GHENT UNIVERSITY

Course Specifications

From the academic year 2020-2021 up to and including the academic year

Molecular Plant Breeding (I002628)

Course size *(nominal values; actual values may depend on programme)*

Credits 5.0	**Study time 150 h**	**Contact hrs**	50.0h

Course offerings and teaching methods in academic year 2022-2023

A (semester 1)	English	Gent	excursion	10.0h
			lecture	30.0h
			seminar: coached exercises	10.0h

Lecturers in academic year 2022-2023

Geelen, Danny	LA21	lecturer-in-charge
Haesaert, Geert	LA21	co-lecturer

Offered in the following programmes in 2022-2023	**crdts**	**offering**
Master of Science in Bioscience Engineering: Cell and Gene Biotechnology	5	A
Exchange Programme in Bioscience Engineering: Cell and Gene Biotechnology (master's level)	5	A

Teaching languages

English

Keywords

Selection, genetic marker, linkage map, association mapping, quantitative trait locus (QTL), marker assisted selection (MAS), genomics, GWAS, pre-breeding, genome elimination, hybrids, mutation

Position of the course

Plant breeding is an ancient discipline that creates new genotypes adapted to specific growing conditions (e.g. abiotic and biotic stress), crop management techniques (e.g. mechanization, one-time harvest) and that addresses consumers and society requirements (e.g. food processing, nutritional value, etc.). With the advent of molecular genetics and genomics, the array of tools and methods has drastically expanded making the plant breeding process more efficient. Moreover, molecular genetics creates the possibility to introduce new characteristics. This course begins with an introduction to the basics of plant breeding (creating diversity and selection methods), which is a prerequisite to understand and implement molecular tools in plant breeding programs. The second part of the course will address molecular techniques for the characterization of genomes in the context of breeding (e.g. diversity screening, developing molecular markers, etc.). The third part of the course will highlight some of the most recent advances in sexual reproduction and genome analysis. This is relevant for the student who has an interest in engaging in research that aims to improve or develop new technologies useful for plant breeding and plant genetic studies.

Contents

1. Basic principles of plant breeding e.g. diversity, heritability, back crosses and selection methods.
2. Molecular principles of selection
- DNA-fingerprinting of plants
- DNA-marker technologies and interpretation of DNA marker results
- Estimation of genetic relationships, diversity using DNA-markers
- Germplasm characterisation
- Population genetics
- Linkage, 'Linkage Disequilibrium' (LD) and association genetics
- Strategies for the identification of markers linked to traits of agricultural relevance
- Marker assisted selection programs

- Genomics breeding

3. Advanced breeding tools.
- Doubled haploid production,
- genome elimination,
- chromosome substitution lines,
- apomixis,
- modulation of meiotic recombination,
- polyploidization,....

Initial competences

Basic knowledge of plant genetics, molecular biology and statistics

Final competences

1 Have knowledge on the principles of plant breeding
2 Have knowledge of methodologies available for the identification of a genetic locus associated with a plant trait.
3 Apply DNA-marker technologies in pLant breeding
4 Have insight into 'marker assisted selection' and 'genomics assisted selection'
5 Analyze molecular data used for plant breeding
6 Have knowledge on ongoing research in the field of molecular plant breeding

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Excursion, Lecture, Seminar: coached exercises

Learning materials and price

All materials will be provided in electronic form. Materials include: notes, presentations and research papers. Estimated total cost: 20 EUR

References

Papers extracted from scientific journals in the field of plant breeding

Course content-related study coaching

Personal: through electronic appointments. Interactive help using Ufora

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written examination with open questions

Examination methods in case of periodic assessment during the second examination period

Written examination with open questions

Examination methods in case of permanent assessment

Report, Participation

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

Students are evaluated during the lectures when they are presenting an overview of an allocated subject and during the discussion after presentations.

Calculation of the examination mark

The written exam will have a weight of 65% in the calculation of the final score; the assignment will have a weight of 35% in the calculation of the final score.
Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.