

PLANT IMPROVEMENT (T)

COURSE OUTLINE

1. GENERAL			
SCHOOL	School of Agricultural Sciences		
ACADEMIC UNIT	Department of Agriculture		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	ΓΠ5004	SEMESTER	1st
COURSE TITLE	Plant Improvement (T)		

INDEPENDENT TEACHING ACTIVITIES if credits are awarded for separate components of the course	WEEKLY TEACHING HOURS	CREDITS
	3	3
	2	2
Total	5	5

COURSE TYPE general background, special background, specialised general knowledge, skills development	Specialised Background Course
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	https://iro.hmu.gr/agriculture-english-courses/

2. LEARNING OUTCOMES
Learning outcomes
LEARNING OUTCOMES Upon successful completion of the course, students will be able to: • describe the fundamental principles and methods of conventional plant breeding; • identify the sources and forms of genetic variation used in the development of new cultivars; • design and justify a simple breeding programme for major crop species; • select appropriate selection and crossing methods, taking into account crop objectives, environmental conditions and market requirements; • evaluate phenotypic data obtained from plant breeding experiments; • use basic statistical and genetic tools in the analysis of breeding data; • critically assess the advantages and limitations of different plant breeding strategies.
General Competences
Generic Competences • Search for, analyse and synthesise data and information using appropriate technologies. • Decision-making. • Generation of new research ideas. • Promotion of free, creative and inductive thinking.

3. SYLLABUS

COURSE CONTENT

Theoretical Syllabus

Introduction to Plant Breeding

Plant breeding is presented as an applied science which, through the manipulation of genetic material, aims to develop new cultivars in order to increase productivity and improve living standards.

Plant Reproduction

The two main modes of plant reproduction, vegetative and sexual reproduction, are examined. Particular emphasis is placed on meiosis and fertilisation as the principal mechanisms generating heritable genetic variation used in plant breeding.

Scope of Plant Breeding

The subject matter of plant breeding is defined through the development of single-genotype and multi-genotype cultivars. The objectives and stages of a breeding programme for the improvement of quantitative agronomic traits are analysed.

Quantitative Traits

Quantitative traits are examined with emphasis on their complex inheritance and the strong influence of the environment, highlighting the need for the use of statistical tools.

Genetic Variation

The course focuses on genetic variation, whether naturally occurring or artificially induced, as the basis of plant breeding. The mechanisms generating variation, its use as starting material, and the technique of controlled pollination are analysed.

Factors Affecting Selection

The critical environmental and genetic factors affecting the objective evaluation of quantitative traits are examined, including spatial heterogeneity and competition. Their contribution to the yield gap is analysed, with emphasis on reducing their adverse effects.

Competition in Crop Production

The effects of competition and cultivar dependence on plant density are analysed. These factors can cause inequality and yield losses within a crop. The productive ideotype is presented as essential for narrowing the yield gap.

Competition in Plant Breeding

The course explains why genotype selection should be conducted under non-competitive conditions. In contrast to intergenotypic competition, the absence of competition maximises phenotypic differentiation, improves heritability and permits high selection intensity.

Experimental Designs in Plant Breeding

Models of agricultural experimentation and methods for controlling spatial heterogeneity are described. Particular emphasis is placed on honeycomb designs, which are systematically used for genotype evaluation under non-competitive conditions.

Mass Selection

Mass selection is presented as the simplest method for improving plant populations.

Pedigree Selection

Pedigree selection is examined as the main method for developing pure lines through successive self-pollination and progeny testing. Its effectiveness is enhanced when applied under non-competitive conditions, thereby maximising heritability and genetic gain.

Hybrid Development

The stages of hybrid development are described, including reselection, development of parental lines and evaluation. Combining ability and heterosis are used as key criteria, while the distinction between heterotic and homozygous superiority is analysed.

Backcrossing

Backcrossing is presented as a specialised breeding method involving successive crosses with the recurrent parent. It is used to transfer one or a few desirable monogenic traits while simultaneously recovering the genetic background of an elite cultivar.

Laboratory Exercises

- Introduction to plant breeding.
- Qualitative and quantitative traits.
- Heredity exercises.
- Flower structure and sex expression.
- Selection of plants for disease resistance.
- Artificial pollination.
- Mutagenesis.
- Male sterility.
- Molecular markers.
- Pedigree selection.
- Seed production and certification.
- Statistical analysis of experimental results.

4. TEACHING and LEARNING METHODS - EVALUATION		
DELIVERY Face-to-face, Distance learning, etc.	Teaching Method: Face-to-face teaching through lectures in the lecture hall and practical sessions in the laboratory.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students	Use of Information and Communication Technologies (ICT) • PowerPoint presentations and other audiovisual teaching materials. • Learning support through the HMU e-Class platform. • Communication with students via the e-Class platform and e-mail.	
TEACHING METHODS The manner and methods of teaching are described in detail.	Activity	Semester workload
	Lectures	39
	Practical/Laboratory Exercises	26
	Independent Study	60
	Course total	125
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure	Theoretical Component Assessment includes: • interim multiple-choice tests administered at the end of each chapter; • a final multiple-choice examination. The final examination consists of 40 multiple-choice questions , each with one correct answer. The number of correct answers obtained in the interim tests is added to the total number of correct answers in the final examination. Therefore, regular attendance and participation contribute positively to the final result. Laboratory Component Assessment consists of a final examination containing 36 multiple-choice questions , each with one correct answer.	

5. ATTACHED BIBLIOGRAPHY
RECOMMENDED LITERATURE • Tokatlidis, I. <i>Plant Breeding: Principles and Methods</i>. Kallipos Open Academic Editions. Eudoxus Book Code: 122074390. • Fanourakis, N. (1999). <i>Plant Breeding: Basic Principles</i>. Ion Publications. • Available bibliography from the course of Genetics

