



SunRise University

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Scheme

**For Two-year Course in M.Sc.
(Agriculture) Horticulture**

COLLEGE OF AGRICULTURE

SUNRISE UNIVERSITY - ALWAR



SUNRISE UNIVERSITY – ALWAR

Campus: Bagad Rajput, Ramgarh, Alwar, Rajasthan 30102

M.Sc(Agriculture) Horticulture

1st Semester (Session - 2021-2022)

Course No	Course Title	Credit Hours		Maximum Marks				
		T	P	Theory			Practical	G. Total
				Mid Term	Internal Assessment	External Theory		
HORT. 511	TROPICAL AND DRY LAND HORTICULTURE	2	1	20	-	50	30	100
HORT. 512	SUB-TROPICAL AND TEMPERATE FRUIT PRODUCTION	2	1	20	-	50	30	100
HORT. 513	PRODUCTION TECHNOLOGY OF WARM SEASON VEGETABLE CROPS	2	1	20	-	50	30	100
	Total	6	3	-	-	-	-	300

Dean

College of Agriculture

SunRise University, Alwar

HORT 511 Tropical and Dry Land Fruit Production 3(2+1)

Objective

To impart basic knowledge about the importance and management of tropical and dry land fruits grown in India.

Theory

Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, role of bio regulators, abiotic factors limiting fruit production, physiology of flowering, pollination, fruit set and

development, honeybees in cross pollination, physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; industrial and export potential, Agri. Export Zones(AEZ) and industrial supports.

Crops

UNIT I: Mango and Banana

UNIT II: Papaya, Coconut and Cashew nut

UNIT III: Sapota and Jackfruit

UNIT IV: Pineapple and Annonas

UNIT V: Aonla, Pomegranate, Phalsa and Ber, minor fruits of tropics (Mahua, Lasoda, Mulberry, Tamarind and Chironji)

Practical

Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, Practices of important agro-techniques, visit to tropical and arid zone orchards, Project preparation for establishing commercial orchards.

Suggested Readings

Bose, TK, Mitra, SK & Rathore, DS. (Eds.). 1988. Temperate Fruits - Horticulture. Allied Publ.

Bose, T.K, Mitra, S.K & Sanyal, D. 2001. (Eds.). Fruits - Tropical and Subtropical. Naya Udyog.

Chadha, K.L & Pareek, O.P. 1996. (Eds.). Advances in Horticulture. Vols. II- IV. Malhotra Publ. House.

Nakasone, H.Y & Paul, R.E. 1998. Tropical Fruits. CABI.

Peter, K.V. 2008. (Ed.). Basics of Horticulture. New India Publ. Agency.

Pradeepkumar T, Suma B, Jyothibhaskar & Satheesan, K.N. 2008. Management of Horticultural Crops. Parts I, II. New India Publ. Agency.

Radha, T & Mathew, L. 2007. Fruit Crops. New India Publ. Agency.

Singh, H.P, Negi JP & Samuel JC. (Eds.). 2002. Approaches for Sustainable
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Development of Horticulture. National Horticultural Board.

Singh, H.P, Singh G, Samuel, J.C & Pathak R.K. (Eds.). 2003. Precision Farming in Horticulture. NCPAH, DAC/PFDC, CISH, Lucknow.

HORT 512 Subtropical and Temperate Fruit Production 3 (2+1)

Objective

To impart basic knowledge about the importance and management of subtropical and temperate fruits grown in India.

Theory

Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, bio regulation, abiotic factors limiting fruit production, physiology of flowering, fruit set and development, abiotic factors limiting production, physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, pre-cooling, storage, transportation and ripening techniques; industrial and export potential, Agri

Export Zones(AEZ) and industrial support.

Crops

UNIT I: Apple, pear, quince

UNIT II: Plums, peach, apricot, cherries

UNIT III: Litchi, loquat, kiwifruit, strawberry

UNIT IV: Nuts- walnut, almond, pistachio

UNIT V : Grapes, Guava, Citrus and Custard apple

UNIT VI: Minor fruits- carambola, bael, wood apple, fig, jamun, rambutan, ker, pilu

Practical

Identification of important fruit plants and its available cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical, subtropical, humid tropical and temperate orchards, Project preparation for establishing commercial orchards.

Suggested Readings

Bose T.K, Mitra S.K & Sanyal D. (Ed.). 2002. Fruits of India — Tropical and Sub-tropical. 3rd Ed. Vols. I, II. Naya Udyog.

Chadha K.L & Pareek O.P. 1996. (Eds.). Advances in Horticulture. Vol. I. Malhotra Publ. House.

Chadha K.L & Shikhamany S.D. 1999. The Grape: Improvement, Production and Post-Harvest Management. Malhotra Publ. House.

Janick J & Moore J.N. 1996. Fruit Breeding. Vols.I-III. John Wiley & Sons. Nijjar GS. 1977. (Eds.). Fruit Breeding in India. Oxford & IBH.

Radha T & Mathew L. 2007. Fruit Crops. New India Publ. Agency.

Singh S, Shivankar V.J, Srivastava A.K & Singh I.P. (Eds.). 2004. Advances in Citriculture. Jagmander Book Agency.

HORT 513 Production Technology of Warm Season Vegetable Crops 3(2+1)

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

UNIT II

UNIT III

UNIT IV

UNIT V

Tomato, eggplant, hot and sweet peppers

Okra, beans, cowpea and clusterbean

Cucurbitaceous crops

Colocasia and sweet potato

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

- Bose T.K & Som M.G. (Eds.). 1986. Vegetable Crops in India. Naya Prokash.
- Bose T.K, Kabir J, Maity T.K, Parthasarathy V.A & Som M.G. 2003. Vegetable Crops. vols. I-III. Naya Udyog.
- Bose T.K, Som M.G & Kabir J. (Eds.). 2002. Vegetable Crops. Naya Prokash.
- Brown H.D & Hutchison C.S. Vegetable Science. JB Lippincott Co.
- Chadha K.L & Kalloo G. (Eds.). 1993-94. Advances in Horticulture. vols. V-X. Malhotra Publ. House.
- Chadha K.L. (Ed.). 2002. Hand Book of Horticulture. ICAR.
- Chauhan D.V.S. (Ed.). 1986. Vegetable Production in India. Ram Prasad & Sons.
- Decoteau D.R. 2000. Vegetable Crops. Prentice Hall.
- Edmond J.B, Musser A.M & Andrews F.S. 1964. Fundamentals of Horticulture. Blakiston Co
- Fageria M.S, Choudhary B.R & Dhaka R.S. 2000. Vegetable Crops: Production Technology. vol. II. Kalyani.
- Gopalakrishanan T.R. 2007. Vegetable Crops. New India Publ. Agency.
- Hazra P & Som M.G. (Eds.). 1999. Technology for Vegetable Production and Improvement. Naya Prokash.
- Kaloo G & Singh K (Ed.). 2000. Emerging Scenario in Vegetable Research and Development. Research Periodicals & Book Publ. House.
- Nayer N.M & More TA 1998. Cucurbits. Oxford & IBH Publ.
- Palaniswamy & Peter Ky. 2007. Tuber Crops. New India Publ. Agency.
- Pandey A.K & Mudranalay y. (Eds.). Vegetable Production in India: Important Varieties and Development Techniques.
- Rana M.K. 2008. Olericulture in India. Kalyani.
- Rana M.K. 2008. Scientific Cultivation of Vegetables. Kalyani.
- Rubatzky V.E & Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall.
- Saini G.S. 2001. A Text Book of Oleri and Flori Culture. Aman Publ. House.
- Salunkhe D.K & Kadam S.S. (Ed.). 1998. Hand Book of Vegetable Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker.
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- Shanmugavelu K.G. 1989. Production Technology of Vegetable Crops. Oxford & IBH.
- Singh D.K. 2007. Modern Vegetable Varieties and Production Technology. International Book Distributing Co.
- Singh N.P, Bharadwaj A.K, Kumar A & Singh K.M. 2004. Modern Technology on Vegetable Production. International Book Distributing Co.
- Singh SP. (Ed.). 1989. Production Technology of Vegetable Crops. Agril. Comm. Res. Centre.

Thamburaj S & Singh N. 2004. Vegetables, Tuber Crops and Spices. ICAR.
Thompson H.C & Kelly W.C. (Eds.). 1978. Vegetable Crops. Tata Mc Graw Hill.

M.Sc(Agriculture) Horticulture
IInd Semester (Session - 2021-2022)

Course No	Course Title	Credit Hours		Maximum Marks				
		T	P	Theory			Practical	G. Total
				Mid Term	Internal Assessment	External Theory		
HORT. 521	SEED PRODUCTION TECHNOLOGY OF VEGETABLE CROPS	2	1	20	-	50	30	100
HORT. 522	PROPAGATION AND NURSERY MANAGEMENT OF FRUIT CROPS	2	1	20	-	50	30	100
HORT. 523	PRODUCTION TECHNOLOGY OF CUT FLOWERS	2	1	20	-	50	30	100
HORT. 524	PRODUCTION TECHNOLOGY OF SPICES CROPS	2	1	20	-	50	30	100
HORT. 525	BREEDING OF VEGETABLE CROPS	2	1	20	-	50	30	100
HORT. 526	BIOTECHNOLOGY OF HORTICULTURAL CROPS	2	1	20	-	50	30	100
HORT. 527	PRODUCTION TECHNOLOGY OF LOOSE FLOWERS	2	1	20	-	50	30	100
HORT. 528	PRODUCTION TECHNOLOGY OF UNDER EXPLOITED VEGETABLE CROPS	2	1	20	-	50	30	100
	Total	16	8	-	-	-	-	800

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HORT 521 Seed Production Technology of Vegetable Crops 3(2+1)

Objective

To educate principles and methods of quality seed and planting material production in vegetable crops.

Theory

UNIT I

Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India.

UNIT II

Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production; floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production.

UNIT III

Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control.

UNIT IV

Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packaging (containers/packets), storage and cryopreservation of seeds, synthetic seed technology.

UNIT V

Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, cole crops, bulb crops, leafy vegetables, okra.

Practical

Seed sampling, seed testing (genetic purity, seed viability, seedling vigour, physical purity) and seed health testing; testing, releasing and notification procedures of varieties; floral biology; rouging of off-type; methods of hybrid seed production in important vegetable and spice crops; seed extraction techniques; handling of seed processing and seed testing equipments; seed sampling; testing of vegetable seeds for seed purity, germination, vigour and health; visit to seed processing units, seed testing laboratory and seed production farms.

Suggested Readings

Agrawal P.K & Dadlani M. (Eds.). 1992. Techniques in Seed Science and Technology. South Asian Publ.

Agrawal R.L. (Ed.). 1997. Seed Technology. Oxford & IBH.

Bendell P.E. (Ed.). 1998. Seed Science and Technology: Indian Forestry Species. 50

Allied Publ.

Fageria M.S, Arya P.S & Choudhary A.K. 2000. Vegetable Crops: Breeding and Seed

Production. vol. I. Kalyani.
George RAT. 1999. Vegetable Seed Production. 2nd Ed. CABI.
Kumar JC & Dhaliwal MS. 1990. Techniques of Developing Hybrids in Vegetable Crops. Agro Botanical Publ.
More T.A, Kale P.B & Khule B.W. 1996. Vegetable Seed production Technology. Maharashtra State Seed Corp.
Rajan S & Baby L Markose. 2007. Propagation of Horticultural Crops. New India Publ. Agency.
Singh N.P, Singh D.K, Singh Y.K & Kumar V. 2006. Vegetable Seed Production Technology. International Book Distributing Co.
Singh S.P. 2001. Seed Production of Commercial Vegetables. Agrotech Publ. Academy.

HORT 522 Propagation and Nursery Management for Fruit Crops 3(2+1)

Objective

Familiarization with principles and practices of propagation and nursery management for fruit crops.

Theory

UNIT I

Introduction, life cycles in plants, cellular basis for propagation, sexual propagation, apomixis, polyembryony, chimeras. Principles factors influencing seed germination of horticultural crops, dormancy, hormonal regulation of germination and seedling growth.

UNIT II

Seed quality, treatment, packing, storage, certification, testing. Asexual propagation — rooting of cuttings. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering — principle and methods.

UNIT III

Budding and grafting - selection of elite mother plants, methods. Establishment of bud wood bank, stock, scion and inter stock, relationship — Incompatibility. Rejuvenation through top working — Progeny orchard and scion bank.

UNIT V

Micro-propagation— principles and concepts, commercial exploitation in horticultural crops. Techniques - in vitro clonal propagation, direct organogenesis, embryogenesis, micro grafting, meristem culture. Hardening, packing and transport of micro-propagules, shoot tip grafting/ micro grafting.

UNIT VI

Nursery — types, structures, components, planning and layout. Nursery management practices for healthy propagule production.

Practical

Preparation and planting of cuttings and layering, Root stock raising, Practices of different methods of budding and grafting, Study of media and PGR. Hardening, micropropagation, explant preparation, media preparation, culturing — in vitro clonal propagation, meristem culture, shoot tip culture, axillary bud culture, direct organogenesis, direct and indirect embryogenesis, micro grafting, hardening. Visit to TC labs and nurseries.

Suggested Readings

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Hartmann H.T & Kester D.E. 1989. Plant Propagation — Principles and Practices.

Prentice Hall of India.

Bose T.K, Mitra S.K & Sadhu M.K. 1991. Propagation of Tropical and Subtropical Horticultural Crops. Naya Prokash.

Peter KV. (Ed.). 2008. Basics of Horticulture. New India Publ. Agency. Singh SP. 1989 Mist Propagation. Metropolitan Book Co.

Rajan S & Baby LM. 2007. Propagation of Horticultural Crops. New India Publ. Agency.

Radha T & Mathew L. 2007. Fruit Crops. New India Publ. Agency.

HORT 523 Production Technology of Cut Flowers 3(2+1)

Objective

To impart basic knowledge about the importance and production technology of cut flowers grown in India.

Theory

UNIT I

Scope of cut flowers in global trade, Global Scenario of cut flower production, varietal wealth and diversity, area under cut flowers and production problems in India- Patent rights, nursery management, media for nursery, special nursery practices.

UNIT II

Growing environment, open cultivation, protected cultivation, soil requirements, artificial growing media, soil decontamination techniques, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and CO₂ on growth and flowering.

UNIT III

Flower production — water and nutrient management, fertigation, weed management, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes.

UNIT IV

Flower forcing and year round flowering through physiological interventions, chemical regulation, environmental manipulation.

UNIT V

Cut flower standards and grades, harvest indices, harvesting techniques, post-harvest handling, Methods of delaying flower opening, Pre-cooling, pulsing, packing, Storage & transportation, marketing, export potential, institutional support, Agri Export Zones.

Crops: Cut rose, cut chrysanthemum, carnation, gerbera, gladioli, tuberose, orchids, anthurium, aster, liliams, bird of paradise, heliconia, bromeliads, dahlia, gypsophilla, statice, cut foliage and fillers.

Practical

Botanical description of varieties, propagation techniques, mist chamber operation, training and pruning techniques, practices in manuring, drip and fertigation, foliar nutrition, growth regulator application, pinching, disbudding, staking, harvesting techniques, post-harvest handling, cold chain, project preparation for regionally important cut flowers, visit to commercial cut flower units and case study.

Suggested Readings

Arora J.S. 2006. Introductory Ornamental horticulture. Kalyani.

Bhattacharjee S.K. 2006. Advances in Ornamental Horticulture. vols. I-VI. Pointer

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Publ.

Bose T.K & Yadav L.P. 1989. Commercial Flowers. Naya Prakash.

Bose T.K, Maiti R.G, Dhua R.S & Das P. 1999. Floriculture and Landscaping. Naya Prakash.

Chadha K.L & Chaudhury B. 1992. Ornamental Horticulture in India. ICAR.

Chadha K.L. 1995. Advances in Horticulture. vol. XII. Malhotra Publ. House.

Lauria A & Ries V.H. 2001. Floriculture — Fundamentals and Practices. Agrobios.

Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios.

Randhawa G.S & Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.

Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra R.L. 2007. High tech Floriculture. Indian Society of Ornamental Horticulture, New Delhi.

HORT 524 Production Technology of Spice Crops 3(2+1)

Objective

To impart basic knowledge about the importance and production technology of spices grown in India.

Theory

Introduction, importance of spice crops-historical accent, present status - national and international, future prospects, botany and taxonomy, climatic and soil requirements, commercial varieties, hybrids, site selection, layout, sowing, planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercropping, mixed cropping, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures and seed planting material and micro-propagation, precision farming, organic resource management, organic certification, quality control, pharmaceutical significance and protected cultivation of:

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

Black pepper, cardamom

Clove, cinnamon and nutmeg, allspice

Turmeric, ginger and garlic

Coriander, fenugreek, cumin, fennel, ajowain, dill, celery

Tamarind, garcinia and vanilla

Practical

Identification of seeds and plants, botanical description of plant; preparation of herbarium, propagation, nursery raising, field layout and method of planting, cultural practices, harvesting, drying, storage, packaging and processing, value addition; short term experiments on spice crops.

Suggested Readings

Agarwal S, Sastry E.V.D & Sharma R.K. 2001. Seed Spices: Production, Quality, Export. Pointer Publ.

Arya PS. 2003. Spice Crops of India. Kalyani.

Bhattacharjee S.K. 2000. Hand Book of Aromatic Plants. Pointer Publ.

Bose T.K, Mitra S.K, Farooqi S.K & Sadhu M.K (Eds.). 1999. Tropical

Horticulture. vol.I. Naya Prokash.
Chadha K.L & Rethinam P. (Eds.). 1993. Advances in Horticulture. vols. IX-X.
Plantation Crops and Spices. Malhotra Publ. House.
Gupta S. (Ed.). Hand Book of Spices and Packaging with Formulae. Engineers
India Research Institute, New Delhi.
Kumar N.A, Khader P, Rangaswami & Irulappan I. 2000. Introduction to Spices,
Plantation Crops, Medicinal and Aromatic Plants. Oxford & IBH.
Nybe E.V, Miniraj N & Peter K.V. 2007. Spices. New India Publ. Agency. Parthasarthy
VA, Kandiannan V & Srinivasan V. 2008. Organic Spices. New India Publ.
Agency.
Peter K.V. 2001. Hand Book of Herbs and Spices. vols. I-III. Woodhead Publ. Co.
UK and CRC USA
Pruthi J.S. (Ed.). 1998. Spices and Condiments. National Book Trust
Pruthi J.S. 2001. Minor Spices and Condiments- Crop Management and Post Harvest
Technology. ICAR.
Purseglove J.W, Brown E.G, Green C.L & Robbins S.R.J. (Eds.). 1981. Spices.
vols. I, II. Longman.
Shanmugavelu K.G, Kumar N & Peter K.V. 2002. Production Technology of Spices and
Plantation Crops. Agrobios.
Thamburaj S & Singh N. (Eds.). 2004. Vegetables, Tuber Crops and Spices.
ICAR.
Tiwari R.S & Agarwal A. 2004. Production Technology of Spices. International
Book Distr. Co.
Yarmudy V. 2001. Marketing of Spices. Daya Publ. House.

HORT 525 Breeding of Vegetable Crops 3(2+1)

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, PP VFR act.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

Potato and tomato

Eggplant, hot pepper, sweet pepper and okra

Peas and beans, amaranth and lettuce

Gourds, melons, pumpkins and squashes

Cabbage, cauliflower, carrot, beetroot, radish and sweet potato

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 insect-pests, disease and environmental tress 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

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

HORT 526 Biotechnology of Horticultural Crops 3 (2+1)

Objective

Understanding the principles, theoretical aspects and developing skills in biotechnology of horticultural crops.

Theory

UNIT I

Harnessing bio-technology in horticultural crops, influence of plant materials, physical, chemical factors and growth regulators on growth and development of plant cell, tissue and organ culture.

UNIT II

Callus culture — types, cell division, differentiation, morphogenesis, organogenesis, embryogenesis.

UNIT III

Use of bioreactors and in vitro methods for production of secondary metabolites, suspension culture, nutrition of tissues and cells, regeneration of tissues, ex vitro, establishment of tissue cultured plants.

UNIT IV

Physiology of hardening - hardening and field transfer, organ culture — meristem, embryo, anther, ovule culture, embryo rescue, somaclonal variation, protoplast culture and fusion.

UNIT V

Construction and identification of somatic hybrids and cybrids, wide hybridization, in vitro pollination and fertilization, haploids, in vitro mutation, artificial seeds, cryopreservation, rapid clonal propagation, genetic engineering in horticulture crops, use of molecular markers. In vitro selection for biotic and abiotic stress, achievements of biotechnology in horticultural crops.

Practical

An exposure to low-cost, commercial and homestead tissue culture laboratories, Media preparation, inoculation of explants for clonal propagation, callus induction and culture, regeneration of plantlets from callus, sub-culturing, techniques on anther, ovule, embryo culture, soma-clonal variation, in vitro mutant selection against abiotic stress, protoplast culture, fusion technique, development of protocols for mass multiplication, project development for establishment of commercial tissue culture laboratory.

Suggested Readings

- Bajaj YPS. (Ed.).1989. Biotechnology in Agriculture and Forestry. Vol. V, Fruits. Springer.
- Brown TA. 2001. Gene Cloning and DNA Analysis and Introduction. Blackwell Publ.
- Chopra VL & Nasim A. 1990. Genetic Engineering and Biotechnology — Concepts, Methods and Applications. Oxford & IBH.
- Gorden H & Rubsell S. 1960. Hormones and Cell Culture. AB Book Publ.
- Keshavachandran R & Peter KV. 2008. Plant Biotechnology: Tissue Culture and Gene Transfer. Orient & Longman (Universal Press).
- Keshavachandran R, Nazeem PA, Girija D, John PS & Peter KV. 2007. Recent Trends in Biotechnology of Horticultural Crops. Vols. I, II. New India Publ. Agency.
- Parthasarathy VA, Bose TK, Deka PC, Das P, Mitra SK & Mohanadas S. 2001. Biotechnology of Horticultural Crops. Vols. I-III. Naya Prokash.
- Pierik RLM. 1987. In vitro Culture of Higher Plants. Martinus Nijhoff Publ.
- Skoog F & Miller CO. 1957. Chemical Regulation of Growth and Formation in Plant Tissue Culture in vitro. Symp. Soc. Exp. Biol. 11: 118-131
- Vasil TK, Vasi M, While DNR & Bery HR.1979. Somatic Hybridization and Genetic Manipulation in Plants. Plant Regulation and World Agriculture. Planum Press.
- Williamson R. 1981-86. Genetic Engineering. Vols. I-V. Academic Press.

HORT 527 Production Technology for Loose Flowers 3(2+1)

Objective

To impart basic knowledge about the importance and management of loose flowers grown in India.

Theory

UNIT I

Scope of loose flower trade, Significance in the domestic market export, varietal wealth and diversity, propagation, sexual and asexual propagation methods, propagation in mist chambers, nursery management, pro-tray nursery under shadenets, transplanting techniques

UNIT II

Soil and climate requirements, field preparation, systems of planting, precision farming techniques.

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UNIT III

Water and nutrient management, weed management, training and pruning, pinching and disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM.

UNIT IV

Flower forcing and year round flowering, production for special occasions through physiological interventions, chemical regulation.

UNIT V

Harvest indices, harvesting techniques, post-harvest handling and grading, pre-cooling, packing and storage, value addition, concrete and essential oil extraction, transportation and marketing, export potential, institutional support, Agri Export Zones.

Crops: Jasmine, scented rose, chrysanthemum, marigold, tuberose, crossandra, nerium, hibiscus, barleria, gomphrena, gaillardia, non-traditional flowers (Nyctanthes, Tabernaemontana, ixora, , physiological disorders and remedies, lilies, tecoma, champaka, pandanus).

Practical

Botanical description of species and varieties, propagation techniques, mist chamber operation, training and pruning techniques, practices in manuring, drip and fertigation, foliar nutrition, growth regulator application, pinching, disbudding, staking, harvesting techniques, post-harvest handling, storage and cold chain, project preparation for regionally important commercial loose flowers, visits to fields, essential oil extraction units and markets.

Suggested Readings

Arora J.S. 2006. Introductory Ornamental Horticulture. Kalyani.

Bhattacharjee S.K. 2006. Advances in Ornamental Horticulture. vols. I-VI. Pointer Publ.

Bose T.K & Yadav LP. 1989. Commercial Flowers. Naya Prokash.

Bose T.K, Maiti R.G, Dhua R.S & Das P. 1999. Floriculture and Landscaping. Naya Prokash.

Chadha K.L & Chaudhury B.1992. Ornamental Horticulture in India. ICAR.

Chadha K.L. 1995. Advances in Horticulture. vol. XII. Malhotra Publ. House.

Lauria A & Ries V.H. 2001. Floriculture — Fundamentals and Practices. Agrobios.

Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios.

Randhawa G.S & Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.

Sheela V.L. 2007. Flowers in Trade. New India Publ. Agency.

Valsalakumari P.K, Rajeevan P.K, Sudhadevi P.K & Geetha C.K. 2008. Flowering Trees. New India Publ. Agency.

HORT 528 Production Technology of Underexploited Vegetable Crops 3(2+1)

Objective

To educate production technology of underutilized vegetable crops.

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, inter-cultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures and seed production of:

UNIT I Asparagus, artichoke and leek

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UNIT II

UNIT III

UNIT IV

UNIT V

Brussels's sprout, Chinese cabbage, broccoli, kale.

Amaranth, celery, parsley, parsnip, lettuce, rhubarb, spinach, basella, bathu (chenopods).

Elephant foot yam, lima bean, winged bean, vegetable pigeon pea and sword bean.

Sweet gourd, spine gourd, pointed gourd and little gourd (kundru).

Practical

Identification of seeds; botanical description of plants; layout and planting; cultural practices; short-term experiments of underexploited vegetables.

Suggested Readings

Bhat K.L. 2001. Minor Vegetables -Untapped Potential. Kalyani.

Indira P & Peter K.V. 1984. Unexploited Tropical Vegetables. Kerala Agricultural University, Kerala.

Peter K.V. (Ed.). 2007-08. Underutilized and Underexploited Horticultural Crops. vols. I-IV. New India Publ. Agency.

Rubatzky V.E & Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall

Srivastava U, Mahajan R.K, Gangopadhyay K.K, Singh M & Dhillon B.S. 2001.

Minimal Descriptors of Agri-Horticultural Crops. Part-II: Vegetable Crops. NBPGR, New Delhi.

**M.Sc(Agriculture) Horticulture
IIIrd Semester (Session - 2021-2022)**

		Credit Hours	Maximum Marks

Course No	Course Title	T	P	Theory			Practical	G. Total
				Mid Term	Internal Assessment	External Theory		
HORT. 531	LANDSCAPING AND ORNAMENTAL GARDENING	2	1	20	-	50	30	100
HORT. 532	POST HARVEST TECHNOLOGY FOR FRUIT CROPS	2	1	20	-	50	30	100
HORT. 533	PRODUCTION TECHNOLOGY OF COOL SEASON VEGETABLE CROPS	2	1	20	-	50	30	100
	Total	6	3	-	-	-	-	300

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Semester-III

HORT 531 Landscaping and Ornamental Gardening 3(2+1)

Objective

Familiarization with principles and practices of landscaping and ornamental gardening.

Theory

UNIT I

Landscape designs, types of gardens, English, Mughal, Japanese, Persian, Spanish, Italian, Buddha garden; Styles of garden, formal, informal and free style gardens.

UNIT II

Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporates.

UNIT III

Garden plant components, arboretum, shrubbery, fernery, palmatum, arches and pergolas, edges and hedges, climbers and creepers, cacti and succulents, herbs, annuals, flower borders and beds, ground covers, carpet beds, bamboo groves; Production technology for selected ornamental plants.

UNIT IV

Lawns, Establishment and maintenance, special types of gardens, vertical garden, roof garden, bog garden, sunken garden, rock garden, clock garden, colour wheels, temple garden, sacred groves.

UNIT V

Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.

Practical

Identification of ornamental plants, practices in preparing designs for home gardens, industrial gardens, institutional gardens, corporates, avenue planting, practices in planning and planting of special types of gardens, burlapping, lawn making, planting herbaceous and shrubby borders, project preparation on landscaping for different situations, visit to parks and botanical gardens, case study on commercial landscape gardens.

Suggested Readings

Bose T.K, Maiti R.G, Dhua R.S & Das P.1999. Floriculture and Landscaping. Naya Prakash.

Lauria A & Yictor H.R. 2001. Floriculture — Fundamentals and Practices Agrobios.

Nambisan K.M.P.1992. Design Elements of Landscape Gardening. Oxford & IBH.

Randhawa G.S & Mukhopadhyay A. 1986. Floriculture in India. Allied Publ.

Sabina G.T & Peter K.Y. 2008. Ornamental Plants for Gardens. New India Publ. Agency.

HORT 532 Post Harvest Technology for Fruit Crops 3(2+1)

Objective

To facilitate deeper understanding on principles and practices of post-harvest management of fruit crops.

Theory

UNIT I

Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration.

UNIT II

Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management, factors leading to post-harvest loss, pre-cooling.

UNIT III

Treatments prior to shipment, viz., chlorination, waxing, chemicals, biocontrol agents and natural plant products. Methods of storage- ventilated, refrigerated, MAS, CA storage, physical injuries and disorders.

UNIT IV

Packing methods and transport, principles and methods of preservation, food processing, canning, fruit juice beverages, pickles, jam, jellies, sauces and ketchup, candies, preserve.

UNIT V

Dried and dehydrated products, nutritionally enriched products, fermented fruit beverages, packaging technology, processing waste management, food safety standards.

Practical

Analyzing maturity stages of commercially important horticultural crops, improved packing and storage of important horticultural commodities, physiological loss in weight of fruits and vegetables, estimation of transpiration, respiration rate, ethylene release and study of shelf life extension in cut flower using chemicals,

estimation of quality characteristics in stored fruits and vegetables, practices of preservation by salt, sugar, vinegar and chemical preservatives, cold chain management - visit to cold storage and CA storage units, visit to fruit and vegetable processing units, project preparation, evaluation of processed horticultural products.

Suggested Readings

Bhutani R.C. 2003. Fruit and Vegetable Preservation. Biotech Books.

Chadha K.L & Pareek O.P. (Eds.). 1996 Advances in Horticulture. Vol. IV.

Malhotra Publ. House.

Haid N.F & Salunkhe S.K. 1997. Post Harvest Physiology and Handling of Fruits and Vegetables. Grenada Publ.

Mitra S.K. 1997. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CABI.

Ranganna S. 1997. Hand Book of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill.

Sudheer K.P & Indira V. 2007. Post Harvest Technology of Horticultural Crops. New India Publ. Agency.

Willis R, Mc Glassen W.B, Graham D & Joyce D. 1998. Post Harvest. An Introduction to the Physiology and Handling of Fruits, Vegetables and Ornamentals. CABI.

HORT 533 Production Technology of Cool Season Vegetable Crops 3(2+1)

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: Potato Colecrops: cabbage, cauliflower, knol-kohl, sprouting broccoli, Brussels sprout Root crops: carrot, radish, turnip and beetroot Bulb crops: onion and garlic 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

Bose T.K & Som M.G. (Eds.). 1986. Vegetable Crops in India. Naya Prokash.

Bose T.K, Som G & Kabir J. (Eds.). 2002. Vegetable Crops. Naya Prokash.

Bose T.K, Som M.G & Kabir J. (Eds.). 1993. Vegetable Crops. Naya Prokash.

Bose T.K, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. Vegetable Crops. vols. I-III. Naya Udyog.

Chadha K.L & Kalloo G. (Eds.). 1993-94. Advances in Horticulture vols. V-X. Malhotra Publ. House.

Chadha K.L. (Ed.). 2002. Hand Book of Horticulture. ICAR.

Chauhan D.V.S. (Ed.). 1986. Vegetable Production in India. Ram Prasad & Sons.

Decoteau D.R. 2000. Vegetable Crops. Prentice Hall.

Edmond J.B, Musser A.M & Andrews F.S. 1951. Fundamentals of Horticulture. Blakiston Co.

Fageria M.S, Choudhary B.R & Dhaka R.S. 2000. Vegetable Crops: Production Technology. vol. II. Kalyani.

Gopalakrishanan T.R. 2007. Vegetable Crops. New India Publ. Agency.

Hazra P & Som MG. (Eds.). 1999. Technology for vegetable Production and Improvement. Naya Prokash.

Rana M.K. 2008. Olericulture in India. Kalyani Publ.

Rana M.K. 2008. Scientific Cultivation of Vegetables. Kalyani Publ.

Rubatzky Y.E & Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall.

Saini G.S. 2001. A Text Book of Oleri and Flori Culture. Aman Publ. House.

Salunkhe D.K & Kadam S.S. (Ed.). 1998. Hand Book of Vegetable Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker.

Shanmugavelu K.G. 1989. Production Technology of Vegetable Crops. Oxford & IBH.

Singh D.K. 2007. Modern Vegetable Varieties and Production Technology. International Book Distributing Co.

Singh S.P. (Ed.). 1989. Production Technology of Vegetable Crops. Agril. Comm. Res. Centre.

Thamburaj S & Singh N. (Eds.). 2004. Vegetables, Tuber Crops and Spices. ICAR.

Thompson H.C & Kelly W.C. (Eds.). 1978. Vegetable Crops. Tata McGraw- Hill

M.Sc(Agriculture) Horticulture
IVth Semester (Session - 2022-2023)

Course No	Course Title	Credit Hours	Maximum Marks		
			Theory		

			Mid Term	Internal Assessment	External Theory	Practical	G. Total
HORT. 541	SEMINAR	1	-	-	-	-	100
HORT. 542	COMPREHENSIVE	2	-	-	-	-	100
HORT. 543	RESEARCH	15	-	-	-	-	100
	Total	-	-	-	-	-	300

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