

Master in Forestry Engineering

Course information

Year 2019-20

GENERAL SPECIFICATIONS				
English name				
Biotechnology and Genetic Improvement in Forestry				
Spanish name				
Biotecnología y Mejora Genética en el Ámbito Forestal				
Code		Type		
1150106		Compulsory		
Time distribution				
	Total	In class	Out class	
Working hours	100	40	60	
ECTS: 4				
Standard group		Small groups		
	Classroom	Lab	Practices	Computer classroom
2.2	0.8	0.5	0.5	0
Departments		Knowledge areas		
Agroforestry Sciences		Environmental technologies/Agroforestry engineering		
Year		Semester		
1º		2º		

TEACHING STAFF			
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SPECIFIC INFORMATION OF THE COURSE
1. Contents description
1.1. In English:
Theoretical and practical background of plant biotechnology. Basics and techniques used in genetic engineering for application in forestry and natural environment General principles of plant selection and breeding applied in forestry and natural environment Main types of cultures in vitro. Techniques required for its establishment, analysis and evaluation Major plant micropropagation techniques Design and application of micropropagation protocols Relevant aspects of the control of secondary metabolism in vitro plant cultures Design and implementation of production processes.
1.2. In Spanish
Bases teóricas y prácticas de la biotecnología vegetal y herramientas de las que se vale dicha disciplina Técnicas de las que se vale la ingeniería genética de y fundamentos necesarios para su

aplicación en el ámbito forestal y natural
 Principios generales de la selección y mejora genética vegetal y la particularidad de aplicación en el ámbito forestal y natural
 Principales tipos de cultivos in vitro y las técnicas necesarias para su establecimiento, análisis y evaluación
 Principales técnicas de micropropagación de plantas
 Diseño y aplicación protocolos de micropropagación
 Aspectos relevantes del control del metabolismo secundario en cultivos vegetales in vitro
 Diseño y aplicación de procesos de producción

2. Background

2.1. Situation within the Degree:

The course is a basic subject of the first year of the Master. The course requires knowledge of plant anatomy and plant physiology, genetic, plant breeding and statistics. Their contributions are essential as a base for the student to be able to know, design and apply biotechnological processes in forest plants..

2.2. Recommendations:

There are no specific prerequisites, but it is highly recommended that students have a background in technical or science subjects at Degree level, as well as in subjects of plant anatomy, plant physiology, genetic, plant breeding and statistics

3. Objectives (as result of teaching):

The student who passes this course must be able to know, design and apply biotechnological processes in the forest plants. Likewise, they will know the techniques for its application in the selection, improvement and conservation of forest genetic resources. All this, with sufficient technical capacity for its application in the national and international levels and knowing the occupational and environmental risks that such activity may entail

4. Skills to be acquired

4.1. Specific Skills:

CEPF06: Adequate knowledge and ability to develop and apply technology in: forest breeding

4.2. General Skills:

CB6: Acquire and understand knowledge that provides a basis or opportunity to develop and implement original ideas, mainly in a research context

CB7: Know how to apply the acquired knowledge and problem-solving skills in new or unfamiliar settings within broader (or multidisciplinary) contexts related to their area of study

CB8: Be able to integrate knowledge and face the complexity of making judgements from information that despite being incomplete or limited include reflections on the social and ethical responsibilities associated with the application of their knowledge and judgements.

CB9: Know how to communicate in a clear and unambiguous way their findings and knowledge and the arguments supporting them to both specialised and non-specialised audiences.

CB10: Acquire the learning skills that will enable them to continue studying in a mostly self-directed or autonomous way.

CG6: Ability to develop techniques and projects in the field of forest genetics

CT1. Manage the acquired information adequately showing advanced knowledge in a scientific and technological research or highly specialized context and demonstrating a detailed and well-founded understanding of theoretical and practical aspects and of the work methodology in the field.

5. Training Activities and Teaching Methods
5.1. Training Activities:
<p>Theory classes on the contents of the Program. Problem Solving sessions. Practical sessions in specialized laboratories or computer rooms. Field sessions to approach the industrial reality. Activities Academically Directed by the Faculty: seminars, conferences, development of works, debates, collective tutorials, evaluation activities and self-evaluation</p>
5.2. Teaching Methods:
<p>Theory classes Practices lessons in the laboratory or Computer Classrooms in small groups Work in groups: Approach, Realization, Tutoring and Presentation of Works Practical work Problem Solving and Practical Exercises Field training in small groups Individual or Collective Tutorials Direct interaction between teachers and students.. Conferences and Seminars. Evaluations and Exams.</p>
5.3. Development and Justification:
<p>1. Theory classes There will be 20 hours of lessons in which the theoretical base of the subject will be explained, with the aid of board work and computer presentations. Participation of the students is highly encouraged and will form part of the evaluation. This activity develops CEPF06, CG6, CB7, CB6 skills.</p> <p>2. Practical lessons in the laboratory or Computer Classrooms in small groups There will be 5-hour sessions in the laboratory. These practical lessons will consist in in vitro culture. Also There will be 2 two-hour session for solving practical tasks. (CEPF06, CG6,CB7, CB6 skills)</p> <p>3. Work in groups: Approach, Realization, Tutoring and Presentation of Works There will be two tasks for students to carry out in small groups: (CB9, CB10, CB7,CT1, CEPF06, CB6)</p> <p>4. Practical work Problem Solving and Practical Exercises. For the practical section of this course, the students will be required to describe the methodology and results of an experiment of in vitro culture according different information that they have gathered and managed. (CB9, CB10, CT1, CEPF06, CG6, CB7, CB6)</p> <p>5. Field training There will be a field trip (1 day) in the province of Huelva in order to know examples on plant breeding. (CB9, CB8, CB10, CB7, CB6)</p> <p>7. Conferences and Seminars. Assistance to Seminars or conferences organized by the teachers of the subjects or other organisms. (CB8, CB7, CT1)</p>

6. Detailed Contents:
<p>THEORY Part I. BIOTECHNOLOGY IN THE FOREST AREA</p> <p>1. Introduction. Biotechnology: concept, nature and historical development. Living beings: cellular and molecular level. Structure of nucleic acids. Replication. Transcription. Translation. Current biotechnology. Genetic engineering. Genetic improvement of forest species: objectives and limitations. Contributions of Biotechnology.</p> <p>2. Genetic engineering. Molecular tools and methods of isolation, characterization and manipulation of DNA. Protocol for the generation of DNA recombinant. Vectors Isolation. Restriction enzymes. Ligases. DNA Recombinant technology. Cloning of genes. Hybridization.</p>

Molecular analysis of DNA, RNA and proteins. DNA amplification. Genetic markers: concept and applications. Types.

3. In vitro culture of tissues. Concept and foundation. Morphogenesis Growth and differentiation in vitro. Explants. Culture media Applications: production and improvement. Micropropagation: concept, stages and factors. Regeneration paths. Meristem culture. Germplasm conservation in vitro. Obtaining doubled haploids. Sexual hybridization, Somatic Hybridization Somaclonal variation.

4. Transgenesis Objective. Basis and Methods. Requirements. DNA transfer systems. Agrobacterium tumefaciens. Biobalistic Applications: Modifications in Growth and Development. Resistance to pests and diseases. Tolerance to high and low temperatures, salinity and drought. Modification of the lignin and cellulose content. Phytodecontamination.

5. Proteomics Concept. Methodology for the analysis of the proteome. Applications: Regulation of Xylogenesis, Formation of tension wood. Juvenile and adult wooden proteomes. Proteomics and Response to water stress.

Part II: FOREST BREEDING

6. Introduction to forest breeding. Concept and objectives of breeding. Advantages and Limitations. Basic terminology. The breeding cycle.

7. Genetic structure of forest stands. Genetic bases of breeding. Variability. Quantitative genetics: Components of the phenotypic variance. Heritability. Selection of the base population. Genetic values of parents. breeding Indicators.

8 Genetic tests Concept and objectives. Essays on the introduction of species, provenances and progenies, clonal tests. Designs of crosses. Experimental design. Analysis of genetic tests.

9. Reproduction of the selected material. Seed orchards, clonal reproduction. Progenitors

10. Breeding methods Asexually propagated species: Clonal Selection and Hybridization. Sexually propagated species: - Autogamous. Masal selection. Selection of pure lines. Hybridization; - Allogamous - Masal Selection, of Progenies, Recurrent. Hybridization.

LABORATORY AND COMPUTER TRAINING PROGRAM

Selection and preparation of individuals for their in vitro propagation

Preparation of culture media and laboratory procedures for in vitro culture.

In vitro implantation

in vitro multiplication

Rooting and acclimatization of plants produced in vitro

Analysis of breeding trials I

Analysis of breeding trials II

7. Bibliography

7.1. Basic Bibliography

Seguí Simarro, J. M. 2011. Biología y biotecnología reproductiva de las plantas. Valencia : Editorial de la Universidad Politécnica de Valencia,

Renneberg, R. 2009. Biotecnología para principiantes . Barcelona : Reverté, XI, 300 p.

Benítez Burraco, A.. 2005. Avances recientes en biotecnología vegetal e ingeniería genética de plantas. Barcelona : Reverté, 196 p.

Martos Núñez, V. M. y García del Moral L. Prácticas de biotecnología vegetal : plan de prácticas-memoria-diario. Granada :Universidad de Granada, 68 p.

Griffiths A.F., Wessler S.R., Lewontin R.C., Carroll S.B. 2008. Genética. Madrid : McGraw-Hill Interamericana de España, 841 p

Cubero Salmerón, J. I. 2003. Introducción a la mejora genética vegetal. Madrid : Mundi-Prensa, , 567 p

Falconer D.S., Trudy F.C. Mackay 2001. Introducción a la genética cuantitativa. Zaragoza : Acribia. 469 p.

Caujapé-Castells, J. 2006. Brújula para botánicos desorientados en la genética de poblaciones. Las Palmas de Gran Canaria. Exegen Ediciones. 132 p.

7.2. Additional Bibliography:

Castillo Rodríguez F. (coord.) 2005. Biotecnología ambiental, Madrid : Tébar, 614 p.

Kreuzer, H. 2004 ADN recombinante y biotecnología : guía para estudiantes. Zaragoza : Acribia,, 449 p.

Caballero, J.L., Valpuesta V., Muñoz J., Blanco J. 2001. Introducción a la biotecnología vegetal: métodos y aplicaciones. Córdoba : Publicaciones Obra Social y Cultural Cajasur, 406 p.

Fita Fernández A.M., Rodríguez Burruezo A., Prohens Tomás J. 2008. Genética y mejora vegetal. Universidad Politécnica de Valencia, 190 p.

Viseras Alarcón, E 2008. Cuestiones y problemas resueltos de genética . Universidad de Granada, 285 p

Ménsua Fernández J.L. 2003. Genética : problemas y ejercicios resueltos. Madrid : Pearson Educación. 386 p.

Nuez F., Pérez de la Vega M., Carrillo J.M (Ed)- 2004. Resistencia genética a patógenos vegetales. Universidad Politécnica de Valencia. 568 p.

8. Systems and Assessment Criteria

8.1. System for Assessment:

1. Theory and practical written assessment
2. Practical work exposition
3. Exposition of written work and report
4. Participation and interest

1. Theory and practical written assessment

This exam represents 60% of the final mark. To pass the subject it is necessary to obtain at least 5 out of 10 in this exam. **(CEPF06,CG6,CB7, CB6, CB8 skills)**

2. Practical work exposition and 3. Exposition of written work and report

Presentation of a memory of the practices carried out in the subject The mark for both works represents 30% of the final mark. The mark is from 0 to 10 and to pass the subject it is necessary to obtain at least 4 points **(CB9, CB10, CT1, CEPF06, CG6, CB7, CB6 skills)**.

3. Participation and interest

The active participation and interest in the subject demonstrated by students will be evaluated, **(CT1, CG6, CB7)**

Final mark

The final mark for the subject will be obtained thus: $0.6 \times A + 0.3 \times B + 0.1 \times C$,

where A is the mark for the theory-practical written exam. B is the mark for the Practical work exposition and exposition of written work and report and C is the teacher's evaluation of the interest and active participation of the student.

To pass the subject, students have to obtain at least 5 points in the final mark, with at least 4 points in the grades for B and C.

Alternative modality for evaluation of practical lessons (Practical work):

Those students who cannot attend classes, for work, health or other reasons included in Article 8 of the Regulations for the Degree and Official Master's Degrees of the University of Huelva (approved by the Government Council of July 16, 2009) (Modification approved by the Government Council of July 29, 2016), must:

1. To communicate it to the coordinator of the subject as soon as the circumstance arises.
2. To carry out a bibliographic work related to the practices of the subject. The teacher will offer several alternatives taking into account the interest of the student.
3. To inform the professor of practices on the development of work at least two times during the course.
4. To deliver the bibliographic work before the official exam dates.
5. To be willing to verbally explain some aspects of the work if requested by the teacher.

Final results will be given in terms of a numerical scale between 0 and 10 (including tenths), with the corresponding qualitative ratings below:

≤4.9: Fail (D)

5.0 -6.9: Pass (C)

•7.0 -8.9: Pass with Merit (B)

•9.0 -10: Distinction (A)