General information	
Academic subject	I.C. Innovative and smart technologies in crop protection – Smart technologies to manage plant pathogens
Degree course	International Master of Science in Innovation Development in Agrifood Systems (IDEAS) – Class: LM-69 Agriculture
ECTS credits	6 ECTS (4 ECTS of Lectures + 2 ECTS of laboratory or field classes)
Compulsory attendance	No
Teaching language	English

Subject teacher	Name Surname	Mail address
	Rita Milvia De Miccolis Angelini	ritamilvia.demiccolisangelini@uniba.it

ECTS credits details		
	4 ECTS Lectures	2 ECTS Laboratory or filed classes

Class schedule	
Period	First semester
Course year	First year
Type of class	Lectures: 4 ECTS (32 hours) Laboratory classroom, working groups, study case, and transferring of stakeholders' experiences 2 ECT (28 hours). E-learning using public (eg MS Teams) platform could be used.

Time management	
Hours	150
In-class study hours	60 (32 L + 28 Ex/Lab)
Out-of-class study hours	90

Academic calendar	
Class begins	October 5th, 2020
Class ends	January 22nd, 2021

Syllabus	
Prerequisites/requirements	Basic knowledge on general biology
Expected learning outcomes	***Knowledge and understanding*** o Knowledge and understanding of innovative and sustainable technologies for crop protection. o Knowledge and understanding of advanced methods for monitoring plant health and early detection of relevant pathogens in novel plant production and management systems. o Knowledge and understanding of advanced methods and tools for managing new epidemics or pandemics caused by phytopathogenic microorganisms. o Knowledge to apply plant disease prediction models and manage decision support systems (DSS), and to analyze and interpret the data. ***Applying knowledge and understanding*** o Knowledge for proposing new safer and environmentally

	friendly solutions for plant protection management. o Ability to identify and suggest appropriate methods for risk assessment and suitable management strategies for pathogens of interest. ***Making informed judgements and choices*** o Ability to maximize efficiency of using new tools for crop protection in different and variable crop management systems in order to ensure yield, quality, safety, and security and minimize the environmental impact and risks for human health. ***Communicating knowledge and understanding*** o Ability of evaluating the benefits, risks, and negative side effects of the new technologies for plant disease management o Ability to promote innovation in crop protection by interacting with the research, industry, and farmer communities. ***Capacities to continue learning*** o 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).
Contents	• 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.

Course program	
Reference books	• 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. Personal notes of the lectures and didactic materials distributed during the course.
Notes	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.
Teaching methods	Oral presentations supported by Power Point slides, web sites and multimedia, documents prepared by the teacher, practical exercises in the classroom, in the laboratory and in the fields and guided visits in farms.
Evaluation 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. The evaluation of the student is based on criteria previously fixed such as reported in the Annex A of the

	Didactic Regulation of the Master Course in Innovation Development in Agrifood Systems.
Evaluation criteria	***Knowledge and understanding*** o Ability to describe innovative and sustainable technologies for plant disease protection. o Ability to describe advanced methods for monitoring plant health and early detection of plant disease and for prevention and control of phytopathological emergencies. o Ability to describe disease prediction models and decision support systems (DSS) for plant disease management. ***Applying knowledge and understanding*** o 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. o 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. ***Making informed judgements and choices*** o 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*** o 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*** o Ability to apply acquired knowledge and skills for problem solving in various operative situations.
Receiving times	From Monday to Wednesday, 9.00 to 13.30 or in the afternoon following an established appointment requested to the teacher (by phone or e-mail).