

Academic Year/course: 2022/23

60570 - Biotechnology in plant and animal breeding

Syllabus Information

Academic Year: 2022/23

Subject: 60570 - Biotechnology in plant and animal breeding

Faculty / School: 201 - Escuela Politécnica Superior

Degree: 546 - Master in Agricultural Engineering

ECTS: 6.0

Year: 2

Semester: First semester

Subject Type: Compulsory

Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that he/she has achieved the expected learning outcomes by means of the following assessment activities

First, a written test at the end of the first theoretical block of Animal Breeding (according to the syllabus). This test will consist of 10 multiple-choice questions and 3 open questions about topics covered in these theoretical and practical classes. The grade of the test will be out of 4 points. Students who pass this test (2 points), may choose to take an exam at the end of the course only on the contents of the remaining topics of Plant Breeding.

Second, a written test at the end of the course, at the first and second sittings, on the contents of the theoretical and practical classes. This test will consist of 20 multiple-choice questions and 6 open questions. The grade for the test will be out of 8 points. Students who have passed the partial exam described in the previous section may eliminate the questions corresponding to the first part of the subject from their exam. In this case, the grade for the written exam will be obtained from the arithmetic sum of both exams, if at least 2 points have been obtained in both.

Third, completion of two reports from the practical classes, one on animal breeding and the other on plant breeding. Both written reports will be presented on the dates indicated in the course calendar and will be valued up to 1 point each.

In order to pass the course, a minimum of 2.5 points must be obtained in each of the two parts (animal and plant). In the case of not achieving this evaluation in any of the parts, the final mark that will be reflected in the subject's minutes will be:

If the final average grade (CF) > 4, Fail, 4.

If the final average grade (CF) < 4, Fail, CF.

Evaluation criteria

Written tests and assignments: answers will be assessed on the correctness, concreteness and

orderly presentation of concepts, as well as the establishment of relationships between techniques applicable in different fields. The quality of the scientific information provided and the incorporation by the student of sustainability criteria in the development of his or her proposal for improvement will be especially valued.

The success rates in previous years are:

2018/19	2019/20	2020/21
66.67%	90.91%	80.00%

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as theory sessions, practice sessions and workshops.

4.2. Learning tasks

The course includes the following learning tasks:

- Theory sessions
- Practice sessions
- Workshops

4.3. Syllabus

The course will address the following topics:

Topic 1. Introduction to animal breeding

- 1.1. Objectives of animal breeding
- 1.2. Evolution of genetics and its application to animal science
- 1.3. Genomics and animal breeding

Topic 2. Inheritance of major traits in animal science

- 2.1. Examples of simple allelic series
- 2.2. Examples of multiple allelic series
- 2.3. Sex-linked inheritance
- 2.4. Examples of genetic anomalies

Topic 3. Fundamentals of population genetics

- 3.1. Genetic characterization of a population
- 3.2. Variation of allele frequencies under selection

Topic 4. Inheritance of polygenic traits

- 4.1. Variables to describe polygenic traits
- 4.2. Determinism in polygenic traits
- 4.3. Genetic variables of polygenic traits

Topic 5. Basic principles on selection within a breed

- 5.1. Concept of breed in animal production
- 5.2. Breeds in Spain
- 5.3. Objectives and criteria for selection
- 5.4. Selecting breeding

Topic 6. Estimates of additive value or indexation

- 6.1. Characterization of genetic indexes
- 6.2. Estimation of the elemental index
- 6.3. Estimation of the synthetic index

Topic 7. Application of genetic indexes

- 7.1. Cattle application
- 7.2. Pigs application
- 7.3. Birds application

Topic 8. Expected Progeny Differences

- 8.1. Relationship between genetic superiority and expected progeny differences
- 8.2. Parameters of expected progeny differences per year
- 8.3. Response to selection

Topic 9. Method of selection

- 9.1. Genomic selection
- 9.2. Selection by ancestors
- 9.3. Individual selection
- 9.4. Selection by collateral relatives
- 9.5. Progeny selection

Topic 10. Cross-breeding

- 10.1. Objective of cross-breeding
- 10.2. Types of cross-breeding

Topic 11. Plant breeding

- 11.1. Introduction
- 11.2. Registration of plant varieties
- 11.3. Genetic consequences of plant reproduction systems
- 11.4. Types of varieties

Topic 12. Breeding methods (I)

- 12.1. Objectives of plant breeding
- 12.2. Pure line breeding.
- 12.3. Backcrossing
- 12.4. Obtaining multiline varieties

Topic 13. Breeding methods (II)

- 13.1. Obtention of open-pollinated varieties
- 13.2. Obtention of synthetic varieties
- 13.3. Obtention of hybrid varieties
- 13.4. Obtention of clonal varieties

Topic 14. Plant molecular breeding. Random markers

- 16.1. Molecular markers
- 16.2. Variety identification
- 16.3. Crossing and purity tests
- 16.4. Genetic diversity analysis

Topic 15. Mapping markers and genes

- 17.1. Linkage and cartography of markers. Maps
- 17.2. Mapping populations
- 17.3. Mapping major genes
- 17.4. Mapping QTLs
- 17.5. Marker assisted selection

Topic 16. Genome sequencing- derived markers

- 16.1. Resequencing: SNP markers.
- 16.2. High throughput genotyping platforms.
- 16.3. Genotyping by sequencing.
- 16.4. Genome wide association studies.
- 16.5. Genomic selection.

Individual work	2	4	4	4	4	4	4	2	4	4	4	4	8	4	4	8	8	8	6		90
TOTAL	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	0	150

(1) Friday 23th of September with monday planning

(2) Friday 30th of September with tuesday planning

(3) Friday 2nd of October with wednesday planning

4.5. Bibliography and recommended resources

- BB** Benítez Burraco, Antonio. Avances recientes en biotecnología vegetal e ingeniería genética de plantas / Antonio Benítez Burraco. Barcelona [etc.] : Reverté, D. L. 2005
- BB** Brown, Jack. An introduction to plant breeding / Jack Brown, Peter D.S. Caligari. Oxford : Blackwell, 2008
- BB** Chawla, H.S. Introduction to plant biotechnology / H.S. Chawla. 3rd. ed. Enfield (NH)[etc.] : Science Publishers, cop. 2009
- BB** Falconer, D.S. Introducción a la genética cuantitativa / D.S. Falconer, Trudy F.C. Mackay ; [traducción realizada por Armando Caballero Rúa ... (et al.)]. 1a. ed. en español, traducción de la 4a. ed. inglesa. Zaragoza : Acribia, 2001
- BB** Nicholas, F.W. Introducción a la genética veterinaria / F.W. Nicholas ; [traducción a cargo de Alfredo Ruiz Panadero, Arcadio Navarro Cuartiellas, Esther Beltrán Paula]. Zaragoza : Acribia, 1998
- BB** SOCIAS I COMPANYY, R. La obtención de variedades?: desde la mejora clásica hasta la mejora genética molecular. [s. l.]: Centro de Investigación y Tecnología Agroalimentaria de Aragón, 2014. ISBN 9788483803202.
- BC** Amélioration génétique des animaux d'élevage : Génome, caractères, sélection et croisements / Roland Jussiau... [et al.]. [3ème. éd.]. Dijon : Educagri, cop. 2013
- BC** Avicultura clásica y complementaria / coordinador y director, Carlos Buxadé Carbó ; con la participación de 18 autores. Madrid [etc.] : Mundi-Prensa, 1995
- BC** Fundamentos de las técnicas de biología molecular / Denis Tagu, Christian Moussard, editores ; traducción realizada por Josep M. Casacuberta. Zaragoza : Acribia, 2006
- BC** Los marcadores genéticos en la mejora vegetal / editores, F. Nuez, J.M. Carrillo. Valencia : Universidad Politécnica de Valencia, D.L. 2000
- BC** Nicholas, F. W. Introduction to veterinary genetics / F.W. Nicholas. 2nd ed. Oxford : Blackwell Publishing, 2003
- BC** Ovino de leche : aspectos claves / con la participación de 34 profesionales ; coordinador y director, Carlos Buxadé Carbó. Madrid [etc.] : Mundi-Prensa, 1997
- BC** Porcinocultura intensiva y extensiva / coordinador y director, Carlos Buxadé Carbó ; con la participación de 26 autores. Madrid [etc.] : Mundi-Prensa, 1996
- BC** Producción animal acuática / coordinador y director, Carlos Buxadé Carbó ; con la participación de 23 autores. Madrid [etc.] : Mundi-Prensa, 1997
- BC** Producción caprina / coordinador y director Carlos Buxadé Carbó ; con la participación de 28 autores. Madrid [etc.] : Mundi-Prensa, 1996
- BC** Producción ovina / coordinador y director, Carlos Buxadé Carbó ; con la participación de 25 autores. Madrid [etc.] : Mundi-Prensa, 1996
- BC** Producción vacuna de leche y carne / coordinador y director, Carlos Buxadé Carbó ; con la participación de 23 autores. Madrid [etc.] : Mundi-Prensa, 1996
- BC** Producciones cinegéticas, apícolas y otras / coordinador y director Carlos Buxadé Carbó ; con la participación de 20 autores. Madrid [etc.] : Mundi-Prensa, 1997

- BC** Producciones cunícola y avícolas alternativas / coordinador y director Carlos Buxadé Carbó. Madrid [etc.] : Mundi-Prensa, 1996
- BC** Producciones equinas y de ganado de lidia / coordinador y director Carlos Buxadé Carbó. Madrid [etc.] : Mundi-Prensa, 1996
- BC** Razdan, M.K. Introduction to plant tissue culture / M.K. Razdan. 2nd ed. Enfield : Science Publishers, cop. 2003
- BC** Vacuno de carne : aspectos claves / coordinador y director Carlos Buxadé Carbó ; con la participación de 41 profesionales. Madrid : Mundi-Prensa, 1997
- BC** Vacuno de leche : aspectos claves / coordinador y director Carlos Buxadé Carbó ; con la participación de 35 profesionales. Madrid : Mundi-Prensa, 1997

The updated recommended bibliography can be consulted in:<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=60570>