

CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT



Syllabus

M. Sc. (Ag.) Horticulture

(2 Year/4 Semester Degree Programme)

(Semester wise)

2026-27

By

Department of Horticulture

Structure of the Programme
Semester-wise Course Distribution
Syllabus for M.Sc. (Ag.) Horticulture for affiliated colleges under CCSU, Meerut

First Semester				Maximum Marks		
S.N.	Code	Course title	Credits	External	Internal	Total
1	J1004	Fundamentals of Statistics and computer Application	4 (3+1)	50	50	100
2	J1061	Propagation and Nursery Management of Horticultural Crops	4 (3+1)	50	50	100
3	J1062	Production Technology of Vegetable Crops	4 (3+1)	50	50	100
4	J1063	Growth and Development of Horticultural Crops	4 (3+1)	50	50	100
	J561	Practical*				200
		Total	16			600
Second Semester				Maximum Marks		
S.N.	Code	Course title	Credits	External	Internal	Total
1	J2004	Statistical Methods in Agriculture	4 (3+1)	50	50	100
2	J2061	Orchard Management	4 (3+1)	50	50	100
3	J2062	Production Technology of Fruit and Plantation Crops	4 (3+1)	50	50	100
4	J2063	Commercial Floriculture	4 (3+1)	50	50	100
	J661	Practical*				200
		Total	16			600
Third Semester				Maximum Marks		
S.N.	Code	Course title	Credits	External	Internal	Total
1	J3061	Post-harvest Management of Horticultural Produce	4 (3+1)	50	50	100
2	J3062	Production Technology of Spices, Medicinal and Aromatic crops	4 (3+1)	50	50	100
3	J3063	Ornamental Gardening and Landscaping	4 (3+1)	50	50	100
4	J3064	Breeding of Fruit and Plantation Crops	4 (3+1)	50	50	100
	J761	Practical*				200
		Total	16			600
Fourth Semester				Maximum Marks		
S.N.	Code	Course title	Credits	External	Internal	Total
1	J4061	Preservation and Processing of Horticultural Produce	4 (3+1)	50	50	100
2	J4062	Seed Production of Vegetable and Flower Crops	4 (3+1)	50	50	100
3	J4063	Protected Cultivation of Horticultural Crops	4 (3+1)	50	50	100
4	J4064	Breeding of Vegetable and Flower Crops	4 (3+1)	50	50	100
	J861	Practical*				200
1		Seminar	2 (0+2)	Satisfactory / Unsatisfactory		
2		Master's Thesis/Project/Dissertation (Mandatory)	20 (0+20)	Satisfactory / Unsatisfactory		
		Total	38			600
		Overall Total Credits	86			2400

*There shall be only one joint external practical examination carrying 200 marks in first, second, third and fourth semesters separately based on all courses.

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Syllabus

Semester-I

I. Course Title: Fundamentals of Statistics and Computer Applications

II. Course Code: J-1004

III. Credit Hours: 4 (3+1)

IV. Aim of the course

This course is meant for students who do not have sufficient background of Statistical Methods. The students would be exposed to concepts of statistical methods and statistical inference that would help them in understanding the importance of statistics. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure to presentation of data, probability distributions, correlation, regression, and the fundamentals of computer applications.

V. Theory

Unit I

Introduction to Statistics, Classification and tabulation of statistical data, frequency distribution, diagrammatic and graphical representation of data-bars, circles, rectangles, histogram, frequency polygon, frequency curve and cumulative frequency curves.

Unit II

Measures of Central Tendency and Dispersion: Mean, median, mode, quartiles and calculation of median, mode and quartiles by graphs; range, quartile deviation, mean deviation, standard deviation, variance, coefficient of variation and standard error of mean.

Unit III

Theory of probability, Random experiment, events-exhaustive, mutually exclusive, equally likely, independent and favourable; definition of probability (with simple exercises), law of addition and law of multiplication of probability (with simple exercises), random variable - discrete and continuous, definitions of Binomial, Poisson and Normal distributions and simple properties of the above distributions (without derivation).

Unit IV

Bivariate data, bivariate frequency distribution, simple correlation, Karl Pearson's correlation coefficient, rank correlation, Spearman's rank correlation coefficient, Introduction to regression, regression lines, regression coefficients and their relation with correlation coefficient, multiple regression, multiple and partial correlation coefficients (for three variables only).

Unit V

Introduction to Computer, Organisation of Computer- Hardware: Input devices, output devices, CPU, storage unit, Software: Types of software, application of software, system software, utility software, general purpose software. Introduction to statistical packages (Excel, SPSS, SYSTAT, R).

Note: Calculators may be used in the theory paper.

Shrjana
14/05/26

VI. Suggested Readings

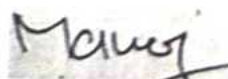
1. **Goel, A. (2010).** Computer Fundamentals, Pearson Education, India
2. **Gupta, S. C., & Kapoor, V. K. (2020).** *Fundamentals of Mathematical Statistics*. Sultan Chand & Sons.
3. **Rangaswamy, R. (2020).** *A Textbook of Agricultural Statistics*. New Delhi: New Age International.
4. **Singh, R. and Sharma, A. K. (2010).** *Statistical Methods and Experimental Designs*. Aman Publishing House, Meerut.
5. **Sinha, P. K. and Sinha, P. (2020).** Computer Fundamentals (8th ed.), BPB Publication, Delhi.
6. **Snedecor, G.W. and Cochran, W.G. (1980).** Statistical Methods, 7/e. Iowa State University Press, Ames, Iowa.



Om



Shjane
14.06.26



TS



I. Course Title: Propagation and Nursery Management of Horticultural Crops

II. Course Code: J-1061

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To understand the principles and methods of propagation and nursery management in fruit crops. The course is organised as general concepts and phenomena, sexual and asexual propagation, micropropagation, management practices and regulation.

V. Theory

Unit I

Introduction, understanding cellular basis for propagation, sexual and asexual propagation, their advantages and disadvantages. Seed: morphology, anatomy, apomixis, polyembryony, chimeras. Factors influencing seed germination and dormancy, hormonal regulation of seed germination and seedling growth.

Unit II

Asexual Propagation: Cutting– principles and methods. Use of PGR in propagation, Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principles and methods.

Unit III

Budding and grafting- principles and methods, establishment and management of bud wood bank. Stock, scion and inter stock relationship, graft incompatibility, physiology of rootstock and top working. Propagation by specialized vegetative structures.

Unit IV

Micro-propagation principles and concepts, commercial exploitation in horticultural crops. Techniques of in-vitro clonal propagation, direct organogenesis, embryogenesis, micrografting, meristem culture, genetic fidelity testing. Hardening, packaging and transport of micro-propagules.

Unit V

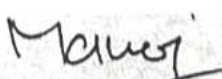
Nursery-types, structures, components, planning and layout. Nursery management practices for healthy propagule production. Nursery Act, nursery accreditation, import and export of seeds and planting material and quarantine.

VI. Practical

- Hands on practices on rooting of dormant and summer cuttings.
- Hands on practices on different layering techniques.
- Hands on practices on various methods of budding.
- Hands on practices on different grafting techniques.
- Visit to commercial tissue culture laboratories and accredited nursery.



Dr. Anil Kumar
14/10/2026



Dr. Anil Kumar



VII. Teaching Methods/ Activities

Class room Lectures, Laboratory/ Field Practical's, Student Seminars/ Presentations Field Demonstrations, Assignments.

VIII. Learning outcome

The student would be expected to equip to acquire skills and knowledge on principles and practices of macro and micropropagation and the handling of propagated material in nursery.

IX. Suggested Reading

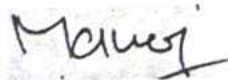
1. **Bose TK, Mitra SK and Sadhu MK. 1991.** Propagation of Tropical and Subtropical Horticultural Crops. Naya Prokash, Kolkata.
2. **Davies FT, Geneve RL and Wilson SB. 2018.** Hartmann and Kester's Plant Propagation- Principles and Practices. Pearson, USA/ Prentice Hall of India. New Delhi.
3. **Gill SS, Bal JS and Sandhu AS. 2016.** Raising Fruit Nursery. Kalyani Publishers, New Delhi.
4. **Sadhu M K, 1989.** Plant Propagation. Wiley Eastern Ltd, New Delhi
5. **Sharma RR and Srivastav M. 2004.** Propagation and Nursery Management. Intl. Book Publishing Co., Lucknow.
6. **Tyagi S. 2019.** Hi-Tech Horticulture. Vol I: Crop Improvement, Nursery and Rootstock Management. NIPA, New Delhi.



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Shriana
14/05/26



TS



I. Course Title: Production Technology of Vegetable Crops

II. Course Code: J-1062

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To impart knowledge and skills on advancement in production technology of vegetable crops.

V. Theory

Introduction, commercial and nutritional importance, scope and constraints, current scenario of vegetable production in India. Soil requirements, climatic factors, 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.

- Unit I.** Fruit vegetables: Tomato, Brinjal, Chilli, Capsicum and Okra
- Unit II.** Cole crops: Cauliflower, Cabbage, Broccoli, Knol-khol, Brussels sprout and Kale.
- Unit III.** Bulb crop: Onion and Garlic.
Root and tuber crops: Potato, Radish, Carrot, Beet root, Turnip, Sweet potato, Colocasia and Elephant Foot Yam.
- Unit IV.** Legume vegetables: Garden pea, Cowpea, French bean, Indian bean, Cluster bean.
Leafy vegetables: Amaranthus and Spinach beet.
- Unit V.** Cucurbits: Pumpkin, Bottle gourd, Cucumber, Musk melon, Water melon, Pointed gourd, Bitter gourd and Sponge gourd.

VI. Practical

- Identification and botanical classification.
- Description of commercial varieties and hybrids.
- Demonstration on methods of irrigation, fertilizers and micronutrients application.
- Use of plant growth substances.
- Study of nutritional and physiological disorders.
- Identification of important pest and diseases and their control.
- Preparation of cropping scheme for commercial farms.
- Production economics of crops

VII. Teaching Methods/ Activities

Classroom lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures, Group discussion

Shilpa
14/05/26

VIII. Learning outcome

After successful completion of this course, the students are expected to acquire knowledge about the production technology and post-harvest handling of vegetable crops.

IX. Suggested Reading

1. Bose TK, Kabir J, Maity TK, Parthasarathy VA and Som MG. 2003. *Vegetable Crops*. Vols. I, II, III. Naya Udyog, Kolkata.
2. Bose TK, Som MG and Kabir J. (Eds.). 1993. *Vegetable Crops*. Naya prokash, Kolkata.
3. Fageria MS, Choudhary BR and Dhaka RS. 2000. *Vegetable Crops: Production Technology*. Vol. II. Kalyani publishers.
4. Thamburaj S and Singh N. (Eds.), 2004. *Vegetables, Tuber Crops and Spices*. ICAR.

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Sumit
14/05/26

TS

Course Title: Growth and Development of Horticultural Crops

II. Course Code: J-1063

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To develop comprehensive understanding on growth and development of different horticulture crops.

V. Theory

Unit I

Growth and development- definition, parameters of growth and development, growth dynamics and morphogenesis.

Unit II

Environmental impact on growth and development- effect of light, temperature, photosynthesis and photoperiodism, vernalisation, heat units and thermoperiodism. Assimilate partitioning, influence of water and mineral nutrition in growth and development.

Unit III

Concepts of plant hormone and bioregulators, history, biosynthesis and physiological role of auxins, gibberellins, cytokinins, abscisic acid, ethylene, growth inhibitors and retardant, brassinosteroids, other New PGRs.

Unit IV

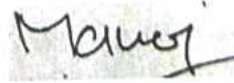
Developmental physiology and biochemistry during dormancy and germination of seed, bud break, juvenility, vegetative to reproductive interphase, flowering, pollination, fertilization and fruit set, fruit drop, fruit growth, ripening and seed development.

Unit V

Growth and developmental process during stress-manipulation of growth and development, impact of pruning and training, chemical manipulations and Commercial application of PGRs in fruit crops, molecular and genetic approaches in plant growth and development.

VI. Practicals

- Understanding seed dormancy mechanisms in fruit crops.
- Study of seed stratification and scarification.
- Techniques of growth analysis.
- Understanding ripening phenomenon in fruits.
- Practical on use of growth regulators.



Dr. Anil Kumar
14/05/26



I. Teaching Methods/ Activities

Class room Lectures, Laboratory/ Field Practicals, Student Seminars/ Presentations, Field Demonstrations, Assignments

VIII. Learning outcome

Consequent upon successful completion of the course, the students are expected to have, equipped with understanding of various growth and development processes. Learned about the role of environment and growth substances.

IX. Suggested Reading

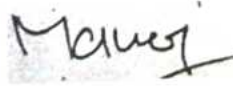
1. **Bhatnagar P. 2017.** *Physiology of Growth and Development of Horticultural Crops.* Agrobios (India).
2. **Buchanan B, Gruissem W and Jones R. 2002.** *Biochemistry and Molecular Biology of Plants.* John Wiley & Sons, NY, USA.
3. **Dhillon WS and Bhatt ZA. 2011.** *Fruit Tree Physiology.* Narendra Publishing House, New Delhi.
4. **Durner E. 2013.** *Principles of Horticultural Physiology.* CAB International.
5. **Taiz L, Zeiger E, Moller IM and Murphy A. 2023.** *Plant Physiology and Development* (7th edition). Oxford University Press.



Dr. P.



Dr. R. Jones
14/10/26



Dr. B.



Semester -II

I. Course Title: Statistical Methods in Agriculture

II. Course Code: J-2004

III. Credit Hours: 4 (3+1)

IV. Aim of the course

This course is meant for students of agricultural and animal sciences. The students would be exposed to concepts of statistical methods and statistical inference, tests of significance, and elementary sampling techniques that would help them in understanding the importance of statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to the concepts of Design of Experiments to enable them to understand the planning, designing, and analysis of their experiments.

V. Theory

Unit I

Test of Significance, Null and alternative hypothesis, two types of error, level of significance, power of the test, one-tailed and two-tailed tests. Z and t-tests for testing equality of two means, test of significance of correlation coefficient and regression coefficients, chi-square test for testing goodness of fit, independence of attributes (contingency table) with Yates correction and testing for the variance of population, F-test for testing the equality of two variances and homogeneity of means (analysis of variance).

Unit II

Non-parametric tests- sign, Wilcoxon, Mann-Whitney U-test, Run test for the randomness of a sequence. Median test.

Unit III

Uniformity trials, shape and size of the plots and blocks, Analysis of Variance, Transformations of data. Basic principles of design of experiments, completely randomized, randomized block, and Latin square designs, and their analysis.

Unit VI

Simple factorial experiments of the 2^2 and 2^3 , Split plot and strip plot designs, analysis of covariance and missing plot techniques in randomized block and Latin square designs.

Unit V

Concept of sampling, sampling Vs complete enumeration, simple random sampling, stratified sampling, systematic sampling, cluster sampling and multi-stage sampling (methods, advantages and disadvantages only).

Note: Statistical tables and calculators may be used in the theory paper.

Z. J. J. J.
14/05/26

VI. Suggested Readings

1. Cochran, W. G. (1977). *Sampling Techniques* (3rd ed.). John Wiley & Sons.
2. Cochran, W.G. and Cox, D.R. (1987). *Experimental Designs*. John Wiley and Sons, New York.
3. Gibbons, J. D. and Chakraborti, S. (2011). *Nonparametric Statistical Inference*, (5th ed.), Springer.
4. Gomez, A. G. and Gomez, A. A. (1994). *Statistical Procedures for Agricultural Research*, 2/e. John Wiley and Sons, New York.
5. Murthy, M.N. (1977). *Sampling Theory and Methods*. Statistical Publishing Society, Calcutta.
6. Rangaswamy, R. (2020). *A Textbook of Agricultural Statistics*. New Delhi: New Age International.
7. Singh, R. and Sharma, A. K. (2010). *Statistical Methods and Experimental Designs*, Aman Publishing House, Meerut.



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Manoj

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I. Course Title: Orchard Management

II. Course Code: J-2061

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To impart knowledge on principles and practices in orchard management for quality fruit production.

V. Theory

Unit I

Establishing of orchard – selection of site, soil preparation, planning and layout, planting systems, digging and filling of pits, planting and aftercare of young plants. Selection and procurement of quality planting material. Types of orchards.

Unit II

Irrigation management of fruit trees; water requirement and method and time of application. Abnormalities caused due to excess and deficiency of moisture. Manurial requirement of fruit trees, major and minor nutrients, nutrients deficiency and their remedies, foliar feeding and use of bio-fertilizers.

Unit III

Orchard floor management; Clean cultivation, sod culture, intercropping, cover crops, filler crop, mulching and organic farming.

Unit IV

Growing and fruiting habits of fruit trees. Pollination and pollinizers. Unfruitfulness, Alternate bearing, Protection from insect- pest and diseases; Integrated insect-pest management. Dryland farming in fruit crops.

Unit V

Canopy; importance and factors affecting canopy development. Canopy management. Training and pruning in fruit crops. Rejuvenation of old and uneconomic orchards. Top working and frame working. High density planting system in orchards.

VI. Practical

- Study of layout of different systems of orchard.
- Study of soil management, clean, inter, cover and mixed cropping, fillers.
- Study of use of mulch materials, organic and inorganic.
- Study of training and pruning

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VII. Teaching Methods/ Activities

Class room Lectures, Laboratory/ Field Practicals,, student Seminars/ Presentations, Field Demonstrations, Assignments

VIII. Learning outcome

After successful completion of the course, the students are expected to learn, the basic principles orchard management and acquired skills on training and pruning of fruit crops, and growth regulation

IX. Suggested Reading

1. **B.C. Mazumdar. 2004.** Orchard Irrigation and Soil Management Practices. Daya Publishing Agency, New Delhi
2. **B.C. Mazumdar. 2004.** Principles and Methods of Orchard Establishment. Daya Publishing House, New Delhi.
3. **Pradeepkumar T. 2008.** *Management of Horticultural Crops.* NIPA, New Delhi.
4. **Singh G. 2010.** *Practical Manual on Canopy Management in Fruit Crops.* Dept. of Agriculture and Co-operation, Ministry of Agriculture (GoI), New Delhi.
5. **Srivastava KK. 2012.** *Canopy Management in Fruits.* ICAR, New Delhi

Shriyana
14/05/26

Course Title: Production Technology of Fruit and Plantation Crops

II. Course Code: J-2062

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To impart comprehensive knowledge to the students on cultural and management practices for growing tropical, subtropical, and temperate fruits and plantation crops.

V. Theory

Introduction, commercial and nutritional importance, scope and constraints, current scenario of fruit production in India. rootstocks and commercial varieties of regional, national and international importance, eco-physiological requirements. Planting and Orchard Floor Management: Asexual and sexual methods of propagation, planting systems and planting densities, training and pruning methods, rejuvenation, intercropping, nutrient management, water management, fertigation, use of bio-fertilizers, role of bio-regulators, abiotic factors limiting fruit production. Physiology of flowering, pollination management, fruit set and development, physiological disorders-causes and remedies, crop regulation, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; insect and disease management.

Unit I

Tropical fruits: Mango, Banana, Guava, Papaya, Pineapple and Sapota.

Unit II

Sub-tropical Fruits: Grapes, Citrus, Litchi and Pomegranate.

Unit III

Temperate Fruits: Apple, Peach, Pear, Plum, Apricot and Straw-berry.

Unit IV

Minor Fruit : Ber, Bael, Aonla, Jackfruit, Jamun.

Unit V

Plantation crops: Coconut, Cashew nut, Areca-nut, Tea and Coffee.

VI. Practical

- Identification and Classification of fruit and plantation crop.
- Distinguished features of different fruit crop, cultivars and rootstocks.
- Physiological disorders-malady diagnosis.
- Identification of important pest and diseases and their control
- Physico-chemical analysis of fruit quality attributes.
- Field visits to fruit orchards.
- Project preparation for establishing commercial orchards.

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VII. Teaching Methods/ Activities

Class room Lectures, Laboratory/ Field Practicals, Student Seminars/ Presentations.
Field Visit/Demonstrations, Assignment.

VIII. Learning outcome

The students are expected to equip themselves with know-how on agro-techniques for establishment and management of an orchard leading to optimum and quality fruit production of tropical fruits.

IX. Suggested Reading

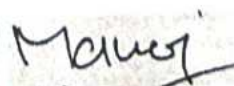
1. **Bose TK, Mitra SK and Sanyal D. 2002.** *Fruits of India – Tropical and Sub-Tropical.* 3rd Edn. Naya Udyog, Kolkata.
2. **Chadha TR. 2011.** *A Text Book of Temperate Fruits.* ICAR, New Delhi.
3. **Dhillon WS. 2013.** *Fruit Production in India.* Narendra Publ. House, New Delhi.
4. **Midmore D. 2015.** *Principles of Tropical Horticulture.* CAB International.
5. **Sandhu S and Gill BS. 2013.** *Physiological Disorders of Fruit Crops.* NIPA, New Delhi.
6. **Sharma RR and Krishna H. 2018.** *Textbook of Temperate Fruits.* CBS Publishers and Distributors Pvt. Ltd., New Delhi.



Dr. M. K. Singh



Dr. S. K. Singh
14/05/26



Dr. S. K. Singh



I. Course Title: Commercial Floriculture

II. Course Code: J-2063

III. Credit Hours: 4 (3+1)

VI. Aim of the course

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

V. Theory

Scope, scenario and importance of cut and loose flowers, constraints, and opportunities in cut and loose flower production. Nursery management, pro-tray nursery under shade nets, soil and climate requirement, growing environment; open and protected condition, soil media requirements, Field preparation, systems of planting. Commercial flower production- Commercial varieties, water and nutrient management, fertigation, weed management, crop specific practices, ratooning, training and pruning, pinching, deshooting, bending, desuckering, disbudding. Use of growth regulators, physiological disorders and remedies, IPM and IDM. Flower regulation-Flower forcing and year-round/ offseason flower production through physiological interventions, chemical regulation, environmental manipulation. Harvest indices, harvesting techniques, post-harvest handling and grading, precooling, packaging and storage. Important local markets, Export potential, transportation and marketing, APMC and online trading, institutional support, Crop Insurance.

Unit I

Rose, Carnation, Chrysanthemum, Gerbera

Unit II

Gladiolus, Tuberose, Tulip, Orchids, Lilium, Alstroemeria

Unit III

Marigold, Jasmine, Dahlia, Aster, Crossandra, Anthurium

Unit IV

Cultivation of cut foliage, cut greens and specialty cut flowers.

VI. Practical

- Identification of ornamental crops.
- Training and pruning techniques, Pinching, deshooting, disbudding, desuckering..
- Practices in manuring, drip and fertigation, foliar nutrition, growth regulator application.
- Identification of important pest and diseases and their control.
- Harvesting techniques, post-harvest handling, cold chain.
- Economics, Project preparation for regionally important cut flowers, crop specific.
- Visit to commercial cut flower units.

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II. Teaching Methods/ Activities

Lectures, Group discussions, Assignment and student presentation, Hands on training of different procedures and exposure visits

VIII. Learning outcome

After successful completion of this course, the students are expected to develop a thorough understanding of production and post- harvest management of flower crops. Acquire the required skills to prepare project reports on different crops for financing.

IX. Suggested Reading

1. **Arora JS. 2010.** *Introductory Ornamental Horticulture*. Kalyani Publi. 6th Edition, pp. 230.
2. **Bose T.K. , Aswath C., Bhatia R., Dutta K., Rajiv Kumar & T N Saha .** 2021- *Commercial Flowers*-3rd revised edition, Daya publishing house.
3. **Randhawa GS and Mukhopadhyay A. 2001.** *Floriculture in India*. Allied Publ. pp 660.
4. **Reddy S, Janakiram T, Balaji Kulkarni S and Misra RL. 2007.** *Hi- Tech Floriculture*. Indian Society of Ornamental Horticulture, New Delhi, India.
5. **Singh AK. 2006.** *Flower Crops: Cultivation and Management*. New India Publ. Agency, New Delhi, India. pp. 475.

G.M.

Sumit
14/05/26

Manoj

Semester-III

I. Course Title: Post-harvest Management of Horticultural Produce

II. Course Code: J-3061

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To impart comprehensive knowledge on management of horticultural produce thus extending the post-harvest life of the produce by various treatments and methods.

V. Theory

Unit I

Importance and scope of Postharvest technology of horticultural produce. Nature and structure of horticultural produce. Pre and Postharvest losses and their causes.

Unit II

Climacteric and non-climacteric fruits. Regulation of ripening by use of chemicals and growth regulators. Control of sprouting, rooting and discoloration in horticultural crops.

Unit III

Maturity indices for harvest. Harvesting and harvesting tools. Curing in roots and tubers. Prepackage Operation: Precooling, washing, sorting, grading of horticultural perishables for local markets and export. Postharvest handling of plantation crops, medicinal and aromatic plants. Equipment's for washing, sizing, grading.

Unit IV

Pre and Postharvest treatments for extending storage life/ vase life. VHT, irradiation treatment, skin coating, degreening, etc. Role of sugar, growth regulators and chemicals in vase-life of flowers. Pulsing, holding solution, bent-neck, geotropic bending and foliage discoloration in flowers. Pre-packaging, Packaging techniques for local market and export. Standards and specifications for fresh produce.

Unit V

Principals and methods of storage. Controlled and modified atmospheric storage, low pressure storage. Principles of transport, modes of transportation, types of vehicles and transit requirements for different horticultural produce. Marketing: factors influencing marketing of perishable crops, marketing systems and organizations.

VI. Practical

- Study of maturity indices for harvest.
- Study of protective skin coating with wax emulsion.
- Study of Pre and Postharvest treatment to extend the shelf life.
- Extension of vase-life of cut flowers by use of chemicals and growth regulators.
- Control of sprouting of potato and onion by using growth regulators.
- Study of modern harvesting, sorting and grading equipment's.
- Study of effect of pre-cooling on shelf-life.

Dr. M. S. Singh
14/05/26

II. Teaching Methods/ Activities

Lecture, Assignment (Reading/ Writing), Student presentation and Group Work

VIII. Learning outcome

After successful completion of this course, the students are expected to be able to understand; Regulation of ripening by use of chemicals and growth regulators, Pre and Postharvest treatments for extending storage life/ vase life and Standards and specifications for fresh produce.

IX. Suggested Reading

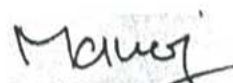
1. **Bhattacharjee SK and Dee LC. 2005.** *Postharvest technology of flowers and ornamental plants*. Pointer publishers, Jaipur.
2. **Chattopadhyay SK. 2007.** *Handling, transportation and storage of fruit and vegetables*. Gene-Tech books, New Delhi.
3. **Thompson AK. (Ed.) 2014.** *Fruit and Vegetables: Harvesting, Handling and Storage* (Vol. 1 & 2) Blackwell Publishing Ltd, Oxford, UK. ISBN: 9781118654040.
4. **Verma LR and Joshi VK. 2000.** *Postharvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management*. Indus Publishing Company, New Delhi, India. ISBN 8173871086.



Dr. M. L. Verma



Srijana
14/05/26



TS16



Course Title: Production Technology of Spices, Medicinal and Aromatic Crops

II. Course Code: J-3062

III. Credit Hours: 4 (3+1)

IV. Aim of the course

The course is designed to provide both basic and applied knowledge on various aspects of production technology of spice, medicinal and aromatic crops grown in India.

V. Theory

Importance and scope of spice crops, medicinal and aromatic plants; Role in national economy, utility sectors of medicinal and aromatic crops, role of institutions, Spice board, Medicinal Plant Board and NGO's in research and development of spices, medicinal and aromatic crops. Botanical classification and other methods of classification of spices, medicinal and aromatic crops. 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, plant protection. Maturity indices, harvesting methods, harvesting seasons in spices, medicinal and aromatic crops. Post harvest management including primary processing, extraction, grading, packaging, and storage, good manufacturing practices (GMP) in spices, medicinal and aromatic crops.

Unit I

Black pepper, Small and Large Cardamom, Cinnamon, Clove, Nutmeg and Mace.

Unit II

Turmeric, Ginger, Fenugreek, Coriander, Cumin.

Unit III

Fennel, Ajowain, Black-cumin, Saffron, Asafoetida, Dill.

Unit IV

Aloe Vera, Ashwagandha, Sarpagandha, Kalmegh, Isabgol, Safed musli, Senna, Opium Poppy.

Unit V

Lemongrass, Citronella grass, Khus grass (Vetiver), Mentha, Geranium, Palmarosa, Ocimum. Patchouli.

VI. Practical

- Identification of seeds and plants
- Study of Botanical description
- Field layout and method of planting
- Study of crop specific cultural practices
- Study of harvest maturity, harvesting *etc.*

Signature
14/05/26

II. Teaching Methods/ Activities

Lecture, Assignment (Reading/ Writing), Presentation and Group work.

VIII. Learning outcome

After successful completion of this course, the students are expected to develop the technical skill in commercial cultivation of spice crops and able to start spice-based enterprises

IX. Suggested Reading:

1. **Barche S. 2016.** *Production Technology of Spices, Aromatic, Medicinal and Plantation Crops.* New India Publishing Agency, New Delhi.
2. **Das K. 2013.** *Essential Oils and their Applications.* New India Publishing Agency, New Delhi
3. **Kumar NA, Khader P, Rangaswami and Irulappan I. 2000.** *Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants.* Oxford and IBH.
4. **Pruthi JS. 2001.** *Minor Spices and Condiments- Crop Management and Post Harvest Technology.* ICAR.
5. **Pruthi JS. Ed. 1998.** *Spices and Condiments.* National Book Trust.
6. **Tiwari RS and Agarwal A. 2004.** *Production Technology of Spices.* International Book Distr.m Co.



Dr. M. L. Singh



Dr. S. K. Das
14/05/26

Dr. S. K. Das

Dr. S. K. Das



Course Title: Ornamental Gardening and Landscaping

II. Course Code: J-3063

III. Credit Hours: 4 (3+1)

IV. Aim of the course

Familiarization with principles and practices of landscaping. The students need to imbibe the principles of landscaping and should develop skills for planning under different situations.

V. Theory

Unit I

Historical background of gardening, Importance and scope of ornamental gardening, styles and types of gardens, formal and informal style gardens. English, Mughal, Japanese, Persian, Spanish, Italian, French, Hindu and Buddhist gardens.

Unit II

Garden components (living and non-living): ornamental trees, shrubs, palm, cycads, 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, colour wheels, clock garden, bamboo groves, bonsai; Non -living components like path, garden gate, fencing, paving and garden features like fountains, garden seating, swings, lanterns, basins, bird baths, sculptures, waterfalls, bridge, steps, ramps, Lawn -genera and species, establishment and maintenance.

Unit III

Specialised gardens such as vertical garden, roof garden, terrace garden, water garden, sunken garden, rock garden, shade garden, temple garden, sacred gardens (with emphasis on native plants), Zen garden.

Unit IV

Basic drawing skills, use of drawing instruments garden symbols, steps in preparation of garden design, programmes phase, design, phase, etc. Elements and principles of landscape design. Organization of spaces, visual aspects of plan arrangement- view, vista and axis. Principles of circulation, site analysis and landscape, water requirement, use of recycled water. Use of CAD in designing gardens.

Unit V

Urban landscaping, Landscaping for specific situations such as residential, farm houses, institutions, corporate sector, industries, hospitals, roadsides, traffic islands, Children parks, public parks, xeriscaping, airports, railway station and tracks, river banks and dam sites and IT/ SEZ parks, City square and boulevards. Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening.

14/05/26

I. Practical

- Identification of various types of ornamental plants for different gardens and occasions.
- Practices in planning and planting of special types of gardens.
- Burlapping, lawn making, planting of edges, hedges, topiary, herbaceous and shrubby borders.
- Visit to parks and botanical gardens.

VII. Teaching Methods/ Activities

Lectures, Group discussions, Flip classes, Assignment and group seminars, Hands on training on different models of landscaping and Exposure visits

VIII. Learning outcome

The students will be apprised of different types of gardens and have a thorough understanding of principles of landscape gardening. Develop skills for landscaping under different situations and layout of garden components.

IX. Suggested Reading

1. Bose TK, Maiti RG, Dhua RS and Das P. 1999. *Floriculture and Landscaping*. Naya Prokash, Kolkata, India.
2. Grewal HS and Singh P. 2014. *Landscape Designing and Ornamental Plants*. Kalyani Publishers, New Delhi.
3. Lauria A and Victor HR. 2001. *Floriculture-Fundamentals and Practices*. Agrobios Publ., Jodhpur.
4. Misra RL and Misra S. 2012. *Landscape Gardening*. Westville Publ. House, New Delhi, India.
5. Sabina GT and Peter KV. 2008. *Ornamental Plants for Gardens*. New India Publ. Agency, New Delhi, India.
6. Singh A and Dhaduk BK. 2015. *A Colour Handbook: Landscape Gardening*. New India Publ. Agency, New Delhi, India

Om

Shruti
14/05/26

Tim

Course Title: Breeding of Fruit and Plantation Crops

II. Course Code: J-3064

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To impart comprehensive knowledge about principles and methods of breeding of self- and cross-pollinated fruit and planation.

V. Theory

Fruit breeding-definition, problems in fruit breeding, Precocity induction in perennial fruit crops. 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, Genome editing, PPV&FR Act.

Unit I

Tropical fruits: Mango, Banana, Guava, Papaya, Pineapple, Sapota.

Unit II

Sub-tropical Fruits: Grapes, Citrus, Litchi, Pomegranate.

Unit III

Temperate Fruits: Apple, Peach, Pear, Plum, Straw-berry.

Unit IV

Minor Fruit: Ber, Bael, Aonla, Jamun.

Unit V

Plantation crops: Coconut, Cashew nut, Areca nut, Tea, Coffee.

VI. Practical

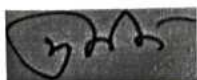
- Study of floral biology studies
- Pollen related studies
- Observation and analysis of various qualitative and quantitative traits.
- Study & practice of crossing technique in major fruit crops

VII. Teaching Methods/ Activities

Classroom Lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures and Group discussion

VIII. Learning outcome

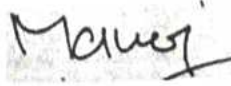
After successful completion of this course, the students are expected to acquire knowledge about the breeding of self- and cross-pollinated fruit, Improve yield, quality, abiotic and biotic resistance, and other important traits of fruit. Also understand how to start the breeding programme



Dr. J. S. Choudhary



Dr. S. S. Choudhary
14/05/26



Dr. M. S. Choudhary

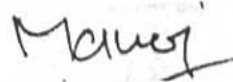


X. Suggested Reading

1. **Badenes ML and Byrne DH. 2012.** *Fruit Breeding*. Springer Science, New York.
2. **Dinesh MR. 2015.** *Fruit Breeding*, New India Publishing Agency, New Delhi.
3. **Jain SN and Priyadarshan PM. 2009.** *Breeding Plantation and Tree Crops: Tropical Species*. Springer Science, New York.
4. **Keshavachandran R, Nazeem PA, Girija D, John PS and Peter KV. 2007.** *Recent Trends in Biotechnology of Horticultural Crops*. Vols. I, II. NIPA, New Delhi.
5. **Litz RE. 2005.** *Biotechnology of Fruit and Nut Crops*. CABI, UK.
6. **Ray PK. 2002.** *Breeding Tropical and Subtropical Fruits*. Narosa Publ. House, New Delhi.



Girijana
14/05/20



I. Course Title: Preservation and Processing of Horticultural Produce

II. Course Code: J-4061

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To impart comprehensive knowledge on understand principles and different methods of preservation, principal spoilage organisms, canning of fruits and vegetables, processing equipments and layout of processing industry.

V. Theory

Unit I

History, importance, scope and present position of preservation. Concept and scope of value addition. General principles of fruit and vegetable preservation.

Unit II

Methods of preservation; asepsis, drying and dehydration, freezing, thermal processing (pasteurization, sterilization, canning) carbonation, irradiation. Preservatives; natural (sugar, salt, oil, vinegar, spices etc) and chemical (SO₂, benzoic acid, sorbic acid, antioxidants and antibiotics, newer preservatives.). Food fermentation – alcoholic, acetic and lactic fermentation. Hurdle technology. Minimally processed products.

Unit III

Processing unit- layout and establishment, processing tools. Quality requirements of raw materials for processing, preparation of raw material, primary processing: grading, sorting, cleaning, washing, peeling, slicing and blanching; minimal processing.

Unit IV

Preparation of various processed products from fruits and vegetables, flowers; role of sugar, salt, vinegar, spices and pectin in processed products. Jam, Jelly, Marmalade, Murabba, beverages, candy, pickle, tomato products; puree, ketchup, paste sauce etc.

Unit V

Quality assurance and storage system for processed products; FPO and AGMARK specialization, HACCP, FSSAI. Government policy on import and export of processed product and food law. Nutritive value of raw and processed products, plant sanitation and waste disposal. Types of horticultural and vegetables wastes and their uses, utilization of by- products from fruits and vegetables processing industries.

VI. Practical

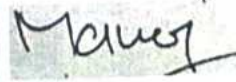
- Study of preparation and preservation of fruit-based beverages
- Study of preparation of Jam, Jelly and Marmalade
- Study of preparation of murraba, pickle etc.
- Study of preparation of dehydrated fruit and vegetables
- Sensory evaluation of fresh and processed fruits and vegetables



Dr. M. S. Reddy




Dr. S. S. Reddy
14/05/26



Dr. M. S. Reddy





VII. Teaching Methods/ Activities

Lecture, Assignment (Reading/ Writing), Student presentation and Group Work

VIII. Learning outcome

After successful completion of this course, the students are expected to be able to understand; unit operations of processing and preparation of various value-added products.

IX. Suggested Reading

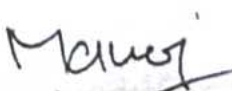
1. **FAO. 2007.** *Handling and Preservation of Fruits and Vegetables by Combined Methods for Rural Areas- Technical Manual.* FAO Agricultural Services Bulletin 149.
2. **Fellows PJ. 2009.** *Food Processing Technology: Principles and Practice* (3rd Edition), Woodhead Publishing, ISBN 9781845692162.
3. **Srivastava RP and Kumar S. 2014.** *Fruit and Vegetable Preservation: Principles and Practices* (3rd Edition), CBS Publishing, ISBN 9788123924373.
4. **Verma LR and Joshi VK. 2000.** *Postharvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management.* Indus Publishing Company, New Delhi, India. ISBN 8173871086.



Om



Srijana
14/05/26



Bir



Course Title: Seed Production of Vegetable and Flower Crops

II. Course Code: J-4062

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To impart a comprehensive knowledge and skills on quality seed production of vegetable and flower crops.

V. Theory

Unit I

Introduction, history and Scenario of Seed Industry: Scope, scenario and importance of seed production in vegetable and flower crops. Constraints in vegetable and flower seed production. Marketing and economics of vegetable and flower seeds.

Unit II

Definition of seed and its quality, seed morphology, development and maturation. Modes of propagation and reproductive behaviour; Pollination mechanisms and sex forms in vegetables. Isolation distance. Type of seed – Breeder, Foundation, Registered, Certified. Seed act, Seed rule.

Unit III

Seed production techniques of tomato, brinjal, chilli, okra, cauliflower, cabbage, cucurbits, garden pea, cowpea, radish, carrot, onion, palak and TPS of potato (true potato seed).

Unit IV

Seed production techniques of marigold, petunia, calendula, aster, phlox and annual chrysanthemum.

Unit IV:

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. Seed testing and Seed certification. Improved agro-techniques and field and seed standards. Import and export of seed and quarantine.

VI. Practical

- Study of floral biology and pollination mechanisms.
- Use of pollination control mechanisms in hybrid seed production.
- Maturity standards and seed extraction methods.
- Seed sampling and testing;
- Visit to commercial seed production areas,

VII. Teaching Methods/ Activities

Classroom Lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures and group discussion.

Dr. Jyoti
14/10/26

III. Learning outcome

After successful completion of this course, the students are expected to acquire knowledge about the complete seed production technology, extraction and post-extraction processing of vegetable and flower seeds

IX. Suggested Reading

1. **Agarwal PK and Anuradha V. 2018.** *Fundamentals of Seed Science and Technology.* Brilliant publications, New Delhi.
2. **Basra AS. 2000.** *Hybrid Seed Production in Vegetables.* CRC press, Florida, USA.
3. **Fageria MS, Arya PS and Choudhary AK. 2000.** *Vegetable Crops: Breeding and Seed Production.* Vol. I. Kalyani Publishers, New Delhi.
4. **Hazra P and Som HG. 2015.** *Seed Production and Hybrid Technology of Vegetable Crops.* Kalyani publishers, Ludhiana.
5. **Bhattacharjee SK. 2018.** *Advances in Ornamental Horticulture.* Vols. I-VI. Pointer Publ. Reprint, pp. 2065.

Oml

Sumit
14/05/26

Bindu

Course Title: Protected Cultivation of Horticultural Crops

II. Course Code: J-4063

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To impart latest knowledge about growing of horticulture crops under protected environmental conditions. The course is constructed given as under:

V. Theory

Unit I

Concept, scope and importance of protected cultivation of horticulture crops. Principles, design, orientation of structure, low and high-cost polyhouses / greenhouse structures.

Unit II

Classification and types of protected structures greenhouse/ polyhouses, plastic-non plastic low tunnels, plastic walk-in tunnels, high roof tunnels with ventilation, insect proof net houses, shed net houses, rain shelters, NVP, climate control greenhouses, hydroponics and aeroponics. Soil and soilless media for bed preparation. Design and installation of drip irrigation and fertigation system.

Unit IV

High-tech vegetable nursery raising in protected structures using plugs and portrays, different media for growing nursery under protected cultivation. Nursery problems and management technologies including fertigation.

Unit V

Regulation of flowering and fruiting in horticultural crops. Protected cultivation technology for raising tomato, sweet pepper, cucumber, rose, chrysanthemum, gerbera, liliun, orchid, strawberry; protected structures, including varieties and hybrids, training, pruning and staking in growing vegetables, flowers and fruits under protected structures.

Unit VI

Problems of growing different crops in protected structures and their remedies, physiological disorders, insect-pest, nematodes and disease management in protected structures. Use of protected structures for seed production. Application and importance of artificial intelligence (AI) and smart app in protected cultivation. Economics of greenhouse crop production. Component and application of precision farming; variable rate applicator (VRA), GIS and GPS in horticulture crop

VI. Practical

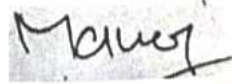
- Study of various types of protected structure
- Study of different methods to control temperature, carbon dioxide and light
- Study of different types of growing media, training and pruning systems in greenhouse crops
- Study of fertigation and nutrient management under protected structures
- Study of insect pests and diseases in greenhouse and its control
- Use of protected structures in hybrid seed production of vegetables and flowers
- Economics of protected cultivation (Any one crop)



Dr. J. K. Singh



Dr. J. K. Singh
14/05/26



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VII. Teaching Methods/ Activities

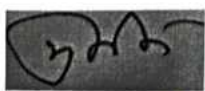
Classroom Lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures and Group discussion.

VIII. Learning outcome

After successful completion of this course, the students are expected to appreciate the scope and scenario of protected cultivation in India. Acquire knowledge about the effect of abiotic factors on growth, flowering and production of vegetable crops. Gaining knowledge about the designing of various low cost protected structures.

IX. Suggested Reading

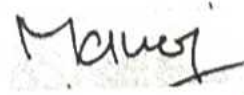
1. **Chandra S and Som V. 2000.** *Cultivating Vegetables in Greenhouse*. Indian horticulture 45:17-18.
2. **Kaloo G and Singh K. (Eds.). 2000.** *Emerging Scenario in Vegetable Research and Development*. Research periodicals and Book publ. house.
3. **Parvatha RP. 2016.** *Sustainable Crop Protection Under Protected Cultivation*. E-Book Springer.
4. **Singh B. 2005.** *Protected Cultivation of Vegetable Crops*. Kalyani publishers, New Delhi
5. **Singh DK and Peter KV. 2014.** *Protected Cultivation of Horticultural Crops* (1st Edition) New India publishing agency, New Delhi.



Dr. S. Chandra



Dr. G. Kaloo
14/05/26



Dr. K. Singh



I. Course Title: Breeding of Vegetable and Flower Crops

II. Course Code: J-4064

III. Credit Hours: 4 (3+1)

IV. Aim of the course

To impart comprehensive knowledge about principles and methods of breeding of self- and cross-pollinated vegetable and flowers.

V. 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, genome editing, PPV&FR Act.

Unit I

Tomato, Potato, Brinjal, Chilli, Okra,

Unit II

Cole Crops, Bulb crops and Leafy Vegetable Crops

Unit III

Legume Crops, Cucurbits, Radish, Carrot.

Unit IV

Rose, Chrysanthemum, Gerbera, Gladiolus, Carnation, Orchids.

Unit V

Marigold, Jasmine, Dahlia, Tuberose, Aster, Crossandra.

VII. Practical

- Study of floral biology of important crop.
- Study of selfing and crossing procedure.
- Observations and analysis of various qualitative and quantitative traits

VII. Teaching Methods/ Activities

Classroom Lectures, Assignment (written and speaking), Student presentation, Hands on training of different procedures and group discussion.

VIII. Learning outcome

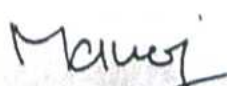
After successful completion of this course, the students are expected to acquire knowledge about the breeding of self- and cross-pollinated vegetable and flower crops and understand how to start the breeding programme



Dr. M. S. Singh



Dr. S. K. Singh
14/05/26

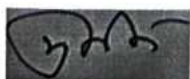


Dr. R. K. Singh

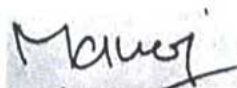


X. Suggested Reading

1. **Bhattacharjee SK. 2018.** Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ. Reprint, pp. 2065.
2. **Bose TK, Yadav LP, Pal P, Parthasarathy VA and Das,P. 2003.** Commercial Flowers. Vol. I & II. Naya Udyog, Kolkata, India.
3. **Fageria MS, Arya PS and Choudhary AK. 2000,** Vegetable Crops: Breeding and Seed Production. Vol. I. Kalyani.
4. **Hari Har Ram, 2025.** *Vegetable Breeding : Principles and Practices.* Kalyani Publishers, Ludhiana.
5. **Hazra P and Som MG. 2016.** Vegetable Seed Production and Hybrid Technology (Second Revised Edition), Kalyani Publishers, Ludhiana, 459 p



Prjane
14/05/26



TSim

