Universitat de Lleida

DEGREE CURRICULUM

ANIMAL BREEDING

Coordination: ESTANY ILLA, JUAN

Academic year 2022-23

ANIMAL BREEDING 2022-23

Subject's general information

<table>
<tr><td>Subject name</td><td>ANIMAL BREEDING</td></tr>
<tr><td>Code</td><td>100314</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Double bachelor's degree: Bachelor's Degree in Veterinary Medicine and Bachelor's Degree in Science and Production</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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</td></tr>
<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>0.8</td><td>1.6</td><td>3.6</td></tr>
<tr><td>Number of groups</td><td>4</td><td>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>ESTANY ILLA, JUAN</td></tr>
<tr><td>Department</td><td>ANIMAL SCIENCE</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>On-site actuvities (lectures and practicals): 60 h
Independent student work: 90 h</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan: 65%
Spanish: 30%
English: 5%</td></tr>
<tr><td>Distribution of credits</td><td>Teaching activites: 2,4 ECTS (60 h)
Theory (one grup): 1.44 ECTS (36 h)
Problems and computer lab practicals (groups): 0.56 ECTS (12 h)
Seminars and other activities (groups): 0.40 ECTS (12 h).</td></tr>
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ANIMAL BREEDING 2022-23

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
ESTANY ILLA, JUAN	joan.estany@udl.cat	8	
ROS FREIXEDES, ROGER	roger.ros@udl.cat	1,2	
VILLALBA MATA, DANIEL	daniel.villalba@udl.cat	,8	

Subject's extra information

The pdf version of the Teaching Guide of the present course is in the Resources file, ANIMAL BREEDING area, Campus Virtual

Learning objectives

The course intends to enable the student to get acquainted with the scientific fundamentals of animal selection and breeding programmes, which are developed later in the poultry, cattle and pig management and production courses. It is assumed that the student has taken the Genetics course (first semester) and therefore they already know the fundamentals of heredity and the causes of genetic change in populations.

Knowledge objective

Th course intends to provide the student with the knowledge of the key features defining the structure of an animal breeding programme and, particularly, with the methodology currently used for predicting animal breeding values.

Skills to be adquired

1. To identify the goal, objectives and steps of an animal breeding programme
2. To predict the genetic progress of a breding programme, identifying the key factors affecting response to selection
3. To formulate and solve a model for genetic evaluation in animals.
4. To correctly interpret an animal breeding value.
5. To describe the basic structure of livestock and poultry breeding programmes
6. To know the genetic criteria used to purchase and replace breeding animals.

Competences

Subject contents

THEORY

Animal breeding programmes and organizations. The breeding goal. The concept of genetic evaluation.

PART I. SELECTION

1. Modelization of quantitative traits

The quantitative traits. Phenotypic and genotypic models. Heritabilty of a trait. Genetic correlation between traits**.**

2. Individual selection

Individual selection. Selection on repeated records. Indirect selection.Examples.

3. Response to selection

Response to selection for a quantitative trait. Parameters of selection. Opportunities to increase the response to selection.

4. Selection methods for a single trait

Definition, calculation and properties of selection indexes. Selection on familiy records. Cases: selection on ancestors, collaterals and progeny records.

5. Selection methods for more than one trait

Selection index for more than one trait. Selection for more than one trait on family records. Limitations of selection indexes.

PART II. ANIMAL MODEL

6. The animal model

The mixed linear model. The breeding value as a random effect. The animal model.

7. The BLUP

Types of predictors of the breeding value. BLUP (Best Linear Unbiased Predictor). Relation of BLUP with selection indexes.

8. BLUP-animal model

The mixed model equations (MME). The relationship matrix. Estimation and prediction errors.

9. Solving the BLUP-animal model

Rules for calculating MME. Calculation of the inverse of the relationship matrix. Algorithms for solving MME.

10. The animal model in practice

Repeatability models and models with common environmental effects. Models with genetic groups. Multi-trait animal models. Estimation of genetic parameters.

PART III. BREEDING PROGRAMMES AND BIOTECNOLOGY

11. Crossbreeding and breeding programmes

Inbreeding depression and heterosis. Complementarity of traits. Breeds and lines. Crossbreeding systems. The principles of the design of a breeding programme.

12. Breeding programmes for low prolific species

The progeny test. Breeding schemes for ruminants. Interpretation of sire genetic evaluations

13. Breeding programmes for prolific species

Selection schemes for pigs, poultry and rabbits. Replacement alternatives. Genetic progress and genetic lag.

14. Genomic selection

Genomics in animal breeding. Molecular markers and chip-based genotyping. Marker and gene assisted selection. Genomic selection.

15. Genetic biotechnology

The new biotechnologies. Applications of genetic engineeering to animal breeding. Transgenesis and gene editing.

PRACTICALS

0. Introduction to statistical concepts and matrix operations.Spreadsheet exercices.

1. Understanding selection methods. Prediction of selection response on a case-based approach.

2. Solving BLUP- animal. Genetic evaluation of animal populations under different animal models.

3. Simulation of crossbreeding systems. Interpretation of commercial sire summaries and genetic catalogues.

4. Genome association analyses. Candidate gene detection.

Methodology

The teaching activity is structured around theory sessions, problems and practicals, in line with the planning and timescale provided on the first day of class. .

1. Theory. Master class lectures presenting the subject of each theme.

2. Practicals. Problems or computer sessions devoted to solve the exercices and problems presented in the theory lectures and to anlayze different simulated selection and genetic evaluation cases in animals.

3. Seminars and other activities. Sessions in reduced groups or in personal attention aimed at giving support and advice in revisiting statistical concepts, solving the practicals and dispelling general questions or queries. These activities can ocassionally include laboratory sessions and invited conferences.

All activities are complemented with the appropriate documented teaching material, which can be downloaded from the Resources file, Animal breeding Area, Campus Virtual.

Development plan

The planning of the course is given below and timescale for the current course is in the document Teaching Guide in the Resources file, Animal breeding Area, Campus Virtual.

TEO: Theory; PRO: Problems and cases; INF: Computer lab; SEM: seminar; ACD: Targeted activity; AVAL: Evaluation

JE: Joan Estany; RR: Roger Ros; DV: Daniel Villalba

Time schedule: Tuesday (17 to 19 h) and Thursday (15 to 17 h) – Room: ETSEA - 3.0.02

ANIMAL BREEDING 2022-23

Tipus d'activitat	Activitat	Sessió	Grups	Professor	Dia (hora)
TEO	**Introduction**	1,2		JE	
ACD	**Practice 0**	3,4	A1/A2	JE	
TEO	**Topic 1**	5,6		JE	
TEO	**Topic 2**	7,8		JE	
ACD	**Practice 0**	3,4	B1/B2	JE	
TEO	**Topic 3**	9,10		JE	
PRO	**Practice 1.1**	11,12	A	JE	
			B	JE	
TEO	**Topic 4**	13,14		JE	
PRO	**Practice 1.1**	15,16	B	JE	
			A	JE	
TEO	**Topic 5**	17,18		JE	
ACD	**Doubts**	19,20	B1/B2	JE	
	Doubts		A1/A2	JE	
INF	**Practice 1.2 Computer lab**	21,22	A	DV	
			B	DV	
AVAL	**Exam 1 / Report 1**	23,24		JE	

TEO	**Topic 6-7**	25,26		JE	
ACD	**Practice 0**	27,28	A1/A2	JE	
TEO	**Topic 8**	29,30		JE	
ACD	**Practice 0**	27,28	B1/B2	JE	
TEO	**Topic 9**	31,32		JE	
INF	**Practice 2. 1 Computer lab**	33,34	B	JE	
			A	JE	
TEO	**Topic 10**	35,36		JE	
INF	**Practice 2.2 Computer lab**	37,38	A	JE	
			B	JE	
ACD	**Doubts**	39,40	B1/B2	JE	
			A1/A2	JE	
AVAL	**Exam 2 / Report 2**	41,42		JE	
TEO	**Topic 11**	43,44		DV	
TEO	**Topic 12**	45,46		DV	
INF	**Practice 3 Computer lab**	47,48	B	DV	
			A	DV	
TEO	**Topic 13**	49,50		DV	

TEO	**Topic 14**	51,52		RR	
TEO	**Topic 14**	53,54		RR	
INF	**Practice 4 Computer lab**	55,56	A1/A2	RR	
			B1/B2	RR	
INF	**Practice 4 Computer lab**	57,58	B1/B2	RR	
			A1/A2	RR	
TEO	**Topic 15**	59,60		RR	
AVAL	**Exam 3 / Reports 3 +4**	61,62		DV/RR	
AVAL	**Second-chance exam**			JE	

Evaluation

The complete evaluation system is in the document Teaching Guide in the Resources file, Animal Breeding Area, Campus Virtual.

Continuous evaluation. Evaluation is based on three partial exams (75%), one per part (25% each exam), and four practical reports (25%), to be delivered at the end of part I (5%), part II (10%) and two during part III (5% each one). Practical reports will only be considered if the average mark of the three exams is 4 out of 10.

Extraordinary exam. If a student fails to get a minimum mark of 5 following the previous criteria but has an average mark of the three partial exams of 3.5, will have the opportunity to do an extraordinary exam at the end of the course and within the semester evaluation period. This extraodinary exam will encompass the three parts of

the course in a similar format than partial exams. A mininum mark of 4 is required to average the mark of the extraordinary exam (75%) and the mark of the practical reports delivered during the course (25%). The students that pass the course thanks to the extraordinary exam will have a final mark of 5.

Bibliography

BASIC BIBLIOGRAPHY

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COMPLEMENTARY BIBLIOGRAPHY

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HENDERSON, CR.1984. Application of linear models in animal breeding. Guelph Univ. Press

PIPER, L, RUVINSKY, A. (Eds.). 1997. The Genetics of Sheep. CABI Publishing.

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