PhD PROGRAMME IN “PLANT AND ANIMAL SCIENCES”

Coordinator
Prof. Roberta BERNINI

Department
Department of Agriculture and Forest Sciences

Program duration
3 years: 1st November 2023 - 31st October 2026
Thesis Defence: within July 2027

Program objectives
The PhD program aims to train researchers of high scientific qualification able of addressing the various aspects of research in the agricultural sciences, from planning a research project to its implementation, from the interpretation of data to the presentation of results, the writing of articles in scientific journals and, where possible, patents. Over the course of the three years, the PhD students develop research topics and carry out training activities with an innovative and interdisciplinary approach thanks to the different scientific skills of the members of the Academic Board in the fields of agricultural, biological and chemical sciences and the possibility of carrying out internships and periods of research and study abroad at Universities and research institutes of high scientific qualification. Research topics are agronomy, animal husbandry, biotechnologies, plant breeding, plant protection, soil science, applications of nanomaterials in agriculture, natural organic compounds, valorisation of agro-industrial wastes, project and development of methodologies for the synthesis of bioactive molecules, production of recombinant products of high added value from plant materials, biosensors for the environmental monitoring and the production chain, study of the role of the environmental factors on the agricultural productions, landscape planning, aspects of technological and nutritional quality of products, food and production safety, models for product, process and organizational innovation of the agro-food system.

Number of positions
Total positions 13

<table>
<thead>
<tr>
<th>Description</th>
<th>Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Positions with “PNRR DM 117” scholarship</td>
<td>3</td>
</tr>
<tr>
<td>D.M. 117/2023 - M4C2 Inv. 3.3</td>
<td></td>
</tr>
<tr>
<td>B) Positions with “PNRR Digital and Environmental Transitions” scholarship</td>
<td>1</td>
</tr>
<tr>
<td>D.M. 118/2023 - M4C1 Inv. 3.4</td>
<td></td>
</tr>
<tr>
<td>C) Positions with “PNRR Research” scholarship</td>
<td>3</td>
</tr>
<tr>
<td>D.M. 118/2023 - M4C1 Inv. 4.1</td>
<td></td>
</tr>
<tr>
<td>D) Positions with scholarships funded by external public bodies/Department/University</td>
<td>6</td>
</tr>
</tbody>
</table>

(A) Positions with “PNRR DM 117” scholarship

M4C2 Inv. 3.3 “Innovative doctorates aimed at strengthening the demand of innovation of enterprises and promoting the employment of researchers by enterprises”

N. 3 scholarships aimed at carrying out the following research:

1) “Evaluation of the relationships between climate change, biodiversity and food security: mitigating climate change through the use of soil improvers obtained from food industry waste using circular bioeconomy approach”

Co-funding body: Department for Sustainability - ENEA
Scientific responsible DAFNE: Prof. Roberta Bernini
Scientific responsible ENEA: Dr. Annamaria Bevivino
A fair, healthy, sustainable and environmentally-friendly food system represents one of the most important challenges of our society. Intensive agriculture is destroying traditional forms of agriculture, increasing food insecurity and making people dependent on food they are unable to produce. One of the objectives of the research is to identify, classify and evaluate the factors that influence food security at local and European level and evaluate the relationships between climate change, biodiversity and food security. A system based on the circular bioeconomy reduces dependence on external production inputs, increases the resilience of the food system and guarantees food security. The research project has the second objective of identifying food processing residues at a national level in order to obtain "soil improvers" that can sustain the soil health status and reduce the negative impact of chemical fertilisers. Waste from the food industry contains nutrients and organic matter that can contribute to soil health, fertility and restoration, when such waste cannot be put to other higher value uses. The ability of production technologies to inactivate biological risk will be evaluated and the quality and safety of the products will be monitored. Metagenomic analysis of representative samples of final products will allow to evaluate their stability and determine the correct method to maintain the stabilized formulations.

(2) “Integrating genomic and phenomic approaches to exploit germplasm banks for wheat improvement”
Co-funding body: Cereal and Industrial Crops - CREA
Scientific responsible DAFNE: Prof. Francesco Sestili
Scientific responsible CREA: Dr. Pasquale De Vita
Brief description: Plant genebanks provide genetic resources for breeding and research programs worldwide. These programs benefit from having access to high-quality, standardized phenotypic and genotypic data. Recently, technological advances have made it possible to collect phenomic and genomic data from germplasm banks, and with the use of appropriate analytical computer tools, they can be integrated directly into pre-breeding and breeding programs. The PhD program will evaluate the homogeneity and heterogeneity of accessions to the CREA gene bank in Triticum spp. and will collect the available documentation. The PhD student will collect, organize and manage historical genomic and phenomic data and address any missing data with new genotyping analyses and/or specific phenotyping field trials. The program will explore future opportunities that could emerge from better documentation and integration of genomic and phenomic data of plant genetic resources into new breeding programs.

(3) “Development and testing of model-based algorithms for irrigation, fertilization and precision seeding for field crops using multi- and hyperspectral satellite data”
Co-funding body: Evaluation Center LTD, Rome
Scientific responsible: Prof. Raffaele Casa
Company manager: Dr. Stefano Lo Presti
Brief description: The research project aims to answer the following scientific questions: 1. How to reduce uncertainty in monitoring spatial and temporal variability of crops and agricultural soils? 2. How to leverage
Crop and soil monitoring information for the development of innovative precision management strategies? 3. How to evaluate the benefits of site-specific precision management practices of sowing, fertilization and irrigation compared to conventional agronomic management in terms of sustainability? For point 1, research will be conducted focusing on new possibilities for monitoring soil and crop variables offered by the increased accuracy and availability of hyperspectral satellite remote sensing (PRISMA, EnMAP) data, as well as fusion with proximal sensing (e.g., geoelectric mapping). In point 2, for the exploitation of crop and soil monitoring information for the characterization of spatial and temporal variability, the most appropriate approach is based on the coupling of monitoring information from remote sensing to crop simulation models. For point 3, the evaluation of the possible advantages of precision management, compared to conventional practice, will be evaluated by experimental tests of different algorithms for the definition of the dose of fertilizer and variable rate seed in wheat, maize and sunflower, as well as variable rate irrigation recommendation, e.g. based on the Tethys system.

(B) Positions with “PNRR Digital and Environmental Transitions DM 118” scholarship

M4C1 Inv. 3.4 – “Digital and Environmental Transitions”
N. 1 scholarship to undertake research on “Study of innovative aspects of wildlife monitoring”
Scientific responsibles: Prof. Umberto Bernabucci/Prof. Riccardo Primi
Co-funding body: Ambito Territoriale di Caccia Roma 2
Responsible Ambito Territoriale di Caccia Roma 2: Dr. Sandro Fosso
Brief description: the project is aimed at the advancement of knowledge relating to innovative techniques and methods for monitoring wildlife. The study of new technologies is of interest for understanding the impacts of agricultural activity on ecosystems and biodiversity, for verifying improvements in environmental performance in agriculture and the impact of some species (e.g., wild boar and other wild ungulates) on agriculture itself (e.g., damage to crops) which undermine its competitiveness.

(C) Positions with “PNRR Research DM 118” scholarship

M4C1- Inv. 4.1 - “PNRR Research lines”
N.3 scholarships aimed at carrying out the following research:
(1) “Production of extracts of application interest from medicinal plants”
Co-funding body: MUR (DAFNE, Progetto Dipartimento di Eccellenza D.I.Ver.So)
Scientific responsible: Prof. Prof. Roberta Bernini
Brief description: The objective of this project is the selection of medicinal plants typical of the Mediterranean area, aimed at the production of extracts and essential oils characterized in terms of quality and quantity. The extraction processes will be conducted with sustainable methodologies and processes, following the principles of green chemistry. Waste plant parts of the selected matrices may also be used as raw material for the production of extracts. The extracts obtained may be tested and intended for various applications.

(2) “Disentangling the mechanisms behind plant-microbe interactions involved in abiotic stress tolerance”
Co-funding body: MUR (CN Agritech)
Scientific responsible: Prof. Carla Caruso
Other scientific responsible: Prof. Laura Bertini/Prof. Silvia Proietti
Brief description: An in-depth analysis of plant-microbe interactions will be conducted in order to understand the role of microorganisms in fitness and defense against abiotic stress in tomato plants. The molecular mechanisms of the cross-talk between plant and beneficial fungi (also in a consortium) will also be analyzed to i) identify the metabolic and cellular processes activated by the plant-microorganism symbiosis; ii) the protection against stress of various nature. The study will be conducted using high throughput sequencing technologies and -omics techniques.

(3) “Food quality and safety of tomato and other species of agronomic interest in the Mediterranean basin”
Co-funding body: ENEA
Scientific responsible: Prof. Luca Santi
Scientific Responsible ENEA: Olivia Demurtas, Gianfranco Diretto
Brief description: The project aims to extend current knowledge for the definition of the quality of agri-food products along the entire production chain and to increase their sustainability, with particular reference to the identification of characteristics associated with the production of molecules responsible for sensory characteristics and with pro- and anti-nutritional activity or involved in the fitness of plant species of agricultural interest. In detail, different tomato varieties will be considered, focusing on characteristics related to color and nutritional potential (carotenoids and apocarotenoids) of the berry or the ability to resist biotic and abiotic stresses (drought, weed tolerance, etc.) in order to: i) obtain specific tomato metabolomic databases for each variety/treatment/process; ii) generate transcriptomic datasets of tomato varieties under control, biotic stress treatment and processing conditions; iii) define genes associated with nutritional metabolic traits and resistance to biotic stresses at the level of raw materials and finished products.

Please note that the acceptance of a PNRR scholarship implies obligations additional to those of a regular scholarship: see art. 17 of this Call.

(D) Positions with fellowship funded by public bodies and by Department/ University

N.6 scholarships aimed at carrying out the following research:

(1) “Evaluation of ecosystem services of agro-pastoral activities”
Funding: Ambito Territoriale di Caccia Roma 2 and DAFNE (Progetto Dipartimenti di Eccellenza DIVerSo)
Scientific Responsible UNITUS: Prof. Umberto Bernabucci/Prof: Riccardo Primi
Scientific Responsible Ambito Territoriale di Caccia Roma 2: Dr. Sandro Fosso

(2) “Emissions of greenhouse gases in domestic ruminants”
Funding: MUR (CN Agritech) and University of Tuscia
Scientific responsible UNITUS: Prof. Nicola Lacetera

(3) “Omic approach to define novel apocarotenoids biosynthetic pathways in plants”
Funding: ENEA - Dipartimento Sostenibilità dei Sistemi Produttivi e Territoriali, Casaccia and DAFNE (Progetto Dipartimenti di Eccellenza DIVerSo)
Scientific responsible UNITUS: Luca Santi
Scientific Responsible ENEA: Dr. Olivia Demurtas/Dr. Gianfranco Diretto
(4) “Innovative techniques for soil mapping and monitoring in olive and other fruit tree systems”
Funding: Agreement between the Lazio Region, the University of Tuscia, the Industrial Development Consortium of Rieti and University of Tuscia Consortium of Rieti
Scientific responsible UNITUS: Prof. Valerio Cristofori/Prof. Simone Priori
Responsible Agreement: Prof. Alessandro Ruggieri

(5) “Development of population dynamics models for Bactrocera oleae”
Funding: Agreement between the Lazio Region, the University of Tuscia, the Industrial Development Consortium of Rieti and University of Tuscia Consortium of Rieti
Scientific responsible UNITUS: Prof. Stefano Speranza
Responsible Agreement: Prof. Alessandro Ruggieri

(6) “Plant production of antibodies and antigens for the development of new generation vaccines and diagnostic assays to be used in the control and prevention of infectious reproductive diseases of livestock”
Funding 100%: ENEA
Scientific Responsible UNITUS: Prof. Roberta Bernini
Scientific Responsible ENEA: Dr. Marcello Donini

| Admission requirements | ▪ Admission is open to candidates of any nationality and age who have one of the following requirements by the deadline of the call for application: 
▪ Italian degree “Laurea Vecchio Ordinamento”
▪ Italian degree “Laurea Specialistica” or “Magistrale”
▪ International academic qualification (degree) awarded in a foreign University or in the context of inter-university cooperation and mobility agreements.
▪ Admission is also open to students will obtain their degree within 31 October 2023. |
| Evaluation of candidates (Maximum score: 80/80) | The candidates are evaluated by qualifications and exam (interview). The maximum score assigned is 80/80. |
| Evaluation of the qualifications (Maximum score: 15/80) | The evaluation of qualifications concerns the candidate's educational path, professional and research experiences. In particular, the following qualifications are evaluated: 
▪ Degree thesis accompanied by an abstract in English language
▪ University career (passed exams and graduation marks)
▪ Scientific publications relating to the research topics of the PhD Program
▪ Participation in research projects
▪ Scholarships
▪ Professional experience and other qualifications held by the candidate in the curriculum vitae et studiorum, including any letters of introduction from university professors
▪ Research project proposed.
▪ The maximum score is 15/80.
▪ Before the interview, the scores assigned to the candidates will be published on the University website address: |
### Evaluation of the interview

( Maximum score: 65/80 )

The interview is aimed at ascertaining the preparation and aptitudes of candidates for scientific research and includes the assessment of knowledge of the English language. The minimum score is 40/65 and the maximum is 65/80.

### Topics of the interview

The interview, aimed at ascertaining the aptitude of candidates for scientific research, will focus on the presentation and discussion of the proposed research project, on the research topics of the PhD program and on knowledge of the English language. The project, described at most in 4 pages, can be written in Italian or English according to the model shown on the University website address: [http://www.unitus.it/it/unitus/post-lauream1/articolo/dottorati-di-ricerca](http://www.unitus.it/it/unitus/post-lauream1/articolo/dottorati-di-ricerca). The interview includes the assessment of knowledge of the English language by reading and translating some paragraphs of a scientific text. After the interview, the scores will be published on the University website address: [http://www.unitus.it/it/unitus/post-lauream1/articolo/dottorati-di-ricerca](http://www.unitus.it/it/unitus/post-lauream1/articolo/dottorati-di-ricerca).

### Timetable and interview location

The exams will be held between 6th – 20th September 2023. The date(s) of the interview will be published on the University website at the site: [www.unitus.it > Didattica > Offerta post lauream > Dottorati di Ricerca](http://www.unitus.it) by the deadline of the application call.

### Contacts for information

Prof. Roberta BERNINI
E-mail: [dottorato.spva@unitus.it](mailto:dottorato.spva@unitus.it)