University of Catania – Department of Agricultural, Food and Environment

Academic Year 2023/2024 - Educational Project – PhD Course on Agricultural, Food and Environmental Science

Title and duration	Teacher	Dates	Aim of the course	Content of the course	Type of exam
1. Managing biological data with R: applications for plants and fruit tree species					
20 hrs	Mario di Guardo	22nd, 23rd, 24th, 25th and 26th January 2024	The course is aimed at the utilization of the R software, one of the most employed software for data and statistical analysis. The course is structured in 20 hours of theoretical-practical activities covering the most widely used functions for the analysis and interpretation of biological data. A prior knowledge of the R software is not required	- Introduction to R environment - Introduction to R Studio environment - Set the working directory - Import a dataset - Element extraction from vectors and matrix - Matrix and dataframe subsetting - Summary functions (*table, str, dim, nrow, ncol*) - Save a dataframe or a matrix - Graphical functions (*plot, barplot, hist, boxplot, qqplot*) - Text functions (*nchar, substr, gsub*) - Mathematical functions (*sum, mean, sd, max, min*) - Apply functions while grouping by factors (*aggregate*) - Logical functions (*ifelse*, and, or, equal to, different from) - Apply iterative functions to vector (*sapply*) - Apply iterative functions to data.frame (*apply*) - Merge two objects (*merge*) - Apply iterative functions to vector (*sapply*) - Apply iterative functions to data.frame (*apply*) - Merge two objects (*merge*) - Statistical functions (*cor.test, shapiro.test, t.test, aov*)	Practical
2. General and Multivariate Statistical Analysis: application with the R software					
20 hrs	Maria Raimondo	7th, 11th, 14th and 18th March 2024	The course welcomes students enrolled within the framework of the PhD school: 'Agricultural, Food and Environmental Science'. It aims to introduce PhD students to some fundamental concepts of basic statistics for multivariate statistical analysis. The course is structured in 20 hours of theoretical and practical activities with the R software. A prior knowledge of the R software is required	- Correlation - Inferential statistics - Introduction to hypothesis testing - Implementation in R - Introduction to the t-test - Analysis of Variance - The structural model in the Analysis of Variance - Chi-Square test - Factorial Analysis - Cluster Analysis - Implementation in R	Written
3. Introduction to a literature review process: overview and guidelines					
10 hrs	Giuseppe Antonio Di Vita	12th, 19th February 2024 and 4th March 2024	This introductory course, designed for doctoral students who are in the early stages of their doctoral trajectory, provides guidance for the complete literature review process	- Literature Search and Selection - Evaluation of sources (Managing Data) - Identification of themes and gaps - Outline the structure - Results Presentation - Scientific Mapping	Practical and Oral

4. Scientific publishing in the peer review era					
4A. Article submission process for publishing scientific papers 6 hrs	Michele Ricupero	8th and 9th April	The students will learn the aspects required before the submission of scientific papers for the publication in a targeted academic journal	- Submission of a scientific article - Authorship and ethics - Selecting the target journal - Language - Additional information and documents - Cover letter - The submission processes	Written
4B. Editorial process and scientific article publication 4 hrs	Antonio Biondi	10th April	The students will learn how to interact with publishers for navigating the editorial process after they article submission, what are the needed actions after submission and acceptance of the manuscripts and how to promote their published research in academic and non-academic communities	- Editorial process after submission - The peer review process - Editorial decision-making - Proof corrections - Correction or retraction - Publishing and promoting article after Acceptance - Type of paper access – rights transfer - Estimating and promoting the impact of articles	Written
5. Introduction and recent trends on experimental approaches for Agricultural Engineering					
5A. GIS applications for environmental impact representation of livestock housing systems 4 hrs	Provvidenza Rita D'Urso	15th December 2023	The course "GIS applications for environmental impact representation of livestock housing systems" aims at applying Geographic Information Systems (GIS) and spatial data to document and illustrate local and global issues related to agriculture. This course is designed for students who are already familiar with the fundamentals of QGIS and want to improve their skills in applying advanced GIS principles and tools. During the course, exercises will focus on the field of livestock production with regard to the distribution of livestock housing systems and their environmental impacts	- Advanced spatial features for livestock housing systems - Advanced data analysis and geoprocessing - Advanced thematic maps and print layout	Practical
5B. Multispectral indexes for detecting crop features 4 hrs	Daniela Vanella	12th January 2024	This module will introduce the theoretical framework behind the use of multispectral data obtained from satellite and unmanned aerial vehicle (UAVs) platforms. Within this sub-module, real applications will be presented aiming at detecting the main crop features (e.g., crop vigour, biomass, crop water status from abitioc and/or biotic stresses). In addition, hands-on demonstrations will be also carried-out	- Basics and case studies on multispectral approaches (1 hr); - Data acquisition and processing (2.5 hrs); - Evaluation test (0.5 hs).	Written
5C. Hyperspectral and thermal data for precision agriculture applications	Juan Miguel Ramirez-Cuesta	19th January 2024	This module will cover the basics related to the application of hyperspectral and thermal data in the context of the precision agriculture. Within this sub-module, the potentialities of these technologies will be	- Basics and case studies on hyperspectral and thermal approaches (1 hr); - Data acquisition and processing (2.5 hrs); - Evaluation test (0.5 hr).	Written

4 hrs			explored by showing real applications. Hands-on demonstrations will be also carried-out		
6. Agricultural policies in the EU: from the past to the future					
10 hrs	Giovanni La Via	18th, 19th and 22nd December 2023	The aim of the course is to improve the scientific knowledge on Agricultural policies at Regional, National and European level. We will try to make an overview of the public support for Agriculture and a forecast for the next future	- The history of the public support in Agriculture - The legislative process at Regional, National and European level - The regional in the last forty years - The evolution of the National support to Agriculture - The Common Agricultural policy: past, present and future	Written
7. Introduction and recent trends on experimental approaches for Food Science					
7.A. Introduction and recent trends on experimental approaches for Food Microbiology 5 hrs	Alessandra Pino	11th and 12th April 2024	The course provides a comprehensive overview of modern "Omics" as a tool to encompass genomics, transcriptomics, proteomics, and metabolomics with the aim to understand and view different food ecosystems from a global perspective	- Introduction to the principles of omics research - Multi-omics approach: a new direction toward precisely clarifying the roles of microorganisms - Application of Omics technologies to different food ecosystems - Case studies: examples of application of the most advanced technologies in food science (theoretical lessons and discussions on scientific articles)	Oral
7.B. The potential of agro-food by-products to enhance the Food Quality 5 hrs	Lucia Parafati	26th April and 3rd May 2024	The aim of the course is to improve the scientific knowledge about the innovative strategies in the food sector through the valorization agro-food by-products	- Introduction to the concepts of waste and by-product - Extraction techniques and valuable compounds that can be obtained from food by-products - Potential application of by-products as functional ingredients in foods - Recent studies regarding the use of agro- food by-products to improve the food quality (discussions on scientific articles)	Oral
8. Introduction and recent trends on experimental approaches for Animal Science					
8.A. New insights on the impact of animal nutrition on product quality 4 hrs	Antonio Natalello	23rd February 2024	The module will give an overview on new insights on the influence of animal nutrition on product quality with an emphasis on lipid metabolism in ruminants. The effect of bioactive compounds on products quality will be discussed in the light of the recent advances	- New insights on lipid metabolism in ruminants - The role of endogenous plant factors - Chromatographic analysis to evaluate the product quality	Oral
8.B. Basics of bioinformatic approach for livestock biodiversity studies 6 hrs	Andrea Criscione	1st and 8th March 2024	The module will introduce students to the basic steps to build a reproducible analysis pipeline using genome-wide data for livestock diversity studies. The main topics of biodiversity conservation will be also covered. Students are required to use their laptops	- Introduction to biodiversity and livestock diversity studies - Practicalities, set-up, and description of datasets - Genomic data handling in mirroring exercises using custom software and command line	Practical
9. Introduction and recent trends on experimental approaches for Plant Science					

10 hrs	Chiara Catalano	15th and 22nd March, 5th April 2024	Conventional and molecular breeding for fruit tree species: providing knowledge on conventional and biotechnological strategies applied for breeding in fruit tree species according to the emerging challenges of the modern agriculture	Main characteristics of fruit tree species influencing genetic improvement strategies choice; management and conservation of fruit crops germplasm; main objectives of breeding for fruit tree species; traditional breeding and molecular breeding strategies; use of segregating populations for understanding the genetic determinism of agronomic traits. Examples of application of traditional and biotechnological breeding approaches on fruit tree species will be discussed	Written
10. Introduction and recent trends on experimental approaches for Crop Protection					
10.A. Introduction and recent trends on experimental approaches in Plant Disease 5 hrs	Santa Olga Cacciola	14th and 15th February 2024	Acquire the strategy and methodology related to the development and application of environmentally sustainable strategies for the prevention and control of plant diseases, using innovative technologies and understanding the molecular mechanisms that trigger plant disease resistance	- Classes: strategy for the development in the laboratory of new eco-friendly formulates and the selection of a novel and efficient BCA (Biological Control Agent) - Laboratory activities: planning the experiment to assay the potential new formulates and BCA; transcriptome analysis to understand how to study the expression of genes in a complex system (host plant - pathogen - formulates or BCA	Written
10.B. Introduction and recent trends on experimental approaches in Entomology 5 hrs	Pompeo Suma	21st and 22nd February 2024	Early detection methods for insect alien species: the course will provide the basic concepts and tools useful for planning effective and economically sustainable surveillance programs to detect alien invasive pests, based on the most recent approaches	- Classes: main detection and monitoring methods of invasive species to prevent their establishment and spread, in new areas (e.g. remote sensing, chemical ecology, and internet-based applications) - Laboratory activities: will be showed the tools used and the activities carried out to manage the infestation of the red palm weevil as case study of alien insect species in Italy	Oral
11. Joint workshops of the Agriculture-oriented PhD programs at Unict, Unifg and Uniud					
28 hrs		Late Sept/Oct 2024 and 2025 June 2026	At least 6 key note speakers will give inter, trans and multi-disciplinary talks	- 1st year students will present a poster and a 3-minute talk - 2nd and 3rd year students will present a 15-minute talk - The active participation to at least two Joint Workshops, within the three years, is mandatory for all students	
12. Scientific seminars					
12.A. Seminars organized by various institutions of the University of Catania, including Di3A, and advertised by the Coordinator by *ad hoc* invitation emails		Within the 1st and 2nd years		- Students will have to attend at least 4 seminars and provide a brief abstract (200 words max) of the seminar content in the first- and second-year annual report	
12.B. Seminars organized by other institutions		Within the 1st and 2nd years		- Students will have to attend at least 4 seminars and provide a brief abstract (200 words max) of the seminar content in the first- and second-year annual report	

- The attendance to courses 1, 2, 3 and 4 with successful exams are mandatory for all 1st year students, and open to 2nd and 3rd year PhD students.
- For courses 5, 6, 7, 8, 9 and 10, each first-year student will have to choose, attend and successfully pass the exams of at least 3 of them. 2nd and 3rd year PhD students will attend at least the course of their area.