



IFTM
UNIVERSITY
M O R A D A B A D

NAAC ACCREDITED

N.H-24 Lodhipur Rajput , Delhi Road, Moradabad, Uttar Pradesh-244001

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(Effective from 2018-19)

Programme: M.Sc. Ag. Horticulture (Vegetable Science)

Programme Outcomes (POs):

Students completing this course will be able to:

1. Research based subjects such as scientific writing and ethics help students to build research aptitude.
2. The curriculum of this course lays strong emphasis on in-depth knowledge of theoretical and practical aspects for managing emerging issues in vegetable production by highlighting the usage of in protected cultivation and good agriculture practices in commercial vegetable crops.
3. Seminar based course develop presentation and technical skills in students.
4. A candidate who possesses a M.Sc. Ag. degree in Horticulture with specialization in Vegetable Science can be benefitted with an enormous number of job profiles under public and private organizations.
5. A growing export industry, increasing product demands and advances in horticultural technology is making this an extremely lucrative career.
6. Students can work in a wide range of areas in post harvest industries, agribusiness, crop management, high quality vegetable production units etc.
7. Students can also render their services as a scientist in the field of vegetable sciences.
8. The training institutes welcome such candidates for the posts of training organizers.
9. Students can go for higher degree programs for further research work.
10. Jobs are being created in sectors, both private and public, in fields such as research and journalism and also within and outside the borders.
11. Students may develop as an entrepreneur by producing and processing of vegetables.

School of Agriculture Sciences & Engineering
IFTM UNIVERSITY, MORADABAD
STUDY & EVALUATION SCHEME
M. Sc. Ag. Horticulture (Vegetable Science)

YEAR - I, SEMESTER – I

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
			L	T	P	Mid Term Exam		External Exam			
						CT	AS +AT		Total		
Theory											
1.	MAHV 101	Production Technology of Cool Season Vegetable Crops	3	0	0	20	10	30	70	100	3
2.	MAHV 102	Growth and Development of Vegetable Crops	3	0	0	20	10	30	70	100	3
3.	MAHV 103	Organic Vegetable Production Technology	3	0	0	20	10	30	70	100	3
4.	MAHV 104	Protected Cultivation of Vegetable Crops	3	0	0	20	10	30	70	100	3
Practical's / Project											
5.	MAHV 151	Production Technology of Cool Season Vegetable Crops Lab	0	0	2	20	10	30	70	100	1
6.	MAHV 152	Growth and Development of Vegetable Crops Lab	0	0	2	20	10	30	70	100	1
Total			12	0	4	-	-	-	-	600	14

School of Agriculture Sciences & Engineering
IFTM UNIVERSITY, MORADABAD
STUDY & EVALUATION SCHEME
M. Sc. Ag. Horticulture (Vegetable Science)

YEAR – I, SEMESTER – II

S.N.	Course Code	Course Name	Periods			Evaluation Scheme				Course Total	Credits
			L	T	P	Mid Term Exam			External Exam		
						CT	AS +AT	Total			
Theory											
1.	MAHV 201	Production Technology of Warm Season Vegetable Crops	3	0	0	20	10	30	70	100	3
2.	MAHV 202	Fundamentals of Processing of Vegetables	3	0	0	20	10	30	70	100	3
3.	MAHV 203	Elective I	3	0	0	20	10	30	70	100	3
4.	MMAG 204	Agricultural Statistics and Experimental Designs	3	0	0	20	10	30	70	100	3
Practical's / Project											
5.	MAHV 251	Production Technology of Warm Season Vegetable Crops Lab	0	0	2	20	10	30	70	100	1
6.	MMAG 254	Agricultural Statistics and Experimental Designs Lab	0	0	2	20	10	30	70	100	1
Total			12	0	4	-	-	-	-	600	14

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M. Sc. Ag. Horticulture (Vegetable Science)

YEAR – II, SEMESTER – III

S.N.	Course Code	Course Name	Periods			Evaluation Scheme				Course Total	Credits
			L	T	P	Mid Term Exam		External Exam			
						CT	AS +AT		Total		
Theory											
1.	MAHV 301	Breeding of Vegetable Crops	3	0	0	20	10	30	70	100	3
2.	MAHV 302	Seed Production Technology of Vegetable Crops	3	0	0	20	10	30	70	100	3
3.	MAHV 303	Elective II	3	0	0	20	10	30	70	100	3
Practical's / Project											
4.	MAHV351	Breeding of Vegetable Crops Lab	0	0	2	20	10	30	70	100	1
5.	MAHV352	Seminar	0	0	2	-	-	100	-	100	1
6.	MAHV354	Pre- Dissertation	0	0	2	-	-	50	50	100	1
Total			9	0	6	-	-	-	-	600	12

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M. Sc. Ag. Horticulture (Vegetable Science)

YEAR - II, SEMESTER – IV

S.N.	Course Code	Course Name	Periods			Evaluation Scheme				Course Total	Credits
						Mid Term Exam			External Exam		
			L	T	P	CT	AS +AT	Total			
Theory											
-	-	-	-	-	-	-	-	-	-	-	-
Practical's / Project											
1.	MAHV 451	Dissertation Work	0	0	20	-	-	300	300	600	20
Total			-	-	20	-	-	-	-	600	20

School of Agriculture Sciences & Engineering
IFTM UNIVERSITY, MORADABAD
STUDY & EVALUATION SCHEME
M. Sc. Ag. Horticulture (Vegetable Science)

List of Electives

Group - A

Elective I

S.N.	CODE	Name of Elective
1.	MAHV 203 I	Diseases of Vegetable Crops and Management
2.	MAHV 203 II	Abiotic Stress Management in Vegetable Crops

Group - B

Elective II

S.N.	CODE	Name of Elective
1.	MAHV 303 I	Production Technology of Under Exploited Vegetable Crops
2.	MAHV 303 II	Systematic of Vegetable Crops

MAHV-101 Production Technology of Cool Season Vegetable Crops L:T:P 3:0:0

Objective: To impart comprehensive knowledge of the scientific production technology of vegetables grown in cool season.

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

UNIT I

Potato.

UNIT II

Cole crops: cabbage, cauliflower, knoll kohl, sprouting broccoli, Brussels. Sprout

UNIT III

Root crops: carrot, radish, turnip and beetroot.

UNIT IV

Bulb crops: onion and garlic.

UNIT V

Peas and broad bean, green leafy cool season vegetables.

Course outcomes:

After completion of this course students would be able to

- Understand the cultivation practices of different cool season vegetables for commercial production.
- Know the general informations regarding plant protection and post harvest management of commercial vegetable crops of cool season.

References:

1. Bose TK & Som MG. (Eds.). 1986. *Vegetable Crops in India*. Naya Prokash.
2. Bose TK, Som G & Kabir J. (Eds.). 2002. *Vegetable Crops*. Naya Prokash.
3. Bose TK, Som MG & Kabir J. (Eds.). 1993. *Vegetable Crops*. Naya Prokash.

4. Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. *Vegetable Crops*. Vols. I- III. Naya Udyog.
5. Chadha KL & Kalloo G. (Eds.). 1993-94. *Advances in Horticulture* Vols. V-X. Malhotra Publ. House.
6. Chadha KL. (Ed.). 2002. *Hand Book of Horticulture*. ICAR.
7. Chauhan DVS. (Ed.). 1986. *Vegetable Production in India*. Ram Prasad & Sons.

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- <https://iasri.icar.gov.in/>
- <https://tnau.ac.in/>
- <http://ecoursesonline.iasri.res.in/>

MAHV 151 Production Technology of Cool Season Vegetable Crops Lab L:T:P 0:0:1

List of Experiments:

1. Study of cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of winter vegetable crops and their economics.
2. Conduction of experiments to demonstrate the role of mineral elements.
3. Study the effect of plant growth substances on cool season vegetables crops
4. Study the herbicides use in cool season vegetable crops
5. Identification and study of different physiological disorders in vegetable crops
6. Preparation of cropping scheme for commercial vegetable farms
7. A visit to commercial greenhouse/ polyhouse.

MAHV 102

Growth and Development of Vegetable Crops

L:T:P 3:0:0

Objective: Concepts dealing with the physiological response of crop plants to the environment from the time of seed germination through to reproduction

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Physiology of fruit set, fruit development, fruit growth, flower and fruit drop; parthenocarpy in vegetable crops; phototropism, ethylene inhibitors, senescence and abscission; fruit ripening and physiological changes associated with ripening.

UNIT V

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

Course outcomes:

On completion of the course students should be able to:

- Distinguish key physiological processes underlying the formation of seedlings from seed embryos;
- Identify the physiological factors that regulate growth and developmental processes of crop plants, and clearly define their roles;
- Evaluate the different strategies used by plants to acquire and utilize resources, and formulate a logical argument of their impact on crop productivity;

- Recognize the significance of assimilate translocation and patterns of its partitioning in determining crop yield;
- Demonstrate clear understanding of crop-environment interaction and its implication on crop growth and yield;
- Relate crop physiological processes with agronomic practices used in crop production systems; and
- Integrate and apply their knowledge of crop physiology for analytical thinking and solving practical problems experienced in agricultural systems.

References:

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

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- <https://www.extension.iastate.edu>
- https://plantcellbiology.masters.grkraj.org/html/Plant_Growth_And_Development12-Physiology_Of_Dormancy.htm
- <http://www.freepatentsonline.com/y2017/0073308.html>
- <https://iasri.icar.gov.in/>
- <https://tnau.ac.in/>

List of Experiments:

1. Preparation of solutions of plant growth substances and their application.
2. Experiments in breaking and induction of dormancy by chemicals.
3. Induction of parthenocarpy and fruit ripening.
4. Application of plant growth substances for improving flower initiation.
5. Changing sex expression in cucurbits and checking flower and fruit drops and improving fruit set in solanaceous vegetables.
6. Growth analysis techniques in vegetable crops.

Objective: To impart knowledge about the cultivation of vegetable using organic inputs and utilizing on farm resources.

UNIT I

Importance, principles, perspective, concept and component of organic production of vegetable crops

UNIT II

Organic production of vegetables crops, *viz.*, solanaceous crops, cucurbits, cole crops, root and tuber crops.

UNIT III

Managing soil fertility, pests and diseases and weed problems in organic farming system; crop rotation in organic horticulture; processing and quality control for organic foods.

UNIT IV

Methods for enhancing soil fertility, mulching, raising green manure crops. Indigenous methods of compost, Panchagavya, Biodynamics preparation etc. Pest and disease management in organic farming; ITK's in organic farming. Role of botanicals and bio-control agents.

UNIT V

GAP and GMP- Certification of organic products; organic production and export - opportunity and challenges.

Course outcome:

After completion of this course students will be able to

- know different organic inputs for vegetable production
- understand the standard techniques of application of organic input for commercial cultivation of vegetables
- know different mechanical, cultural and biological technologies to replace agro chemicals
- understand the methodology and process of organic certification of organic vegetable produce.

References:

1. Dahama AK. 2005. *Organic Farming for Sustainable Agriculture*. 2nd Ed. Agrobios.
2. Gehlot G. 2005. *Organic Farming; Standards, Accreditation Certification and Inspection*. Agrobios.
3. Palaniappan SP & Annadorai K. 2003. *Organic Farming, Theory and Practice*. Scientific Publ.
4. Pradeepkumar T, Suma B, Jyothibhaskar & Satheesan KN. 2008. *Management of Horticultural Crops*. New India Publ. Agency.
5. Shivashankar K. 1997. *Food Security in Harmony with Nature*. 3rd IFOAMASIA Scientific Conf.. 1- 4 December, 1997, UAS, Bangalore

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Objective: Explain the basics of protected cultivation and its significance in crop cultivation. Demonstrate about different types of greenhouse, its design and cost estimation.

Crops: Tomato, capsicum, cucumber, melons and lettuce

UNIT I

Importance and scope of protected cultivation of vegetable crops; principles used in protected cultivation, energy management, low cost structures; training methods; engineering aspects.

UNIT II

Regulatory structures used in protected structures; types of greenhouse/polyhouse/nethouse, hot beds, cold frames, effect of environmental factors, *viz.* temperature, light, CO₂ and humidity on growth of different vegetables, manipulation of CO₂, light and temperature for vegetable production, fertigation.

UNIT III

Nursery raising in protected structures like poly-tunnels, types of benches and containers, different media for growing nursery under cover.

UNIT IV

Regulation of flowering and fruiting in vegetable crops, technology for raising tomato, sweet pepper, cucumber and other vegetables in protected structures, training and staking in protected crops, varieties and hybrids for growing vegetables in protected structures.

UNIT V

Problem of growing vegetables in protected structures and their remedies, insect and disease management in protected structures; soil-less culture, use of protected structures for seed production.

Course outcomes:

At the end of the course the student should be able to

- Summarize the scope and importance of greenhouse technology in improving crop production.
- Compare various types of greenhouses, its advantages and cost benefits.

- Students are able to successfully growing the different vegetable crops in protected conditions.

References:

1. Anonymous 2003. *Proc. All India Seminar on Potential and Prospects for Protective Cultivation*. Organised by Institute of Engineers, Ahmednagar. Dec.12-13, 2003.
2. Chandra S & Som V. 2000. *Cultivating Vegetables in Green House*. *Indian Horticulture* 45: 17-18.
3. Prasad S & Kumar U. 2005. *Greenhouse Management for Horticultural Crops*. 2nd Ed. Agrobios.
4. Tiwari GN. 2003. *Green House Technology for Controlled Environment*. Narosa Publ. House.

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MAHV–201 Production Technology of Warm Season Vegetable Crops L:T:P 3:0:0

Objectives: To impart comprehensive knowledge about the scientific production technology of vegetables specially grown in warm season

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

UNIT I

Tomato, eggplant, hot and sweet peppers

UNIT II

Okra, beans, cowpea and cluster bean

UNIT III

Cucurbitaceous crops

UNIT IV

Tapioca and sweet potato

UNIT V

Green leafy warm season vegetables

Outcome: after completion of this course students will be able to

- understand the cultivation practices of different warm season vegetables for commercial production.
- know the general informations regarding plant protection and post harvest management of commercial vegetable crops of warm season.

References:

1. Bose TK & Som MG. (Eds.). 1986. *Vegetable Crops in India*. Naya Prokash.
2. Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. *Vegetable Crops*. Vols. I-III. Naya Udyog.

3. Chadha KL & Kalloo G. (Eds.). 1993-94. *Advances in Horticulture*. Vols. V-X. Malhotra Publ. House.
4. Chauhan DVS. (Ed.). 1986. *Vegetable Production in India*. Ram Prasad & Sons.
5. Decoteau DR. 2000. *Vegetable Crops*. Prentice Hall.
6. Edmond JB, Musser AM & Andrews FS. 1964. *Fundamentals of Horticulture*. Blakiston Co
7. Fageria MS, Choudhary BR & Dhaka RS. 2000. *Vegetable Crops: Production Technology*. Vol. II. Kalyani.
8. Gopalakrishanan TR. 2007. *Vegetable Crops*. New India Publ. Agency.
9. Hazra P & Som MG. (Eds.). 1999. *Technology for Vegetable Production and Improvement*. Naya Prokash.
10. Kalloo G & Singh K (Ed.). 2000. *Emerging Scenario in Vegetable Research and Development*. Research Periodicals & Book Publ. House.
11. Nayer NM & More TA 1998. *Cucurbits*. Oxford & IBH Publ.
12. Palaniswamy & Peter KV. 2007. *Tuber Crops*. New India Publ. Agency.
13. Pandey AK & Mudranalay V. (Eds.). *Vegetable Production in India: Important Varieties and Development Techniques*.
14. Rana MK. 2008. *Olericulture in India*. Kalyani.
15. Rana MK. 2008. *Scientific Cultivation of Vegetables*. Kalyani.

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List of Experiments:

1. To study the cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of summer vegetable crops and their economics.
2. Study and identification of different physiological disorders and deficiency symptoms of mineral elements.
3. Preparation of cropping schemes for commercial vegetable farm.
4. Laid out the experiments to demonstrate the role of mineral elements.
5. Study the use of plant growth substances regarding the warm season vegetables
6. Study the use of herbicides for controlling the weeds in warm season vegetables
7. Study the procedure and techniques of seed extraction of different warm season vegetables
8. Identification of important pests and diseases and their control.
9. To study the maturity standards (indices) in different vegetable crops
10. To study the economics of production of warm season vegetable crops.

Objectives: To educate the students about fundamentals of vegetable processing.

UNIT I

History of food preservation. Present status and future prospects of vegetable preservation industry in India.

UNIT II

Spoilage of fresh and processed horticultural produce; biochemical changes and enzymes associated with spoilage of horticultural produce; principal spoilage organisms, food poisoning and their control measures. Role of microorganisms in food preservation.

UNIT III

Raw materials for processing. Primary and minimal processing; processing equipments; Layout and establishment of processing industry, FPO licence. Importance of hygiene; Plant sanitation.

UNIT IV

Quality assurance and quality control, TQM, GMP. Food standards – FPO, PFA, etc. Food laws and regulations., Food safety – Hazard analysis and critical control points (HACCP). Labeling and labeling act, nutrition labeling.

UNIT V

Major value added products from vegetables. Utilization of by products of vegetable processing industry; Management of waste from processing factory. Investment analysis. Principles and methods of sensory evaluation of fresh and processed vegetables

Course outcomes:

On successful completion of this course a student will be able to:

- Summarize the history and scope of processing of vegetables.
- Aware about the different quality assurance and control measures of processing of vegetables
- Identify the spoilage in fruits and vegetables and state the reason for the spoilage following safety precautions.

- Able to prepare different value added products.

References:

1. Arthey D & Dennis C. 1996. *Vegetable Processing*. Blackie/Springer- Verlag.
2. Chadha DS. 2006. *The Prevention of Food Adulteration Act*. Confed. of Indian Industry.
3. Desrosier NW. 1977. *Elements and Technology*. AVI Publ. Co.
4. FAO. 1997. *Fruit and Vegetable Processing*. FAO.
5. FAO. *CODEX Alimentarius: Joint FAO/WHO Food Standards Programme*. 2nd Ed. Vol. VB. *Tropical Fresh Fruits and Vegetables*. FAO.
6. FAO. *Food Quality and Safety Systems – Training Manual on Food Hygiene and HACCP*. FAO.
7. Fellow's P. 1988. *Food Processing Technology*. Ellis Horwood International.

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Objective: The main aims of this course are to provide comprehensive knowledge of the basic information of agriculture statistics and experimental design. To provide the scientific basis for the study of the development of economic and social development, planning and decision making in the field of agricultural engineering.

Unit I

Presentation of Data: Frequency distributions; graphical presentation of data by histogram, frequency polygon, frequency curve and cumulative frequency curves Measures of Locations and Dispersion: Mean, median, mode and their simple properties (with-out derivation) and calculations of median by graphs; range, mean deviation, standard deviation, standard error, coefficient of variation.

Unit II

Probability and Distributions: Random distributions; events exhaustive, mutually exclusive and equally likely; definition of probability (with simple exercises); definitions of binomial, Poisson's and normal distributions; and simple properties of the above distributions (without derivation)

Unit III

Correlation and Regression: Bivariate data-simple correlation and regression coefficients and their relation; Spearman rank correlation; limits of correlation coefficient; effect of change of origin and scale on correlation coefficient; linear regression and equations of line of regression; association and independence of attributes.

Unit IV

Sampling: Concept of population and sample; random samples; methods of taking a simple random sample. Tests of significance: sampling distribution of mean and standard error; z and t-test (equality of means; paired and unpaired t-test); t-test for comparison of means when variances of two populations differ; Chi- square test for goodness of fit; independence of attributes, and homogeneity of samples; interrelation between t-test and F-Test.

Unit V

Experimental Designs: Principles of experimental designs; completely randomized, randomized complete block design (missing plot value in RBD); latin square designs; augmented block design; simple factorial experiments including split and strip plot design

(mathematical derivations not required); analysis of variance (ANOVA) and its use including estimation of LSD (CD).

Course Outcomes:

The student is able to

- Understand basic theoretical and applied principles of agricultural statistics needed to enter in agriculture.
- Demonstrate an understanding of the basic concepts of probability and random variables.
- Understand and interpret the concepts of descriptive statistics from the obtained data.
- Utilize and apply regression and other statistical methods to analyze commodity markets and economic data.
- Gain proficiency in using statistical software for data analysis.

References:

1. J. Medhi: Statistical Methods, New age International (P) Ltd.
2. J.K.Goyal & J.N.Sharma, Mathematical Statistics.
3. J.K.Ghosh, Mathematical Statistics, John Wiley & Sons, New York.
4. S.C.Gupta & V.K.Kapoor. Advanced Statistics, S.Chand.
5. M.Ray, Mathematical Statistics, R.P & Sons, Agra.
6. Goulden, C.H. (1952). Methods of Statistical Analysis, 2/e, John Wiley, New York
7. Panse, V.C. and Sukhatme, P.V. (1967). Statistical Methods for Agricultural Workers, I.C.A.R., New Delhi.

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List of Experiments:

1. Measurement of central tendency and dispersion
2. Standard deviation and standard error
3. Principle uses of χ^2 , F and T- test.
4. Correlation Coefficient, Regression coefficient and Regression equation.
5. Analysis of data generated from completely randomized design, randomized block design.
6. Analysis of data generated from Latin square design, factorial experiments in 2^2 , 2^3 Split plot designs
7. Missing plot techniques.
8. Analysis of covariance.
9. Sampling in field experiments.
10. Analysis of variance (ANOVA).

Objective: To become students aware of scope of breeding in vegetable crops for conservation of development of area specific variety/hybrids indulging disease resistance.

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

UNIT I

Potato and tomato

UNIT II

Eggplant, hot pepper, sweet pepper and okra

UNIT III

Peas and beans, amaranth, chenopods and lettuce

UNIT IV

Gourds, melons, pumpkins and squashes

UNIT V

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

Course outcomes:

- Students will be able to determine the breeding objectives, selection criteria and methods for improvement of vegetables.
- Students can assess the performance and preserve the genetic resources of vegetables for further breeding use.
- Students make them clear about protection of varieties and rights of their use for farmer and breeder.
- Students will be able to introduce the new plants or varieties on the basis of its nutritive values, yield potential and disease resistance.

References:

1. Allard RW. 1999. *Principles of Plant Breeding*. John Wiley & Sons.
2. Basset MJ. (Ed.). 1986. *Breeding Vegetable Crops*. AVI Publ.
3. Dhillon BS, Tyagi RK, Saxena S. & Randhawa GJ. 2005. *Plant Genetic Resources: Horticultural Crops*. Narosa Publ. House.
4. Fageria MS, Arya PS & Choudhary AK. 2000. *Vegetable Crops: Breeding and Seed Production*. Vol. I. Kalyani.
5. Gardner EJ. 1975. *Principles of Genetics*. John Wiley & Sons.34
6. Hayes HK, Immer FR & Smith DC. 1955. *Methods of Plant Breeding*. McGraw-Hill.
7. Hayward MD, Bosemark NO & Romagosa I. (Eds.). 1993. *Plant Breeding- Principles and Prospects*. Chapman & Hall.
8. Kalloo G. 1988. *Vegetable Breeding*. Vols. I-III. CRC Press.
9. Kalloo G. 1998. *Vegetable Breeding*. Vols. I-III (Combined Ed.). Panima Edu. Book Agency.
10. Kumar JC & Dhaliwal MS. 1990. *Techniques of Developing Hybrids in Vegetable Crops*. Agro Botanical Publ.
11. Paroda RS & Kalloo G. (Eds.). 1995. *Vegetable Research with Special Reference to Hybrid Technology in Asia-Pacific Region*. FAO.
12. Peter KV & Pradeepkumar T. 2008. *Genetics and Breeding of Vegetables*. Revised, ICAR.
13. Rai N & Rai M. 2006. *Heterosis Breeding in Vegetable Crops*. New India Publ. Agency.
14. Singh BD. 1983. *Plant Breeding*. Kalyani.

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- <https://horticulture.ces.ncsu.edu/horticulture-vegetables/vegetable-breeding/>
- <https://worldveg.tind.io/record/17970?ln=en>
- <http://cucurbitbreeding.com/>

List of Experiments:

1. Study of selection of desirable plants from breeding population
2. Observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations;
3. Study of induction of flowering, phenological characters
4. Study of selfing and crossing techniques in vegetable crops
5. To study the procedure of hybrid seed production of vegetable crops in bulk.
6. To study the screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops,
7. Demonstration of sib-mating and mixed population; molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques.
8. A visit to breeding blocks.

MAHV 302 Seed Production Technology of Vegetable Crops L:T:P 3:0:0

Objective: To make the students aware about new seed polices, maintenance of different categories of seeds, their processing and storage.

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 VI

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, vegetatively propagated vegetables.

Course outcomes:

- Students will become aware about increased scope of vegetable seed production in seed industry as per new seed polices.
- Students will be able to the generation system of seeds, certification standards and process.
- Students will become self-reliant in producing own farm seeds for harvesting profuse yield.
- Students will be able to determine the requirements of processing and storage of seed.

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1. Agrawal PK & Dadlani M. (Eds.). 1992. *Techniques in Seed Science and Technology*. South Asian Publ.
2. Agrawal RL. (Ed.). 1997. *Seed Technology*. Oxford & IBH.
3. Bendell PE. (Ed.). 1998. *Seed Science and Technology: Indian Forestry Species*. Allied Publ.
4. Fageria MS, Arya PS & Choudhary AK. 2000. *Vegetable Crops: Breeding and Seed Production*. Vol. I. Kalyani.
5. George RAT. 1999. *Vegetable Seed Production*. 2nd Ed. CABI.
6. Kumar JC & Dhaliwal MS. 1990. *Techniques of Developing Hybrids in Vegetable Crops*. Agro Botanical Publ.
7. More TA, Kale PB & Khule BW. 1996. *Vegetable Seed production Technology*. MAHVarashtra State Seed Corp.
8. Rajan S & Baby L Markose. 2007. *Propagation of Horticultural Crops*. New India Publ. Agency.
9. Singh NP, Singh DK, Singh YK & Kumar V. 2006. *Vegetable Seed Production Technology*. International Book Distributing Co.
10. Singh SP. 2001. *Seed Production of Commercial Vegetables*. Agrotech Publ. Academy

Website Sources:-

- <http://ecoursesonline.iasri.res.in/course/view.php?id=174>
- https://avrdc.org/portfolio_category/seed-production/
- <http://www.ciks.org/downloads/seeds/4.%20Seed%20Production%20Techniques%20for%20Vegetables.p>

Objective: To study major diseases and their management of vegetable crops.

Economic Importance, symptoms, cause, disease cycle and integrated management of diseases of crops given below:

Unit I

Chilli (anthracnose, viral disease)

Brinjal (Phomopsis blight, fruit rot, sclerotinia rot, bacterial wilt, root knot)

Unit II

Potato (early and late blight, black scurf, common scab, bacterial wilt, viral disease)

Okra (YMV), Colocasia spp.

Unit III

Tomato (Damping-off, wilt root knot, late and early blight, viral disease)

Beans (anthracnose, blights, viral disease, rust),

Unit IV

Crucifers (damping-off, downy mildew and black rot)

Onion (yellow dwarf), coconut (root wilt, stem rot)

Unit V

Cucurbits (downy mildew, powdery mildew, Fusarium wilt, mosaic)

Course outcome

- Students will know diagnosing symptoms, etiology, disease cycle and management of major diseases of vegetable crops.

References:

1. Pathak, V. N. 1980. Diseases of Fruit Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Singh, R.S. 1994. Diseases of Vegetable Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Singh, R.S. 2000. Diseases of Fruit Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Sohi, H. S. 1992. Diseases of Ornamental Plants in India. ICAR, New Delhi.
5. Varma, L.R. and Sharma, R.C. 1999. Diseases of Horticultural Crops. Indus Publishing Co., New Delhi.

Website Sources:

- <https://agrimoon.com>
- <https://tnau.ac.in/>
- <https://www.rku.ac.in>
- <http://ecoursesonline.iasri.res.in/>
- <https://iasri.icar.gov.in/>
- <http://www.agrilance.com>

MAHV 203 (II) Abiotic Stress Management in Vegetable Crops L:T:P 3:0:0

Objective: To develop the understanding of growing vegetable crops under abiotic stress and harmful effect of adverse soil conditions on plant growth and development.

UNIT I

Environmental stress and its types, soil parameters including pH, classification of vegetable crops based on susceptibility and tolerance to various types of stress; root stock, use of wild species, use of anti-transpirants.

UNIT II

Mechanism and measurements of tolerance to drought, water logging, soil salinity, frost and heat stress in vegetable crops.

UNIT III

Soil-plant-water relations under different stress conditions in vegetable crops production and their management practices.

UNIT IV

Techniques of vegetable growing under water deficit, water logging, salinity and sodicity.

UNIT V

Techniques of vegetable growing under high and low temperature conditions, use of chemicals in alleviation of different stresses.

Course outcomes:

- Students will understand the use of rootstocks and anti-transparent under stress soil conditions.
- Understanding of soil-plant-water relations is used to develop management practices under different stress conditions in vegetable crops production.
- Students can be able to compare techniques of vegetable growing under high and low temperature conditions.

References:

1. Dwivedi P & Dwivedi RS. 2005. Physiology of Abiotic stress in Plants. Agrobios.
2. Lerner HR (Ed.). 1999. Plant Responses to Environmental Stresses. Marcel Decker.

3. Maloo SR. 2003. Abiotic Stresses and Crop Productivity. Agrotech Publ. Academy.

Website Sources:

- <https://icar.org.in/files/English-Unit/Horticulture/ABIOTIC%20STRESS%20MANAGEMENT%20IN%20VEGETABLE%20CROPS.html>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5827537/>
- https://www.researchgate.net/publication/251118836_Plant_Water_Relations_Plant_Stress_and_Plant_Production.
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6379354/>
- <https://www.mdpi.com/2311-7524/3/2/30/htm>
- https://scielo.conicyt.cl/scielo.php?script=sci_arttext&pid=S0718-95162012000200003

MAHV 303 (I) Production Technology of Underexploited Vegetable Crops L:T:P 3:0:0

Objectives: To educate the students about production technology of underexploited vegetable crops.

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

UNIT I

Asparagus, artichoke and leek

UNIT II

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

UNIT III

Amaranth, celery, parsley, parsnip, lettuce, rhubarb, spinach, basella, bathua (chenopods) and chekurmanis.

UNIT IV

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

UNIT V

Sweet gourd, spine gourd, pointed gourd, Oriental pickling melon and little gourd (kundru).

Course outcomes:

- The students will be well versed with package of practices of underexploited vegetables so as to enhance their production.

References:

1. Bhat KL. 2001. *Minor Vegetables - Untapped Potential*. Kalyani.
2. Indira P & Peter KV. 1984. *Unexploited Tropical Vegetables*. Kerala Agricultural University, Kerala.

3. Peter KV. (Ed.). 2007-08. *Underutilized and Underexploited Horticultural Crops*. Vols. I-IV. New India Publ. Agency.
4. Rubatzky VE & Yamaguchi M. (Eds.). 1997. *World Vegetables: Principles, Production and Nutritive Values*. Chapman & Hall
5. Srivastava U, MAHVajan RK, Gangopadyay KK, Singh M & Dhillon BS. 2001. *Minimal Descriptors of Agri-Horticultural Crops*. Part-II: *Vegetable Crops*. NBPGR, New Delhi.

Website Sources:

- <http://www.rvskvv.net/>
- <http://www.hillagric.ac.in/>
- <https://iasri.icar.gov.in/>
- <https://tnau.ac.in/>
- <http://ecoursesonline.iasri.res.in/>

Objective: To make the students able to classify the vegetables.

UNIT I

Principles of classification; different methods of classification; salient features of international code of nomenclature of vegetable crops.

UNIT II

Origin, history, evolution and distribution of vegetable crops, botanical description of families, genera and species covering various tropical, subtropical and temperate vegetables.

UNIT III

Cytological level of various vegetable crops; descriptive keys for important vegetables.

UNIT IV

Importance of molecular markers in evolution of vegetable crops; molecular markers as an aid in characterization and taxonomy of vegetable crops.

Course Outcomes:

- Students learn the systematics of naming crops based on different methods of classification.
- Students would be able to understand the climatic requirement of vegetable crops for their distribution in adaptable climatic zones.
- Students will understand the role of molecular markers in characterization of vegetable crops at cytological level.

References:

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2. Dutta AC. 1986. A Class Book of Botany. Oxford Univ. Press.
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4. Peter KV & Pradeepkumar T. 2008. Genetics and Breeding of Vegetables. (Revised), ICAR.
5. Soule J. 1985. Glossary for Horticultural Crops. John Wiley & Sons.
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7. 2001. Minimal Descriptors of Agri-Horticultural Crops. Part-II: Vegetable Crops. NBPGR, New Delhi.
8. Vasistha. 1998. Taxonomy of Angiosperm. Kalyani.

9. Vincent ER & Yamaguchi M. 1997. World Vegetables. 2nd Ed. Chapman & Hall.

Website Sources:

- <https://icar.org.in/files/English-Unit/Horticulture/SYSTEMATICS%20OF%20VEGETABLE%20CROPS.html>
- <https://www.cabi.org/Uploads/CABI/OpenResources/45346/Welbaum%20Ch1.pdf>
- <https://link.springer.com/book/10.1007%2F978-94-011-7907-2>.
- <https://actascientific.com/ASAG/pdf/ASAG-03-0348.pdf>
- https://www.researchgate.net/publication/227251030_Molecular_markers_Its_application_in_crop_improvement.