Universidad Zaragoza

Academic Year/course: 2024/25

60570 - Biotechnology in plant and animal breeding

Syllabus Information

Academic year: 2024/25
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

This subject aims to introduce the student to the basics of animal breeding and to advance in the knowledge of plant breeding techniques, with special emphasis on biotechnological tools related to genomics.

Genetic improvement is fundamental for the profitability and sustainability of agricultural production. It is a complex discipline based on population and quantitative genetics, and more recently on molecular genetics, which helps to increase the effectiveness and efficiency of breeding. This subject will review the classical tools and improvement methods, in order to frame the applications of biotechnology relevant to this professional activity.

The general contents of the subject are in line with the following sustainable development objectives:

Goal 2. End hunger, Achieve Food Security and Improved Nutrition, and Promote Sustainable Agriculture.

Goal 12. Ensure Sustainable Consumption and Production Patterns.

2. Learning results

- To be able to understand the basic concepts and fundamentals of animal and plant breeding.
- To be able to explain the methods used in the genetic improvement of different animal and plant species of productive interest.
- To be able to integrate biotechnological tools in animal and plant breeding programs.
- To be able to apply genomic and plant genetic engineering techniques.
- To be able to analyse data from practical cases and to write scientific-technical reports on such cases.

3. Syllabus

THEORY PROGRAM

Topic 1. Introduction to animal breeding

Topic 2. Inheritance of monogenic traits of zootechnical interest

Topic 3. Elements of population genetics

Topic 4. Inheritance of polygenic traits

Topic 5. Principles of intra-race selection

Topic 6. Additive genetic value estimation or indexing

Topic 7. Application of selection indexes

Topic 8. Expected genetic progress

Topic 9. Selection methods

Topic 10. Crossbreeding

Topic 11. Plant breeding

Topic 12. Breeding methods (I)

Topic 13. Breeding methods (II)

Topic 14. Molecular breeding. Random markers.
Topic 15. Marker and gene mapping.

Topic 16. Markers derived from genome sequencing

Topic 17. Marked genes, cloned genes

Topic 18. Applications of in vitro culture techniques in breeding

Topic 19. Applications of plant genetic engineering (I)

Topic 20. Applications of plant genetic engineering (II)

PRACTICAL SESSIONS PROGRAM

1. Spanish Friesian Breeding Program.

2. Beef cattle breeding program: *Parda de Montaña* breed.

3. Breeding program for the improvement of a promotion breed: *Rasa Aragonesa*.

4. Improvement program for a breed in danger of extinction: *Gallina del Sobrarbe* breed.

5. Swine breeding program.

6. Evaluation of quantitative characteristics. Selection. Heritability.

7. Analysis of genetic diversity in grapevine by means of microsatellite markers.

8. Analysis of SNP markers in barley: mapping of QTLs.

9. SNP marker analysis in rice: GWAS.

10. Genetic transformation of tomato.

4. Academic activities

Theoretical sessions (20 classes of 2 hours each) will consist of expository and participative lessons. Theoretical and practical test evaluations may be proposed to the students during the development of the theoretical sessions.

Practical laboratory/computer room (10 sessions of 2 hours each). These will be demonstrative-active-interrogative activities in which students will be able to perform various analytical techniques and procedures that will train their observation, analysis and critical thinking skills.

Some of the cases raised in the practical classes on data analysis will be solved autonomously by the student, who will present a written report on them (one on a case of animal breeding and another on plant breeding).

5. Assessment system

Performance of a written test at the end of the first block of Animal Breeding, consisting of 10 multiple-choice questions and 3 open questions. The grade for the test will be out of 4 points. Students who pass it (≥ 2 points), may choose to take an exam at the end of the subject only on the contents of the remaining topics of Plant Breeding.

A written test at the end of the subject, in the first and second call, consisting of 20 multiple-choice questions and 6 open questions. The grade will be out of 8 points. Students who have passed the partial test described above do not need to answer the questions corresponding to the first part of the subject in their exam. In that case, the grade of the written test will be obtained from the arithmetic sum of both exams, if at least 2 points have been obtained in both.

Completion of two works proposed in the practical classes, one on animal breeding and the other on plant breeding. Both written reports shall be submitted on the examination dates and shall be valued up to 1 point each.

A minimum of 2.5 points in each of the two parts (animal and plant) is required to pass the subject.

In case the student does not achieve this grade in any of the parts, the final grade that will be reflected in the minutes of the subject will be:

If the final averaged grade (CF) ≥ 4, failed, 4.
If final grade averaged (CF) < 4, failed, CF.

Success rates in previous years

2020/2021	2021/2022	2022/2023
80%	68,18%	52,94%

6. Sustainable Development Goals

2 - Zero Hunger
12 - Responsible Production and Consumption