

60570 - Biotechnology in plant and animal breeding

Información del Plan Docente

Academic Year	2016/17
Academic center	201 - Escuela Politécnica Superior
Degree	546 - Master in Agricultural Engineering
ECTS	6.0
Course	2
Period	First semester
Subject Type	Compulsory
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

Theoretical sessions, practical sessions and workshops

5.2.Learning activities

Theoretical sessions, practical sessions and workshops

5.3.Program

Unit 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

Unit 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

Unit 3. Fundamentals of population genetics

3.1. Genetic characterization of a population

3.2. Variation of allele frequencies under selection

Unit 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

Unit 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

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5.4. Selecting breeding

Unit 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

Unit 7. Application of **genetic indexes**

7.1. Cattle application

7.2. Pigs application

7.3. Birds application

Unit 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

Unit 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

Unit 10. Cross-breeding

10.1. Objective of cross-breeding

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10.2. Types of cross-breeding

Unit 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

Unit 12. Breeding methods (I).

12.1. Objectives of plant breeding.

12.2. Pure line breeding.

12.3. Backcrossing

12.4. Obtaining multiline varieties

Unit 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

Unit 14. Applications of tissue culture techniques in plant breeding

14.1. Sanitary clonal selection

14.2. Somaclonal variation; in vitro induced mutagenesis

14.3. Embryo rescue

14.4. Obtention of haploid and doublé-haploid plants

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Unit 15. Applications of plant genetic engineering

15.1. Transgenic varieties

15.2. Genetic improvement of abiotic stress tolerance

15.3. Genetic improvement of biotic stress tolerance

15.4. Genetic improvement of quality

15.5. Plant as biofactories

15.6. Legal regulation of transgenic varieties

15.7. Genome editing

Unit 16. Applications of random molecular markers

16.1. Molecular markers

16.2. Variety identification

16.3. Crossing and purity tests

16.4. Plant genetic diversity analysis

Unit 17. Mapping markers and genes.

17.1. Linkage and cartography of markers. Maps

17.2. Mapping populations

17.3. Mapping major genes

17.4. Detection of QTLs

17.5. Marker assisted selection

17.6. Development of allele-specific markers

Unit 18. Applications of genome sequencing

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18.1. Resequencing: SNPs markers.

18.2. Platforms for mass-genotyping

18.3. Genotyping by sequencing

18.4. Genome wide association analysis

18.5. Genomic selection

Unit 19. Identification and characterization of genes (I) .

19.1. Positional cloning

19.2. Cloning genes by sequence homology

19.3. Programs to predict genes

19.4. Reverse genetics strategies

Unit 20. Identification and characterization of genes (II)

20.1. Functional cloning

20.2. Genetic expression analysis

20.3. Proteomics

20.3. Metabolomics

PRACTICAL PROGRAM

1- Breeding program of 'Frisona Española'

2- Breeding program in 'Raza Parda de Montaña'

3- Breeding program in 'Rasa aragonesa'

4- Breeding program in 'Gallina del Sobrarbe'

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5- Breeding program in pork

6 - Evaluation of quantitative traits in cultivated plants

7- Heritability. Selection.

8- Genetic transformation of tomato

9- Analysis of genetic diversity in grapevine using SSR markers

10- Analysis of SNP markers in rice

5.4.Planning and scheduling

Week	Theory	Practical session	Hours of study	Total
1	Unit 1 Unit 2	-	-	4
2	Unit 3 Unit 4	-	study (4 h)	8
3	Unit 5 Unit 6	-	study (4 h)	8
4	Unit 7	Practical session 1	work (2 h) study (2 h)	8
5	Unit 8	Practical session 2	work (2 h) study (2 h)	8
6	Unit 9	Practical session 3	work (2 h) study (2 h)	8

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7	Unit 10	Practical session 4	work (2 h) study (2 h)	8
8	Unit 11	Practical session 5	work (2 h) study (2 h)	8
9	Unit 12 Unit 13 (Exam session)	-	study (4 h)	8
10	Unit 14	Practical session 6	work (2 h) study (2 h)	8
11	Unit 15 Unit 16	-	work (2 h) study (2 h)	8
12	Unit 17	Practical session 7	work (2 h) study (2 h)	8
13	Unit 18	Practical session 8	work (2 h) study (2 h)	8
14	Unit 19	Practical session 9	Work (2 h) study (2 h)	8
15	Unit 20	Practical session 10	study (4 h)	8
16	-	-	study (8 h)	8
17	-	-	study (8 h)	8

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18	-	-	study (8 h)	8
19	-	-	study (8 h)	8
20	Exam session			2
Total Hours	42	20	88	150

5.5. 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** Los marcadores genéticos en la mejora vegetal / editores, F. Nuez, J.M. Carrillo . Valencia : Universidad Politécnica de Valencia, D.L.200
- 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
- BC** Amélioration génétique des animaux d'élevage : Génome, caractères, sélection et croisements / Roland Jussiau... [et al.] .

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[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 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

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/ 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