**Thesis topics for IMAHS students proposed**

Prof. Sanja Baric

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Topic: Plant Pathology

Title: Occurrence and abundance of root-lesion nematodes in high-density apple orchards in South Tyrol

Scientific Leader: Prof. Sanja Baric

Summary:

Apple production plays an important economic role in South Tyrol. The high-density orchards are mainly located in the major river valleys and their side slopes. Most of the orchard sites have been planted with apple trees for many decades. Consequently, apple replant disease (ARD), which is manifested by stunted growth, delayed cropping and mortality of trees, may represent a major challenge for the renewal of apple orchards. Apart from abiotic soil factors, in particular biotic interactions have been implicated in the complex etiology of ARD. Several recent studies have addressed the soil and rhizosphere bacterial and fungal communities in ARD-affected orchards in South Tyrol. Less attention has been given to plant-parasitic nematodes, which were associated with root destruction and growth reduction in other geographic areas dealing with replant problems. This study shall thus be a first step to a systematic survey on the occurrence and abundance of root-lesion nematodes in roots of apple trees, which are to be collected from orchards affected to different degrees by ARD. In addition to field surveys and classic nematode isolation techniques, molecular tools shall be applied to species identification and assessment of genetic variability.

Duration: six months

Expertise/competences achieved during the research training: Nematode sampling techniques; Isolation of nematodes from root and soil samples; Microscopic determination of root-lesion nematodes; Molecular techniques for species determination

Possible external collaborations: Research activity will be conducted in collaboration with Martin Thalheimer from the Laimburg Research Centre

Prof. Stefano Cesco

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Topic: Agricultural Chemistry

Title: Aromatic profiles of hydroponically-grown aromatic herbs and salads affected by the composition of nutrient solution and the inoculation with Plant Growth-Promoting Rhizobacteria

Scientific Leader: Prof. Stefano Cesco

Summary: The research will consist in studying the influence of both the composition of the hydroponic solution and the inoculation with the plant growth-promoting rhizobacteria Azospirillum brasilense on the nutraceutical value and the aromatic profile of aromatic herbs and salads grown in a soil-less system. Plants will be grown until commercial maturity and afterwards shoots and roots will be separated assessing fresh weight (FW) and dry weight (DW) of the tissues together with the root to shoot ratios; furthermore, the chemical composition of leaves extracts will be determined, through targeted and untargeted methods. In particular, the content of organic acids, sugars and amino acids will be assessed via HPLC analyses, whilst the concentration of antioxidant compounds, as for instance total phenolics, flavonoids and flavonols, will be determined by spectrophotometric methods. In addition, the plants extracts will undergo an untargeted metabolomic analysis carried out by a hybrid quadrupole-time-of-flight mass  spectrometer coupled to an UHPLC chromatographic system. The composition of shoots and roots in terms of mineral elements will be also determined by ICP-OES. The whole dataset will be processed through multivariate statistical methods in order to unravel the relationships between the growing conditions (i.e. chemical composition of the nutrient solution) and the quality parameters of the leafy vegetables.

Duration: Approximately 6/8 months.

Expertise/competences achieved during the research training: Students will learn the basics of hydroponic cultivation of plants and about the analytical methods required for the assessment of the chemical and nutraceutical composition. In addition, they will be introduced and trained in using multivariate statistical methods.

Possible external collaborations: none foreseen

Topic: Agricultural Chemistry

Title: Influence of agrochemicals treatments on the rhizosphere microbiome of soil-cultivated crop plants (e.g. barley, tomato).

Scientific Leader: Prof. Stefano Cesco

Summary: The research will be focused on studying the effects induced by commercial agrochemicals, used for crop protection against pests, on the root-inhabiting microbiome. In particular, the study will aim at assessing whether the application of pesticides can induce an alteration of the qualitative and quantitative root exudation pattern in soil cultivated crop plants (e.g. barley, tomato) and, consequently, of the microbial community associated to the root system. To reach these objectives, the chosen crop plants will be germinated and afterwards cultivated in small pots filled with previously characterized soil; after two/three weeks of growth, the plants will be treated with either a fungicide or an insecticide, without directly spraying the soil. At fixed time points, samples will be collected; in particular, shoots and roots will be separated assessing fresh weight (FW) and dry weight (DW) of the tissues together with the root to shoot ratios, whilst rhizosphere soil will be isolated and subjected to further analyses. Root exudates from rhizosphere soil will be extracted with aqueous solvents and the chemical composition in terms of organic acids, sugars and amino acids will be assessed via HPLC analyses, whilst the concentration of other compounds, as for instance total phenolics, will be determined by spectrophotometric methods. In addition, the available fraction of mineral nutrients will be determined by a rhizosphere soil DTPA extraction and followed by ICP-OES analysis.

The rhizosphere soil will be also used as starting material for the extraction of total DNA that will be amplified through standard PCR methods to specifically target the bacterial 16S rDNA. The selected amplicons will be sequenced through high-throughput methods (e.g. Illumina sequencing) to obtain a comprehensive survey of the microbial community associated to the plant roots.

The whole dataset will be processed through multivariate statistical methods in order to unravel the relationships between the treatment with agrochemicals and all the plant-mediated rhizosphere processes (i.e. release of root exudates, recruitment of the root microbiome) and the related effects on the bioavailability of mineral nutrients.

Duration: (day/week, number of months…) Approximately 8/10 months.

Expertise/competences achieved during the research training: Students will learn the basics of plants cultivation and about the analytical methods required for the assessment of the chemical composition of root exudates. Students will also learn the extraction of nucleic acids (DNA) from soil and standard molecular techniques, as PCR. In addition, they will be introduced and trained in using multivariate statistical methods.

Possible external collaborations: none foreseen

Dr Sergio Angeli

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Topic: Applied Entomology in Horticultural Crops

Title: Study of herbivore-induced plant volatiles as a new insect control strategy for sustainable agriculture

Scientific Leader: Dr Sergio Angeli

Summary: This project will focus on agricultural crops –we work on both apple and grape– and their key pest insects, characterizing the herbivore-induced plant volatile compounds, released by plants under attach of specific pests. The ecological role of these compounds and their possible use in pest control will also be investigated. The project is in collaboration with USDA, Swedish University of Agricultural Sciences, University of Göttingen, Fondazione Mach, Hemlholtz Zentrum München.

Duration: 3-5 months, anyway the duration of the thesis will be set according to the student interest/constrains and first discussed during the thesis proposal.

Expertise/competences achieved during the research training: Students will conduct lab experiments dealing with insect infested plants, gas-chromatography/mass-spectrometry and/or proton-transfer-reaction/mass-spectrometry. Field experiments on trapping insects could also be included.

Possible external collaborations: USDA, Swedish University of Agricultural Sciences, University of Göttingen, Fondazione Mach, Hemlholtz Zentrum München.

Topic: Applied Entomology in Horticultural Crops

Title: Pest Smart Monitoring using automatic trapping devises

Scientific Leader: Dr Sergio Angeli

Summary: This project will focus on a new technology of trapping devises for pest insects, called ‘Smart Traps’, in collaboration with the two partner companies: FOS srl and SmarTeam srl. These remote-sensing traps will be tested for the first time considering pest species of the main crops of South Tyrol. The luring chemicals for each tested species will be developed by internal knowledge of our research group and in agreement with a Fondazione Mach. The student will help our research group in setting the experiments, classify the trapped insects during the string/summer 2018 and record the archived results. The project is in collaboration with FOS srl, SmarTeam srl and Fondazione Mach.

Duration: 2-3 months during spring/summer 2018

Expertise/competences achieved during the research training: Students will conduct mainly field experiments, however computational analysis, and remote image recognition may also be included.

Possible external collaborations: FOS srl, SmarTeam srl and Fondazione Mach.

Topic: Applied Entomology in Horticultural Crops

Title: Developing new yeast-based trapping lure for the exotic species Drosophila suzukii.

Scientific Leader: Dr Sergio Angeli

Summary: This project will be part of an EU-project in collaboration with Laimburg Research Center and Swedish University of Agricultural Sciences. The project focus on the development of a yeast-based trapping system to control the invasive species Drosophila suzukii as a new eco-friendly pest management strategy. The student will join a task force of three research teams and may learn one of more aspects related to the GC-MS identification of volatile compounds of the years headspace, D. suzukii electroantennography and field experiments.

Duration: 3-4 months during spring/summer 2018

Expertise/competences achieved during the research training: Students will learn about volatile compounds, odour coding, host plant volatiles, insect trapping, yeast cultures.

Possible external collaborations: Research Center and Swedish University of Agricultural Sciences

Topic: Applied Entomology in Horticultural Crops

Title: Bee pollination service and pesticides

Scientific Leader: Dr Sergio Angeli

Summary: This project focus on the impact of pesticides, particularly, neonicotinoids, on bee health and their pollination service. The student will join a regional project in collaboration with Fondazione Mach and the University of Trento, on sublethal effects of imidacloprid and thiametoxam on bee colony performance and possible disorientation.

Duration: 3-4 months during summer 2018

Expertise/competences achieved during the research training: Students will learn about pesticide residues, apiculture and modelling of population dynamic.

Possible external collaborations: University of Trento, Fondazione Mach.

Prof. Carlo Andreotti

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Topic: Viticulture

Title: Evaluation of the potential impacts of biochar application on grapevine cultivation: effects on soil-water relation, grapevine water status and N cycle.

Scientific Leader: prof. Carlo Andreotti

Summary: research activities are foreseen both in vineyard (located in the area of Meran, BZ) and under semi-controlled environment (grapevines cultivated in pots under tunnel conditions). The goal is to investigate the impacts of the use of biochar as amendment on soil and vine water status and on N cycle in grapevine. The methodology used for the experiments will be the follow: continuous measurements of volumetric soil water content, periodical analysis of leaf water potential, gas exchanges at leaf level, leaf temperature and fluorescence. As for the analysis of the N-cycle in grapevine, plants will be treated with a labelled nitrogen fertilizer. The results of the spectrometric isotopic analysis of 15N concentration in leached solutions and in the different vine’s organs (roots, trunk, branches, shoots and bunches) will describe the overall N-cycle, therefore delivering useful information to be implemented in optimized fertilization programs developed for biochar amended vineyards.

Duration: (day/week, number of months…

summer – autumn 2018 (field and lab work)

Expertises/competences achieved during the research training: monitoring of vine water status, leaf gas exchange measurements, quality characterization of grape berries, isotopic analysis.

Possible external collaborations: none foreseen

Topic: Viticulture

Title: Pre-harvest techniques to control fruit ripening in Sauvignon Blanc grapevines.

Scientific Leader: prof. Carlo Andreotti

Summary: The recent trend toward an increasing warming of the temperature is determining new ripening dynamics of grape berries that often lead to excessive sugar accumulation in fruits and alcohol development in wines. This somehow conflicts with the actual trend of wine markets that is increasingly asking for fresh, easy-to-drink, low alcohol wines. Moreover, other important quality traits of grapes and wines such as color, aroma, acidity and pH are detrimentally affected by ripening processes that occur largely during the hottest period of the season. Aim of the thesis project is the study of the effect of different canopy management approaches (such as the use of antitranspirant products, leaves removal and photosynthesis inhibitors) on the maturation dynamic, final quality and incidence of grapevine ripening disorders in Sauvignon blanc berries.

Duration: June-September 2018 (field work + lab work)

Expertise/competences achieved during the research training: canopy management techniques, leaf gas exchange measurements, quality characterization of grape berries.

Possible external collaborations: none foreseen

Topic: Fruit production

Title: Evaluation of the use of biostimulant substances to enhance growth performances and quality of fruit crops.

Scientific Leader: Prof. Carlo Andreotti

Summary: this thesis project aims at investigate the use of biostimulant products (plant extracts, algae, amino acids, organic polymers, etc.) on growth performances of fruit crops. Experiments are planned in controlled conditions and will focus on the efficacy of biostimulant products to enhance fruit quality at harvest and after storage. The study will possible involve also the evaluation of the potential efficacy of selected biostimulants as natural protection agents against different types of biotic stresses.

Duration: May-September

Expertise/competences achieved during the research training: leaf gas exchange measurements, monitoring of vegetative/reproductive growth and fruit ripening, characterization of fruit quality, HPLC analysis, measurement of pathogenic incidence and severity on fruit crop.

Possible external collaborations: none foreseen

Dr. Francesca Scandellari

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Topic: Sustainable orchard management

Title: application of a synthetic index to evaluate management sustainability of apple orchards

Scientific Leader: dr. Francesca Scandellari

Summary: It is known that some agricultural practices normally applied to commercial orchards may create environmental damages and, in the long term, decrease or impair fruit production and its quality. On the other side, several actions can be taken by the farmers to minimize their environmental impact. The aim of this thesis is to survey a selected number of orchards in Trentino-Alto Adige and to evaluate, using a synthetic index, the environmental impact of different agricultural practices. The final goal of this project is to provide scientific support to those farmers willing to improve the environmental fingerprint of their orchards.

Duration: 6-9 months including lab and field work

Expertises/competences achieved during the research training: Students will acquire knowledge on the environmental effects of agricultural practices and of the main parameters that need to be gathered to evaluate it. Most of the work will involve soil and plant biomass analysis.

Possible external collaborations: farmers and farmer coops.

Prof. Massimo Tagliavini

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Topic: Irrigation water management

Title: Assessing the effect of irrigation frequencies and volume of wetted soil on apple orchard

Scientific Leader: prof. Massimo Tagliavini/dr. Damiano Zanotelli

Summary: Irrigation is a necessary agronomic practice also in local horticultural crops to avoid detrimental effects of water shortage on fruit production and fruit quality. The goal of this research is to test two methods of precise irrigation (drip and microjet irrigation) wetting different portion of soil surface, both providing water with two frequencies in order to allow the apple trees to reach different levels of water potential. Irrigation will be guided based on the trend of soil water potential measured by tensiometers connected to the electro-valve of the irrigation system. The activity will consist on collecting the data of soil water content in the different irrigation treatments, monitor plant water potential by using a pressure chamber, measure physiological behaviour of plant via the use of a portable leaf gas exchange instrument (ADClc pro), and detect the occurrence of water stress with the use of a thermocamera or the fluorimeter (Walz). Measurement of shoot and fruit growth will also be taken throughout the growing season. Final fruit production will be compared among treatments in terms of quantity and quality.

Duration: 6-9 months including lab and field work

Expertises/competences achieved during the research training: Students will acquire expertise in sustainable irrigation management. Most of the work will involve field measurements and data analysis.

Possible external collaborations: Laimburg Research Centre and farmers.

Topic: Nitrogen fertilization

Title: Assessing the role of leaf vs. soil nitrogen application in determining the amount of absorbed and allocated nitrogen

Scientific Leader: prof. Massimo Tagliavini/Dr. Francesca Scandellari

Summary: Both dry and wet N-deposition are increasing the amount of reactive nitrogen available for plant growth, whose effects on above-and below-ground growth have not been clarified yet. Potted apple trees (~35-70 depending on tree size) will be fertilized using labelled nitrogen (15N) at three increasing N levels, either to the soil or to the leaves, in order to separate the amount of simulated N deposition absorbed by the roots or by the canopy. Activity will involve setting up the trees, preparing and distributing fertilizer solutions, monitoring plant growth, collecting and analysing the plant material at the end of the experiment to assess the amount of N allocated to different organs and the 15N derived from deposition absorbed either from the roots or from the leaves

Duration: 6-9 months including work in greenhouse and laboratory

Expertises/competences achieved during the research training: Students will acquire knowledge on the nitrogen cycle and on the problem of nitrogen deposition in a horticultural perspective where the presence of a natural source of N can modify fertilization practices. Most of the work will involve field measurements and data analsyis.

Possible external collaborations: none

Topic: Plant Water Relations

Title: Dynamics of water content of apple plant tissues during winter dormancy

Scientific Leader: Prof. Massimo Tagliavini

Summary:

Stunted or delayed growth of apple trees in early spring is frequently observed after periods of drought and/or intense cold during the period of winter dormancy. Reduced water uptake during winter in relation to transpiration losses from plant tissues might be a possible cause for this phenomenon. There are however little data available about the extent of water loss by epidermal transpiration during winter as well as about water uptake by apple trees during winter dormancy, which may occur both by root uptake of soil moisture or by direct uptake of atmospheric water deposition on above ground tree tissues.

This study aims at monitoring changes of the water content of apple shoots during winter dormancy and attempt to correlate these changes to soil water availability and prevailing environmental conditions. Tissue water content will be monitored by sampling of shoots at regular intervals and assessing water content in the laboratory. The potential role of root water uptake during winter could be investigated by cutting the trunk of some trees at soil level and comparing the water dynamics of their above ground organs with those of intact control trees. If feasible, also other methods might be implemented.

Duration: six months

Expertise/competences achieved during the research training: plant sampling techniques; determination of gravimetric water content; environmental data acquisition.

External collaborations: Research activity will be conducted in collaboration with Martin Thalheimer of the Laimburg Research Centre

**Dr. Spinelli Francesco**

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| **Topic:** Microbial ecology |
| **Title: *Pseudomonas syringae* pv. *actinidiae* sensitivity to environmental stimuli** |
| **Scientific Leader: Francesco Spinelli** |
| **Summary:** *Pseudomonas syringae* pv. *actinidiae* (Psa) is the aetiological agent of the bacterial canker of kiwifruit. In this work, several mechanisms employed by Psa to perceive environmental stimuli (such as host compatibility), to react to microbial competitors, and to coordinate its own metabolism will be investigated. |
| **Duration:** 6-12 months |
| **Expertises/competences achieved during the research training:** microbiological methods and phenotyping, biochemical determination (HPLC, GC-MS), transcriptional analysis |
| **Possible external collaborations:** Grower associations, analytical services |

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| **Topic:** Microbial ecology |
| **Title:** **Efficacy of biological control agents on *Pseudomonas syringae pv. actinidia of* kiwifruit** |
| **Scientific Leader: Francesco Spinelli** |
| **Summary**: *Pseudomonas syringae pv. actinidiae* (Psa) is the aetiological agent of the bacterial canker of kiwifruit, the most severe disease of *Actinidia* spp, which acquired a significant relevance after the heavy epidemics occurred in central-northern Italy since 2008. A selection of isolates will be assay to evaluate its efficacy against Psa. A first experiment will be conducted in greenhouse-controlled conditions, to verify its ability to survive on leaves and flowers of *Actinidia chinensis*. Subsequently, the effectiveness of the different BCAs on Psa growth inhibition, the pathogen and the beneficial microorganisms will be co-inoculated on flowers or leaves will be evaluated, along with the monitoring of disease parameters: disease incidence, disease severity, evaluated by: i) leaf spots; ii) twig wilting, iii) necrotic flowers*.* |
| **Duration:** end of april-september |
| **Expertises/competences achieved during the research training:** microbiological methods and  phenotyping, monitoring plant disease status |
| **Possible external collaborations:** Grower associations, BCA commercial developers |

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| **Topic:** Microbial ecology |
| **Title:** **Functional characterization of fruit tree-associated microbiome** |
| **Scientific Leader: Francesco Spinelli** |
| **Summary**: Plants provide a unique ecological biocoenosis for diverse communities of symbiotic microbes which often contribute with multiple benefits, such as enhanced photosynthetic efficiency, nutrient and water use and tolerance to abiotic and biotic stress. The thesis work will aim to decipher the biodiversity inside the bacterial microbiota associated with a colture of choice. Multidisciplinary approaches based on functional ecology will lead to a broad description of functionality of the microbiome which can be used for improve colture production and improve colture management. |
| **Duration:** 6-12 months |
| **Expertises/competences achieved during the research training:** microbiological methods and  phenotyping, molecular biology and transcriptional assays (PCR, QPCR), biochemical analysis. |
| **Possible external collaborations:** Grower associations, analytical services |
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**Dr. Vittuari Matteo**

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**Topic:** Food policy with particular focus on food waste

**Summary / short description:** Despite a growing attention from the academic world, civil society and policy makers, the debate on food waste is affected by a lack of a consensus over its definition and scope boundaries, the conditions that lead to its creation and the (lack of) quantification along the food supply chain. Moreover, as policies and policy proposals are emerging, there is a greater need for quantification and analysis of policy interventions.

**Possible Thesis Duration**: 6 months

**Expertise/competences achieved during the research thesis:** Food waste qualification and quantification, policy analysis and evaluation; development of comparative analysis; case study development; basics in policy design; basics of life cycle analysis (LCA) and life cycle costing (LCC) for analysis of impacts and policy scenarios. Competencies might vary depending on the chosen subject.

**Related projects**

FP7 - FUSIONS Food Use for Social Innovation by Optimising Waste Prevention Strategies

**Potential related destinations**

University of Rovira i Virgili (Spain); University of Missouri (USA); Oregon State University (USA); Tuskegee University (USA); University of Guelph (Canada); University of Wageningen (The Netherlands);

**Topic:** Behavioural economic approaches for food waste prevention, reduction and valorization

**Summary / short description**: Investigate food waste related business and consumer behavior through the development of specific case studies.

**Possible Thesis Duration**: 6 months

**Expertise/competences achieved during the research thesis:** Food waste qualification and quantification, basics of behavioural economic, case study method and development, etc.Competencies might vary depending on the chosen subject.

**Related projects**

Horizon 2020 - REFRESH Resource Efficient Food and dRink for the Entire Supply cHain

**Potential related destinations**

University of Rovira i Virgili (Spain); University of Missouri (USA); Oregon State University (USA); Tuskegee University (USA); University of Guelph (Canada); University of Wageningen (The Netherlands);

**Topic**: Food (and food waste) - energy nexus

**Summary / short description**: The energy intensity of modern food systems represents a major issue in a scenario of decreasing oil resources and increasing population and energy demand. Besides renewable energy, an increased efficiency in food systems could represent a primary energy saving strategy. In this sense, the reduction of food losses and waste (FLW) might lead to crucial consequences also on the energy balance.

Investigate the interface between food and energy:

- food losses and wastes implies a double waste of energy: both the large amount of energy used in the production and distribution phase, and the energy used for the management and the disposal of food wasted at consumption;

- food waste also causes a large share of greenhouse gas emissions;

- etc.

**Possible Thesis Duration:** 6 months

Expertise/competences achieved during the research thesis: Energy and food nexus; bioenergy from byproducts; basics of life cycle analysis (LCA) and life cycle costing (LCC) for analysis of impacts and policy scenarios. Competencies might vary depending on the chosen subject.

**Related projects**

FIRB project: Multidisciplinary and innovative methodologies for sustainable management in agricultural systems; other projects and collaborations

**Potential related destinations**

University of Rovira i Virgili (Spain); University of Missouri (USA); Oregon State University (USA); Tuskegee University (USA); University of Guelph (Canada); University of Wageningen (The Netherlands); others

**Topic**: Rural policy with particular regard on bioenergy

**Summary / short description**: Rural areas can be seen as the prime locus for ‘bioeconomy’ and bioenergy systems. So, innovation in the sphere of bioenergy (an element within the bioeconomy) takes place in local rural contexts, through different actions often involving both public and private actors.

Under what conditions local innovation systems, can better meet the needs of a sustainable rural development where social, economic and environmental goals are met simultaneously.

What are the conditions to develop sustainable bioenergy systems?

What is the impact of local bioenergy systems?

Possible Thesis Duration: 6 months

**Expertise/competences achieved during the research thesis**: Understand and analyze innovation within bioenergy systems; identify and evaluate policy interventions aimed at the development of innovation in rural areas; basics of life cycle analysis (LCA) and life cycle costing (LCC) for analysis of impacts and policy scenarios. Competencies might vary depending on the chosen subject.

**Related projects**

FIRB project: Multidisciplinary and innovative methodologies for sustainable management in agricultural systems; other projects and collaborations

**Potential related destinations**

University of Rovira i Virgili (Spain); University of Missouri (USA); Oregon State University (USA); Tuskegee University (USA); University of Guelph (Canada); others

**Prof. Francioso Ornella**

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**Topic:** Soil fertility

**Title:** Biostimulant activity evaluation of digestates from biogas plants by using a treatment with Basidiomycetes

**Scientific Leaders:** Ornella Francioso and Antonio Prodi

**Summary:** The aim of this reasearch is to investigate the biostimulant activity, in terms of auxin- and gibberellin-like, of diffent solid anaerobic digestates induced by inoculation with Basidiomycetes.The laboratory activities concern the chemical, structural and thermogravimetric analyses and the screening of fungal strains on different digestates. Identification of fungi will be performed by using PCR; whilst the biostimulant activity will be evaluated on model plants in laboratory scale.

**Duration**: eight months, anyway the duration of the project is flexible and related to the part the student decides to develop.

**Expertises/competences achieved during the research training:**

The student during the research activity will acquire knowledge on chemical, structural and mycological processes involved during the digestate treatment. Furthermore, he/she will gain practical knowledge necessary to use digestate as amendant in horticulture practices.

**Possible external collaborations:** Prof. Serenella Nardi Dipartimento Agronomia Animali Alimenti Risorse Naturali e Ambiente University of Padova, Biotec sys srl, Bologna

**Dr. Brunella Morandi**

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**Topic:** Plant Physiology

**Title:** Precision irrigation in kiwifruit: how time of irrigation during the day affects tree water relations, leaf gas exchanges, fruit growth and quality.

**Scientific Leader:** Dr Brunella Morandi

**Summary**: The aim of this research is to develop new precise irrigation protocols aimed at increasing fruit dry matter content while reducing water use in kiwifruit (Actinidia Deliciosa) orchards. To do so, the daily patterns of leaf gas exchanges, leaf, stem and fruit water potentials, fruit growth and vascular flows will be compared among irrigation protocols differing for the time of the day and the amount of water supplied. This study builds from previous encouraging results showing how species with high hydraulic conductivity like kiwifruit responds very quickly to irrigation and can take advantage of a higher water supply during the central part of the day, when the evaporative demand from the atmosphere is higher due to the high temperature and low relative humidity.

Being able to modulate the vine water status during the 24 hours by supplying water at specific times during the day and in the right quantity, may allow both to increase fruit strength as a sink thus improving the fruit capacity to attract resources and accumulate dry matter, and to save water.

The trial will be carried out in a commercial kiwifruit (cv. Hayward) orchard. Physiological measurements will be performed at 3 times during the season, in June, July and September (each time for about one week).

**Duration:** 1 week in June, July and September. Trials will be carried out during the season 2017 and 2018, but only one vegetative season is sufficient to collect enough data for a Master Thesis.

Starting in 2017 is highly advisable for students graduating in Oct.-Nov. 2018.

**Expertises/competences achieved during the research training:** Students will learn how to monitor the main physiological parameters related to tree water status and physiological performances in the field: leaf gas exchanges using a portable gas exchange analyser, leaf, stem and fruit water potentials using the Scholander pressure chamber, continuous fruit growth and fruit vascular flows, through the use of automatic fruit gauges connected to a wireless station. Also, they will learn the basis for a field experimental set-up and how to analyse, interpret and drive conclusions from scientific data.

**Possible external collaborations:** This work will be carried out in cooperation with “Consorzio per il canale Emiliano Romagnolo – CER”, the cooperative “APOFRUIT” and Centro Ricerche Produzioni Vegetali (CRPV) within the activities of an Operational Group (PSR E.R. 2014-2020).

**Prof. Maurizio Canavari**

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| **Topic 1:** Agro-food marketing |
| **Title: Cost-benefit analysis for investments in precision horticulture** |
| **Scientific Leader: Maurizio Canavari** |
| **Summary:** Before deciding to invest in a new technology, it is crucial for businesses to understand financial implications, namely cost and benefit, so that, producers will have the possibility to assess which return is foreseen for his/her investment.  This study will focus on cost-benefit analysis of investing in precision agriculture technology. The benefits and costs associated to adoption of precision agriculture technology in the years after the investment is made will be estimated and summed up. The analysis will allow to compute the Net Present Value (NPV), the Benefit Cost Ratio (BCR) and the Internal Rate of Return (IRR) and these indexes will be used to assess the investment return. The selection of the specific horticulture domain and technology will be decided together with the student. **(Italian B2 required)** |
| **Duration:** Four months are foreseen as necessary in designing the questions, collecting the data and perform the analysis. |
| **Expertise/competences achieved during the research training:** Competence in performing financial analysis of the investment. Hands-on in questionnaire design and interviewing farmers. Expand or create knowledge on spreadsheet/statistical software for data analysis. This knowledge is potentially useful for future PhD students and market research professionals. |
| **Possible external collaborations:** Interactions with experts from the department of business and colleagues from abroad collaborating in the project VAROS/PAMCoBA. |

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| **Topic 2:** Agro-food marketing |
| **Title: Consumer preference and willingness to pay for apple characteristics based on experimental auctions** |
| **Scientific Leader: Maurizio Canavari** |
| **Summary:** This study will focus on the evaluation of the most important factors affecting consumers’ willingness to pay (WTP) for Apples. Experimental Auctions (EA) and questionnaire will be applied. Since consumers tend to overrate their WTP for goods in a hypothetical context, we use EA to overcome this issue by putting subjects (consumers) in an active real market environment where real goods and real money are exchanged. A questionnaire will measure other personal features such as socio-demographic data, lifestyle and eating habits. **(Italian B2 required)** |
| **Duration:** Five months are foreseen as necessary in designing the experiments, collecting the data and doing the analysis. |
| **Expertise/competences achieved during the research training:** Hands-on in experiment and questionnaire design. Expand or create knowledge on statistical software for data analysis. This knowledge is potentially useful for future PhD students and market research professionals. |
| **Possible external collaborations:** Interactions with experts from the department of economics, contacts with VOG Alto Adige who will provide apples for the experiment. |

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| **Topic 3:** Agro-food marketing |
| **Title: Consumer willingness to pay for reduced Carbon Footprint in fruit-flavored dairy products** |
| **Scientific Leader: Maurizio Canavari** |
| **Summary:** This study will focus on eliciting consumer preferences and willingness-to-pay for environment-friendly products. The methodology to be used will be chosen between hypothetical Discrete Choice Experiments (DCEs) and non-hypothetical Experimental Auctions (EAs). Student who is interested in implementing DCEs could choose to conduct the experiments at his/her country, hence, Italian language is not mandatory. However, student who is interested in implementing EAs should conduct his/her study in Italy because it will involve the real products (sponsor by Granarolo), hence, a minimum B2 level of Italian is required. |
| **Duration:** Five months are foreseen as necessary to complete the study. |
| **Expertises/competences achieved during the research training:** Hands-on in design and application of DCEs or EA and questionnaires. Expand or create knowledge on statistical software for data analysis. These knowledges are potentially useful for future PhD students and market research professionals. |
| **Possible external collaborations:** Interactions with Granarolo. |

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| **Topic 4:** Agro-food marketing |
| **Title: Value Chain Analysis of fruit/vegetables (you name it) value chains/networks** |
| **Scientific Leader: Maurizio Canavari** |
| **Summary:** The student will choose a fresh product (fruits or vegetables) and will analyse the whole value chain of the product. Value chain analysis is a strategy tool used to analyze internal firm (or chain/network) activities. Its recognizes, which activities are the most important for the firm (or chain/network), which activities are source of cost and/or differentiation. Moreover, through value chain analysis firms consider how to improve their activities to achieve competitive advantage. **(Students might conduct the study in their country of origin or anywhere it is relevant)** |
| **Duration:** Four months are foreseen as necessary in conducting the study. |
| **Expertises/competences achieved during the research training:** By the end of the study students will improve or create knowledge regarding value chain organization and analysis. |
| **Possible external collaborations:** Interactions with experts from other departments of agricultural economics. |

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| **Topic 5:** Agro-food marketing |
| **Title: Interests in the integration of auction mechanisms in e-Commerce applications for Farmers’market** |
| **Scientific Leader: Maurizio Canavari** |
| **Summary:** This study will focus on the interests of farmers of fresh produce/fruits and consumers toward the development of E-Commerce Applications for farmers’ market in which an auction mechanism will be included. The aim is to use e-commerce facility to support farmers’ market such as in organizing the supply chain (order and delivery) and setting the prices using auction between farmers and consumers. Hence, before developing the App, it is necessary to understand whether there are interests from both farmers and consumers. The student will conduct a survey on farmers’ and consumers’ interests toward the App. The students can choose to conduct the study in their country or in Italy. In case of conducting the study in Italy, a minimum B2 level of Italian is required. |
| **Duration:** Four months are foreseen as necessary in conducting the study. |
| **Expertises/competences achieved during the research training:** Competent in performing questionnaire design and farmers’ and consumers’ surveys. Expand or create knowledge on statistical software for data analysis. This knowledge is potentially useful for future PhD students and market research professionals. |
| **Possible external collaborations:** Interactions with (potential) external partner who wants to develop an e-commerce application. |

**Prof. Antonella Samoggia**

Contacts: [antonella.samoggia@unibo.it](mailto:antonella.samoggia@unibo.it)

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| **Topic:** Horticultural Economics, Agro-food Marketing |
| **Title:** Determinants of fruit and vegetables consumption |
| **Scientific Leader:**  **Antonella Samoggia**  Assistant Professor  50, v.le G. Fanin, 40127 Bologna Italy  tel. +39 051 209 6130  fax +39 051 209 6105  [antonella.samoggia@unibo.it](mailto:antonella.samoggia@unibo.it)  Scientific area: AGR/01 Agricultural economics  <http://www.unibo.it/SitoWebDocente/default.aspx?UPN=antonella.samoggia%40unibo.it> |
| **Summary:** (500 words maximum)  The research objective is to understand consumer’s main determinants of fruit and vegetables consumption to suggest possible intervention strategies. |
| **Duration:** around6 weeks |
| **Expertises/competences achieved during the research training:**  **-** Interviewing  - Preparing survey data collection instruments  - Analysing survey data  - Liaising with food manufacturers  - Liaising with responsible at point of sale of food retailers  - Writing research report/paper |
| **Possible external collaborations:**   * Benchmark activities and cross national comparison with current and past research activities carried out by scientific leader. * Exploiting contacts of scientific leader to plan and carry out the foreseen interviews |

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| **Topic:** Horticultural Economics, Agro-food Marketing |
| **Title:** Heathy food labelling |
| **Scientific Leader:**  **Antonella Samoggia**  Assistant Professor  50, v.le G. Fanin, 40127 Bologna Italy  tel. +39 051 209 6130  fax +39 051 209 6105  [antonella.samoggia@unibo.it](mailto:antonella.samoggia@unibo.it)  Scientific area: AGR/01 Agricultural economics  <http://www.unibo.it/SitoWebDocente/default.aspx?UPN=antonella.samoggia%40unibo.it> |
| **Summary:** (500 words maximum)  The research objective is to understand consumer’s perception of heathy food labelling. In particular, given that nutrition and health claims influence consumers’ food choices, the aim is to assess the extent and nature of nutrition and health claims on the front-of-pack of ‘healthy’ and ‘less-healthy’ packaged foods. |
| **Duration:** around6 weeks |
| **Expertises/competences achieved during the research training:**  **-** Interviewing consumer  - Preparing survey data collection instruments  - Analysing survey data  - Liaising with food manufacturers  - Liaising with responsible at point of sale of food retailers  - Writing research report/paper |
| **Possible external collaborations:**   * Benchmark activities and cross national comparison with current and past research activities carried out by scientific leader. * Exploiting contacts of scientific leader to plan and carry out the foreseen interviews |

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| **Topic:** Horticultural Economics, Agro-food Marketing |
| **Title:** Health apps |
| **Scientific Leader:**  **Antonella Samoggia**  Assistant Professor  50, v.le G. Fanin, 40127 Bologna Italy  tel. +39 051 209 6130  fax +39 051 209 6105  [antonella.samoggia@unibo.it](mailto:antonella.samoggia@unibo.it)  Scientific area: AGR/01 Agricultural economics  <http://www.unibo.it/SitoWebDocente/default.aspx?UPN=antonella.samoggia%40unibo.it> |
| **Summary:** (500 words maximum)  The research objective is to evaluate health apps, so to identify how diet apps affected their users and if using apps was associated with changes in diet in particular, in increasing consumption of vegetable and fruit. |
| **Duration:** around6 weeks |
| **Expertises/competences achieved during the research training:**  - Interviewing consumer  - Preparing survey data collection instruments  - Analysing survey data  - Collecting App data and comments  - Writing research report/paper |
| **Possible external collaborations:**   * Benchmark activities and cross national comparison with current and past research activities carried out by scientific leader. * Exploiting contacts of scientific leader to plan and carry out the foreseen interviews |

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| **Topic:** Horticultural Economics, Agro-food Marketing |
| **Title:** Food chains for local agro-food economy promotion |
| **Scientific Leader:**  **Antonella Samoggia**  Assistant Professor  50, v.le G. Fanin, 40127 Bologna Italy  tel. +39 051 209 6130  fax +39 051 209 6105  [antonella.samoggia@unibo.it](mailto:antonella.samoggia@unibo.it)  Scientific area: AGR/01 Agricultural economics  <http://www.unibo.it/SitoWebDocente/default.aspx?UPN=antonella.samoggia%40unibo.it> |
| **Summary:** (500 words maximum)  The objective of the thesis is the analysis of the commercialization of local farmers’ products in local private or public food service activities, such as restaurants, retailers, schools, café, etc.. |
| **Duration:** around6-8 weeks |
| **Expertises/competences achieved during the research training:**  - Interviewing consumers and/or stakeholders  - Preparing survey data collection instruments  - Analysing survey data  - Consultation and analysis of policy programmes and regulations  - Content analysis  - Writing research report/paper |
| **Possible external collaborations:**   * Benchmark activities and cross national comparison with current and past research activities carried out by scientific leader. * Exploiting contacts of scientific leader to plan and carry out the foreseen interviews |

**Prof. Annamaria Pisi**

**Contacts: annamaria.pisi@unibo.it**

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| **Title:** Studies on population polymorfism of *Fusarium graminearum* and *F. poae*, mycotoxin producer fungi |
| **Scientific Leader:** DrAnnamaria Pisi |
| **Summary:**  The research includes the application of biological and molecular techniques for the identification of Fusarium fungi associated with Fusarium Head Blight of wheat. *F*. *graminearum* and *F*. *poae* are genotype for the production of trichothecene mycotoxins. Tests *in vitro* will be carried out, to verify the role of the mycotoxins in this disease and to study the interaction of Fusarium strains producing different mycotoxins. The strains which will be considered the most interesting will be tested in the fields to study *in vivo* the relationship between the strains. Protocols for Real Time PCR will be set up for the quantification of fungal biomass. These data will be related with the amount of mycotoxins and disease severity. |
| **Duration:** (day/week, number of months…)  4/weeks, five/six months, anyway the duration of the project is flexible and related to the part the student decides to develop. |
| **Expertises/competences achieved during the research training:** Students will learn the basics for the recognition of macroscopic fungi being studied by classical optical and electron microscopes. Furthermore they will acquire practical knowledge necessary to apply molecular techniques and skills on nucleic acid extraction, amplification, detection and cloning.  Students will learn how to set up *in vitro* and *in vivo* the pathogenicity tests. |

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