



ESCOLA TÈCNICA SUPERIOR D'ENGINYERS AGRÒNOMS

COURSE TITLE IN SPANISH	Recursos fitogenéticos		
COURSE NAME/TITLE:	4935 Plant genetic resources		
DEGREE:	Engineer in Agronomy		
DEGREE PROGRAM:	1999	YEAR OFFERED:	5 SEMESTER: 9
ORIENTATION/ SPECIALIZATION:	Recursos Naturales y Medio Ambiente (Natural Resources and Environment)		
TOTAL CREDITS			
		LECTURE	2
		SEMINAR	1
		CLASSROOM PRACTICE	0.75
		LABORATORY PRACTICE	1.5
		FIELD WORK	0.75
DEPARTMENT:	Biotechnology		
COURSE COORDINATOR:	Jaime Prohens Tomás		
TEACHING STAFF:	Jaime Prohens Tomás		

València, 17 de Junio de 2003



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COURSE TITLE: Plant Genetic Resources

OBJECTIVES

The objective of this subject is that the students become conscious of the importance of plant genetic resources in the present and future feeding of the world population, as well as informing them of the increasing risk of genetic erosion caused by modern agriculture. To achieve the global objectives the students have to know the strategies of recovery, conservation and management of these natural resources, as well as the structure of national and international organisms and their activities for the safeguard of plant genetic resources. In addition, the patents international system and its effects on the development of new cultivars is presented, with an important emphasis being made on the impact of new biotechnologies.

EVALUATION

As it is a half-yearly subject, for the theory part only one exam will be made. This exam will include practical questions on the acquired knowledge (70% of the final mark). Furthermore, each student will present a discussion work on a contemporary issue on plant genetic resources (30% of the final mark). Assistance to practice sessions will be compulsory.

COURSE TITLE: Plant Genetic Resources

CONTENTS: THEORY (1/2)

Theme 1. Introduction.

- 1.1. Biodiversity: What is it and why it is necessary?
- 1.2. The Neolithic revolution and the origins of agriculture. Domestication, centers of origin and diversity of cultivated plants.
- 1.3. Genetic diversity.
- 1.4. Man induced diversification. The first movements of plants. Harlan's cycle of diversification-hybridization. Trade routes. The encounter of two worlds.
- 1.5. The need for developing complementary strategies for conservation.
- 1.6. Native populations and conservation. Plant breeding and uniformity. The Green Revolution.

Theme 2. International activities for the safeguard of plant genetic resources.

- 2.1. Background on the initiatives in favour of the conservation of plant genetic resources.
- 2.2. FAO Commission on Plant Genetic Resources.
- 2.3. CGIAR collections. Associated centres for divulgation.



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- 2.4. Separation of IBPGR from CGIAR and creation of IPGRI (International Institute for Plant Genetic Resources)
- 2.5. The Keystone center. Structure, functioning and actions to develop.
- 2.6. The United Nations Convention and the Convention on Biological Diversity

Theme 3. Sources of information.

- 3.1. Sources of information on plant genetic resources.
 - 3.1.1. Reference works
 - 3.1.2. Primary publications – journals
 - 3.1.3. Secondary sources – analytical summaries, databases, ‘World Wide Web’
 - 3.1.4. Updating mechanisms/alert systems
- 3.2. Organizations dealing with plant genetic resources and the information they have: To whom ask for information?

Theme 4. Collection.

- 4.1. Reasons for collecting germplasm.
- 4.2. Types of collecting missions.
- 4.3. Centralized collection *vs.* decentralized collection.
- 4.4. Dangers of collection (introductions, plant health, dangers of excessive collection).
- 4.5. Elements of a successful collection mission.
- 4.6. Legal aspects and FAO Conduct Code.
- 4.7. Plant breeders’ rights
- 4.8. Patents
- 4.9. The FAO World System
- 4.10. CNUMAD
- 4.11. Participative strategies on plant genetic resources collection, including the autochthonous knowledge
- 4.12. Sampling strategies
- 4.13. Strategies for collecting wild species
- 4.14. Practical aspects. Planification of collection missions. Permits and legal requirements. The collection team. Transport. Route. Duration. Data documentation in the field. Processing of the harvested material.

Theme 5. In situ conservation

- 5.1. Conservation in exploitations.
- 5.2. In situ conservation of wild species.
- 5.3. Vigilance of the conserved diversity.
- 5.4. Management of the conserved diversity.
- 5.5. Data management.
- 5.6. Participation of the local communities in in situ conservation.

Theme 6. Ex situ conservation.

- 6.1. Ex situ collections. Aspects related to the genetic stability.



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6.2. Conservation of seeds.

6.2.1. Principles for the storage of seeds (orthodox *vs.* recalcitrant)

6.2.3. Germplasm banks design

6.2.4. Genetic stability

6.3. Root and tuber crops.

6.4. Tree crops.

6.5. Forest tree nurseries and botanical gardens.

6.6. In vitro conservation

6.6.1. Tissue culture (slow growth)

6.6.2. Cryopreservation

6.7. Conservation of other materials

6.7.1. Pollen/ovules

6.7.2. DNA

Theme 7. Regeneration of samples.

7.1. Genetic principles of regeneration (including stability)

7.2. Methods, frequencies, number of plants and places for regeneration.

7.3. Norms and directions

7.4. Regeneration by farmers

7.5. Data management

Theme 8. Characterization and evaluation.

8.1. Measurement of genetic variation (including descriptors lists)

8.1.1. Morphological and physiological characters

8.1.2. Cytological characters

8.1.3. Biochemical (isozymes) markers

8.1.4. Molecular markers (RAPD, RFLP, SSRs, AFLP, etc.)

8.1.5. Characterization and evaluation by farmers.

8.2. Data analysis (introduction to genetical statistics, diversity indexes).

8.3. Data management.

8.3.1. Design and development of databases.

8.3.2. Publication of results, catalogues.

Theme 9. Documentation.

9.1. General concepts.

9.2. Design and use of databases.

Theme 10. Germplasm utilization.

10.1. Uses and types of users (importance of sustainability). Research. Introduction of plants. Selection. Plant breeding. Utilization by local populations (ethnobotany, community forestry, farmers' breeding, etc.)

10.2. Obstacles for the utilization and how to overcome them. Information on collections. Base collections. Plant health aspects. Policies restricting access and exchange of plant genetic



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resources.

10.3 Nuclear collections.

Theme 11. Plant health and safe transport of germplasm.

11.1. Transport of germplasm.

11.2. Directions for the exchange.

11.3. Quarantine services.

11.4. Selection for resistance to pests/diseases.

Theme 12. Study cases.

12.1. Wild species *vs.* crops.

12.2. Seeds *vs.* vegetative propagation.

12.3. Orthodox *vs.* recalcitrant seeds.

12.4. Allogamous *vs.* autogamous reproduction.

12.5. Annual *vs.* perennial crops

12.6. Available resources (human, facilities)

12.7. Climatic factors.

COURSE TITLE: Plant Genetic Resources

CONTENTS: THEORY (2/2)

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CONTENTS: PRACTICE

Practice 1. Functioning of germplasm banks. Visit to COMAV Bank and conference on their activities (2 sessions).

Practice 2. Characterization of wild and cultivated species (laboratory) (1 session).

Practice 3. Characterization of wild and cultivated species (greenhouse) (1 session).

Practice 4. Genetic diversity in germplasm collections. Morphological and molecular characterization and data analysis techniques (laboratory) (5 sessions).

Practice 5. Databases. International activities for the safeguard of plant genetic resources (computers room) (2 sessions).

COURSE TITLE: Genetics and Breeding

RECOMMENDED BIBLIOGRAPHY

Brown, A.H.D. 1989. The use of plant genetic resources. Cambridge University Press, Cambridge.

Brush, S.B. 1999. Genes in the field: on-farm conservation of crop diversity. Lewis, Boca Raton.

Callow, J.A.; Ford-Lloyd, B.V.; Newbury, H.J. 1997. Biotechnology and plant genetic resources: conservation and use. CAB International, Wallingford.



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- Cooper, H.D.; Spillane, C.; Hodgkin, T. 2001. broadening the genetic base of crop production. IPGRI, Rome.
- Evenson, R.E.; Gollin, D.; Santaniello, V. 1998. Agricultural values of plant genetic resources. CABI, Oxon.
- Ford-Lloyd, B.; Jackson, M. 1986. Plant genetic resources: an introduction to their conservation and use. Edward Arnold, London.
- Hawkes, J.G.; Maxted, N.; Ford-Lloyd, B.V. 2000. The ex situ conservation of plant genetic resources. Kluwer Academic Publishers, Dordrecht.
- Holden, J.H.W.; Williams, J.T. 1984. Crop genetic resources: conservation and evaluation. George Allen and Unwin, London.
- Oldfield, M.L. 1989. The value of conserving genetic resources. Sinauer, Massachusetts.
- Virchow, D. 1999. Conservation of genetic resources: costs and implications for a sustainable utilization of plant genetic resources for food and agriculture. Springer, berlin.