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DIPARTIMENTO
DI SCIENZE AGRARIE,
ALIMENTARI E AMBIENTALI

Department of Agriculture, Food and Environmental Sciences at the University of Perugia

October 1st - 2nd, 2025
Aula Magna – DSA3 - Borgo XX Giugno 74, Perugia

PROGRAM AND BOOK OF ABSTRACTS

Program

DAY 1	
14:15 – 14:30	**Welcome**
14:30 – 14:40	**Institutional Greetings**
Session I - Plant Disease & Pest Management 14:40 - 15:50 ***Chairpersons*** *Daniele Colombi* *Eleonore Cinti*	**Paolo Masini** – Ectoparasitoids of xylophagous insect pests: host selection, morphology and behaviour **Anna Scian** – Reduction of the use of copper-based products for controlling bacterial diseases **Lorenzo Salvatore Frisullo** – Developing a genetic map for resistance to *Xylella fastidiosa* subsp. pauca in olive tree **Alessandro Mariani** – Win the challenge against Tomato Brown Rugose Fruit Virus (ToBRFV) *(pages 4-7)*
15:50 – 16:20	*Coffee Break*
Session II - Genetics and Genomics Application 16:20 - 17:30 ***Chairpersons*** *Lorenzo Salvatore Frisullo* *Claudia Camplone*	**Aaron Anderson** – A structural genomic study of alfalfa neotetraploids **Daniele Colombi** – Sustainable beef cattle breeding: the contribution of genomic selection **Daniele Andreani** – Modulation of gene expression as a response to heat stress in cold-adapted yeasts as a model for studying the ability of eukaryotes to adapt to climate change *(pages 8-10)*
17:30	Final Remarks and Next Sessions Previews
17:40	**End of the First Day**

Program

DAY 2	
09:00 – 9:10	**Institutional Greetings**
Session III - Agro-Ecological Innovations and Climate Adaptation 9:10 - 10:20 ***Chairpersons*** *Jennifer Bertuzzi* *Chiara Poesio*	**Eleonore Cinti** – Stomatal apparatus, mesophyll architecture, and gas exchange: how plants adapted to climate change **Vito Antonio Giannuzzi** – Investigating *Halyomorpha halys* population dynamics for the development of a digital decision support system **Lucia Giordano** – Mitigating solar stress and investigating flood tolerance in grapevines: a dual pathway to climate resilience *(pages 11-13)*
Session IV - Social and Economic Aspects in Agriculture 10:20 – 11:00 ***Chairpersons*** *Stefano Cimarelli* *Simone Pelaracci*	**Veronica Rossi** – Social farming, workplace inclusion and integrated tobacco supply chain: a survey results **Arianna Tiralti** – Payments for ecosystem services in the Natura 2000 network: analysis through the value-belief-norm model **Giacomo Giulietti** – The food atlas of the south-west Orvieto internal area: a knowledge tool for local food policies *(pages 14-16)*
11:00 – 11:30	*Coffee Break*
Session V - Food Quality, Sustainability, and Valorization 11:30 - 12:30 ***Chairpersons*** *Flavio Grotto* *Michele Arcangelo Dicorato*	**Stefano Bettini** – Modulating the rumen microbiota with a *Saccharomyces cerevisiae*–based postbiotic in Chianina cattle: effects on *in vitro* digestibility, performance, rumen environment and microbiota. **Arianna Bonucci** – Oleogel enriched with phenolic extract: a novel lipid matrix for diverse food uses **Claudia Camplone** – Using a Life Cycle Assessment (LCA) approach in the integrated management of fungal diseases of common wheat **Simone Pelaracci** – Environmental assessment of crop-livestock interactions through agricultural Life Cycle Assessment and modelling *(pages 17-20)*
12:30 – 14:15	*Lunch*

Program

Poster Session 14:15 – 15:10 Short Posters Presentations ***Chairperson*** *Chiara Traini*	**I.** **Monni Vittorio** - Sustainable weed management strategies in herbaceous cropping systems **II.** **Stefano Cimarelli** - Environmental assessment of legume-based cropping systems through agricultural life cycle assessment and ecosystem services modelling **III.** **Luana Zamponi** - The role of LAGs in Local Food Policies **IV.** **Flavio Grotto** - TomatoClima: development of tomato varieties adapted to future climates **V.** **Giorgia Carboni Marri** - Vibrational cues in the host location of Bethylidae **VI.** **Akash Kalyanrao Jadhav** - Development and optimization of malt extracts for beer production **VII.** **Zulfiqar Bilal** - Integrating ecosystem services into Life Cycle Assessments for legume-based cropping systems **VIII.** **Michele Arcangelo Dicorato** - Valorization of brewing by-products as an alternative protein source **IX.** **Andrea Morettini** - Morphological, molecular and aromatic characterization of truffles in relation to their origin **X.** **Santomassimo Chiara** - Omics-driven approaches to enhance meat quality in Italian beef cattle

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15:10 - 15:50	Poster Viewing & Voting
Session VI - Water, Soil, and Environmental Protection 15:50 - 17:10 ***Chairpersons*** *Lucia Giordano* *Paolo Masini*	**Jennifer Bertuzzi** – Technologies for a sustainable management of water resources in agriculture **Chiara Traini** – Effect of high density on yield, canopy structure and Water Use Efficiency (WUE) on hazelnut (*Corylus avellana* L.) orchard **Chiara Poesio** – Soil quality and functionality in agricultural systems with different degrees of ecological intensification **Adriana Poccia** – Nature-based solutions for natural resources and environment protection *(pages 21-24)*
17:10	Award ceremony for the best poster and final remarks
17:20	**Closing ceremony**
17:30	**End of the Event**

Paolo Masini – Ectoparasitoids of xylophagous insect pests: host selection, morphology and behaviour

Our study investigated the functional morphology, taxonomy, and behavioral ecology of ectoparasitoids associated with xylophagous insects, focusing on two bethylid wasps of the genus *Sclerodermus* (*S. cereicollis* and *S. domesticus*) (Hymenoptera: Bethylidae) and the mite *Pyemotes tritici* (Acarina: Pyemotidae). These arthropods show promising potential as biological control agents against wood-boring pests but are also implicated in sting-induced dermatitis in humans, raising public health concerns. A detailed morphological and functional analysis of the antennae and ovipositor of both *Sclerodermus* species revealed specialized adaptations for host detection and parasitization. Taxonomic investigations resulted in the redescription of *S. cereicollis* and the discovery of a new Afrotropical species, *Sclerodermus annobonensis* n. sp., based on distinctive morphological traits and distribution. Behavioral assays using static, Y-tube, and open arena olfactometers were conducted to explore host location mechanisms. Both *Sclerodermus* species and *P. tritici* exhibited convergent responses to host-related cues, emphasizing the importance of indirect chemical signals in host searching and confirming their role as generalist ectoparasitoids. In addition, *P. tritici* was tested for its response to non-volatile compounds present on human skin. The mite showed significant behavioral attraction, suggesting a chemosensory basis for host recognition and offering a plausible explanation for bite-induced dermatitis in humans. Overall, these findings enhance our understanding of the sensory biology, taxonomy, and ecological roles of parasitoid arthropods associated with wood-boring insects, with key implications for improving biological control approaches and assessing public health risks.

Anna Scian – Reduction of the use of copper-based products for controlling bacterial diseases

Managing plant bacterial diseases is becoming increasingly challenging. This is due to the ecotoxicological impact of copper, which has led regulatory bodies to impose restrictions on its use. Moreover, the emergence of resistant bacterial strains has made the search for sustainable alternatives an urgent necessity. This research project investigates the antimicrobial potential of various substances, including low-copper and nanoparticle-based formulations, as well as both organic and inorganic materials. Among these, basalt flour has shown promising potential both as a biostimulant and as a protective agent. The efficacy of *Farina di Basalto® XF* (Basalti Orvieto s.r.l.) in controlling bacterial speck disease in tomato, caused by *Pseudomonas syringae* pv. tomato was evaluated both *in vitro* and *in planta*. *In planta* assays showed a significant reduction in disease severity, while *in vitro* tests and confocal microscopy revealed a potential bacteriostatic effect. Histochemical staining further demonstrated pronounced callose deposition in leaf tissues, suggesting the activation of plant defence responses. Ongoing transcriptomic analyses aim to unravel the molecular defence pathways involved. These results highlight basalt flour as a promising and environmentally friendly alternative to copper based compounds in crop protection.

Lorenzo Salvatore Frisullo – Developing a genetic map for resistance to *Xylella fastidiosa* subsp. pauca in olive tree

This research, part of the OMIBREED project, aims to develop a genetic map for the identification of markers associated with genes for resistance or tolerance against *Xylella fastidiosa* subsp. pauca (strain CoDiRO), the causative agent of the olive quick decline syndrome (OQDS) in *Olea europaea*. To this end, F1 samples from crossings between a resistant olive tree cultivar "*Leccino*" with two susceptible cultivars, "*Ogliarola Salentina*" and "*Cellina di Nardò*", were collected, for a total of 50 and 25 samples, respectively. For the genomic and epigenomic characterizations, we applied the MCSeEd (ddRAD-like) protocol. For the SNP calling, sequencing data were aligned to the *Olea europaea* var. *Leccino* reference genome and SNPs were identified with the *Freebayes* program. SNPs retrieved in each population were then filtered based on quality scores and employed for the construction of genetic maps with the MAPpoly R package. The resulting genetic maps from the two populations will then be combined and integrated into a single map using the "*Leccino*" cultivar as the common parental. Afterward, the combination of the genetic map with phenotypic data for resistance/susceptibility in the two populations will allow the identification of SNPs associated with resistance or tolerance against OQDS, thus enabling, in future breeding programs, the selection of new, more resistant, and productive olive cultivars.

Alessandro Mariani – Win the challenge against Tomato Brown Rugose Fruit Virus (ToBRFV)

Tomato (*Solanum lycopersicum* L.) is one of the most widely cultivated horticultural crops worldwide. However, the emergence of new viral pathogens, such as *Tomato Brown Rugose Fruit Virus* (ToBRFV), represents a growing threat to its production. First identified in Jordan in 2015 on the cv. Candela, ToBRFV causes mild foliar symptoms and characteristic brown, wrinkled fruits. It can infect over 40 species across four plant families, but primarily targets tomato and pepper.

ToBRFV overcomes the resistance conferred by the *Tm-1*, *Tm-2*, and *Tm-22* genes, which are effective against other tobamoviruses such as *Tobacco Mosaic Virus* (TMV) and *Tomato Mosaic Virus* (ToMV). Despite the importance of genetic resistance as a sustainable disease control strategy, few resistant or tolerant tomato cultivars are currently available.

In this study, a GWAS (genome-wide association study) was conducted on an F_2 segregating population derived from a cross between resistant and susceptible tomato lines. The analysis identified highly significant SNPs on chromosome 8 that are strongly associated with ToBRFV resistance. Based on these SNPs, CAPS (Cleaved Amplified Polymorphic Sequence) markers were developed to facilitate marker-assisted selection (MAS).

These molecular tools represent a useful resource for breeding programs aiming to introduce resistance alleles into elite tomato lines. The identification of markers tightly linked to resistance loci contributes to a more efficient selection of resistant genotypes and accelerates the development of ToBRFV-resistant commercial varieties.

Aaron Anderson – A structural genomic study of alfalfa neotetraploids

Many agronomically important crop species are polyploids. The process of polyploidization can cause a genetic bottleneck of sorts where genes and alleles present in diploid progenitors are not present in established polyploid populations. Therefore, some biodiversity for these species can only be found in diploid populations. The *Medicago sativa* complex encompasses several diploid and tetraploid subspecies able to interbreed resulting in cultivated alfalfa, an autotetraploid (2n=4x=32). Many studies on the mechanisms of polyploidization have focused on inbred allopolyploid species, so we believe focusing on an outcrossing autopolyploids species will provide unique insights. This work seeks to understand the process of polyploidization to bridge the gap between diploid and tetraploid germplasm to ease the introduction of more biodiversity into breeding programs. By comparing a unique population of neotetraploids that arose from bilateral sexual polyploidization by crossing two diploid meiotic mutants to their diploid full siblings, we sought to better understand the structural genomic changes between diploids and their polyploid siblings. Using telomere to telomere sequencing from the Pac Bio Revio system, we have constructed detailed genomes of 3 neotetraploids, 3 diploid full siblings, and the 2 diploid parents to determine regions of interest for genes and structural changes that allow for the formation of viable polyploids. This “natural polyploidization” pathway can circumvent the formation of adverse gene mutations through chemical polyploidization and may allow for prebreeding gains in diploid wild relatives to be more effectively introduced into polyploid cultivated varieties while addressing a lack of research on obligate outcrossing autopolyploid evolution.

Daniele Colombi – Sustainable beef cattle breeding: the contribution of genomic selection

Due to the fewer advantages and lower economic return, genomics and genomic selection are still less common in beef cattle compared to dairy. Nonetheless, the implementation of genomic information could result in deepened knowledge of genetic diversity, evolutionary history, genetic-dependant biological processes, alongside a faster and more accurate genomic selection compared to the traditional pedigree-based genetic selection. In this context, the five Italian beef cattle breeds Marchigiana, Chianina, Romagnola, Maremmana, and Podolica show no exception, with the first genomic indices being implemented only recently. The present project aimed to explore the benefits of genomics applied to the study, development, and selection on these breeds. The genomic diversity and population structure were investigated, as well as the genomic regions involved in determining the main production traits, with a particular focus on the myostatin gene in Marchigiana breed, where a hypertrophic phenotype is present. Finally, several single-step, single- and multi-breed, and single- and multi-trait genomic prediction scenarios were tested and validated to define eventual favourable modelling approaches to better leverage all the available data from small and local populations. Results indicated interesting insights on the common ancestry for these breeds, being genetically closely related although completely differentiated and specialized. Moreover, genomic selection was confirmed always favourable compared to the classic pedigree-based in terms of prediction accuracies, and multi-breed and multi-trait modelling approaches resulted feasible and promising approaches for genomic selection on small populations or difficult-to-select traits. This project highlighted the benefits of a genomic-based survey and selection even in these breeds.

Daniele Andreani – Modulation of gene expression as a response to heat stress in cold-adapted yeasts as a model for studying the ability of eukaryotes to adapt to climate change

The genus *Mrakia* comprises psychrophilic and psychrotolerant yeasts that play key roles in biogeochemical cycles in cold ecosystems and exhibit promising biotechnological properties. As part of a comprehensive genomic investigation of the entire *Mrakia* genus, we performed whole-genome sequencing and functional annotation, supported by RNA-seq data, to clarify the taxonomic structure, genome architecture, and metabolic potential of these extremophiles. To further explore cold-stress adaptation, we directed our focus toward *Mrakia gelida*, a strictly psychrophilic yeast, and its transcriptional response to thermal fluctuations. We selected three strains (DBVPG 5952, 10596, 10741), isolated from different Alpine and Apennine regions of Italy. Cultures were grown in liquid YPD media at optimal temperature (15 °C), exposed to cold stress (4 °C), and returned to 15 °C (recovery). RNA-seq data were quantified using quasi-reference-based mapping (Salmon). Preliminary results suggest a dynamic and reversible gene expression program. Cold exposure leads to the downregulation of genes involved in translation, mitochondrial import, and cell cycle progression, consistent with an energy-saving strategy. Conversely, genes related to metabolic rewiring, redox homeostasis, and signal transduction are upregulated to promote adaptation and survival. Recovery at 15 °C induces partial reversion to basal expression levels. This study contributes to the understanding of molecular adaptation strategies in cold-adapted eukaryotes and provides a basis for future investigations into stress-resilience mechanisms relevant to climate change scenarios.

Session III – Agro-Ecological Innovation and Climate Adaptation

Eleonore Cinti – Stomatal apparatus, mesophyll architecture, and gas exchange: how plants adapted to climate change

This project is a comparative approach that combines anatomical traits and physiological responses to investigate how variations in stomata and mesophyll contribute to plant adaptation under different environmental stresses.

The first study analysed the evolution of dumbbell-shaped stomata, found in the Poaceae family. This shape is considered more advanced and efficient than kidney-shaped stomata, as it enhances the regulation of gas exchange. Morphological analyses were conducted in the Carex and Cyperus, which possess guard cells that elongate similarly of grasses, despite notable structural differences. The research aimed to determine whether dumbbell-shaped stomata evolved once or developed independently multiple times, indicating convergent evolution.

Secondly, it was examined the effects of elevated CO_2 levels on gas exchange, stomatal density and size, and mesophyll structure in *Triticum turgidum* ssp. dicoccoides (wild) and *T. turgidum ssp*. durum (cultivated). A different behavior was observed in these two species.

Thirdly, the study analyzed the responses of different *Quercus* species to combined stressors of drought and heat. Significant species-specific differences were observed in CO_2 net assimilation and in biochemical photosynthetic capacity parameters among them. These findings highlight the diverse photosynthetic strategies and varying degrees of resilience within the genus. The study compared different mesophyll conductance models to refine species response interpretations.

The three experiments described above included a wide range of species and demonstrate that a comparative approach, ranging from evolutionary morphology to physiological responses, can elucidate the mechanisms by which plants adjust the relationship between structure and function in response to stress. One of the interesting outcomes is the demonstration of the high plasticity in the stomatal morphology and distribution compared to conservative anatomical characteristics.

Session III – Agro-Ecological Innovation and Climate Adaptation

Vito Antonio Giannuzzi – Investigating *Halyomorpha halys* population dynamics for the development of a digital decision support system

Integrated Pest Management (IPM) approaches are increasingly replacing traditional control methods. Monitoring is a key component of IPM, supported by digital agriculture tools and predictive models that enhance decision-making and promote sustainable pesticide use. The brown marmorated stink bug, *Halyomorpha halys* (Stål) (Hemiptera: Pentatomidae), is an invasive pest native to East Asia that has spread to numerous countries across Europe and the Americas. Controlling this species is particularly challenging and requires a combination of strategies. Effective monitoring systems, combined with digital tools, can improve the timing and sustainability of control measures. To support this effort, pest population monitoring was conducted in diverse agroecosystems. During 2023 and 2024, a monitoring campaign was carried out in a natural reserve to evaluate the attractiveness of different types of dispensers and lures. In 2023, another monitoring effort was conducted to collect various stink bug species across diverse agroecosystems. The relationship between species abundance and landscape features was evaluated by characterizing vegetation variability within buffer zones of varying diameter. In October 2024, a parallel campaign was conducted across three regions to capture *H. halys* and *Nezara viridula* specimens from olive orchards, soybean fields, and residential buildings. Experiments on the physiological and thermal requirements for overwintering and the onset of reproductive activity were conducted. Nutrient content before and after overwintering was also analyzed to assess the relationship between nutritional status, survival, and physiological performance. All data collected will be used to refine and improve a predictive model for *H. halys*, developed in a Python environment.

Session III – Agro-Ecological Innovation and Climate Adaptation

Lucia Giordano – Mitigating solar stress and investigating flood tolerance in grapevines: a dual pathway to climate resilience

Managing abiotic stress is critical for sustainable viticulture in the face of climate change, which presents dual threats from excessive solar radiation to extreme water events like flooding. To address heat and light stress, which elevates potentially detrimental flavonols in grape skins, a new bioprotector (NBP) containing β-carotene and α-pinene was evaluated. In 2023-2024 studies across Italy (Emilia Romagna, Umbria and Sicily) and South Australia (Adelaide) on six cultivars, NBP application at veraison significantly reduced skin flavonol accumulation. While it moderately lowered gas exchange rates, the treatment did not impact yield. It also delayed ripening, resulting in lower sugars and higher acidity, offering a promising tool to mitigate heat effects and improve wine sensory profiles.

In parallel, another trial in 2024 explored grapevine resilience to prolonged late-season flooding. A study on Montepulciano and Sangiovese revealed that submersion severely impaired photosynthesis. However, responses were cultivar-specific, with Montepulciano showing greater recovery efficiency than the more sensitive Sangiovese. Flooding also advanced veraison and led to incomplete ripening, highlighting the profound impact of waterlogging on vine physiology and phenology. This differential response is being investigated at the molecular level, an epigenomic analysis aims to identify the differentially methylated genes (DMGs) that regulate this enhanced tolerance, linking physiology directly to genetic adaptation.

These studies demonstrate the need for a comprehensive approach to climate resilience. This involves both the deployment of innovative tools like the NBP to manage solar radiation stress, and the selection of cultivars with inherent genetic tolerance to other extremes such as flooding. Integrating these strategies is essential for adapting vineyards to a changing climate and securing grape quality.

Veronica Rossi – Social Farming, workplace inclusion and integrated tobacco supply chain: a survey results

Italy is the only EU member State with specific legislation on Social Farming—Law No. 141 of August 18, 2015—that promotes social farming as a form of multifunctionality aimed at developing social, health, educational, and socio-occupational integration services. The law recognizes four types of activities, one of which concerns “socio-employment integration of workers with disabilities and disadvantaged workers, immigrants, and minors of working age included in rehabilitation and social support projects.”
In order to capture the potential interactions between Social Farming (SF) and the Tobacco Sector about the workplace inclusion of disadvantaged people, a survey was conducted involving 40 farmers from the three Italian tobacco regions (Campania, Umbria and Veneto) who contract with Philip Morris Italia (PMIT).
The questionnaire used for the survey was constructed to collect information regarding: the propensity to innovate and invest according to the principles of multifunctionality; the workforce and skills used to carry out agricultural activities; the job inclusion of fragile people through SF projects.
The results reveal the persistence of family businesses with a strong presence of paid work, especially among immigrants. Three organizational models have emerged in relation to the use of labor: in Campania, family-run farms prevail where family labor covers on average 33% of the work employed with the presence of Italian and foreign paid labor; in Umbria, family-run farms prevail where family labor covers on average 21% of the work employed and a large part of the foreign workers come from local agricultural workers' cooperatives; in Veneto, capitalist farms prevail with a prevalence of paid labor of foreign origin. In each region, a work inclusion path was found that can be traced back to the principles of SF: a permanent job placement of a person with a cognitive disability in a farm in Veneto; a fixed-term job placement of a young migrant on a Campanian farm; the activation of a traineeship in an Umbrian farm with a school-work alternation project.
The interest shown by tobacco farmers in the topic of SF stimulates us to delve deeper into this combination.

Arianna Tiralti – Payments for ecosystem services in the Natura 2000 network: analysis through the value-belief-norm model

The critical degradation of ecosystems worldwide calls for urgent action to integrate ecological and behavioral knowledge into environmental policy. Building on a systematic literature review conducted as the first step of this doctoral research, which analyzed how psychological theories of pro-environmental behavior are applied to biodiversity and habitat conservation, this study focuses on university students' support for ecosystem services (ES) and conservation tools such as Payments for Ecosystem Services (PES).

The main objective is to investigate the psychological drivers that influence pro-environmental intentions related to ES conservation among university students in Italy and Spain, applying the Value-Belief-Norm (VBN) theory. Specifically, the research aims to: (1) assess students' knowledge and perceptions of ES and PES; (2) validate the VBN model in a university context; and (3) identify key predictors of pro-environmental intentions across different socio-demographic and academic groups.

A questionnaire based on the VBN model was administered to 1,733 students from the University of Perugia and Miguel Hernández University of Elche. Constructs included values, beliefs, ecological worldview (NEP), personal norms, environmental knowledge, perceived importance of ES, and behavioral intentions. Data were analyzed using descriptive statistics, non-parametric tests, and Structural Equation Modeling (SEM).

SEM results confirmed the VBN model's validity, showing that biospheric values, NEP, knowledge, and personal norms significantly predicted pro-environmental intentions. Findings highlight the need to strengthen environmental knowledge in higher education to support ES conservation. Future research will extend the VBN approach to businesses and forest owners in Natura 2000 sites to explore opportunities for implementing PES schemes.

Giacomo Giulietti – The food atlas of the south-west Orvieto internal area: a knowledge tool for local food policies

In urban food systems research, maps are a widespread and versatile tool, used with varying levels of participation from below, particularly when the analysis is aimed at supporting public food policies.
Cartography finds application in all phases of the food system: production, distribution, retail, consumption, and waste management, and can play a central role as a tool for analyzing and interpreting territorial phenomena (Dansero et al. 2015).
In the SNAI South West Orvietano internal area, the co-design of an alternative food supply chain within the PhD project cannot ignore the knowledge and mapping of the territory where the supply chain will have its effects. For this purpose, the Food Atlas tool was chosen: a shared representation of the local food system to support food policies, integrating data collection and visualization with the active participation of local stakeholders (Dansero et al., 2015). The Food Atlas operates as an innovative methodology for participatory territorial analysis, aimed at increasing collective knowledge of the local food system and guiding the development of sustainable and inclusive food strategies.
This involves an integrated analysis of the various stages of the supply chain: production, processing, distribution, consumption, and post-consumption, and their interrelationships with the social, economic, environmental, and cultural dimensions of the territory.
In the context of the Alto Orvietano municipalities of Fabro, Ficulle, Montegabbione, Monteleone d'Orvieto, and San Venanzo, the creation of this document responds to the need for a comprehensive and scientifically based tool that allows us to understand, represent, and communicate the dynamics of the local food system.
The goal is to promote greater awareness among citizens, institutions, and economic operators, strengthen networks between local stakeholders, and provide an operational tool to guide policies and interventions toward a more sustainable, fair and resilient food system.

Stefano Bettini – Modulating the rumen microbiota with a *Saccharomyces cerevisiae*–based postbiotic in Chianina cattle: effects on *in vitro* digestibility, performance, rumen environment and microbiota.

Postbiotics are interesting tools to improve livestock performance and health; a *S. cerevisiae*–based postbiotic has been used in Chianina cattle diet to modulates rumen environment, microbiota, and animal performance. One *in vitro* batch fermentation experiment with Chianina rumen liquor and 0, 5, or 10 mL postbiotic inoculation has been used to evaluate the effects on pH, *in vitro* dry matter and NDF digestibility. Later, a first *in vivo* and a second *in vitro* studies were conducted with high forage ratio diet (5 control and treated animals, 10-12 months old) with 90 mL/day added to the concentrate of treated animals for 60 days, evaluating *in vitro* digestibility, dry matter intake (DMI), profiling volatile fatty acids (VFAs), and the rumen pH and microbiota, sequencing V3-V4 16S gene. Moreover, a second *in vivo* study was carried out with high concentrate ratio in the diet (11 control and 12 treated animals, 21-23 months old) and 1.5–2% of postbiotic added to the concentrate of treated animals for 60 days, to evaluate DMI, performance, and rumen pH, VFAs and microbiota. *In vitro*, pH at 48 h increased only at 10 mL. In first *in vivo* study, total VFAs were lower in treated cattle and significantly higher *Fibrobacteraceae* at D60. *In vivo* experiment 2 rumen microbiota α-diversity was lower in treated animals (Chao1 p=0.01). Overall, effects were context-dependent indicating diet and age stage specific responses. The reduced number of animals and general good health can have hidden postbiotic effects suggesting the need of larger trials to confirm its efficacy.

Arianna Bonucci – Oleogel enriched with phenolic extract: a novel lipid matrix for diverse food uses

Edible oils and fats are an integral part of culinary traditions, serving both as cooking ingredients and condiments. Today, food innovation focuses on health properties of food, driving demand for fats that combine technological performance, sustainability, and sensory satisfaction. Extra virgin olive oil (EVOO) is valued for its balanced fatty acid profile, sensory qualities, and high content of phenolic compounds, which support health and protect ingredients from heat-induced degradation. This study aimed to develop novel EVOO-like products, solid at room temperature, capable of replacing the texture and stability of traditionally solid fats, while preserving the sensory and health-promoting properties of EVOO and its protective role against degradation during cooking processes. The technique selected to obtain solid oil was organogelation, a promising structuring strategy that allows the conversion of liquid oils into semi-solid systems without altering their quality. Different prototypes, varying in the types of oils and organogelators used, were formulated using a mild process. A phenolic extract, derived from the olive mill wastewater, was added to all prototypes, which were then characterized. A 4-month real time shelf-life study is underway, under different storage conditions, evaluating commercial quality parameters, fatty acid composition, phenolic and aromatic profiles, antioxidant activity, and sensory properties. The stability of the added phenols is assessed across different formulations and under the tested storage conditions. The findings will provide the basis for the development of a novel, multipurpose solid fat, evaluating its performance both as a new healthy fat-based spread or as a thermal protector/flavoring agent during cooking.

Claudia Camplone – Using a Life Cycle Assessment (LCA) approach in the integrated management of fungal diseases of common wheat

Due to population growth and the increasing demand for food, agriculture has evolved in a direction that involves the use of many inputs to optimize production and meet current demand. Within this context, several public and private strategies for sustainability have been proposed, along with methods to assess them, such as Life Cycle Assessment (LCA).
This method is particularly effective in calculating the environmental impact of a production process across different impact categories. However, some elements remain difficult to account for, including the use of pesticides. For this reason, a review was conducted to explore existing models in the literature for estimating the emissions and environmental impacts of pesticides, also analyzing their spread by continent and crop type through statistical tests.
In addition, a regionalized inventory was created to support future studies not only on pesticide use but also on the broader data collection and inventory phases, which are often the most critical steps of an LCA study.
To evaluate how various elements influence this type of methodology, another study is currently in progress. It compares the environmental impact of a real farm before and after replacing its machinery fleet with smart and precision agricultural equipment, which affects both inputs and outputs of the production system. Preliminary results showed an environmental impact reduction of approximately 35%.

Simone Pelaracci – Environmental assessment of crop-livestock interactions through agricultural Life Cycle Assessment and modelling

The livestock sector significantly contributes to global greenhouse gas (GHG) emissions, with 45% arising from feed production. Improving the environmental sustainability of livestock systems requires accurately assessing crop-livestock interactions, focusing especially on soil organic carbon (SOC) sequestration as a critical mitigation strategy. This PhD research, part of the PATHWAYS project, aims to enhance the environmental assessment of these interactions by integrating advanced modelling techniques with life cycle assessment (LCA).

Initially, a systematic review harmonized existing methodologies for SOC estimation in agricultural LCAs, identifying DNDC (Denitrification-Decomposition) as the most accurate and applicable model.

The harmonization process involved a comprehensive evaluation of existing SOC estimation methods, employing a modified Delphi approach with international expert workshops. Criteria such as transparency, robustness, applicability, and accuracy were systematically assessed, resulting in the selection of the DNDC model.

Building on this, the second phase involves detailed field data analysis from experimental trials at the University of Perugia to calibrate and validate DNDC, specifically for Mediterranean agricultural conditions.

The primary objectives include identifying the most impactful elements within meat production through comprehensive crop-livestock modelling, integrating accurate SOC calculations into LCAs to refine GHG emission assessments, and addressing growing demands for emission reductions.

Ultimately, this research will yield practical insights into how agronomic management influences GHG emissions and SOC sequestration, offering scientifically grounded recommendations for sustainable agricultural practices. The outcomes will support policy-making, farm-level decision-making, and contribute significantly to climate mitigation efforts within the European livestock sector.

Jennifer Bertuzzi – Technologies for a sustainable management of water resources in agriculture

The increased frequency and severity of droughts worldwide, resulting from climate change, leads to substantial decreases in crop yields, with major implications for livelihoods and food security. The unsustainable global demand for fresh water in agriculture requires the use of sensors for monitoring, the application of modelling tools and the integration of the two to optimise irrigation management. To this end, three irrigable crops located in Umbria, Italy, were selected, i.e. olive (*Olea europea*, cv "Maurino"), maize (*Zea mays*) and tomato (*Lycopersicum esculentum* Mill.). Several variables related to local climatic conditions and soil and crop water status were monitored with ground-based sensors during the summers 2023, 2024 and 2025. In addition, both soil and plant hydraulic traits were characterised. To determine the irrigation schedule and water volumes to be provided during the 2025 summer season, each crop was managed with a specific methodology, with the goal of saving water without causing severe water stress in plants that would lead to yield reduction. Specifically, tomato was irrigated through a dynamic calibration procedure of the low-cost FDR soil moisture probes to estimate evapotranspiration; olive trees were treated through the calibration, validation and first application of the Sureau hydraulic model, using climatic data and plant and soil hydraulic parameters as input data; finally, data-driven models were trained on the basis of climatic and soil moisture data collected on maize to estimate transpiration, validated through sap flow measurements. Here we report the results in terms of water volumes and production.

Chiara Traini – Effect of high density on yield, canopy structure and water use efficiency (WUE) on hazelnut (*Corylus avellana* L.) orchard

Hazelnut (*Corylus avellana* L.) is a globally important crop whose cultivation is expanding beyond traditional regions to include areas such as South America, Australia, and South Africa. With the increasing adoption of high-density planting systems (up to 2,500 plants/ha), it is crucial to understand the effects of plant spacing on vegetative growth, yield quality, and water use efficiency—especially in the context of climate change and water scarcity.
This three-year study investigates the agronomic and physiological performance of the *Tonda Francescana*® cultivar grafted on a non-suckering rootstock under three planting densities (625, 1,250, and 2,500 plants/ha) and two irrigation regimes (1.6 and 2.4 L/h). Conducted in an experimental hazelnut orchard in Deruta, Italy, the research utilizes advanced tools such as UAV imaging, laser scanning, TreeTalker sensors, SPAD, LI-COR, and soil moisture sensors to monitor canopy volume, light interception, physiological status, and fruit characteristics.
Preliminary results from the 2024 growing season indicate that higher densities result in greater plant height but reduced canopy volume and light penetration, which may influence photosynthetic activity and overall productivity. Water use efficiency is also being analyzed to determine optimal management strategies for sustainable high-density orchards. This research provides valuable insights into the design of future orchards that balance productivity with environmental sustainability.

Chiara Poesio – Soil quality and functionality in agricultural systems with different degrees of ecological intensification

Enhancing soil health and carbon sequestration through sustainable agricultural practices requires understanding how management strategies affect soil functionality. This study evaluated the impact of three contrasting farming systems on key soil functions that support ecosystem services, including biomass production, considering both topsoil and subsoil dynamics.

A 10-year trial at the FieldLab (Papiano, PG) was investigated, where wheat–maize rotation was managed through the following systems: CONV (integrated management, no cover crops, conventional tillage), ORG (organic management, cover crops, conventional tillage), and NOTILL (integrated management, cover crops, no tillage). Soil was sampled up to 60 cm depth and analysed to investigate physical (soil aggregation), chemical (macronutrient dynamics), and biological (microbial and faunal) indicators.

Among the results obtained, the most significant observations are as follows. ORG and NOTILL promoted macroaggregates development and intense OC cycling. However, the total OC content throughout the soil depths was similar among the agricultural systems, except for NOTILL topsoil which had a higher value. In NOTILL topsoil, higher values were also recorded for total nitrogen and available phosphorus, while the latter was higher in CONV subsoil compared to the other systems. The respiration (ΣC-CO2) and microbial biomass (Cmic) data revealed larger metabolic (ΣC-CO2/Cmic) and mineralization (ΣC-CO2/labile OC) quotients in the subsoil of ORG and NOTILL compared to that of CONV. DNA was extracted from soil and sent for sequencing to determine bacterial, fungal and invertebrate populations (in progress). Overall, the OC stock of the whole soil did not change among the studied systems, suggesting that a priming effect was promoted from cover crops, without allowing the stabilization and accumulation of greater OC content.

Adriana Poccia – Nature-based solutions for natural resources and environment protection

Nature-based Solutions are innovative approaches that use ecological processes to protect natural resources, increase biodiversity, and improve environmental quality. One promising approach is the use of natural substances to manage insect pests, helping to reduce the use of synthetic pesticides and support more sustainable agriculture. In this study, field trials were carried out with multifunctional vegetated strips designed with selected plant species to increase insect biodiversity. These strips provide food and habitat for beneficial insects such as natural enemies and pollinators, improving ecosystem services related to biological pest control and crop pollination. At the same time, we tested natural substances with repellent or attractive effects on important agricultural pests. For the invasive pest *Halyomorpha halys*, natural compounds were evaluated for their repellent activity, while for the xylem-feeding vector *Philaenus spumarius*, vector of *Xylella fastidiosa*, essential oils were studied to investigate their effects on insect behaviour. The results suggest that these natural products, when carefully selected, could be applied within push–pull strategies that combine attractive and repellent elements for more targeted and sustainable pest control. The combination of different natural solutions represents a promising opportunity to develop more resilient agroecosystems and reduce the environmental impact of conventional plant protection practices.

Poster Session

P1. Vittorio Monni - Sustainable weed management strategies in herbaceous cropping systems

The European ‘Green Deal’ and ‘Farm to Fork’ strategy emphasise sustainable agriculture, including effective weed management. This PhD research aims to integrate preventive and direct weed control measures to optimise herbicide use, adopting agronomic techniques and technologies for weed detection and decision-making.

The main objective is to develop integrated weed management strategies to reduce chemical inputs in agriculture. Specific goals include optimising chemical controls, integrating control methods, studying weed-crop competition, exploring natural herbicidal substances, and analysing the effects of different light spectra on weeds.

Research activities will involve wheat, maize, quinoa, teff, tomato, coriander, and mugwort. Experimental trials will evaluate false sowing, chemical controls in various stages, mechanical tools (hoeing, finger-weeder), allelopathic extracts, and light spectrum effects. Data collection will include plant counts, biomass sampling, species recognition, weed coverage assessments (Braun-Blanquet method), phytotoxicity scoring, and yield measurements. Statistical analyses will apply ANOVA and non-linear dose-response regression models.

Results will identify sustainable strategies for weed management in herbaceous cropping systems, reducing dependence on herbicides while maintaining or improving crop yields. Additionally, potential natural herbicidal substances with allelopathic effects will be identified, and the critical period of weed-crop competition will be defined.

This research will support the transition towards sustainable agriculture by integrating mechanical, physical, biological, and chemical methods. The outcomes will benefit farmers by optimising weed management, reducing environmental impact, and aligning with European sustainability directives.

P2. Stefano Cimarelli - Environmental assessment of legume-based cropping systems and products through agricultural life cycle assessment and ecosystem services modelling

Legumes provide a wide range of ecosystem services (ES), which contribute to the sustainability of the productive system. Agricultural life cycle assessment (LCA) is a useful tool for estimating the environmental burdens of agricultural production, but ES are currently poorly integrated into LCA.

The objectives of the project are: i) identifying ES assessment methods and knowledge gaps for ES-LCA integration; ii) modelling C and N dynamics in legume-based cropping systems; iii) developing novel LCA methodology for pollinators; iv) performing an improved LCA of agricultural systems, integrating legumes ES.

A multi-step approach is proposed, consistently with the objectives presented. In the first step, a systematic review has been carried out to identify ES methods. The second step consists on the calibration of an agroecosystem model for C and N. In the third step, a novel methodology for pollinators will be developed. All the works will converge in the final step, integrating legumes ES into agricultural LCA.

During the first year we gathered methods for ES assessment, highlighting knowledge gaps and best-practices for ES-LCA integration. Our results show that several ES need to be harmonized prior to be integrated into LCA, while other ES completely lack methodologies.

This project will advance the methodology for agricultural LCA, bringing to more comprehensive assessments and to a better representation of agroecosystem interactions in the context of agricultural LCA.

P3. Luana Zamponi - The role of LAGs in local food policies

As part of the activities promoted for the LEADER Forum, a workshop was set up by the Media Valle del Tevere LAG on “The role of Local Action Groups (LAGs) in Local Food Policies (LFPs).” The workshop aims to critically analyze the role of LAGs in PLCs, with the goal of identifying strategic levers, operational tools, and action scenarios consistent with the specificities of the territorial contexts. The activity represents a preparatory phase for the creation of a Living Food Lab, an experimental space for discussion, learning, and co-design among local actors.
Through the analysis of case studies involving the direct or indirect involvement of 15 LAGs in food governance experiences, the aim is to highlight significant practices, critical issues, and potential for intervention, assessing the capacity of these actors to influence agroecological transition processes and sustainable local development. In this context, we propose the establishment of a micro-observatory dedicated to the LAGs involved, aimed at collecting, systematizing, and producing knowledge useful for understanding the local agri-food system.
The observatory will focus on analyzing the fundamental components of the system—resources, actors, relationships, policies—along the entire agri-food chain: from production to consumption to post-consumption. The approach will be multi-scalar and multidimensional, considering food not only as a material good, but also as a generator of cultural, social, and environmental values.
This knowledge and operational base will be the starting point for the shared design of a PLC, based on previous experiences or developed from scratch, with measures that can be activated immediately or planned, in response to the potential of the territories involved.

P4. Flavio Grotto - TomatoClima: development of tomato varieties adapted to future climates

Genetic improvement of tomato (*Solanum lycopersicum*) represents a key strategy to enhance both nutritional quality and resistance to emerging diseases. In this context, the main objective of this research is to alter the function of the *psy1* gene, involved in carotenoid biosynthesis, through the induction of targeted mutations using CRISPR/Cas9-based approaches. This gene interacts with several others that significantly influence its expression and function, making its regulation complex and subject to multiple variables.

The methodology combines genome editing aimed at generating transient mutations, without stable transgene integration, with phenotypic and molecular characterization of the edited lines. Specifically, the approach involves the use of a “dead” Cas9 (dCas9), giving rise to the CRISPR/dCas9 method. As a proof of concept, a traditional CRISPR/Cas9 knock-out of *psy1* will also be performed.

The expected results include the phenotypic manifestation of gene silencing. Additionally, analyses will be carried out to detect the presence of the construct, assess trait stability across subsequent generations, and verify the presence or absence of the construct in these generations.

The anticipated conclusions aim to provide new insights into the genetic regulation of the *psy1* gene, as well as to support the development of tomato varieties with distinct phenotypic traits. This may allow the circumvention of undesirable genetic effects that are often the result of traditional breeding processes.

P5. Giorgia Carbonari Marri - Vibrational cues in the host location of Bethylidae

Flat wasps of the genus *Sclerodermus* (Hymenoptera: Bethylidae) comprise at least 81 species, which are generalist idiobiont ectoparasitoids of the immature stages of various insect species including wood-boring beetles. In bethylid ectoparasitoids, visual cues play a limited role in host-location behaviour, while chemical cues are known to play a key role in host detection. In this context, the specific contribution of physical cues like vibrational signals in host-location behaviour remains poorly understood in this group.

This research aims to investigate whether vibrational cues produced by host larvae during feeding can influence host-location behaviour in two parasitoid species, *Sclerodermus domesticus* and *Sclerodermus cereicollis*. Vibrations generated by larvae of *Hylotrupes bajulus* and *Trichoferus holosericeus* (Coleopetra: Cerambycidae) were recorded using a laser Doppler vibrometer and analysed with Raven Pro software. These recordings were then used in behavioural bioassays, employing a vibrational Y-arena to assess parasitoid responses.

Two types of experiments were conducted: choice tests, measuring the residence time in different arena arms, and behavioural observations, assessing antennal drumming, leg rubbing, walking, and resting. Results showed a significant preference for arms playing back *T. holosericeus* vibrations. These results showed, also, at least in one species of *Sclerodermus*, an increase in leg rubbing and antennal drumming behaviours in response to vibrations emitted by the hosts.

These findings highlight the ecological relevance of species-specific vibrational cues in host detection by parasitoids and contribute to the broader understanding of vibrational communication in insects. The study also underscores the potential of biotremology as a tool for improving biological control strategies involving parasitoid species.

P6. Akash Kalyanrao Jadhav - Development and optimization of malt extracts for beer production

The global brewing industry is increasingly driven by innovation, sustainability, and the need for flexible production of diverse beer styles, particularly No/Low Alcohol (NOLO) beers. Malt extracts, obtained via enzymatic hydrolysis of malted barley, offer high starch conversion efficiency (90–95%), consistent quality, and reduced energy and water consumption. Their rich content of fermentable sugars, proteins, and phenolic compounds enhances brewing process control and final product quality. This research investigates the optimization of diastatic (enzyme-active) and non-diastatic (enzyme-inactive) malt extracts for use in both traditional and NOLO beer production.

Research objectives:

1. Characterization of Malt Extracts: Evaluate Diamalteria's existing extracts by simulating industrial brewing conditions, focusing on fermentability, pH, colour, and sugar composition in line with NOLO definitions.
2. Product Development: Formulate 2 non-alcoholic and 2 light beers using Diamalteria extracts and compare them with traditional and commercial alternatives.
3. Product Characterization: Analyze sensory, chemical, and physical parameters, including alcohol content, foam, flavour compounds, and turbidity.
4. Dissemination: Collaborate with Diamalteria through monthly project updates.
5. Thesis & Literature: Conduct in-depth bibliographic review and document outcomes in publications and the final thesis.

Optimized malt extract formulations are expected to improve brewing efficiency and support the development of high-quality NOLO and traditional beers with improved sustainability.

This research contributes to sustainable brewing innovation by enhancing flexibility in beer production and reducing dependency on traditional malt-based processes.

P7. Zulfiqar Bilal - Integrating ecosystem services into Life Cycle Assessments for legume-based cropping systems

Legumes play a vital role in sustainable agriculture by providing essential ecosystem services (ES) such as biological nitrogen fixation, soil health improvement, and biodiversity enhancement. However, their full sustainability potential remains undervalued in conventional Life Cycle Assessment (LCA) frameworks, which often overlook critical benefits like carbon sequestration, reduced agrochemical dependency, and long-term soil fertility. This research addresses these gaps by developing an integrated LCA-ES framework to holistically evaluate and optimize legume-based cropping systems for environmental and agronomic sustainability. The study aims to: i) integrate key ES — such as soil fertility, C/N fluxes, biological nitrogen fixation (BNF), pest and weed control — into LCA frameworks for legume-based systems; ii) Incorporate agronomic data (growth, yield) into LCA models for better environmental assessment; iii) Investigate legumes role in pest/weed control to reduce pesticide reliance; and iv) Evaluate how soil properties (organic matter, water retention) influence ES and LCA outcomes. The research employs an interdisciplinary approach, combining field experiments, soil-plant interaction analyses, and advanced LCA modeling. Data on legume performance, soil health indicators, and ecosystem service provision are integrated into a unified framework to quantify trade-offs and synergies in legume-based systems. Preliminary results highlight the significant yet underrepresented benefits of legumes in enhancing soil organic carbon, reducing nitrogen fertilizer needs, and promoting ecological resilience. The integrated LCA-ES framework demonstrates potential for more accurate sustainability assessments, revealing opportunities to optimize legume cropping for both productivity and environmental outcomes. This research offers a science-backed framework to optimize legume benefits, helping farmers and policymakers enhance productivity, sustainability, and climate goals.

P8. Michele Arcangelo Dicorato - Valorization of brewing by-products as an alternative protein source

The brewing industry produces large volumes of underutilized by-products, such as brewer's spent grain (BSG), spent yeast (BSY), and spent hops (SH). These by-products are rich in proteins and other functional compounds. BSG is generated at a rate of ~20 kg per 100 L of beer and contains 15–30% protein. BSY is produced at 2.6 kg/hL with up to 78% protein, and SH at 1.4 kg/hL with up to 70% denatured proteins. The objective of this PhD research is to develop a strategy to transform these by-products into food-grade protein-rich fractions suitable for plant-based food formulations.

The research is structured into four main activities: (1) physicochemical characterization of BSG, BSY, and SH; (2) optimization of protein extraction using green and sustainable methods (alkaline, enzymatic); (3) evaluation of functional properties (solubility, emulsifying and foaming capacity, water and oil holding), amino acid profiles and molecular distribution; (4) formulation of food prototypes integrating the extracted proteins.

Preliminary results indicate promising protein recovery rates (80%) from wet BSG using alkaline extraction. Defatting pretreatment from dry BSG using green solvent (2M-THF and CPME) result also efficient. Future expected outcomes include, valorize all brewing by-products, defining the need for pre-treatment (defatting and/or drying) and achieving high purity, efficient protein recovery (>80%), and the development of functional protein ingredients for sustainable food systems.

This project contributes to the circular economy, offering an alternative to animal-derived proteins and supporting the development of innovative, plant-based foods.

P9. Andrea Morettini - Morphological, molecular and aromatic characterization of truffles in relation to their origin

Truffles are among the most esteemed gastronomic products worldwide, yet their high market value and limited traceability make them highly susceptible to fraud and mislabeling. The occurrence of morphologically similar, lower-value species in non-European countries further threatens consumer trust and truffle biodiversity.
This research aims to establish robust parameters for discriminating truffle origin and quality, thereby contributing to biodiversity conservation and fraud prevention.
Adopting a multidisciplinary approach, the study focuses on two commercially traded European species, *Tuber aestivum* Vittad. and *Tuber magnatum* Picco, with samples from Italy, Europe and extra Europe sites.
Each truffle is evaluated for firmness, peridium integrity, gleba appearance, and maturity.
The aromatic profile is assessed by the attribution of scores to key aromatic attributes on a 1–10 scale and by more objective analyses using Solid Phase Microextraction coupled with Gas Chromatography–Mass Spectrometry (SPME-GC-MS).
Sterile gleba slices are collected for RNA sequencing, methylation profiling, and phylogenetic analysis. Metabarcoding will characterize the microbiome within the truffles and in adjacent soil, aiming to identify microbial signatures associated with geographical origin.
The integration of morphological, molecular, aromatic, and microbiome datasets, supported by advanced statistical modelling, will enable the identification of reliable markers for origin authentication. The expected outcomes will provide a validated framework for truffle quality control and certification, strengthening consumer confidence, safeguarding biodiversity, and supporting the sustainable management of this high-value resource in global markets.

P10. Chiara Santomassimo - Omics-driven approaches to enhance meat quality in Italian beef cattle

Improving meat quality in Italian beef breeds through the integration of omics technologies and phenotypic evaluations represents a key challenge for the beef industry. This PhD project, co-funded by Consorzio Produttori Carne Bovina Pregiata delle Razze Italiane (CCBI), aims to develop innovative selection tools by combining classical and molecular approaches. The project is structured into four main phases.

First, we decide to start with a market analysis targeting both carcass sectioning operators and consumers, to understand their preferences and identify key attributes influencing meat and carcass selection.

Then we moved the focus on the Marchigiana breed and involves a collaboration with a farm located in the Marche region. Indeed, the hair samples are collected from young bulls to determine the genotype at the *MSTN* locus and to select five normal and five heterozygous animals for sampling and performing meat-quality analysis. Different approach is used for Chianina breed, for which 50 bulls are randomly selected and sampled at 24h after slaughtering time for performing meat-quality analysis. According to the meat data, 10 animals are selected for further analysis: the fattest 5 animals *vs* the leanest 5 ones.

These selected animals for both Chianina and Marchigiana undergo the omics analysis including transcriptomic and proteomic investigations, to explore the biological effects of myostatin variants on meat quality regarding the Marchigiana breed, and to highlight the pathways involved in the fat deposition and muscle composition in Chianina breed.

Finally, the integration of omics and phenotypic data (carcass features and meat quality analysis) aims to identify biomarkers linked to premium meat quality traits. These findings will support the development of genomic selection tools and the implementation of genetic indices for meat quality improvement, with direct application in breeding programmes for Italian beef cattle.

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