

## ASSISTANT DIRECTOR OF HORTICULTURE IN THE DEPARTMENT OF HORTICULTURE

### PAPER-2: SPECIFIC PAPER

Eligibility M.Sc. (Hort.)

#### **1. FUNDAMENTALS OF HORTICULTURE**

Definition, Importance of Horticulture in terms of Economy, Production, and Employment generation. Nutritional value of Horticultural Crops. Divisions of Horticulture and their importance. Horticultural Research Stations in Karnataka. Horticultural zones of India and Karnataka.

Temperature, Light, Humidity, Rainfall and Soil requirements for Horticultural Crops. Selection of site for establishing an Orchard. Orchard plan, Systems of Planting and Establishment of an orchard. Importance, Scope and Practicing of Organic Farming in Horticultural Crop Production.

Nutrition of Horticultural Crops – assessment of nutritional requirements based on soil, tissue analysis and field experiments. Identification of deficiency symptoms of various nutrients and methods of nutrient application. Assessment of irrigation requirements for different horticultural crops and different methods of irrigation. Pruning and training, their objectives and methods.

Pollination and fruit set, problems and requirements, flower and fruit drop, stages, causes and remedial measures. Fruit thinning, objectives, advantages and disadvantages. Unfruitfulness-reasons and remedial measures.

#### **2. PLANT PROPAGATION AND NURSERY MANAGEMENT**

Introduction, principles and classification of plant propagation methods. Selection of site for commercial nursery. Ecological and economic factors. Plant propagation structures, containers and media.

Sexual propagation and its importance. Seed germination, process of seed germination. Factors affecting seed germination and pre-germination treatments and viability tests. Asexual propagation and its importance. Propagation of plants by cuttage, types of cuttings and factors affecting regeneration of plants from cuttings. Propagation by layerage. Methods of layerage. Factors affecting regeneration of plants by layerage.

Propagation by grafting and importance of graftage. Methods of grafting. Factors for successful graft formation and steps in graft union. Methods of budding and bud wood selection. Role of rootstocks in fruit production. Selection of rootstocks for commercial fruit plants. Production of nursery stock. Propagation of various fruit and ornamental plants. Role of growth regulators in propagation.

Importance of micro propagation of plants. Types of aseptic cultures. Types of media, preparation of media and inoculation of explants, establishment, sub culture and rooting of explants. Establishing of *in-vitro* rooted cuttings in growing media and hardening. Commercial nurseries & certification.

### **3. FRUIT CROPS**

Area, production, importance, uses, origin, distribution, botany, classification of varieties, use of rootstocks, high density planting, climate, soils, planting methods, training and pruning, nutrition, irrigation scheduling, intercrops, weed control, problems in orchard management, flowering, fruit set, problems in fruit set, harvesting indices, harvesting, pre & postharvest treatments, use of growth regulators, yield, grading, packing for internal and export markets, ripening methods and storage in respect of mango, banana, citrus, grape, pineapple, guava, papaya, pomegranate, fig, sapota, Jack, Jamun, Aonla, custard apple, kokum, karonda, carambola and other fruit crops of Karnataka

### **4. VEGETABLE CROPS**

Importance of vegetables in human diet and National economy. Detailed study regarding origin and distribution, area and production, importance, nutritive value, botany, varieties, soil and climatic requirements, seed treatment, seed sowing/nursery raising, transplanting, nutrition, irrigation, intercultural operations, physiological disorders, harvest indices, harvesting, post harvest handling, curing, storage and usage of plant growth regulators in tomato, brinjal, chillies, sweet pepper, potato, okra, cucurbitaceous crops like cucumber, pumpkin, ridge gourd, snake gourd, bitter gourd, bottle gourd, chow-chow, melons like water melon and musk melon, leguminous vegetables like cluster bean, French bean, dolichos bean, pea and broad bean, cole crops like cabbage, cauliflower and knol khol, root crops like radish, carrot, beetroot and turnip, bulb crops like onion and garlic, tuber crops like sweet potato, tapioca, amorphophallus, colacasia, dioscorea and yam, leafy vegetables like amaranthus, palak, Roselle, perennial vegetables like drumstick, coccinia and curry leaf and mushroom cultivation.

### **5. PRESERVATION OF FRUITS AND VEGETABLES**

Importance and scope of fruit and vegetable preservation in India. Principles of preservation by heat, low temperature, fermentation, chemicals and various methods of preservation. Selection of site for processing, processing unit layout and precautions for hygienic conditions of the unit. Preservation of fruits and vegetables through canning, bottling, freezing, dehydration, drying, Irradiation and Food Standards, (HACCP, FSSAI, Sanitary & Phytosanitary Measures) Micro-organisms associated with spoilage of fruit and vegetable products. Spoilage of canned products -hydrogen swell, flipper, dent, leaker etc., Biochemical changes associated with spoilage of fruit and vegetable products. Preservatives and colours permitted and prohibited in India.

Different kinds of equipments used in processing. Preparation of jams, jellies, marmalades, candies, crystallized and glazed fruits, preserves, chutneys, pickles, ketchup, sauce, puree, syrups, juices, squashes and cordials and alcoholic beverages.

### **6. PLANT PHYSIOLOGY (INCLUDING C<sub>3</sub> & C<sub>4</sub> PLANT) PHOTOSYTHESIS RESPIRATION Etc. GROWTH REGULATORS, HARMONES & MINERAL NUTRITION**

Nomenclature of plant growth substances. Plant growth substances and their classification. History, occurrence, distribution, mode of action, movement, mechanism of action and function

of auxins, gibberellins, cytokinins, ethylene, inhibitors, retardants, phenolic substances and morphactins, BR's, ABA.

Role of plant growth regulators in seed and bud dormancy, juvenility, maturity and senescence, flowering, pollination, fruitset including parthenocarpy, fruit growth, fruit drop and fruit ripening (climacteric and non-climacteric) and fruit colour development, tuber and bulb formation and sex expression and extension of shelf life in fruits, vegetables and flowers. Role of growth regulators in plant propagation.

6(a) ENTOMOLOGY: Commonly occurring pests of horticultural crops, their life cycle, control measures including IPM and bee keeping.

6(b) PATHOLOGY:

Commonly occurring diseases of horticultural crops, life cycle of bacteria, fungi, viruses, phytoplasma, parasites, control measures including IDM.

## **7. COMMERCIAL FLORICULTURE**

Area, production, importance, uses, origin, distribution, classification of varieties, propagation, environmental factors affecting growth and flowering, soils, nutrition, irrigation, weeding, special techniques of production such as growth regulation and enhancement of flowers, use of growth regulators, harvesting, postharvest handling of commercial flower crops such as Rose, Chrysanthemum, Jasmine, Carnation, Gladiolus, Anthurium, Tuberose, China aster, Marigold, Crossandra and Gerbera, Dahlia, Bird of paradise, Orchids, Heliconia, Lilioms. Extension of vase life and Dry flower technology. Potted plants: Nerium, Petunia, Hibiscus, Bougainvillea.

Flowering annuals (Zinnia, Cosmos, Dianthus, Snapdragon, Pansy Heliconia, alstroemeria, alpinia, ornamental ginger, bromeliads, Gypsophilla, Limonium, Statice) and Ornamental Foliages. Barleria, Celosia, Gomphrena and Non-traditional flowers.

## **8. GREENHOUSE MANAGEMENT OF HORTICULTURAL CROPS**

Importance, uses, scope and production of horticultural crops in greenhouse. Status and development of greenhouse production of horticultural crops in the world and India. Development, constraints, research needs and future of protected culture of horticultural crops in India and Karnataka. Points to be considered before establishing a greenhouse. Types of greenhouses, classification of greenhouses based on the shapes, material used, utility and cladding material used. Size and arrangement of greenhouses and characteristics of various greenhouse cladding materials, greenhouse benches etc.,

Management of light, temperature (greenhouse heating and cooling), CO<sub>2</sub> and relative humidity inside the greenhouse.

Various types of growing media used and their suitability for different horticultural crops. Preparation of growing media and its pasteurization. Management of nutrients through fertigation.

Detailed production technology in respect of tomato, capsicum, cucumber, rose, carnation, gerbera, chrysanthemum, orchids and anthurium under greenhouse/polyhouse.

## 9. MEDICINAL, AROMATIC, SPICES AND PLANTATION CROPS

Origin, Importance, export potential, varieties, climate, soil requirements, propagation, planting and after care, manuring, irrigation, training, pruning, harvesting, yield and post harvest handling, curing and processing practices, storage methods and distillation of essential oils of the following crops.

### Medicinal Plants

Aloe vera, Amla(aonla), Stevia, Ashwagandha, Dioscorea, Opium poppy, gloriosa, Sarpangandha, Steroids bearing Solanum, Chakramuni, Madhunasini, Sweet flag, *Catharanthus roseus*, Isabgol, Fox glove, Belladonna, Senna, Tinospora, Annatto, Coleus, noni, Safed musli and Asparagus and other important crops grown in Karnataka.

### Aromatic Crops

Citronella, Lemon grass, Palmrosa, Vetiver, Geranium, Davana, Mint and lavender.  
Spice crops: Turmeric, Ginger, Coriander, Fenugreek, Cardamom, Black Pepper, Cinnamon, Clove, Nutmeg and Cumin and other important crops grown in Karnataka

Plantation Crops: Coconut, Cashewnut, Arecanut, Oil palm, Betelvine, Coffee, Tea, Cocoa, vanilla and Rubber.

## 10. ORNAMENTAL GARDENING AND LANDSCAPE ARCHITECTURE

Need for bioaesthetic planning, places suitable for bioaesthetic planning-Towns, Cities, Villages, Schools, Temples, Road side, Parks, Ghats of Rivers and Canals, Platforms, Railway lines, Public and Private Buildings, Institutes and Places of Worship. Ornamental Trees, palms, Shrubs and Climbers used in Bioaesthetic or Landscape Gardening. Cacti, Succulents and Bonsai. Principles of Garden designs, Styles of Gardens-Japanese, English and Moghul gardens. Various features of gardens such as paths, garden walls, fencing, steps, edges, hedges, arches, Pergolas, Shrubbery, Topiary, Rockery, Flower beds, Lawns, Fountains, Statues, Water garden, Conservatory and Glass or Greenhouse. Garden adornments. Indoor plants and their management.

Flower arrangement – Principles, Styles, Containers and Holding solutions.

## 11. DRY LAND HORTICULTURE AND WATERSHED MANAGEMENT

Dry land horticulture farming, introduction, definition, dry climate and their classifications with reference to India in general and Karnataka in particular. Importance of horticultural crops in dry land, yield potential of horticulture crops in dry lands. Fruits and vegetables crops suitable for dry land farming. Adaptive features of dry land fruit crops for drought and salinity.

Watershed management, objectives, approaches, steps in watershed development planning, land use capability, classification, soil and rain water conservation, water harvesting measures in watershed area. Problems and prospects under water shed. Alternate water use system. Choice of crops. Cultural practices like planting, training, pruning, nutrition and water management and

harvesting of important dry land fruits viz.. ber, pomegranate, custard apple, phalsa, fig, aonla, jamun and tamarind.

## **12. SOCIAL AND FARM FORESTRY**

Introduction – forests in India, forest policy and law, gap between demand and supply of forest products. Principles of general silviculture and tree species under silviculture.

Social forestry – need, objectives and scope, choice of species for fuelwood, fodder, smaller timber and timber, their culture, propagation, application of agro-techniques and economic benefits, management of social forestry plantations nurseries and their practices.

Afforestation on different problematic sites. Voluntary organizations, Joint farm management (JFM) and their role in promoting afforestation programmes. Maintenance and conservation of village woodlots. Energy plantations. Social forestry for watershed management.

**Farm forestry** – objectives and role, need for shelter belts and wind breaks, types of farm forestry. Agro/ Horti. forestry – need, objectives, scope, principles and practices of agro/ horti. forestry systems, choice of the tree species, and management implications. Forest products, their processing and use including minor forest products.

**Irrigation** – Water requirement of different Horticultural Crops – various irrigation methods including **Drip, Sprinkler, Fogging, Misting** and Water Stress on Horticultural Crops-Plasticulture- Mulching types.

## **13. SPECIAL TOPICS**

### **13.1 Organic farming**

Definition of organic farming, scope of organic farming in Horticulture Crops. Certification of organic production of Hort. Crops. Scientific use of microbial inoculants in Horti. Crops. Preparation and use of organic manures viz. Enriched compost, Vermi compost, Green manuring, Beejamrutha, Jeevainrutha, panchagavya, Biodigester, Vermi wash, Cow urine, Neem cake, BD-500, etc. Use of Biofertilizers viz., *Rhizobium*, *Azotobacter*, *Azospirillum*, phosphate solubilizers, *Azolla*, plant growth promoting rhizobacteria, VAM in different Horticulture crops. Methods of application of biofertilizers. Use of microbial consortia in composting of Agri/ Horticultural wastes and enrichment of compost. Microbial biocontrol agents viz., *pseudomonas*, *Bacillus*, PGPR etc. Crops suitable for organic farming.

**Precision farming:** Definition and implementation in Horticulture crops. Definition of IFS, its principles and practices.

### **13.2 Seed Science and Technology**

Types of seeds, concept of seed quality and factors affecting it. Role and Goal of seed Technology. Generation system of seed multiplication, classes of seed. Principles of seed production, seed certification, and processing. Seed testing methods (Germination, physical

purity, moisture and TZ test.). Principles and methods of seed storage, IPR and its utilization, PPVR & FR, Techniques of seed production in important vegetables (tomato, brinjal, onion, cucurbits, root vegetables etc.)

### **13.3 Soil Science And Agricultural Chemistry**

Importance of soil testing, Soil sampling procedure for horticultural crops and interpretation. Plant nutrients – Introduction, Definition of Nutrients, nutrient accumulation, nutrient uptake and nutrient removal. Stout criteria of essentiality. Classification of essential nutrients as primary, secondary and micronutrients. Functions and deficiency symptoms of nutrients and remedial measures. Organic matter, importance of organic matter, humus, types of humus, importance of humus and organic manure. Fertilizers- Definition, differences between organic manures and fertilizers, Classification of fertilizers. Problematic soils: Causes and reclamation methods. Quality of irrigation water and management and Integrated plant nutrient management

Recent Advances in Horticulture, Soilless Culture- Hydroponics, Aeroponics, Urban & Peri-urban Horticulture, GPS & GSM, Agri-Export Zones & industrial support.