RAMA UNIVERSITY, UTTAR PRADESH, KANPUR

Faculty of Agricultural Sciences and Allied Industries



EVALUATION SCHEME

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SYLLABUS

[Effective from the Session 2024-25]

M.Sc. (Ag.) Horticulture (Fruit Science)

RAMA UNIVERSITY UTTAR PRADESH, KANPUR

A meeting of the Board of Studies of the Faculty of Agriculture & Allied Sciences, Rama University Uttar Pradesh, Kanpur was held on 11th May 2024-25 at 11 AM. The following members were present:

- 1. Dr. Aneeta Yadav
- 2. Dr. Jitendra Kumar
- 3. Dr. Vinay Joseph Silas
- 4. Dr. V.K Tripathi

The quorum of the meeting was complete. Agenda of the meeting:

- 1. Assessment Criteria
- 2 Cestion Paper Format
- 3. Syllabus

The meeting resolved unanimously that attached Assessment Criteria, Question Paper Format and Syllabus are justified and approved.

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Convener Signature: .. Dr. Aneeta Yadav Name Date

Internal Members

Signature:

te:

1..... Name: Dr. Jitendra Kumar

Dr. Vinay Joseph Silas

External Members 1..... Name : Prof (Dr) V. K Tripathi

Date:

Convener Member Member External Member

Faculty of Agricultural Sciences and Allied Industries Rama University, Kanpur, Uttar Pradesh Effective from Session (2024-25) M.Sc. (Ag) Horticulture (Fruit Science)

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S.	Subject Code	Subject Name	Pe	Period		Evaluation Scheme		Subject Total	Credit Hours	
140.			L	T	P	CE	MTE	ETE	2	
			1	Theor	y Sub	jects				
			1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	Sem	ester-	1st				1
1.	HOFS -501	Tropical Fruit Production.	2	0	0	20	20	60	100	2
2.	HOFS-503	Propagation and Nursery Management for Fruit Crops.	2	0	0	20	20	60	100	2
3.	HOFS-508	Nutrition of Fruit Crops	2	0	0	20	20	60	100	2
4.	MSS-102	Soil Fertility and Fertilizer Use	2	0	0	20	20	60	100	2
5.	ENT-731	Pests of Horticultural and Plantation Crops	2	0	0	20	20	60	100	2
6.	MAS-104	Computer Application	2	0	0	20	20	60	<u>,</u> 100	2
7.	GPB-312	Intellectual Property Rights	2	0	0	20	20	60	100	2
				P	ractic	al/Proje	et		1	1
1.	HOFS -501 P	Tropical Fruit Production.	0	0	1	30	20	50	100	
2.	HOFS-503 P	Propagation and Nursery Management for Fruit Crops	0	0	1	30	20	50	100	
3.	HOFS-508 P	Nutrition of Fruit Crops	0	0	1	30	20	50	100	1
4.	MSS-152	Soil Fertility and Fertilizer Use	0	0	1	30	20	- 50	100	1
5.	ENT-731 P	Pests of Horticultural and Plantation Crops	0	0	1	30	20	50	100	1
6.	MAS-153	Computer Application	0	0	1	30	20	50	100	1
7.	MSS-353	Library and Information Services	0	0	1	30	20	. 50	100	1
8.	LNG-502	Technical writing and Communication Skills	0	0	1	30	20	50	100	1
	Total		14	0	8	380	300	820	1500	22

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Faculty of Agricultural Sciences and Allied Industries Rama University, Kanpur, Uttar Pradesh Effective from Session (2024-25) M.Sc. (Ag) Horticulture (Fruit Science)

S. No.	Subject Code	Subject Name	Period			Eval	uation Schen	Subject Total	Credit Hours	
1.0.	Coue		L	T	P	CE	MTE	ETE		
			-	Theor	y Sul	bjects		ē		
				Sem	ester	-2 nd			1	
1.	HOFS-502	Subtropical and Temperate Fruit Production	2	0	0	20	20	60	100	2
2.	HOFS-504	Breeding of Fruits Crops	2	0	0	20	20	60	100	2
3.	HOFS-506	Canopy Management of Fruits Crops	1	0	0	20	20	60	100	1
4.	MSA-204	Agro-meterology and Crop Weather Forecasting	2	0	0	20	20	60	100	2
5.	MSPP-202	Disease of Fruits ,Plantation & Ornamental Crops	2	0	0	20	20	60	100	2
6.	MAS-205	Basics of Experimental Design	2	0	0	20	20	60	100	2
		-		F	Practi	cal/Proje	ct			
1.	HOFS-502 P	Subtropical and Temperate Fruit Production	0	0	1	30	20	50	* 100	1
2.	HOFS-504 P	Breeding of Fruits Crops	0	0	1	30	20	50	100	1
3.	HOFS-506 P	Canopy Management of Fruits Crops	0	0	1	30	20	50	100	1
4.	MSA-254	Agro-meterology and Crop Weather Forecasting	0	0	1	30	20	50	100	1
5.	MSPP-252	Disease of Fruits ,Plantation & Ornamental Crops	0	0	1	30	20	50	100	1
6.	MAS-255	Basics of Experimental Design	0	0	1	30	20	50	100	1
7.	HOFS-514 P	Basics Concepts in Laboratory Techniques (Fruit Science)	0	0	1	30	20	50	100	1

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8.	HOFS-597	Masters Research (Synopsis Presentation)	0	0	5	Satis	5			
-	Total	Tresentation)	11	0	12	330	330	710	1300	23

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Faculty of Agricultural Sciences and Allied Industries Rama University, Kanpur, Uttar Pradesh Effective from Session (2024-25) M.Sc. (Ag) Horticulture (Fruit Science)

S.	Subject Code	Subject Name	Period			Evaluation Scheme			Subject Total	Credit Hours		
NO.			L	T	P	CE	MTE	ETE				
				Theo	ry Su	bjects						
				Sen	neste	r-3 rd			T			
1.	HOFS-513	Minor Fruits Production	2	0	0	20	20	60	100	2		
2.	HOFS-510	Organic Fruit Culture	1	0	0	20	20	60	100	1		
		Culture		P	racti	cal/Pro	ject					
1.	HOFS-513 P	Minor Fruits	0	0	1	30	20	50	100	1		
2.	HOFS-510 P	Organic Fruit	0	0	1	30	20	50	100	1		
	LIOES 580	Masters Seminar	0	0	1	S	atisfactory/U	nsatisfa	ctory	1		
3.	n0r5-380	Iviasiers Seminar	0		-					5		
4.	HOFS-598	Masters Research	0	0	5	S	Satisfactory/Unsatisfactory					
	Total		3		8	100	80	220	400	11		

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Faculty of Agricultural Sciences and Allied Industries Rama University, Kanpur, Uttar Pradesh Effective from Session (2024-25) M.Sc. (Ag) Horticulture (Fruit Science)

S.No.	Subject Code	Subject Name	Po	eriod T	P	Evaluation Scheme	Subject Total	Credit Hours
			F	racti	cal S	ubjects		
		-		Ser	neste	r-4 th		00
1.	HOFS-599	Masters Research Work and Thesis	0	0	20	Satisfactory/Unsatisfa	actory	20
		Writing	0	0	20		-	
	Total		U	-			2	1 1
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Evaluation Scheme:

L-Lecture, P- Practical, MTE-Mid Term Examination, ETE-End Term Examination

1. Course with practical components

- For MID Term Examination is such as: 30 Marks
- Practical Examination (Assignments/Quiz / Seminar/Term paper /Project) :10 Marks
- External Viva : 10Marks
- ETE End Term Examination: 50 Marks

2. Course without practical components

- For MID Term Examination is such as: 40 Marks
- (Assignments/Quiz / Seminar/Term paper /Project) :10 Marks
- ETE End Term Examination: 50 Marks

Course Learning Outcomes (CLO)

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- Identify the area of research in field of horticulture.
- Develop a research problem and plan for further investigation.
- Propose research topic and objective of research work planned.
- Quote the available literature during development of research plan.
- Collect suitable review of literatures related to the planned work

RAMA UNIVERSITY UTTAR PRADESH, KANPUR Faculty of Agricultural Sciences & Allied Industries Department of Horticulture (Fruit Science) Program: M.Sc. (Ag.) Horticulture (Fruit Science)

Report on Feedback on Curriculum by Stakeholders (2024-2025)

- > The external experts suggested that Students need to be aware of industry exposure.
- As extension activities are part of the curriculum, more activities suiting the current needs were to be organized.
- The faculty suggested that more emphasis is given to conduct the research trials in the campus.

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BoS Chairman

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RAMA UNIVERSITY UTTAR PRADESH, KANPUR Faculty of Agricultural Sciences & Allied Industries Department of Horticulture (Fruit Science) Program: M.Sc. (Ag.) Horticulture (Fruit Science)

Action Taken Report based on Feedback at BoS held on 11.05.2024

- Invited resource persons from industries were made to address the students.
 - Visits and interaction with progressive farmers, ICAR research stations to learn about the latest technologies.
 - Students are conducting their trails in the campus for the research associated with the horticultural crops.

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BoS Chairman

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M.Sc. (Ag.) Horticulture (Fruit Science)

1. Course Code : HOFS- 501, Course Title : Tropical Fruit Production, Credit Hours : (2+1) Why this course ?

Tropical fruits occupy a distinct place in global fruit production. Apart from ecological specificities, tropical fruits enjoy favour among masses being delicious and nutritious. As such, the course has been designed to provide update knowledge on various production technologies of tropical fruits on sustainable basis.

im of the course

To impart comprehensive knowledge to the students on cultural and management practices for growing tropical fruits.

The course is organised as follows: No. Blocks Units

1 Introduction I Importance and Background

2 Agro-Techniques I Propagation, Planting and Orchard Floor Management

PCrop Management I Flowering, Fruit-Set and Harvesting

Theory

Block 1: Introduction

Unit I: Importance and Background: Importance, origin and distribution, major species, rootstocks and commercial varieties of regional, national and international importance, eco-physiological requirements.

Block 2: Agro-techniques

Unit I: Propagation, 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.

Block 3: Crop Management

Unit I: Flowering, Fruit-Set and Harvesting: 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.

Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1

rops

viango, Banana, Guava, Pineapple, Papaya, Avocado, Jackfruit, Annonas, Aonla, Ber, etc. **Practicals**

- Distinguished features of tropical fruit species, cultivars and rootstocks (2):
- Demonstration of planting systems, training and pruning (3);
- Hands on practices on pollination and crop regulation (2);
- Leaf sampling and nutrient analysis (3);
- Physiological disorders-malady diagnosis (1);
- Physico-chemical analysis of fruit quality attributes (3);
- Field/ Exposure visits to tropical orchards (1);
- Project preparation for establishing commercial orchards (1).

Teaching Methods/ Activities

- Class room Lectures
- · Laboratory/ Field Practicals
- Student Seminars/ Presentations
- Field Tours/ Demonstrations

Assignments

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.

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Bartholomew DP, Paull RE and Rohrbach KG. 2002. The Pineapple: Botany, Production. and Uses CAB

Bose TK, Mitra SK and Sanyal D. 2002. Fruits of India - Tropical and Sub-Tropical.3rd Edn. Naya Udyog,

Kolkata.

Dhillon WS. 2013. Fruit Production in India. Narendra Publ. House, New Delhi. Iyer CPA and Kurian RM. 2006. High Density Planting in Tropical Fruits: Principlesand Practices. IBDC

Litz RE. 2009. The Mango: Botany, Production and Uses. CAB International. Madhawa Rao VN. 2013.

Midmore D. 2015. Principles of Tropical Horticulture. CAB International. Mitra SK and Sanyal D. 2013. Guava, ICAR, New Delhi.

Morton JF. 2013. Fruits of Warm Climates. Echo Point Book Media, USA.

Nakasome HY and Paull RE. 1998. Tropical Fruits. CAB International.

Paull RE and Duarte O. 2011. Tropical Fruits (Vol. 1). CAB International.

mi S, Sharma A and Wali VK. 2018. Guava (Psidium guajava L.). Astral, New Delhi.

Robinson JC and Saúco VG. 2010. Bananas and Plantains. CAB International.

Sandhu S and Gill BS. 2013. Physiological Disorders of Fruit Crops. NIPA, New Delhi. Schaffer B, Wolstenholme BN and Whiley AW. 2013. The Avocado: Botany, Production and Uses. CAB

Sharma KK and Singh NP. 2011. Soil and Orchard Management. Daya Publishing House, New Delhi. Valavi SG, Peter KV and Thottappilly G. 2011. The Jackfruit. Stadium Press, USA. Horticultural Sciences Fruit Science

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2. Course Code : HOFS- - 502, Course Title : Subtropical and Temperate Fruit Production, Credit

Agro-climatic diversity in India facilitates growing a wide range of fruits extending from tropical to subtropical to temperate fruits and nuts. To highlight their ecological specificities, seasonal variations and pertinent cultural practices, a course is designed exclusively for subtropical and temperate fruits.

To impart comprehensive knowledge to the students on cultural and management practices for growing subtropical and temperate fruits. The course is organised as follows: No. Blocks Units

2 Agro-Techniques Propagation, Planting and Orchard Floor Management

3 Crop Management Flowering, Fruit-Set and Harvesting

Block 1: Introduction

Unit I: Importance and Background: Origin, distribution and importance, major species, rootstocks and commercial varieties of regional, national and international importance, eco-physiological requirements. All a contract of the second of the second

Unit I: Propagation, Planting and Orchard Floor Management: Propagation, planting systems and densities. ining and pruning, rejuvenation and replanting, intercropping, nutrient management, water management, fertigation, use of bio-fertilizers, role of bio-regulators, abiotic factors limiting fruit production. Block 3: Crop Management

Unit I: Flowering, Fruit-Set and Harvesting: 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

Crops

Citrus, Grapes, Litchi, Pomegranate, Apple, Pear, Peach, Plum, Apricot, Cherries, Berries, Persimmon, Kiwifruit, Nuts- Walnut, Almond, Pecan, etc.

Practicals

• Distinguished features of fruit species, cultivars and rootstocks (2);

- Demonstration of planting systems, training and pruning (3);
- Hands on practices on pollination and crop regulation (2);

• Leaf sampling and nutrient analysis (3); Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1

• Physiological disorders-malady diagnosis (1);

• Physico-chemical analysis of fruit quality attributes (3);

(Wield/ Exposure visits to subtropical and temperate orchards (1);

• Project preparation for establishing commercial orchards (1).

Teaching Methods/ Activities

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

Learning outcome

After successful completion of the course, the student are expected to equip themselves with principles and practices of producing subtropical (citrus, grapes, litchi, pomegranate, etc.) and temperate fruits (apple, pear. peach, plum, apricot, cherries, berries, kiwifruit, etc.) and nuts (almond, walnut, pecan, etc.)

Suggested Reading

Chadha KL and Awasthi RP. 2005. The Apple. Malhotra Publishing House, New Delhi. Chadha TR. 2011. A Text Book of Temperate Fruits. ICAR, New Delhi Childers NF, Morris JR and Sibbett GS. 1995. Modern Fruit Science: Orchard and Small Fruit

Low

Culture. Horticultural Publications, USA.

Creasy G and Creasy L. 2018. Grapes. CAB International.

Davies FS and Albrigo LG. 1994. Citrus. CAB International.

Dhillon WS. 2013. Fruit Production in India. Narendra Publishing House, New Delhi.

Jackson D, Thiele G, Looney NE and Morley-Bunker M. 2011. Temperate and Subtropical Ladanyia M. 2010. Citrus Fruit: Biology, Technology and Evaluation. Academic Press.

Layne DR and Bassi D. 2008. The Peach: Botany, Production and Uses. CABI. Menzel CM and Waite GK. 2005. Litchi and Longan: Botany, Production and Uses. CAB

Pandey RM and Randey SN. 1996. The Grape in India. ICAR, New Delhi.

Rajput CBS, and Haribabu RS. 2006. Citriculture, Kalyani Publishers, New Delhi.

Sandhu S and Gill BS. 2013. Physiological Disorders of Fruit Crops. NIPA, New Delhi.

Sharma RM, Pandey SN and Pandey V. 2015. The Pear - Production, Post-harvest Management and Protection. IBDC Publisher, New Delhi.

Sharma RR and Krishna H. 2018. Textbook of Temperate Fruits. CBS Publishers and DistributorsPvt. Ltd.,

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Singh S, Shivshankar VJ, Srivastava AK and Singh IP. 2004. Advances in Citriculture. NIPA,

momp J, Webster AS and Wertheim SJ. 2005. Fundamentals of Temperate Zone Tree Fruit Production. Backhuys Publishers, Lieden, The Netherlands. Webster A and Looney N. Cherries: Crop Physiology, Production and Uses. CABI.

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Westwood MN. 2009. Temperate Zone Pomology: Physiology and Culture. Timber Press, USA.

3. Course Code : HOFS- 503, Course Title : Propagation and Nursery Management in Fruit Crops, Why this course ?

Availability of sufficient and healthy planting material is pivotal for expandingfruit culture. This necessitates requisite skill and efficient multiplication protocolsHorticultural Sciences-Fruit Sciencefor raising plants and their in house management prior to distribution or fieldtransfer, hence the course is developed.

To understand the principles and methods of propagation and nursery managementin fruit crops. The course is organised as follows:

No. Blocks Units

1 Introduction I General Concepts and Phenomena

2 Propagation I Conventional Asexual Propagation

II Micropropagation

3 Nursery I Management Practices and Regulation

Theory

Block 1: Introduction

Unit 1: General Concepts and Phenomena: Introduction, understanding cellularbasis for propagation, sexual and asexual propagation, apomixis, polyembryony, chimeras. Factors influencing seed germination of fruitcrops, dormancy, hormonal regulation of seed germination and seedlinggrowth. Seed quality, treatment, packing, Trage, certification andtesting. Solf to Hampert Street Street

Block 2: Propagation

Unit I: Conventional Asexual Propagation: Cutting- methods, rooting of softand hardwood cuttings under mist and hotbeds. Use of PGR inpropagation, Physiological, anatomical and biochemical aspects of rootinduction in cuttings. Layering - principle and methods. Budding and grafting - principles and methods, establishment andmanagement of bud wood bank. Stock, scion and inter stock relationship- graft incompatibility, physiology of rootstock and top working.

Unit II: Micropropagation: Micro-propagation - principles and concepts, commercial exploitation in horticultural crops. Techniques - in-vitroclonal propagation, direct organogenesis, embryogenesis, micrografting, meristem culture, genetic fidelity testing. Hardening, packaging and transport of micropropagules.

Block 3: Nursery

Unit I: Management Practices and Regulation: Nursery - types, structures, components, planning and layout. Nursery management practices forhealthy propagule production. Nursery Act, nursery accreditation, importand export of seeds and planting material and quarantine.

Practical

Hands on practices on rooting of dormant and summer cuttings (3);

Anatomical studies in rooting of cutting and graft union(1);

- Hands on practices on various methods of budding and grafting (4);
- Propagation by layering and stooling (2);

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• Micropropagation- explant preparation, media preparation, culturing - meristemtip culture, axillary bud culture, micro-grafting, hardening (4); 34

• Visit to commercial tissue culture laboratories and accredited nurseries (2).

Teaching Methods/ Activities

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

Learning outcome

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

Suggested Reading

Bose TK, Mitra SK and Sadhu MK. 1991. Propagation of Tropical and Subtropical HorticulturalCrops. Naya Prokash, Kolkatta.

Davies FT, Geneve RL and Wilson SB. 2018. Hartmann and Kester's Plant Propagation-

Principles and Practices. Pearson, USA/ PrenticeHall of India. New Delhi.

Section of the

Gill SS, Bal JS and Sandhu AS. 2016. Raising Fruit Nursery. Kalyani Publishers, New Delhi.

Jain S and Ishil K. 2003. Micropropagation of Woody Trees and Fruits. Springer.

Jain S and Hoggmann H. 2007. Protocols for Micropropagation of Woody Trees and Fruits.

Springer.

Joshi P. 2015. Nursery Management of Fruit Crops in India. NIPA, New Delhi.

Love et al. 2017. Tropical Fruit Tree Propagation Guide. UH-CTAHR F_N_49. College of Tropical

Agriculture and Human Resources University of Hawaii at Manwa, USA.

Peter KV, eds. 2008. Basics of Horticulture. New India Publishing Agency, New Delhi.

Rajan S and Baby LM. 2007. Propagation of Horticultural Crops. NIPA, New Delhi.

Sharma RR. 2014. Propagation of Horticultural Crops. Kalyani Publishers, New Delhi.

Sharma RR and Srivastav M. 2004. Propagation and Nursery Management. Intl. Book PublishingCo., Lucknow.

Singh SP. 1989. Mist Propagation. Metropolitan Book Co.

Singh RS. 2014. Propagation of Horticultural Plants: Arid and Semi-Arid Regions. NIPA, New Walhi.

ryagi S. 2019. Hi-Tech Horticulture. Vol I: Crop Improvement, Nursery and RootstockManagement. NIPA, New Delhi.

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4. Course Code : HOFS- -504, Course Title : Breeding of Fruit Crops, Credit Hours : (2+1) Why this course ?

Development of genetically improved varieties and rootstock is a continuous processwhich is realized through selection and breeding approaches. This is necessary toenhance the productivity and meet ever-changing climatic conditions and market/consumer preferences. As such, a course is formulated to generate know-how ongenetic and breeding aspects of fruit crops.

Aim of the course

To impart comprehensive knowledge on principles and practices of fruit breeding.Horticultural Sciences-Fruit Science

The course organisation is as under: No. Blocks Units

1 Introduction Importance, Taxonomy and Genetic Resources

2 Reproductive Biology Blossom Biology and Breeding Systems

3 Breeding approaches Conventional and Non-Conventional Breeding

Theory

Block 1: Introduction

Unit I: Importance, Taxonomy and Genetic Resources: Introduction and importance, origin and distribution. taxonomical status - species andcultivars, cytogenetics, genetic resources.

Block 2: Reproductive Biology

Unit I: Blossom Biology and Breeding Systems: Blossom biology, breedingsystems - spontaneous mutations, Apploidy, incompatibility, sterility, parthenocarpy, apomixis, breeding objectives, ideotypes.

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Block 3: Breeding Approaches

Unit I: Conventional and Non-Conventional Breeding: Approaches for cropimprovement - direct introduction. selection, hybridization, mutationbreeding, polyploid breeding, rootstock breeding, improvement of qualitytraits, resistance breeding for biotic and abiotic stresses, biotechnologicalinterventions, achievements and future thrusts.

Crops

Mango, Banana, Pineapple, Citrus, Grapes, Litchi, Guava, Pomegranate, Papaya, Apple, Pear, Plum, Peach, 10000 1 Apricot, Cherries, Strawberry, Kiwifruit, Nuts

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Practicals

- Exercises on bearing habit, floral biology (2);
- Pollen viability and fertility studies (1);
- Hands on practices in hybridization (3);
- Raising and handling of hybrid progenies (2);
- Induction of mutations and polyploidy (2);
- Evaluation of biometrical traits and quality traits (2);
- Creening for resistance against abiotic stresses (2);
- Developing breeding programme for specific traits (2);
- Visit to research stations working on fruit breeding (1).

Teaching Methods/ Activities

- Class room Lectures
- Laboratory/ Field Practicals
- Student Seminars/ Presentations
- Field Tours/ Demonstrations In the product of the state of the state of the Assignments

Learning outcome

After successful completion of the course, the students are expected to. Have an understanding on importance and peculiarities of fruit breedingRestructured and Revised Syllabi of Post-graduate Programmes Vol. 1

• Have an updated knowledge on reproductive biology, genetics and inherent breeding

systems.

• Have detailed knowledge of various methods/ approaches of breeding fruit crops

Suggested Reading

Abraham Z. 2017. Fruit Breeding. Agri-Horti Press, New Delhi.

Badenes ML and Byrne DH. 2012. Fruit Breeding. Springer Science, New York.

Dinesh MR. 2015. Fruit Breeding, New India Publishing Agency, New Delhi.

Ghosh SN, Verma MK and Thakur A. 2018. Temperate Fruit Crop Breeding-Domestication to Cultivar Development. NIPA, New Delhi.

Hancock JF. 2008. Temperate Fruit Crop Breeding: Germplasm to Genomics. Springer Science, New York.

Jain SN and Priyadarshan PM. 2009. Breeding Plantation and Tree Crops: Tropical Species. Springer Science, New York.

Jain S and Priyadarshan PM. 2009. Breeding Plantation and Tree Crops: Temperate Species. Springer Science, New York.

Janick J and Moore JN. 1996. Fruit Breeding. Vols. I-III. John Wiley & Sons. USA.

Kumar N. 2014. Breeding of Horticultural Crops: Principles and Practices. NIPA, N. Delhi.

Moore JN and Janick J. 1983. Methods in Fruit Breeding. Purdue University Press, USA.

Ray PK. 2002. Breeding Tropical and Subtropical Fruits. Narosa Publ. House, New Delhi.

5. Course Code : HOFS- 505, Course Title : Systematics of Fruit Crops, Credit Hours : (2+1) Why this course ?

Life forms and their behaviour are best understood if properly described to thestake holders. Therefore, intification and characterization are pre-requisites to distinctly describe the plant species. The fruit crop species are no exception, and thus an exclusive course on their categorisation and description exhibiting a greatdeal of variation.

Aim of the course

To acquaint with the classification, nomenclature and description of various fruitcrops.

The course is organised as under:

No. Blocks Units

1 Biosystematics Nomenclature and Classification

2 Botanical Keys and Descriptors Identification and Description

3 Special Topics Registration and Modern Systematics

Theory

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Block 1: Biosystematics

Unit I: Nomenclature and Classification: Biosystematics – introduction and significance; history of nomenclature of cultivated plants, classification and nomenclature systems; International code of nomenclature forcultivated plantsHorticultural Sciences–Fruit Science

Block 2: Botanical Keys and Descriptors

Unit I: Identification and Description: Methods of identification and description cultivated fruit and nut cies and their wild relatives features; development of plant keys for systematic identification and classification.Development of fruit crop descriptors- based upon BioversityInternational Descriptors and UPOV/ DUS test guidelines, botanicaland pomological description of major cultivars and rootstocks of tropical, subtropical and temperate fruits and nut crops

Block 3: Special Topics

Unit I: Registration and Modern Systematics: Registration, Use of chemotaxonomy, biochemical and molecular markers in modernsystematics

Practicals

- Exercises on identification and pomological description of various fruit species and cultivars (6);
- Development of descriptive blanks vis-a-vis UPOV/ DUS test guidelines and Bioversity International (4);
- Descriptors for developing fruit species and cultivar descriptive databases (4);
- Visits to major germplasm centres and field genebanks (2).

Teaching Methods/ Activities

- Class room Lectures
- Laboratory/ Field Practicals
- Student Seminars/ Presentations

- Field Tours/ Demonstrations
- Assignments

Learning outcome

- After successful completion of the course, the students would be able to-• Categorise different fruit species into broad groups.
- Identify various fruit cultivars on basis of distinguishing features
- Characterize fruit cultivars for description, registration and protection

ASHS. 1997. The Brooks and Olmo Register of Fruit and NutVarieties. 3rd Ed. ASHS Press. Bhattacharya B and Johri BM. 2004. Flowering Plants: Taxonomy and Phylogeny. Narosa Pub. Pandey BP. 1999. Taxonomy of Angiosperms. S. Chand & Co. New Delhi.

Pareek OP and Sharma S. 2017. Systematic Pomology. Scientific Publishers, Jodhpur. Sharma G, Sharma OC and Thakur BS. 2009. Systematics of Fruit Crops. NIPA, New Delhi. Simpson M. 2010. Plant Systematics. 2ndEdn. Elsevier.

Spencer RR, Cross R and Lumley P. 2003. Plant Names. 3rd Ed. A Guide to Botanical Nomenclature, CISRO, Australia.

Srivastava U, Mahajan RK, Gangopadyay KK, Singh M and Dhillon BS. 2001. Minimal Descriptors of Agri-Horticultural Crops. I: Fruits. NBPGR, New Delhi.

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Pelinski QB. 1955. Modern Systematic Pomology. Wm. C. Brown Co., Iowa, USA. Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1

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6. Course Code : HOFS- 506, Course Title : Canopy Management of Fruit Crops , Credit Hours : (1+1) Why this course ?

Plant architecture plays an important role in enhancing photosynthetic efficiency and resultant quantity and quality of the fruit produce. Manipulation of plantgrowth and development can be done by employing different training and pruningprocedures besides through the use of growth regulators, specific rootstocks, etc.Hence this course is developed to address the aforesaid issues.

Aim of the course

To impart knowledge on principles and practices in management of canopyarchitecture for quality fruit production. The course organisation is as follows: No. Blocks Units

1 Canopy Architecture Introduction, types and Classification

2 Canopy Management Physical Manipulation and Growth regulation

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Theory

Block 1: Canopy Architecture

Unit I: Introduction, Types and Classification: Canopy management -importance and factors affecting canopy development. Canopy typesand structures, canopy manipulation for optimum utilization of lightand its interception. Spacing and utilization of land area - Canopyclassification.

Block 2: Canopy Management

Unit I: Physical Manipulation and Growth Regulation: Canopy managementthrough rootstock and scion. mopy management through plant growthregulators, training and pruning and management practices. Canopydevelopment and management in relation to growth, flowering, fruitingand fruit quality.

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Practicals

• Study of different types of canopies (2);

- Training of plants for different canopy types (2);
- Canopy development through pruning (2);
- Understanding bearing behaviour and canopy management in different fruits (2);
- Use of plant growth regulators (2);
- Geometry of planting (1):
- Development of effective canopy with support system (2);
- Study on effect of different canopy types on production and quality of fruits (2).

Teaching Methods/ Activities

- Class room Lectures
- Laboratory/ Field Practicals
- Student Seminars/ PresentationsHorticultural Sciences-Fruit Science
- Field Tours/ Demonstrations

Assignments

Sarning outcome

After successful completion of the course, the students are expected to learn

- The basic principles of canopy management to modify plant architecture
- The skills on training and pruning of fruit crops, and growth regulation as pruning (A)

Suggested Reading

Bakshi JC, Uppal DK and Khajuria HN. 1988. The Pruning of Fruit Trees and Vines. Kalvani Publishers, New Delhi.

the second the

Chadha KL and Shikhamany SD. 1999. The Grape, Improvement, Production and Post Harvest Management. Malhotra Publishing House, Delhi.

Iyer CPA and Kurian RM. 2006. High Density Planting in Tropical Fruits: Principles and Practices. IBDC Publishers, New Delhi.

Pradeepkumar T. 2008. Management of Horticultural Crops. NIPA, New Delhi.

Singh G. 2010. Practical Manual on Canopy Management in Fruit Crops. Dept. of Agriculture

and Co-operation, Ministry of Agriculture (GoI), New Delhi.

Srivastava KK. 2012. Canopy Management in Fruits. ICAR, New Relhi

7. Course Code : HOFS-507, Course Title : Growth and Development of Fruit Crops, Credit Hours :

Why this course ?

The underlying principles and parameters of growth and development needs to beunderstood for harnessing maximum benefits in term of yield and quality. Externalenvironment and inherent hormonal and metabolic pathways considerably determinegrowth dynamics. Thus, a course is formulated to develop know-how on physiological and physical aspects of growth and development processes.

Aim of the course

To develop comprehensive understanding on growth and development of fruitcrops. The course is structured as under:-

No. Blocks Units

1 Introduction General Concepts and Principles

2 Environment and Development Climatic Factors, Hormones and Developmental a second long and

Physiology

3 Stress Management Strategies for Overcoming Stress

Theory

Block 1: Introduction

TRANSA TAR. TAR. Unit I: General Concepts and Principles: Growth and development- definition, parameters of growth and development, growth dynamics andmorphogenesis. a hard for an

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Rock 2: Environment and Development

chit I: Climatic Factors, Hormones and Developmental Physiology: Environmental impact on growth and development- effect of light, Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1

temperature, photosynthesis and photoperiodism, vernalisation, heatunits and thermoperiodism. Assimilate partitioning, influence of waterand mineral nutrition in growth and development: concepts of planthormone and bioregulators, history, biosynthesis and physiological roleof auxins, gibberellins, cytokinins, abscissic acid, ethylene, growthinhibitors and retardant, brasssinosteroids, other New PGRs.

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

Block 3: Stress Management

Unit I: Strategies for Overcoming Stress: Growth and developmental processduring stress - manipulation of growth and development, impact of pruning and training, chemical manipulations and Commercialapplication of PGRs in fruit crops, molecular and genetic approaches inplant growth and development. own have write the

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Practicals

• Understanding dormancy mechanisms in fruit crops and seed stratification (2);

Techniques of growth analysis (2);

valuation of photosynthetic efficiency under different environments (2);

- Exercises on hormone assays (2);
- Practicals on use of growth regulators (2);
- Understanding ripening phenomenon in fruits (2);
- Study on impact of physical manipulations on growth and development (1);
- Study on chemical manipulations on growth and development (1);
- Understanding stress impact on growth and development (1).

Teaching Methods/ Activities

• Class room Lectures

- Laboratory/ Field Practicals
- Student Seminars/ Presentations
- Field Tours/ Demonstrations
- Assignments

Learning outcome

Consequent upon successful completion of the course, the students are expected tohave • Equipped with understanding of various growth and development processes

Soven

· Learned about the role of environment and growth substances

• Acquired the skills to realise optimum growth and development under stressconditions Suggested Reading

Bhatnagar P. 2017. *Physiology of Growth and Development of Horticultural Crops*. Agrobios (India).

Buchanan B, Gruiessam W and Jones R. 2002. *Biochemistry and Molecular Biology of Plants*. John Wiley & Sons, NY, USA.

Dhillon WS and Bhatt ZA. 2011. Fruit Tree Physiology. Narendra Publishing House, New Delhi. Durner E. 2013. Principles of Horticultural Physiology. CAB International. Horticultural Sciences–Fruit Science

Epstein E. 1972. *Mineral Nutrition of Plants: Principles and Perspectives*. John Wiley & Sons, NY, USA.

Faust M. 1989. Physiology of Temperate Zone Fruit Trees. John Willey & Sons, NY, USA. Fosket DE. 1994. Plant Growth and Development: a Molecular Approach. Academic Press, USA. Leopold AC and Kriedermann PE. 1985. Plant Growth and Development. 3rd Ed. McGraw-Hill, New Delhi.

Roberts J, Downs S and Parker P. 2002. Plant Growth Development. In: Salisbury FB and Ross CW. (Eds.) *Plant Physiology*. 4th Ed.Wadsworth Publications, USA.

Schafeer, B. and Anderson, P. 1994. Handbook of Environmental Physiology of Fruit Crops. 1. 1 & 2. CRC Press. USA.

Seymour GB, Taylor JE and Tucker GA. 1993. Biochemistry of Fruit Ripening. Chapman & Hall, London.

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8. Course Code : HOFS- 508, Course Title : Nutrition of Fruit CropsII. III. Credit Hours : (2+1)

Nutrients play a significant role in almost every growth and development processdetermining vigour, yield and quality of fruits. Henceforth, a course is designed tohave an in depth study of various nutrients, their uptake and To acquaint with principles and practices involved in nutrition of fruit crops

A CHARGE

No. Blocks Units

1 Introduction General Concepts and Principles

2 Requirements and Applications Diagnostics, Estimation and Application 3 Newer Approaches Integrated Nutrient Management (INM)

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Block 1: Introduction

Unit I: General Concepts and Principles: Importance and history of nutritionin fruit crops, essential plant nutrients, factors affecting plant nutrition; nutrient uptake and their removal from soil. **Block 2: Requirements and Applications**

Unit I: Diagnostics, Estimation and Application: Nutrient requirements, rootdistribution in fruit crops, soil and foliar application of nutrients inmajor fruit crops, fertilizer use efficiency. Methods and techniques revaluating the requirement of macro- and micro-elements, Diagnosticand interpretation techniques including FRIS. Role of different macroandmicro-nutrients, their deficiency and toxicity disorders, correctivemeasures to overcome deficiency and toxicity disorders. **Block 3: Newer Approaches**

Unit I: Integrated Nutrient Management (INM): Fertigation in fruit crops, biofertilizersand their use in INM systems.Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1

• Visual identification of nutrient deficiency symptoms in fruit crops (2);

• Identification and application of organic, inorganic and bio-fertilizers (1);

- Soil/ tissue collection and preparation for macro- and micro-nutrient analysis (1);
- Analysis of soil physical and chemical properties- pH, EC, Organic carbon (1);
- Determination of N,P,K and other macro- and micronutrients (6);
- Fertigation in glasshouse and field grown horticultural crops (2);
- Preparation of micro-nutrient solutions, their spray and soil applications (2).

Teaching Methods/ Activities

Class room Lectures

Aboratory/ Field Practicals

tudent Seminars/ Presentations

- Field Tours/ Demonstrations
- Assignments

Learning outcome

After successful completion of the course, the students would be expected to

- Know the importance and various types of nutrients and their uptake mechanisms
- · Analyse soil and plant status with respect to various nutrients
- Make use of corrective measures to overcome deficiency or toxicity

Suggested Reading

Atkinson D, Jackson JE and Sharples RO. 1980. Mineral Nutrition of Fruit Trees. Butterworth - Heinemann.

Bould C, Hewitt EJ and Needham P. 1983. Diagnosis of Mineral Disorders in Plants Vol. 1 Principles. Her Majesty's Stationery Office, London.

Cooke GW. 1972. Fertilizers for maximizing yield. Grenada Publishing Ltd, London. Epstein E. 1972. Mineral Nutrition of Plants: Principles and Perspectives. Wiley Eastern Ltd. Kanwar JS. 1976. Soil Fertility-Theory and Practice. ICAR, New Delhi.

Marchner Horst. 1995. Mineral Nutrition of Higher Plants, 2nd Ed. Marschner, Academic Press Inc. San Diego, CA.

Mengel K and Kirkby EA. 1987. Principles of Plant Nutrition. 4th Ed. International Potash Institute, Worblaufen-Bern, Switzerland.

Prakash M. 2013. Nutritional Disorders in Fruit Crops: Diagnosis and Management. NIPA, New Delhi.

Tandon HLS. 1992. Management of Nutrient Interactions in Agriculture. Fertilizer Development and Consultation Organization, New Delhi.

Westerman RL. 1990. Soil Testing and Plant Analysis, 3rd Ed. Soil Science Society of America, Inc., Madison, WI.

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Yawalkar KS, Agarwal JP and Bokde S. 1972. *Manures and Fertilizers*. 3rd Ed. Agri Horticultural Publishing House, Nagpur.

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9. Course Code : HOFS- 509, Course Title : Biotechnology of Fruit Crops, Credit Hours : (2+1) Why this course ?

In the recent times, biotechnological interventions in fruit crops have contributedin enhanced yield, biotic and abiotic stress management and improved qualitytraits to a considerable extent. Hence, a course is designed to improved fruit thepossibilities and progress made through biotechnology for educate on production.Horticultural Sciences-Fruit Science

Aim of the course

To impart knowledge on the principles and tools of biotechnology. Structure of the course is as under: No. Blocks Units

1 General Background Introduction, History and Basic Principles

2 Tissue Culture In-vitro Culture and Hardening

3 Genetic Manipulation In-vitro Breeding, Transgenics and Gene Technologies

Theory

Block 1: General Background

Unit I: Introduction, History and Basic Principles: Introduction and significance, history and basic principles, influence of explant material, physical, chemical factors and growth regulators on growth and development Solant cell, tissue and organ culture.

ock 2: Tissue Culture

whit I: In-vitro Culture and Hardening: Callus culture - types, cell division, differentiation, morphogenesis. organogenesis, embryogenesis; Organculture - meristem, embryo, anther, ovule culture, embryo rescue, somaclonal variation, protoplast culture. Use of bioreactors and in-vitro

methods for production of secondary metabolites, suspension culture, nutrition of tissues and cells, regeneration of tissues. Hardening and exvitro establishment of tissue cultured plants.

Block 3: Genetic Manipulation

Unit I: In-vitro Breeding, Transgenics and Gene Technologies: Somatic cellhybridisation, construction and identification of somatic hybrids and cybrids, wide hybridization, in-vitro pollination and fertilization.haploids. in-vitro mutation, artificial seeds, cryopreservation, In-vitroselection for biotic and abiotic stress. Genetic engineering- principlesand methods, transgenics in fruit crops, use of molecular markers and genomics. Gene silencing, gene tagging, gene editing, achievements ofbiotechnology in fruit crops.

Practicals

• An exposure to low cost, commercial and homestead tissue culture laboratories (2);

- Media preparation, Inoculation of explants for clonal propagation, callus induction
- and culture, regeneration of plantlets from callus (3);
- Sub-culturing techniques on anther, ovule, embryo culture, somaclonal variation (4); n-vitro mutant selection against abiotic stress (2);

- Protoplast culture and fusion technique (2);
- Development of protocols for mass multiplication (2);
- Project development for establishment of commercial tissue culture laboratory (1).

Teaching Methods/ Activities

- Class room Lectures
- Laboratory/ Field PracticalsRestructured and Revised Syllabi of Post-graduate Programmes Vol. 1
- Student Seminars/ Presentations
- Field Tours/ Demonstrations
- Assignments

Learning outcome

After the successful completion of the course, the students are expected to know

- Basic principles and methods of plant tissue culture and other biotechnologicaltools.
- The use and progress of biotechnology in fruit crops.

Suggested Reading

Bajaj YPS. Eds., 1989. Biotechnology in Agriculture and Forestry. Vol. V, Fruits. Springer,

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USA.

Brown TA. 2001. Gene Cloning and DNA Analysis and Introduction. Blackwell Publishing, USA.

Chahal GS and Gosal SS. 2010. Principles and Procedures of Plant Breeding: Biotechnological and Conventional Approaches. Narosa, New Delhi.

Chopra VL and Nasim A. 1990. Genetic Engineering and Biotechnology – Concepts, Methods and Applications. Oxford & IBH, New Delhi.

Kale C. 2013. Genome Mapping and Molccular Breeding in Plant, Vol 4. Fruit and Nuts. Springers.

Keshavachandran R and Peter KV. 2008. Plant Biotechnology: Tissue Culture and Gene Transfer. Orient & Longman, Universal Press, US.

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.

Litz RE. 2005. Biotechnology of Fruit and Nut Crops. CABI, UK.

Miglani GS. 2016. Genetic Engineering – Principles, Procedures and Consequences. Narosa Publishing House, New Delhi.

Parthasarathy VA, Bose TK, Deka PC, Das P, Mitra SK and Mohanadas S. 2001. *Biotechnology of Horticultural Crops*. Vols. I–III. Naya Prokash, Kolkata.

Ster KV. 2013. Biotechnology in Horticulture: Methods and Applications. NIPA, New Delhi. Sil TK, Vasi M, While DNR and Bery HR. 1979. Somatic Hybridization and Genetic Manipulation in Plants. Plant Regulation and World Agriculture. Platinum Press, UK.

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10. Course Code : HOFS- - 510, Course Title : Organic Fruit Culture, Credit Hours : (2+1)

Why this course ?

Considering threats to environment and human health on account of excessive useof chemicals and synthetic fertilizers, organic farming is looked upon as analternative. Though the organic and other natural farming practices are in evolvingphase and are yet to be time scale tested, there is a general perception that thesewould hold good. As such a course is customised to educate the Graduates onvarious issues related to organic farming. Aim of the course

To develop understanding on organic production of fruit crops. Horticultural Sciences-Fruit Science

The course is structured as under:-

No. Blocks Units

1 General Aspects Principles and Current Scenario

2 Organic Culture Farming System and Practices

3 Certification Inspection, Control Measures and Certification

Theory

Block 1: General Aspects

Unit I: Principles and Current Scenario: Organic horticulture, scope, area, production and world trade, definition, principles, methods and SWOTanalysis.

Bock 2: Organic Culture

vit I: Farming System and Practices: Organic farming systems includingbiodynamic farming, natural farming, noma organic farming, rishi krishi, EM technology, cosmic farming; on-farm and off-farm production oforganic inputs, role of bio-fertilizers, bio enhancers, legumes, intercropping, cover crops, green manuring, zero tillage. mulching and theirrole in organic nutrition management. Organic seeds and plantingmaterials, soil health management in organic production, weedmanagement practices in organic farming, biological management ofpests and diseases, trap crops, quality improvement in organic production of fruit crops.

Block 3: Certification

Unit I: Inspection, Control Measures and Certification: Inspection and certification of organic produce. participatory guarantee system (PGS), NPOP, documentation and control, development of internal controlsystem (ICS), Concept of group certification, constitution of grower groupas per NPOP, preparation of ICS manual. internal and externalinspection, concept of third party verification, certification of smallfarmer groups (Group Certification), transaction certificate, groupcertificate, critical control points (CCP) and HACCP, IFOAM guidelineson certification scope and chain of custody, certification trademark -

The Logo, accredited certification bodies under NPOP. Constraints incertification, IFOAM and global scenario of organic movement, postharvest management of organic produce. Economics of organic fruitproduction. Practicals

Design of organic orchards/ farms management (1);

Conversion plan (1);

• Nutrient management and microbial assessment of composts and bio-enhancers (2);

• Preparation and application of composts, bio-enhancers and bio-pesticides (2);

• Organic nursery raising (1):

• Application of composts, bio-enhancers, bio-fertilisers and bio-pesticides, greenmanure, cover, mulching (2):

• Preparation and use of neem based products (1);

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• Biodynamic preparations and their role in organic agriculture, EM technologyand products, biological/ natural management of pests and diseases (2);

- Soil solarisation (1);
- Frame work for GAP (1);
- Documentation for certification (1).

Teaching Methods/ Activities

- Class room Lectures
- Laboratory/ Field Practicals
- Student Seminars/ Presentations

- Field Tours/ Demonstrations
- Assignments

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Learning outcome

On successful completion of the course, the students are expected to be able to

• Familiarize with the concepts and practices of organic and other natural farmingsystems

• Generate know-how on procedures, policies and regulation for inspection andcertification of organic produce

Suggested Reading

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Claude A. 2004. The Organic Farming Sourcebook. Other India Press, Mapusa, Goa, India. Dabholkar SA. 2001. Plenty for All. Mehta Publishing House, Pune, Maharashtra.

Das HC and Yadav AK. 2018. Advances in Organic Production of Fruit Crops. Westville Publishing House, New Delhi.

Deshpande MS. 2003. Organic Farming with respect to Cosmic Farming. Mrs. Pushpa Mohan Deshpandey, Kolhapur, Maharashtra.

Deshpande WR. 2009. Basics of Organic Farming. All India Biodynamic and Organic Farming Association, Indore. MP.

Gaur AC, Neblakantan S and Dargan KS. 1984 Organic Manures. ICAR, New Delhi. Lampkin, N. and Ipswich, S. 1990. Organic Farming. Farming Press. London, UK.

Lind K, Lafer G, Schloffer K, Innershofer G and Meister H. 2003. Organic Fruit Growing. CAB International.

Janiappan SP and Annadurai K. 2008. Organic Farming- Theory and Practice. Scientific rublishers, Jodhpur, Rajasthan, India.

Palekar S. 2004. The Technique of Spritual Farming. Chandra Smaritee, Sai Nagar, Amrawati, Maharashtra.

Proctor P. 2008. Biodynamic Farming and Gardening. Other India Press, Mapusa, Goa. Ram RA and Pathak RK. 2017. Bioenhancers. Lap Lambert Academic Publishing, AP.

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13.Course Code : HOFS- 513, Course Title : Minor Fruit Production, Credit Hours : (2+1)

Why this course ?

Apart from commercially grown fruits, several other fruits inspite of being rich innutrients and potential future crops, remains neglected/ underexploited. The hardyRestructured and Revised Syllabi of Post-graduate Programmes Vol. 1nature coupled with the possibility of diversification (newly domesticated crops)further adds to their importance. The course outlines the efforts made instandardizing agro-techniques for propagation and cultivation besides know-howon their nutraceutical value and other uses.

Aim of the course

To import basic knowledge underexploited minor fruit crops. The course is structured as under:-No. Blocks Units

1 Introduction Occurrence, Adoption and General Account

- 2 Agro-Techniques Propagation and Cultural Practices
- 3 Marketing and utilization Post-Harvest Management

Learning outcome

On successful completion of the course, the students are expected to know about

- Various minor fruits hitherto neglected and their commercial value
- Efforts made to domesticate minor fruits and standardization of agro-techniques.
- Their utilization in processing industry.

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tock 1: Introduction

whit I: Occurrence, Adoption and General Account: Importance - occurrenceand distribution, climate adaptation in fragile ecosystem and wastelands. 1. 公司公司家

Block 2: Agro-Techniques

Unit I: Propagation and Cultural Practices: Traditional cultural practices and recent development in agrotechniques; propagation, botany-floralbiology, growth patterns, mode of pollination, fruit set. ripening. fruitquality.

Block 3: Marketing and Utilization

Unit I: Post-Harvest Management: Post harvest management, marketing; minorfruit crops in terms of medicinal and antioxidant values; their uses foredible purpose and in processing industry

Crops

Bael, chironji, fig, passion fruit, jamun, phalsa, karonda, woodapple, cactus pear.khejri, kair, pilu, lasoda, loquat, tamarind, dragon fruit, monkey jack, mahua,khirni, amra, kokum, cape gooseberry, kaphal, persimmon. pistachio, seabuckthorn, hazel nut and other minor fruits of regional importance

Practicals

• Visits to institutes located in the hot and cold arid regions of the country (2);

dentification of minor fruits plants/ cultivars (2);

Collection of leaves and preparation of herbarium (1);

• Allelopathic studies (2);

- Generating know-how on reproductive biology of minor fruits (4);
- Fruit quality attributes and biochemical analysis (3);
- Project formulation for establishing commercial orchards in fragile ecosystems(1).

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Teaching Methods/ Activities

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

Suggested Reading

Ghosh SN, Singh A and Thakur A. 2017. Underutilized Fruit Crops: Importance and Cultivation. Jaya Publication House, New Delhi.

Krishna H and Sharma RR, 2017. Fruit Production: Minor Fruits. Daya Publishing House, Mazumdar BC. 2014. Minor Fruit Crops of India: Tropical and Subtropical. Daya Publication Nath V, Kumar D, Pandey V and Pandey D. 2008. Fruits for the Future. Satish Serial Publishing Pareek OP, Sharma S, and Arora RK. 2007. Underutilised Edible Fruits and Nuts, IPGRI, Peter KV. 2010. Underutilized and Underexploited Horticultural Crops. NIPA, New Delhi. Rana JC and Verma VD. 2011. Genetic Resources of Temperate Minor Fruit (Indigenous and Saroj PL and Awasthi OP. 2005. Advances in Arid Horticulture, Vol. II: Production Technology Saroj PL, Dhandar DG and Vashishta BB. 2004. Advances in Arid Horticulture, Vol.-1 Present Singh et al. 2011. Jamun. ICAR, New Delhi. Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1 MINOR COURSE OFFERED TO THE OTHER DEPARTMENT 14. Course Code : HOFS- -715, Course Title: Fruit Production and Post- Harvest Management, Credit Postharvest management of fruits and vegetable: A potential for reducing a minimum postharvest losses as well as can potentially reduce production cost . A dual purpose of preventing losses that occur due to harvest losses of fruits and vegetables vary from 25% to 40%, depending on the kind of produce and the pre and post-harvest practices they are put through. The Course is organized as follows: 1. Fruit Production 1. Introduction 2. Management of horticultural crops 2. Post-Harvest Management 1. Post harvest management in horticulture procurement 2. Post harvest management in horticulture ocess

Marketing of fruits

ví. Theory

Block 1: Fruit Production

Unit 1: Introduction: Global and National Status of Horticultural production in India and emerging scenario

Unit 2: Management of horticultural crops: Establishing an orchard, basic cultural practices, regulation of flowering, fruiting and thinning, protection against insectpest, weeds: Maturity indices, Harvesting and its relationship with quality, sorting and grading, pre-harvest crop management practices and their influence on quality during storage and marketing.

Block 2: Post-Harvest Management

Unit 1: Post-harvest management in horticulture-procurement: Procurement management, important factors for marketing, standardization and quality control, packaging. Physiology of ripening and senescence. Storage system: on-farm storageevaporatively cooled stores, ventilated storage, pit storage etc. Refrigerated storage refrigeration cycle, controlled/modified atmosphere, hypobaric storage.

Unit 2: Post harvest management in horticulture process: Application of growth regulators for quality assurance, post-harvest treatments: pre cooling, heat treatments (hot water, hot air and vapor heat), fungicides & biologically safe chemicals, irradiation. curing, pulsing etc. Packingline operations, packaging of horticultural produce. Transportation rail, road, sea, air. Codex norms for export ofperishables. Development of fruit-based carbonated drinks, development of dehydrated products from

Restructured and Revised Syllabi of Post-graduate Programmes Vol. 2

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someimportant fruits, storage of pulp in pouches, essential oils from fruit waste, dehydrated fruits. Market structure and export potential of fruits. Unit 3: Marketing of fruits: Problems in marketing of fruits, and government

policy; quality standards for domestic and international trade. VII. Teaching methods/activities

Serle and Services

• Lecture and Discussion

· Case Study

PPT presentation

VIII. Learning outcome

To impart knowledge about management of horticultural crops and post-harvest

. Suggested Reading

•Rathore NS, Mathur GK and Chasta SS. 2013. Post-Harvest Management and Processing of Fruits and Vegetables, ICAR.

• Chadha KL and Pareek OP. 1993. Advances in Horticulture. Vols. I-IV. Malhotra Publ. House. • Kader AA. 1992. Post-harvest Technology of Horticultural Crops. Univ. of California. Div. of

• Jacob JP. 2012. Handbook on Post Harvest Management of Fruits and Vegetables, ASTRAL

• NIIR Board of Consultants & Engineers. 2016. The Complete Technology Book on Processing, Dehydration, Canning, Preservation of Fruits & Vegetables, NIIR PROJECT CONSULTANCY

• Thompson K. 2003. Fruit and Vegetables: Harvesting, Handling and Storage, Wiley-

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