

## **VSC 501: PRODUCTION OF COOL SEASON VEGETABLE CROPS (2+1)**

### **THEORY**

Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/hybrids, seed rate and seed treatment, raising of nursery, sowing/planting time and methods, hydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of crops.

**Unit I:** *Bulb and tuber crops*- Onion, garlic and potato

**Unit II:** *Cole crops*- Cabbage, cauliflower, kohlrabi, broccoli, Brussels sprouts and kale

**Unit III:** *Root crops*- Carrot, radish, turnip and beetroot

**Unit IV:** *Peas and beans*- Garden peas and broad bean

**Unit V:** *Leafy vegetables*- beet leaf, fenugreek, coriander and lettuce

### **PRACTICAL**

1. Scientific raising of nursery and seed treatment
2. Sowing and transplanting
3. Description of commercial varieties and hybrids
4. Demonstration on methods of irrigation, fertilizers and micronutrients application
5. Mulching practices, weed management
6. Use of plant growth substances in cool season vegetable crops
7. Study of nutritional and physiological disorders
8. Studies on hydroponics, aeroponics and other soilless culture
9. Identification of important pest and diseases and their control
10. Preparation of cropping scheme for commercial farms
11. Visit to commercial farm, greenhouse/polyhouses
12. Visit to vegetable market
13. Analysis of benefit to cost ratio

## **VSC 502: PRODUCTION OF WARM SEASON VEGETABLE CROPS (2+1)**

### **THEORY**

Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/hybrids, seed rate and seed treatment, raising of nursery including grafting technique, sowing/planting time and methods, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices namely hydroponics, aeroponics, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and economics of crops.

**Unit I:** *Fruit vegetables*- Tomato, brinjal, hot pepper, sweet pepper and okra

**Unit II:** *Beans*- French bean, Indian bean (Sem), cluster bean and cowpea

**Unit III:** *Cucurbits*- Cucumber, melons (water melon and muskmelon), gourds (Bitter gourd, Bottle gourd, Ridge gourd, Sponge gourd), pumpkin and squashes (Summer squash and Winter squash)

**Unit IV:** *Tuber crops*- Sweet potato, elephant foot yam, tapioca, taro and yam **Unit V:** *Leafy vegetables*- Amaranth and drumstick

### **PRACTICAL**

1. Scientific raising of nursery and seed treatment
2. Sowing, transplanting, vegetable grafting
3. Description of commercial varieties and hybrids
4. Demonstration on methods of irrigation, fertilizers and micronutrients application
5. Mulching practices, weed management
6. Use of plant growth substances in warm season vegetable crops
7. Study of nutritional and physiological disorders
8. Studies on hydroponics, aeroponics and other soilless culture
9. Identification of important pest and diseases and their control
10. Preparation of cropping scheme for commercial farms
11. Visit to commercial farm, greenhouse/polyhouses
12. Visit to vegetable market
13. Analysis of benefit to cost ratio

## VSC 503: GROWTH AND DEVELOPMENT OF VEGETABLE CROPS (2+1)

### **THEORY**

**Unit I: Introduction and phytohormones-** Definition of growth and development; Cellular structures and their functions; Physiology of phyto-hormones functioning/biosynthesis and mode of action; Growth analysis and its importance in vegetable production

**Unit II: Physiology of dormancy and germination-** Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellins, cytokinins and abscisic acid; Application of synthetic PGRs including plant growth retardants and inhibitors for various purposes in vegetable crops; Role and mode of action of morphactins, antitranspirants, anti-auxin, ripening retardant and plant stimulants in vegetable crop production

**Unit III: Abiotic factors** Impact of light, temperature, photoperiod, carbon dioxide, oxygen and other gases on growth, development of underground parts, flowering and sex expression in vegetable crops; Apical dominance

**Unit IV: Fruit physiology** Physiology of fruit set, fruit development, fruit growth, flower and fruit drop; parthenocarpy in vegetable crops; phototropism, ethylene inhibitors, senescence and abscission; fruit ripening and physiological changes associated with ripening

**Unit V: Morphogenesis and tissue culture** Morphogenesis and tissue culture techniques in vegetable crops; Grafting techniques in different vegetable crops

### **PRACTICAL**

1. Preparation of plant growth regulator's solutions and their application
2. Experiments in breaking and induction of dormancy by chemicals
3. Induction of parthenocarpy and fruit ripening
4. Application of plant growth substances for improving flower initiation, changing sex expression in cucurbits and checking flower and fruit drops and improving fruit set in solanaceous vegetables
5. Growth analysis techniques in vegetable crops
6. Grafting techniques in tomato, brinjal, cucumber and sweet pepper

## VSC 504: PRINCIPLES OF VEGETABLE BREEDING (2+1)

### **THEORY**

**Unit I: Importance and history-** Importance, history and evolutionary aspects of vegetable breeding and its variation from cereal crop breeding

**Unit II: Selection procedures-** Techniques of selfing and crossing; Breeding systems and methods; Selection procedures and hybridization; Genetic architecture; Breeding for biotic stress (diseases, insect pests and nematode), abiotic stress (temperature, moisture and salt) resistance and quality improvement; Breeding for water use efficiency (WUE) and nutrients use efficiency (NUE)

**Unit III: Heterosis breeding-** Types, mechanisms and basis of heterosis, facilitating mechanisms like male sterility, self-incompatibility and sex forms

**Unit IV: Mutation and Polyploidy breeding;** Improvement of asexually propagated vegetable crops and vegetables suitable for protected environment.

**Unit V: Ideotype breeding-** Ideotype breeding; varietal release procedure; DUS testing in vegetable crops; Application of *In vitro* and molecular techniques in vegetable improvement

### **PRACTICAL**

1. Floral biology and pollination behaviour of different vegetables
2. Techniques of selfing and crossing of different vegetables *viz.*, Cole crops, okra, cucurbits, tomato, eggplant, hot pepper, *etc.*
3. Breeding system and handling of filial generations of different vegetables
4. Exposure to biotechnological lab practices.
5. Visit to breeding farms

## **VSC 505: BREEDING OF SELF POLLINATED VEGETABLE CROPS (2+1)**

### **THEORY**

Origin, botany, taxonomy, wild relatives, cytogenetics and genetics, types of pollination and fertilization mechanism, sterility, breeding objectives, breeding methods (introduction, selection, hybridization, mutation and polyploidy), varieties and varietal characterization, resistance breeding for biotic and abiotic stresses, breeding for protected environment and quality improvement, molecular markers and marker's assisted breeding; QTLs, PPV and FR Act.

Unit I: *Tuber crops*: Potato

Unit II: *Fruit vegetables*- Tomato, eggplant, hot pepper, sweet pepper and okra Unit III: *Leguminous vegetables*- Garden peas and cowpea

Unit IV: *Leguminous vegetables*: French bean, Indian bean, cluster bean and broad bean Unit

V: *Leafy vegetables*- Lettuce and fenugreek

### **PRACTICAL**

1. Floral mechanisms favouring self and often cross pollination
2. Progeny testing and development of inbred lines
3. Selection of desirable plants from breeding population, observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations
4. Palynological studies, selfing and crossing techniques
5. Hybrid seed production of vegetable crops in bulk
6. Screening techniques for biotic and abiotic stress resistance in above mentioned crops
7. Molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques
8. Visit to breeding farms

## VSC 508: SEED PRODUCTION OF VEGETABLE CROPS (2+1)

### **THEORY**

**UNIT I: *Introduction, history, propagation and reproduction***- Introduction, definition of seed and its quality, seed morphology, development and maturation; Apomixis and fertilization; Modes of propagation and reproductive behaviour; Pollination mechanisms and sex forms in vegetables; History of vegetable seed production; Status and share of vegetable seeds in seed industry

**UNIT II: *Agro-climate and methods of seed production***- Agro-climate and its influence on quality seed production; Deterioration of crop varieties, genetical and agronomic principles of vegetable seed production; Methods of seed production, hybrid seeds and techniques of large scale hybrid seed production; Seed village concept

**UNIT III: *Seed multiplication and its quality maintenance***- Seed multiplication ratios and replacement rates in vegetables; Generation system of seed multiplication; Maintenance and production of nucleus, breeder, foundation, certified/ truthful label seeds; Seed quality and mechanisms of genetic purity testing

**UNIT IV: *Seed harvesting, extraction and its processing***- Maturity standards; Seed harvesting, curing and extraction; Seed processing viz., cleaning, drying and treatment of seeds, seed health and quality enhancement, packaging and marketing; Principles of seed storage; Orthodox and recalcitrant seeds; Seed dormancy

**UNIT V: *Improved agro-techniques and field and seed standards***- Improved agro-techniques; Field and seed standards in important:

1. Solanaceous (Tomato, Brinjal, Hot pepper and Sweet pepper)
2. Leguminous (Garden Pea, French bean, Cowpea)
3. Cucurbitaceous vegetables(Pumpkin, Summer squash, Winter squash, Cucumber, Watermelon, Muskmelon, Bitter gourd, Bottle gourd, Ridge gourd and Sponge gourd)
4. Cole crops(Cabbage, Cauliflower, Knolkhol)
5. Leafy vegetables(Amranthus, Coriander, Spinach)
6. Bulbous :Onion
7. Root crops :R ad ish and C arrot
8. Okra
9. Clonal propagation and multiplication in vegetative propagated crops: Sweet potato, Tapioca, Garlic
10. Seed plot techniqueand true potato seed production in potato

### **PRACTICAL**

1. Study of floral biology and pollination mechanisms in vegetables
2. Determination of modes of pollination
3. Field and seed standards
4. Use of pollination control mechanisms in hybrid seed production of importantvegetables
5. Maturity standards and seed extraction methods
6. Seed sampling and testing
7. Visit to commercial seed production areas
8. Visit to seed processing plant
9. Visit to seed testing laboratories

## **VSC 509: PRODUCTION OF UNDERUTILIZED VEGETABLE CROPS (2+1)**

### **THEORY**

Importance and scope, botany and taxonomy, climate and soil requirement, commercial varieties/hybrids, improved cultural practices, physiological disorders, harvesting and yield, plant protection measures and post-harvest management of:

**UNIT I: *Stem and bulb crops***- Asparagus, leek and chinese chive

**UNIT II: *Cole and salad crops***- Red cabbage, chinese cabbage, kale, sweet corn and babycorn

**UNIT III: *Gourds and melons***- Sweet gourd, spine gourd, teasle gourd, round gourd, and little/Ivy gourd, snake gourd, pointed gourd, kachri, long melon, snap melon and gherkin

**UNIT IV: *Leafy vegetables***- Celery, parsley, indian spinach (poi), spinach, chenopods, chekurmanis and indigenous vegetables of regional importance

**UNIT V: *Yam and beans***- Elephant foot yam, yam, yam bean, lima bean and winged bean

### **PRACTICAL**

1. Identification and botanical description of plants and varieties
2. Seed/planting material
3. Production, lay out and method of planting
4. Important cultural operations
5. Identification of important pests and diseases and their control
6. Maturity standards and harvesting
7. Visit to local farms