INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Biotechnology applied to genetic improvement			Field of study	Biology and biochemistry/Animal and agrarian production	
Bachelor in	Biology and Biotechnology			School	School of Agriculture	
Academic Year	2022/2023	Year of study	3	Level	1-3	ECTS credits 6.0
Type	Semestral	Semester	1	Code	9029-510-3103-00-22	

Workload (hours)	162	Contact hours	T	30	TP	-	PL	30	TC	-	S	-	E	-	OT	4	O	-

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s)	Maria José Miranda Arabolaza, Vasco Augusto Pilão Cadavez

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Have notions of classic Animal and Plant Breeding. Crossbreeding and animal and plant selection.
2. Molecular markers most used for animal and plant breeding. Query Databases
3. Recognizing the advantage of improvement assisted by molecular markers and their impact on annual genetic progress

Prerequisites

Before the course unit the learner is expected to be able to:
None

Course contents

Concepts of Classic Animal and Plant Breeding Improvement by crossing and Animal and Plant selection, different gene actions involved. Selection assisted by molecular markers. Karyotypes, QTLs and microarrays. Genetic transformation of plants. Genetic engineering in plant breeding.

Course contents (extended version)

1. Concept of Plant Biotechnology
2. Plant Genetic Resources: Source of natural variability Biotechnology as a source of variability
3. Molecular markers
   - Morphological markers
   - Biochemical markers
   - Molecular markers
   - Gene mapping
   - Markers assisted selection (MAS): validation, advantages of MAS over conventional breeding protocols
4. Biotechnological techniques in plant breeding
   - Artificial pollinization
   - Somatic Hybridization: protoplast fusion, hybridization selection of the fusion product.
   - Mutagenesis. Tilling. CRISPR
   - Tissue culture. Somaclonal variation
5. Genetic transformation of plants
   - Direct methods: electroporation and biolistic
   - Indirect methods: Agrobacterium mediated transfer
6. Transgenic plants
7. Animal Breeding
   - Overview of animal breeding programs. Organization principles and steps involved.
   - Quantitative genetics: genes effects and sources of variation.
   - Selection: objectives, Effects of selection, indirect selection, multiple trait selection.
   - Heritability and genetic gain.
   - Inbreeding: implications and applications.
   - Crossbreeding: genetic basis of crossbreeding.
8. New technologies applied to the improvement. Improvement assisted by molecular markers
   - Microsatellites and quantitative trait loci (QTLs)
   - Karyotype analysis
   - Microarray technology (chips with SNPs) applied to animal breeding
9. Analyzing the impact of new technologies in the annual genetic progress

Recommended reading

1. BRACKETT, B. G. ; SEIDEL, G. E. and SEIDEL, S. M. , 2012. New Technologies in Animal Breeding. Academic press. London
2. GAMA, L. T. , 2002. Melhoramento Genético Animal. Lisboa
3. KINGHORN, B. ; Van der WERF, J. and Ryan M. , 2002. Animal Breeding- Use of new Techonologies. Beef CRC and University of New England.
4. CUBERO, J. I. , 2013. Introducción a la Mejora Genética Vegetal. 3ª ed. Ed. Mundi-Prensa.
5. ACQUAAH, G. , 2012. Principles of Plant Genetic and Breeding. 2ª ed. Wiley-Blackwell.

Teaching and learning methods

Teaching classes (included practices of laboratory) . In no present classes, the students will have to produce a work handing to a teacher over a final report, present and discuss it. Resources: audiovisual, multimedia, computer, online library, laboratory equipment,

Assessment methods

1. Continuous - (Regular, Student Worker) (Final)
   - Intermediate Written Test - 35% (Minimum score 9. 5)
   - Final Written Exam - 35% (Minimum score 9. 5)
   - Practical Work - 30% (Minimum score 9. 5)
2. Final examen - (Regular, Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 100% (Minimum score 9, 5)

Language of instruction

Portuguese

Electronic validation

Maria José Miranda Arabolaza, Vasco Augusto Pilão Cadavez	Paula Cristina Santos Baptista	Altino Branco Choupina	Paula Cristina Azevedo Rodrigues
21-12-2022	21-12-2022	21-12-2022	21-12-2022