University of Catania – Department of Agricultural, Food and Environment
Academic Year 2024/2025 - 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. Statistic for experimental applications					
Applied statistics for experimental applications 9 hrs	Daniela Ferrarello, Di3A, UniCT	24 June, 27 June, 3 July 2025 9-12 AM Classroom H	The aim of the course is to introduce statistical methods for analyzing experimental data. It covers both univariate and multivariate analysis, equipping participants with essential mathematical tools for data interpretation. Practical examples and exercises will help Ph.D. students to apply statistical techniques effectively in experimental research.	Introduction to descriptive statistics and univariate analysis of experimental data: - Data types: qualitative and quantitative data - Data visualization: diagrams - Measures of central tendency: mean, median - Measures of dispersion: range, variance and standard deviation Bivariate analysis of experimental data: - Introduction to bivariate data analysis: relationship between two variables - Data visualization: scatter plots - Covariance - Correlation coefficient (Pearson's *r*) Multivariate analysis of experimental data: - Introduction to multivariate data analysis - Matrices and determinants - Eigenvalues and eigenvectors - Introduction to Principal Component Analysis (PCA) - Dimensionality reduction to simplify complex datasets	Written
2. Managing biological data with R: applications for plants and fruit tree species					
Managing biological data with R: applications for plants and fruit tree species 20 hrs	Mario di Guardo, Di3A, UniCT	From 7 to 11 July 2025 2-6 PM Classroom H	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*)	Practical

				- 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*)	
3. Introduction to a literature review process: overview and guidelines					
Introduction to a literature review process: overview and guidelines 8 hrs	Daniela Spina, Di3A, UniCT	5 and 12 May 2025 2-6 PM Classroom O	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					
Scientific publishing in the peer review era 8 hrs	Michele Ricupero, Di3A, UniCT	May 15 and16 2025 2-6 PM Classroom K	Students will develop skills in writing and preparing scientific papers for publication in targeted academic journal, learn how to navigate the editorial process with publishers, understand post-submission and acceptance procedures, and explore strategies to promote their research to both academic and non-academic communities.	I. Foundational principles - Understanding the scientific publishing landscape - Impact factors and other metrics - Ethical consideration II. Writing skills - Writing different types of scientific papers - Data presentation and visualization III. Publishing skills - Navigating the publication process - Working with publishers and editors IV. Post-publication and dissemination - Promoting your research - Post-publication activities	Written
5. Aligning your PhD research to the Sustainable Development Goals					
Aligning your PhD research to the Sustainable Development Goals 3 hrs	Vincent Caruana, Centre for Environmental Education & Research, University of Malta, Malta	17 June 2025 2-5 PM Classrom H	This course provides a space for doctoral students to: - question the current paradigms of development; - develop an interdisciplinary world view of sustainability and critically examine the SDGs' role in developing this view - identify the challenges inherent in the implementation of the SGDs and ways of how they can be addressed - discuss issues concerning sustainability from different disciplinary perspectives - critique unsustainable actions and ethical issues inherent in the SDGs - identify ways of how their line of research can effectively contribute to the achievement of certain SDG targets.	- The contribution of doctoral researches to the Sustainable Development Goals (SDGs). - Consider how sustainability principles—such as environmental stewardship, social equity, and economic viability—can be infused into PhD work. - Identify which SDGs PhD research of participants aligns with, how it addresses key challenges in sustainability, and what ethical or practical considerations arise. - Elucidation of concrete ways to strengthen PhD participant research's impact on the SDGs, whether through interdisciplinary collaboration, policy engagement, or innovative methodologies.	Written
6. Introduction and recent trends on experimental approaches on Agricultural Engineering					

6.A Advanced tools for GIS applications for land representation 3hrs	Provvidenza Rita D'Urso, Di3A, UniCT	10 June 2025 3-6 PM Classroom M	The course "Advanced tools for GIS applications for land representation" aims at applying Geographic Information Systems (GIS) and spatial data to document and illustrate local and global issues related to agriculture. GIS principles and advanced tools will be carried out using the open-source programme QuantumGIS to create thematic maps from freely-available online spatial data. During the course, exercises will focus on the application of these tools for analysing environmental impacts from agriculture and livestock sectors.	- Basics and case studies on advanced tools for - Data acquisition and processing - Evaluation test	Practical
6.B Multispectral monitoring applications for precision agriculture 3hrs	Daniela Vanella, Di3A, UniCT	9 July 2025 9-12 AM Classroom D	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 abiotic and/or biotic stresses). In addition, hands-on demonstrations will be also carried-out.	- Basics and case studies on multispectral approaches - Data acquisition and processing	Written
6.C Hyperspectral and thermal data for precision agriculture applications 3hrs	Juan Miguel Ramirez-Cuesta, Centro de Investigaciones sobre Desertificación (CIDE CSIC-UV-GVA), Spain	10 July 2025 9-12 AM Classroom D	The module will describe the basic concepts behind the use of hyperspectral and thermal data obtained from satellite and drones. Real applications will be presented in the context of the precision agriculture. Hands-on demonstrations will be also carried-out.	- Basics and case studies on hyperspectral and thermal proximal/remote sensing - Data acquisition and processing	Written
7. Introduction and recent trends on experimental approaches for Animal Science					
7.A Ruminal biohydrogenation and fatty acid composition of milk and meat 3 hrs	Pilar de Frutos Fernandez, CSIC, Spain	21 May 2025 2-5 PM Classroom K	The main aim of this course is to unravel the complexity of the fatty acid composition of feeds and foods, and of the ruminal biohydrogenation. By learning some basic concepts about fatty acids and ruminant digestion, we will gain an understanding of the lipid profile of feeds and ruminant derived foods (e.g., milk).	Understanding fatty acids. What is n-3, n-6, CLA, PUFA, DHA, etc.? Potentially health promoting fatty acids. Rumen biohydrogenation. Practical exercise (fatty acid composition). Nutritional strategies to modulate the fatty acid profile of meat and milk.	Written
7.B How ruminants learn to select nutritious diets and avoid intoxications	Pilar de Frutos Fernandez, CSIC, Spain	21 May 2025 9-11 AM Classroom H	The main aim of this module is to provide an overview on how wisely herbivores select their diet, particularly to avoid intoxications. The course will focus on the role of plant	Plant-herbivore balance. What are phyto-toxins (or plant secondary compounds) and what are they for? Models of diet selection. Learning through consequences.	Written

2 hrs			secondary compounds (or phytotoxins), on how herbivores learn what to eat and how to avoid intoxication, and on physiological adaptations.	Conditioned aversions. Adaptation of detoxification systems.	
7.C Use of new sources of protein in animal nutrition: from vegetable by-products to insects 3 hrs	Gonzalo Hervás Angulo, CSIC, Spain	22 May 2025 2-5 PM Classroom E	This module provides an overview of the use of new protein sources in animal nutrition. Novel and alternative protein sources to replace soybean meal for animal feeding will be presented in the light of recent advances.	Why do we need new proteins? Main sources of protein in animal feeding New sources of protein for animal feeding (agro-industrial by-products, insects, mussels, microalgae, seaweeds, duckweeds or single-cell protein)	Written
8. Introduction and recent trends on experimental approaches for Food Science					
8.A Introduction and recent trends on experimental approaches for Food Microbiology 4 hrs	Alessandra Pino, Di3A, UniCT	26 June 2025 9-13 AM Classroom D	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
8.B The potential of agro-food by-products to enhance the Food Quality 4 hrs	Lucia Parafati, Di3A, UniCT	23 June 2025 2-6 PM Classrom D	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)	Written
9. Introduction and recent trends on experimental approaches for Plant Science					
9.A Agronomic mineral biofortification to enhance the nutritional value of vegetables 2 hrs	Cherubino Leonardi, Di3A, UniCT	2 July 2025 10-12 AM Classrom H	The lecture aims to evaluate recent advances in agronomic biofortification of vegetables to enhance their mineral as well as phytochemical content, through targeted cultivation practices. It explores challenges related to crop interactions, mineral bioavailability, and the lack of standardized protocols for other essential elements highlighting the complexity of effective mineral enrichment strategies.	- Role of vegetables for human health - How biofortification can have an impact on vegetable quality - Agronomic biofortification - From biofortifified to tailored vegetables - Future trends	Written
9.B Agroecological transition and agroecosystems sustainability assessment 3 hrs	Paolo Guarnaccia, Di3A, UniCT	19 June 2025 11 AM – 2 PM Classrom H	This course provides an overview on agroecological transition and agroecosystems sustainability assessment.	- Introduction on crisis of industrial agriculture and the principles of agroecology; - Role and use of biodiversity in the design of sustainable agroecosystems; - Transitioning conventional agroecosystems to agroecological management;	Oral

				- Agroecological adaptation strategies to climate change and methodologies to assess sustainability and resilience of agroecosystems.	
10. Introduction and recent trends on experimental approaches for Crop Protection					
10.A Sustainability throughout the adoption of Integrated Pest Management 4hrs	Adeney de Freitas Bueno, EMBRAPA, Brazil	13 May 2025 2 – 6 PM Classrom H	The course will provide the basic concepts of innovative and experimental pest management tools for sustainable production of industrial crops based on the most recent approaches.	- RNA interference for controlling stinkbug pests - Novel egg parasitoid applications - GM plants resistant to insect pests - Economic thresholds applied to modern pest control tools - Area-wide insect pest sampling	Written
10.B How to deal with fungal pathogens: laboratory and field perspective 4 hours	Giorgio Gusella and Alessandro Vitale, Di3A, UniCT	April 30 2025 2-6 PM Classroom K	In this course innovative strategies and new research trends for fungal diseases management with an emphasis on fungal canker pathogens and soilborne pathogens of ornamental and horticultural crops will be presented. The course will explore various experimental results on disease control methods, innovative approaches and limiting factors. Special emphasis will be on the challenges of fungicide resistance, following laboratory and field procedures. Students will learn from real study cases.	- New trends in plant pathology diagnosis concepts: from the "one pathogen" concept to the "syndrome". - New research lines and new approaches for fungal diseases management: laboratory and field protocols. - Real study cases regarding the procedures applied for the monitoring of fungicide resistance phenomenon (key points and limitations).	Written
11. Joint workshop of the Agriculture-oriented PhD programs at Unict, Unifg and Uniud					
28hrs per workshop	Organized mainly by University of Udine (late September 2025), University of Catania (June 2026), University of Foggia (September 2027)	Several 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 talk - The active participation to at least two Joint Workshops, within the three years, is mandatory for all students		
12. Seminars at UNICT					
Eight seminars of at least 2 hrs each	Seminars organized by various institutions of the University of Catania (e.g. PhD Days), including Di3A	To be attended within the 1st and 2nd years	- Students will have to attend at least eight seminars and provide a brief description (150/200 words) of the seminar content within the first- and second-year annual report		
13. Workshops and Classes organized by non-Di3A institutions					
At least a total of 10hrs	Workshops (e.g. Summer schools) and/or Classes (e.g. Linguistic courses) organized by non-Di3A institutions	To be attended within the 1st and 2nd years	- Students will have to attend at least 10hrs of courses and/or classes and provide a brief description (150/200 words) of their content within the first- and second-year annual report		

- The attendance to courses 1, 2, 3, 4 and 5 with successful exams are mandatory for all 1st year students, and open to 2nd and 3rd year PhD students.
- For courses 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.