeyapuram
- Bee keeping and Training Centre, Kottalammude
- KVK, Kayamkulam
- State Seed Farm, Mavelikkara
- RARS, Kayamkulam

5. Kottayam

- District Agriculture Farm, Kozha
- KVK, Kumarakom
- RARS, Kumarakom
- VFPC, Ettumanoor
- JEYES Farm, Neendoor
- Chaithanya (NGO), Kottayam

6. Idukki

- Bapuji KVK, Santhanpara
- Cardomom Research Station, Myladumpara
- VFPC, Thodupuzha, Adimali, Munnar, Kanthalloor, Vattavada
- Spice Board, Idukki

7. Ernakulam

- Aromatic and Medicinal Plants Research Station (AMPRS), Odakkali.
- Pineapple Research Station, Vazhakkulam
- Coconut Development Board, Neriamangalam
- Spices Board, Kochi
- Nadukkara Agroprocessing Society (NAPC), Nadukkara
- RATTC, Vytilla
- Kinfra Park, Nellad
- Parasite Breeding Station, Vytilla
- Hafi orchids, Kalamassery
- Sevashram (NGO), Ankamaly
- Aiswarya Farm (NGO), Kalady
- Grandma Pickles, Muvattupuzha.

8. Thrissur

- KVK, Mannuthy
- State Biocontrol Lab, Mannuthy
- Cashew Research Station, Madakkathara
- Pineapple Research Station, Madakkathara
- Banana Research Station, Kannara
- Central Training Institute, Mannuthy
- State Seed Farm, Pananchery and Nadavarambu
- National Rose Garden, Vellanikkara
- TEEOSE Gardens, Madakkathara
- RAYIRATH Gardens, Pattikkad

9. Palakkad

- IRTC, Mundur
- Integrated Seed Development Farm, Eruthiampathy
- Precision Farm, Perumatti
- Sugarcane Breeding Research Institute (Sub center), Puthur
- Seed Processing Plants, VFPCCK, Alathoor
- High Tech Dairy Farm, Malampuzha, Dhoni

10. Malappuram

- RARS, Aanakkayam

11. Kozhikode

- Koothali Farm
- IISR Kozhikode
- KVK, Peruvannamoozhy, Kozhikode
- Fruit Processing Center, Balussery

12. Kannur

- KVK Kannur
- Pepper Research Station, Panniyur
- District Agricultural Farm, Thaliparamabu
- Private Nurseries
- Coconut Nursery, Polayad
- Kinathy Farms, Kuthiparambu
- Soil Testing Lab, Thaliparambu
- Seed Farm, Vengad
- Germplasm collection center, Kannur
- Agromachinery Center, Chelod

- High Tech Farms, Pinarayi
- RAIDCO, Kannur.

13. Kasaragod

- CPCRI, Kasaragod
- KVK, Kasaragod
- College of Agriculture, Padannakkad
- RARS, Pilicode
- Agricultural Farm, Nileswar
- State Seed Farm, Karanthakad, Kasaragod
- Cashew Progeny Orchard, Gwalimukham
- Private nurseries
- Jenny flowers, Kasaragod
- Mechirath Nursery, Kasaragod

14. Wayanad

- MSSRF, Kalpille
- RARS, Ambalavayal
- KVK, Ambalavayal
- Wayanad Social Service Society, Mananathavady
- Private Nurseries
- Hitech Farms

CERTIFICATION OF SKILLS IN EACH MODULE

- Module I : Certificate in Agri Field Techniques
- Module II : Certificate in Crop Production Technology
- Module III : Certificate in Applied Agriculture
- Module IV : Certificate in Post Harvest Technology

OVERVIEW OF MODULE - 1

The first module “Agri field Techniques” aims to introduce the very basic concepts needed in all agriculture and related job roles. This module goes through basic Agri field techniques, weather advisory services, techniques in soil health management, micro irrigation techniques and fertigation, advanced plant propagation techniques including vegetable grafting and basic aspects of crop pest management.

Expected Skills

- ◆ Understands the major crops in India and Kerala.
- ◆ Identifies the use of meteorological equipments.
- ◆ Observes and Classifies the major soils of Kerala, macro and micro elements, their deficiency symptoms, manures and fertilizers.
- ◆ Understands the need of organic farming and its role in sustainable crop production.
- ◆ Understands different methods of irrigation.
- ◆ Understands the rain harvesting techniques.
- ◆ Applies and practices methods of sexual and asexual propagation.
- ◆ Identifies major pests diseases and weeds of Kerala.
- ◆ Applies and practices pest management measures.

Unit	Name of the Unit	Hours
1	Introductory agriculture	16
2	Agro meteorology	18
3	Soil health management	84
4	Irrigation technology	42
5	Plant propagation techniques	80
6	Crop pest management	100
	Total	340

Module 1 : AGRI FIELD TECHNIQUES		Unit : (periods)	
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p>Agriculture-definition, branches, milestones in agriculture development in India</p> <p>SKILLS:</p> <ul style="list-style-type: none"> • Observation • Tabulation • IT skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • define agriculture and enumerate its branches and explain the milestones in Agriculture development in India 	<ul style="list-style-type: none"> • General discussion (W), • Brainstorming (W) • Powerpoint presentation (G) • Time line (W) 	<ul style="list-style-type: none"> • Notes • Discussion points with consolidation • Tree diagram • Quiz
<p>Major crops in India and Kerala, Area, production and productivity of major crops in Kerala</p> <p>SKILLS:</p> <ul style="list-style-type: none"> • Observation • Classification • Communication • Practical skill 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • calculate the production and productivity of major crops in Kerala 	<ul style="list-style-type: none"> • Slide show with photographs (W) • Live specimens (I) • Establishment of crop museum (G) • Bar diagram showing comparison (G), • Map of India and Kerala showing area of major crops under cultivation (G) • Productivity calculation (I) 	<ul style="list-style-type: none"> • List of crops in tabular form • Collection • Field Diary • Prepared bar diagram • Assignment report-calculation of productivity
<p>Important Agricultural Institutions-teaching and research institutions, extension centres and agri based govt/semi govt organisations.</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Identification • Observation • Inference 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • enlist the important Agricultural Teaching and Research Institutions, Extension centers, and Commercial Agri- based government and semi government organisations. 	<ul style="list-style-type: none"> • Map of Kerala and India(major centres) • Table 	<ul style="list-style-type: none"> • Match Board

Module 1 : AGRI FIELD TECHNIQUES		Unit : (periods)	
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p>Meteorology-agricultural meteorology-definition, weather and climate</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Communication • differentiation 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • define Agricultural meteorology, distinguish between weather and climate. 	<ul style="list-style-type: none"> • General discussion (W) • Animated CDs (W) • Paper cuttings of daily weather report (G) • Collection of weather data (I) 	<ul style="list-style-type: none"> • Quiz • Assignment • Presentation
<p>microclimate, meteorological observatory and instruments to measure weather elements, Automated weather stations</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Classification • Instrumental skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • realise the use of meteorological observatories, handle the instruments to measure weather elements. • get acquainted with the Automated Weather Stations. 	<ul style="list-style-type: none"> • Animated CDs (W) • Collection of weather data • Visit • Model of observatory & instruments 	<ul style="list-style-type: none"> • Notes • Quiz with power point • Presentation • Report • viva-voce
<p>weather forecasting, Crop seasons in India and Kerala, Monsoons in Kerala</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Classification • Analysis • Tabulation 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • establish the relationship between weather forecasting and cultivation of crops. • analyse the rainfall data and identify the monsoon seasons in Kerala, relate it with agricultural seasons and prepare the crop calendar. 	<ul style="list-style-type: none"> • General Discussion (W) • Collection of rainfall data, analysis and presentation (G) • Notes • Calendar preparation of major crops of the locality (G) 	<ul style="list-style-type: none"> • Class test • Graph • Presentation report • Match Board

Module 1 : AGRI FIELD TECHNIQUES		Unit : (periods)	
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p>Soil profile, physical properties-soil structure and texture , Soils of Kerala-problem soils of Kerala</p> <p>SKILL</p> <ul style="list-style-type: none"> ● Observation ● Identification ● Interpretation ● Analysis ● inference 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> ● explain soil profiles with relevant diagrams and experience soil structure and texture. ● mention soils of Kerala and suggests crops suitable to each type of soil. ● explore and explain the problem soils in Kerala and their reclamation. 	<ul style="list-style-type: none"> ● Diagrams (G) ● Power point presentation (W) ● Map of Kerala (G) ● Chart preparation (I) ● Collection of samples (I) 	<ul style="list-style-type: none"> ● Preparation of Model ● Class Test ● Notes ● viva -voce ● Presentation
<p>Soil acidity- liming materials , soil alkalinity and its amelioration</p> <p>SKILLS</p> <ul style="list-style-type: none"> ● Observation ● Analysis ● Classification ● Instrumental skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> ● analyse soil -acidity, soil -alkalinity and applies remedial measures such as liming and amelioration respectively. 	<ul style="list-style-type: none"> ● Animated CDs (W) ● Demonstration of Specimens of liming materials and ameliorants (G) ● Collection of soil sample (G) ● pH analysis and correction (G) 	<ul style="list-style-type: none"> ● Class test ● Presentation
<p>Soil erosion-definition, types of erosion-water erosion- Wind erosion- Soil and water conservation-agronomic measures- mulching, contour farming, strip cropping, alley cropping, multier cropping, mixed cropping, intercropping, crop rotation, grass/fodder cultivation, cover cropping, zero tillage, biofencing/ vegetative fencing. Engineering measures- Percolation pits/ soak pits, contour bunding, making basins around trees, trenches, bench terracing, check dams,</p>	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> ● observe, make and present reports on the type of soil erosion and practice agronomic and engineering measure of soil and water conservation. 	<ul style="list-style-type: none"> ● Animated CDs (W), ● Power point presentation (W) 	<ul style="list-style-type: none"> ● Poster preparation ● Presentation ● Exercise planting

Module 1 : AGRI FIELD TECHNIQUES		Unit :		(periods)
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment	
<p>gabions, inward and outward terracing, brushwood check dams, gabion checkdams, artificial water holding structures and renovation of existing funds, weirs, sidewalls, geotextiles</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Communication • IT skills 				
<p>Soil pollution- causes, practices to maintain soil health, Soil quality monitoring- Soil health card, Remote Sensing and GIS.</p> <ul style="list-style-type: none"> • Observation • Analysis • collection 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • explore and make reports on the causes of soil pollution , check factors affecting soil health hazards and apply measures to maintain soil health and interpret the information in a Soil Health Card, familiarise remote sensing and GIS. 	<ul style="list-style-type: none"> • CD show(W), • videos showing calamities (W) • Collection of soil health card (I) • Geotextiling (G) • strip cropping (G) • Cultivation of vetiver (G) 	<ul style="list-style-type: none"> • Poster Preparation • Presentation 	
<p>Tillage-definition and objectives, types and effects of tillage in soil- zero tillage, minimum tillage, primary and secondary tillage implements, small farm machinery</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Classification • Analysis" 	<p>The learner will be able to :</p> <ul style="list-style-type: none"> • define Tillage and its types and share its objectives, and effects of tillage in soil and classify tillage implements into primary and secondary and operates them. • describe small farm machinery and practise them in needy contexts. 	<ul style="list-style-type: none"> • CD shows (W) • CD (KAU)(W) • slide show(W) • Group discussion (W) • Field preparation • Visit to RAIDCO, KAMCO, Agroindustries, Karmasena, Agroservice Centres 	<ul style="list-style-type: none"> • Notes • Presentation • Operation of Tillage implements • Report 	

Module 1 : AGRI FIELD TECHNIQUES		Unit : (periods)	
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p>Plant Nutrition- Essential elements-macro-micro, Functions, Deficiency and toxicity symptoms of N, P, K, Manures and fertilizers-classification, Organic manures- bulky and concentrated- FYM, compost, different composting methods, green manuring, Chemical fertilizers-straight, complex, mixed fertilizers, biofertilizers-examples and use. Integrated Nutrient Management, Methods of fertilizer application, Calculation of fertilizer requirement, KAU Fertilator</p> <p>SKILL</p> <ul style="list-style-type: none"> • Observation • Classification • Analysis 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • explain plant nutrition, enlist the essential macro and micro elements, the functions deficiency and toxicity symptoms of N,P,K. • classify manures and fertilizers and identifies the need of Integrated Nutrient Management. • calculate Fertilizer Requirement using scientific methods, using soft- wares like Fertilator and practise different methods of fertilizer application 	<ul style="list-style-type: none"> • Animated CD (W) • Charts (G) • CD show (W) • Group Discussion (G) • Familiarising with KAU fertulator (G) • Collection and identification (I) visit to fertilizer Depot (W) • Visit to farmers field (W) • Fertilizer calculation using formula (I) • Field application (G) 	<ul style="list-style-type: none"> • Notes • Response to interactive media • Enlist the commonly used manures&fertilizers • Class Test • Presentation • Collection field diary • Report • Calculation of fertilizers
<p>Soil fertility evaluation- soil testing, plant tissue analysis-DRIS methods, critical levels in plants, rapid tissue tests, indicator plants, biological methods of soil fertility evaluation, Soil based plant nutrient management information system, organic farming and sustainable agriculture</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Analysis • Instrumental skills • Practical skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • prepare soil samples for testing, interpret the results and give recommendations based on the result. • apply different methods for soil fertility evaluation such as soil testing, plant tissue analysis by DRIS method. • identify critical level of nutrients in plants and collects data regarding biological methods to evaluate soil fertility such as rapid tissue tests, indicator plants. • explain and prepare notes on soil based Plant Nutrient Management Information System, recognize the need of organic farming and its role in sustainable crop production, nutrient management, disease and pest management. • realize the need and significance of sustainable agriculture. 	<ul style="list-style-type: none"> • Videos (W) • Photographs (W) • Power point presentation (W) • Videos on organic farming (W) • Collection of soil sample and sending to soil testing lab (G) • Visit to soil testing lab (W) • Field visit (W) 	<ul style="list-style-type: none"> • Soil sampling • Visit to research stations • On field experience

Module 1 : AGRI FIELD TECHNIQUES		Unit :		(periods)	
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment		
Irrigation-definition, methods of irrigation-surface, subsurface (definition and examples only), micro irrigation, special methods-in detail (drip, sprinkler, mist, bubbler, pivot) SKILLS <ul style="list-style-type: none"> • Observation • communication 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • define irrigation, methods of irrigation such as surface, sub-surface, micro-irrigation, and detail special methods such as drip, sprinkler, mist, bubbler and pivot. 	<ul style="list-style-type: none"> • Animated CD (W) • Model (G) • Installation of irrigation units (G) • Field visit to established irrigation units (W) 	<ul style="list-style-type: none"> • Installation of irrigation units • Notes 		
Fertiligation, chemigation, quality of irrigation water and its management, drainage-importance in crop production SKILLS <ul style="list-style-type: none"> • Observation • Communication 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • explain fertiligation, chemigation and recognize quality of irrigation water and its management, drainage and its importance in crop production 	<ul style="list-style-type: none"> • Discussion (G) 	<ul style="list-style-type: none"> • Presentation • Exercise • Report 		
Rainwater harvesting-techniques and structures-ferrocement tank, percolation pits(emerging innovative models) SKILLS <ul style="list-style-type: none"> • Reference • Communication 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • describe rain water harvesting techniques and structures-ferrocement tank, percolation pits and other emerging innovative models. 	<ul style="list-style-type: none"> • Videos and animated CD (W) • Working models (G) • Visit to nearby RW harvesting structures (W) 	<ul style="list-style-type: none"> • Notes • Presentation • Exercise • Report 		
Types of propagation-sexual propagation-seed- definition, qualities of good seed, classes of seed, sowing methods, seed bed preparation, vegetable seedling production, portray seedling production, seed testing-methods of testing germination percentage SKILLS <ul style="list-style-type: none"> • Observation • Communication • classification 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • identify types of propagation define seed and enumerate the qualities of good seed, classes of seed, sowing methods. • practise sexual propagation in plants, seed-bed preparation, vegetable seedling production, portray seedling production. • practise seed testing- methods of testing germination percentage. 	<ul style="list-style-type: none"> • Animated CD (W) • Collection of labels of different seed classes (G) • Flow chart. (I) • Selection of seeds having good quality from a lot through observation (G) • Field experience (G) • Seed bed preparation (G) • Methods of testing germination percentage (I) 	<ul style="list-style-type: none"> • Notes • Response to interactive media • Enlist the commonly used seeds • Class Test • Presentation • Collection • field diary • Report 		

Module 1 : AGRI FIELD TECHNIQUES		Unit :		(periods)
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment	
<p>Asexual propagation methods- cutting, layering, budding, grafting, tissue culture, vegetable grafting</p> <ul style="list-style-type: none"> • Observation • Classification • Practical skills • Instrumental skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • practise asexual propagation methods in plants- cutting, layering, budding, grafting, tissue culture and vegetable grafting. 	<ul style="list-style-type: none"> • Animated CD (W) • Demonstration (I) 	<ul style="list-style-type: none"> • Notes • Exercise 	
<p>Pest-definition, classification with examples, plant disease-common symptoms and pathogens, weeds-uses and harmful effects, dryland and wetland weeds</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Identification • Communication 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • define pests, classify pests, describe plant diseases, their common symptoms and pathogens, weeds- uses and harmful effects, dry land and wet land weeds 	<ul style="list-style-type: none"> • Discussion (W) • Power Point Presentation (W) • Field visit (W) • Preparation of herbarium (I) • Collection of live specimens (I) 	<ul style="list-style-type: none"> • Notes • Herbarium • Insect box 	
<p>Plant protection methods, Biopharmacy, plant protection chemicals and different formulations (emphasis to new generation pesticides), plant protection equipments, weed management, E- Crop Doctor, Crop diagnostic centres.</p> <ul style="list-style-type: none"> • Observation • Identification • Classification • Reference skill • Practical skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • explain plant protection methods, Biopharmacy, plant protection chemicals and their formulation and enlist pesticides in use with emphasis on new generation and banned pesticides. • identify plant protection equipments, weed management, E- crop doctor and visit crop diagnostic centres. 	<ul style="list-style-type: none"> • Discussion (W) • Animated CDs (W) • Familiarisation with different formulations (W) • Power point presentation (W) • Familiarisation of E-crop doctor from websites (G) • Visit to pesticide shop (W) • Preparation of botanical pesticides and fungicides (G) • Familiarisation of plant protection equipments- working and maintenance (G) • Setting up of crop diagnostic centres in school (W) 	<ul style="list-style-type: none"> • Charts • Class test • Exercise 	

PRACTICAL ACTIVITIES- MODULE I

- Live specimens
- establishment of crop museum
- Bar diagram showing comparison
- Map of India and Kerala showing maximum and minimum temperature
- Area of major crops under cultivation
- Productivity calculation
- Map of Kerala and India(major institutions)
- Table of important institutions related to agriculture
- Collection of weather data
- Visit to observatory
- Model of observatory & instruments
- Notes based on visit
- Calendar preparation of major crops of the locality
- Chart preparation soil profile and soils of Kerala
- Soil sample collection
- pH analysis and amelioration of problem soil
- Geotextiling
- Strip cropping
- Cultivation of vetiver
- Collection of soil sample and sending to soil testing lab.
- Visit to soil testing lab
- Field preparation with small farm machinery
- Visit to RAIDCO, KAMCO, Agroindustries, Karmasena, Agroservice Centres
- Collection of Live specimens
- Collection and identification of fertilizers
- Visit to fertilizer Depot
- Visit to farmers field

- Fertilizer calculation using formula
- Field application
- Field visit
- Installation of irrigation units
- Field visit to established irrigation units
- Working models
- Visit to nearby rain water harvesting structures
- Selection of seeds having good quality from a lot through observation
- Field experience
- Seed bed preparation
- Methods of testing germination percentage
- Preparation of herbariums
- Visit to Pesticide shop
- Familiarisation with various formulations
- Preparation of Botanical pesticides and Bio pesticides
- Familiarisation with Plant Protection equipments using live models
- Setting up of crop diagnostic centers at School

OVERVIEW OF MODULE - 2

Crop Production Technology

The second module Crop Production Technology gives importance on cultivation aspects of major crops of Kerala. This module imparts capacity of crop production techniques including their latest trends. Familiarization of different cropping systems including the “ Integrated Farming System” is also aimed at.

Expected Skills

- ◆ Identifies different classes of crops
- ◆ Observes and understands different farming systems
- ◆ Understands the different crop production technologies of field crops like rice, tapioca and fodder crops.

- ◆ Applies and practices different crop production technologies of vegetables
- ◆ Understands the different crop production technologies of coconut, rubber and pepper
- ◆ Understands the different crop production technologies of fruit plants like mango and applies in plants like banana and pine apple
- ◆ Familiarise with the different crop production technologies of ornamental flowers like orchid, anthurium, jasmine and rose.
- ◆ Familiarise with different medicinal plants of economic importance

Unit No	Name of the Units	Hours
1	Classification of crops	7
2	Farming system	16
3	Crop production technology of field crops and fodder crops	80
4	Crop production technology of vegetables	60
5	Crop production technology of Plantation Crops	65
6	Crop production technology of fruits	40
7	Crop production technology of Flowers	60
8	Importance of medicinal plants in Kerala	12
	Total	340

Module 2 : Unit :			(periods)
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
Agronomic classification of crops SKILLS <ul style="list-style-type: none"> • Observation • Communication 	The learner will be able to : <ul style="list-style-type: none"> • explain different agronomic classes of crops and list out their examples 	<ul style="list-style-type: none"> • Interactive session (G) • Brain storming (W) • Setting up Crop Cafeteria (G) • Specimen Collection (I) • Herbarium (I) • Seed Collection (I) 	<ul style="list-style-type: none"> • Quiz • Vocational Diary • Practical Record • Table preparation
Concept - different types of farming system SKILLS <ul style="list-style-type: none"> • Observation • Classification • Analysis 	The learner will be able to : <ul style="list-style-type: none"> • define different farming systems, their merits and demerits, with emphasis on IFS 	<ul style="list-style-type: none"> • Exhibition (G) • Video showing different farming systems (W) • Discussion (G) • Layout preparation and report presentation (G) • Field visit (W) • Debate (G) 	<ul style="list-style-type: none"> • Unit test • Vocational Diary • Practical Record • Model preparation
Different types of cropping systems SKILLS <ul style="list-style-type: none"> • Classification • Analysis • Observation 	The learner will be able to : <ul style="list-style-type: none"> • explain mono cropping, crop rotation, intercropping, mixed cropping, ratoon cropping, multi tier cropping, relay cropping, mixed farming, home stead farming. 	<ul style="list-style-type: none"> • Animated CD show (W) • Discussion (G) • Identification of the given layout (G) • Ppt (W) • Field visit (W) 	<ul style="list-style-type: none"> • Unit test • Vocational Diary • Practical Record • Presentation
Integrated farming systems SKILLS <ul style="list-style-type: none"> • Observation • Classification • Communication • Analysis 	The learner will be able to : <ul style="list-style-type: none"> • define IFS and shares its goals and components, advantages and disadvantages of different IFS models 	<ul style="list-style-type: none"> • Farm visit (W) • Collection of photos and paper cuttings (I) • Video show on IFS (W) • General discussion (W) • Role play (G) 	<ul style="list-style-type: none"> • Unit test • Vocational Diary, • Model preparation • Practical Record • Quiz

Module 2 :		Unit : (periods)	
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p>Crop production technology of rice</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Classification • Observation • Analysis 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • describe the climatic requirements, suitable soil and season for rice cultivation. • explain the varieties of rice, recently released varieties and geographic indexing. • identify and prepare notes on seed rate, seed treatment, nursery preparation (advanced and recently developed techniques) transplanting and spacing • describe and suggest fertilizer recommendation for effective rice cultivation. • List out common weeds in rice fields, insect pests, diseases and their management. • Identify and prepare notes on <i>Kole</i>, <i>Pokkali</i>, and <i>Kaippad</i> cultivation of rice. • describe SRI (System of Rice Intensification Technique) • explores and explain scope of farm mechanization in rice cultivation and post harvest handling • list out the important rice research stations in Kerala and make notes on current trends in rice production. 	<ul style="list-style-type: none"> • Mapping (G) • General Discussion (W) • CDs (W) • PPT (W) • Group Discussion (G) • Debate (G) • Map of Kerala showing rice research stations (W) • Interaction with Rice Growers (G) • Field visit (W) • Demonstration (G) • Specimen Collection Album (I) • Field visit (W) 	<ul style="list-style-type: none"> • Unit test • Quiz • Vocational diary • Practical Record • Collection • Herbarium • Album • Viva voce
<p>Crop production technology of Tapioca</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Communication • Analysis • Inference • Classification • observation 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • describe the varieties climatic requirements, suitable soil and season for tapioca cultivation. • identify and explain propagation and mini sett tapioca propagation techniques. • explain the process of preparation of land, describe the season and planting, manuring and irrigation, inter cropping related to tapioca cultivation. • List out insect pests, diseases and their management in tapioca and enlist the bio pesticides made from tapioca. • Familiarise the current trends in tapioca production. 	<ul style="list-style-type: none"> • CDs(CTCRI) (W) • General Discussion (W) • Group discussion (G) • Field visit (W) • Seminar (I) • Planting in trays at school (G) • Interaction with cassava cultivators (G) 	<ul style="list-style-type: none"> • Quiz • Unit test • Vocational diary • Seminar report • Exercise

Module 2 : Unit : (periods)			
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p>Crop production technology of Fodder crops</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Classification • Communication • Tabulation 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Enlist fodder crops such as Guinea Grass, Hybrid Napier, Congo Signal Grass, Subabul, Agathi and Stylo with reference to important varieties , planting material, fertilizer recommendations, harvesting and yield. • Mention techniques of fodder preservation-Silo, Silage and Haylage 	<ul style="list-style-type: none"> • Power Point Presentation (I) • Field visit (W) • Collection of paper cuttings (I) 	<ul style="list-style-type: none"> • Quiz • Vocational diary • Herbarium
<p>Crop production technology of vegetables</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Classification • Analysis • Communication • Creativity skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Identify and prepare charts Solanaceous vegetables such as brinjal, tomato, chilli, in terms of their varieties, seed rate, spacing, manuring, insects, pests and diseases. • Identify cultivation practices of Cucurbitaceous vegetables such as bitter gourd, snake gourd, bottle gourd, ash gourd, pumpkins and gherkins in terms of varieties, seed rate, spacing, manuring, insects pests and diseases. • Identify and prepare charts cool season vegetables such as carrot, cabbage, cauli flower in terms of their varieties, seed rate, spacing, manuring, insects, pests and diseases. • identify and prepare chart on amaranthus, bhindi, cowpea in terms of their varieties, seed rate, spacing, manuring, pests and diseases. 	<ul style="list-style-type: none"> • General discussion using chart (W) • Video show (W) • PPT (W) • Field visit (W) • Preparing chart (I) • Vegetable carving (G) • Field work (G) 	<ul style="list-style-type: none"> • Vocational diary • Quiz • Unit test • Table preparation
<p>Kitchen gardening and terrace gardening</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Practical skills • Observation • Communication 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Practice kitchen gardening and terrace cultivation. • Familiarize current trends in vegetable cultivation and its value addition. 	<ul style="list-style-type: none"> • Video show (W) • General Discussion (W) • Case study (G) 	<ul style="list-style-type: none"> • Record • Vocational diary • Presentation

Module 2 :		Unit :		(periods)
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment	
<p>Crop production technology of Coconut</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Communication 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Identify and explain the scientific name of coconut, soil suitable for coconut crop production and site selection • List out important coconut cultivars hybrids and coconut nursery techniques. • Explain the cultivation practices of coconut in terms of land preparation, planting seedlings, spacing, planting systems, time of planting, irrigation, weeding, manuring and intercropping.. • Explain the techniques for drought management such as husk burial, mulching, and use of cover crops and green manure crops • explain plant protection of coconut plants- identifies pests, diseases and explain their management with special emphasis on biocontrol. • Familiarize the current trends in coconut cultivation and its value addition 	<ul style="list-style-type: none"> • General discussion using chart (W) • PPT (G) • Video shows (W) • Articles and Publications (I) • Field visit (W) 	<ul style="list-style-type: none"> • Quiz • Unit test • Seminar, paper cuttings • Assignment • Practical records • Viva voce • Exercise 	
<p>Crop production technology of rubber</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Analysis • Classification 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Identify and explain the scientific name of rubber, soil suitable for rubber crop production and site selection • Enlist the important varieties, clones of rubber and their nursery 	<ul style="list-style-type: none"> • General discussion using chart (W) • PPT (G) • Video shows (W) • Field visit (W) • Articles and Publications (I) 	<ul style="list-style-type: none"> • Quiz • Vocational diary • Presentation • Assignment • Viva voce 	

Module 2 : Unit : (periods)		
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities
	<ul style="list-style-type: none"> • Explain the cultivation practices of rubber in terms of land preparation, planting clones, cover cropping and mulching, weeding, manuring, use of rain guard and tapping. • familiarize plant protection of rubber- identifies pests, diseases with special emphasis on abnormal leaf fall, powdery mildew, pink disease. • Familiarize the current trends in rubber and allied industries, different products and their value addition. 	
<p>Crop production technology of pepper</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Analysis • Classification • Communication • Practical work 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • state the scientific name of pepper and explain soil suitable for pepper crop production and site selection • list out important varieties of pepper, describes the selection of mother plants, and raising rooted cuttings. • explain the cultivation practices of pepper in terms of land preparation, planting vines, spacing, planting methods, time of planting, irrigation, weeding, manuring and underplanting. • practise bush pepper propagation • explain plant protection of pepper, lists out its pests and diseases. • familiarize the current trends in pepper cultivation and lists out different product made out of pepper and its value addition. 	<ul style="list-style-type: none"> • General discussion using chart (W) • PPT (G) • Video shows (W) • Articles and Publications (I) • Field work
		<ul style="list-style-type: none"> • Quiz • Vocational diary • Assignment • Paper cuttings

Module 2 : Unit : (periods)		
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities
<p>Crop production technology of Banana</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Analysis • Classification • Practical skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • identify and explain the scientific name of banana, soil suitable for banana crop production and site selection. • List out the important varieties of banana. • Describe sucker selection and preparation of suckers for planting in banana. • explain the cultivation practices of banana in terms of land preparation, planting, spacing, time of planting, irrigation, weeding, manuring and intercropping. • familiarize the tissue culture techniques in banana and leaf banana cultivation. • Explain the plant protection of banana, its pests and diseases. • List out different products made out of banana and its value addition. 	<p>Assessment</p> <ul style="list-style-type: none"> • Quiz • Vocational diary • Unit test • Assignment • Practical Record • Viva voce • Exercise
<p>Crop production technology of Mango</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Communication • Practical skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Familiarize with the scientific name of mango, soil suitable for mango crop cultivation, season and site selection. • List out the important varieties of Mango and their propagation. • Familiarize the cultivation practices of mango in terms of land preparation, planting, spacing, time of planting, irrigation, weeding, manuring and intercropping. • Describe the high density planting in mango. • Familiarize with plant protection in Mango and list pest and diseases. • explain the current trends in mango cultivation and list out different products made out of mango and its value addition. 	<p>Assessment</p> <ul style="list-style-type: none"> • Quiz • Assignment • Unit test • Practical Record • Vocational diary

Module 2 :		Unit :		(periods)
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment	
<p>Crop production technology of Pine apple</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Communication • Analysis • Observation 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Familiarizes with the scientific name of pine apple, soil suitable for pine apple cultivation, and site selection. • List out the important varieties of pine apple and explain pine apple sucker selection and preparation of suckers for planting. • Familiarize the cultivation practices of pine apple in terms of land preparation, planting, spacing, time of planting, irrigation, weeding, manuring and flowering induction. • Familiarize with the plant protection of pine apple, and list pests and diseases. • List out different products made out of pine apple and its value addition. 	<ul style="list-style-type: none"> • General discussion using chart (W) • PPT (G) • Video shows (W) • Articles and Publications (I) • Field visit (W) 	<ul style="list-style-type: none"> • Quiz • Vocational diary • Assignment • Practical record 	
<p>Crop production technology of Anthurium</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Classification • Practical skills • Communication 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Describe the varieties of Anthurium, and its propagation methods, planting and potting media preparation, fertilizer recommendation, intercultural operation, plant protection, harvesting. 	<ul style="list-style-type: none"> • General discussion using chart (W) • Video show (W) • PPT (G) • Field visit (W) • Field work (G) 	<ul style="list-style-type: none"> • Quiz • Vocational diary • Poster preparation 	
<p>Crop production technology of Orchid</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Classification • Observation • Practical skills • Communication 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Describe the varieties of Orchid, and its propagation methods, planting and potting media preparation, fertilizer recommendation, intercultural operation, plant protection, harvesting. 	<ul style="list-style-type: none"> • General discussion using chart (W) • Video show (W) • PPT (G) • Field visit (W) • Field work (G) 	<ul style="list-style-type: none"> • Quiz • Vocational diary • Practical record • Poster preparation 	

Module 2 : Unit : (periods)			
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p>Crop production technology of Rose</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Classification • Practical skills • Communication • IT skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Familiarize with the classification and varieties of Rose, propagation planting and potting mixture preparation, manuring, pruning, plant protection, harvesting, packing and marketing, value added products and rose oil. 	<ul style="list-style-type: none"> • General discussion using chart (W) • PPT (G) • Field visit (W) 	<ul style="list-style-type: none"> • Quiz • Vocational diary • Presentation • Practical record
<p>Crop production technology of Jasmine</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Analysis • Communication • Practical skill 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Familiarize with the cultivation, varieties and propagation of jasmine, rooting hormones, land preparation, spacing, manuring, irrigation, pruning, inter cultural operation, weed control, pests, diseases ,yield and value added product- Jasmine oil. 	<ul style="list-style-type: none"> • General discussion using chart (W) • PPT (G) • Field visit (W) 	<ul style="list-style-type: none"> • Quiz • Vocational diary • Presentation • Practical record
<p>Importance of medicinal plants in Kerala</p> <p>SKILLS</p> <ul style="list-style-type: none"> • Observation • Classification • Communication • Reference skills 	<p><i>The learner will be able to :</i></p> <ul style="list-style-type: none"> • Familiarize with the importance of medicinal plants in Kerala, lists them out with their common name, parts used and scope of medicinal plants in Ayurveda. 	<ul style="list-style-type: none"> • Group Discussion (G) • PPT (G) • Field visit (W) 	<ul style="list-style-type: none"> • Quiz • Vocational diary • Poster presentation

PRACTICAL ACTIVITIES- MODULE II

- Setting up of Crop Cafeteria
- Specimen Collection
- Seed Collection
- Exposure visit to successful farms(IFS preferred)
- Interview
- Setting up of different components(Azolla, Vermicompost, Mushroom, Biogas etc.) of IFS
- Field visit
- Preparation of herbariums
- Interaction with farmer
- Wet land/ Upland paddy cultivation – prefer SRI-Land preparation, Seed treatment, Nursery preparation - Dapog, Types of Sowing, Cultivation, Fertiliser Calculation and application, Plant Protection Major pest and diseases - IPM, Harvesting, Value addition, Marketing.
- Collection of Specimens of Pest, Diseases of various crops
- Identification of Varieties of various crops
- Identification and management of major pest and diseases of various crops
- Cultivation using mini setts in tapioca
- Familiarisation with Botanical pesticides from tapioca leaves – *NANMA/MENMA*
- Familiarisation with Value added products of various crops
- Identification of fodder crops
- School Vegetable Garden
- Portray seedling production
- Familiarisation with safer chemical pesticides, botanical pesticides, Biopesticides.
- Identification and collection of vegetable seeds
- Visit to VFPC market

- Drought management practices in coconut
- Familiarisation with Palm Climber
- Fertiliser application in coconut
- Bush pepper growing
- Rapid propagation in Pepper
- Rubber tapping
- Fertiliser application in Banana
- Tissue culture Banana – work experience
- Flowering induction in Pineapple
- Identification of Physiological disorders in mango
- Harvesting Index of Banana, Mango, Pineapple
- Preparation of Potting media for anthurium and orchid cultivation
- Potting and repotting
- Propagation of anthurium and orchid
- Identification of medicinal plants
- Setting up of medicinal garden
- Field visit to nearby Ayurveda centre

OVERVIEW OF THE MODULE

Module III : Applied Agriculture (Draft)

UnitNo	Name of the Unit	Hours
1	Agri-clinics, pest & disease diagnosis& IPDM techniques	55
2	Organic farming-production, techniques and certification	55
3	GAP & certifications	32
4	Hi-tech cultivation-different types	67
5	Supplementary and complementary enterprises for profit maximization and resource utilization	74
6	ICT enabled extension services in Agriculture	57
	TOTAL	340

Module IV: Post Harvest Technology (Draft)

Unit No	Name of the Units	Hours
1	Secondary Agriculture-Post harvest management- importance & scope	23
2	Techniques of Post Harvest Technology-grading, packing, storage and marketing	40
3	Post harvest management and product diversification of cereals, pulses, tapioca, fruits and vegetables, spices and condiments, plantation crops, medicinal and aromatic crops	83
4	Post harvest management and product diversification of flowers	40
5	Principles and methods of preservation	28
6	Packing, storage and marketing of processed products	31
7	Machineries and protocol in processing	45
8	Entrepreneurship Development of Agri based processing industries	50
TOTAL		340

DETAILED UNIT ANALYSIS

Name of Module : **AGRI-FIELD TECHNIQUES**

Name of Unit : **Agrometeorology**

Overview of the Unit

As plant growth is governed by the climatic factors, its study has developed into a science called Agricultural Meteorology. Here, the learners will study the various weather elements like temperature, wind, relative humidity, rainfall and sunlight in relation to plant growth and their interaction in creating a suitable condition for cultivation. These weather elements are continuously monitored, recorded and weather forecasting is done based on the interpretation made. In India, we are using satellite systems and super computers for the collection and analysis of weather data and weather forecasting. Besides, the weather data can also be used for the forecasting of pest and disease outbreaks.

In Kerala, we have two monsoons. The SW monsoon popularly known as "Edavapathy" which commences from the last week of May to first week of June which contributes to 60 % of the water received through rainfall. The NE monsoon is known as "Thula Varsham" which commences by September. The first and second crop season are known

as Virippu and Mundakan which coincides with SW and NE monsoons respectively.

Agriculture depends upon vagaries of nature and the variations are closely monitored now a days using automated weather stations.

Concept 1

- **Meteorology**
- **Agrometeorology**

Suggested Activities

General Discussion-led by the teacher based on the following discussion points

Points to be discussed

- What are the climatic factors affecting plant growth?
- What is meant by Meteorology and Agrometeorology?

Multimedia presentation-displays the ppt related to meteorology-factors influencing and the difference between weather and climate and their importance in plant growth.

Consolidation

- The factors influencing plant growth like temperature, rainfall, wind, sunlight.
- Branch of science dealing with that of atmosphere is known as meteorology.
- A science concerned with the application of meteorology to the measurement and analysis of the physical environment in agricultural systems

Assessment

- Quiz- questions related to factors influencing plant growth (temperature, rainfall, wind and sunlight).
- Notes on difference between meteorology and agrometeorology.

Concept 2

- **Weather and climate.**

Activity suggested

Group discussion based on weather & climate.

Points to be discussed

- What is the difference between weather and climate?
- What are the specialities of climate in India?
- What are the different crops cultivated in these climatic condition?

Presentation of animated CDs.

Collection of weather data from news paper (PE)

Consolidation

- Weather is the condition of the atmosphere from few hours to about weeks of a particular region. Climate is the totality of weather elements for a few years.
- Tropical- temperature, humidity high through out India
- Maritime-
- Monsoonal - Rain abundant in S. India.
- Wheat, rice, sugarcane, mustard, soybean, jute, coffee, tea, pepper, rubber, banana, tapioca, coconut.

Assessment

- Assignment - Collection of weather data from different dailies for 1 week.
- Note book - Weather, climate, difference between weather and climate, specialities of climate in India, different crops cultivated in these climatic conditions.
- Chart preparation - Chart of Weather data for 1 week, chart showing difference between Weather and climate, charts showing different crops cultivated in different climatic condition.

Concept 3

Microclimate

Activity suggested

Group discussion - Teacher divides students into groups, displays the points to be discussed.

Points to be discussed

- Why are the water bodies making the atmosphere cool?
- What are the reasons for the increase of room temperature in sunny days?
- What is the difference between two nearby location regarding plant density?

Presentation of Animated CDs on micro climate.

Consolidation

Groups present their views.

- In normal condition water bodies use the internal energy to get vaporized which help to cool the water body. A cooler water

surface results in cooler air temperature.

- Evaporation of water bodies due to sun rays will again make the atmosphere cool due to condensation of water vapour.
- When infrared rays from the sun reach the earth and reflect back. It gets trapped by the gases (CO₂, SO₂ etc.) present in the atmosphere. Hence the atmospheric temperature and subsequently the room temperature rises up.
- Micro climate is the climatic condition around a plant or the condition existing over a small area of the plant.
- Micro climatic factors like humidity, air flow, temperature, light intensity.

Assessment

- Notebook - Entries related to microclimate and allied factors

Concept 4

- **Meteorological observatory and instruments to measure weather elements**

Activity suggested

Presentation of animated CDs, Presentation of video shows, Group discussion.

Points to be discussed

- What are important points to be considered for the site selection of Meteorological Observatory?
- What are the various instruments used to measure weather elements?
- What are the features of a Meteorological Observatory?

Visit, Model of instruments, chart of instruments and its uses (PE)

Consolidation

- A standard observatory is required to familiarize with the weather of a given place.
- Various instruments are required to measure and understand weather components like instruments measuring soil and atmospheric temperature, direction and velocity of wind, duration and intensity of sun light, rain fall, humidity, evapo transpiration.
- Meteorological observatory is a place where different instruments which record meteorological data are lodged
- The observatory should be located at a site which is representative of the area

- The area should be enclosed by a wire fence
- Site should be free from obstructions like tall trees or buildings on all sides
- The size of the plot must be 55m in North South Direction and 36m in East West Direction
- Stevenson Screen - Relative Humidity and temperature
- Soil Thermometers - Soil Temperature
- Sunshine Recorder - Sun shine duration
- Wind vane - Wind direction
- Cup anemometer - Wind Speed
- Open Pan evaporimeter - Evaporation
- Rain gauge - Rain
- Automatic/Self Recording Rain gauge
- Dew gauge - Dew
- Automatic weather station

Assessment

- Presentation of assignment-Features of meteorological observatory.
- Points to be considered for the site selection of meteorological observatory.
- Participation in group discussion
- Active involvement in practical
- Preparation of models of instruments like cup anemometer
- Quiz - Question and answers regarding meteorological observatory.
- Practical record - Handling of instruments required to measure weather components.

Concept 5

- Weather forecasting

Activity suggested

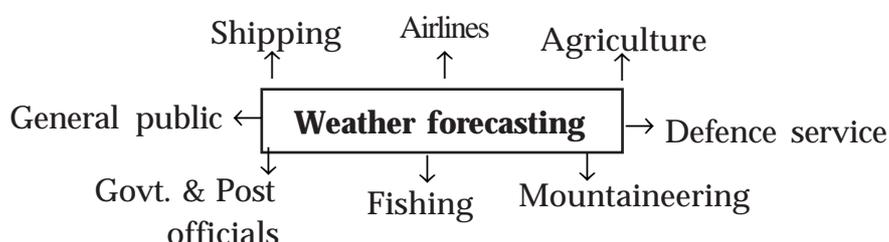
General discussion

Points to be discussed

- What is weather forecasting?
- How the forecast is given to the farmer?
- Who are the beneficiaries?
- Which are the types of forecasting?

Power point presentation - Teacher's powerpoint presentation on need and importance of weather forecasting.

Chart preparation.



Consolidation

- The prediction of weather for the next few days to follow is called weather forecasting

Weather forecasting helps in -

- Prediction of weather and climate.
- Short, medium and long term forecasting.
- Purpose or beneficiary.
- Agencies - IMD, Doordarsan, Air.

Assessment

- Notebook entries - weather parameters
- Unit assessment - Written examination on the points discussed above.

Concept 6

- Importance of Automated weather stations

Activity suggested

Group discussion

Points to be discussed

The facilitators initiates a discussion on automated weather stations.

- What is an automated weather station?

Multimedia presentation - Followed by discussion.

Consolidation

- Automated weather stations is an automatic type of traditional weather station either to enable measurements from remote areas or to save human labour

Assessment

- Note book- Discussion report on automated weather station.

Concept 7

- Crop seasons and Monsoons in Kerala

Activity suggested

Group discussion - Teacher leads a general discussion on crop seasons and monsoons in Kerala and then group discussion.

Interactive multimedia presentation.

Collect paper cuttings (PE).

Analysis of collected rainfall data from internet for the last 10 years (PE)

The students are asked to analyse the rainfall data chart and initiate discussion based on monsoons and crop calendar of rice.

List out the months having higher rain fall.

Compare with crop calendar and identify agricultural seasons.

Crop seasons in Kerala with special reference to rice (virippu, mundakan, puncha).

Monsoons of Kerala (South West, North East, Summer seasons)

Face to face interaction with key informants of nearby farming community (PE).

Consolidation

- Kerala receives two monsoons. The South West monsoons popularly known as Edavapathy which commence from last week of May. It contributes 60% rainfall. The first crop season of paddy ie. Virippu coincides with this monsoon. North East monsoon is known as Thulavarsha which commences from September. The Second crop season called Mundakan coincides with this period. It contributes 30% of rainfall. Puncha is the third season of paddy which do not coincide with any monsoon.

Assessment

- Participation in Group discussion
- Chart
- Report on group discussion
- Practical record
- Oral test
- Unit test

Repository of CE

Process Assessment	Portfolio Assessment	Unit Assessment
<ul style="list-style-type: none"> • Participation in group discussion • Active involvement in practical • Face to face interaction with farmer groups • Field visit 	<ul style="list-style-type: none"> • Presentation of Assignment Report of Group discussion • Preparation of model observatory and instruments • Chart of weather data chart of difference between weather & climate • Report on field visit 	<ul style="list-style-type: none"> • Quiz competition • Written examination • Oral test

CE Questions

1. A few students of 8th standard seek clarification on the almost similar term weather and climate, after a class on meteorology. Give good reason and justify.
2. Schools have been requested by DEO to setup model weather observatory to familiarize students with weather element/parameters in the era of climate change. Make a list of instruments that will be required with its use and criteria to be followed for selection of site for setting up of observatory.
3. Climate change poses a major challenge to the farming community. Government agencies like Department of Meteorology in collaboration with Doordarshan and AIR give yeoman service to former. Suresh being a volunteer plans a campaign to make aware about those agricultural services. Prepare a script for this campaign highlighting the purpose of these services and the service provided.
4. Monsoon tourism has great potential in Kerala. Foreign tourists need to be made aware about the character of monsoon in Kerala. Briefly write a note with special reference to paddy seasons to be published on a popular tourism website

LIST OF TOOLS, EQUIPMENTS AND MATERIALS

Sl. No.	Name of items (with specifications)	Quantity required (per 25 students)	Remarks
1	Hand sprayer (2L)	10	
2	Rocker sprayer (5L)	2	
3	Knap sack sprayer (10 L)	2	
4	Knap sack sprayer (5 L)	2	
5	Hand rotary duster	2	
6	Rat trap (cage type)	2	
7	Rat trap (wooden type)	1	
8	Rat trap (gullettin type)	2	
9	Rat trap (adhesive type)	2	
10	Bio gas plant (Modular)	1	
11	Polythene cover (Different sizes)	5 kg	
12	Grow bag	25	
13	Hygrometer	1	
14	Steel rack	2	
15	Drum (250L)	1	
16	Pressure cooker (10L)	1	
17	Tiller (Model)	1	
18	Seeder(Model)	1	
19	Transplanter(Model)	1	
20	Chain saw	1	
21	Augur	1	
22	Power sprayer	1	
23	Coconut Climber	2	
24	Telescope harvester	1	
25	Pedal pump	1	
26	Toolset and spare	1	
27	Budding cum grafting knife	25	
28	Budding knife	25	
29	Grafting knife	25	
30	Secateur (falcon)	5	
31	Pots (Small)	25	
32	Pots (Medium)	20	

33	Pots (Large)	15
34	Hand cultivator	10
35	Hand fork	10
36	Hand rake	5
37	Land mower	1
38	Hole digger	1
39	Rose can	5
40	Garden shear	10
41	Japanese hoe	5
42	Trench hoe	5
43	Spade	10
44	Kunthali	5
45	Axe	2
46	Pick axe	5
47	Dibbler	5
48	Pruning saw	5
49	Pruning knife	5
50	Insect traps	3
51	Hand nets	25
52	Wind vane	1
53	Cup anemometer	1
54	Stevenson screen	1
55	Rain gauge	1
56	Cultivator(model)	1
57	Clod crusher (model)	1
58	Thresher (model)	1
59	Winnower(model)	1
60	Combined Harvester(model)	1
61	Tractor (model)	1
62	Seeder(model)	1
63	Transplanter(model)	1
64	Rotovator(model)	1
65	Good quality hose(30mts)	1
66	Charts	10

67	Models	1
68	Sprinkler	1
69	Drip	5 set
70	Portrays	30
71	Thermometer	1
72	Barometer	1
73	Barograph	1
74	Sunshine recorder	1
75	Pan evaporimeter	1
76	Iron pan	10
77	Rubber basket	10
78	Country plough (Model)	1
79	Mould Board Plough(Model)	1
80	Leveller (Model)	1
81	Hand Trowel	5
82	Showel (3 inch, nose D type handles)	5
83	Hand Showel	10
84	Sickle	25
85	Bill hook	5
86	Felling knife	5
87	Grass cutting knife	5
88	Rubber tapping knife	5
89	Petridishes	25
90	Germination tray	10
91	Orchid flower pot	10
92	Hammer	3
93	Country trap	2
94	Wonder trap	2
95	Back braking trap	2
96	Killing bottles	25
97	Setting board	25
98	Setting box	25
99	Insect display board with glass cover	2
100	Mammatty fork (4 prongs)	5

STANDARD LIST OF CONSUMABLES FOR MODULES I AND II

Sl.	Name of items (with specifications)	Quantity required (per 25 students)	Remarks
1	Vermiculite	10kg	
2	Perlite	10kg	
3	Vermicompost	10kg	
4	Formalin	3L	
5	Urea	As per requirements	
6	Super phosphate	As per requirements	
7	Ammonium Sulphate	As per requirements	
8	Mussoriephos	As per requirements	
9	MOP	As per requirements	
10	Factomphos	As per requirements	
11	17:17:17 complex	As per requirements	
12	10:5:20 Mixture	As per requirements	
13	7:10:5 Mixture	As per requirements	
14	Rose mixture	5kg	
15	Garden mixture	3kg	
16	Bone meal	5kg	
17	Sterameal	5kg	
18	Oil cakes	10kg	
19	Propagation media	As per requirements	
20	Red earth	500kg	
21	Sand	As per requirements	
22	FYM	As per requirements	
23	Spagnum moss	10kg	
24	Charcoal	5kg	
25	Coir dust	5kg	
26	Liming materials	As per requirements	
27	Lime	As per requirements	
28	Dolomite	As per requirements	
29	Gypsum	As per requirements	

30	Biofertilizers	As per requirements
31	Other items	As per requirements
32	Spawn	5kg
33	Straw	As per requirements
34	Polytube	10kg
35	Kora cloth	30m
36	Paraffin wax	2kg
37	Cotton	1kg
38	Coir	10kg
39	Non absorbant cotton	1kg
40	GI wire	10kg
41	Tobacco	2kg
42	Bar soap	10no
43	Chemicals	As per requirements
44	Copper sulphate	As per requirements
45	Ammonium carbonate	As per requirements
46	Neem kernel	As per requirements
47	Neem oil	As per requirements
48	Rootex B1, B2, B3	250gm each
49	Pottasium ferrocyanide	1kg
50	Chloroform	As per requirements
51	Insecticide	As per requirements
52	Fungicide	As per requirements
53	Herbicide	As per requirements
54	Rodenticide	As per requirements
55	Acaricide	As per requirements
56	Antibiotics	As per requirements
57	Seeds, Flowers, fruits, vegetables	As per requirements

LIST OF BOOKS AND INSTRUCTIONAL MATERIALS

1. Nene, Y.L. and Choudhary, S.L. 2002. Agricultural heritage of India. Asian Agri – History foundation, Secundrabad.
2. Randhawa, M.S., 1980 – 86. A history of Agriculture in India. Vol. I, II, III and IV. Indian council of Agricultural Research, New Delhi.s
3. Raychaudhuri, S.P. 1964. Agriculture in ancient India. Indian council of Agricultural Research, New Delhi.
4. Razia Akbar (Tr) 2000. Muskha Dar Fauni – Falahat (The art of agriculture). Agri – History Bulletin No. 3. Asian Agri. History foundation, Secundrabad.
5. Sadhale Nalini (Tr) 1996. Surapala’s Vrikshayurveda (The science of plant life). Asian. History Bulletin No. 1. Asian – Agri – History foundation, Secundrabad.
6. Sadhale, Nalini Tr) 1999. Krishi – Parashara (Agriculture by Parashara). Agri- History Bulletin No. 2. Asian Agri – History foundation, Secundrabad, India
7. Ayachit, S.M. (Tr) 2002. Kashyapiya Krishisukti (A treatise on Agriculture by Kashyapa). Agri – History Billetin No. 4. Asian – Agri History foundation, Secundrabad
8. Choudhary, S.L., Sharma, G.S. and Nene, Y.L. 2000. Ancient and medievel history of Indian agriculture and its relevance to sustainable agriculture in the 21st century. Proceedings of the summem school held from 28 May to 17 June 1999. Rajasthan College of Agriculture, Udaipur, India
9. FARM GUIDE- GoK
10. Krshipaddam- Dr R.Heli
11. Krishiyile Nattarivukal- Sri. Muraleedharan, Thazhakkara
12. Buchel, K. H. 1983 Chemistry of pesticides. John Wiley and Sons New York.
13. Collings G. H. 1955 Commercial Fertilizers. Mc Graw Hill Publishing Co. New York.
14. Geroge W. W 1986. Fundamentals of pesticides A self-instruction Guide. Thomas publication P.O. Box 9335. Frenocalifornia.
15. Sree Ramulu, U. S. 1979. Chemistry of Insecticides and Fungicides. Oxford and IBH Publishing House Co. New Delhi.

16. Basak, N.N. 1994 Surveying and Levelling. Tata Mc-Grew Hill Publishing Company, New Delhi.
17. Ghanashyam Das, 2000. Hydrology and Soil Conservation engineering, Prentice hall of India Private Limited New Delhi.
18. Gurmail singh, 1982. A Manual on Soil and Water Conservation, ICAR Publication, New Delhi.
19. Kanetkar, I.P. and S.V.Kulkarni, 1984. Surveying and Levelling, Part I Pune Vidyarthi Giiha: Prakasan, Pune.
20. Murthy, V.V.N. Land and Water Management Engineering. 1998. Kalyani Publishers, Ludhiana.
21. Suresh.R. 1982. Soil and Water Conservation Engineering. Standard Publication, New Delhi.
22. Veeraragavathatham, D., Jawaharlal, M., Jeeva, S., Rabindran, R and Umopathy, G. 2004 (2nd edition). Scientific fruit culture. Published by M/s. Suri associates, 1362/4, Velraj Vihar Complex, Thadagam Road, Coimbatore- 2
23. Chattopadhyay, 1998. A textbook on pomology (sub-tropical fruits) vol.III. Published by M/s. Kalyani publishers, Ludhiana, New Delhi, Noida. UP.
24. Bose, T.K., S.K. Mitra and D. Sanyal 2001, Fruits : Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta.
25. Bose, T.K., S.K.Mitra, A.A. Farooqi and M.K. Sadhu (Eds) 1999. Tropical Horticulture Vol.1. Naya Prokash, Calcutta.
26. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, Delhi
27. Chattopadhyay, T.K., 2001. A Text Book on Pomology (4 volumes). Kalyani Publishers, Ludhiana.
28. Kumar, N. 1997. Introduction to Horticulture. Rajalakshmi Publications, Nagercoil, Tamil Nadu.
29. Mitra, S.K., T.K. Bose and D.S. Rathore. 1991. Temperate fruits. Horticulture and allied Publishers, Calcutta.
30. Pal, J.S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.
31. Sadhu, M.K. and P.K. Chattopadhyay.2001. Introductory Fruit Crops. Naya Prokash, Calcutta.
32. Singh, S.P. 1995. Commercial Fruits. Kalyani Publishers, Ludhiana.

WEBSITES:

1. KAU AGRI PORTAL
2. www.keralaagriculture.gov.in/
3. html/institution/insti.html
4. www.youtube.com (kissan kerala, harithabharatham, harithakeralam etc...videos)
5. SIET KERALA (animated online videos) sietkerala.gov.in
6. www.imd.gov.in/section/hydro/distrainfall/kerala/html
(Indian Meteorological Department -IMD)
7. www.imdtvm.gov.in
8. www.imd.gov.in/section/nhac/dynamic/monsoon_frame.html
9. www.keralastat.com/meteorologicaldata/22/rainfall/238/stat.aspx
10. www.automaticweatherstation.com/index.html
11. www.tnau.ac.in Agritechportal
12. www.sietkerala.gov.in