

Course title: Interaction between biotechnology and environment in the context of the Argentinean agro-ecosystems

University: School of Agriculture of the University of Buenos Aires, Argentina

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Language of instruction: English

Contact hours: 45 hours

Course's website: <http://www.agro.uba.ar>

General course description

The description of the DNA structure by Watson & Crick in the 50's laid the foundation for the later development of modern biotechnology. The improvement of the knowledge about the transmission of the genetic message and the development of techniques of genetic engineering has given new possibilities to increase the yields in agriculture. The addition of this new biotechnology to the principles of the Second Green Revolution proposed by Norman Borloug resulted in a new kind of agriculture, where the production process starts in the laboratory and ends in the consumer's table. The emergence of these new technologies had an impact not only in the production systems, but also in the society and the environment. In this context, there are countries which are very critical with the Genetic Modified Organisms (GMOs) while others have adopted them very fast. Argentina is one of the last cases where, from the first transgenic crop in 1996 till today, the agro-biotechnology had a development which, together with USA and Brazil, had led the global food production.

This course analyzes the evolution of the agro-biotechnology in Argentina with the implications in social and environmental issues. It describes the main transgenic crops and the different production systems used. The bases of the regulatory process and the effects on the environment of the technological package associated with transgenic crops are studied.

Objectives

The overall goal of this course is to offer to students a wide approach of the contributions of the biotechnology to the Argentinean agricultural production systems and the new challenges that these ones impose in terms of social and environmental aspects.

The specific objectives for students are:

- To know and understand the more usual agricultural production system in Argentina based in transgenic crops.
- To get information about the history of the agro-biotechnology in Argentina.
- To be in contact with the main techniques for generating transgenic plants.
- To know the principles of the Argentinean regulation system for the registration of a new transgenic crop
- To analyze the effect of the acquisition of the new biotechnological package on the rural environment
- To evaluate the social implications of the adoption of this new technologies

Course organization and contents

The course will consist of:

1. Brief lectures on relevant theoretical concepts and applied examples of Agro-biotechnology.
2. Reading and discussion of selected scientific articles.
3. Lab training in basic techniques of molecular biology and genetic engineering.

Course pre-requisites

Some background in biology and biochemistry is recommended.

Required readings

The most relevant readings for the course are listed below. Many of them are available online or in PDFs. This list is not exhaustive, though, so a complete list of readings together with a detailed calendar of the course will be available on the course's website a month in advance of the start date.

- Pengue, W.A. (2005) Transgenic crops in Argentina: The ecological and social debt. *Bulletin of Science, Technology and Society*, 25 (4), pp. 314-322.
- Mas, M.T., Verdú, A.M.C., Kruk, B.C., De Abelleira, D., Guglielmini, A.C., Satorre, E.H. (2010) Weed communities of transgenic glyphosate-tolerant soyabean crops in ex-pasture land in the southern Mesopotamic Pampas of Argentina. *Weed Research*, 50 (4), pp. 320-330.
- Jaffe, G. (2004) Regulating transgenic crops: A comparative analysis of different regulatory processes. *Transgenic Research*, 13 (1), pp. 5-19.
- Pellegrini, P.A. (2013) What risks and for whom? Argentina's regulatory policies and global commercial interests in GMOs. *Technology in Society*, 35 (2), pp. 129-138.
- Raney, T. (2006) Economic impact of transgenic crops in developing countries. *Current Opinion in Biotechnology*, 17 (2), pp. 174-178.

- Ponti, L.(2005) Transgenic crops and sustainable agriculture in the European context. *Bulletin of Science, Technology and Society*, 25 (4), pp. 289-305.
- Hilbeck, A. (2001) Implications of transgenic, insecticidal plants for insect and plant biodiversity. *Perspectives in Plant Ecology, Evolution and Systematics*, 4 (1), pp. 43-61.
- Cerdeira, A.L., Gazziero, D.L.P., Duke, S.O., Matallo, M.B., Spadotto, C.A. (2007) Review of potential environmental impacts of transgenic glyphosate-resistant soybean in Brazil. *Journal of Environmental Science and Health - Part B Pesticides, Food Contaminants, and Agricultural Wastes*, 42 (5), pp. 539-549.
- Smale, M., Zambrano, P., Falck-Zepeda, J., Gruñire, G., Matuschke, I. (2008) The economic impact of transgenic crops in developing countries: A note on the methods. *International Journal of Biotechnology*, 10 (6), pp. 519-551.
- Flint, J., Gil, L., Verastegui, J., Irrarrazabal, C., Dellacha, J. (2000) Biosafety information management systems. A comparative analysis of the regulatory systems in Canada, Argentina, and Chile. *Electronic Journal of Biotechnology*, 3 (1), pp. 9-29.
- Burachik, M. (2012) Regulation of GM crops in Argentina. *GM crops & food*, 3 (1), pp. 48-51.
- Grau, H.R., Gasparri, N.I., Aide, T.M. (2005) Agriculture expansion and deforestation in seasonally dry forests of north-west Argentina. *Environmental Conservation*, 32 (2), pp. 140-148.
- Burachik, M. (2010) Experience from use of GMOs in Argentinian agriculture, economy and environment. *New Biotechnology*, 27 (5), pp. 588-592.
- Trigo, E.J., Cap, E.J. (2003) The impact of the introduction of transgenic crops in Argentinean agricultura. *AgBioForum*, 6 (3), pp. 87-94.
- Marshall, A. (2010) 2nd-generation GM traits progress. *Nature Biotechnology*, 28 (4), p. 306.
- Vila-Aiub, M.M., Vidal, R.A., Balbi, M.C., Gundel, P.E., Trucco, F., Ghersa, C.M. (2008) Glyphosate-resistant weeds of South American cropping systems: An overview. *Pest Management Science*, 64 (4), pp. 366-371.
- Christoffoleti, P.J., Galli, A.J.B., Carvalho, S.J.P., Moreira, M.S., Nicolai, M., Foloni, L.L., Martins, B.A.B., Ribeiro, D.N. (2008) Glyphosate sustainability in South American cropping systems. *Pest Management Science*, 64 (4), pp. 422-427.
- Cerdeira, A.L., Gazziero, D.L.P., Duke, S.O., Matallo, M.B. (2011) Agricultural impacts of glyphosate-resistant soybean cultivation in South America. *Journal of Agricultural and Food Chemistry*, 59 (11), pp. 5799-5807.
- Benech-Arnold, R., Semmartin, M., Oesterheld, M. (2012) Seed science in the 21st century: Its role in emerging economies. *Seed Science Research*, 22 (SUPPL. 1), pp. S3-S8.

Course calendar

The course will run from Monday to Thursday over four consecutive weeks. Daily sessions (including lectures, discussions and practices) will be three hours long.

Day 1	The evolution of the agricultural biotechnology. Historical context.
Day 2 and 3	Bases of molecular biology and genetic engineering.
Day 4	Methods for the generation of transgenic plants.
Day 5 and 6	Different transgenic crops used in Argentina in relation with productive regions.
Day 7 and 8	The technological package used in Argentina. Relations between transgenic crops and the acquisition of new tillage

	technologies.
Day 9	Official regulations for transgenic crops in Argentina.
Day 10	Environmental impact of the new agro-technologies.
Day 11	Emergence of resistant pests and challenges of the biotechnology.
Day 12	Social implications of the acquisition of the new agro-technologies. Public impact and consumer's opinion about transgenic foods.
Day 13	Visit to a seed company.
Day 14	Visit to the Ministry of Agriculture
Day 15	Case discussion.
Day 16	Exam.

A calendar of the course with details of the readings suggested for each class will be available on the course's website one month in advance of the starting date.

Evaluation criteria

Evaluation will be mainly based on a final exam about the topics included in the course.

The final grade will be calculated as follows: attendance and participation (20%); exam (80%).

Students reach the success of the course with the 60% of the final grade.

Attendance policy

Students are required to attend at least 75% of the classes. Students with lower levels of attendance risk the registration of the course.

Special activities

Students are invited to visit one of the most important Argentinean seed company located in the inner of Buenos Aires province. Also, the students visit the different dependences of the Ministry of Agriculture to be in contact with the regulatory process for approbation of OGMs.