



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche		
ACADEMIC YEAR	2021/2022		
BACHELOR'S DEGREE (BSC)	BIOTECHNOLOGIES		
INTEGRATED COURSE	AGRICULTURAL BIOECHOLOGIES - INTEGRATED COURSE		
CODE	20423		
MODULES	Yes		
NUMBER OF MODULES	3		
SCIENTIFIC SECTOR(S)	AGR/17, AGR/02, AGR/03		
HEAD PROFESSOR(S)	MARRA FRANCESCO PAOLO	Professore Ordinario	Univ. di PALERMO
OTHER PROFESSOR(S)	AMATO GAETANO MASTRANGELO SALVATORE MARRA FRANCESCO PAOLO	Professore Ordinario Ricercatore a tempo determinato Professore Ordinario	Univ. di PALERMO Univ. di PALERMO Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	3		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	<p>AMATO GAETANO Tuesday 09:00 12:00 Studio docente: Viale delle Scienze, Edif. 4, Ingr. L, piano 2° stanza n. 217 oppure in modalita telematica su piattaforma Teams Wednesday 09:00 12:00 Studio docente: Viale delle Scienze, Edif. 4, Ingr. L, piano 2° stanza n. 217 oppure in modalita telematica su piattaforma Teams</p> <p>MARRA FRANCESCO PAOLO Monday 09:00 11:00 Sede polo decentrato di Caltanissetta Tuesday 09:00 13:00 Ed. 4 H PT-98 Thursday 09:00 13:00 Ed. 4 H PT-98</p> <p>MASTRANGELO SALVATORE Monday 10:00 12:00 Ed4-Ing.G-PT68 Wednesday 10:00 12:00 Ed4-Ing.G-PT68</p>		

DOCENTE: Prof. FRANCESCO PAOLO MARRA

PREREQUISITES	Basic knowledge about: general and systematic botany; Mendelian genetics, inheritance and variations; structure and function of DNA and on genetic mutations; genetic molecular markers.
LEARNING OUTCOMES	Knowledge and understanding: at the end of the course students will have specific knowledge concerning biotechnology applied in the areas of field, fruit crops and livestock breeding. Applying knowledge and understanding: the knowledge and skills' acquired will allow the student to apply in practice the conventional and innovative techniques of plant and livestock breeding (as well as propagation of field and tree crops) and process them according to specific technical requirements. Making judgments: students will be able to suggest the adoption of technologies and devices to improve the quantitative and qualitative level and the overall efficiency of the activities of plant and livestock breeding and plant propagation, according to the specific features of company. Communication skills: the student will be able to use a simple and proper language, even with stakeholders who do not have a scientific background, in presenting the development or research projects, and in addressing the plant and livestock breeders and the nurseries and seed companies Learning skills: the knowledge acquired will allow the student to interact with specialists in the field of plant and livestock breeding and propagation of agricultural species and to use effectively and autonomously the technical and scientific sources of the sector upgrading.
ASSESSMENT METHODS	Learning is assessed through an interview. The questions (usually six or eight), open or semi-structured, tend to test knowledge, acquisition of interpretative skills, capacity of connecting and processing the topics, as well as a relevant presentation capacity. The final grade will be expressed in thirtieth and will be judged insufficient when the student will demonstrate: difficulty to focus on the proposed topics, a shallow knowledge of the topics and an extreme limited exposure ability. As the degree of details of the proven knowledge increase will proportionally increase the positivity of the grade as follow: assessment "Excellent" with a score from 30 to 30 cum laude, "Very Good" with a score from 26 to 29, "Good" with a score from 24 to 25, "Satisfactory" with a score from 21 to 23, "Sufficient" with a score from 18 to 20. The maximum score (30 - 30 cum laude) is obtained in case of excellent mastery and critical-interpretative jurisdiction of the subject content of the course, a good exposition and the use of proper scientific terminology.
TEACHING METHODS	Lectures, laboratory, tutorials

MODULE TREE FARMING

Prof. FRANCESCO PAOLO MARRA

SUGGESTED BIBLIOGRAPHY

Plant propagation, principles and practices. Harmann and Kester's Hartmann; Kester; Davies, Jr.; Geneve (ISBN: 9780136792352).
 Biotecnologie delle colture frutticole. Sussidio didattico a cura di S. Sansavini e M. Pancaldi. Clueb Bologna (ISBN: 9788849111453)
 E. Baldini - Arboricoltura generale - Clueb (ISBN: 9788849100143)
 References provided during the course. Lecture notes.
 Ubicazione stanza docente: Viale delle scienze, Ed. 4, PT, Studio n.033

AMBIT	50080-Discipline biotecnologiche con finalità specifiche:agricarie
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

Objectives of the course.
 This course will provide information on the state-of-the-art of some aspects of plant biotechnology and on the opportunities, limitations, and possible development of green biotechnology applied to fruit crops breeding and propagation, with specific reference to fruit crops. Particular emphasis will be given to the importance and utilization of in vitro tissue culture for fruit crop propagation and genetic improvement.
 Knowledge and comprehension skills
 After the course students should have a detailed understanding of the potential deriving from application of green biotechnology to fruit crop species.
 Ability to apply knowledge and comprehension
 Students should be able to evaluate the opportunities offered by biotechnological tools for genetic improvement and plant propagation.

SYLLABUS

Hrs	Frontal teaching
1	Introduction, objectives and description of the course.
2	Woody plant. Fruit crops: variety and rootstocks
2	Woody plants in the Mediterranean area.
2	Biodiversity of fruit crops.
4	Seed Propagation: Seed Production Systems. Seed-Propagated Cultivars and Species. Seed quality, collection and conservation, Dormancy, Germination, Seedling Production Systems. Vegetative Propagation: Cuttings, factors affecting rooting. Grafting, Seedling and Clonal Rootstock Systems, Graft Incompatibility, Layering, Clones, Mutations, Chimeras, Apomixis.
2	Innovative methods applied to nursery technique. Nursery industry characteristics. Genetic-sanitary certificate information.
4	In vitro morphogenesis: organogenesis, somatic embryogenesis.
3	Micropropagation: steps, objectives, methodologies, perspectives. Somaclonal variation. In vitro germplasm preservation.
2	Characterization, conservation, enhancement biodiversity.
2	Sanitation: Nucellar lines; In vitro shoot-tip grafting
2	Biotization. Synthetic seed technology.
3	Fruit crop breeding.
2	Embryo rescue.
2	Protoplast isolation, Somatic Hybridization, Cybrid production.
3	Ploidy manipulation. Haploidy Technology. Gametic Embryogenesis. Anther and isolated microspore culture. Endosperm culture.
4	Molecular markers applied to nursery and fruit crop breeding. MAS
Hrs	Workshops
12	Culture Media preparation. Explant sterilization and culture. Synthetic seed preparation. In vitro shoot-tip grafting.

**MODULE
HERBACEOUS CROPS**

Prof. GAETANO AMATO

SUGGESTED BIBLIOGRAPHY

G. Barcaccia, M. Falcinelli (2012) *Genetica e Genomica 2: Vol. 2: Miglioramento genetico*. Liguori Editore. ISBN 978-8820737429
 F. Lorenzetti, S. Ceccarelli (2011) - *Genetica agraria*. Patron Editore. ISBN 978-8855531238
 E. Ciriofolo, P. Benincasa (2017) *Sementi - Biologia, produzione e tecnologia*. Edagricole, Milano. ISBN 978-8850655328
 R.W. Allard (1999) *Principles of plant breeding (2nd ed)* John Wiley & Sons Inc. ISBN 978-0471023098
 L. O. Copeland, M. B. McDonald (2001). *Principles of Seed Science and Technology (4th ed.)*. Springer-Verlag US. ISBN 978-0-7923-7322-3
 Materiale bibliografico indicato dal docente durante il corso.

AMBIT	10643-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	47
COURSE ACTIVITY (Hrs)	28

EDUCATIONAL OBJECTIVES OF THE MODULE

The course aims to provide the basic elements of knowledge on: methods of reproduction and propagation of crop species; genetic structure of the variety of crop species; genetic control of traits of agricultural interest; conservation, exploitation and use of agrobiodiversity; methods to create new variability; management models of segregating generations and major conventional methods of improvement of agricultural species. Moreover, the course provides the scientific basis, standards and techniques related to the activities of the seed sector aimed at the biotechnological efficiency of the seed companies.

SYLLABUS

Hrs	Frontal teaching
2	Introduction to the course. Reproductive systems and propagation of cultivated species. Species that are propagated vegetatively. Species propagated by seed: mostly self- and auto-pollinated. Evaluation of the frequency of allo-pollination.
4	Introduction to population genetics. Genetic structure of populations of predominantly self-pollinating and cross-pollinating species. Hardy-Weinberg equilibrium. Inbreeding. Genetic drift. Genetic variability in natural populations.
3	Agro-biodiversity. Mechanisms of domestication and evolution of the cultivated species. Sources of natural genetic resources. Genetic erosion in the cultivated species. Methods to create new variability. Controlled pollination and intra- and interspecific hybridization. Manipulation of ploidy level. Mutagenesis. In vitro cultures and molecular biotechnologies.
5	Genetic bases of selection. Selection for traits with continuous and discontinuous variation. Main methods of plant breeding for predominantly self-pollinating and cross-pollinating species.
2	Plant variety protection. Rules for seed production and trade. Role of the seed sector within agricultural sector. GM varieties.
Hrs	Practice
3	Principles of applied statistics to biology and selection. Determining the variability due to genetic and to environmental causes. Applications of the H-W principle. Estimation of genotype distribution.
6	Crossing procedures. Progenies growth and selection. Design and execution of plant breeding programs. Implementation of the most used schemes of conservation and multiplication of crop varieties.
3	Organization of laboratories and facilities at the seed companies.

**MODULE
ZOOTECHNICS**

Prof. SALVATORE MASTRANGELO

SUGGESTED BIBLIOGRAPHY

G. Pagnacco - GENETICA ANIMALE Applicazioni Zootecniche e Veterinarie (Terza Edizione) - Casa Editrice Ambrosiana - ISBN 978-880852017-3

G. Bittante, I. Andrighetto, M. Ramanzin - TECNICHE DI PRODUZIONE ANIMALE - Editore Liviana Scolastica- ISBN: 8849470835

AMBIT	10643-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	51
COURSE ACTIVITY (Hrs)	24

EDUCATIONAL OBJECTIVES OF THE MODULE

The objective of the discipline is to provide basic knowledges on major livestock species and their productive attitudes and productions. It will be deepened the genetic management of principal autochthonous livestock breeds with limited diffusion (small populations) with attention to the study of genetic variability, safeguard, genetic improvement, and traceability of their productions through modern molecular biotechnologies.

SYLLABUS

Hrs	Frontal teaching
4	The most important bovine, ovine and caprine breeds and their productions. Autochthonous breeds and their productions. Breed standardization and pigmentation genes: pigmentation mechanism, coat colour genes.
2	National livestock Herd Books. Selection in Italy: dairy and meat breeds.
2	Nucleid acids, structure of gene, genetic code and protein synthesis. Genic, genomic and chromosomic mutations. Genetic molecular markers.
2	Population genetics: allele and genotypic frequencies. Causes of variation of allele frequencies.
2	Genetic of quantitative traits, basic genetic model, heritability and repeatability.
4	Genetic relationship among individuals: additive relationship (a_{ij}) and inbreeding (F_i). Measures of relationship. Computational method of additive relationship (a_{ij}) and inbreeding (F_i) among individuals. The Wright's method (path-counting method) and the tabular method. Inbreeding, linebreeding, and heterosis.
Hrs	Workshops
4	Quantitative trait loci (QTL) and major genes. Mapping, characterization and their use in the most important livestock species.
4	Genomic selection: molecular biotechnologies for livestock studies. The DNA genotyping arrays. Linkage disequilibrium between and among loci.
4	Genomic applications: assignment of individuals to their breed of origin, identity, paternity and maternity tests, genetic traceability of livestock productions.