

MASTER OF SCIENCE (HORTICULTURE- VEGETABLE SCIENCE) – FIRST SEMESTER

First Semester			
S. No.	Name of Subject	Credits	Total Marks
1	Production Technology of Cool Season Vegetable Crops	4	100
2	Production Technology of Warm Season Vegetable Crops	4	100
3	Breeding of Vegetable Crops	3	100
4	Growth and Development of Vegetable Crops	3	100
5	Experimental Designs	3	100
6	Soil Fertility and Management	3	100
7	Research-I	4	100
Total		24	

Subject Name: PRODUCTION TECHNOLOGY OF COOL SEASON VEGETABLE CROPS

Objective

To educate production technology of cool season vegetables.

Theory

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed production of:

UNIT I Potato

UNIT II Cole crops: cabbage, cauliflower, knoll kohlrabi, sprouting broccoli, Brussels sprout

UNIT III Root crops: carrot, radish, turnip and beetroot

UNIT IV Bulb crops: onion and garlic

UNIT V Peas and broad bean, green leafy cool season vegetables

Practical

Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of winter vegetable crops and their economics; Experiments to demonstrate the role of mineral elements, plant growth substances and herbicides; study of physiological disorders; preparation of cropping scheme for commercial farms; visit to commercial greenhouse/polyhouse.

Suggested Readings

1. Bose TK & Som MG. (Eds.). 1986. Vegetable Crops in India. Naya Prokash.
2. Bose TK, Som G & Kabir J. (Eds.). 2002. Vegetable Crops. Naya Prokash.
3. Bose TK, Som MG & Kabir J. (Eds.). 1993. Vegetable Crops. Naya Prokash.
4. Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. Vegetable Crops. Vols. I-III. Naya Udyog.
5. Chadha KL & Kalloo G. (Eds.). 1993-94. Advances in Horticulture Vols. V-X. Malhotra Publ. House.
6. Chadha KL. (Ed.). 2002. Hand Book of Horticulture. ICAR.
7. Chauhan DVS. (Ed.). 1986. Vegetable Production in India. Ram Prasad & Sons.
8. Decoteau DR. 2000. Vegetable Crops. Prentice Hall.
9. Edmond JB, Musser AM & Andrews FS. 1951. Fundamentals of Horticulture. Blakiston Co.
10. Fageria MS, Choudhary BR & Dhaka RS. 2000. Vegetable Crops: Production Technology. Vol. II. Kalyani.
11. Gopalakrishanan TR. 2007. Vegetable Crops. New India Publ. Agency.
12. Hazra P & Som MG. (Eds.). 1999. Technology for Vegetable Production and Improvement. Naya Prokash.
13. Rana MK. 2008. Olericulture in India. Kalyani Publ.
14. Rana MK. 2008. Scientific Cultivation of Vegetables. Kalyani Publ.
15. Rubatzky VE & Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall.
16. Saini GS. 2001. A Text Book of Olericulture and Floriculture. Aman Publ. House.

17. Salunkhe DK & Kadam SS. (Ed.). 1998. Hand Book of Vegetable Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker.
18. Shanmugavelu KG. 1989. Production Technology of Vegetable Crops. Oxford & IBH.
19. Singh DK. 2007. Modern Vegetable Varieties and Production Technology. International Book Distributing Co.
20. Singh SP. (Ed.). 1989. Production Technology of Vegetable Crops. Agril. Comm. Res. Centre.
21. Thamburaj S & Singh N. (Eds.). 2004. Vegetables, Tuber Crops and Spices. ICAR.
22. Thompson HC & Kelly WC. (Eds.). 1978. Vegetable Crops. Tata McGraw- Hill.

Subject Name: PRODUCTION TECHNOLOGY OF WARM SEASON VEGETABLE CROPS

Objective

To teach production technology of warm season vegetables.

Theory

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures, economics of crop production and seed production of:

UNIT I- Tomato, eggplant, hot and sweet peppers

UNIT II- Okra, beans, cowpea and cluster bean

UNIT III- Cucurbitaceous crops

UNIT IV- Tapioca and sweet potato

UNIT V Green leafy warm season vegetables

Practical

Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of summer vegetable crops and their economics; study of physiological disorders and deficiency of mineral elements, preparation of cropping schemes for commercial farms; experiments to demonstrate the role of mineral elements, physiological disorders; plant growth substances

and herbicides; seed extraction techniques; identification of important pests and diseases and their control; maturity standards; economics of warm season vegetable crops.

Suggested Readings

1. Bose TK & Som MG. (Eds.). 1986. Vegetable Crops in India. Naya Prokash.
2. Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. Vegetable Crops. Vols. I-III. Naya Udyog.
3. Bose TK, Som MG & Kabir J. (Eds.). 2002. Vegetable Crops. Naya Prokash.
4. Brown HD & Hutchison CS. Vegetable Science. JB Lippincott Co.
5. Chadha KL & Kalloo G. (Eds.). 1993-94. Advances in Horticulture. Vols. V-X. Malhotra Publ. House.
6. Chadha KL. (Ed.). 2002. Hand Book of Horticulture. ICAR.
7. Chauhan DVS. (Ed.). 1986. Vegetable Production in India. Ram Prasad & Sons.
8. Decoteau DR. 2000. Vegetable Crops. Prentice Hall.
9. Edmond JB, Musser AM & Andrews FS. 1964. Fundamentals of Horticulture. Blakiston Co
10. Fageria MS, Choudhary BR & Dhaka RS. 2000. Vegetable Crops: Production Technology. Vol. II. Kalyani.
11. Gopalakrishanan TR. 2007. Vegetable Crops. New India Publ. Agency.
12. Hazra P & Som MG. (Eds.). 1999. Technology for Vegetable Production and Improvement. Naya Prokash.
13. Kalloo G & Singh K (Ed.). 2000. Emerging Scenario in Vegetable Research and Development. Research Periodicals & Book Publ. House.
14. Nayer NM & More TA 1998. Cucurbits. Oxford & IBH Publ.
15. Palaniswamy & Peter KV. 2007. Tuber Crops. New India Publ. Agency.
16. Pandey AK & Mudranalay V. (Eds.). Vegetable Production in India: Important Varieties and Development Techniques.
17. Rana MK. 2008. Olericulture in India. Kalyani.
18. Rana MK. 2008. Scientific Cultivation of Vegetables. Kalyani.
19. Rubatzky VE & Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall.
20. Saini GS. 2001. A Text Book of Oleri and Flori Culture. Aman Publ. House.
21. Salunkhe DK & Kadam SS. (Ed.). 1998. Hand Book of Vegetable Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker.
22. Shanmugavelu KG. 1989. Production Technology of Vegetable Crops. Oxford & IBH.
23. Singh DK. 2007. Modern Vegetable Varieties and Production Technology. International Book Distributing Co.

24. Singh NP, Bharadwaj AK, Kumar A & Singh KM. 2004. Modern Technology on Vegetable Production. International Book Distributing Co.
25. Singh SP. (Ed.). 1989. Production Technology of Vegetable Crops. Agril. Comm. Res. Centre.
26. Thamburaj S & Singh N. 2004. Vegetables, Tuber Crops and Spices. ICAR.
27. Thompson HC & Kelly WC. (Eds.). 1978. Vegetable Crops. Tata Mc Graw Hill.

Subject Name: BREEDING OF VEGETABLE CROPS

Objective

To educate principles and practices adopted for breeding of vegetable crops.

Theory

Origin, botany, taxonomy, cytogenetics, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, mutation), varieties and varietal characterization, resistance breeding for biotic and abiotic stress, quality improvement, molecular marker, genomics, marker assisted breeding and QTLs, biotechnology and their use in breeding in vegetable crops-Issue of patenting, PPVFR act.

UNIT I Potato and tomato

UNIT II Eggplant, hot pepper, sweet pepper and okra

UNIT III Peas and beans, amaranth, chenopods and lettuce

UNIT IV Gourds, melons, pumpkins and squashes

UNIT V Cabbage, cauliflower, carrot, beetroot, radish, sweet potato and tapioca

Practical

Selection of desirable plants from breeding population observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations; induction of flowering, palanological studies, selfing and crossing techniques in vegetable crops; hybrid seed production of vegetable crops in bulk. Screening techniques for insectpests, disease and environmental stress resistance in above mentioned crops, demonstration of sib-mating and mixed population; molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques. Visit to breeding blocks.

Suggested Readings

1. Allard RW. 1999. Principles of Plant Breeding. John Wiley & Sons.
2. Basset MJ. (Ed.). 1986. Breeding Vegetable Crops. AVI Publ.
3. Dhillon BS, Tyagi RK, Saxena S. & Randhawa GJ. 2005. Plant Genetic Resources: Horticultural Crops. Narosa Publ. House.
4. Fageria MS, Arya PS & Choudhary AK. 2000. Vegetable Crops: Breeding and Seed Production. Vol. I. Kalyani.
5. Gardner EJ. 1975. Principles of Genetics. John Wiley & Sons.
6. Hayes HK, Immer FR & Smith DC. 1955. Methods of Plant Breeding. McGraw-Hill.
7. Hayward MD, Bosemark NO & Romagosa I. (Eds.). 1993. Plant Breeding-Principles and Prospects. Chapman & Hall.
8. Kalloo G. 1988. Vegetable Breeding. Vols. I-III. CRC Press.
9. Kalloo G. 1998. Vegetable Breeding. Vols. I-III (Combined Ed.). Panima Edu. Book Agency.
10. Kumar JC & Dhaliwal MS. 1990. Techniques of Developing Hybrids in Vegetable Crops. Agro Botanical Publ.
11. Paroda RS & Kalloo G. (Eds.). 1995. Vegetable Research with Special Reference to Hybrid Technology in Asia-Pacific Region. FAO.
12. Peter KV & Pradeepkumar T. 2008. Genetics and Breeding of Vegetables. Revised, ICAR.
13. Rai N & Rai M. 2006. Heterosis Breeding in Vegetable Crops. New India Publ. Agency.
14. Ram HH. 1998. Vegetable Breeding: Principles and Practices. Kalyani.
15. Simmonds NW. 1978. Principles of Crop Improvement. Longman.
16. Singh BD. 1983. Plant Breeding. Kalyani.
17. Singh PK, Dasgupta SK & Tripathi SK. 2004. Hybrid Vegetable Development. International Book Distributing Co.
18. Swarup V. 1976. Breeding Procedure for Cross-pollinated Vegetable Crops. ICAR.

Subject Name: GROWTH AND DEVELOPMENT OF VEGETABLE CROPS

Objective

To teach the physiology of growth and development of vegetable crops.

Theory

UNIT I Cellular structures and their functions; definition of growth and development, growth analysis and its importance in vegetable production.

UNIT II

Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellins, cytokinins and abscisic acid; Application of synthetic hormones, 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

Role of light, temperature and photoperiod on growth, development of underground parts, flowering and sex expression in vegetable crops; apical dominance.

UNIT IV

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

Plant growth regulators in relation to vegetable production; morphogenesis and tissue culture techniques in vegetable crops.

Practical

Preparation of solutions of plant growth substances and their application; experiments in breaking and induction of dormancy by chemicals; induction of parthenocarpy and fruit ripening; 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; growth analysis techniques in vegetable crops.

Suggested Readings

1. Bleasdale JKA. 1984. Plant Physiology in Relation to Horticulture. 2nd Ed. MacMillan.
2. Gupta US. (Ed.). 1978. Crop Physiology. Oxford & IBH.
3. Krishnamoorti HN. 1981. Application Plant Growth Substances and Their Uses in Agriculture. Tata-McGraw Hill.
4. Peter KV. (Ed.). 2008. Basics of Horticulture. New India Publ. Agency. Saini RS, Sharma KD, Dhankhar OP & Kaushik RA. (Eds.). 2001.
5. Laboratory Manual of Analytical Techniques in Horticulture. Agrobios.
6. Wien HC. (Ed.). 1997. The Physiology of Vegetable Crops. CABI.

Subject Name: EXPERIMENTAL DESIGNS

Objective

This course is meant for students of agricultural and animal sciences other than Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

Theory

Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control, Uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design, Factorial experiments, (symmetrical as well as asymmetrical), orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment, Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications ~ concepts, randomisation procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures.

Practical

Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law; Analysis of data obtained from CRD, RBD, LSD; Analysis of factorial experiments without and with confounding; Analysis with missing data; Split plot and strip plot designs; Transformation of data; Analysis of resolvable designs; Fitting of response surfaces.

References:

1. Cochran WG & Cox GM. 1957. Experimental Designs. 2nd Ed. John Wiley.
2. Dean AM & Voss D. 1999. Design and Analysis of Experiments. Springer.
3. Federer WT. 1985. Experimental Designs. MacMillan.
4. Fisher RA. 1953. Design and Analysis of Experiments. Oliver & Boyd.
5. Nigam AK & Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments. IASRI Publ.
6. Pearce SC. 1983. The Agricultural Field Experiment: A Statistical Examination of Theory and Practice. John Wiley.
7. Design Resources Server: www.iasri.res.in/design.

Subject Name: SOIL FERTILITY AND MANAGEMENT

UNIT- I

Soil fertility and productivity – factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming – basic concepts and definitions.

UNIT- II

Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

UNIT- III

Preparation and use of farmyard manure, compost, green manures, vermicompost, bio-fertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management.

UNIT-IV

Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades; agronomic, chemical and physiological methods of increasing fertilizer use efficiency; nutrient interactions.

UNIT-V

Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermin-compost and residue wastes in crops.

PRACTICAL

- Determination of soil pH, E_{Ce}, organic C, total N, available N, P, K and S in soils
- Determination of total N, P, K and S in plants
- Interpretation of interaction effects and computation of economic and yield optima

Subject Name: RESEARCH-I