COURSE OF STUDY Master's degree in 'Innovation Development in Agrifood Systems' (IDEAS) – Class: LM-69 Agriculture

ACADEMIC YEAR 2023-2024

ACADEMIC SUBJECT I.C. Innovative and smart technologies in crop protection - *Smart technologies to manage plant pathogens*

General information	
Year of the course	1st year
Academic calendar (starting and ending date)	October 16th, 2023 - January 26th, 2024
Credits (CFU/ETCS):	6
SSD	AGR/12 – Plant Pathology
Language	English
Mode of attendance	Attendance is recommended but not mandatory

Professor/ Lecturer	
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Department and address	Department of Soil, Plant and Food Sciences (DiSSPA) – Plant pathology section - University of Bari – via Amendola 165/A – 70126 BARI -Italy
Virtual room	Microsoft Teams code: ix85cgi
Office Hours (and modalities: e.g., by appointment, on line, etc.)	From Monday to Wednesday, 3.00 pm to 6.30 pm or in the morning following an established appointment requested to the teacher (by phone or e-mail).

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
150	32	28	90
CFU/ETCS			
6	4	2	

Learning Objectives	The course is aimed to provide knowledge, understanding and abilities for a smart and sustainable use of innovative technologies for crop and plant protection management, disease prediction models and web-based decision support systems (DSS). The students will be able to suggest new physical, chemical, biological, genetic control methods, possible application of biotechnology and nanotechnology in crop protection, sensor systems and novel smart solutions for plant disease management.
Course prerequisites	Basic knowledge on general biology

Teaching strategie	Lectures supported by Power Point slides, web sites and multimedia. Laboratory classroom, working groups, case studies, and transferring of stakeholders' experiences. E-learning using the MS Team platform will be also used.

Expected learning outcomes in terms of	
Knowledge and understanding on:	○ Innovative and sustainable technologies for crop protection. ○ Advanced methods for monitoring plant health and early detection of relevant pathogens in novel plant production and management systems. ○ Advanced methods and tools for managing new epidemics or pandemics caused by phytopathogenic microorganisms. ○ Knowledge to apply plant disease prediction models and manage decision support systems (DSS), and to analyse and interpret the data.
Applying knowledge and understanding on:	○ Knowledge for proposing new safer and environmentally friendly solutions for plant protection management. ○ Ability to identify and suggest appropriate methods for risk assessment and suitable management strategies for pathogens of interest. ○
Soft skills	• *Making informed judgments and choices* ○ Ability to maximize efficiency of using new tools for crop protection in different and variable crop management systems to ensure yield, quality, safety, and security and minimize the environmental impact and risks for human health. • *Communicating knowledge and understanding* ○ Ability of evaluating the benefits, risks, and negative side effects of the new technologies for plant disease management ○ Ability to promote innovation in crop protection by interacting with the research, industry, and farmer communities. • *Capacities to continue learning* ○ Capacities of updating the knowledge on new approaches and innovative techniques for crop protection. The results of the expected learning, in term of knowledge and ability, are listed in the Annex A of the Didactic Regulation of the Bachelor Course (expressed by the European descriptors of the study title).
Syllabus	
Content knowledge	• Presentation of the course and educational aims. • Potentiality of new products, tools, and strategies for integrated disease management. • New physical control methods for plant protection (i.e., microwave, UV and pulsed light, electrolyzed water, and cold plasma). • Development, introduction, and adoption of novel plant protection products, including natural or synthetic compounds, biological control agents and plant defence activators. • Disease prediction models and web-based decision support systems (DSS) for plant disease management. • Sensor systems and smart agri-robotic solutions for plant disease management. • Biotechnology and nanotechnology in crop protection. • Advanced techniques for pathogen identification and plant disease detection. • New methods for prevention and control of phytopathological emergences. 'Multi-actor approach' concept and methodology for innovation in plant protection.

Texts and readings	• Ul Haq I., Ijaz S. (2020) Plant Disease Management Strategies for Sustainable Agriculture through Traditional and Modern Approaches. Sustainability in Plant and Crop Protection, vol 13. Springer, Cham. • Oerke EC., Gerhards R., Menz G., Sikora R. (2010) Precision Crop Protection - the Challenge and Use of Heterogeneity. Springer, Dordrecht. • Capri E., Alix A. (2018) Sustainable Use of Chemicals in Agriculture. Academic Press. • Reddy, P.P. (2013) Recent advances in crop protection. Springer.
Notes, additional materials	Personal notes of the lectures and didactic materials distributed during the course. Examples of websites: • https://croplife.org/crop-protection/innovation-in-crop-protection-products/ • https://euplantcropp.eu/ • http://www.fao.org/home/en/ • http://www.ecpa.eu/ • http://www.apsnet.org/ Further materials as research articles and websites will be provided on request.
Repository	All didactic materials will be shared in MS Teams.

Assessment	
Assessment methods	The students enrolled in the academic year during which this discipline is offered can have an intermediary exam during the teaching period of the discipline. The result of this intermediary exam remains valid for the whole academic year and concurs to the final evaluation of the student. The intermediary exam will be given on the subjects treated during the lessons and the practical activities up to the suspension of the teaching activity. The evaluation of the intermediary exam is expressed in thirtieths. At the end of the module teaching period, the students who passed positively the intermediary exam, can give the final exam concerning on the subjects treated during the lessons and the practical activities since the intermediary exam. Students who did not pass or give the intermediary exam will be examined on the whole subjects treated during the lessons and the practical activities as reported in the Didactic Regulation of the Master course (art. 9) and syllabus (annex A) and which is correlated to the actual teaching period. The intermediary and the final exams consist of an oral test in English concerning the topics developed during the theoretical and practice lessons. The examinations are public.

Assessment criteria	• *Knowledge and understanding*
	  ○ Ability to describe innovative and sustainable technologies for plant disease protection.
	  ○ Ability to describe advanced methods for monitoring plant health and early detection of plant disease and for prevention and control of phytopathological emergencies.
	  ○ Ability to describe disease prediction models and decision support systems (DSS) for plant disease management.

	• *Applying knowledge and understanding*
	  ○ Ability to define and propose innovative and sustainable protection strategies suitable for present and future crop production systems, by explaining applications modes, associated benefits and risks also related to environmental factors and crop management activities.
	  ○ Ability to identify and propose tools and methods for risk assessment and management of relevant pathogens and to lead the search for innovative solutions for emerging issues in crop protection.
	• *Autonomy of judgment*
	  ○ Ability to analyze and critically evaluate various and dynamic social and economic contexts and to transfer innovative technologies for plant disease management.
	• *Communicating knowledge and understanding*
	  ○ Ability to explain and motivate the choices in the field of crop protection.
	• *Communication skills*
	  ○ Ability to explain in exhaustive way, with appropriate words, the needs of production process management and the potentialities offered by technological innovations and to interact with various professional figures involved in crop protection.
	• *Capacities to continue learning*
	  ○ Ability to apply acquired knowledge and skills for problem solving in various operative situations.

Final exam and grading criteria	The evaluation is expressed in thirtieths. The final exam is passed with a vote of at least 18/30. For students who were undergone the partial check, the final evaluation is expressed by the average of the votes obtained in the two oral tests. A *cum laude* may be added to the highest vote (30/30), as a special distinction. The evaluation of the student's attainment agrees with pre-established criteria, as detailed in Annex A of the Academic Regulations for the Agricultural Technologies and Science Degree Course.
Further information	