Code: 1388 **Quantitative Genetics and Plant Breeding**
Degree: 2nd cycle - Functional Biology; Agriculture
Stream: Agriculture – Agriculture and Animal Production; Horticulture; Plant Protection
Curricular Year: 1st (FB) / **2nd** (Agr) **Semester Course: 1st**
Credits: 6 ECTS **Compulsory** (Functional Biology)
Language: Portuguese/English **Optional** (Agriculture)
Responsible: João Manuel Neves Martins
Other lecturer(s): -
Web Site: http://www.isa.utl.pt/home/node/3766

1. Contact hours:
Lectures 28 **Lecture/Praticals** 42 **Others** 14 **Total** 84

2. Objectives:

Study of the quantitative genetic principles.
Recognizing the nature of plant breeding and of breeder activity
Understanding the advantages (and some drawbacks) of Plant Breeding for agriculture and for the society.
Recognizing the main types of plant varieties and the methods to obtain them.

3. Programme:

Introduction: Plant Breeding general concepts. History of Plant Breeding and main achievements. Objectives of Plant Breeding.
Populations Genetics: Hardy-Weinberg equilibrium. Evolution factors: mutation, migration, selection and genetic drift.
Quantitative genetics: Nature of quantitative traits. Environmental deviation and its control. Average effect and breeding value. Estimation of genetic gain. Heritability. Heritability and response to selection. Profiting from dominance variability: inbreeding depression and heterosis. General and specific combining ability.
Plant material and Genetic Resources conservation and enhancement. Some leading features of crop evolution. Main strategies for genetic conservation. Descriptor and data collecting.
Flower Biology and genetic control of reproductive systems. Self and cross- pollination and apomixis. Main population's genetic structures and plant breeding methodologies used.
Inbred Lines (study case: wheat). Pure Line theory. Single plant selection with progeny test. Genealogical selection: pedigree, bulk" and single seed descent. Multilines.
Open-Pollinated Populations (study cases: maize and pine tree). Recurrent Selection "ear to row". Mass selection with progeny testing with estimation of genetic parameters and genetic gain.
Hybrids (study case: maize): Self-pollinating lines. Combining ability evaluation. Hybrid production. Synthetic varieties.
Clones (study case: grapevine): Genetic variability origin within ancient varieties. Sanitary selection vs. genetic selection based on quantitative genetic principles. Selection results: high genetic gains, variability within varieties quantification, virus biological effects. Problems arising from clonal selection: genetic erosion and GxE interaction.
Polyploidy: chromosomes numerical variation: haploids, aneuploids and polyploids. Autopolyploids and Alopolyploids and its importance in Plant Breeding. The study cases of triticale and raphanus/brassica.
Transgenic plants: Actual situation regarding crops around the world.
Seed degeneration process and the need for Certification. Official agreement and multiplication control. AUV and DHS tests. CNV and LNV catalogues.

4. Bibliography:

Main Bibliography

MARTINS, A. (1980) - *Genética de populações*. ISA.

MARTINS, A. (1986) - *Genética quantitativa*. ISA.

MARTINS, A. (1993) - *Heritabilidade e ganho de selecção em populações de propagação vegetativa e de reprodução sexuada*. ISA.

MARTINS, A. (1982) – *Exercícios de genética*. ISA

MARTINS, A. & MARTINS, J. N. (1992) – *Melhoramento de Plantas I*. ISA.

Other Bibliography

ALLARD, R.W. (1971) – *Princípios do melhoramento genético das plantas*. Edgard Blucher, S. Paulo.

DEMARLY, Y. (1977) – *Génétique et amélioration des plantes*. Masson, Paris.

FALCONER, D. S. & MACKAY, T. (1970) – *Introduction to Quantitative Genetics* (4th ed.). Prentice Hall. Harlow.

GRALL, J. & LEVY, B. (1985) – *La guerre des semences, quelles moissons, quelles societés*? Fayard, Paris.

SANCHEZ-MONGE, E. (1974) – *Fitogenética*. INIA, Madrid.

SIMMONDS, N. W. & SMARTT, J. (1999) – P*rinciples of crop improvement*. Blackwell Sci., London.

5. Assessment:

Reports and monographies
Partial tests each two weeks
Final examination

6. Estimated Workload:	168	Hours
7. Last Update:	14/7/2010	