UCL Université catholique de Louvain

LBRAI2203

2013-2014

Genetic diversity and plant amelioration

3.0 credits	30.0 h + 7.5 h	1q

Teacher(s) :	Bertin Pierre ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	iCampus
Prerequisites :	Mandatory skills in biology, biochemistry, genetics, plant physiology, plant production acquired during the Bachelor of bioengineer and the first year of MS of bioengineer or equivalent. Supplementary skills: complements of genetics, biotechnologies
Main themes :	Critical analysis of the evolution of plant improvement in the context of technology, socio-economics, environment and ethics. Description and analysis of the different plant breeding systems : constraints and possibilities for plant improvement (structure and population evolution). Analysis and synthesis of antagonistic approaches of phenotypical and genotypical selection. Description and analysis of the different improvement strategies : - crosses and phenotypical breeding schemes for autogamous, allogamous and vegetatively-propagated crops ; use of heterosis ; - biotechnologies : varietal cloning, production of fixed varieties through doubled haploids, interspecific crosses, protoplast fusion, GMOs ; - molecular biology and genotypic selection : molecular markers, genome analysis (synteny, gene targeting and gene function, functional genomics and proteomics). Critical evaluation of the potential of each improvement strategy according to selection objectives and genetic determinism of characters. Consequencies for conservation and use of genetic diversity, improvement of qualitative and quantitative characters, diversification. Integration of the different strategies in current plant improvement systems.
Aims :	a. Contribution of the activity with regards to the referential of leaning outcomes Control a pool of scientific knowledge (M1.1 à M.1.5) Control a pool of knowledge in the fied of bioengineering and management (M2.1 à M2.4) Apply a rigorous and innovative scientific approach (M.3.2 à M.3.9) Concept and implement a complete and innovative approach of engineer (M.4.1 à M.4.3 et M.4.5 à M.4.7) Communicate (M.6.1, M.6.3 et M.6.5) Act responsably (M.7.3) b . Specific formulation for this activity AA program (maximum 10) At the end of this activity, the student will be able to : · know and explain the precise features of plant breeding systems (organogenesis, fertilization, embryo development) · know and explain the strategies of plant breeding systems (autogamy, allogamy, vegetative propagation, self-incompatibility, male sterility, apomixis) · Understand the consequencies of the mode of reproduction on the evolution of population of crops · Understand the impact of the mode of reproduction on genetic imrovement strategies · Know and explain the available strategies in paknt improvement (GMOs, genetic mapping, QTLs, marker-assisted selection, functional genomics) · Understand and explain the main strategies of plant improvement · Integrate the knowledge in biology, genetics, technologies and available resources in view of designing sensible imrovement strategies · Understand and evaluate the relevance of plant improvement strategies, integrating crop development constraints and potentials (breeding system, growth cycle) and the evolution of available technologies (Mendelian genetics, quantitative genetics, molecular genetics, GMOs, population genetics, genomics, proteomics) in order to provide crops genetically-adapted to the needs of the human kind (food, environment, industry, medicine) *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	Oral examination with previous written preparation. Situation scenarion: resolve a concrete case of plant improvement on the basis of genetical, biological (reproduction, growth cycle) and economical (selection objectives) constraints
Teaching methods :	Oral teaching Field visits (improvement program of private companies and/or research centers)
Content :	Plant breeding : main breeding systems of higher plants (autogamy, allogamy, vegetative propagation) and consequences on the evolution of the genetic structure of plant populations. Specificities of plant reproduction: floral transition, reproductive organs, double fertilization, male sterility, self-incompatibility, apomixis and consequences for plant improvement. Basic principles of plant improvement : genetic diversity, crop domestication, recombination, selection differential and response to selection, genetic determinisl (Mendelism, quantitative genetics), combining ability, heterosis. Use of genetic diversity and biotechnologies : biodiversity conservation, extent of genetic pools, populations improvement, introgression, interspécific crosses, protoplaste fusion,

	GMOs. Consequences on variability and evolution. Selection schemes : elaboration and analysis as a function of mode of reproduction and of selection objectives (autogamous crops : pedigree method, bulk population, single-seed descent, backcrosses ; allogamous crops : population improvement, selection for combining ability, F1 hybris). Consequences on the genetic structure of resulting populations. Use of molecular biology and genotypic selection : application of genetic mapping, marker-assisted selection and introgression, genomics, functional genomics, proteomics
Bibliography :	Mandatory instruction material Syllabus and powerpoint slides available on icampus Additional lectures see slides
Cycle and year of study :	> Master [120] in Agricultural Bioengineering > Master [60] in Biology
Faculty or entity in charge:	AGRO