AISSA

#UNDER 40 BOOK OF ABSTRACT

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S1 OP1

ECOSYSTEM SERVICES RELATED TO THE PRESENCE OF WILD BOAR IN AGROECOSYSTEMS AND THEIR SOCIO-ECONOMIC IMPACT

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The "Millennium Ecosystem Assessment" project (MEA, 2005) introduces "Ecosystem Services" definition.
An ecosystem is able to provide biodiversity with "direct" and "indirect" benefits (Provisioning; Regulating; Cultural; Habitat-Biodiversity) which, unlike agri-food products, is not easy to transform in monetary value. The correct functioning of an agro-ecosystem depends on the balance stablished between natural communities and human activities. The problems related to the conflict between wild boar and man were investigated (2019-2022). Biodiversity was identifiedn in an area of 113,118 hectares of Avellino's province characterized by hazelnut, chestnut crops, wood, pasture. After estimating the number of wild boars, the disservices associated with them were quantified (damage to agriculture, road accidents) and, subsequently, the services were highlighted (specific hunting, food production, tourism industries). The present work consists in attempting to attribute a monetary value to Ecosystem Services. Results show the disservices: damage to agriculture (€591,450) and road accidents (€25,000). Viceversa, the services attributable to the wild boar are quantified in Provisioning (€242,316) and Cultural (€280,560). Among the Habitat-Biodiversity services we have identified: 1) the superficial plowing of the land by pigs through rooting (€18.00,00); 2) the increase in the vegetation capacity (€103,500); 3) the increase in the prolificacy of worms and earthworms (€18,000); 4) the sharing of the territory with the other animal species to which it indirectly or directly supplies food. The total value attributed to the various species is €26,165. The number of subjects for each species in 100 hectares was obtained by camera traps. Finally, the difference between disservices (€616,450) and services (€688,541) seems to favor Ecosystem Services for €72,091. It is clear that this estimate requires specific multidisciplinary investigations to demonstrate the hypothesis that no animal species is only the cause of disservices but that it is necessary to evaluate the role which plays within inside his habitat.

S1 OP2

MACHINE LEARNING ALGORITHMS FOR THE TIMBER-LEAF COMPONENTS DISCRIMINATION USING TERRESTRIAL LASER SCANNING

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Terrestrial Laser Scanning (TLS) systems allows to characterize the tree architecture at a high resolution. An automated approach for separating the leaf from timber components of standing trees using TLS points is crucial for accurately estimating the above-ground biomass, carbon stock, and vegetational indices (i.e., Leaf Area Index). This research tested the potential of six machine learning algorithms (i.e., Random Forests) for discriminating timber-leaf components using TLS points in eight tree species. We assume that an appropriate choice of machine learning algorithm promotes efficient discrimination of components in terms of accuracy and time-saving. The best and worst algorithms for the timber-leaf discrimination were the stacked ensemble model (overall accuracy 'OA' = 0.90 ± 0.05) and Naïve Bayes (OA = 0.87 ± 0.05), respectively. The best two timber-leaf separation accuracies were obtained in Italian maple and hazel (OA = ~0.94) tree species. In contrast, the worst timber-leaf performance accuracies were obtained in hornbeam and turkey oak (OA < 0.84), respectively. The bark and leave (i.e., smooth bark, bark with fissures) feature has strongly influenced the accuracy of TLS point characterization, making the timber-leaf discrimination very challenging. We expect our approach to be a starting point for accurately assessment of leaf and timber components supporting sustainable forest management and timber supply chains.

S1 OP3

TRACING A HIGH-QUALITY YELLOW TOMATO LANDRACE THROUGH A MULTITRAIT APPROACH

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In the last few years considerable interest is growing for high food quality, both for organoleptic and nutritional aspects. As for tomatoes, the yellow fruit varieties are conquering the consumer markets in many Mediterranean countries. Among the great variability of yellow tomatoes, one landrace of "Pomodorino giallo del Vesuvio", named GiaGiù (E40), differs from the traditional "Pomodorino del Piennolo" for the fruit colour and stands out for its quality traits, such as high glutamic acid, pectin content and titratable acidity of fruit, thus increasing its demand for both fresh consumption and cooking purposes. The aim of this work was to phenotypically and genotypically distinguish the GiaGiù landrace through morphological descriptors and molecular markers, in order to provide an effective tool to authenticate and trace this product along its supply chain from the "field to fork". Morphological characterization evidenced that the distinctive traits of GiaGiù landrace were the potato leaf morphology and the pyriform shape with a pointed apex of the yellow fruits. The genotypic distinction of E40 was performed by using two Cleaved Amplified Polymorphic Sequence (CAPS) markers designed on a Single Nucleotide Polymorphism (SNP) of the Phytoene synthase 1 (psy1) gene that confers the yellow colour to tomato fruit and already known as specific of GiaGiù genotype. Additional CAPS markers were designed on two private mutations of E40 genes derived from data retrieved from a Genotyping-By-Sequencing (GBS) dataset, already available. These findings were confirmed by comparing E40 private mutations with the 360 accessions of the BGI tomato 360 genomes resequencing project. The designed markers allowed to distinguish GiaGiù genotype in all fresh and processed fruit tomato matrices, thus representing a molecular tool able to prevent food fraud and authenticate GiaGiù products, enhancing this local tomato market and preserving Campania agro-biodiversity.

S1 OP4

DEFICIT IRRIGATION, AN OPTION FOR SOYBEAN IRRIGATION IN NORTH ITALY?

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The deficit irrigation is a practice of deliberately irrigation water volume reduction compared with the required volume needed to meet the crop's maximum evapotranspiration. An experiment was conducted on soybean to determine whether deficit irrigation could be an effectively applicable practice to reduce the irrigation volume in this crop. The study was conducted from May to October 2022 in Veneto region (Italy) in open field condition. Four plots (40 m x 40 m) was implemented to compare two different irrigation regimes: complete restoration of crop water requirements (100% CWR) and regulated deficit irrigation (70% CWR during the entire cycle with restoration to 100% CWR during flowering). The same cultivation practices were carried out for all plots and the same irrigation system was used (micro-irrigation), which was managed through continuous monitoring of the soil water balance using capacitive probes and tensiometers. The cumulative water volume received by soybean (irrigation + rain) was 463 mm (70% CWR) and 518 mm (100% CWR). The two different irrigation regimes did not significantly affect grain yield (3,78 t ha^{-1} for 70% CWR and 3,98 t ha^{-1} for 100% CWR). However, the grain protein content was significantly higher (+3.1%) in the 100% CWR treatment than 70% CWR (41.8%). Although the obtained results need to be confirmed in the next growing seasons, they suggest that the proposed deficit irrigation management for soybean is able to save water without negative impact on grain yield while safeguarding farmers' income and increasing sustainability.

S1 OP5

ENERGY PERFORMANCE EVALUATION OF ELECTRIFIED IMPLEMENTS

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The reduction of the environmental impact due to agricultural practices is a key challenge for the agricultural sector. This process involves the reduction both of greenhouse gases emission and the use of chemicals for crop protection and fertilization. In the last two decades, many manufacturers have focused their research activity on tractors and agricultural machinery electrification. The replacement of mechanical and hydraulic components with electric actuators can support many benefits in terms of energy saving, more effective implements control, as well as improved safety and comfort in implement connection thanks to the elimination of the cardan shaft in Power Take Off (PTO) driven machines.
Despite the number of prototypes of electric agricultural machines that have been developed, only a few of them are available on the market. The main obstacle to the diffusion of electrification in agriculture is the need for high-power electric energy to supply implements that conventional tractors cannot provide. External PTO-driven electric generators connected to a tractor, or installed on implements, represent a viable solution waiting for electrified tractors to become available on the market.
This work is focused on the energy performance evaluation of two different full electric implements, developed within the "MArcEL" research project, which are a four-rotor tedder and a vine leaf stripper, compared with their conventional counterparts in the same operating conditions. The implements were supplied by external PTO-driven generators hooked to a tractor. Specifically, the tedder was connected to a 700 V generator (50 kW), considering its high-power requirement, while a 48 V generator (10 kW) was adopted for the leaf stripper. In both cases, full electric implements have shown a reduction in PTO power abortion respect to the conventional ones. The percentage energy saving of the leaf stripper was greater than the tedder one since the conventional stripper was hydraulically driven (5 kW was required only for oil circulation).

S1 OP6

THE CONCEPT OF RESILIENCE IN THE ECOLOGICAL TRANSITION OF RURAL AREAS: NEW DIMENSIONS AND MEASURES

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The vagueness with which the concept of resilience is still addressed in the literature and the need to have clearer ideas on how it can be defined and measured, given its possible fruitful implications for European policies, led us to undertake a Systematic Literature Review. The research question we asked is as follows: How is the resilience of rural areas identified and measured in the context of the EU agricultural policy?
The electronic databases surveyed were Scopus and Web of Sciences. Using as search query ("resilience" AND "rural development" AND "european policy") and after screening title and abstract and applying the eligibility criteria (timeline period, language restriction, relevancy to the research question, etc), 25 articles were included in the study.
From a semantic analysis of the text of the works included in the systematic review, it has been possible to identify the object of resilience and the factors that can affect resilience.
This process has allowed to define three clusters: resilience as farm characteristic, resilience of rural area and resilience as community.
Some of the characteristics that turn out to influence the resilience are: robustness, adaptability, transformability, cooperation and crop diversification (for the first cluster); increasing economic competitiveness, manage the relationship between resilience and vulnerability, having the capacity of a region to generate new growth trajectories (for the second cluster); community leadership is visionary, community has a community economic development plan, citizens are involved in community vision and goals (for the third cluster).
Among other conclusions extrapolated from the analyzed literature there are: an increasingly dynamic vision of the concept of resilience - aspect that has been confirmed also from external literature to that validated for the systematic review - and the existence of a relationship between resilience and sustainability and between resilience and vulnerability.

S1 OP7

ASSESSING THE POTENTIAL WATER SAVINGS OF OPTIMIZED SURFACE IRRIGATION MANAGEMENT IN PADANA PLAIN

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The impact of climate change on water availability affects the effectiveness of surface irrigation, which is a widely used method of applying water to row crops. To promote water savings at the farm scale, a shift towards flexible irrigation scheduling and better design and management of irrigation practices is necessary. This study examines the benefits of adopting flexible irrigation scheduling, optimizing irrigation management variables, and field layout to increase the efficiency of border irrigation, leading to water savings and improved crop production. The analysis was conducted on two maize fields in the Padana Plain over two years with different rainfall patterns. The AquaCrop-OS agro-hydrological model combined with continuous monitoring of soil moisture status was used to manage flexible irrigation scheduling, and WinSRFR 5.1 USDA software was used to optimize irrigation management and field geometries. The results show that significant water savings can be achieved with flexible irrigation scheduling and proper irrigation management and field layout. In a dry agricultural season, seasonal water savings of about 10% were obtained just by scheduling irrigation based on actual crop water needs, while water savings reached up to 60% in a wetter season. On average, an additional 7% of water savings was achieved over the agricultural season when the irrigation duration was correctly applied to each border of the experimental plots, while approximately 20% of water was saved when the border width was designed based on inflow availability. These findings provide useful information for improving the management of border irrigation in practice, both under current conditions and in the face of increasing freshwater scarcity in the future.

S1 OP8

STUDY OF THE PHYSIOLOGICAL AND BIOCHEMICAL RESPONSES OF TWO ORNAMENTAL SPECIES UNDER DROUGHT AND REWATERING COMBINED WITH THE ONLINE MONITORING OF LEAF WATER CONTENT: NEW PERSPECTIVES FOR NURSERIES CULTIVATION

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Nursery management requires large amounts of water to maintain high quality production and its use often exceeds the actual needs of plants. This study investigates the physiological and biochemical responses of two woody ornamentals, Photinia × fraseri and Viburnum tinus, to water deficit and rewatering, and to monitoring water content through a leaf sensor (leaf water meter, LWM). Four three-year-old potted plants of both species were subjected to progressive severe water stress (WS), followed by a rewatering treatment, while four plants were well-watered as control (WW). Some leaves were clamped with the LWM and the water treatments were continuously monitored by recording the leaf dehydration level (DL). Moreover, biochemical, and physiological parameters such as water relations (relative water content [RWC] and water potential [Ψw]), gas exchange, maximum photochemical efficiencies of PSII (Fv/Fm), epidermal flavonoids (Flai) and chlorophyll index (ChLi) were measured. In WS plants, the DL progressively increased during water stress and gradually decreased after re-watering. These changes in leaf water status were confirmed by Ψw and RWC measurements. Despite a strong decrease in stomatal conductance and photosynthesis, WS plants showed no photoinhibition, except for V. tinus at severe stress. After re-watering, a recovery of gas exchange and water relations were observed for both species and no degradation of chlorophyll was observed during the experiment whereas the imposed stress triggered an increase in Flai at severe stress in the WS plants of both species. In conclusion, regulating stomatal conductance and accumulating antioxidant flavonoids enabled both species to withstand drought without permanent leaf damage and recover their physiological functions after re-watering. Finally, LWM is confirmed as a promising technology that can contribute to optimize irrigation scheduling in the nursery sector for maintaining the optimal watering level without affecting plant aesthetic quality.

S2 OP1

THE IMPACT ON CLIMATE CHANGE OF DIGITALIZATION AND DEMATERIALIZATION: THE CASE STUDY OF FORESTRY ADMINISTRATIVE PROCEDURES

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The aim of this study is to determine the Carbon Footprint (CF) of administrative procedures concerning forest managements. Questionnaires and interviewers were submitted to forestry consultants and regional forestry offices. Three different forest administration systems have been defined. The first concerns forest administrative procedures with low level of digitalization, the second the procedures with intermediate level of digitalization and the last scenario with a total dematerialization and full digitalization of the administrative proceedings. Within the forestry administrative procedures, three main phases have been determined: a first phase for acquiring the necessary permits for forest management, the second one is the operational phase in the forest and finally the phase for monitoring the forestry utilization once they are finished. The carbon footprint is estimated in accordance with ISO 14067 standards, with the functional unit of the study determined in the forestry administrative process and the system boundaries identified as cradle to grave, from the commissioning of the forestry professional to the release of disclaimer document.. The total carbon dioxide emissions for a single forestry administrative procedure are 102.29 kg of CO_2 for the administrative procedure with low digitalization, 51.25 kg of CO_2 for the administrative procedure with intermediate digitalization and 14.26 kgCO_2 for the advanced digitalization scenario. The study shows that the reduction in emissions is directly proportional to the advancement of digitalization and dematerialization in forestry administrative procedures, with a percentage decrease in CO_2 emissions of 49.90% when moving from a system with low digitalization to one with intermediate digitalization, a further reduction of 72.18% when passing from intermediate to advanced digitalization, and an overall diminution of 86.06% of carbon dioxide emissions when is considering the scenarios with low digitalization and the one with full digitalization and dematerialization.

S2 OP2

BIOCHAR ENRICHED WITH MICRORGANISM CAN IMPROVE THE PRODUCTION OF TOMATO SEEDLINGS UNDER REDUCED IRRIGATION REGIME

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The managment of irrigation water has become crucial in agriculture as climate change is increasing the risk of drought events and decreasing soil water availability. Tomato is the second most important vegetable crop next to potato, with a global economic significance in many diets worldwide. Nowdays, a key factor for high yielding tomato crops is the production of seedlings, a nursery phase with high water consumption.
Biochar, a fertiliser rich in inorganic carbon and obtained via pyrolysis of woody biomass, can be used to modify growth substrates and to improve the water holding capacity of peat while reducing the water lost for evaporation. Furthermore, the pourous structure of biochar has been proposed as a habitat for soil microorganisms.
In this contest, the objective of this study was to investigate the use of biochar in the production of tomato seedlings under reduced irrigation. At sowing, biochar (either pure or enriched with Ensifer sp. bacteria), was mixed with peat at several concetrations (0, 2, 5, 10, 20 annd 33%). Three weeks after sowing, two irrigation regimes (full and reduced) were applied for the next 15 days. The results showed that the use of biochar at high concentrations (33%) was phytotoxic and prevented seed germination. Interestingly, the peat enriched with 5% of biochar, both with or without microrganisms, and the peat enriched at 2% of biochar with microrganisms, increased the dry biomass of seedlings (+17% in comparison with the untreated control) and the water use efficency (+ 11–19 % in comparison to the untreated control). Furthermore, the seedlings grown in 5% and 2% biochar enriched with Ensifer sp. showed less drought stress damages. Therefore, we propose here that the use of biochar at low percentages (2-5%) enriched with microrganisms can represent a good solution to reduce water consuption in tomato seedling production.

S2 OP3

SYNERGIC EFFECT OF BIODEGRADABLE MULCHING AND IRRIGATION STRATEGIES FOR IMPROVING WATER PRODUCTIVITY AND FRUIT YIELD OF PROCESSING TOMATO CROP

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Processing tomato (*Solanum lycopersicum* L.) is a high water-demanding crop and recent shifts in climate patterns (e.g., increase of mean temperature) are severely impacting the sustainability of this crop (Cammarano et al., 2022). The objective of this study was to assess the synergic effect of biodegradable mulching film (BMF) and regulated deficit irrigation (RDI) on processing tomato water productivity and fruit yield. The study was carried out in Southern Italy (Marigliano) in 2022 on H1534 tomato hybrid. It compared the ordinary drip irrigation (ORD, restoring 100% ETc) with two RDI strategies, applied after 950 growing degree days: (1) RDI-1, supplying 50% ETc; and (2) RDI-2, as RDI-1 combined with a BMF. Each treatment had three replicates and all data were analyzed by ANOVA test. Overall, RDI strategies ensured a 31.6% irrigation water saving (4621 m^3 ha^{-1}) with respect to ORD (6754 m^3 ha^{-1}), resulting in a shift of dry biomass partitioning from leaves (-26.3%) to fruits (+48.8%), and in an improvement of important fruit quality traits (titratable acidity, +14.0%; soluble solids content +9.5%; dry matter content +12.4%). However, RDI reduced the histidine content (-58.8%), an essential amino acid for plant growth and development. RDI-2 strategy guaranteed a higher root (+25.1%) and shoot (+22.2%) biomass, a better fruit setting (+9.4% number of fruits per plant) and a lower plant stress than RDI-1, as reduced secondary metabolism (+42.7% phenylalanine) and flavonols leaf content (-13.6%) were observed. Furthermore, RDI-2 strategy improved total yield (+32.2%), water productivity (+85.4%) and Brix Yield (+39.5%) if compared to ORD, also maintaining a comparable lycopene content. These results highlighted the crucial role of BMF in the mitigation of drought stress induced by a RDI strategy, ensuring high yield and reducing crop water consumption and, in turn, increasing the environmental sustainability of processing tomato production under Mediterranean area conditions.

S2 OP4

COMPARISON OF TRAINING SYSTEMS AND IRRIGATION TREATMENTS FOR *ARBUTUS UNEDO* L. FRUIT FARMING. RESULTS OF A THREE-YEAR FIELD TRIAL

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Arbutus unedo L., a Mediterranean evergreen shrub, produces fruits with good nutritional and nutraceutical properties. Integration of A. unedo cultivation in marginal areas would allow the diversification of the production and bring economical return for local farmers. The aim of this study was to select the best training system and irrigation treatment for the cultivation of A. unedo as a fruit crop and to increase fruit productivity and quality. A three-year field trial (from 2020 to 2022) was conducted on an orchard located in southern Tuscany. Six-year-old plants were cultivated using single-stemmed (SS) and multi-stemmed (MS)systems and were subjected to full and deficit irrigation (FI and DI). A total of 24 plants (6 per treatment combination) were seasonally monitored performing physiological measurements (gas exchange, water relations, and chlorophyll fluorescence). In fall 2022, fruit yield and sensory evaluation were also assessed. Results showed that the DI treatment did not substantially compromise plant physiological status during the whole experimental period, thus highlighting the capacity of A. unedo plants to withstand water stress conditions in the field. Regarding the training methods, SS plants showed better physiological performances and water status than MS plants over the entire study. Despite the larger size of fruits produced by MS plants, fruit yield was higher in SS than in MS plants in both FI and DI plants. Furthermore, fruits produced by FI plants (both SS and MS) were the most appreciated in terms of color, juiciness and aroma. In conclusion, the single-stemmed training system and the full irrigation treatment were the most promising methodsfor the A. unedo fruit crop cultivation, as they resulted in greater fruit yield and sensory profile.

S2 OP5

VINEYARD MANAGEMENT TO IMPROVE SEASONAL CARBON SEQUESTRATION

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Agro-ecosystems play a crucial role on production of carbon dioxide, contributing with 31% of global anthropogenic emissions. In accordance with European environmental and agricultural policies, improve carbon sequestration and storage is a key strategy to mitigate climate change. Vitis vinifera L., one of the most intensively farmed species in the world, can provide multiple ecosystem services if properly managed.

This study aims to identify canopy and soil practices to improve seasonal carbon storage in grapevine organs (bunches, leaves, shoots). Tested vineyard, planted with Chardonnay cv, is located in central Italy (Umbria region), a sensitive area to climate changes. Three practices were performed during two consecutive seasons (2021 and 2022): (i) early leaf removal (ELR) at full flowering (BBCH-065), (ii) organo-mineral fertilization (OMF) done with two treatments per year (in spring and autumn), (iii) use of a foliar corroborant based on Basalt Flour® (FB) applied at 3% volume 3-4 times per year; additionally, an ordinary management according to farm protocols (C). Microclimate parameters were monitored using a network of multiple ground sensors (temperature/humidity of canopy and soil) and a standard weather station. Representative vines samples were collected to quantify fresh and dry weights and analyze carbon and nitrogen storage. Results showed as in both semi-arid seasons, ELR was able to modulate leaf demography, lateral shoot emission and enhance storage of CO2 in vegetative organs (4.74 CO2eq). Similar results were provided by OMF (3.60 CO2eq). FB showed greater carbon sequestration in bunch (4.53 CO2eq) due to greater crop load and bunches weight.

Also, it was able to protect the plant from extreme events. Taken together results exhibited as management practices could modulate the carbon sink function of grapevines and highlight as, also under abiotic limited conditions, the choice of sustainable practices improve ecological services of viticultural systems while preserving berry quality.

S2 OP6

COMPARISON OF DIFFERENT NH3 MITIGATION STRATEGIES DURING STORAGE OF BUFFALO DIGESTATE

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Ammonia mitigation strategies have been gaining interest since ammonia is responsible for environmental pollution. Ammonia emission is a consequence of intensive animal farming and slurry storage. To overcome this issue, the cover of manure storage tank is considered as a possible solution. This work investigates the application of natural and permeable covers to mitigate ammonia emission during the digestate storage.
Specifically, the interaction of the covers with the buffalo digestate was assessed, in terms of ammonia emission rates and covers behaviour. The tested covers were straw (S), clay LECA (L), biochar (B) and natural crust (C) and for each of them a layer of 2 cm was used. The whole trial took place under laboratory condition in controlled environment with the temperature set at 20 °C. Ammonia emissions were monitored using the dynamic chamber technique. The results show that the interaction between the digestate and the covers depends on covers characteristics and influenced the emission rate. In particular, on the first day of measurement was registered the biggest ammonia emission difference among the covers, namely, 4.85, 0, 7.8, 3.3 mg NH3/m2h for L, B, C and S, respectively. Afterward, all the emission rates started to decrease, except for B that started to emit circa 0.3mg NH3/m2h. At the beginning C showed higher emissions compared to the other treatments since it didn't show any crust formation yet. From the 6th day, L although covered stared to emit more than C. This result is due to the start of the natural crust formation that act as physical barrier. On the other hand, L proved to be less effective in reducing NH3 emission, since it was constituted by one single pebble layers half immersed in the digestate. B was the most effective treatment showing also the best floating attitude.

S2 OP7

ASSESSING FOOD-FEED COMPETITION AND CLIMATE CHANGE IMPACT IN DAIRY FARMS

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Public opinion attack frequently livestock sector for hypothetical negative impact on the environment, animal welfare, and human health but the demand for animal products is increasing worldwide, it is therefore crucial to identify the animal product contribution to the food supply chain. This study evaluates the competition between animal and human diets analysing dairy farms' efficiency in producing food. Two indices were calculated: Land Use Ratio (LUR) and Human-edible Feed Conversion Efficiency (heFCE) and, in addition, GWP per kg of FPCM for 10 dairy cattle farms in Northern Italy, with a representative size and farm management of intensive dairy system. The indices (heFCE energy, heFCE protein, LUR) were correlated with each other and with GWP per kg of FPCM. The heFCE protein index was found to be particularly related to GWP (R^2=0.88). The innovation of the study was applying LUR at farm level that identified high variability among individual farms (1.54±1.22) and inversely correlation with herd size (R^2=0.78), milk production (R^2=0.86), land availability (R^2=0.72), and use of by-products (R^2=0.51). The study showed that dairy farms can be net producers of protein and important strategies for sustainability (in terms of human-animal competition and environmental impact) may be: increasing milk production, increasing herd size and using by-products in animal rations. Further studies are needed to include in the evaluation amino acid profiles in plant-based and animal-based products.
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S2 OP8

EVALUATE PATTERNS OF METHANE EMISSIONS IN RUMINANTS WITHOUT INTERFERING WITH ANIMAL BEHAVIOUR

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In cattle dairy systems, the enteric methane emission represents about the half of total emissions as CO_2-eq. In the next years, novel strategies are necessary to reduce the environmental impacts of livestock due to the increase of demand of dairy products, and further smart techniques are necessary to quantify the effectiveness of enteric methane mitigation strategies.
Several methods are available to estimate enteric methane emission such as: (i) respiration chamber, (ii) GreenFeed, and (iii) sulphur hexafluoride (SF_6). The Laser Methane Detector (LMD) is a hand-held device, with low purchasing and operating costs, which does not interfere with animals' routine and behaviour. It has been initially developed to detect gas leaks in the industry sector. More recently, it has been utilized by researchers to measure the methane emissions from ruminants.
On February 2023, at CiRAA Research Centre (Pisa), an experiment was carried out to test the ability of LMD to measure methane emissions in dairy cattle. Methane emitted from respiration and eructation of four late-lactating cows was measured at 0.1s interval. The duration of the measurement period was five minutes, and it was repeated eight times with an interval of one hour on each cow. The first measurement period was carried out two hours after the morning feeding and the last one before the afternoon milking. The measurements were repeated three times on three consecutive days. A meteorological station was used to record data about: air temperature and relative humidity, and black globe temperature.
The average daily methane emissions varied among cows from 165253 ± 48567 to 232168 ± 36910 (ppm*m CH_4, mean ± st. dev.). Preliminary results show that LMD can identify low- and high-emitter animals and that an accurate measurement of microclimatic conditions is required, due to their effect on LMD measures.

S3 OP1

EVALUATION OF THE BIOSTIMULATORY EFFECT OF A PROTEIN HYDROLYZATE OF VEGETABLE ORIGIN AND ITS FRACTIONS AT DIFFERENT MOLECULAR WEIGHTS APPLIED ON LETTUCE GROWN UNDER ABIOTIC STRESS

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Protein hydrolysate (PH) biostimulants are environmentally friendly options for the reduction of nitrogen input, but their plant growth-promoting mechanisms are still not completely unveiled. To evaluate the most active peptide fraction of a protein hydrolyzate under conditions of nitrogen deficiency, a greenhouse experiment was performed using lettuce (*Lactuca sativa* L.) as a model crop, irrigated with a nutrient solution containing a low level of NO3 (1 mM) compared with an optimal level (8 mM) and treated separately with the whole product Vegamin®: PH, or with one of the three fractions with different molecular weight (fraction PH1 (>10 kDa), PH2 (1–10 kDa) and PH3 (<10 kDa)). PH1 and PH3 significantly increased fresh yield (+8%) under optimal conditions, but not under low NO3 conditions. Ascorbic acid, lutein and β-carotene increased with PH3 application, while disinapoylgentobiose and kaempferol-3-hydroxyferuloyl-sophorosie-7-glucoside increased with PH treatments and the 3 peptide fractions under both NO3 conditions, equally for total phenols with the PH2 treatment. The complete hydrolyzate and the analyzed peptide fractions have differential biostimulatory effects, improving the growth under conditions of no stress and the nutritional quality of lettuce in both nitrogen levels. Such results permit the design of a better generation of biostimulants having targeted effects in particular conditions.

S3 OP2

USE OF COMPOST FROM FENNEL PROCESSING WASTE AS A SOIL CONDITIONER TO IMPROVE LETTUCE PRODUCTION AND NUTRACEUTICAL CHARACTERISTICS

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In recent years, we are witnessing an increasing focus on the sustainability of agricultural production. In this perspective, the application of circular economy principles in agriculture allows for a more efficient use of resources and the valorization of waste, which itself becomes a resource. One of the main agro-industrial waste biomasses produced in Campania is fennel processing waste. In fact, only 40% by weight of the biomass collected represents the commercial part of this vegetable, while the remaining 60% constitutes waste to be disposed of at high cost. In the present work, the effect of fennel compost on the qualitative-quantitative characteristics of lettuce production grown in pots in a protected environment was evaluated. The experimental trial involved the comparison of two composts, from the crop residues of two different fennel cycles (F1 and F2, characterised by a C/N ratio of 23 and 9, respectively), added in four different doses (0%, 1%, 5% and 10% by weight) to a loamy soil. The assessed measurements covered biometric, physiological (SPAD index, fluorescence and gas exchange), qualitative (mineral content, chlorophylls, ascorbic acid and antioxidant activity) and nutraceutical (phenolic profile and β-carotene and lutein content) measurements. The results showed a significant increase in production and photosynthetic activity with the addition of 5% compost compared to the control (+20% and +10% for F1 and F2, respectively). Finally, the content of total polyphenols increased in lettuces grown on composted soil compared to the control. Fennel compost can be transformed from waste into a resource for reuse in horticulture.

S3 OP3

EXPLOITATION OF WASTED BREAD AS SUBSTRATE FOR POLYHYDROXYALKANOATES PRODUCTION THROUGH THE USE OF HALOFERAX MEDITERRANEI AND SEAWATER

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The use of biotechnology to produce bioplastic was widely investigated considering the interest to find sustainable ways for the production of disposable products. Different biotechnologies were exploited evaluating the use of low-cost raw materials and selected microorganisms. The halophile microorganism Haloferax mediterranei, able to synthesize poly(hydroxybutyrate-hydroxyvalerate) (PHBV), is a promising strain for the industrial production of bioplastic from carbohydrates and minerals rich substrates through bioprocessing. Wasted bread was used as substrate for bioplastic production by microbial fermentation by using microfiltered seawater and wasted bread-derived substrate instead of expensive media and minerals supplement required for Hfx. mediterranei DSM1411 growth. The best ratio of wasted bread homogenate and seawater was evaluated and 40:60 was the optimum for microbial growth. Protease and amylaseadditions to the bread homogenate stimulated microbial growth, but without significantly increasing bioplastic production, which reached 1.53 g/L under experimental conditions in a 3-liter bioreactor. Instead of using the traditional extraction method for PHBV recovery with chloroform, a process based on repeated washing with water, followed or not by a purification using ethanol precipitation, was used. Yield of PHBV obtained using the different extraction methods were 21.6 ± 3.6 (standard extraction/purification procedure with $CHCl_3$:H_2O mixture), 24.8 ± 3.0 (water-based extraction), and 19.8 ± 3.3 mg PHAs/g of wasted bread (water-based extraction followed by ethanol purification). The PHBV produced using the water-based extraction had a slightly greater hydroxyvalerate concentration (12.95 vs. 10.78%, w/w) than the traditional one without affecting the purity of the recovered biopolymer which reached 100% (w/w). This research demonstrated the possibility of using unexpensive substrates, as bread and saltwater, for fermentation-based bioplastic manufacture. Moreover, the set up of green bioplastic recovery, based on osmotic shock by using water, was an efficient operation for obtaining high quality PHBV with comparable concentration compared to conventional solvent extraction.

S3 OP4

EVALUATION OF GHG AND AMMONIA EMISSIONS AND FERTILITY IN AGRICULTURAL SOILS TREATED WITH LIVESTOCK SLUDGES AND ANAEROBIC DIGESTATE: CASE STUDIES IN FARMS IN THE PROVINCE OF BRESCIA

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Livestock wastes as organic fertilizers can improve soil fertility and crop productivity reducing the use of chemical fertilizers. Proper management of livestock waste is required to minimise environmental impact due to in term of greenhouse gasses (GHGs) and ammonia emissions and leaching of nitrate.
The experimental design considered different agricultural soils for maize production and the application of different fertilizers, livestock wastes (liquid slurry and digestate) and chemical fertilizers (urea), evaluating the soil physico-chemical and biochemical properties, GHG (CH_4, CO_2 and N_2O) and ammonia emissions. Results showed that digestate produces higher nitrate concentration and dry matter content than liquid slurry, resulting in higher N and C input in soil. Effects on soil biota functions were also evaluated based on soil respiration and enzyme activities. The application of digestate also affected the organic matter stabilization and P available and consequently the enzyme activities related to P cycle.
The GHG and ammonia emissions were monitored in field by static chambers during the plant growing season. Slurry incorporation in soil drastically reduced ammonia emissions, whereas the N2O emission was only observed after chemical (urea) fertilization.
The field experiments are part of a complex project aiming at assessing the nutrient fluxes in livestock farms and reducing nutrient losses from agricultural system. Results can be used for developing develop a decision support system for improving sustainability of soil fertilization to promote ecological transition of livestock farming systems.

S3 OP5

SOFTWOOD-DERIVED BIOCHAR AND MUNICIPAL SOLID WASTE COMPOST AND THEIR COMBINATION AS PROMISING AND SUSTAINABLE SOLUTION TO RESTORE THE FUNCTIONALITY OF POTENTIALLY TOXIC ELEMENTS CONTAMINATED SOILS

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Potentially toxic elements (PTEs) like antimony and zinc may affect soil ecosystem services, leading to biodiversity decline and increasing environmental risks. It is crucial to implement measures to remediate PTEs-contaminated soils to maintain healthy and sustainable environment. Organic amendments, like biochar and compost have shown different effects in remediating PTE-contaminated soils. Therefore, their combination could be more efficient in restoring PTEs-contaminated soils. Consequentially, softwood-derived biochar (B), municipal solid waste compost (C) and tree mixtures of them (B50%+C50%; B75%+C25%; B25%+C75%) were added at 3% rate to Sb (2362 mg·kg−1) and Zn (2801 mg·kg^{-1}) contaminated soil to evaluate their effects on soil fertility, functionality (soil respiration and enzyme activities), PTEs mobility, *Lolium rigidum* L. growth (root and shoots length and biomass) and PTEs uptake. Untreated soil (U) was used as control. Amendments addition did not affect PTEs soil content. Biochar, compost and their combination enhanced soil fertility (i.e. pH, total organic matter, available P, CEC, exchangeable Ca and Mg increased between 1.07- and 3.38-fold). Compost was the most effective to restore soil functionality, as highlighted by soil enzyme activities and respiration increases in C soil compared to the other treatments. All amendments reduced Zn labile fraction and Sb not specifically adsorbed, this last was reduced between 1.04- and 1.12-fold following the order B>B75%+C25%≥B50%+C50%>B25%+C75%>C. *L. rigidum* was able to grow in the contaminated soil, and its growth were positively affected by amendments addition. Biochar was the most effective to reduce plant PTEs concentration, i.e. Sb and Zn uptake decreased by 1.23- and 1.35-fold in plants grown in B soil compared to control plants. Overall, these results indicated that biochar and compost had different effects in soil restoration, and their combination might suit best to favour sustainable PTEs-contaminated soils restoration, increasing plant growth and reducing PTEs uptake.

S3 OP6

THE USE OF HEMP SEED CAKE IN THE DIET OF ORGANIC REARED LAYING HENS: EFFECTS ON EGGS QUALITY AND FATTY ACIDS PROFILE

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The use of hemp seed oil cake as a source of protein and polyunsaturated fatty acids in livestock feeding is of interest to link food and feed chains in a circular economy and agricultural byproducts valorization perspective. This approach is even more important in organic farming, where the use of conventional protein sources such as soybean meal is banned. In this study, we evaluated the effects of including hemp cakes in the diet of organically reared laying hens on the commercial and nutritional quality of eggs. Two groups of Hy-Line brown hens, 150 each, were fed two isoenergetic and isonitrogenous diets: a control (CTR) standard concentrate based on soybean and maize meals, and a HEMP concentrate that included hemp cake at 25% dry matter. The trial was divided into two periods of 8 weeks each, consisting of 2 weeks of adaptation and 6 weeks of sampling (30 eggs/group every two weeks). At the end of the first period, the diets previously assigned to the two groups were reversed. The proximate composition, commercial traits, and fatty acid (FA) composition of eggs were determined. Data were processed by ANOVA (GLM procedure) using diet and period as the factors. The commercial traits of eggs as well as the pH, a_w and chemical composition of albumen and yolk were not affected by diet and period. In contrast, the FA profile of HEMP yolk showed higher ($P<0.05$) linoleic and linolenic acid contents (20.99% vs 16.97% and 1.17% vs 0.59%, respectively), while oleic acid was higher ($P<0.05$) in CTR eggs (39.51% vs. 34.77%). In addition, PUFA/SFA and n-6/n-3 ratios were more beneficial in hemp eggs than in CTR eggs ($P<0.05$). Overall, the use of hemp cake positively influenced the nutritional composition of the yolk without altering the quality traits of the eggs.

S3 OP7

PRODUCTION OF HYDROPONIC BARLEY FORAGE AND THE ENERGY FOOTPRINT OF BUFFALO MILK: RESULTS FROM A STUDY CASE

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Hydroponic forage production in a controlled environment has gained attention in recent years due to the scarcity of arable land and the adverse effects of climate change on forage production. However, little is currently known about the impact of hydroponic technology on sustainable resources use by dairy farms. In this study we compare the impact of replacement of maize silage (MS) with hydroponic barley forage (HBF) on the energy footprint of buffalo milk production through a single-issue life cycle assessment. The system boundary was defined from the cradle to the farm gate, implying that direct and indirect energy inputs were quantified for all processes involved until milk left the farm gate. All inputs were referred to the functional unit of 1 kg of energy-corrected milk (ECM) produced by buffaloes fed diets based on HBF and MS. The crop energy balance highlighted that the total energy for producing 1 kg of DM from forage amounted to 1.96 and 26.97 MJ, respectively for MS and HBF. Total net energy for producing HBF was negative (-982446 MJ yr^{-1}), indicating the loss of energy during the production process. Barley seed production was by far the main energy-consuming input for HBF production (81% of total energy inputs). The dietary inclusion of HBF did not alter the intake of DM (14.6 vs 14.92 kg, respectively for MS and HBF based diets) and quantity of ECM produced by cows (20.4 vs 21.7 kg). However, replacing MS with HBF raised the energy embedded into the daily ration from 45.1 to 138.9 MJ, resulting in an additional energy cost of 3.9 MJ per kg of ECM produced. Based on these results, the analyzed HBF production cannot be considered an environmentally friendly alternative to conventional maize silage production.

S3 OP8

IMPROVING THE ENVIRONMENTAL SUSTAINABILITY OF RABBIT PRODUCTION THROUGH FEED RESTRICTION SYSTEMS AND LOW PROTEIN DIETS

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This study evaluated the effects of the feeding system (AL: *ad libitum*; R1: monophasic feed restriction; R2: biphasic feed restriction) and the dietary crude protein (CP) level (HP: 16% CP; LP: 14% CP) on the environmental footprint of rabbit production computed by Life Cycle Assessment (LCA). A total of 336 crossbred growing rabbits were reared from weaning to slaughtering (33-78 d of age) in 48 collective pens. The access time to feeders decreased from 16 to 9 h/d in the first week of trial in both R groups; it was 8 h/d given in a single slot (R1 group) or in two slots (R2 group: 4 h + 4 h separated by 4 h without feed access) during the 2nd and 3rd week. Then, access time increased to 12 h/d during the 4th week and, thereafter, it was 12 h/d in a single slot of access for both R groups until the end of the trial. The HP and LP diets were administered from 33 to 60 d of age, then a fattening diet (14% CP) was provided to all groups. The LCA used the pen as the reference unit and considered impacts from animal and manure management and dietary ingredients production to assess global warming potential (GWP), GWP including land-use change (GWP_LUC), acidification (AP) and eutrophication (EP) potentials, and land occupation (LO). The functional unit was 1 kg chilled carcass weight. Both feed restriction systems significantly reduced ($P<0.001$) GWP (-10.6%), GWP_LUC (-10.6%), AP (-13.1%), EP (-11.5%) and LO (-9.9%) compared to AL. The GWP_LUC decreased with decreasing the CP level (-3.6%; $P<0.001$), whereas the other impact categories did not change. In conclusion, time-based feed restriction systems can reduce the environmental footprint of rabbit production, whereas limited benefits are expected by decreasing the dietary CP level from 16% to 14%.

S4 OP1

RELIABILITY OF SATELLITE-BASED LAND PHENOLOGY TO ASSESS THE IMPACT OF LAND USE AND MANAGEMENT ON FORAGE AVAILABILITY IN MEDITERRANEAN GRASSLANDS

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Mediterranean grasslands are under threat from land degradation and climate change. Remote sensing from satellite can be a tool to assess the impact of management and help farmers make sustainable decisions. Multispectral indices such as the Normalized Difference Vegetation Index (NDVI) can help to understand the impact of management on vegetation dynamics. This study aimed to assess the effect of contrasting land uses and management practices on seasonal vegetation parameters derived from NDVI time-series analysis in Mediterranean grasslands. A total of 38 plots (250.7 ha) characterized by different environmental conditions were identified on the island of Sardinia, Italy. Land uses included permanent and wooded grasslands, with contrasting management strategies (continuous vs rotational grazing, oversown vs unsown areas). Biomass production was measured from 2017 to 2022. For the same period, remote sensing data from Sentinel-2 were acquired using Google Earth Engine to calculate the NDVI. A set of phenological parameters was obtained by smoothing the NDVI time series using the Savitzky-Golay method implemented in TIMESAT software (version 3.3). A Principal Component Analysis (PCA) was performed using the RStudio software, including the 14 different land phenology parameters (e.g., start of season, time peak). A good agreement (r= 0.70) was observed between the NDVI and biomass dynamics over the growing seasons. The first two PCA components explained 82.1% of the variability. The phenological variables discriminated between location, land use (wooded vs. treeless grasslands), and grassland management (sown vs. unsown areas). Among wooded grasslands, grazing management (rotational vs. continuous) was also well-identified. The preliminary results confirm the hypothesis that seasonal parameters from NDVI time-series are suitable to identify contrasting land uses and grassland management under Mediterranean conditions. Further insights are needed to understand the effect of the interaction between environmental factors and management on forage availability parameters (e.g. autumn production) during the growing season.

S4 OP2

GRASSVISTOCK: A PROCESS-BASED MODEL FOR SIMULATING BIOMASS ACCUMULATION AND CARBON FLUXES IN AGRO-PASTORAL SYSTEMS

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Agro-pastoral systems are widespread and provide multiple ecosystem services (primary production, carbon sequestration, biodiversity conservation, etc.; Dibari et al., 2021). However, the impact of global warming is affecting these ecosystems by reducing their potential to climate change mitigation (https://www.ipcc.ch/report/sixth-assessment-report-cycle/; Chang et al., 2021). In order to evaluate the climate change effect on agro-pastoral systems and to identify adaptation and mitigation strategies, some process-based models have currently been developed (e.g. PaSim, Riedo et al., 1998; BASGRA, Bouman et al., 1996). Among these, the GRASSVISTOCK model was implemented from Bellini et al. (VISTOCK model; 2023) as simplified approach for simulating the daily trend of biomass accumulation and carbon fluxes in grasslands and pastures. The model was coupled with the Roth C module (Coleman & Jenkison, 1996) for estimating organic carbon turnover and soil respiration, by considering temperature and moisture effects, and the vegetation cover. GRASSVISTOCK was calibrated in three sub-alpine grasslands (IT-Tor: 45.84 °N, 7.58 °E; AT-Neu: 47.12 °N, 11.32°E; CH-Cha: 47.21°N, 8.41°E), and run on different temperatures (+1°C, +2°C, +3°C), CO_2 (460.8 ppm, 534.3 ppm, 538.4 ppm) and precipitation (-5%, -10%, -20%) scenarios, in

order to evaluate model sensitivity to the changes in climate conditions. The preliminary results showed a satisfactory accuracy at simulating Net Ecosystem Exchange (NEE; e.g. IT-Tor: r = 0.72; RMSE = 0.02 Mg C ha^{-1}), Gross Primary Production (GPP; e.g. IT-Tor: r = 0.86; RMSE = 0.02 Mg C ha^{-1}) and Ecosystem respiration (RECO; e.g. IT-Tor: r = 0.65; RMSE = 0.02 Mg C ha^{-1}; simulated every 10 days). Additionally, the sensitivity analysis highlighted the main role of temperature in affecting NEE, GPP and RECO trends, with increasing carbon emissions especially under the most extreme scenarios. This study represents a first step towards the implementation of an optimized tool for estimating carbon fluxes in agro-pastoral systems.

SE OP3

MONITORING *PINUS PINEA* DECLINE FOR THE URBAN ENVIRONMENT OF ROME BY SENTINEL-2 AND PLEIADES DIACHRONIC ANALYSIS DATA

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The ongoing climate change leading the occurrence of stressful events including high temperatures, droughts and the spread of pests, exacerbating its effects in urban areas, due to the low plasticity of the system. Urban green areas and trees provide several ecosystem services and aesthetic value, consequently, it is important to preserve trees health in the urban environment and to identify decay or disease outbreaks. In the coastal areas of central Italy and in the city of Rome, the widely used Pinus pinea population is strongly affected by biotic stresses including Toumeyella parvicornis as well as drought. The aim of the study was to monitor pine trees health of three historical park in Rome (Villa Ada, Borghese and Panfili), through ESA Sentinel-2 images and the high-resolution (0.5 m) Pleiades satellite. The pine tree census was conducted through a photointerpretive analysis and the polygons obtained were subsequently divided into classes according to the size of the canopy. The health conditions of the trees were assessed by the Normalized Difference Vegetation Index (NDVI) of the pine's polygons. Diachronic NDVI were calculated on July scenarios performed on 2015-2021 for Sentinel-2 images and on 2015, 2018 and 2021 for Pleiades. Frequency distribution histograms of NDVI values of the pines highlight a clear decline started in 2018 and reaching the lowest values in 2021. This trend is confirmed by the Pleiades scenarios values. More than 90% of the tree's canopies are affected by severe decay including different areas with dead trees. Size class results show that Pleiades images allows to monitoring even young and isolated pine trees. The use of remote sensing techniques has proven to be a useful tool to pine tree health-check in the urban environment allowing actuation of preventive measures, to timely replace dead trees with high quality trees adapted to the climate.

S4 OP4

RELATIONSHIPS BETWEEN FIELD DATA AND NDVI DATA OF BEECH FORESTS IN CZECH REPUBLIC AND SOUTHERN ITALY

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European beech *(Fagus sylvatica L.)* is an important broadleaf species from an economic and ecological point of view for many country not only in central Europe but also in southern Europe. It is also a species very sensitive to drought and for this reason in this scenario of climate change its future is threatened. The main purpose of this study was investigate the trend of growth of beech forests in Czech Republic and southern Italy in order to research the relationships with thermo-pluviometric data and verify whether the field data reflects NDVI data for the period 2000-2017. The research was conducted on four research plots located between 760 and 1340 m a. s. l, (two plots in Czech Republic and two in southern Italy). In central Europe, beech stands have shorter vegetation season in compare to the Mediterranean area, which was reflected in the size of the radial growth. Our results shows that the most significant positive correlation to beech radial growth was observed with max seasonal NDVI in italians plots in compare to czech plots; temperature (annual mean) had a negative effect on growth while precipitation (annual mean) had a positive effect in all plots but correlations were not significant. The lack of correlations between NDVI and growth in Czech Republic plots could also indicated that NDVI is not reliable for the study of forests located in non-arid areas such as those of southern Italy; however further studies are needed to confirm this result.

S4 OP5

SATELLITE LIDAR DATA AS A TOOL FOR A HIGH-RESOLUTION TREE HEIGHT MAPPING OF MEDITERRANEAN FORESTS

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Structural information about forests, such as individual tree heights, trunk diameter, and tree density, is strongly important for biomass and carbon stock quantification and managing forest ecosystems. Anthropogenic pressures to forests from rapid climate and land use change means that is important to collect these data continuously and accurately to effectively monitor forest health. From late 2018 NASA's Global Ecosystem Dynamics Investigation mission characterized canopy heights worldwide (51.6° N and 51.6° S latitudes). Whilst the GEDI mission has provided a wealth of data so far, the footprint of the satellite does not provide high resolution spatial data on tree heights globally. In this study, we test an upscaling approach for wall-to-wall canopy heights mapping and validate its accuracy Airborne Laser Scanning (ALS) data from two Mediterranean forest types, pure coniferous and mixed-species stands. This approach combines GEDI canopy heights with active and passive remotely sensed data through three machine learning algorithms: Random forests, gradient boosting, and CART. The overall accuracy of tree height prediction was higher in pure (Adjuted-R-squared 'Adj-R^2'> 0.50; Root Mean Squared Error 'RMSE' < 6m) rather than in mixed-species stands and the best and worst compromises between Adj-R^2 and RMSE were found in Random forests and CART prediction, respectively. We expect that the proposed upscaling approach will be a starting point for monitoring inaccessible or abandoned forests worldwide.

S4 OP6

FULL-SCALE FARM WETLAND FOR STORMWATER AND AGRICULTURAL DRAINAGE WATER TREATMENT - EFFICIENCY MONITORING AND PREDICTION

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Constructed wetlands (CWs) are nature-based solutions that mimic processes present in natural wetlands and use them to treat polluted waters. They can be used for different types of influents (e.g. domestic wastewater, industrial discharge), but they might be rather suitable for agricultural drainage water, as well as stormwater treatment due to their ability to manage varying inlet volumes and loading rates, the fact more and more important in the view of climate change. In order to test this hypothesis, a full-scale surface flow CW from an experimental agricultural farm near the city of Bologna was monitored within the H2020 project WATERAGRI in the period April 2020 – September 2022, in the term of different parameters (COD, TOC, TSS, TN, NO_3-N, TP). The influent to the system is mostly agricultural drainage water, mainly originating from stormwater. However, due to the unpredictable nature of this type of influent, it is also important to be able to predict how a certain system would behave under different weather (e.g. temperature) or operational (e.g. loading rate) conditions. To that purpose, a simple model developed within the CARIPLO project MONAIISa was tested for the real influent and effluent data and then used to predict performance of the same farm wetland for the future events. Due to the exceptionally low precipitation during the monitoring period, there were not many events where the effluent from the farm wetland monitored was present. However, the system has shown a remarkable efficiency in the treatment of different compounds, even two decades after the construction. Moreover, the model used was able to simulate in a good way the effluent concentration after a certain calibration.

S4 OP7

DROUGHT AND HIGH TEMPERATURE IN ITALIAN VITICULTURE: FROM REMOTE SENSING AN INSIGHT INTO THE EXTREME EVENT OF SUMMER 2022

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Viticulture is a widely spread agricultural practice in the Mediterranean basin. Italy is a key country in this market and the world's largest wine producer. In addition to its economic importance, viticulture is often associated with cultural and social values, as in the case of cultural landscapes. They combine wine production with authentic traditional knowledge and sustainable land management. Italy is home to numerous examples, sometimes inscribed in lists such as UNESCO Cultural Landscapes (for instance: "Le Colline del Prosecco di Conegliano e Valdobbiadeneo" site) and FAO-GIAHS sites (such as: "Soave Traditional Vineyards"). Viticulture has a close connection with environmental factors. Climate change could alter the growing conditions of vineyards with potential impacts on fields. 2022 was a symbolic year in terms of climate change. Especially the summer brought the attention of scientists and citizens because of the severe drought and heatwave that affected Europe. Such processes threaten vineyards through water stress and high temperatures, causing plant damage and severe losses to production. Satellite remote sensing products are interesting tools for analyzing similar large-scale natural hazards. This research focused on July 2022, the most critical month. We identified Italian vineyards using the Corine Land Cover data. Then, we implemented MODIS data in Google Earth Engine to map conditions of extreme agricultural drought (using the Vegetation Health Index - VHI) and high Land Surface Temperature (LST > 35°C) in vineyards. By cross-referencing the data, we mapped the areas potentially affected by the combination of processes. Research findings show that vineyards in northern Italy were among the most affected, including remarkable cultural landscapes. Our analysis could help identify Italian wine-growing areas at risk of similar future events, promoting measures for more sustainable and climate change-resilient production.

S4 OP8

LABORATORY TESTS OF PROTOTYPE NOZZLES USED FOR SPRAY APPLICATIONS IN VINEYARDS USING UASSs

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Uncrewed aerial spray systems (UASSs) have been tested for spray applications in arable crops, and, in the last years, research activities are also focusing on 3D crops. Concerning arable crops, when dealing with UASSs, the off-target spray losses are mainly due to the drift phenomenon. On the contrary, in 3D crops, the off-target spray losses can be mainly attributable to the in-field spray losses. Indeed, the UASS directly sprays on both the free-crop surface and the canopy. Therefore, targeted spray applications can help in reducing the off-target spray losses, firstly avoiding broadcast applications, and secondly targeting just the canopy with the sprayed liquid. With the final aim of targeting as much as possible the sprayed liquid into the canopy when flying above the vine row, prototypes of hollow cone nozzles with a narrow spray angle of 30° (lower than standard values) were tested at the crop protection technology laboratory (DiSAFA facilities). Laboratory tests were performed according to the ISO 5682/1 regulation. Specifically, the prototype nozzles (conventional and drift reducing) were tested to measure: i) the volume flow rate in L min-1 with an inlet liquid pressure of 0.3 MPa, ii) the spray angle at three different inlet liquid pressures (0.3, 0.6 and 0.9 MPa), iii) the droplet size spectra (D[v,0.1], VMD, D[v,0.9], V100, and RSF - relative span factor) using a Malvern Spraytec laser diffraction system STP534 at three different inlet liquid pressures (0.3, 0.6 and 0.9 MPa), and iv) the horizontal spray pattern at three different inlet liquid pressures (0.3, 0.6 and 0.9 MPa) and two heights (0.5 and 1 m). The 30° prototype nozzles comply with the reference regulatory standards and can potentially reduce the off-target losses of 86% when compared to 60° commercial nozzles.

S4 OP9

A CASE STUDY ON THE EMPLOYMENT OF DRONE-BASED MONITORING FOR THE CONSERVATION AGRICULTURE-BASED CULTIVATION OF 'PIENNOLO' TOMATOES IN THE VESUVIAN REGION IN SOUTHERN ITALY

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The global climate crisis has raised serious concerns about the potential irreversible damage to the agricultural sector and there is a need to shift to innovative farming systems where technology can play a key role in simplifying the management and implementation of agricultural operations. This study aims to examine the impact of promoting less impactful agricultural practices, particularly systems based on conservation agriculture, to mitigate the negative effects of climate change on crops. The shift from conventional agriculture to conservation farming methods, which are structurally predisposed to be integrated with the paradigms of agriculture 4.0, is a rewarding combination for these ambitious goals. Tradition and innovation thus become inseparable concepts, where the advantages of sustainability and profitability are combined with those of productivity, digitisation and traceability of processes and products. Conservation agriculture promotes agricultural production by optimising the use of resources, improving agricultural soil structure and sustaining long-term crop productivity. This case study aims to compare the agronomic techniques of conventional agriculture and conservation agriculture on an agricultural area dedicated to the production of tomatoes of the piennolo variety in the Vesuvius area, a PDO product of the Campania Region, Italy. The comparison between the two agronomic practices took place on two evaluation levels. The first evaluation phase was carried out by monitoring the various phenological phases with a UAV equipped with a multispectral camera. The analysis of the multispectral images made it possible to calculate vegetation indices, such as NDVI, LCI and NDRE, which highlighted any differences in the health status of the crops in relation to the two agronomic practices followed. The second evaluation phase involved a quali-quantitative analysis of the product obtained. The results obtained showed support for the choice of conservation agriculture, which, supported by precision farming technologies, makes it possible to achieve eco-sustainability objectives.

S4 OP10

GIS-BASED SPATIAL ANALYSIS AS SUPPORT TO MANURE MANAGEMENT IN CAMPANIA REGION

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The increase of heads reared within livestock farms lead to an aggravation of environmental pollution due to nitrogen losses from animal manure. The consequences of its bad management would lead to poor conditions of terrestrial and aquatic ecosystems in the surrounding areas. This implies the need for an improvement of manure management also at a landscape scale. This paper aims to provide a spatial analysis with the identification of hotspot areas in the Campania Region (Italy). Accordingly, the livestock database of the year 2020 accounting for all types of farming (cattle, buffalo, poultry, pig and sheep/goat) was used. The total amount of nitrogen produced was calculated and then spatialized by means of the use of GIS software. Moreover, different Kernel Density (KD) classifications were compared to identify focus areas, by calculating the density of nitrogen produced by farms distributed in the surrounding area. Three KD classifications were considered: (i) Defined Interval (DI), which divides the range of values into 3 classes (0-170, 170-340, >340 kg N/ha); (ii) Quantile (Q), where each class contains an equal number of points and (iii) Natural Breaks (NB), which maximizes differences between classes and minimizes differences within the class. The spatial analysis results show that livestock farms (48123) are distributed among the Campania provinces as follows: 33% in Salerno (SA), 22% in Benevento (BN), 19% in Avellino (AV), 13% in Caserta (CE) and 13% in Naples (NA). Furthermore, buffalo farms are characterized by the highest number of heads, which accounts for 296046 with annual nitrogen production of 14608 t N/year. Specifically, the buffalos are mainly located in CE (63%) and SA (35%) whereas the other species are diffused in all the provinces. This study provides new insight for a realistic quantification of zootechnical nitrogen per hectare, helping decision-makers in identifying areas more susceptible to pollution.

S4 OP11

GIS-BASED LAND SUITABILITY EVALUATION AS TOOL FOR ENVIRONMENTAL-FRIENDLY MANAGEMENT

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The pedoclimatic condition choise for crops is an important topic in terms of sustainable agriculture policies and agricultural planning. This study presents a model to evaluate land suitability for cultivation of sweet chestnut (Castanea sativa) for nut production (SCNP) in the northern part of the Apennine chain in Italy. This work aimed to i) develop a method able to identify the areas suitable for SCNP cultivation from a geomorphological and pedological point of view; and ii) propose a remote-sensing-based methodology able to identify the SCNP cultivated lands. The Municipality of Castel del Rio (Emilia-Romagna Region, Italy) was selected as testing area. The areas were considered suitable if located within an altitude ranging between 300 and 1000 m above sea level with north-facing exposition, slope gradient <20°, soils with dystric features and developed from carbonate-free parent materials. The topographic, lithological, and pedological information were processed by QGIS software. The later vegetative re-growth of the chestnut trees compared to other plant species allowed the georeferencing of the SCNP cultivated areas through the use of Google Earth Pro remote sensing images. Overlapping the georeferenced and the suitable areas, the suitable areas accounted for 10% of the georefencing area. The suitability map showed that most of SCNP cultivated areas were in steep areas and, therefore, with increase of degradation risks (e.g., erosion). These findings highlighted that the knowledge of the current use of territory through remote-sensing images is necessary to foresee the best management practices that should be applied for both land and soil conservation and/or conversion. Finally, because of its easy execution, the proposed methodology used for building land suitability maps coupled with land-use monitoring using remote-sensing images can be applied to SCNP at a wider geographical scale and to other crops. This procedure could allow to formulate environmentally sound land use plans.

S4 OP12

AN INTEGRATED EVALUATION OF ECOSYSTEM SERVICES AND SOIL HEALTH TROUGH A WEB-BASED DSS.

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In this work we present the LandSupport Soil Health tool for an integrated evaluation of multiple potential soil-based ecosystem services (SESs) through the use of a process-based modelling, simulating the crop growth and water balance in the soil-plant-atmosphere system. Specifically, we evaluate the soil contribution to i) food provisioning, through the estimation of biomass of winter wheat and maize; ii) nutrient and pollutants retention and release, through the estimation of soil filtering capacity and mineralization rates; iii) water regulation, through the estimation of yearly percolation toward groundwater; iv) water regulation/water storage through the water yearly stored in the soil; and vi) microclimate regulation, through the total actual evapotranspiration and total SOC change. The proposed approach was framed in the context of the geospatial Decision Support Systems LandSupport (www.landsupport.eu) that, in the latest years, proved to be a powerful and state-of-art instrument for the what-if scenario analysis, in support of multiple stakeholders and end-users, at different spatial scales. Thanks to the LandSupport features, the end-user can evaluate the soil health resilience by simulating the effects of some degradation processes such as: i) a compacted plow layer, ii) a decrease of organic matter, iii) a thickness reduction of the Ap horizon following an erosion process. Furthermore, the gain in soil health can be evaluated by simulating the effect of multiple best practice managements, such as different tillage operations, residue retain and/or the insertion of a cover crop. Each of the above simulated ESs is than mapped and classified to give to the interested end-user an indicator of the soil health status. The Soil Health tool is designed to assist Public Authorities, such as regional environmental agencies, farmers and farmer advisors in designing plans and in evaluation of impacts of the measures in order to ensure a good health of the soils.

S5 OP1

DEVELOPMENT OF A LABORATORY ON CHIP (LOC) FOR WINE POLYPHENOLS ANALYSIS

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For red wine production phenolic content is extremely important. Anthocyanins, flavonoids and total polyphenols content and availability strongly influence both the harvest time and quality of wine grapes and wine body, color and texture. The polyphenol content in musts and wines, over that by the grape berry accumulation and the cellular maturity, is significantly influenced by maceration and fermentation techniques. To date, polyphenol evaluation is performed using destructive, laborious, expensive and environmental unfriendly methods of analysis. Nowadays, companies that want to be competitive in a global market must necessarily undergo to a process of innovation and digital transformation. In this context, the main goal of our research is to engineer a portable platform for precision enology based on acoustic wave sensors, and using the modern technology of connectivity (clouding) to reduce the costs of chemical analyses for wineries guaranteeing, anyway, a precise and consistent number of analyses. We here introduce novel chemical functionalization strategies for gold-based acoustic transducers that could detect polyphenols in wine. By using a Quartz Crystal Microbalance with Dissipation Monitoring (QCM-D) instrumentations, we developed two different probes based on Gelatin A (Gel-A) and Murine Salivary Protein 5 (MP5). We found that they were effective in detecting polyphenols in commercial wines without requiring any sample pre-treatment. Our results are promising and suggest a possible employment of these devices for in-field precision enology analysis. The work here presented is supported by VIOLoC project (FISR2019_03020).

S5 OP2

SIMULTANEOUS IMPROVING OF DURUM WHEAT YIELD AND GRAIN PROTEIN CONTENT BY USING ASSOCIATION TESTS AND WEIGHTED GBLUP

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Despite the importance of grain protein content (GPC) in determining wheat quality, its negative correlation with grain yield (GY) is still one of the major challenges for breeders and farmers. Here, a durum wheat panel of 200 genotypes was evaluated for GY, GPC, and their derived indices (GPD and GYD), under different agronomic management for two consecutive years. A genome-wide association study using two statistical models revealed dozens of marker-trait associations (MTAs), each explaining up to 30% of phenotypic variance. Two SNP markers on chromosomes 2A and 6B were consistently identified by both models and were found to be significantly associated with GY and GPC. MTAs identified for phenological traits co-mapped to well-known adaptive genes (i.e., Ppd-1, Vrn-1). The significance value (p-values) that measure the strength of the association of each SNP marker with the target traits were used to perform genomic prediction with a genomic best linear unbiased prediction (WGPLUP) model. This statistical model outperformed conventional GBLUP for all traits (prediction accuracy increase up to 70%). The trained models were ultimately used to predict the agronomic performances of an independent durum wheat panel, confirming the utility of genomic prediction, although environmental conditions and genetic backgrounds may still be a challenge to overcome. The results generated through our study confirmed the utility of GPD and GYD to mitigate the inverse GY and GPC relationship in wheat, provided novel markers for marker-assisted selection and opened new ways to develop new cultivars through genomic prediction approaches

S5 OP3

NON-RENEWABLE PHOSPHORUS IN THE AGRICULTURAL SYSTEM: A SUSTAINABLE SOLUTION FROM LOW-PHYTATE MAIZE

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Conventional agriculture relies on chemical inputs to boost production. The phosphorus (P) used in agriculture is obtained from rock phosphate, a non-renewable resource. In seeds, the main reserve of P is phytic acid (PA), a strong anti-nutrient. PA can bind essential minerals, making them unavailable for monogastric animals and humans. Monogastrics assimilate only the 10% of the PA in the feed, while 90% is excreted, becoming a pollutant, and causing eutrophication. Therefore, the reduction of PA in cereal seeds has become an important challenge in breeding programs and many *low phytic acid* (*lpa*) mutants have been isolated in major crops. In these mutants, the reduction of PA and the proportional increase in free P leads to negative pleiotropic effects that can affect seed germination and, in general, plant performance. In maize, *lpa1-1* is the most promising and is characterized by a 66% reduction in PA. Here I present the main results obtained with *lpa1-1*, highlighting the benefits and challenges of using low-phytate mutants. First, we exploited the natural genetic variability of PA and free P in different landraces. Then, a multi-year field trial was set-up, and it was found that *lpa1-1* had a comparable (or even better) seed weight/ear than the wild-type; the main problem of this mutant was the reduced field emergence (~40%), which consequently led to lower yield. To restore germinability, two possible approaches have been proposed: i) a genetic approach, based on conventional breeding; ii) a technological approach, based on seed priming. It was found that germinability improved by 20% in *lpa1-1* seeds with a hydropriming treatment, suggesting a possible role of seed priming in restoring germination rates. Overall, low-phytate crops have the potential to improve the long-term P sustainability in agriculture, but more research and support is needed to optimize the agronomic performance of low-phytate maize.

S5 OP4

PLANT VIRUSES IN THE EUROPEAN VIRUS ARCHIVE NETWORK

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The European Virus Archive - Global (EVA-Global; https://www.european-virus-archive.com/) is a non-profit organisation involving a global network with expertise in animal, human and -starting in 2020 - plant virology, consisting of more than 40 partner laboratories both based in EU member states and abroad. EVA-Global as part of the European Union's Horizon 2020 research and innovation programme's funding is conceived to be an open access entity aiming at facilitating and developing synergies between scientific and industrial community. The web-based catalogue (https://www.european-virus-archive.com/evag-portal), provides easy access for the end user to the collections including viruses, derived materials (nucleic acids, antisera, controls, infectious cDNA clones etc...) and services. The consortium ensures that the available materials meet the highest scientific standards in terms of safety, quality and characterization through the implementation by partners of a quality management system. While the property of the provided materials remains with the originators, specific EU funding provides the option for free-of-charge access to viral resources for public research institutions. Besides virus material and derived products cutting edge methodology for virus cultivation, preservation and analysis are available. The large number of viruses and isolates available through EVA-Global is crucial for preparedness, as amply demonstrated during the current SARS-CoV-2 pandemic. Currently the plant virology section within EVA-Global is constituted by partners from France (ANSES, CIRAD, INRAE), Germany (DSMZ, JKI), Italy (CNR), Slovakia (BMC SAS) and South Africa (ARC). Up to now, approximately 400 plant virus isolates and derived products can be found in the web-based EVA-G Catalogue and are publicly available.

S5 OP5

SHRIMP WASTE EXTRACTS: A PROMISING OPTION FOR THE CONTROL OF FUNGAL AND OOMYCETE PLANT PATHOGENS

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Phytopathogenic fungi and oomycetes are responsible for many serious diseases that affect agricultural production both in pre- and post-harvest, resulting in severe economic losses, especially in countries with agricultural-based economies. To minimize production losses and maintain crop sustainability, various strategies have been adopted over time that are based on agronomic, genetic, physical, chemical or biological means. Due to their marked effectiveness and ease of application, synthetic fungicides are still largely used to control plant diseases. However, the green-economy model pursued by the EU aims at a drastic reduction in their use in agriculture. In order to meet the growing demand for products that can substitute synthetic fungicides and to conform to a circular economy strategy, over the past few years the research has focused on non-toxic and ecofriendly natural substances resulting from food wastes. This study evaluated the fungicide efficacy of an extract obtained from the minimal processing of shrimp (*Parapenaeus longirostris*) wastes with nitric acid. It was tested on major fungal and oomycete plant pathogens, including *Alternaria, Colletotrichum, Fusarium, Penicillium, Plenodomus and Phytophthora* species. In vitro tests the shrimp extract showed a marked inhibitory activity toward all the tested fungal and oomycete pathogens. The value of MIC for all tested pathogens was in the range of 2 to 3.5%. The shrimp extract was also tested in vivo on citrus (oranges and lemons) and apple fruits artificially inoculated with *Penicillium digitatum and P. expansum*, respectively. Overall, the treatment with the extract significantly reduced the severity of rots in all tested fruit species. The inhibitory activity of shrimp waste extract against a broad range of fungal and oomycete pathogens appears very promising. Based on preliminary results, the antifungal activity of this natural product could be exploited in the management of post-harvest fruit rots.

S5 OP6

INDUCTION SYSTEMIC RESISTANCE AS A COMPONENT OF THE COMPOST SUPPRESSIVENESS TO REDUCE WILD ROCKET TRACHEOFUSARIOSIS

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Wilting caused by the fungal pathogen *Fusarium oxysporum f.sp. raphani* is a much-feared soil-borne disease of wild rocket (*Diplotaxis tenuifolia*), due to its high economic impact. Soil sickness is one of the predisposing factors for disease occurrence and compost may have a potential as a means of control due to its suppressive properties and help reduce dependence on synthetic fungicides. Suppressiveness is the ability of a compost to create conditions unfavorable for the development of pathogenesis and the induced systemic resistance (ISR) is a defense mechanism that allows to prime plant defenses before a pathogen's attack. In particular, the ability to induce systemic resistance in the plants by a previously selected high suppressive compost, was here investigated. The most suppressive compost selected by a previous screening of wide collection, is obtained by on-farm composting 50% (dry weight) olive prunings, 15% green baby-leaf vegetable leftover and 35% green tomato plant residues. The experiments were performed by inoculating wild rocket plants, previously grown for 2 weeks on peat, compost or compost biofortified with spores (10^6 conidia mL^{-1}) of a *Trichoderma harzanium* strain TH23, with *F. oxysporum f.sp. raphani* by dipping root systems in conidia water suspension (10^6 conidia mL^{-1}) of the pathogen. Inoculated plantlets, then, were transplanted onto sterile peat, and the disease course was followed for the successive two weeks. Uninoculated plants were used as reference control. The experiment was repeated three times. Treatment with compost and *Trichoderma*-biofortified compost leads to an improvement of plant health status by decreasing the degree of disease in comparison to the control plants previously grown on sterile peat only. Findings suggest that ISR may be a valuable mechanism contributing to the overall suppressiveness of the compost exploitable to reduce development of endophytic pathogens, such as *F. oxysporum f.sp. raphani*.

S5 OP7

ISOLATION AND CHARACTERIZATION OF ENDOPHYTIC BACTERIA ASSOCIATED WITH LENTIL ROOT NODULES

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Legumes contribute to soil fertility by symbiotically interacting with nitrogen-fixing rhizobia in root nodules. Some bacterial endophytes can coexist with rhizobia in nodules and may support legumes, helping to establish a symbiotic relationship with rhizobia, providing stress tolerance, producing plant hormones that stimulate growth, and increasing plant nutrient uptake. In this study, we isolated and characterized bacterial endophytes associated with *Lens culinaris* root nodules grown in intercropping with *Triticum durum*. Based on molecular and biochemical *in vitro* characterization, we chose promising plant growth-promoting (PGP) strains. In detail, a total of 26 endophytic bacteria was isolated from surface-sterilized lentil root nodules, and total DNA was extracted. Amplification of the 16S rDNA sequence was used to identify the isolated bacteria, and a phylogenetic analysis was inferred leading to the identification of 10 bacterial genera. The strains were molecularly characterized by using specific primer pairs to assess the presence of genes related to 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase and nitrogenase (*nifh2*). In addition, the endophytic strains were biochemically characterized *in vitro* for the ability to produce indole acetic acid and ACC deaminase, along with inorganic phosphate solubilization. Six strains were chosen based on their PGP traits. Their growth was evaluated on nutrient media containing varying concentrations of NaCl (0.5%, 2.5%, 5%, 7.5%, and 10%) to test their tolerance to salinity, and different concentrations of polyethylene glycol (PEG) 6000 (10%, 20%, 30%, 40%, and 50%) to test their tolerance to osmotic stress. The phenotypic characterization allowed the selection of three bacterial strains (*Pseudomonas koreensis* 19NL2, *Bacillus megaterium* 11NL3, and *Bacillus* sp. 19NL1) with promising PGP traits that are tolerant to salinity (5-10% NaCl) and osmotic stress (40-50% PEG 6000). Further genotypic characterization is being carried out, and future research will focus on testing these PGP strains *in planta* under saline and water stress conditions.

S5 OP8

A MOLECULAR METHOD FOR THE RAPID DETECTION OF A STRAIN OF *METSCHNIKOWIA PULCHERRIMA* DURING GRAPEVINE BIOCONTROL

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Microbial biocontrol is a biological strategy receiving increasing interest as a sustainable innovation, effective for preventing and managing crop diseases and food spoilage arising from microbial contamination. The work hereby presented was carried out within a research project focusing on bio-protection against *Botrytis cinerea*, in the context of post-harvest biocontrol on fruits. Among biocontrol agents, non-*Saccharomyces* yeasts have recently gained attention in the wine industry for their ability to enhance organoleptic characteristics and, at the same time, for their bioprotective activity which can reduce the need for the use of chemical preservatives. A species with great potential as a bioprotective agent is *Metschnikowia pulcherrima,* which was proven able to inhibit the growth of spoilage microorganisms through various mechanisms. In this work, a specific strain of *M. pulcherrima,* previously selected for its potential to inhibit *B. cinerea,* was tested in post-harvest conditions. Its ability to persist throughout the withering period of grapes for *Passito* wine production has been investigated for the inhibition of *B. cinerea* in real-winemaking conditions. In order to rapidly assess persistence during withering via PCR, a pair of strain-specific primers was designed to differentiate the experimental strain from other strains of *Metschnikowia,* possibly present in the environment since the *M. pulcherrima* clade is common in the winemaking environment. The proposed molecular method, indeed, consists of a rapid technique based on an optimized protocol of colony-PCR with primers designed through *in silico* comparison of different nucleotide sequences of a specific region that allows differentiation with the type strain of the same species and other closely related species due to a SNP. The application of the strain-specific PCR showed that the strain applied persists on grapes throughout all the withering period, moreover its ability to inhibit *B. cinerea* was confirmed compared with the untreated control.

S5 OP9

KNOCKING ON CELL'S DOOR: MOLECULAR CASCADES TRIGGERED BY POWDERY MILDEW INFECTION IN GRAPE

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Grapevine defends itself against pathogenic attacks using a complex molecular system whose components and interactions are not fully known. Of all the molecular components, the LysM receptor kinases (LYK) receptors can recognize fungal elicitors and initiate the PTI (PAMP-Triggered-Immunity) response by intracellular signaling. These proteins with three lysine motif domains (LysM) bind chitin oligosaccharides at the apoplast level of infected cells. The aim of the present study is the study of the function and variability of LYK genes and proteins in grapevine. Exploiting genomic and transcriptomic data the grapevine family of LYK was annotated and their gene expression profiles were characterized. Phylogenetic analysis clearly distinguished three *V. vinifera* LysM-RKs (VvLYKs) located in the same clade as the *Arabidopsis* CHITIN ELICITOR RECEPTOR KINASE1 (AtCERK1), which mediates chitin-induced immune responses. The Arabidopsis mutant Atcerk1, impaired in chitin perception, was transformed with the three putative orthologous genes encoding VvLYK1-1, -2, or -3 to determine if they would complement the loss of AtCERK1 function. Our results provide evidence that VvLYK1-1 and VvLYK1-2, but not VvLYK1-3, functionally complement the Atcerk1 mutant by restoring chitooligosaccharide-induced MAPK activation and immune gene expression. Moreover, to understand the mechanism of action of LYKs for triggering PTI, we investigated the interaction between LYKs proteins using the yeast-two-hybrid approach. Our results showed that among the LYKs found in grapes, VvLYK1-1, VvLYK4-2, and VvLYK5-1 can interact each other. Overall, our study provides food for thought on improving the sustainability of viticulture by integrating genetic and biotechnological strategies for pathogen resistance identifying new genetic resources for future breeding programs.

S5 OP10

MICROALGAL BIOSTIMULANTS TO IMPROVE THE RED CHARD CULTIVATION SUSTAINABILITY

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Microalgae are attracting the interest of agrochemical industries and farmers due to their biostimulant and biofertilizer properties. Many studies have indicated that microalgae contain certain substances that promote plant growth such as auxins, cytokinins, betaines, amino acids, vitamins and polyamines (Stirk et al., 2013). The use of microalgal biostimulants could be an eco-sustainable solution able to cope with abiotic stress and improve the agronomic, physiological and qualitative performance of crops. In the present study the effects of 5 microalgae have been analyzed: *Isochrysis galbana, Nannochloropsis gaditana, Porphyridium sp., Spirulina spp. and Tetraselmis suecica* applied as foliar spray weekly on red chard, a crop of marked interest in the IV range agriculture sector. During crop cycle, several surveys were carried out, which demonstrated a biostimulant effect of microalgae. From the agronomic point of view, was noted that treatments with microalgae led to an increase in the fresh weight of the leaves and in particular the treatment with *Isochrysis galbana* diluted 1:100 v/v. The same treatment reported excellent results in terms of leaf area, a parameter that together with the fresh weight of the leaves determines greater appreciation on the market. From a qualitative and physiological point of view, was noted that once again the treatment with *Isochrysis galbana* (1:100) caused the reduced water losses by reporting statistically lower stomatal conductance values than the other theses, and at the same time optimizing nitrogen use efficiency and crop water productivity. The surprising effect of microalgae on agronomic, physiological and quality parameters has also been observed in previous studies conducted on other baby leaf species, but at the same time, further research is needed to better understand their potentials.

S5 OP11

RELATION BETWEEN THE AGE AND THE TREND OF PARASITIZATION FOR THE HOUSEFLY PUPAL PARASITOIDS *SPALANGIA CAMERONI* AND *MUSCIDIFURAX ZARAPTOR*

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Musca domestica (Diptera, Muscidae) is a significant pest in livestock farms and a major concern for both humans and farmed animals due to its ability to transmit over 100 pathogens. The use of pupal parasitoids is a sustainable strategy for controlling this pest. *Spalangia cameroni* and *Muscidifurax zaraptor* (Hymenoptera, Pteromalidae) are commonly used as biocontrol agents for *M. domestica*. In this study, the aim was to determine the oviposition peak of the female parasitoids in relation to their age and the sex ratio of the newly emerged adults. 20 fresh pupae of *M. domestica* (24-48h) were supplied daily to each fertilized female for 14 days for both species and subsequently checked for parasitoid emergence. A control group of 20 pupae without female parasitoids was maintained. Results showed that *S. cameroni* had a higher overall percentage of parasitization (57.71%) compared to *M. zaraptor* (32.41%). The parasitization trend of *S. cameroni* remained almost constant throughout the 14-day period, while that of *M. zaraptor* decreased drastically after the 12th day. Peak oviposition for *S. cameroni* was on day 5 with 13 parasitized pupae, while *M. zaraptor* parasitized 8 pupae/day in 4 days during its peak oviposition period (between 4th and 8th day). The newly emerged parasitoids had a skewed sex ratio towards females: 81% for *S. cameroni* and 66% for *M. zaraptor*. The presence of these parasitoid species resulted in fewer new housefly emergences than in the control group, where natural pupal mortality was lower in the absence of parasitoids. This information may be invaluable in optimizing the mass production and time-use of the two parasitoid species for effective biocontrol of houseflies in livestock farms.

S5 OP12

CHARACTERIZING MICROBIAL COMMUNITIES IN THE FOOD INDUSTRY THROUGH METAGENOMICS: A STRATEGY FOR ENSURING FOOD QUALITY AND SAFETY

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In the food industry, the processing environment (including tools and machines) is routinely cleaned and disinfected to remove food residuals and control the microbial population, which might influence the quality and safety of the products. However, some microbes might overcome sanitation and become specific to the processing plant. Currently, sanitation efficacy is mainly assessed through the cultivation of microorganisms collected from surfaces on agar media, which is slow and unable to detect several strains. Therefore, we tested the resolution and the efficacy of a procedure aiming to map the microbiome associated with the production environment of different industrial settings, i.e., minimally processed vegetables producing facilities, slaughterhouses and cheesemaking industries. Swabs were collected from sanitized surfaces and equipment, then we adopted a low-biomass tailored protocol to extract the microbial DNA, which was further shotgun-sequenced. Overall >1300 samples from 78 facilities were collected. Spoilage/pathogenic or pro-technologic Metagenome-Assembled Genomes (MAGs) were reconstructed from surfaces and further characterized. Also, bioinformatics tools lead us to highlight that food processing environments host selected microbiomes with a wide range of transferable virulence traits and antimicrobial resistance genes potentially dangerous to human health. On the other hand, we detected environmentally selected facility-specific strains in cheesemaking industries potentially contributing to shaping the sensorial profile of cheeses. In conclusion, we described in depth the communities residing in food industries, also deciphering their metabolic potential. Therefore, this procedure might support quality and safety management plans, making the food industry more sustainable by reducing spoilage-caused food loss.

S6 OP1

EFFECTS OF SHADING ON THE YIELD, MORPHOLOGY, AND PHYSIOLOGY OF FOUR TYPES OF LETTUCE GROWN IN A MEDITERRANEAN ENVIRONMENT

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Lettuce (*Lactuca sativa* L.) is a leafy vegetable with several varieties with a predominantly spring-spring outdoor cycle in southern Italian climates. The high year-round demand for this vegetable requires production under protected crops, usually carried out in tunnel greenhouses. However, high temperatures can compromise summer lettuce production, requiring adopting tolerant types and practical agronomic strategies such as shading. The research aimed to evaluate the morpho-physiological changes and production response of four different lettuce types ('Ballerina', Canasta', 'Oak Leaf' and 'Romana') grown in a greenhouse under white shade netting at 49% shading in comparison to an unshaded control. At harvest, yield parameters and some morpho-physiological characteristics of the leaves were determined. Under shaded conditions, the yield of 'Ballerina', 'Oak Leaf' and 'Romana' increased compared with the control, while stomatal density decreased. In contrast, 'Canasta' showed increased fresh and dry biomass production, higher water use efficiency (ratio of net CO2 assimilation to transpiration) and lower stomatal density in control compared with the shaded thesis. In general, 'Canasta' showed more effective adaptive mechanisms to high temperatures and strong summer irradiances, resulting in the best production performance. Using a white shading net proved to be a suitable agronomic practice to improve the production performance in the protected crop in the summer of the more sensitive 'Ballerina', 'Oakleaf' and 'Romana'.

S6 OP2

AIR POLLUTANTS REMOVAL AND URBAN FORESTS IN MUNICIPALITY OF CAMPOBASSO

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Urban areas are characterized by high levels of air pollutions caused by anthropogenic sources. The urban forests are the major provider of multiple ecosystem services able to improve and maintain human well-being. This work aims to assess the capacity of the urban forest of Monte Sant'Antonio, in Campobasso city (IT), to remove air pollutants and atmospheric carbon. For this purpose, the pollutant absorption modelling tool called i-Tree Eco (v.6) was used. This area was affected by four reforestation activities that have created four different stands, mainly composed of Pinus nigra, Cupressus sempervirens and Fraxinus ornus, which cover about 13 ha. The absorption capacity of stands, called '61, '75, '81 and Adulte (respectively in accordance with the year of planting), have been studied. The analysis of the values per hectare shows that the stand with the highest sequestration capacity is '81 with 16691.71 kg·ha-1·yr-1of air pollutants removed. The results obtained by i-Tree Eco were compared to results obtained by using allometric equations constructed for Italian National Inventory. The comparison took place following the definition of linear regression models that contained the total tree biomass as an independent variable. In general, it can be saidthat all models have found a very good correlation (r2 between 0.66 and 0.92) and that the trend is very similar. The variation over time in the removal capacity of air pollutants by Pinus nigra and Fraxinus ornus, species present in all four stands, was also analyzed. Moreover, the comparison showed that there is a slight tendency for the air pollutant removal capacity to increase with increasing age. From the results obtained, we can say that when planning urban forests, it is important to consider the specific composition and diversity of air pollutant removal capacity and how it varies over time, to optimize this ecosystem service.

S6 OP3

EVIDENCE OF THE IMPACTS OF POLYETHYLENE MICROPLASTIC SOIL POLLUTION ON THE GROWTH AND PHYSIOLOGY OF STRAWBERRY PLANTS (*FRAGARIA X ANANASSA VAR. ALBA*) AND FRUIT QUALITY

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Strawberries are commonly cultivated in open field, using polyethylene mulching films to prevent weed growth. Mulching films are usually susceptible to wear and tear and breakage, releasing fragments of a range of sizes until microplastics (MPs; 100 nm-5000 µm), and nanoplastics (NPs; 1-100 nm). This study aims to investigate biometric, physiological, and biochemical responses of strawberry plants and fruit (*Fragaria x ananassa* var. Alba) to MPs soil pollution. Strawberry plants were grown in natural soil contaminated with 0.2 or 0.02% (w/w) polyethylene MPs with two different sizes (i.e., maximum diameter of 35 µm or 125 µm), to be compared with plants grown in uncontaminated soil (CNT). Plants treated with 35 µm/0.2% showed the most prominent effects by MPs in terms of plant physiology compared to CNT. Indeed, in plants subjected to 35µm/0.2%, it was observed a decrease in net photosynthesis (Pn; –26.21%) and stomatal conductance (gs; –17.77%), and an increase in oxidative stress (measured by H2O2 and lipid peroxidation level), especially at the root level (+59.11 and +20.75% respectively) compared to CNT. Similarly, the impact on fruit production was more severe for plants grown with 35 µm/0.2%, with a reduction in the production of strawberries per plant (-60%), a drop of fruit size (–21.78%) and weight (–41.9%), and a decrease in anthocyanin (–24.94%) and soluble solid contents (–9.78%) compared to CNT. Therefore, it might be concluded that the smallest size of MPs at the highest concentration (i.e., 35 µm/0.2%) induced major effects on plants and impaired strongly fruit production/quality with respect to the higher-sized MPs utilized in the present experiment. Further investigations are needed to confirm the effects of MPs and elucidate the mechanism by which they influence plant physiology and growth.

S6 OP4

TRIFOLIUM REPENS L. AND *LOTUS CORNICULATUS* L. LIVING MULCHES IMPROVE THE NUTRACEUTICAL VALUE OF ORGANIC BROCCOLI

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Intensive tillage exposes the soil to wind and water erosion, deteriorates soil structure and accelerates organic carbon loss. The adoption of legume living mulches (LMs) can represent a successful agroecological solution to manage conservation agriculture in organic vegetable systems. In this study we investigated the effects of LMs on the production and phytochemical compounds and nutraceutical properties including chlorophylls, phenolic compounds, vitamin C, glucosinolates and antioxidant activity on broccoli inflorescence. For this purpose, a plot experiment was carried out on an organic field near Pisa, testing the perennial living mulches Trifolium repens (TFREP) and Lotus corniculatus (LOTCO). The control plots (CNT) were managed according to the standard cultivation of organic broccoli. Results showed that living mulch of LOCTO and TFREP determined a marketable biomass (dry weight) reduction respectively by the 23% and 39% compared with CNT. Phenolic content and antioxidant activity was significantly higher in broccoli grown in presence of LOTCO than CNT, whereas chlorophyll and total glucosinolate content was negatively affected by LMs. Five glucosinolates were identified in broccoli inflorescence: glucoraphanin, 4-methoxyglucobrassicin, 4-hydroxyglucobrassicin, glucobrassicin and neoglucobrassicin. Glucobrassicin and derivatives (except for 4-hydroxyglucobrassicin) were lower in mulched broccoli than CNT, whereas glucoraphanin did not show significant differences when compared to CNTs. 4-hydroxyglucobrassicin resulted lower only in mulched broccoli with TFREP. The reduction of molecules as neoglucobrassicin can be considered as a positive effect of the LMs application, since in presence of myrosinase, the enzyme contained in broccoli and activated upon chewing, neoglucobrassicin breakdown products can inhibit glucoraphanin mediated stimulation of antioxidant responses and may have mutagenic activity. Future investigations are needed to understand how to compensate for the yield loss and determine the physiological and biochemical mechanisms by which LMs induce the selective reduction of glucosinolate content. In this way, the application of sustainable agroecological practices can concomitantly increase the level of health-promoting compounds deriving by glucosinolates as thiocyanates and isothiocyanates and to diminish the presence of undesirable compounds such as neoglucobrassicin.

S6 OP5

UPVALUING CHESTNUT FLOUR FOR GLUTEN FREE PRODUCT DEVELOPMENT

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After a period of production crisis related to social and phytopathological aspects, the cultivation of the Chestnut tree in Italy has been gaining some interest in food processes. Its nutritional characteristics, including the presence of fiber and antioxidant compounds, make this fruit an interesting ingredient for the development of food products; in addition, the absence of gluten drives its use in the production of gluten-free foods. This work aimed to expand the knowledge about the characteristics of flour from two varieties of chestnuts (Balestrera and Rossera) and their suitability for the production of gluten-free pasta and crackers. Results showed lower fiber (7.8%) and lipid (3.3%) content in the Balestrera variety than in the Rossera variety (10.1% and 4.5%, respectively) but higher starch (43.0% vs. 38.5%) and protein (6.9% vs. 5.5%). Regarding the starch fraction, the two varieties show different pasting properties, suggesting a greater tendency for the Balestrera variety to gelatinize and retrogradate, thus forming a gel with a different consistency. However, such differences did not affect the considered products. Indeed, the second phase of the work focused on the development of gluten-free pasta and crackers with 15% and 25% of chestnut flour. Regarding fresh pasta, the addition of chestnut flour decreased the optimal cooking time (and consequently water-absorbing capacity) and firmness. However, at 25% enrichment level, fresh pasta showed less cooking loss compared to the control and pasta enriched with 15% of chestnut probably as a result of reduced cooking time. As for crackers, neither the variety used, nor the enrichment level had a significant impact on the product quality. Project partially funded under the National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 Investment1.3 -Call for tender No. 341 of 15/03/2022 of Italian Ministry of University and Research funded by the European Union –NextGenerationEU.

S6 OP6

ASSESSING YIELD AND QUALITY OF EGGPLANT (*SOLANUM MELONGENA* L.) IMPROVED BY BIODEGRADABLE MULCHING FILM

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Low-density polyethylene (LDPE) mulch films have an important function, but at the end of their life they pose an economic and environmental problem in terms of removal. Biodegradable mulch films are an alternative to LDPE to avoid these environmental problems. This research was conducted to evaluate the effects of biodegradable films for mulching on the morphological and physiological characteristics, fruit yield and quality performance of the hybrid eggplant "Mirabelle F1", grown in open fields, in southern Italy. Four mulching treatments (two black biodegradable MaterBi films, MB22N1 and MB22N4, 15 µm thick; black polyethylene film, LDPE, 50 µm thick; unmulched control) were compared using a randomized complete block design with three replicas. Throughout the crop cycle, in addition to the thermopluviometric conditions, the soil temperature was monitored at 5 cm, with respect to the ground level, under the mulch sheets. The average soil temperature under LDPE was higher (about 1°C) than that under MaterBI films and they had a greater effect during the night with differences between 2.5 and 3°C. The biodegradable mulching films, together with the non-mulched control, have led to an improvement in the morphological and physiological characteristics of the plants. The commercial yield was higher in the MaterBi films, while lower yields were found in the non-mulched theses. Regard to the qualitative characteristics of the fruit, the LDPE film determined a higher content of vitamin C and a greater consistency of the fruit, MB22N1 a greater content of IAA (Lipophilic Antioxidant Activity), while the MB22N4 film a greater content of chlorophyll a+b. No differences were found between all the compared theses for the coordinates of the color and dry matter of the fruits. Biodegradable mulching films have improved the conditions of growth, yield and some qualitative parameters of the fruit, showing suitable characteristics and allowing for simpler and more sustainable management of the same at the end of the eggplant crop cycle.

S6 OP7

IMPACT OF CERTIFICATIONS, PRICE, NUTRITIONAL CLAIM AND COLOUR ATTRIBUTES ON CONSUMER CHOICES OF TOMATOES

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Organic farming is the most popular approach to avoid pesticides in food, but given the constraints of organic standard, private standards are emerging, such as "residue-free", which limits the pesticides residues on the final product. Since tomatoes are among the Italian vegetables where "residue-free" certification is more likely to be found, they have been chosen as a case study. Moreover, nutritional claims as "nickel free" and the popularity of novel colour varieties are becoming increasingly relevant to tomato. The objective of the study is to assess the impact consumers place on the following attributes of tomatoes: certifications (none, organic or residue-free), price, nickel-free (presence or absence of the nutritional claim), and colour (red or yellow). To the authors' knowledge, this attribute combination has never been tested for tomato. Moreover, the study aims at identifying homogeneous profiles of consumers based on their individual utility pattern. Data were collected employing a multi-section survey, and a ranking conjoint experiment based on linear assumption was performed. An orthogonal design was used to deal with model and response efficiency and subsequently a cluster analysis using wards method was performed. The conjoint mean relative importance scores identified certifications as the most important aspect, followed by price, nickel-free, and colour. Utility scores reveal greater utility for organic certified tomatoes. Intermediate price and nickel-free products provide similar utility to consumers, suggesting that they have a similar role in product differentiation, followed by residue-free tomatoes and lastly by red tomatoes. Cluster analysis identified three groups of consumers: price-sensitive, organic and nickel free-oriented and organic-oriented whatever the price. The study reveals a focus on organic certification, preferred since more familiar than residue-free certification, which results promising nonetheless. Consumer awareness actions are needed to broaden the "residue-free" certification prospect, without forgetting the impactful role of other attributes, in particular of price.

S6 OP8

QUALITY STANDARDS AND CONTRACTUAL TERMS AFFECTING FOOD LOSSES: THE PERSPECTIVE OF PRODUCER ORGANIZATIONS IN ITALY

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Most research on food loss and waste has focused on the downstream stages of the supply chain so far, while data about food loss in the upstream stages are scarcer (Caldeira et al, 2019). Roots, tubers and fruits and vegetables (F&V) are the products that are lost most often from post-harvest to distribution, with a loss between 20 and 25% of produce for F&V (FAO, 2019; pag 9). The aim of this work is to analyse how contractual terms and quality standards imposed by buyers (in particular, retailers and food industry) affect food loss in the post-harvest phase of the F&V supply chain. Three semi structured interviews have been conducted with Producers' Organizations (POs) from different Italian regions, and their answers are analysed with a qualitative content analysis approach through the MAXQDA.From the interviews, the most relevant issues affecting food loss generation in the interface between POs and buyers (industry and retailers) are disclosed. The respondents agree that retailers' cosmetic specification on F&V products are a main cause of food losses. These standards, that are typically stricter with respect to those imposed by the law, generate significant amounts of suboptimal products which are likely to become waste in absence of alternative markets. Another issue is the structure of contracts regulating commercial transactions between POs, industry and retailers. Retailers hold a great bargaining power and tend to impose the conditions most favourable for them during the negotiation of contracts (Herzberg, R. et al, 2022). The key role of POs in the post-harvest phase of the supply chain is also underlined: planning and managing different products and increasing farmers' bargaining power against the buyers. Prices, however, are seen as fair by the POs and farmers in interactions with retailers (and to a minor extent, the industry).

S6 OP9

IRRIGATING WITH WASTEWATER - RISKS OR ADVANTAGES? A PILOT-SCALE STUDY ON TOMATO (*SOLANUM LYCOPERSICUM* L.)

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The reuse of treated wastewater has been identified as a pivotal strategy in semi-arid areas with water shortages or increased consumption. Nonetheless, the presence of emerging contaminants (ECs) such as pharmaceuticals and personal care products causes concern for human health and the environment. An experiment was conducted in Southern Italy to investigate the uptake phases, accumulation, and translocation processes of ECs in tomato (*Solanum lycopersicum* L.cv Taylor F1) production irrigated with treated wastewater. Moreover, the human and ecotoxicological impacts of chemicals was investigated. Tomato plants were grown in lysimetric weighing tanks (0.8 m^3) during the period June-September 2021. The experiment involved three irrigation strategies: i) irrigation using conventional water ('FW'); ii) irrigation with treated wastewater additionally refined with the target contaminants in a dose comparable to the European average (TWWx1); iii) irrigation wastewater treated and refined with emerging contaminants in a triple dose (TWWx3). Considering the various balance items, the results showed a different behavior of ECs, and homogeneity between the 'TWWx1' and 'TWWx3' strategies. Specifically, in the 'TWWx3' strategy, Clarithromycin (antibiotic), Carbamazepine (anti-epileptic), Metoprolol (beta-blocker), Fluconazole, and Climbazole (antifungals) showed an interaction with the soil-plant system, most markedly for Carbamazepine and Fluconazole, which presented degradation percentages of 53% and 11% respectively, soil accumulation percentages of 39% and 70%, and plant accumulation percentages of 5%. The opposite behavior was found for Naproxen, Ketoprofen (anti-inflammatory), Sulfamethoxazole, Diclofenac, and Trimethoprim (antibiotics), the whose results showed degradation. This study showed a risk of active uptake of some ECs by the plant. In the period from June to September 2022, the study was repeated using the same methodology. The results from an agronomic point of view showed a

significant increase in yield in plants irrigated with wastewater (‘TWWx1’; ‘TWWx3’), compared to plants irrigated with conventional water ('FW'), which is attributable to a higher presence of nutrients in this water. Although partial, these results highlight benefits but also potential risks. Future studies will be indispensable to define guidelines for responsible water reuse.

S6 OP10

ASSESSMENT OF LEAF WATER POTENTIAL AND STOMATAL CONDUCTANCE TO DEFINE EARLY SIGNS OF STRESS IN *CORYLUS AVELLANA*

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Corylus avellana is a species highly susceptible to water stresses due to vapor pressure deficit and high temperature. The transpiration process is strongly constrained even in good water availability in the soil. Low relative air humidity values combined with high temperatures and intense solar radiation result in reduced leaf transpiration, which cause leaf edge burning in dry and hot winds. The high sensitivity to water stresses, due to ineffective resistance mechanisms, indicates the need to identify early indicators of stress that are easy to measure, effective and efficient. The research, in Corylus avellana var. 'McDonald', explored the possibility of using stomatal conductance and leaf water potentials as early indicators of stress. For this purpose, leaf values were evaluated with different exposure to the four cardinal points and at different times of the day, under irrigated and unirrigated conditions. The research examined, in the irrigated treatment, the trends in stomatal conductance and leaf water potential for three successive irrigation cycles, under conditions of increasing, but always relatively mild water stress. Similar measurements were conducted in the non-irrigated treatment. The results showed that stomatal conductance takes statistically different values between the two treatments. Hazelnut trees rapidly reduced leaf stomatal conductance when the vapor pressure deficit was between 2 and 2.5 kPa in both irrigated and non-irrigated trees, even with good water availability. This suggests leaf stomatal conductance can be an efficient and effective early indicator of stress. In addition, the results suggest measuring the stomatal conductance of leaves on the west and north aspects of the canopy, where they assumed lower and higher values respectively. Leaf and stem water potential values increase during the measurement period and show a strong correlation, but their mean values do not show statistically significant differences between treatments. In our experimental conditions, stomatal conductance provided earlier indication of stress than water potential The results obtained are of methodological importance for the future design of research plans.

S6 OP11

PLANT EXTRACT IMPROVE THE QUALITY OF GREEN AND RED LETTUCE CULTIVARS

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The use of biostimulant products in agriculture has been rapidly growing in the recent years, due to their positive effects on crop yield and product quality. Therefore, in the present study we evaluated the efficacy of a plant-derived biostimulants, obtained from the maceration of borage (*Borago officinalis*, L) flowers on two lettuce cultivars, namely a green (*Lactuca sativa* L. cv. Expertise RZ) and red (*Lactuca sativa* L. cv. Codex RZ) Salanova®. The research work was focused on physiological traits during plant growth and on primary and secondary metabolism at harvest. Foliar applications of the plant extract did not affect the primary metabolism and the accumulation of total sugars was not altered in both cultivars. However, the lettuce head weight was negatively affected by the extract application in green cultivar whereas it did not change in the red one. The nitrogen-flavonol index (NFI) significantly increased after the third application of borage extract in both cultivars, suggesting an improvement of nitrogen nutrition status or reduce stress condition of lettuce. A different response resulted in term of maximum quantum efficiency of PSII (Fv/Fm ratio), performance index (PI), nitrate, and anthocyanin accumulation in leaves. The Fv/Fm significantly increased in green lettuce cultivar after the first application and at harvest. The PI showed a slight but not significant growth at the same time points. On the contrary, the PI was significantly higher in red lettuce cultivar after the third application. Interestingly, the borage extract induced a significant decrease of nitrate accumulation in lettuce leaves of the red cultivar. At the same time a positive variation of anthocyanin content was observed in red lettuce. The application of biostimulant products might improve the quality of some lettuce varieties as regards the accumulation of metabolites useful for the plant to overcome stress conditions and fundamental in human healthy diet.

S6 OP12

EUSTRESS AND BIOFORTIFICATION: EFFECTS ON *MENTHA × PIPERITA* L.

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Selenium is an essential micronutrient for humans. It is introduced into the animal's diet through plant tissues. However, the availability of Se in the soil can vary greatly depending on geographical region and agricultural practices, resulting in differences in the amount of Se present in plants. Se deficiency in animals can result from a Se-deficient diet or from factors such as climate and antinutritional compounds that interfere with Se uptake. Biofortification and eustress techniques can be used to increase Se concentration in plants. In this study, salinity eustress and Se biofortification were used to increase Se content in plants. The experiment was conducted using peppermint (*Mentha × piperita* L. var. *officinalis* forma *rubescens* Camus) plants. Sodium selenate (1 mg L^{-1}) and/or sodium chloride, (10 mmol L^{-1}) were used to fortify the plants, while control plants were grown without the addition of either salt or selenium. The cultivation was carried out in a glasshouse using a Floating Growing System. Biometric data, yield, micro-macroelement content, total phenol and chlorophyll content, and activities of catalase (EC 1.11.1.6), ascorbate peroxidase (EC 1.11.1.11) and guaiacol peroxidase (EC 1.11.1.7) were evaluated. The results showed a higher uptake of Se by the plants grown with Se (ca. 30 mg kg^{-1} DM) compared to the plants grown under control plants (0.5 mg kg^{-1} DM). Furthermore, plants grown with the simultaneous presence of sodium chloride and Se absorbed 25% more Se than plants with Se alone. Increasing the market supply of fresh foods biofortified with. Se may help reduce the occurrence of chronic diseases related to Se deficiency. In addition, increasing. Se in plants under saline conditions may help mitigate future challenges related to the reduction of available drinking water due to the increased salinity in rivers and groundwater that may result from current climate change.

S1 P1

AGRO-BIODIVERSITY VALORIZATION PATHS AND FARMERS' PROPENSITY TO INTRODUCE NATIVE GENETIC RESOURCES

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Agrobiodiversity is a part of the whole variability of life forms or variety of organisms and represents the diversity of cultivated agricultural systems. Since the adoption of agrobiodiversity produces a flow of goods and services, the term "genetic resource" has been adopted, which highlights how biodiversity can determine value for food and agriculture. It is estimated that, in recent decades, 75% of the genetic diversity of agricultural crops has been lost (FAO website). The disappearance of local varieties is accompanied, at the same time, by a strong loss of agricultural, historical, and cultural wealth The local varieties have been maintained until today thanks to the multiplication/conservation action of the farmers and the exchange of seeds and/or other vegetative propagation material between them. This exchange was also accompanied by information on uses and traditions. The role of farmers is therefore fundamental for the conservation of genetic resources. To evaluate the commitment of agricultural operators to halt biodiversity loss, the study aims to analyze the propensity and the intention of farmers to introduce agrobiodiversity on their farms The factors that interact with the choice of crop can be of economic, social, and environmental reasons. Therefore, we have chosen to use a widely adopted theoretical framework to explain human behavior, the “Planned Behavior Theory” (TPB). With the aim of understanding the factors that influence farmers' intentions, a questionnaire based on the extension of the three determinants postulated by the TPB was used: attitudes, social norms, and perception of control. After the interview collection phase, data will be analyzed through the Structural Equation Modeling (SEM), a model widely used to estimate relationships between latent variables. The results obtained will allow to trace the road to set up more effective valorization paths for ancient local varieties according with needs and points of view of farmers.

S1 P2

AGRICULTURE AS A DRIVER FOR SUSTAINABILITY AND THE CULTURAL VALUE OF ANCIENT TOMATOES VARIETIES: EXPLORING A BIODIVERSITY MARKETING APPROACH

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Purpose

Due to economic interests toward the production of varieties resistant to diseases, insects, and climate change, ancient tomato varieties in the Mediterranean area have been neglected causing biodiversity loss. By reversing the common view of agriculture and sustainability, this work shifts attention from investigating how to make agriculture more sustainable to how to make agriculture a driver for promoting sustainability. The hypothesis is that marketing can successfully support strategies that leverage the cultural value of biodiversity. Accordingly, the aim is this study is to explore the current interest of marketing studies for biodiversity to identify possible paths to follow for driving attention to ancient tomatoes varieties as a strategy for promoting sustainability.

Design/methodology/approach

Using a bibliometric approach (VOSviewer software) to map available knowledge, a multiple exploration of social sciences and managerial literature is conducted searching for contributions from the marketing field that focus on sustainability and biodiversity. Subsequently, literature on the well-established stream of studies on the cultural value of biodiversity is explored to identify paths to follow. Possible approaches to adopt are outlined with reference to the case of ancient tomatoes varieties.

Results

The main findings of the literature exploration indicate gaps to cover and trajectories to follow for framing a marketing strategy useful to valorize the agriculture contribution to sustainability. Specifically, the findings show that while sustainability is a well-established area of interest in the marketing studies, less attention is devoted to biodiversity, under exploiting the marketing potential of the cultural value of biodiversity. Accordingly, biodiversity marketing emerges as a promising stream to work on for framing strategies aimed at valorizing the agriculture contribution to sustainability leveraging the cultural value of ancient varieties.

Originality/value

This work proposes a reverse perspective to valorize agriculture and agricultural products as a means to the end of promoting sustainability by highlighting the little explored contribution of biodiversity marketing to enhance the cultural value of ancient tomato varieties.

S1 P3

THE ROLE OF LIVESTOCK FARMING IN THE CILENTO, VALLO DI DIANO AND ALBURNI NATIONAL PARK THROUGH AN ECONOMIC-STRUCTURAL ANALYSIS

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The research wants to deepen the current economic and structural aspects of the livestock farms in an area of the Cilento, Vallo di Diano and Alburni National Park, to identify critical issues and development opportunities. Information about the consistency and the typology of livestock farms present in the study area (GAL "Casacastra"), and the trend in the last twelve years, were acquired thought the consultation of the national livestock register of the Italian Ministry of Health. Subsequently a questionnaire was submitted to a sample of farmers to better know the characteristics of the breeders and of the husbandries. The results showed that in the study area there are 4% of the cattle and sheep herds of the Campania Region, and 7% of those with goats. The most representative farm size is the class with less than 20 animals per breeding type and between 2010 and 2022 there has been a reduction in the number of all type of analyzed husbandries. The most represented productive orientation is that for meat, while completely absent the specialization in the production of milk in sheep and goat breeding. The interviews revealed that the breeders are almost all over forty, with a middle and high school qualification but a consolidated experience. The workforce involved in the farms is mainly the family one and often breeders are people engaged in other non-agricultural activities. Despite the permanence in some cases of archaic husbandry methods, in the study area the breeders play a key role for the protection of the territory and the conservation and enhancement of local animal and plant genetic resources at risk of extinction. Anyway, their survival is linked to the development of new forms of local economy, in which the presence of institutions plays a fundamental role.

S1 P4

THE USE OF INTENSIVE GRAZING TO INCREASE PASTURE CONSUMPTION AND DECREASE THE COST OF THE FEED RATION

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Grazing is often associated with a marginal and unprofitable idea of agriculture, but if well managed it represents an extraordinary opportunity to reduce ration costs. This study was conducted at Bagaggera farm, an organic farm in northern Lombardy with a herd of 110 high-producing Camosciata dairy goats. The animals usually pasture from the beginning of April to the end of September. For years the livestock has habitually used pastures of about 1,000 or 1,500 square meters for a few hours a day. In this way, however, the pasture is not fully used. In fact, having a large surface available makes the animal more inclined to choose the most attractive plants, and increases the amount of unused pasture due to trampling or soiling. In order to maximize the grazing yield, and to include it in the normal daily ration of about 4 kg of dry matter, it was decided to introduce intensive grazing by bringing the herd to graze on small fenced areas of about 250 m^2. Furthermore, to leave more land for growing crops, areas unsuitable for cultivation either because of their location or because they are too steep are used for grazing. The animals maintained high production levels and used pasture intensively. Based on the analyses, an ingestion of pasture of about one kilogram of dry matter per head per day was estimated. During the intensive grazing period, the dry matter of the ration administered in the stable was reduced by a quarter. Specifically, during the grazing period, 320 quintals of hay were saved. This work has thus resulted in an improvement in the economic sustainability of the farm.

S1 P5

RENEWAL OF "POST-XYLELLA" AGRICULTURE IN SALENTO (ITALY) BY RECONVERSION WITH ALTERNATIVE TRADITIONAL AND INNOVATIVE WOODY CROPS

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Since the first discovery in 2013, the epidemic of *Xylella fastidiosa* subs. *pauca* ST53 in few years devastated the olive orchards of 3 provinces in Salento (Puglia, Italy) causing huge economic, landscape and environmental problems as well raising the need to rebuild the main and almost unique arboreous coverage, increasing biodiversity and resilience of the agro-ecosystem. The selection and evaluation of alternative woody agricultural and agro-forestry crops/species, native or allochthonous but potentially adaptable to the soil/climatic conditions of Salento, is the starting point to regenerate and reconvert the future agriculture co-existing with the bacterium. In the framework of a wider national project, the research is aimed to study the main traits of alternative plants in term of agronomic requirements, characteristics, cultivation, protection, uses, investments, market, strengths and weaknesses supported by comparison with local agricultural and agro-industrial businessmen. It has been selected a tree crops list of about 80 (still in progress) intensive and extensive species classifiable in already present at small scale (i.e. almond, fig), totally new (i.e. jojoba, argan) or widely cultivated in the past (i.e. caper) in Salento with the aim to contrast climate changes and soil consumption, using the ecological benefits that perennial tree crops offer. The information will be available in an accessible database and summarized in a "*reasoned catalogue*" that draws data/info from bibliographical research, specialist consulting, small farming experiences and pilot projects intercepted in the infected area, as well as to evaluate innovative crops and alternative production trends (i.e. forage from cactus pale). Furthermore, for the species new for Salento, pathogenicity tests to ST53 will be conducted, by controlled artificial/vector inoculation and molecular analyses, to verify their immunity or the level of resistance. The results are addressed to producers/technicians to guide investments as well to policy makers to define strategies and related funding measures.

S1 P6

MORPHO-PHYSIOLOGICAL CHARACTERIZATION OF LANDRACES OF *PISUM SATIVUM* L.

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The aim of this work was to morpho-physiologically characterize four genetic autochthonous resources of *Pisum sativum* L.: 'Centogiorni', 'Santacroce acc. M', 'Santacroce acc.T' and 'Cornettone'. This work was possible thanks to the funding Campania Regional Development Program 2014-2020. To enrich the regional germplasm of autochthonous resources, including some belonging to the Pisum species. The experimental test was carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the varieties and for the conduct of the examination. To test the Distinctness, Uniformity and Stability (DUS-test) of the four varieties an experimentation was carried out in the field, in ex-situ mode, for three number of growing cycles (2019-2020-2021). The GlBA's n.32 guideline was used for the morphological characterization and Lavagna, Cornetto, Espresso generoso and Santacroce napoletano referment varieties were used. At the end of the three growing cycles, 852 plants were examined. Ten descriptors showed the same level of expression in the genotype compared. The remaining characters were the subject of a Multiple Correspondence Analysis (ACM), performed with IBM SPSS version 28 software. The analysis provided a model with good statistical reliability showed by the high value of Cronbach's Alpha index (0 888) [0 900 first dimension and 0 873 second dimension]. Distinctness, uniformity, and stability were detected in Santacroce acc T, while these requirements were not detected in the other three autochthonous resources. However, a table of Characteristics have been drawn up for the four resources and uploaded to the institutional website of the Campania region www.genidellacampania.eu. The breeding has provided for crop and phytosanitary treatments carried out respecting the soil and climate of the area being cultivated for an increasingly sustainable agriculture, useful for soil conservation and enhancement.

S1 P7

MORPHOPHYSIOLOGICAL CHARACTERIZATION OF THE LANDRACE MARACUOCCIOLO (*LATHYRUS CICERA* L.)

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The Campania Regional Development Program 2014-2020 funded Crea to characterize morpho-physiologically 80 Plant Genetic Resources, including a landrace of *Lathyrus cicera* L. named Maracuocciolo. To test the Distinctness, Uniformity and Stability (DUS-test) of Maracuocciolo an experimentation was carried out in the field, in ex-situ mode, for three number of growing cycles (2019-2020-2021). The IPGRI 2000 guideline has been used to detect the 21 descriptors for the morphological characterization. A resource of the germplasm bank of Perugia University (IT363 acc. 4622) has been used as control variety of Maracuocciolo. The two resources belong to: *Magnoliopsida class; Fabales order; Fabaceae Family; Lathyrus Genus; cicera species. Lathyrus cicera* L. is an annual herbaceous species, which is glabrous with suberect or semi-prostrate habit, with red flowers, pointed pods, brown or gray angular seeds with the possible presence of marbling or pointed or striped spots. Pollination is mainly self-fertile but allogamous phenomena are frequent. At the end of the three crop cycles, the distinctness was confirmed between the two resources: some qualitative descriptors were found to be identical, some qualitative descriptors were completely different, while to view if there was a statistically significant difference between the remaining quantitative characters it was performed a pairwise comparison both for the relative variance (*Levene's* test for the equality of the variances) and for the respective means (T-test for the equality of the means). Statistically significant differences were detected in seven descriptors ($p<0,001$ *and* $p<0,005$). In addition, the Maracuocciolo has been sufficiently uniform and stable over the years. It is important to find out local varieties with high nutrient value, easy to grow, undemanding in fertilizer and phytosanitary useful for rural environments with extremely rugged terrains. Maracuocciolo and ITA363 acc4622 in this experimental trial, have shown to possess these characteristics and so suitable for supporting eco-sustainable cultivation environments.

S1 P8

VARIABILITY IN FIELD-RESPONSE TO A LOCAL CONSORTIUM OF ARBUSCULAR MYCORRHIZAL FUNGI SUPPORTS THE SELECTION OF BARLEY GENOTYPES FOR ENHANCING STABILITY AND PRODUCTIVITY

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The application of microbial biostimulants based on arbuscular mycorrhizal fungi (AMF) is commonly reported to enhance crop productivity, food quality and to reduce plant biotic and abiotic stresses under several pedo-climatic conditions. Despite the growing number of field studies, beneficial effects of AM fungal isolates or consortia on crops can be largely affected by host genotype and environment, in some cases creating an obstacle to an efficient AM fungal application. The aim of this study was to investigate the field response of barley genotypes to the application of a local consortium of AMF. Moreover, we aimed to study the AM fungal establishment and development within barley roots. A two-year (2020-2021) field experiment was carried out in Pisa (Italy) with three barley genotypes (Atlante, Atomo and Concerto) and AM fungal inoculation (+M, with AMF) in comparison to a mock inoculated control (-M) under organic agriculture and without fertilizer application. Inoculum was applied by coating the seeds. Grain yield, macro- and micronutrient concentration and AM fungal abundance in roots were assessed. Root AM fungal diversity was characterized by Illumina MiSeq. AM fungal inoculation promoted grain yield in Atomo and Concerto in 2020, and in Concerto and Atlante in 2021. In both years, inoculation promoted AM fungal root colonization of Concerto suggesting a high compatibility of this genotype to the inoculated local AM fungal consortium. Overall, grain mineral concentration was differently affected in barley genotypes and years of cultivation and AM fungal root communities were positively related to the outcome of the symbiosis. These results highlight the importance of selecting highly AM fungal responsive plant genotypes and using local AM fungal consortia to enhance the stability and productivity of barley and maintain a functional AM fungal community.

S1 P9

AGROECOLOGICAL APPROACH TO REDUCE ENVIRONMENTAL IMPACTS AND INCREASE BIODIVERSITY IN FORAGE SYSTEMS SERVING DAIRY FARMS

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This work investigated herbaceous plant diversity, carabid and butterfly assemblages, earthworm richness in an intensively managed agricultural area in northern Italy. We hypothesized that lowering the intensity of agricultural practices, measured as Carbon Footprint (CF), without lowering the yield potential, could contribute to reducing the loss of biodiversity at field level. Samples were collected in fields and field margins on farms that represent three cropping systems and five different intensity levels of agricultural practices: mono-cropped maize with high or low chemical pressure; maize in rotation with alfalfa and low chemical pressure; herbaceous strips with no chemical pressure. The intensity of agricultural practices was computed at field level as CF, nutrient balance, and intensity use of agrochemicals. The intensity of agricultural practices, as quantified in terms of CF, has been correlated to biodiversity indicators, such as species richness and composition of herbaceous plants, carabids, and butterflies. The results from the current research suggest that all species from the intensity agricultural practices in maize observed in the two-year study showed large coefficients of determination between CF and biodiversity indexes. A decrease in species richness was observed as CF and N surplus increased over all the fields and field margins. This suggests that, although only a small fraction of the biodiversity of natural ecosystems comes from cultivated lands, these agricultural areas, because of their extension, could become key components for the conservation of biodiversity, if particular emphasis is paid to the intensity of the adopted agricultural practices. These findings provide further evidence that well-implemented, diverse cropping systems could be a benefit for biodiversity at farm level, without compromising yield potential, and could offer European policy and agricultural decision makers indications for the design of more specific, effective management options for future policy measures.

S1 P10

TRANSITIONING PHASE FROM CONVENTIONAL TO NO-TILLAGE: NITROGEN FERTILIZATION IS A KEY PRACTICE TO REDUCE THE PRODUCTIVITY GAP BETWEEN THE TWO SOIL MANAGEMENTS IN DURUM WHEAT

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No-tillage (NT) is a sustainable and efficient agricultural practice that can improve soil health and reduce the environmental impact of agricultural systems. However, the transition from conventional tillage (CT) to NT is a process that requires careful planning and adjusting crop management practices. Indeed, the application of NT can determine a reduction in crop productivity, especially in the transition phase. Here we conducted a 2-year experiment to investigate how soil N availability can affect durum wheat performances in the switch year from CT to NT. We investigated the crop N uptake, grain yield, and N use efficiency (NUE) of two durum wheat (Triticum durum Desf.) genotypes (one modern variety and one old landrace) grown in CT and NT in presence of five N-fertilization rates (0, 40, 80, 120, and 160 kg N ha−1) under semiarid Mediterranean conditions. In the no-fertilization treatment (N0) the application of NT reduced both wheat N uptake and grain yield regardless of the genotype. The gap in N uptake and grain yield between the two tillage systems decreased at greater soil N supply and disappeared at 80 kg N ha−1. The two genotypes showed the same trend in all the applied treatments. However, noteworthy, the reduction of productivity observed under no fertilization conditions was less pronounced in the landraces than in the modern variety. Overall, the component analysis of the NUE showed that the advantages observed under no fertilization and at low N fertilization rates are due to a greater natural soil N availability in CT compared to NT. In conclusion, our experiment showed that the transition from CT to NT is a delicate process that cannot stand alone without a substantial reduction in plant performance. By contrast, integrating the transition from CT to NT with other agronomical practices, particularly with the N fertilization strategy, is essential to maximize crop N use efficiency and yield.

S1 P11

FIRST RESULTS RELATING TO THE AGRONOMIC, MORPHOLOGICAL AND QUALITATIVE CHARACTERIZATION OF THE "ONION OF SAN PIETRO AL TANAGRO" (SA), A VEGETABLE RESOURCE AT RISK OF EXTINCTION

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As part of the "Agrobiodiversità Campana" project (PSR 2014-2020 Campania Region, Measure 10) experimental activities were carried out to characterize the onion of "San Pietro al Tanagro". This onion belongs to the "Ramata" onion group and has medium to large bulbs with a flattened shape. The flavor tends toward sweet and makes it suitable for fresh consumption but also for processing and storage. The crop cycle goes from March to August, so it is a spring onion variety. Traditionally this onion was grown in the Vallo of Diano (SA) area. The experimental field was set up at Sassano (SA) at the Durante farm, on an area of about 0,08 ha, with three repetitions. During the cultivation period, the temperature and rainfall trend was monitored. The cultivation was planted in single rows (0.80 m apart) with the distance of 0.15 m between the plants (8 plants m^2), according to local customs. During the crop cycle, phenological stages were monitored and non-destructive surveys were carried out such as SPAD and the height of the aerial part of the plants. Harvesting took place during the first decade of August 2022 and in correspondence the surveys for the determination of the production were carried out. After that, 8 samples were taken from every repetition on which qualitative analysis were performed (fresh weight, dry matter, bulb diameters, number of inner bracts, Brix degrees, colour, penetration resistance). The results showed excellent productivity and an average diameter higher than 8 cm. Evaluation of soluble sugar content reflects the sensory characteristics of this onion by showing an average Brix degree higher than 5. These are the first data collected for this resource and enriches the knowledge about this cultivation and quality characteristics, contributing to the conservation of biodiversity, the dissemination throughout the territory and its enhancement.

S1 P12

AGRICULTURAL LANDSCAPE OVER-SIMPLIFICATION AND AGROBIODIVERSITY DETRIMENT: THE REHABILITATING ROLE OF AGROFORESTRY PRACTICES IN THE PO PLAIN DISTRICT

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The agricultural systems capacity to sustain territorial, ecological and productive functions is currently significantly undermined, consequently to agricultural mechanization, rural landscape over-simplification affecting its underpinned support-regulating functions and services. The Po Plain district brings striking evidence on such impacts, combined to the condensed urbanization and grey infrastructures impacts, restricting natural ecosystems, often degraded and dominated by invasive alien species. To face this, integrated approaches are needed, working on multi-scale assessment and management strategies, enabling to rehabilitate the landscape ecological functioning, restoring its capacity to support higher agrobiodiversity levels. To this aim, our study intends to bring light on the role of farm-scale and local-scale landscape features management (agroforestry approach), by locally testing viable monitoring tools for recognising and supporting farmers' contribution to agroecosystems' biodiversity. Landscape ecology analyses are led on 4 pilot farms (Western Po Plain) adopting agroforestry approaches to different degrees. An extended set of landscape structure indices (composition, shape, connectivity) is computed at farm-scale and local-scale, comparing agroforestry-based approaches to conventional management. Functional interpretations of structural traits refer to two non-specific taxa groups (sensitive and generalist behaviours). Wider scale qualitative analyses frame lower scale results. Indices comparison allowed us to: i. distinguish the most virtuous farm management model; ii. forecast the effects of landscape features design scenarios on connectivity values; iii. highlight the influence of local-scale landscape ecological conditions on farm-scale ecological processes; iv. detect indices sensitiveness to management options, their relative correlations patterns, allowing their preliminary screening (indices selection, suitable for representing Po Plain landscape peculiarities). Our assessment is conceived as a pilot tool for: i. accounting and promoting virtuous management models, supporting agrobiodiversity values; ii. coherently driving agroforestry farm design and management strategies; iii. integrate the more commonly used field-scale agrobiodiversity assessment approaches (e.g floristic-vegetational, faunal studies), framing them into a multi-scale perspective, enhancing their mutual informative potential whilst optimising assessment efforts.

S1 P13

MYCORRHIZATION OF FOREST PLANTS WITH TRUFFLES FOR THE ENHANCEMENT OF INLAND AREAS

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The internal areas of our peninsula are rich of small and different inhabited centers of high cultural and landscape value. Over the years the population of those villages has decreased significantly because of the land does not offer much opportunities for young people that are forced to emigrate elsewhere. It is also currently of great importance to safeguard the role of forests for the contribution they can make to climate mitigation and biodiversity conservation. In order to enhance the role of the forest in these areas might be helpful using mycorrhization seedlings with truffle. They take place in the nursery by establishing a symbiotic relationship between a fungus and a plant. Plants transplanted into suitable soil will grow in about 10 years time and then the will be ready to get into a full-production cycle. A research has been conducted since 2017 in collaboration with Southern Apennines Observatory Consortium in order to create truffle plants starting from native plants mycorrhizal with native truffles, both from the Campania region. The ultimate goal of the research project was the production of mycorrhize forest plants, at the nursery of the regional company Improsta (Eboli, SA), to be used for the planting of cultivated truffle grounds. Based on the results of this research it was possible to quantify the cost of a seedling and therefore of a truffle ground, based on mycorrhizal plants with Tuber aestivum, widely spread in the territory of the Campania region. The data obtained allow us to take stock of the investments in a cultivated truffle ground in economic terms. The results of the research, contributes to give young people an opportunity to start new productive activities that allow them to remain in the internal hilly areas, also contributing to the environmental protection of the land.

S1 P14

INCREASE OF THE HERBACEOUS GENETIC RESOURCES COLLECTION OF CAMPANIA REGION

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The collection of the Campania Region is composed of 77 herbaceous plant resources at risk of extinction. The loss of genetic diversity, in a particular area and in a given period of time, including the loss of single genes or combinations of genes, as can be found in landraces or varieties (FAO/IPGRI, 2002). This has meant that Campania was interested in increasing the collection of genetic resources of its germplasm banks. The aim of Campania Regional Development Program 2014-2020 funded CREA - Research Centre for Plant Protection and Certification and University of Naples Federico II is to characterize morpho-physiologically 126 new varieties. The species entrusted to Crea were 11 on a total of 80 local varieties including four landraces of Vicia faba L.: "di Miliscola", "A Sciabola", "Lunga" and "Lunga (Somma Vesuviana)". The experimental trials made in ex.situ mode at Battipaglia (SA): Lat. 40,608772, Long. 14,983035 and Alt. 72 meters above sea level., was carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the varieties and for the conduct of the examination for three number of growing cycles (2019-2020-2021). Official varieties: "Aguadulce supersimonia", "Slonga", "Lunga delle Cascine", "Meraviglia di Novoli", "Sfardella" and "Grossaba 20" were used as control varieties. Tools used to detect characteristics of plants were those of GIBA's n.36 guideline: caliper, balance, optical microscope, color charts, metric rods, cameras. Statistical analysis was carried out to study the degree of homogeneity, differentiability and stability turn out to be enough for four varieties. This output allowing to increase the germplasm bank of Campania with new vegetable varieties the one of greatest interest for the world agricultural economy and suitable of territories.

S1 P15

MORPHOLOGICAL AND FUNCTIONAL VARIABILITY IN THE ROOT SYSTEM OF FOUR OLIVE CULTIVAR UNDER WATER STRESS

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The root system is the primary organ that absorbs water and nutrients, it carries out an essential function in the growth and productivity of plants. The size and distribution of the root system in the soil are closely linked to its capacity to water and nutrient uptake. When plants are exposed to drought, the roots perceive the water deficit first and activate physiological and biochemical responses, including morphological and architectural changes, to better cope with the water stress. A study was carried out on four potted olive cultivars, with different vigour, to evaluate root physiological and growth responses in water deficit conditions. Two years old trees of the cultivar Biancolilla, Calatina, Nocellara del Belice and Koroneiki, were subjected to three irrigation treatments, T20, T50 and T100, by returning 20, 50 and 100% of the plants' evaporative transpiration demand respectively. We investigated the root morphological parameters, including total root length, root average diameter, total root surface area, total root volume, and total root dry weight. Midday leaf water potential and plant leaf area were measured during the growing period. Root length, average root diameter, and root dry mass decrease with drought while increasing root density. Further investigation in the root architecture will confirm the importance of study root morphological adaptations for the selection tree in olive orchards.

S1 P16

INVASIVE ALIEN PLANTS IN URBAN SETTINGS: NEW MANAGEMENT STRATEGIES AND ALTERNATIVES CULTIVARS

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Urban ecosystems are transformed in many ways by human activities and their flora consists of a high number of invasive alien species. They provide colonization sites for the establishment, dispersal and proliferation of Invasive alien plants species (IAPS). They pose a greatest threats to natural ecosystems through their direct and indirect effects such as contribute to unfavourable conservation of biodiversity worldwide, causing negative impacts on human health, affecting infrastructure effectiveness and causing important socio-economics problems like impact to human health and costly management efforts. Although ornamental horticulture has been a source of invasive plants which are significant for nursery industry like as Buddleja davidii Franch., Spiraea japonica L. and Lonicera japonica Thunb, it may also be able to provide some solutions for example through the development of non-invasive cultivars and the phasing out of the sale of invasive ornamentals. The invasive potential of a species is closely related to fast growth, high fecundity, highs levels of phenotypic plasticity, high propagule pressure, vegetative reproduction and high competitive ability. Some of these traits can be targeted using genetic tools and traditional plant breeding to reduce invasiveness. The process provides forms of genetic mutation and traditional breeding to create sterile male and female plants as well as plants that produce only sterile seeds. In the field of managing invasive species, there may be more than one formula for a success. The present research program titled “Assessment and management of invasive plants in urban ecosystems” within the project “National Biodiversity Future Centre - NBFC” is funded by PNRR, has just begun and will take place between 2023 and 2026; through dialogue with stakeholders will seek to prioritize management of invasive species based on the impacts caused and find functional management practices for the development of economically, socially and environmentally sustainable urban horticulture.

S1 P17

EVALUATION OF OGF NATURALNESS WITHIN THE POLLINO NATIONAL PARK

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Old-growth forests (OGF) have a primary ecological value, as an example of how were thev primeval forest may looked like in Europe. OGF are recognized worldwide as important sites for biodiversity conservation and ecosystem services provision. They also play a key role in carbon sequestration and storage, regulating climate and providing several habitat for endangered wildlife species. Currently, OGF account for only 3% on 158 million hectares of forest area in Europe. Most of the italian OGF are located in Apennine mountains, especially in the Pollino, Sila and Aspromonte National Parks, where many ancient trees have lifespans between 400 - 500 years. As a result, protectc these ecosystems has become an important objective in EU biodiversity conservation strategies such as the "Pan-European Biological", "Landscape Diversity Strategy" and the "European Strategy for Plant Conservation". However, currently our knowledge, about these precious natural ecosystems, are still limited in Italy due to lack of accurate data and studies. In our research we selected 9 remnants OGF located within the Pollino National Park (southern Italy) with the overall aim to characterize the stand structure and vegetation biodiversity through the assessment of innovative indices and parameters determinant of old growtness. These indicators allowed us to characterise the high degree of naturalness and biodiversity and to confirm that these sites can be acccounted among the most relevant forest ecosystems in Europe hightlighted by comparing the parameters measured in the field with literature reference values.

S1 P18

ERUCA SATIVA AND *RESEDA LUTEA*: POTENTIAL MULTIPURPOSE PLANTS FOR POLLINATORS

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Pollinators play a strategic role within ecosystems and agroecosystems for the reproduction of wild plants and crops, depending for their yield success on pollination services. During the last 30 years a drastic insect decline is occurring, caused by several factors: wild habitat loss, monoculture, pesticide use, diseases and climate change. Strategies adopted to contribute to insect safety include: hedge presence, left uncultivated areas, habitat fragmentation reduction, adoption of minimum tillage management and attractive strips sowing of pollinator flowers. In the present study Eruca sativa and Reseda lutea, respectively belonging to the Brassicaceae and Resedaceae family will be evaluated to investigate their pollinator attraction potential. They are plants native to the Mediterranean basin, tolerating hot and dry climates, with an abundant flowering over time, not overlapping between the two species. They belong to the Brassicales order, whose families are characterized by the presence of glucosinolates (GLS) in the plant tissues. GLS are secondary metabolites involved in the plant defense system, whose degradation products, the isothiocyanates in particular, are studied for their antimicrobical, antioxidant, anti-flammatory, anticancer and biocide effects. Aims of this doctorate research will be: 1) to evaluate the potential pollinator attraction of the cited two species by classifying the captured visiting insects; 2) to characterize the flower GLS content at different flowering times, and to assess any correlation and relationships between pollinator visits and GSL content in the flowers; 3) to prepare GLS formulations from flower tissue given as feeding to fight honeybee pathogens and improve their health. Preliminary results obtained during the first year of research in a single environment in Northern Italy (Anzola, BO, Italy), will be shown, in relation to the main pollinator groups visiting the plants, the frequencies of their visits, and in relation to the flower biomass, fundamental plant phenological data.

S1 P19

OPTIMIZATION OF MICROWAVE-ASSISTED EXTRACTION OF ANTIOXIDANTS FROM SPRING ONION LEAVES USING BOX-BEHNKEN DESIGN

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The agri-food sector generates large amounts of waste such as crop residues, food processing by-products, expired or unsold food, and packaging materials.[1,2] Many agrifood waste materials contain high levels of bioactive compounds (polyphenols, flavonoids, carotenoids, vitamins, fiber, and other phytochemicals) which have been associated with various health benefits, including antioxidant, anti-inflammatory, antimicrobial, anticancer, and cardiovascular protective effects. By utilizing agrifood waste as a source of bioactive compounds, we can reduce environmental pollution and waste while also creating value-added products with potential health benefits. In this study, we developed and optimized a microwave-assisted extraction (MAE) method for the recovery and isolation of bioactive compounds from green stalk (leaves) of "Cipollotto Nocerino DOP" onion. Onion (*Allium cepa* L.) is an example of a widely consumed vegetable that contributes considerably to municipal and industrial wastes, commonly known as Onion Solid Wastes.[3,4] A response surface methodology (RSM) through a Box–Behnken design (BBD) was employed to evaluate the effect of different variables of the MAE (temperature, time, extraction volume and ethanol concentration) on the investigated factors as total polyphenols content (TPC) and the antioxidant power of the extracts (FRAP assay). Furthermore, the optimized extraction conditions were 60 °C, 22 min, 11 mL and 50 % v/v EtOH. Under these condition, experimental TPC and FRAP values were 1.35 (mg GAE g^{-1} DW) and 14.02 (mmol Fe(II)E g^{-1} DW), respectively, in agreement with the predicted values. Moreover, the extract obtain through the optimized conditions was characterized by UHPLC-ESI-Orbitrap-MS analysis. In addition, the ability of CN extract to inhibit the intracellular reactive oxygen species (ROS) release in a hepatocarcinoma cell line using an H_2O_2-induced oxidative stress model, was evaluated. Our results suggest that leaves of "Cipollotto Nocerino DOP" are a potential source of valuable antioxidant polyphenols.

S1 P20

EDIBLE FLOWERS AS A RESOURCE FOR SUSTAINABLE AGRICULTURE

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The collection and consumption of wild edible plants goes back to ancient times becoming part of the human diet and traditional food systems. Many species of edible flowers were already used in ancient Greece and Rome, in medieval France, and Victorian England as relishes and flavor enhancers of many dishes. Nowadays, the interest in the use of edible flowers is increasing, not only for their aesthetic properties and their specific taste and smell, but also because of their health benefits, including antioxidant and antimicrobial activities. In this regard, the present communications aims to describe the plant lore concerning the wild and cultivated edible flowers consumed in the Mediterranean basin. A recent review documented 251 taxa as being used as food plants by traditional users in the countries bordering the Mediterranean basin. The plant species of the cited taxa belong to 45 families and 141 genera. Asteraceae (54 taxa) is the most frequently cited family, followed by Lamiaceae (39) and Fabaceae (17). Sambucus nigra L. is the most cited species. Cultivated species include, for example: Viola odorata L., Calendula officinalis L., Tropaeolum majus L., whose flowers can be used in salads or as a condiment for some dishes. Based on several studies, the use of edible flowers is closely linked to both the local flora and the traditional knowledge, thus playing a key role in traditional gastronomy and consequently in the cultural identity of some geographical areas. Therefore, new field investigations aimed at specific knowledge of edible flowers are desireble since they may also have a great potential to become an important resource for profitable, integrated, local, and agricultural activities.

S1 P21

SELF-ORGANIZING MAP: AN INTUITIVE APPROACH FOR SOIL BIODIVERSITY VISUALIZATION

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Soil biodiversity plays a crucial role in the functionality of ecosystems and their healthiness. As part of the H2020 EXCALIBUR project, a powerful machine learning technique called Self-Organising Map (SOM) was applied for the analysis, visualisation, and classification of data on biocontrol and biofertilisation practices in horticultural agriculture. The objective is to enhance and protect soil biodiversity by optimising the use of such practices according to soil type and all available field variables. The SOM is based on the principle of self-organization, that is, the neural network learns to classify the input data based on similarities and differences without any external supervision. The resulting map is organized in such a way that similar data points are clustered in nearby nodes. This makes it easy to identify patterns and relationships between different data points. In this work, a data set comprising soil characteristics (chemical, physical) and several biodiversity parameters related to microorganisms, micro-, meso- and microfauna, was analysed applying SOM. The data set included data from initial analysis of soil biodiversity of 32 sites located under different pedo-climatic conditions in Europe.

This approach allowed for a general assessment of the interaction between the different variables under baseline conditions, which was useful for contextualizing observed changes following treatments in the future. SOMs were performed on four datasets (4 Focus considering different groups of variables including qPCR-genes, all other trophic levels of soil biota, environmental) considering 6 factors (Crop, Treatment, Partner, Management, Condition, Environmental Zone). SOM evidenced how considering different focuses visible differences in the factors could be observed. In conclusion, SOM is an intuitive and descriptive method that can be used to analyse, visualize, and classify data. Its unsupervised learning approach, combined with its visual representation, makes it an effective tool for exploratory data analysis and research in a variety of fields.

S1 P22

MICROBIAL DIVERSITY ACROSS AGROECOSYSTEMS: A CASE STUDY IN PIEDMONT

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Agroecosystems diversification and their integration with natural elements in the surrounding landscape are among the most promising strategies to increase the agricultural systems resilience, and thus their ability to adequately support food production in the long term. However, when investigating diversity patterns, we often focus only on vegetation and animals, for which consolidated monitoring procedures, local and regional species lists and georeferenced databases exist. The soil microbiota, despite being involved in nutrient cycling, soil fertility and other ecosystem regulation processes is seldom explored, and mainly at field scale, often in relation to the application of particular management procedures. In order to describe the contribution given by the coexistence of different ecological elements within an agroecosystem in terms of microbial diversity, we applied a metabarcoding approach and characterized the soil bacterial and fungal communities associated with three ecosystem types (agricultural field, grassland, and woodland) across two areas of Piedmont. Our results highlighted that bacterial and fungal communities were clearly separated by sampling area in terms of community structure, and different areas showed contrasting trends in terms of species richness and diversity. Focusing on ecosystem types, only for fungi a clear separation at different taxonomic scales was find among field, grassland and woodland communities, while species richness and diversity did not show significant differences. Although based on a limited number of samples and geographical areas, this work suggests an innovative sampling approach to be applied in the context of agroecosystem diversity studies: targeting different but spatially close ecosystems gives an overview on the potential microbial diversity of the investigated site, offering reference values that usually lack in microbiological studies not based on time series.

S1 P23

FARMING WITH TREES: ACHIEVEMENTS OF TEN YEARS OF EXPERIMENTAL ACTIVITIES ON AGROFORESTRY SYSTEMS

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Recent literature shows the importance of both traditional and innovative agroforestry systems to produce low impact goods and to deliver agro-ecosystem services. The authors' research activities were carried out by different type of projects: field trials, operational groups, and multi-actor Horizon research and innovation projects. The main goal was to develop participatory approaches to unlock synergies in agroforestry systems aiming to increase sustainability and resilience of farming systems with a focus livestock farming in agrosilvopastoral systems. At the crop level results highlight that the tree presence reduces crop yield in the tree-crop interface with significant differences among crop species: legumes, such as alfalfa and sulla, more than grasses are negatively affected by the tree presence, and forage quality can be improved by light reduction. At the tree level, poplar leaf and shoots can provide protein-rich forage to dairy sheep farms allowing to cope the limited availability of forage in summer in the Mediterranean grassland-based systems. At animal level, the optimization of pasture exploitation by part-time grazing and rotational stoking is crucial for a rational utilization of forage resources. Animal welfare is significantly affected by microclimatic conditions; heat load is reduced by the canopy while the reduction local wind circulation by high tree cover density negatively affected microclimate parameters associated to thermal stress. At system level, cradle-to-gate LCA analysis of dairy and meat production combined with tree carbon sequestration assessment or scenario analysis by agroforestry modelling, demonstrates the potential of agroforestry to mitigate a large portion of the overall GHGs emitted by livestock. The realization of surveys, fuzzy cognitive maps and co-design workshops are useful activities to recognize, at the same time, limitations but also practical and social stakeholder perspectives. Our outcomes should encourage researchers to develop further experiments to increase knowledge on agroforestry.

S2 P24

IDENTIFICATION AND COLLECTION OF AGRICULTURAL BEST MANAGEMENT PRACTICES IN EAST AFRICA

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Climate change is affecting the accessibility to water and land, particularly in East Africa, by exacerbating drought. Under the DeSIRA (Development Smart Innovation through Research in Agriculture) EU Programme, the WATDEV (Climate Smart WATer Management and Sustainable DEVelopment for Food and Agriculture in East Africa) project aims to identify and introduce Best Management Practices (BMPs) that can improve sustainable water and land management in Egypt, Ethiopia, Kenya, and Sudan. Both top-down and bottom-up techniques were used to identify the BMPs that could be adopted. The top-down approach was based on the data analysis from research studies on the adoption of BMPs able to improve water and land management in the aforementioned countries. Questionnaires were used to gather socio-environmental information on the BMPs and their effect on agricultural production. Using online survey tools, 191 BMPs were collected, refined and filled into an online repository. Qualitative data were translated into quantitative data by a grading procedure based on questionnaire responses to generate a list of candidate BMPs. Agroforestry, crop rotation, fertilization, and mulching were some of the BMPs with the highest score. The bottom-up strategy was built on Local Brokerage events, where local stakeholders were chosen to act as political, economic, cultural and agriculture community representatives to investigate needs and gaps on local knowledge and farmer perceptions. The four Local Brokerages examined community needs and cooperative attitude of the groups during a facilitated open discussion between stakeholders and WATDEV partners. Each Brokerage event output was matched with BMP repository data to identify "candidate" BMPs to meet environmental and socioeconomic requirements. Manuring, Water User Associations, crop rotation, seed selection, and irrigation system management were the identified BMPs. The WATDEV following stages will include a final BMP selection by decision-makers and their national adoption. Finally, any possible environmental impact will be modeled.

S2 P25

ANALYSIS OF AGRONOMIC ADAPTATION STRATEGIES WITHIN MEDITERRANEAN CATCHMENTS: THE CASE OF OMBRONE CATCHMENT, TUSCANY

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Agriculture in Mediterranean regions is expected to suffer from strong negative impacts induced by climate change. Adaptation strategies, either incentivised or farmer-led, will be therefore fundamental to limit yield losses. Many studies simulated climate change impacts and adaptation strategies focusing on crop yield and, more rarely, on water footprint. Likewise, the impacts of climate change on the water cycle have been frequently assessed. However, the effects of adaptation strategies on water balance components at the catchment scale have been mostly neglected. We conduct a comprehensive assessment of the adaptive capacity to climate change of agricultural systems of the Ombrone catchment, in the Tuscany region, using a validated SWAT+ with five bias-corrected climate models. Six agronomic adaptation strategies are then simulated, individually and in combinations. Results show unclear and negative impacts on crop yields under RCPs 4.5 and 8.5, respectively, and consistent opposite trends for water footprints. The adaptive capacity of agricultural systems in the Ombrone catchment is high, even more when combinations of adaptation strategies are considered. For the three crops considered, the most effective strategy considering crop yield and water footprint is the use of longer crop cycle varieties. For wheat, earlier sowing is also beneficial, while in specific climate scenarios supplemental irrigation and cover crops are effective for wheat and sunflower. The impacts of adaptation strategies on water balance components, considering only cropland and not the whole catchment, are considerable. We conclude that management changes can have significant and non-negligible impacts on some water balance components in agricultural catchments, sometimes higher than those caused by climate change. Future assessment of adaptation strategies should not be limited to considering only crop yield and water footprint, but they should be as integrated and comprehensive as possible and evaluate also the impacts at the catchment scale.

S2 P26

IMPROVING CROP WATER PRODUCTIVITY OF PEANUT GENOTYPES UNDER MEDITERRANEAN CONDITIONS BY BIOFERTILIZER INOCULATION

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Peanut is a macro-thermal crop largely cultivated in Africa, Asia and America for the production of seeds rich in proteins and fats. The adaptability in Mediterranean environment is still to be tested. The purpose of the current study was to observe the crop response of two different peanut market types, Virginia and Spanish, to agronomic management, in particular to irrigation and fertilization. Two field experiments were carried out at Foggia, in south Italy, in 2021 and 2022 years in a factorial design, with three replications, with two genotypes (Virginia, Spanish), two irrigation regimes (weekly replenish of 50% and 100% of ET) and three fertilization management: a) an unfertilized control, b) basal nitrogen application and c) supplemental biofertilizer application with a consortium of microorganisms, including arbuscular mycorrhizal fungi (AMF) and plant growth promoting bacteria (PGPB). Crop response was observed in terms of marketable yield and yield components. Further, agricultural water productivity was also carried out, in order to evaluate environmental sustainability. Crop reflectance was assessed at pod filling by hyperspectral measurements and the main vegetation indexes were calculated. Relationships between digital spectral measurements and crop productivity were carried out. Genetic differences were observed with higher yield of Virginia type peanut which showed a better response to irrigation supply during both crop years. Also, for the same genotype, the application of the plant biofertilizer led to the achievement of the highest agricultural water productivity.

S2 P27

INNOVATIVE AGRO-ECOLOGICAL APPROACHES TO ACHIEVING RESILIENCE TO CLIMATE CHANGE IN MEDITERRANEAN COUNTRIES - (CHANGE-UP PROJECT)

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Intensive agricultural systems based on optimizing productivity of monocultures are now widely criticized for their negative environmental impacts. Conversely, highly diversified cropping systems based on agro-ecological principles have been shown to have potential benefits in terms of biodiversity conservation and ecological sustainability. In this context, the cultivation of evolutionary populations, mixtures of seeds of different varieties of the same cereal species, is establishing itself, relying on a spontaneous selection and evolution brought about by the environment. This strategy will be able to limit yield losses due to extreme climatic conditions and diseases and will guarantee farmers' income, as evolutionary populations can continuously adapt to the conditions in which they are growing. Furthermore, perennial grains, characterized by the recovery of the vegetative phase after harvest, could offer a valid opportunity to meet the growing demands for food without depleting natural resources and contribute to reducing erosion and to implementing sequestration of carbon in the soil. This study regards the integration of two common wheat evolutionary populations (EP), in crop rotation with different species of leguminous plants and the cultivation of perennial grains (PG), in different Mediterranean areas. Field trials are carried out to evaluate the agronomic characteristics of the EPs and PGs. Several soil parameters are evaluated in order to study their ability to provide ecosystem services such as lower water consumption, preservation and accumulation of nutrients, carbon storage and increase in soil biodiversity. The nutritional and technological characterization of the grains and flours are carried out. The socio-economic impact of the adoption of this agricultural system is investigated, as well. Due to the intrinsic characteristics of the two approaches, the proposed strategy may have the potential to improve the environmental parameters and socio-economic conditions of the Mediterranean agricultural system.

S2 P28

PASTORAL MANAGEMENT AND CLIMATE HAVE A COMPARABLE EFFECT ON THE VARIATION OF BOTANICAL COMPOSITION OF ALPINE PASTURES: AN EVALUATION OVER A 20-YEAR TIME SPAN

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The main aim of the research was to evaluate the relative effects of climate and grazing management on the composition of pastoral vegetation in alpine environments. The specific objectives were: i) to assess the magnitude of variation in botanical composition of pastures over a ~20-year period, and ii) to test the effect and weight of climatic and management variables on botanical composition. From a large database of vegetation surveys carried out in the early 2000s (historical surveys) throughout the western Piedmontese Alps and by considering the proximity of weather stations, 58 surveys spread across 5 pastures were selected. In 2021 and 2022, the selected surveys were carried out again in the same position of the historical ones (recent surveys). The climatic variables were computed for the period 2003-2021. The livestock stocking rate over the period 2003-2021 and the terrain slope were used to quantify the management pressure. To assess how much the botanical composition changed over time, a PCA was carried out and the distance was interpreted as the magnitude of change in botanical composition: the further the historical survey was from the recent one, the greater the change in botanical composition. A GLM was used to test the effect and weight of climatic and management variables on botanical composition change. Management and climatic variables showed a similar importance in affecting changes in botanical composition. The interaction between the stocking rate and slope showed that the most pronounced changes in botanical composition occurred in conditions of over and under grazing. Vegetation changes were larger where the trend of increasing average annual temperatures has been most rapid over the last twenty years and where total annual precipitation has decreased. This research showed that, in a climate-change context, grazing management plays a crucial role in conditioning the botanical composition of alpine pastures.

S2 P29

EVALUATING THE IMPACT OF DROUGHT STRESS IN NURE AND TREMOIS BARLEYS (HORDEUM VULGARE) TREATED WITH PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) AT SEEDLING PHASE

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Barley is the fifth cultivated herbaceous crop in the world, and its important is due to its economic and nutritional value. Climate change is posing a new challenge to barley production. While drought stress was traditionally associated with the flowering and caryopsis filling stages in barley plants, a new form of drought is now emerging in seedling stage. To mitigate the impact of environmental stresses, plant growth promoting rhizobacteria (PGPR) have been proposed to promote nutrient absorption and plant growth with the production of a range of beneficial substances, such as phytohormones, organic acids, and enzymes. The aim of this study was to evaluate the genotype response and the impact of PGPR treatment on two cultivars of barley, Nure (Italian feeding barley, winter habitus) and Tremois (French malting barley, spring habitus) in seedling phase under drought stress. At sowing, the soil was treated with PGPR and after two weeks of control condition two different water regimes were applied on seedlings (control at 25% and stressed at 12% of soil moisture). The results showed that both genotypes exhibited analogous stress response, however the PGPR treatment showed different effects on the two cultivars. Specifically, PGPR treatment increased root dry weight in stress conditions in Nure seedlings (by 36.6%) and increased dry weight in control conditions in Tremois seedlings (by 31.1%). Furthermore, the treatment increased the photosynthesis efficiency (PhiPS2) in Tremois seedlings (by 6.2%) and generally in both cultivars (by 7.6%) under drought stress. These findings suggest that the use of PGPR could be a useful tool for protecting barley seedlings against drought stress in early stages of development. However, further research is needed to fully understand the mechanisms of action to determine the optimal conditions for using this approach in the field.

S2 P30

RELATIONSHIP BETWEEN "GREEN LUNGS" AND TEMPERATURE IN NON-CONVENTIONAL URBAN CONTEXTS

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The management of public green spaces is gaining in importance and cities are converting urban areas to an increasingly green management, in order to create urban 'Green Lungs' (parks, tree-lined avenues, social gardens, public and private gardens) useful for CO2 sequestration and temperature mitigation. The research focused on the eco-archaeological park of Pontecagnano Faiano (SA), a large green area of 22 hectares, close to the urban centre, under the protection of the Superintendence of Archaeology, Fine Arts and Landscape of Salerno and Avellino, and managed by Legambiente Campania ("Occhi Verdi" Club). The study aimed to test whether "non-conventional" green areas can contribute to create "Green lungs", that our cities need in the path towards the "ecological transition". For this reason, temperatures and relative humidity wer measured continuously by a sensor, on an hourly basis, during the period June - September 2022, in two different conditions within the Park: the asphalt road leading to the park ("Grey area"), and an area rich in trees and shrub vegetation ("Green lung"). In the same period, on a monthly basis, measurements were carried out in 15 locations in the park, differing in terms of vegetation cover, using a infrared thermal camera. The results evidenced the average difference of +1.8 °C between the asphalt road (grey area) and the "Green lung", with a lower temperature range for the latter. The differences were higher during warmer months. Data confirmed the difference in relation to plant cover and shading. The results, confirms the impact of vegetation on temperature mitigation, even in sites not far from each other. It can be said, therefore, that urban green, in all its forms, represents a fundamental resource in the mitigation of temperatures, contributing substantially to fight the phenomenon of the "heat islands" in urban centers.

S2 P31

VALUATION OF THE USE OF ORGANIC FERTILIZERS TO INCREASE THE SEQUESTRATION AND STORAGE OF CO_2 IN URBAN SOILS

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Climate change and urbanization directly and indirectly alter the chemical, physical and biological properties of urban soils resulting in a reduction of soil ecosystem services, due to compaction or stripping of the surface soil. Soil ecosystem services can be restored, using organic amendments available in urban areas. Among the soil remediation practices the incorporation of stabilized organic matter can be used to improve carbon stocks in urban soil. Organic amendments of different origin and composition, deriving from the biomass recycling process (e.g. compost and biochar), can provide nutrients to the soil, as well as increase the organic matter content of the soil, with concomitant benefits for soil health. Urban soil quality can be improved administrating organic fertilizers such as biochar, that is emerging to improve soil properties over the long term. The purpose of the PNRR biodiversity, spoke 5, task 2.3 is to evaluate the role of urban soils in the sequestration and storage of atmospheric CO_2 in response to the use of soil amendments, taking into consideration the location of the investigated site, the characteristics of the soil microbiome and plant growth. In particular, according to studies present in the literature, two types of amendments were selected: compost and biochar. The addition of organic fertilizers can therefore be effective in improving the quality of urban soils both at the time of planting and in subsequent years using quantities of organic fertilizers that are calculated based on the characteristics of the soil and crop requests. It should be highlighted that one of the major problems of the research is that the experimental constraints and the peculiarities of the organic fertilizers are often different, making difficult the results transferability on similar as well as different environment. This research was funded by the “National Biodiversity Future Center -NBFC”-National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 Investment 1.4-Call for tender No. 3138 of 16 December 2021, rectified by Decree n.3175 of 18 December 2021 of italian Ministry of University and Research funded by the European Union-Next Generation EU, Project code CN_00000033.

S2 P32

HEAT STRESS REDUCTION IN CHILEAN MEDITERRANEAN-TYPE EXTENSIVE LIVESTOCK SYSTEMS: INSIGHTS FROM DIFFERENT TREE DENSITY IN THE ESPINAL TRADITIONAL SILVOPASTORAL SYSTEM

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The 'espinal' is a pseudo-savanna environment, widespread in the Mediterranean part of Chile, consisting of a single dominant tree species, the Roman cassie, Acacia caven (Molina), traditionally combined with sheep rearing. This system is currently under threats since landowners are converting these systems into fruit-tree plantations or crops. The Roman cassie provides shade and fodder to the sheep during the driest season and it is well adapted to arid environments. However, to the best of our knowledge, there are no measurements about the variability of microclimate parameters associated to animal heat stress in the espinal. Field measurements were conducted in the O'Higgins Region of Chile, in February 2023. Eight HT30 Wet Bulb Globe Temperature sensors were located in two areas representing high and low density of trees. Air temperature, relative air humidity, and black globe temperature were recorded at one-hour intervalsin eight positions: north, south, east, and west of a tree, both under and outside the canopy. Measurements were repeated three alternated days for each espinal density. Black Globe-Humidity Index (BGHI) was calculated to estimate potential heat stress conditions. BGHI threshold value is 79. The effect of tree density, cardinal position, and location under the canopy on BGHI were estimated with a mixed linear model. Density, position, and distance affected BGHI. Averagely, BGHI was higher in the high respect to the low density system, 77.79 vs 75.91 ($p < 0.001$), while under the tree canopy BGHI was significantly lower than outside, 74.73 vs 78.96 ($p < 0.001$). The present study shows that to better exploit ecosystem services provided by silvopastoral systems, design, and management of

trees, together with the evaluation of local wind circulation patterns should be considered to obtain an effective reduction of animal thermal stress. The experiment was conducted within the H2020-MSCA UNDERTREES project (n° 872384) and ANID PIA/BASAL FB0002.

S2 P33

ASSESSING CLIMATE-SMART FORESTRY OF MEDITERRANEAN FORESTS BASED ON NATIONAL FOREST INVENTORY DATA

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Climate-Smart forestry (CSF) is a new sustainable forest management approach to forefront climate crisis aimed to identify adaptation and mitigation management strategies promoting forest conservation, productivity and the provision of ecosystem services. Despite CSF is attracting attention worldwide, studies on Mediterranean forests are very limited. This study aims to introduce a new assessment framework of CSF using national forest inventory data, namely INFC 2005 and INFC 2015, to develop a straightforward and user-friendly method to define a composite smartness indicator. The methodological approach includes: (i) selection of CSF indicators; (ii) normalization of indicators; (iii) weighting of indicators; and (iv) aggregation of indicators. CSF indicators were selected through a systematic literature review (keywords: “climate smart forestry”; “forest management”; “indicator”; “mitigate*”; “adapt*”) using Elsevier’s Scopus® database. A total of 39 indicators were obtained from 81 examined papers. Six indicators (i.e., growing stock, carbon stock, diameter distribution, tree species composition, forest damage, deadwood), among the most frequently cited, were evaluated to quantify the smartness of the main Italian forestry categories. To compare the indicators with each other they were normalized using two main techniques: distance to target or min-max normalization. Preliminary results show an increment of smartness value in all forestry categories from 2005 to 2015, except for the poplar plantations and other deciduous broadleaved forest categories. This increase is more pronounced for some categories than others. High smartness values (> 4) are obtained for: Fir forests, Larch and Stone pine forests, Norway spruce forests, Scots pine forests, Chestnuts forests and Black pine forests. Finding will provide useful suggestions for improving the smartness of forest management across Mediterranean forests to promote the mitigation and adaptation.

S2 P34

TOMATO YELLOW LEAF CURL SARDINIA VIRUS CONTRIBUTES TO INCREASE THE TOLERANCE OF TOMATO TO DROUGHT STRESS

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One of the main physiological stress factors that has a negative impact on agricultural productivity is drought stress, which modifies essential aspects of plant development and metabolism. Viruses can affect how plants respond to abiotic stress and their tolerance capacity. Begomovirus (family Geminiviridae), have been demonstrated to increase ability to tolerate heat and drought stresses in the plant model Arabidopsis thaliana. We decided to investigate if the performances of tomato (Solanum lycopersicum L.), one of the most significant crops in agriculture, towards drought stress were increased upon infection by a begomovirus. For this, we investigated the tolerance to drought in tomato plants infected by the tomato yellow leaf curl Sardinia virus (TYLCSV). Transcriptional analyses of genes associated to hormone metabolism and stress response, together with analysis of morphological and physiological traits, were conducted in three conditions, i.e. well-watered, water-stressed and after recovery. TYLCSV-infected plants were more tolerant to water stress and recovered from dehydration more quickly compared to mock-inoculated plants. Our research improves the state of knowledge on how viruses affect the plant's ability to adapt to environmental challenges, opening new research avenues for the study of agricultural adaptation to climate change.

S2 P35

VALORIZATION OF WASTES FROM BOTH THE PRODUCTION OF READY-TO EAT FRESH-CUT VEGETABLES AND BUFFALO FARMS TO DEVELOP PRODUCTS TO IMPROVE SOIL QUALITY AND PROMOTE CARBON STORAGE

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Nowadays, it urges to deal with serious and worrying environmental issues, including the intensive exploitation and impoverishment of fertile soils, accompanied by the widespread decrease in organic matter, the severe impacts on both plant production and microbial vitality, and the large consumption of non-renewable mineral resources. The proper recycle of agricultural waste biomasses represents a virtuous approach to generate potentially useful products for soil, perfectly in line with circular economy and sustainable development models. In fact, chemical transformation/conversion/stabilization processes of organic wastes can lead to new high-potential products capable to imply significant benefits to soil (resilience, chemical, physical, and biological fertility) or crops (resilience, higher yields, improved commercial and nutraceutical qualities), at the same time, enabling the release of N, S, and P nutrients. The present research project aims to develop, optimize and test technologies for valorising agricultural wastes for sustainable production of organic fertilisers and organic amendments with carbon sequestering properties and capable to reduce soil vulnerability, in line with guidelines of the new EU fertilizer regulation. In particular, anaerobic digestate and vermicompost have been obtained through the valorisation of zootechnical wastes into a biogas plant, while compost and hydrochar have been produced through a conversion of by-products of vegetable crops suited for the ready-to-eat fresh product productions. A relevant and interesting part of the research focuses on the optimization of both hydrochar production parameters and the pelletizing of the most promising products. The real benefits on soil quality and health, as well as on vegetative-productive plant activities will be assessed via mesocosm and field tests, before and after the application of products. The research is carried out within the Agritech National Research Center and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4 – D.D. 1032 17/06/2022, CN00000022).

S2 P36

DEDUCING EMISSION RATES FROM GAS CONCENTRATIONS IN A LIVESTOCK FARM THROUGH A BACKWARD LAGRANGIAN STOCHASTIC METHOD-BASED MODEL

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This work suggests a practical methodology for calculating greenhouse gases (GHG) emissions and other types of gas in dairy cattle farms. Climate change is one of the Sustainable Development Goals (2015) and European Union wants to reach climatic neutrality by 2050. In agriculture, ruminant livestock farming is the most impactful sector, in terms of methane and nitrous oxide emissions, according to ISPRA computations (2021). We need valid measuring protocols for assessing emissions in every production phase to reduce emissions in livestock and cropland systems. The equipment required to build a system capable of measuring GHG emissions from livestock farms is composed of Multi-Sensor Platforms (MSP), an anemometer, and various types of software for data analysis. Once a valid measurement protocol is established, emission rates from surface area sources in a livestock farm, such as a slurry storage tank, can be calculated. An MSP contains sensors to quantify gas concentrations and sensors to characterize turbulent transport on the micro-meteorological scale, like temperature and pressure sensors. An anemometer is also needed to obtain wind speed and wind direction. Surveys can measure on the ground and, if necessary, in the low troposphere using a drone. WindTrax is a free software tool for simulating short-range atmospheric dispersion, that uses Lagrangian stochastic particle models. The results provided by the model are numerical and graphical. WindTrax supplies datasets containing calculated emission rates and concentrations. Georeferenced atmospheric dispersion maps can be realized, using calculated concentrations in a GIS environment. We validated model concentrations with CO_2 measurements at 2, 3, and 4 meters from the ground at two different points of a dairy cattle farm. Finally, by identifying the surface area sources most impactful we will apply appropriate mitigation solutions at exactly the right time to reduce emissions in the air from livestock systems.

S2 P37

MODERATE DEFICIT IRRIGATION CAN MODULATE THE SECONDARY METABOLITES OF *PISTACIA LENTISCUS* L. FRUITS DURING RIPENING

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Pistacia lentiscus L. (PL) is a shrub of the Anacardaceae family whose fruits are used to produce an edible oil. This plant is one of the most common species in the Mediterranean basin and is highly adaptable to different abiotic stresses, particularly drought. PL fruits are also rich in health-promoting phytochemicals owing to their polyphenol and terpene abundance. There is evidence that controlled water deficit may increase the concentration of secondary metabolites, thereby potentially improving plant antioxidant defenses and fruit quality. The aim of the present study was to assess the changes in secondary metabolites of PL fruits in response to moderate water deficit applied in the last two ripening stages (December-January). Water deficit was applied to six five-year-old PL potted plants providing 70% of the fraction of transpirable soil water, while six well-watered plants were irrigated daily to pot capacity. Measurements of soil moisture, plant water relations, gas exchange, and chlorophyll fluorescence were performed to monitor the plant physiological responses to stress. HPLC-DAD analyses of polyphenols and GC-MS analysis of terpenes were also conducted. The results show that the ripening of PL fruits was affected by the irrigation treatment, both for their polyphenolic and terpene content. In addition, water stress had a different effect on the phytochemical composition depending on the fruit ripening stage. These results are important for understanding the effects of water stress on PL physiological performances and how can be used to modulate PL fruit quality, especially regarding the production of antioxidant compounds beneficial for human health.

S2 P38

UV-B PRIMING REDUCES THE NEGATIVE EFFECTS OF SALT STRESS ON THE PHOTOSYNTHETIC APPARATUS IN TOMATO SEEDLINGS

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Salinity affects about 20% of the worldwide lands. Due to climate changes, seawater intrusion and agricultural practices, soil salinization is predicted to increase, posing serious threats to both natural and cultivated plants. Seed and seedling priming is a sustainable solution frequently adopted by researchers to increase the tolerance towards various stresses. Exposure to a mild stress can in fact activate defensive mechanisms that boost plant tolerance towards a subsequent stress. In the present work tomato seedlings (*Solanum lycopersicum*, cv. Moneymaker) were pretreated with UV-B radiation (0.4 W m^{-2}, 16h/day for 7 days) provided by LEDs (peak at 310 nm), before being subjected to salt stress (150 mM NaCl) to verify if UV-B radiation might act as a priming factor to improve the salt tolerance of the photosynthetic apparatus. The chlorophyll fluorescence analysis indicated that the actual quantum yield of PSII (Φ_{PSII}) was significantly reduced in salt-stressed plants but did not change in salt-treated and UV-B primed ones. The same trend was shown by electron transport rate (ETR). The polypeptide profile of photosystem II (PSII) complex was investigated using western blot analysis of D1, D2, LHCII, cp43, and cp47. These findings, together with the results on pigments quantification, lipid peroxidation index, proline and minerals content, biometric parameters, and some enzymatic and non-enzymatic antioxidant systems indicate the potential of UV-B pre-treatment to preserve the photosynthetic functionality, giving the seedlings an advantage against saline stress.

S2 P39

PHYSIOLOGICAL EVALUATION OF A *SOLANUM PENNELLII* INTROGRESSION LINE TOLERANT TO COMBINED ABIOTIC STRESS

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Increased daily temperatures and water shortage are two of the major concerns in agriculture that usually occur concurrently in open field. In order to identify genetic resources with greater flexibility to abiotic stresses, in this work we analysed the tolerance traits in a *Solanum pennellii* introgression line (IL12-4-SL) under prolonged conditions of high temperature and water stress compared to the cultivated line M82. In particular, we analyzed biometric traits, the content of photosynthetic pigments and key antioxidants, leaf gas exchanges and chlorophyll a fluorescence emission. When exposed to single and combined abiotic stress, IL12-4-SL showed higher heat tolerance than M82. Moreover, the IL12-4-SL line showed a higher capacity to produce viable flowers under stress. Water stress and combined stresses strongly affected photosynthesis in both genotypes compared to heat stress alone. Despite the decrease in carbon fixation, the quantum yield of linear electron transport of PSII in IL12-4-SL was not affected by stress, thus indicating that photochemical processes other than CO_2 fixation acted contributed to maintain the electron chain in an oxidised state and prevent photodamage. The ability of the IL12-4-SL line to accumulate more ascorbic acid was another key trait for its increased tolerance to heat stress and drought, both single and combined. We state that IL12-4-SL is a promising line to be cultivated considering the major challenges that the Mediterranean agriculture will face associated to climate change and sustainability.

S2 P40

PROTEOMIC ANALYSIS REVEALS DISTINCT PATHWAYS INVOLVED IN PLANT CELL RESPONSE TO ABRUPT OR GRADUAL WATER DEFICIT IN POTATO

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Osmotic stress, including drought and salinity, negatively affects plant growth, productivity and food quality. Plants adapt to osmotic stresses through the modulation of different mechanisms depending on the stress duration and intensity. Understanding the molecular basis of plant stress response and adaptation is central to obtain new tolerant genotypes able to grow and produce even under unfavorable conditions. Many varieties of *Solanum tuberosum*, the cultivated potato, are very sensitive to water-limiting conditions and therefore, great efforts need to be addressed to improve potato plant adaptation to water deficit. We previously established a reliable in vitro model to mimic abrupt exposure (shock) or gradual adaptation to water deficit in potato suspension cells. In particular, we showed that divergent cellular and molecular mechanisms were activated in shocked and adapted cells. Herein, to identify protein expression modifications occurring during gradual adaptation with respect to abrupt water stress, a mass spectrometry-based proteomics approach on adapted and shocked cells was performed. Interestingly, our results showed that both adapted and shocked conditions caused significant alterations in the expression of proteins involved in several metabolic pathways, including carbon metabolism, metabolism of the osmotic regulation substances, and antioxidant defense system. However, in adapted cells, we found an increased abundance of proteins related to fatty acid biosynthesis and metabolism, confirming the key role of fatty acids in regulating potato cells adaptation to water deficit. Worth mentioning, we found that several proteins involved in transcriptional and translational machinery and chromatin organization are specifically expressed in adapted cells, strongly suggesting a central role of the epigenetic changes that will be further investigated in future works. Not least, our results provide a helpful list of candidate proteins to be considered for further functional analysis to establish their roles in plant stress and adaptive mechanisms.

S2 P41

THE IMPORTANCE OF FINDING NEW LENTIL (*LENS CULINARIS* MEDIK.) GENOTYPES TO EXPAND THEIR PRODUCTION IN A CHANGING ENVIRONMENT

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Lentil (*Lens culinaris* Medik.) is a very important pulse crop, cultivated in more than 50 countries around the world. It is also incredibly nutrient; in fact, it is a rich source of dietary fiber, protein, B vitamins, and minerals, and has low levels of sodium, cholesterol, fat, and calories. There are more than 58,000 accessions of lentil (cultivated and wild species) currently stored in different gene banks worldwide, but only a fraction is used due to the difficult adaptation of lentils when grown in different environments. For this reason, lentils are usually grown close to areas where they were bred. Nowadays it is very important to identify lentil genotypes that can easily grow in different environments, due to the climate changes. In this study, two field experiments were performed in Metaponto (Basilicata, Southern Italy) in 2016 and 2017. 324 lentil accessions from different countries and genebanks around the world were grown in small plots and evaluated according to vegetative and reproductive IPGRI descriptors for lentils. Morpho-agronomic and phenological traits related to adaptation were assessed in order to identify stable and high-yielding genotypes. The identification of promising, novel adapted genotypes can be used right away to help farmers to choose cultivars suitable in changing environments and to increase the area for lentil production in Italy. More significantly, breeding programs might use the data gained from this work to introduce new cultivars or novel sources of useful alleles.

S2 P42

SPEED BREEDING IN LENTILS: POTENTIAL TECHNOLOGY FOR ENHANCING GENETIC GAINS IN BREEDING PROGRAMS

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Lentil (*Lens culinaris* ssp. culinaris) is an annual, self-pollinated diploid (2n = 14, genome size ~4Gb) cool-season pulse crop and an essential component of sustainable cropping systems. Plant breeding using traditional techniques is a laborious process. Using conventional methods, it takes a decade or more to develop new varieties of crops like lentil. Cycle time is the most effective parameter for enhancing genetic gain in the breeder's equation, a model of the expected change in a trait in response to selection. In this context, speed breeding technology, which primally depends on photoperiod extension, temperature control, and early seed harvest, has the potential to accelerate the rate of plant breeding improvement. In this study a simple low-cost speed breeding technology was tested in six different genotypes of lentil by comparing an extended photoperiod treatment of 20 h light and 4 h dark at 20 °C in a growth cabinet and a conventional control treatment under field condition and glasshouse condition. Results for the different treatments were statistically different. Under the speed breeding, multiple generations per year using the single seed descent method could be achieved instead of one single generation under the control treatment. Lower number of days to flowering and days to maturity were obtained for the speed breeding method compared to the conventional methods. The obtained results highlight the potential of this method to speed breeding and pre-breeding in lentil and for rapid development of high yielding, biotic and abiotic stresses resistant and climate change resilient lentil lines.

This study was carried out within the Agritech National Research Center and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4 – D.D. 1032 17/06/2022, CN00000022).

S2 P43

OCCURRENCE OF *PLUM POX VIRUS* AND *PLUM BARK NECROSIS STEAM PITTING ASSOCIATED VIRUS* IN THE AUTOCHTHONOUS PLUM CV. COSCIA DI MONACA IN TUSCANY (CENTRAL ITALY)

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Although Tuscan autochthonous plum trees (*Prunus domestica*) have large diffusion and genetic interesting features, they were neglected and never investigated from a virological point of view. To address this gap, a commercial orchard composed by the autochthonous plum cv. Coscia di Monaca was selected in Arezzo district (Tuscany, Italy), and the presence of widespread (i.e., *Plum pox virus*, PPV; *Prune dwarf virus*, PDV; *Prunus necrotic ringspot virus*, PNRSV) and not widespread (i.e., *Apple chlorotic ringspot virus*, ACLSV; *Apple mosaic virus*, ApMV; *Myrobalan latent ringspot virus*, MLRSV; *Plum bark necrosis steam pitting associated-virus*, PBNSPaV) stone fruit viruses were assayed, also detailing the rates of mixed infections. Furthermore, plant-virus interactions were investigated by assessing physiological and biochemical responses. The polymerase chain reaction analysis carried out on leaves revealed the presence of PPV (55%) and PBNSPaV (64%) with cycle threshold values ranging between 15-19 and 21-31, respectively. Mixed infections were found in eight (36%) samples, followed by PBNSPaV in six (27%) and PPV in four (20%). Molecular typing revealed the presence of PPV-M strain. All symptomatic plants were infected by mixed infections (four) or PPV only (one), and none with PBNSPaV alone. Physiological and biochemical measurements revealed that mixed and single infections had different effects in leaves. Mixed infection and PPV alone affected photosynthesis due to putative alterations in the xanthophyll cycle. Conversely, although also PBNSPaV reduced xanthophyll content, it seemed not to affect the photosynthetic process. The presence of PPV in leaf tissue increased α-tocopherols, sucrose and fructose contents, whereas it decreased quinic acid levels. Differently, PBNSPaV increased malic acid and quinic acid contents. Overall, the results here presented represent an important step to fill knowledge gaps about the effects of *Prunus* viruses in autochthonous Tuscan plums.

S2 P44

WHEAT VIRUSES TRANSMITTED THROUGH THE SOIL: HOW IMPORTANT FOR ITALIAN DURUM WHEAT?

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Durum wheat (*Triticum turgidum* L. subsp. durum (Desf.) Husn.) contributes 14% of total EU wheat production, and Italy represents the greatest European producer. This cereal can be affected by numerous pathogens, including various viruses that can significantly compromise productivity. In particular, a number of soil-borne wheat viruses have been reported throughout the world. Two soil-borne viruses have been reported in Italy on wheat: soil-borne cereal mosaic virus (SBCMV) and wheat spindle streak mosaic virus (WSSMV). Both viruses have a ssRNA genome and are transmitted by Polymyxa graminis Led., a plasmodiophorid that can persist in soil for up to 20 years. Although these two viruses have been described more than twenty years ago, their real prevalence in the Italian wheat-producing areas remains unknown. This lack of knowledge is caused mainly by two factors. First, the difficulty in distinguishing symptoms caused by these viruses from plant nutritional imbalances or physiological stress. Second, lack of fast, sensitive and cost-effective detection tools. Actually, the detection assays currently available are costly and time- consuming (RT-PCR) or have limited sensitivity (ELISA). Since the prevalence and severity of these viruses are expected to increase due to climate change, there is a need for new detection tools, with improved performance: no extraction steps, very fast results (minutes), and a sensitivity that allows the pooling of a large number of samples. We have developed two protocols for the rapid, easy and highly sensitive detection of SBCMV and WSSMV that can be used in the field to simplify the surveillance of these viruses. The protocols are based on a reverse transcription loop-mediated isothermal amplification (RT-LAMP) and can be performed on plant crude extracts, without the need for RNA extraction. The sensitivity of RT-LAMP compares well with RT-qPCR, with the obvious advantage that it produces results in minutes rather than hours.

S2 P46

VALORIZATION OF A GREEN EXTRACT FROM *CHLORELLA VULGARIS* BIOMASS: EXPLORING THE ENHANCEMENT OF MICROGREEN GROWTH AND QUALITY

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In recent years, there has been a growing interest in exploring algae biomasses rich of biologically active compounds, especially for their potential use in agriculture as sustainable products to improve crop productivity. The present study focused on evaluating the efficacy of residual *Chlorella vulgaris* water extract, with high polysaccharides content, as an agrifood biostimulant for *Eruca sativa* microgreens. Microgreens are young seedlings that are harvested within 7-20 days after sowing and have gained popularity due to their high nutritional value, delicious taste, and appealing appearance. *Chlorella* biomass was produced at lab scale in photobioreactor (PBR). Following a spray-drying step and a biomass pre-treatment (mechanical wall disintegration), a sustainable extraction procedure, alternative to traditional extraction methods, was set up using a green solvent (water). Studies of the influence of process variables such as solvent ratio, extraction temperature and time, number of cycles, mechanical method of cell wall disintegration led to extraction range yield (2-19%, w/w). Result of the optimization of the extraction was the production of CHL-P extract, which had a complex mono- and poli-saccharide composition, low protein (36.5 ± 0.36 ± 2.1 mg/g CHL-P) and high carbohydrates (486.45 ± 8.4 mg/g CHL-P) content, spectrophotometrically determined. Moreover, the extract was characterized by Fourier Transform infrared spectroscopy (FT-IR). The effect of the application of CHL-P on *Eruca sativa* microgreens was evaluated both *in vitro* as seed germination and *in vivo as* determination of the biometric parameters (root and stem length, fresh weight of aerial and underground parts) of microgreens, showing significant benefits. Additionally, the extract enhanced the bioactive molecules content in the selected microgreens. These results suggest the potential use of *Chlorella* water extract, rich in polysaccharides, as a potential biostimulant for enhancing the growth, nutritional value, and nutraceutical properties of *Eruca sativa* microgreens. The implications on sustainable agriculture practices are evident; the use of CHL-P, a renewable natural and environmentally friendly product, can minimize the use of chemical fertilizers also enhancing crop productivity.

S2 P47

WHAT NEW STRATEGIES FOR THE GOVERNANCE AND VALORISATION OF ITALIAN CHESTNUT FORESTS?

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Proper governance of natural resources can help address the triple planetary crisis (climate, biodiversity, and air pollution). In today's challenging and fast-changing era, for governance to be effective, it is necessary to adopt strategies that are flexible and scalable, if necessary. In this regard, the use of multi-criteria analysis techniques can help in the decision support of strategic choices. In this study, the focus was on the governance of chestnut forests, involving a group of resource experts (n=20). The A'WOT technique was used to identify (SWOT) and quantify (AHP - Analytic Hierarchy Process) the factors potentially required for the development of successful management strategies. The results highlighted a priority role for external environmental factors over those intrinsically linked to the resource. Specifically, the opportunities linked to the social component, such as the participation of civil society in decision-making processes and its awareness of ecosystem services, appear to be the most promising levers for the revitalisation of the chestnut forest sector. The study also demonstrated the adaptability of A'WOT for supporting the governance of natural resources and its potential for application also at spatial scales larger than the local one.

S3 48

LIVESTOCK WASTES SUSTAINABLE USE AND MANAGEMENT: ASSESSMENT OF RAW SHEEP WOOL REUSE AND VALORIZATION

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Worldwide, several tons of agricultural waste are yearly generated, including livestock wastes (i.e., sheep wool), which create several critical environmental issues if not properly treated. In order to reduce the environmental issues related to the management and disposal, their use as natural fiber for green building component has notably developed over the last years. Indeed, sheep wool, which is a natural animal fiber coming from shearing sheep's fleece, is considered to be a problem of increasing concern for the complex and difficult disposal management. Recently, several researchers have demonstrated that "low quality wool" (i.e., not appropriate for tex;le uses) is suitable for thermal and acoustic insula;on of buildings. In fact, thanks to its thermo-hygrometric and acoustic characteristics, it can be used as a reinforcing fiber for composite materials. In this study, a Geographical Information System (GIS)-based model to locate and quantify both the yearly amount of livestock waste, i.e., sheep wool, and the territorial distribution of sheep farms, through their GPS coordinates, was carried out and applied within the selected study area (i.e., Sicily region). The aim was to identify those territorial areas highly characterized by this kind of waste and therefore most suitable for localizing new shared wool collection centers to sustainable manage the reuse of this waste as poten;al green building component. Data related to both sheep farms and sheep number and the related wool waste yearly production were acquired and applied in GIS. By GIS-based model results, suitable collec;on centers have been identified with the aim of valorizing wool waste for green building component, by minimizing the economic and environmental impacts. The achieved results could represent a first step to plan the sustainable re-use wool waste as natural, renewable, and biodegradable fiber in construction sector, providing the possibility of creating a new supply chain.

S3 49

CIRCULARITY AND SUSTAINABILITY OF AGRO-FOOD SUPPLY CHAINS: APPLICATION OF LIFE CYCLE METHODOLOGIES TO CLOSED-LOOP SCENARIOS IN THE OLIVE-OIL SECTOR

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Circular economy (CE) supports a complete rethinking of the production model, aimed at reusing materials and products as inputs for new production, while minimising wastes. This model offers opportunities to maximise the value of available resources through advanced recovery and upcycling processes. This Is of utmost importance in the current global economic and environmental context characterised by resource scarcity, an increased demand for food, the global climate change and environmental degradation. In this framework, the study proposes the evaluation of closed-loop pathways through Life Cycle (LC) methodologies - Life Cycle Costing (LCC) and Life Cycle Assessment (LCA) and on circularity performance indicators, providing comprehensive results on the economic and environmental impacts generated by one of the most important Mediterranean agribusinesses: olive oil production. This production chain is an essential socio-economic and cultural pillar, being part of the healthy Mediterranean diet, with a great interest also linked to landscape and territorial value, and at the same time it is also one of those that produce a great deal of waste and by-products. To validate the methodological application, this research proposes a comparison between a "circular" and a "linear" case study. Research results show that the circular scenario has better environmental sustainability, with a 40% improvement, but not for all impact categories. The use of LCA therefore proves to be crucial in highlighting the criticalities even of models that may seem more sustainable. From an economic point of view, it appears that the circular scenario is more profitable, but requires a higher outlay in terms of investment, which may be an obstacle in adopting the closed-loop approach. The circularity indicator also confirms the better performance of the closed-loop scenario, due to the lower amount of inputs used and wastes produced.

S3 P50

CIRCULAR BIOECONOMY AND THE FOREST-WOOD SECTOR: BRIDGING THE GAP BETWEEN POLICIES AND DISADVANTAGED FOREST AREAS

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The adoption of circular bioeconomy (CBE) strategies in forest-wood supply chains is a possible avenue for the future of this sector. However, the transition to a circular bioeconomy model that fully exploits the sector potential is not straightforward in all contexts. The uptake of CBE models faces several barriers, particularly in disadvantaged forest areas lacking appropriate resources and conducive environment to start innovation pathways. Understanding context-specific drivers, barriers, and potential strategies is thus crucial for bridging the gap between CBE agendas and territorial development challenges. The main objective of this study is therefore to contribute to generating geographically situated knowledge by analysing a case study in Southern Italy, where despite the existence of strong regional differences and excellence hotspots, the forest-wood sector struggles to express its economic potential. More specifically, the current research addresses the following research questions: (1) What are the strengths, weaknesses, opportunities, and threats to the transition of disadvantaged forest areas into a circular bioeconomy? (2) Which strategies can be adopted to foster the transition? To answer these questions, information gathered by interviewing forest entrepreneurs and key informants was used. Specifically, the study presents the outcomes of a qualitative analysis of the interaction with 29 experts, business actors and representatives of the forest-wood sector of the Salerno province (Southern Italy). An inductive process was used to generate a SWOT analysis of the interviews and to derive the strategies for the transition in the selected context. The study offers an outlook of the potentialities of CBE in disadvantaged forest areas, highlighting the role of policy actors in patronizing investments, stimulate know-how and cooperation, and fix policy inconsistencies related to biomass valorization. It provides, to the best of our knowledge, the first comprehensive socio-economic assessment of how to approach a circular bioeconomy transition in the forest-wood sector of Southern Italy.

S3 P51

LIFE CYCLE METHODOLOGIES AND SOCIO-METABOLIC APPROACH TO EVALUATE THE SUSTAINABILITY OF AGROECOLOGY PRACTICES IN MEDITERRANEAN OLIVE GROWING

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In Mediterranean basin, olive growing is considered a main component of socio-economic and cultural life, shaping the rural natural landscapes of many regions and preventing rural depopulations, as well as being an important source of income. In addition, olive groves are the predominant landscape of many villages of the Mediterranean basin and therefore changes in the practices of management might have not only socio-economic but also environmental consequences. Nevertheless, olive systems are characterized by critical aspects such as high production costs and low market prices of olive oil. If on the one hand, the intensification of olive production processes has tried to solve these problems, on the other hand, that resulted in simplified landscapes with low-nature value, driving greater negative environmental impacts. This contribution illustrates the rationale, and some preliminary results, behind a methodological proposal for sustainability assessment in the international ongoing project "SUSTAINOLIVE" (funded by PRIMA-H2020 programme) based on the Social Agrarian Metabolism (SAM) and Life Cycle approaches. The former focuses on biophysical functioning, flows and funds, and on the role played by energy flows within olive groves, taking into account not only the harvested olives but also the unharvested biomass, which is essential to provide and reinforce ecosystem services. In addition, Life Cycle Assessment (LCA), Life Cycle Costing (LCC) and Social Life Cycle Assessment (sLCA) are currently well-established methods to evaluate impacts and socio-economic effects and uncover burden shifts during the whole life cycle of a product or service. The methodological approach here presented aims to evaluate the environmental and socio-economic performances of different olive farms (in Spain, Italy, Greece, Portugal, Tunisia, and Morocco) - by comparing "agro-ecological" (i.e., Sustainable Technological Solutions – STSs, for example, the use of spontaneous or seeded cover crops, or the integration of olive farming and livestock production) and "ordinary" (i.e., non-STSs) management practices.

S3 P52

THE IMPORTANCE OF A SENSORY GARDEN THROUGH ITS ECOSYSTEM SERVICES

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The concept of the garden goes back in time and has accompanied the evolution of different civilizations, assuming different meanings and functions. Today the role of urban vegetation is at the center of European policies and directives. Urban greenery is entrusted with the task of helping to mitigate climate change through the sequestration of CO_2, the reduction of emissions, the lowering of temperatures. Sensory gardens are leisure spaces designed to stimulate and refine the five senses and, in addition to promoting environmental awareness, offer a pleasant methodology in teaching tree species. The aim of the research was to test the value of the creation of a sensory garden within the eco-archaeological park of Pontecagnano Faiano (Salerno Province) which offers, due to its characteristics, a wide range of opportunities, both botanical and archaeological. The set-up activities (area identification, tree species classification, design, panels installation, QR Codes creation, furniture, essential oils and aromatic waters preparation by aromatic plants) were carried out between 2020 and 2021, when the limitations of movement and social life caused by COVID-19 offered a further opportunity to reflect on the positive role played by sensory and vegetable gardens. The workshop activities, involving about 60 sighted and blind children and young people, were set up to test whether a sensory and environmental education path at school age can influence and change attitudes and behaviors towards the environment and others, as well as improve their knowledge about it. The results obtained showed that the activities carried out have favored learning, socialization, and inclusion. This sensory garden has proved effective as a non-formal learning and therapeutic tool, not just for people with disabilities, as a promoter of well-being and integration between groups, in which the emotional factor of the charm of the places also has played an important role.

S3 P53

CIRCULARITY IN LIVESTOCK FARMING: AN EMERGING RESEARCH TOPIC OR ESTABLISHED CONCEPT?

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The world's population is constantly increasing, while natural resources are becoming limited. In intensive livestock farming is relying more and more on external inputs in order to meet the growing demand for food, with a negative impact environmental sustainability and resilience to volatility of markets. The purpose of this study is to examine the literature focused on the theme of *circularity*. A database of 403 articles extracted from the 'Web of Science' platform was constructed using keywords: *circularity*, *dairy, cows, sustainability, self-sufficiency, by-products, nutrients stocks* and *environment*. SAS® 9.4 software was used to calculate descriptive statistics and to perform correlation and multiple correspondence analysis. Articles specifically focused on *circularity* area accounted for only 3.72% of the database, indicating the novelty of the topic. The remaining articles were related to *by-products* (52.8%), *nutrient stock* (29.3%), *self-sufficiency* (14.1%). Into the database studies from Europe were 111, followed by North America (n=102), South America (n=70), Asia (n=58) and others (n=50) (not specified n=12). In North America, the interest in these topics was considerable already before 2010 (43.1%). Conversely, in Europe, the largest number of articles on these topics have been published since 2017 (41.4%). Regarding the keywords *circularity* and *self-sufficiency*, appeared respectively for 60% and 76.4% in European articles. Multivariate analysis showed that articles from 2017 focus on issues related to *self-sufficiency* and *environment* issues, for which the livestock sector is often criticised. Despite not yet being a widespread field of research, circularity is essential for the survival of farms and fundamental for achieving sustainable livestock farming system production.

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S3 P54

YIELD RESPONSE TO BIOTIC STRESSES, PLANT PHYSIOLOGICAL STATUS AND THEIR INTERACTIONS. A META-ANALYSIS

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The world population is continuously increasing thus there is a need to produce more food considering also environmental, energetic, and therefore economic sustainability. However, there is a gap between potential and actual crop yield that is mainly due to the interaction between biotic and abiotic stresses at the soil-plant system level. The FOLOU project (Bringing knowledge and consensus to prevent and reduce FOod LOss at the primary production stage. Understanding, measuring, training and adopting, grant agreement n. 101084106) aims to prevent and reduce food losses at the primary production stage in line with the EU Green Deal priorities and with Sustainable Development Goals (SDGs). This will be achieved through the creation and building of an innovative crop management that integrates remote sensing techniques with other precision farming practices (irrigation, nutrition and defense against plant diseases and harmful insects) to be implemented within the different farming systems of Europe. In line with FOLOU project aims, the goal of this meta-analysis is to analyze the scientific literature on the influence of plant water and nutritional status on pathogen attack and insect damage causing a decrease in yields. The metanalysis focused on wheat, sunflower, pulses, and maize, being four of the most representative crops of Mediterranean cropping system. Published papers from 2014 to 2023 were sampled in March 2023 using the Web of Science™ and SCOPUS™ tools. The search resulted in 703 articles of which 110 were selected. Preliminary results show that about 70% of the scientific papers focus on maize and wheat crops and study the interaction of plant water status on pathogen and insect attacks. Conversely, sunflower and pulses are less studied as well as the interaction between plant nutritional status and pathogens attacks. The results of this meta-analysis will support the interpretation of FOLOU field trials.

S3 P55

AGRO-FOOD BY-PRODUCTS FOR EFFECTIVE PHOSPHATE ROCK FERTILISATION

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Due to the easy formation of insoluble complexes, P is the less accessible macronutrient in agricultural soils, which leads farmers to overuse fertilisers. Phosphate rock (PR) is a barely-soluble, widely used, renewable fertiliser whose consumption speed is leading to the depletion of the parent mineral. To increase phosphate rock solubility and efficient agricultural use, we propose PR combination with agro-food by-products (as olive pomace - O, brewer'sspent grain - B, and citrus pomace - C). This work is a two-step experiment to identifying a sustainable strategy for P fertilisation management. Firstly, we tested the mixtures of PR and agro-food by-products in an *in-vitro* trial for quantifying periodically total and water-soluble P, pH, organic matter, and ash content. Then we used these mixtures in a soil-plant system for the quantitative and qualitative assessment of the effects on rocket salad, soil chemical and biological parameters. The two trials were run in sequence, and both lasted 30 days. Treatments evaluated were single agro-food by-products, PR, and their combination (OPR, BPR, and CPR) in 3:1 ratio. In the *in-vitro* trial, all the mixtures performed better than PR in terms of P- release and water-soluble P. In contrast, the increased solubility of PR in mixtures was significantly ($p < 0.001$) ascribed to the reduction in pH. In the *in-vivo* trial, mixtures led to higher and better yields and soils so amended had higher available-P content coupled with good P-enzymatic activity. These results, as well as the pointed-out mechanisms of action of the agro-food by-products on PR solubilisation, were promising, suggesting feasible solutions for more effective P-fertilisation strategies. In turn, the investigation of simple and easy solutions, as the one proposed here, can reduce the distance between research achievements and field applications.

S3 P56

LEONARDITE EFFECTS ON SPINACH IN OPEN FIELD: PRELIMINARY RESULTS

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In order to evaluate the effect of biostimulant application on the growth parameters of spinach, an experiment was conducted on September 2022, in Sant'Omero, Italy. In this experiment, the effect of two levels of Leonardite biostimulant (1 and 2 liter per ha) on yield and growth indices of spinach (Bufflehead variety) was evaluated in the field condition. Experiment was carried in a randomized complete block design with three replications. Biostimulant was applied 3 times from 3-4 leaves stages, with a time interval of approximately 10 days. Results showed that, the use of biostimulant until 48 days after planting (the second time of biostimulant application) did not have a significant effect on the fresh and dry weight (FW and DW, respectively). But, after the third biostimulant's application, FW and DW significantly increased by 31 and 25%, respectively, compared to the control. The highest FW and DW was observed in Leonardite-2 L ha^{-1}, Leonardite-1 L ha^{-1}, and control, respectively. Biostimulant application was also found to improve leaf area index (LAI), compared to the control. In conclusion, our results showed the positive and significant effect of Leonardite on the spinach growth.

S3 P57

COMPARATIVE TRIALS TO TEST THE EFFECTIVENESS OF A WASTE COOKING OIL FROM DOMESTIC USE AND ITS DERIVATES AGAINST WEEDS AND PESTS

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The development of novel eco-friendly formulations to control weeds and pests represents a viable strategy for a more sustainable agriculture according to Farm to Fork Strategy. The current work aimed to test the potential activity of a waste cooking oil from domestic use and its derivates, including the deacidified oil and its methyl ester (obtained according to literature procedures) and potassium salts of fatty acids (obtained by alkaline hydrolysis) against some weeds at their juvenile stage and against a target insect, *Planococcus ficus* (Hemiptera Pseudococcidae). Laboratory bioassays were performed to compare the acute toxicity towards *P. ficus* of bio-based products and standard formulations, as well as to calculate LD_{50} and LD_{95} of each tested product. Treatments did not show any symptom of toxicity in weeds while showed activity against *P. ficus* under laboratory conditions, as insect mortality was significantly affected by the treatment for both nymphs ($F_{6,21}$=4.16, p<0.01), and adult females ($F_{6,21}$=10.78, p<0.01). Among all tested bio-based products, potassium salts of fatty acids at the dose of 1.2% caused 97.5 and 92.5% mortality of nymphs and adult females, respectively, showing an efficacy comparable to that of standard product sprayed at the doses of 1.2% and 1.5%. A concentration-dependent effect was found for all products, and LC_{50} and LC_{95} varied depending on bio-based products and the insect development stage. However, the formulation of potassium salts of fatty acid was the only tested product that showed comparable LC_{50} and LC_{95} values for nymphs and adult females.

S3 P58

CHARACTERIZATION OF AREATED AND NOT-AREATED COMPOST TEAS PRODUCED FROM A WALNUT CHAIN RESIDUES-BASED COMPOST

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The term Compost Tea (CT) refers to the aqueous extract of a compost that contains beneficial microorganisms and bioactive molecules, that makes it a source of phytostimulatory and protective effectors. CT-producing process can be conducted by oxidation or fermentation in liquid phase. Quality and activity of CTs may be influenced by a lot of factors, including compost source, process duration, which can range from few hours to two weeks, aerobic or anaerobic conditions, liquid phase, etc. Other influencing conditions may be the addition or not of some nutrients, temperature, ratio of compost to water, or certain chemical properties such as electrical conductivity and pH levels. There is significant literature regarding the use of CTs in horticulture, both for biostimulation of plant growth and capabilities of CT microbiome for biocontrol action due to its suppressive properties against a variety of plant pathogens. The goal of this work is to evaluate two CTs, named Aerated-CT3 and Not-aerated-CT3, obtained from a compost containing 60% of walnuts residues + 40% wood and giant reed chips, for physicochemical proprieties, microbiological composition, biostimulation and biocontrol activities. Biostimulation and biocontrol tests were performed on wild rocket plants (*Diplotaxis tenuifolia*) to assess the growth-promoting effects and suppressive capacity of the two CT against rotting disease caused by *Sclerotinia sclerotiorum,* one of the main pathogens of the crop. Results obtained indicate a good microbial composition and interesting biostimulation propriety of both CTs on seed germination and seedling growth at dilution upper to 1:10 vol. Regarding suppressiveness, both aerated and not-areated CTs showed potential in reducing Sclerotinia disease on wild rocket when they were used at dilutions 1:100 and 1:10, respectively. These findings gave indications to be exploited in practical greenhouse applications aimed at reducing crop external imput and improve sustainability.

S3 P59

SOIL FERTILITY AND AGRONOMIC PERFORMANCE OF GREEN MANURE IN VINEYARD

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The practice of green manure has numerous positive effects on soil fertility in vineyard. It improves soil structure, reduces erosion, acts on the nitrogen and organic matter content, temporarily immobilises nutrients and releases them gradually. Moreover, green manure promotes the biodiversity of the entire vineyard system. The aim of this research was to study, over a medium-term period, the effect of a balanced green manure mixture on soil organic matter (SOM), soil nitrogen (N) and vineyard agronomic performance. The trial was conducted starting in 2011 in a Pinot blanc vineyard in Trentino, organised in plots under integrated (mineral fertilisation on the row) and organic management (green manure on alternate inter-rows), named MIN and GM respectively. SOM and total N were determined using the Dumas method. Organic carbon (OC) fractions with different degrees of stability were measured using TOC and CN analysers after acid hydrolysis in H_2SO_4. Yield was determined at technological ripeness as kg per vine and vine growth was evaluated in winter as pruning wood (kg/vine). The SOM content only in the GM thesis showed an increasing trend over the ten years of study. The OC labile and stable fractions grew statistically in the thesis with green manure seven years after the start of the trial, in contrast to the MIN thesis. Total N in GM also showed a significant increase in the last two years of the study compared to the first years, demonstrating that the mineral N fixed by N-fixing bacteria in *Fabaceae* was converted into soil organic N. Vine yield was comparable between the theses over the study period. The relationship between yield and pruning woods showed a deficit in the woody biomass. In this study, green manure was shown to enhance carbon sequestration and improve soil fertility. While ensuring an adequate yield, the vegetative results indicated the need in the medium to long term to integrate nutrients not supplied by green manure, to maintain a good vegetative-productive ratio.

S3 P60

HAZELNUT CULTIVATION IN CAMPANIA REGION: ESTIMATION OF ITS ENVIRONMENTAL COST THROUGH THE LCA METHODOLOGY

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In Italy hazelnut production occurs on about 94,500 hectares for a total value of € 260 million. Campania is the third region with the largest area cultivated with hazelnut (22,120 ha) and with the highest production (240,000 q). In recent years, more and more producers and consumers are becoming aware of the environmental impact of products they produce and consume and are looking for more sustainable solutions. As for other agri-food productions, also the assessment of environmental impacts of hazelnut production is essential to identify more sustainable cultivation practices. The aim of the present research was to evaluate the environmental sustainability of the hazelnut cultivation in Campania region (South Italy), also in terms of the social cost of pollution. 19 hazelnut cultivation systems were analyzed (4 organic growing systems, 14 integrated, and 1 conventional) through the Life Cycle Assessment methodology. Impact categories were calculated according to the Environmental Prices method, with particular attention to global warming potential. Results show that the cultivation of one ha of hazelnut caused CO_2 eq emissions ranging from 1144 (BIO 2 system) to 2672 kg (INT 10 system). Fertilization, soil tillage and harvesting were the most impactful operations, accounting for more than 80% of the total impact. Per kg of hazelnut harvested, the emissions ranged from 0.32 (BIO 4 system) to 2.63 kg of CO_2 eq (INT 8 system). In economic terms, the cost of pollution was on average equal to 594 € ha^{-1}, with the conventional system with the highest social cost (1204 € ha^{-1}). In inland areas, hazelnut cultivation protects territories from erosion, supports the economy of rural districts and stimulates the development of close supply chain relationships, with positive effects on employment levels. Therefore, the environmental cost to pay, considerably lower than for other land uses, is necessary to ensure its survival.

S3 P61

USE OF HUMAN URINE AS A FERTILIZER TO INCREASE SUSTAINABLE FOOD PRODUCTION

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Greenhouse horticulture involves the greatest use of chemicals, particularly nitrogen (N), per unit area than any other agricultural system, causing high costs and severe environmental impacts. Therefore, there is a need to adopt new, more environmentally friendly fertilization practices able to increase nitrogen use efficiency (NUE) and maintain and/or increase agricultural productivity while reducing both costs and negative effects of N fertilizers on the environment and human health. To this end, the effects of human urine derivatives (liquids and precipitates) and commercial fertilizers on the metabolic profile and antioxidant activity of lettuce (*Lactuca sativa* L.) cv. Grand Rapidswere studied. The treatments were compared with respect to biometric parameters, carbohydrate, protein and amino acid content, including essential amino acids, anthocyanins and polyphenols, hydrogen peroxide, malondialdehyde and antioxidant enzyme activity. Two solid urinary derivatives (K-struvite and urine precipitate-CaO) and one liquid derivative (ED concentrate) resulted in yields similar to commercial fertilizer. However, hydrolyzed urine promoted the highest concentrations of total and essential amino acids. Stabilized urine at low pH induced the highest synthesis of hydrogen peroxide and anthocyanins, with reduced growth parameters. The use of aurine increased proline, alanine, and serine concentrations, and the activity of the antioxidant enzymes catalase and glutathione reductase and reduced yield, highlighting the presence of an ongoing abiotic stress, probably saline. From these preliminary data, the use of urine derivatives for nitrogen fertilization appears promising; however, further research is needed to reduce the presence of Na and Cl in these derivatives because of their deleterious effects on the growth and yield of horticultural crops grown in off-soil systems.

S3 P62

UNDERSTANDING THE ACTION OF PLANT-DERIVED PROTEIN HYDROLYSATES ON GREENHOUSE TOMATO UNDER LIMITED WATER AVAILABILITY USING A PHENOTYPIC-METABOLOMIC APPROACH

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Increasing temperatures and changes in precipitation frequency are forcing farmers to find new ways to improve crop resilience to events such as drought. Plant-derived protein hydrolysates (PH) could help to preserve crop production in unfavourable environmental conditions thanks to their ability in enhancing plant tolerance to abiotic stresses like water stress. PHs effect can be monitored in a non-destructive way using high throughput phenotyping platforms, combining the results with omics sciences such as metabolomics. The aim of the study was to understand the biostimulant action of three PHs on a greenhouse tomato crop subjected to water stress. The PHs belonged to the Malvaceae (M-PH), Solanaceae (S-PH), and Fabaceae (F-PH) family respectively. Two irrigation levels were set to observe plant development under optimal and sub-optimal water availability with repeated stress cycles. The PHs were compared to an untreated control. Their effect was monitored on morpho-physiological traits (digital biomass, 3D leaf area, plant height, NDVI, chlorophyll and senescence parameters) using a high throughput phenotyping platform (Tuscia University spin-off Arcadia), and leaves samples were taken to study the biostimulant activity through metabolomic analysis at oloBion laboratory in Spain. Morphological parameters were influenced particularly by M-PH highlighting its positive effect on plant recovery after water stress cycles. 3D leaf area increased using M-PH, affecting the digital biomass which also was higher in plants treated with M-PH compared to S-PH and F-PH. The metabolomic analysis evidenced an increasing number of compounds involved in the stress response and protection mechanisms, and changes in hormones synthesis. The plants treated with M-PH responded positively to the stress thanks to the production of compounds like dipeptides, hormones and metabolites involved in nutrient absorption.

S3 P63

USE OF BIOCHAR AS A SOIL IMPROVER TO MITIGATE THE EFFECTS OF SALT STRESS ON ''FRIARIELLO NAPOLETANO''

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Climate change poses a serious threat to future food security by increasing the frequency, incidence, and severity of abiotic stresses and their adverse effects on plants. Agriculture is therefore called upon to adopt efficient and environmentally sustainable strategies to improve plant tolerance and mitigate the effects of adverse conditions on crops. Biochar is a carbonaceous product obtained by thermal degradation in the absence or minimal presence of oxygen (pyrolysis) of different types of plant biomass. In agriculture, biochar can be used as a soil amendment because it improves the chemical, physical and biological properties of the soil. Soil application of biochar could be considered as a strategy to mitigate the effects of climate. In fact, the use of biochar as a soil amendment could play multiple functions to counteract the negative effects of water and salt stresses on plants. The purpose of this work was to evaluate the effects of adding biochar produced from poplar biomass to a silt-sandy soil [0 %, 1 % and 2 % (V/V)] on the quanti-qualitative production response of ''Novantina'' turnip top (Brassica rapa subsp. Sylvestris var. Esculenta) cv. Riccia di Sarno, subjected to irrigation with saline water (0 mM, 30 mM, 60 mM and 120 mM NaCl). During the culture cycle, physiological measurements (photosynthesis, fluorescence, SPAD) were performed and plant growth was evaluated. At harvest, the biomass produced was evaluated, and analyses were performed to determine the mineral content in the leaves and the qualitative aspect of the product. Finally, analyses of the main physicochemical characteristics were performed on soil samples taken at the beginning and end of the crop cycle. The results obtained confirm that biochar can mitigate the effects of salt stress on crops through improved soil characteristics.

S3 P64

EVIDENCE-BASED BEST SITING OF RURAL WATER PONDS IN TUSCANY

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Droughts are increasingly threatening agricultural production and ecosystem resilience in Italy. A major mitigation strategy for facing water scarcity is the construction of water ponds and small lakes across landscapes, from upstream forested areas to downstream agricultural lands. Although conceived to increase water storage for irrigation purposes, water ponds and small lakes have additional drought-mitigating effects at the landscape scale. Studies on single ponds show positive effects on reducing surface temperature and increasing soil moisture. However, large-scale assessments on the landscape effect of distributed water ponds during droughts are still missing. In this work we analyze a large dataset of water ponds and small lakes of varying size and distribution in the whole of Tuscany (over 16000 records). We explore the best-siting conditions based on Multi-Criteria Decision Analysis and we then assess the soil moisture stress reduction effect based on satellite imagery. By combining siting characteristics and the intensity and timing of the effect of water ponds for moisture conservation/mitigation we provide evidence-based information to plan effective scaling of water ponds for increasing drought resilience in Italy.

S3 P65

ASSESSING ENERGY AND ENVIRONMENTAL SUSTAINABILITY OF AN AUTONOMOUS GROUND VEHICLE IN AGRICULTURE

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The agricultural sector is facing the double challenge of feeding an increasing world population while reducing its impact on the natural environment and human health. To support an ecological and sustainable shift, farms must increase their efficiencies, while minimizing agricultural machinery impacts. Although tractor emissions were reduced by the tightening of engine exhaust emission legislation, further progresses are not expected in the next years, therefore it is mandatory to improve the sustainability of on-field activities. The implementation of new technological solutions in agriculture, such as Autonomous Ground Vehicles (AGVs), would help to achieve better production yields while reducing the environmental impacts of food productions. Unfortunately, AGVs are emerging technologies where the availability of scientific findings, that clearly state the benefits deriving from their implementation in agriculture, are still limited. Thus, the aim of this study was to assess the energy and environmental impact of an AGV implemented for the automation of on-field agricultural activities. The study adopted the LCA methodology to assess cumulative energy demand and climate change impact categories of an autonomous and fully electric terrestrial drone. The AGV analyzed is equipped with two tracks connected to a 2000W electric motor powered by two 220Ah lead-acid batteries. The results obtained showed 5.20 MJ h-1 of incorporated primary energy per unit of AGV's time. For the climate change, CO_2 e emissions accounted to 0.33 kg h-1 of impact per unit of time. The results of the AGV's components highlighted that the batteries represents over 42% of the total impacts followed by the electronic components (14%) and the steel frame (13%). Concluding, the outcomes of this study represent a step forward a more sustainable and conservative farm practices, providing novel results for optimizing the implementation of AGVs in the agricultural sector, and improving the energy and environmental sustainability of food productions.

S3 P66

IDENTIFICATION OF SUSTAINABLE CROPPING SYSTEMS TO PRODUCE BIOMASS FROM ENERGY AND ENERGY EFFICIENCY IN AGRICULTURE

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The increase in the concentration of carbon dioxide in the atmosphere is one of the main causes of climate change and it is necessary to find new strategies to counter it. By decreasing dependence on fossil resources, the concentration of greenhouse gases can be reduced with beneficial effects on the environment. Furthermore, it would allow the creation of new non-food markets for agriculture such as bioenergy, which could represent an alternative source of income for farmers. The project aims to define a circular economy model in agriculture based on a closed-loop system through the production of bioenergy and the recycling and valorization of waste products.

Specifically, the project defines

- sustainable cultivation systems for the production of biomass energy for a hybrid energy system, based on micro-cogeneration from residual plant biomass and integration with additional renewable sources

- essential elements of energy efficiency

- protected cultivation systems capable of valorizing the energy and waste derived from the use of energy biomass produced on the farm

Two lines of activity are envisaged:

1) the first relating to the production of lignocellulosic biomass and the evaluation of the quantity and energy quality of the biomass obtained.

2) the second relating to the development of an energy efficiency model applied to protected crop systems using bioenergy and by-products of its production (biochar and CO2).

The lignocellulosic biomass will be converted into electrical energy, syngas (a synthesis gas) and thermal energy by means of pyrogasification obtained under high temperature conditions in a low-oxygen environment using a micro-generator. The production of CO2, which can be used for carbonic fertilization in a controlled environment, and biochar, which can be used as a soil conditioner to improve crop quality, will be used in a greenhouse to produce table tomatoes.

S3 P67

PRODUCTION OF BIOFERTILIZERS FROM AGRO-INDUSTRIAL WASTES FOR IMPROVING SOIL AND CROP QUALITY

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European and Italian regulations aim to turn current climate issues and environmental challenges into opportunities for all sectors. For this, a new strategy of sustainable growth has been inaugurated through various legislations, promoting a clean and circular economy through the efficient use of resources, restoring biodiversity and reducing environmental pollution. The proposed research, in line with the objectives proposed by European and Italian legislation, aims to reuse different types of agro-industrial by-products (citrus processing residues and sulfur as an industrial residue) with a twofold objective: to improve soil quality and fertility and to increase crop productivity and quality in a sustainable way. Sulfur as a residue from the biorefinery and residual pulp from orange processing were complexed with bentonite, which is allowed in organic farming, serving as an inert substrate and carrier. The obtained biofertilizer was tested against a synthetic fertilizer (NPK) and commercial organic fertilizer (manure) in a climate cell. Fertilization was carried out in pots on tomato plants on two soils of different texture and alkaline pH. Initial results showed that the biofertilizer produced, belonging to the category of correctives, due to its tablet formulation that allows its easy distribution and disintegration in the soil, showed a rapid correction of the pH of the soil itself. Lowering the pH value in the root development zone facilitates the mobility and uptake of nutrients that are poorly mobile at alkaline pH and facilitates the uptake of macronutrients such as nitrogen, phosphorus and potassium. The positive effects of biofertilizer were also recorded on the secondary metabolites of tomatoes. In conclusion, from the first results obtained, it can already be said that the use of a sustainable fertilizer produced from biorefineries, and orange processing residues improves the soil quality in terms of functionality and at the same time crop productivity and quality.

S3 P68

EXPLORING THE RESPONSES OF YOUNG VINE (*VITIS VINIFERA* L.) PLANTS TO COMBINED SOIL AMENDMENT WITH BIOCHAR AND WOOD DISTILLATE

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The increasing interest in bioproducts obtained from recycled waste plant biomass, in a perspective of climate change mitigation and food security, has prompted the investigation of the combined effect of biochar and wood distillate (WD) as soil amendments on plant performance. In this study, the physiological and biochemical responses of young vine plants (*Vitis vinifera* L. var. Sangiovese) were tested under four different soil treatments: 20% (w/w) biochar and 0.5% (v/v) WD, 20% (w/w) biochar, 0.5% (v/v) WD, and a control. WD was provided to the soil through weekly fertigation. After 45 days of growth, regardless of the presence of biochar, WD fertigation led to a decrease in shoot biomass and an increase in root biomass, while biochar application positively affected root expansion and length. Although applying biochar and WD alone led to a decrease in shoot glucose content, their combination resulted in a glucose content like that of the control. WD increased the amino acid content, including phenylalanine and tyrosine, which are precursors of phenolic compounds. Biochar and WD, either alone or in combination, increased K content, while decreased that of Ca, Mg, and P in shoots and roots. However, WD promoted an increase in root P content. Although the Na content in the biochar-amended soil was high, plants primarily accumulated it in the roots, while the roots of WD-amended plants showed even lower Na content than that of the control. Moreover, WD increased soil cation exchange capacity, regardless of biochar addition. Organic C content increased in both biochar- and WD-fertilized soil. In conclusion, this study underlined a synergistic effect of biochar and WD on plant physiology, especially in terms of root growth, indicating that the combined use of these bioproducts could be a potentially feasible and sustainable solution for enhancing crop performance.

S3 P69

NANO-HYDROXYAPATITE FROM ORGANIC WASTE FOR SUSTAINABLE P-FERTILISATION: P SOLUBILIZATION AND DYNAMICS IN SOIL COLUMNS

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According to Yin et al. (2018), nano-enabled agriculture (NEA) describes the potential application of nanotechnologies in agriculture to improve agrochemicals performance. There is still a significant lack of knowledge compared to other sectors, but it seems that nature-derived nanomaterials could be more promising than synthetic ones in NEA (Sampathkumar et al., 2020). At the same time, using biowastes to produce nanomaterials represents a crucial step towards fulfilling circular economy paradigms. Hydroxyapatite (Ca10[PO4]6(OH2]) can be extracted from biowastes, such as bovine and fish bones and scales (Maschmeyer et al., 2020). Promising applications in agriculture arise from the potential of nano-hydroxyapatite (nHAP) that can be used as a P-source for crops or as a carrier for other macro/micro-nutrients or molecules for plant protection (Fellet et al., 2021). In this context, an ongoing soil-leaching experiment has been set up to test the behaviour of nHAPs from animal waste in soil columns. In the first step, nHAPs were synthesized from chicken bones. Two different temperatures were applied during the synthesis via calcination: 300°C (nHAP300) and 700°C (nHAP700). The nHAPs were then characterized by XRD, SEM, ICP-OES, and CHN analysis. The two nanomaterials showed different sizes (nHAP300 = 50-250 nm and nHAP 700 = 50-400 nm) and different surface structures: nHAP700 has a crystalline structure, more regular than nHAP300. They also differ in phosphorous content: 88,3±3,25 gP/kg and 194 ± 2,89 gP/kg for nHAP300 and nHAP700, respectively. The experimental factors are: (i) Ctrl (Control, unfertilized), (ii) TSP (conventional triple superphosphate), (iii) nHAP 300 °C, and (iv) nHAP 700 °C. Each treatment is replicated four times. The columns are irrigated weekly, and the leachates characterized for their P content. Results from the soil-leaching experiment will be presented.

S3 P70

AVOCADO LEAF WASTES FOR THE PRODUCTION OF HIGH-QUALITY HERBAL TEAS

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Tropical fruit, such as avocado (*Persea americana* Mill.), has had a sharp rise in cultivation over the past few years in south Italy, mostly in Sicily. The main causes are to be found in climate change, which is seeing the Mediterranean climate shifting toward the subtropical one, and in the consumer's increasing interest in healthy food; avocado fruits are in fact rich in bioactive substances, such as unsaturated fatty acids, ascorbic acid, vitamin E, polyphenols, and carotenoids. At the same time, increased consumption of avocado fruit has created issues connected to production sustainability, particularly waste management. In fact, both production and processing procedures generate a large amount of by-products such as leaves, seeds, rotting fruits, peels, and pulps, which require additional costs for their disposal. As regard leaves, the annual tree-pruning operation to which avocado trees are subjected to contain their excessive growth and facilitate the harvest operation, lead to a high amount of biomass (1-5 tons/hectare) that must be correctly removed and disposed of. As avocado leaves contain high amounts of bioactive compounds, we aimed to valorize this by-product by using a waste-to-value strategy, giving them a new opportunity in the food sector. In particular, the use of avocado leaves to produce herbal teas and the extraction of bioactive compounds have been evaluated. The leaves of different avocado varieties have been dried using different technologies, and the resulting products were physicochemically, chemically, and sensorially characterized. Consumer science tests have been also carried out to verify the consumer acceptability of the different avocado leaf herbal teas.

S3 P71

VALORIZATION OF COFFEE WASTES FOR MULCHING FILM PRODUCTION: A CONTRIBUTION TO A CIRCULAR ECONOMY

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The valorization of food waste as a source of energy and/or plant nutrition has gained importance in recent years, due to the rapid depletion of primary resources and the increase of waste generation worldwide. Coffee by-products, in particular coffee silver skin (CSS) is a by-product of the roasting process that has attracted a great interest in the formulation of bio-composites; it is a good source of nutrients for microorganisms and it is a functional ingredient for different industrial sectors, including agriculture. A new valorization of CSS has been investigated here: a mulching films for agriculture have been formulated by combining poly butylene succinate-co-adipate (PBSA), a Ncommercially available biodegradable aliphatic polyester and 10, 20 and 30 wt% of CSS. Chemical and microbiological analysis of CSS revealed the presence of mineralMnutrients and potential plant growth-promoting bacteria (PGPB), mainly ascribed to the genus Bacillus, which can survive both the roasting and the compounding processes. The obtained composites were characterized mechanically and thermally, and their hydrophilic nature were investigated by measuring the contact angle. Through in vitro test, the release and quantity of bacteria from the composite films were analysed. The ability of the films to promote plant growth was evaluated in greenhouse using lettuce as a model culture. The composite films were able to release endogenous bacteria into the soil and stimulate foliar and root biomass. The production of biodegradable mulch films by recycling CSS is a new innovation having multiple benefits; in particular, the cost reduction for the mulch material and the exploitation of beneficial microorganisms for fertilization purposes. Therefore, a fully biodegradable mulching film can be prepared, with benefits for the society and the environment.

S3 P72

BASIL PLANTS FERTIGATED WITH WOOD DISTILLATE ARE MORE RESPONSIVE IN COUNTERACTING THE NEGATIVE EFFECTS INDUCED BY THE PRESENCE OF BIOPLASTIC IN THE SOIL

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In agriculture, the use of bioplastics as a sustainable alternative to plastics has garnered considerable attention, as it aligns with the SDGs of UN 2030 Agenda. However, given the expected extensive use of bioplastics and that their residues could cause adverse effects on soil and crops, it is imperative to investigate the environmental impact of bioplastics. This study aimed to evaluate the possible negative effects of a corn starch-based bioplastic on basil (*Ocimum basilicum* L.) and examine the potential of wood distillate (WD), a natural enhancer of plant growth and defence, to mitigate these effects of bioplastic. To accomplish this, plants were grown for 35 days in a soil supplemented with WD, bioplastic, or a combination of both. The study analyzed physiological and biochemical changes in the shoots, including fresh biomass and chlorophyll, protein, sugar, vitamin C, and malondialdehyde contents. WD positively affected basil growth, while bioplastic negatively as also evidenced by increased MDA content. Notably, WD did not affect sugar levels but increased vitamin C levels, which is beneficial, as changes in sugar content can indicate a plant stress condition. Conversely, the bioplastic caused a reduction in sugar content, but no change in vitamin C content, possibly due to the reduction in sugars not reaching the threshold for a significant reduction in vitamin C. The combined treatment of WD and bioplastic was effective in mitigating the bioplastic impact on basil, except for sugar and vitamin C, which were reduced. In this case, the correlation between sugar and vitamin C was fulfilled, likely because the sugar level had reached the critical threshold of reduction. This study emphasized the potential of WD as a tool to remediate bioplastic-contaminated soil, but further research is necessary to understand the mechanisms of WD interaction with bioplastic across different plant species, bioplastic types and doses.

S3 P73

EFFECT OF LIGHT-EXTRACTING FILMS ON *FRAGARIA × ANANASSA* DUCH. NUTRACEUTICAL TRAITS

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Light-extracting (or spectral-shifting) films are among the newly used crop covering materials, adopted for being effective in increasing fruit production and likely, fruit nutraceutical traits. The developed LC® light-extracting films have the potential to increase the transmitted blue or red wavelengths inside the greenhouse/tunnel by converting the UV and green wavelengths, defined as less photosynthetic-efficient lights. In this study, we focus on the functional effect of 3 LC® spectral-shifting films (Blu "B", Pink "P" and Red "R") on secondary metabolite accumulation in *Fragaria × ananassa* Duch. (*cv*. Aromas) fruits. In a period of 3 months, the strawberry plants were cultivated in a coconut-fiber mixture under the tunnel structure covered with each of the LC® films, whereas the control "CNT" was the transparent polyethylene film. The results show that the fruits harvested from "B" tunnel showed a significantly higher total phenol (+29.9%) and flavonols (+126.72%) contents than the "CNT" plants. Moreover, fruits grown under "R" film showed a decrease in the total anthocyanin concentration (-42.72%) whereas no statistical difference for these compounds emerged between "B", "P" and "CNT". In total, 46 secondary metabolites were identified by LC–MS-driven untargeted analysis and overall, a similar metabolite profile was found in all four treatments. However, accumulation of quercetin glucoside (flavonol), procyanidin pentamer and procyanidin hexamer (proanthocyanidin) was significantly promoted in fruits of "B" in contrast to the control treatment. The loss in terms of ascorbic acid concentration was a consistent result between the three tested "P", "B", and "R" LC® films, (-35.59%, -35.98%, -20.56% respectively) compared to the "CNT". The LC® films did not particularly affect the antioxidant activity capacity in fruits. Although the decrease in ascorbic acid concentration by the application of the LC® light-extracting films, these preliminary results show the promising benefit of "B" LC® films on specific bioactive compounds accumulation.

S3 P74

SHORT-TERM EFFECTS OF WOOD BIOCHAR ON SOIL HETEROTROPHIC RESPIRATION, SOIL QUALITY AND FERTILITY

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The biochar is the solid residue resulting from the pyrolysis of biomasses, conducted at controlled conditions. It represents a sustainable strategy to recycle agrosystems wastes and improve soil properties. However, the literature investigating on the biochar action on soil and plants is still limited and sometimes contradictory. Therefore, we evaluated the effects exerted by biochar on the soil, in the short-term, when applied as an exogenous organic soil improver, at different doses in field trials. Soil microplots (1 m^2) were treated either without (0 kg/m2) or with biochar, both at relatively low (1 kg/m^2) and high (3 kg/m^2) concentrations. For each microplot, they were analyzed (1) the heterotrophic respiration (continuously) and (2) the most important chemical parameters potentially affected by biochar (before and after 9 and 54 days from the application). Soil respiration was monitored through a pilot system based on a closed dynamic chamber, designed to measure continuously CO2 fluxes in the open field, in the short and long-term, and characterized by being remotely controllable, equipped with an automated opening of the chamber, environmental sensors, a data-logger and a photovoltaic panel. The soil organic matter from investigated microplots was extracted and the molecular composition was characterized through advanced analytical techniques. Fennels, as a model crop, were transplanted on the experimental microplots to probe the effects induced by biochar on the productive potential of the soils. After 9 days, salinity, organic substance content and CEC increased significantly, as a function of the biochar amount. After 54 days, they tended to decrease, by converging again towards the initial values, thus revealing a temporary effects. The heterotrophic respiration increased significantly only in case of application of the lowest dose of biochar. Accordingly, only the treatment with the lowest amount of biochar gave slightly but significantly better responses for fennel productive parameters.

S3 P75

SUSTAINABLE FUNCTIONAL FOOD INGREDIENTS FROM AVOCADO PROCESSING BY-PRODUCTS

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Recently, in the Mediterranean area, due to climatic changes and the consumer's interest in healthy food, the cultivation of tropical fruits is increasing. In the case of avocado, the processing industries generate a huge amount of by-products such as seeds, pomace, and peel, representing more than 30% of the weight of fruits, which are unutilized or discarded as wastes into landfills. It is well known that these low-cost, readily available by-products possess a large amount of vitamins, minerals, and bioactive compounds such as phenolic acids, flavonoids, terpenes, and terpenoids with different pharmacological activities. The recent tendency for delivering functionality in food had determined the orientation of the scientific community to attractive sustainable and healthy ingredients. Functional foods are whole, fortified, enriched, or enhanced foods that have a potentially positive effect on health beyond basic nutrition when consumed as part of a varied diet regularly. In this context, our research has gained great attention to the avocado production by-products to be used as ingredients for the development of functional foods. To contribute to this approach, avocado (Persea americana cv. Hass) seeds from avocado oil production industry have been processed into flour and its nutritional value, technological functionalities, and sensory features have been assessed. The results revealed the high potential of avocado seed flour as an innovative ingredient for functional food products.

S3 P76

OLIVE CAKE DIETARY SUPPLEMENTATION IN DAIRY COWS: EFFECTS ON MILK FATTY ACIDS PROFILE

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The use olive cake (OC) for alternative animals feed is widespread to reduce cost associated with animal nutrition, to reduce environmental impact and to enhance meat and milk quality. Due to its richness in unsaturated fatty acids (UFA) and polyphenols, this study aimed to evaluate the effects of supplementing OC to mid-lactating Holstein cows on milk fatty acids (FA) profile. 20 cows (10 for each group) were enrolled into 2 homogeneous groups, EOC and CTR. The EOC group was fed with a 7% inclusion of destoned OC, whereas control group (CTR) received a conventional diet. Milk samples were collected on d 0 and the last week of the experimental period on d 28. FAs were extracted, methylated, and separated with a gas-chromatographer fitting a CP-Sil88 column. Data were analyzed with the PROC GLIMMIX of SAS. Values are expressed as a percentage of total FA. The inclusion of OC modified the FA profile of milk. In fact, among saturated, short- and medium-chain FAs, in OC group, milk C10:0 (2.84 vs. 3.68; P=0.08), C13:0 (0.16 vs. 0.24; P=0.08), and C14:0 (12.73 vs. 14.64; P=0.06) tended to be lower compared with CTR. A lower content of C12:0 (3.77 vs. 4.93; P=0.05), C15:0 (1.61 vs. CTR 2.01; P=0.03), C16:0 (33.73 vs. 36.76; P<0.001) was also observed in OC compared with CTR group. OC group had greater milk C18:1cis-9 (20.32 vs. 16.63; P=0.02) than CTR. Milk C18:0 tended to be greater in OC than CTR (6.68 vs. 4.51, respectively; P=0.08), whereas milk C22:2 (0.05 vs. 0.09; P=0.07) and C24:0 (0.04 vs. 0.08; P=0.09) tended to be lower in OC than CTR. These results point out the beneficial effects of supplementing OC since it improves milk FAs that are positively related to human health and are indicative of a better nutritional and nutraceutical properties of milk.

S3 P77

CIRCULARITY PRACTICES AND ENVIRONMENTAL SUSTAINABILITY: THE USE OF BAKERY BY-PRODUCTS IN FEED RATIO OF DAIRY COWS IN A CHALLENGING YEAR

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In the last months, dairy farms suffered for severe crisis due to economic speculation and climate change, which are challenging the sustainability of milk production. In particular, rising raw material prices, drought and the presence of mycotoxins in corn have prompted dairy farms to make changes in the feed ration composition of lactating cows. The aim of the study was to compare the global warming potential (GWP), related to the milk production and to the lactating cows ration, of a farm that switched from a control diet (C) to a circular one, with bakery by-product (B). The C diet was based on energy sources (kg/head) such as corn silage (30.0), whole ear high moisture corn (6.3) and corn meal (1.5); in the B diet, the whole ear high moisture corn, due to aflatoxins, has been reduced (3.0), increasing purchased corn meal (2.2) and adding the bakery by-product (1.8). The protein source was the same in both diets: soybean and sunflower meal, while the C diet also had corn gluten meal, replaced by rumen-protected methionine in the B diet. The GWP of one kilogram of fat and protein corrected milk (FPCM) and of individual daily diet were evaluated through a Life Cycle Assessment approach, using equations as proposed by IPCC (2019) and Simapro software (IPCC 2021 GWP100 method). The average individual daily milk production was higher with the B diet than C (37.5 vs 35.0 kg). The GWP of the milk was higher for the C diet: 1.25 vs 1.19 kg CO2eq/kg FPCM. Comparing only the diets, the individual daily diet GWP (kg CO2-eq) was 19.5 and 18.3 for the C and B rations, respectively. The circular diet seemed to be more sustainable, in terms of GWP, by considering the impact both per kilogram of FPCM and per individual daily diet.

S3 P78

INTEGRATED POULTRY-HAZELNUT ORCHARD SYSTEM: EGG PRODUCTION AND GROUND COVER CONTROL

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In the present study, carried out in the Campania region, we investigated the effects of grazing by hens on plant biodiversity in the ground cover of a hazelnut (H) and a vineyard (V), and evaluated the egg laying rate and feed consumption. Using the quadrat method, a total of 81 (47 in site H and 34 in site V) plant species were identified at the beginning of the experiment. The results showed that hen grazing influenced the composition of the herbaceous layer in the orchards. After hen grazing, the number of identified plants dropped to 58 (34 in site H and 24 in site V). Among the most eaten species we found Lolium sp., Trifolium sp., Polygonum aviculare, Cichorium intybus, Setaria sp., Geranium sp., Malva sp. Alpha and beta diversity analyses confirmed that hen grazing played a role in controlling vegetation growth. The mean laying rate was 0.55 in the H site, 0.45 in the V site. The lower production in site V compared to site H could instead be due to the fact that the hens from this site, which is located in a valley with strong thermal inversions, needed a higher energy consumption for their thermoregulation and consequently consumed +11 g/day/head feed. The lower mean laying rates compared to the control rearing (0.78) could be due to the lack of a balancing light programme to complete the 16-hour day and of an internal feed supply in the chicken coop. Nevertheless, the lower laying rate at both sites compared to the control rearing was more than compensated by the lower feed consumption, which was reduced by about 30%.

S3 P79

EFFECT OF BIOSTIMULANTS ON BIOMASS AND ESSENTIAL OIL YIELD OF ORGANIC ROSEMARY

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Rosmarinus officinalis L. is a xerophytic and evergreen shrub widely used for food and ornamental purposes, belonging to the *Lamiaceae* family. Rosemary shows significant variations in biomass and essential oil (EO) yield due to the effects of biotic and abiotic factors. The development and use of an appropriate cultivation technique can be useful to improve production and qualitative performance of this crop. In accordance with sustainable and organic agriculture criteria, biostimulants can play a relevant role in the growing of rosemary. These new-generation products can be applied to crops to increase and improve the efficiency of nutrient and water uptake, and their tolerance to various stress. The aim of this study was to evaluate the effect of different types of biostimulants on production performance of rosemary. Four different commercial formulations were used: *Eklonia maxima* (B1), *Ascophyllum nodosum* (B2), fulvic acids (B3) and peptides (B4) was to evaluate. The control treatment was provided by water only. The biostimulants were weekly applied as foliar spraying fertilization since the first week of April 2022. Six applications were performed. After harvest, total fresh and dry biomass yield, EO content and yield were determined. All parameters were affected by biostimulants. The lowest values of all parameters in the study, except EO content, were observed in control plants (B0). The highest fresh and dry biomass yield were obtained applying fulvic acids (B3) and peptides (B4), with values of 60% higher than the control. For EO content, the highest value (1.72%) was obtained in control plants while the lowest (1.14%) applying fulvic acids (B3). Regarding EO yield, the lowest value for unit area was observed in the control. The applications of *E. maxima* (B1) and peptides (B4) allowed to obtain the highest EO yield values. This study permits to say that the use of biostimulants can improve production parameters of medicinal and aromatic plants in organic agriculture. Further research is required to evaluate the effect on qualitative characteristics of EO.

S4 P80

TRADE-OFF BETWEEN THE ECONOMIC AND ENVIRONMENTAL SUSTAINABILITY IN THE SHEEP FARMS USING THE FADN DATABASE

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Agriculture and livestock farming contribute significantly to the success of all Sustainable Development Goals (SDGs) of Agenda 2030 and are critical in the sustainability transition of the European agri-food sector. However, those sectors have been criticized for generating negative externalities. In particular, livestock farming has been indicated as one of the activities with the greatest environmental impacts. In this context, the sustainable development of the primary sector and the definition of adequate policies to support it unavoidably require indicators that allow its sustainability assessment. This would be the first step to understanding if the European Union policies that strive to realize win-win opportunities that improve sustainable development and profits in a logic of synergy between farms' environmental and economic dimensions are realistic. Otherwise, one could speak of trade-offs instead of discussing synergistic relationships. This paper focuses on this wave of interest. Specifically, it intends to identify the economic and environmental sustainability degree of dairy sheep farms. To this end, two synthetic indicators have been created for each company, synthesizing six economic and ten environmental indexes. Afterward, using trade-off analysis, the existence and magnitude of synergies or trade-offs between the two sustainability dimensions were assessed. The study was carried out on 219 Sardinian sheep farms included in the Italian Farm Accountancy Data Network (FADN), which, due to the regional peculiarities, make it a good benchmark for analyzing sheep raising and the challenges this sector faces today. Despite the increasing relevance of the trade-off analysis in the agricultural field and the European importance of this sector, to our knowledge, no previous studies assessed the degree of sustainability and its dimensions' relationship in dairy sheep farming. This study provides significant food for thought into the implications of the agri-food transition toward a sustainable paradigm, and several implications for practitioners, academics, and policymakers derive from our findings.

S4 P81

ECOSYSTEM SERVICES ASSESSMENT MODELS FOR THE ENHANCEMENT AND PROMOTION OF AGROFORESTRY SUPPLY CHAINS IN MARGINAL AREAS

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Ecosystem services (ES) are defined by the Millennium Ecosystem Assessment (MEA) as the benefits that people derive from ecosystems. Marginal areas, which in Italy represent most of the internal and mountain territories, show potential not exploited in terms of ES production. This is also by the lack of use of ES quantification and assessment techniques in government plans. To quantify and evaluate at a monetary level the ES expressed both in terms of supply and in terms of measurement of the change in supply as a result of anthropogenic activities, at present, it is an essential step in development. The general objective project is to provide a system of evaluation of the ES to identify the services provided and potentially achievable by the systems useful for improving the quality of life of rural communities through the sustainable use of natural resources and at the same time promoting and enhancing the activation and/or consolidation of production chains in the marginal areas of Basilicata /SNAI (Internal areas of the national strategy). The specific objectives for promoting marginal areas through ES are to improve the resilience of local communities to environmental and promote the development of sustainable technologies and infrastructure. The methodological path necessary to achieve the objectives, includes phase of identifying ecosystems and ES in marginal areas, selecting the most appropriate assessment methods based on needs and available resources, and collecting, analyzing and reporting data. In the second phase, results will be reported to decision makers and local communities, and monitoring and evaluation will continue to ensure that ES benefits continue to be provided in a sustainable manner. The expected results will be aimed at obtaining a quantification of the identified ES, estimating the economic value of ES, building an ES analysis model, and promoting and enhancing agro-forestry supply chains in marginal areas.

S4 P82

ACTIVITY-BASED COSTING USING CANBUS DATA TO IMPROVE THE FARM MANAGEMENT

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Nowadays the concept of sustainability is not restricted to the protection of the environment. Indeed a widely spread accounting framework is the triple bottom line (TBL), which includes in addition to the environmental aspect also social and economic scopes. Regarding the latter, the improvement of economic management in farms has become an important research topic in recent decades as the most dominant feature of current farm management information systems (FMIS). As a result, the availability of trustworthy cost data, particularly information on the use of agricultural machinery, is crucial for FMIS. Estimates of farm operation expenses can be found in technical sheets, grey literature, and international standards, but their accuracy is poor because agricultural machinery is very variable in terms of both working and environmental conditions. This work intends to establish an innovative methodology for cost estimations of field operations using real-world CANBUS data based on the activity-based costing (ABC) approach. The study used a 198-kW tractor equipped with a CANBUS logger and numerous implements that had Bluetooth beacons placed to detect agricultural operations automatically. By looking at machine location (such as in a field, farm, or on a road) and operating condition states, the collected data were processed to identify the daily tasks carried out (e.g., moving, fieldwork, or idling). The ABC technique was implemented in two stages: first, cost driver rates were evaluated to identify capital and non-capital costs, and then the costs of each agricultural operation were defined by connecting the cost drivers to the jobs that were recorded. The findings indicate that the combined effect of fuel and labour expenses accounts for more than 60% of the overall cost per hectare for the evaluated implements. With the aid of this methodology, farmers may be able to manage their lands, crops, and farms more efficiently.

S4 P83

CAN SPECTRAL DETECTORS EFFECTIVELY PROXY FORAGE QUALITY INSTEAD OF TIME-DEMANDING BOTANICAL SURVEYS?

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Forage quality of Alpine pastures can widely vary along the vegetative season in different ways depending on the different grassland types. Analytical methods provide precise assessment but are often time- and cost-demanding. We hypothesised that forage yield and quality can be effectively proxied by remote sensors, namely portable NDVI (normalised difference vegetation index) scanner and stationary PhenoCam, rather than by in-field vegetation surveys or laboratory analyses. We selected three grassland types in the Alpine summer pastures within Gran Paradiso National Park (NW Italy) characterised by contrasting plant compositions, i.e. belonging to eutrophic, mesotrophic, and oligotrophic vegetation communities. In 2021 and 2022, we carried out botanical surveys to assess grassland Pastoral Value (PV, i.e. a synthetic species-based index of forage yield and quality) and we collected a grass sample from each pasture type in four to five dates along the vegetative summer season, then sent to laboratory for biomass and quality (digestibility) assessment. At the same time, we recorded the NDVI measured by the portable scanner and we obtained the green chromatic coordinate (gcc) of the pasture from a PhenoCam positioned close to the permanent survey plots. The suitability of the three synthetic variables (i.e., PV, NDVI, and gcc) in proxying grass biomass and digestibility was assessed through statistical analyses. The tested relationships were highly significant in all contrasts and higher values of biomass and of digestibility corresponded to higher values of PV, NDVI, and gcc. Among the three proxies, the PV showed similar results to gcc, while the best fitting was obtained by the NDVI. This outcomes highlight the relevant potential of new monitoring tools for the assessment of forage yield and quality, especially in harsh environments where in-field measurements can be time-demanding and uneasy, like Alpine summer pastures.

S4 P84

INTEGRATION OF ARMOSA CROPPING SYSTEM MODEL WITH A TOOL FOR THE OPTIMISATION OF MANURE REDISTRIBUTION AT LOCAL AND REGIONAL LEVEL

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Increasing intensification of crop and livestock production raises growing difficulties in the achievement of an optimum balance between economical profitability and environmental sustainability. An integrated system was developed to support stakeholders in the identification of viable solutions to maintain crop productivity and reduce environmental impact at a local or regional scale. A regional database, containing farms data about livestock load, manure-N, and crop nitrogen requirements, was employed to perform long term simulations of the prevalent cropping systems with the ARMOSA process-based model that simulates crop growth and development, water and nitrogen dynamics under different pedoclimatic conditions and crop management practices. A software tool was developed to assess the opportunity of moving manure from farms with excess manure (surplus-farms) to farms where manure is lacking according to the crop N requirement that is fulfilled mainly with mineral fertilizers (deficit-farms). The opportunity of manure moving was estimated using optimization algorithms that consider the distance between surplus-farms and deficit-farms, the costs and CO_2 emissions associated with manure transport and the mineral fertilizers purchased in the deficit-farms. The outcome of the tool is the list of deficit-farms that take the advantage, in terms of costs and CO_2 emissions, of receiving manure and reducing the purchase of mineral fertilizer. In these farms, ARMOSA is applied to assess the crop productivity, soil organic carbon stock, and N losses (NO_3 leaching, N_2O and NH_4 emissions) before and after receiving manure. Additional assessments were performed in deficit-farms after manure redistribution optimization, to evaluate the environmental benefits of alternative management practices aimed at reducing N losses. This integrated system can be applied to data available Europe-wide thus allowing the a priori evaluation, at a regional scale, of the impact of moving manure on N use efficiency and soil carbon stock evolution, in a wide range of pedoclimatic conditions.

S4 P85

QUALITY ASSURANCE IN REFLECTANCE DATA MODELING: A PROTOCOL TO ASSESS PLSR ROBUSTNESS

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Data science offers a collection of techniques that are essential tools for understanding and predicting crop responses to environmental conditions and agricultural management. Among these, Partial Least Squares Regression (PLSR), thanks to its strengths (copes with multicollinearity, features importance can be ranked, minimal computational power required, ease of use), is one of the most popular for the treatment of spectral reflectance data. Anyhow, the assumptions, requirements, and implications of the technique itself are not as diffuse as its use is (our literature survey indicates that, in the last 3 years, less than 50% of the published papers used it properly). In particular, the model validation procedure can be delicate and demands an external independent dataset that may be too costly to provide in agronomic sciences. This restriction is often evaded by the use of an auto-validation technique which randomly divides the original dataset into a calibration and a validation set, nonetheless, this technique has its own needs: the original dataset has to be large, or the calibration/validation sets generation has to consider the distribution of the response variable. Another way is resampling without replacing the two sets to obtain a representation of all possible combinations. We are presenting the minimum viable product of a novel protocol for PLSR over spectral reflectance data, that includes a feature for iterative resampling of the calibration and validation sets that provides a clear view of the model's fit to the data, in the form of a probability distribution, of its own performance indicators. The protocol is openly available in the form of an R language script. Its use is particularly beneficial in cases where it is impossible to provide an external validation set, or when there are few response variable data and/or they largely diverge from the normal distribution.

S4 P86

SATELLITE IMAGES AND MODELING CONTRIBUTE UNDERSTANDING COVER CROP EFFECT ON NITROGEN DYNAMICS AND WATER AVAILABILITY

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The cultivation of cover crops (CCs) is a widely reported practice able to impact the N dynamics and soil water content (SWC) of agricultural systems. Optimizing the CCs potential benefits on both these aspects, however, requires a deep understanding of their growth pattern, N accumulation, and subsequent mineralization. For this reason, the goal of the present study is to use satellite images and a simulation model (CC-NCALC) to analyze different winter CCs growth, and predict their N contribution to subsequent cash crops, while monitoring the SWC over the seasons, in a 3-year maize-soybean rotation in northeast Italy (6.5-ha experimental site). The CCs systems included a fixed treatment with triticale; a 3-year succession of rye, crimson clover, and mustard; and a control with no CCs. Satellite images showed that rye and triticale grew faster during the winter season compared to clover but slower than mustard, which was subjected to frost winterkilling. Both the grasses and the mustard produced higher biomass, but with a lower carbohydrates content at termination, compared to the clover. Regardless of the species, any significant difference was observed in the SWC among CCs and the control treatment, demonstrating that water wasn't a limiting factor for the subsequent cash crop, whose yield and N uptake were the same among treatments. A net N mineralization of all the CCs residues was estimated by the model, except for the N immobilization registered after the triticale roots residues. The clover and mustard released around 33% whereas the triticale around 3% of their total N uptake during the subsequent cash crop season, with a releasing peak 2 months after their termination. The use of a prediction model for CCs residues' N release and remote sensing tools can be valid tools to optimize the CCs utilization and enhance cropping water and N fertilization management efficiency.

S4 P87

GEOGRAPHIC INFORMATION SYSTEMS (GIS) FOR AGROECOSYSTEM ANALYSIS: A CASE OF STUDY IN PIEDMONT

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Agroecosystems play a crucial role in the protection and enhancement of biodiversity; the diversity of these systems supports interactions between the different components and are crucial to enhance ecological processes, such as pest regulation and biological soil activation. Approaches concerning agroecological principles and tools, which enable the synergistic regeneration of environmental and sociocultural elements of the territorial heritage, are useful in this perspective: according to the principles of agroecology the more complex and diverse the structure around the farm, the more functionality it implies at different levels. The use of GIS (Geographic Information System), a tool for investigating the earth's surface, overlaying and manipulating different information layers and extracting information that expresses relationships of various kinds, for the analysis of agroecosystems makes it possible to map the different environmental and agricultural characteristics of an area and is therefore a valuable tool not only for analysis but also for the planning and re-planning of agroecosystems. The case study aims to present an example of an analysis of farms in Piedmont, proposing some indicators derived from the field of agroecology and landscape analysis useful for quantifying external and internal environmental diversity of farms. These indicators evaluates the connections between the agroecosystem and the elements of the surrounding landscape using metrics such as the density of patches or fragments of natural vegetation and bodies of water, along with their proximity and average distance from the agroecosystem's center; these can be detected and analysed using different type of remote sensing image. The strength of this analysis tool is that it can be used at different scales, both to investigate the individual farm and the more general territorial context and consequently different types of planning.

S4 P88

INTRODUCTION TO THE REALISTIC WATER BUDGETING IN PROTECTED AGRICULTURE (REWATERING) PROJECT

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Protected agriculture (e.g., plastic greenhouses) is an established approach to harvest higher yields using optimized environmental conditions. Protected agriculture has scientific, societal, economic and environmental implications. It improves horticulture sustainability by improving the management of water, nutrients and pests. It boosts rural community economies and feeds the growing human population with a healthy diet. It supports food security under climate change, which is leading to longer droughts and more intense rainfall. However, no researches studied water quantity and quality in catchments with protected agriculture. The MSCA-PF project "REalistic WATER budgetING in protected agriculture" (REWATERING) uses and expands integrated surface-subsurface hydrological models (ISSHMs) to predict water quantity and quality in catchments with protected agriculture. ISSHMs can predict short- and long-term water quantity and quality resulting from land management and climatic scenarios. Protected agriculture has substantial consequences on hydrology and contaminant transport. Rainfall does not separate in plant interception, runoff and leaching anymore. Instead, rainfall is intercepted by roofs and does not recharge groundwater. Nonetheless, protected agriculture leads to crop water savings thank to not only the lower reference evapotranspiration than open fields but also from the adoption of drip irrigation systems. Water quality monitoring in agricultural catchments clearly report that rainfall drives fertilizers and pesticide losses to surface water. The presence of roofs in protected agriculture prevent runoff. Whether aquatic contamination might still occur, no water quality monitoring data are available in catchments with protected agriculture. REWATERING focuses on the "destra Sele" area (Salerno, Italy). Here, plastic greenhouses might cover >50% of agricultural land and farmers must store rainwater in engineered retention ponds to prevent floods caused by the catchment imperviousness. Water quantity and quality data are collected in the catchment during the duration of the project.

S4 P89

CULTIVATION OF *PLEUROTUS OSTREATUS* AND *PLEUROTUS CORNUCOPIAE* IN VERTICAL FARMING SYSTEM

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Vertical cultivation systems, mainly used for vegetables species, can increase the productivity and reduce soil consumption. About cultivated mushrooms, this technology is mainly applied for *Agaricus bisporus*, but not for the cultivation of *Pleurotus spp*. In this study (funded by PRIN 2020ELWM82 V-FARM), the cultivation of *P. ostreatus* and *P. cornucopiae* in a vertical farming system using single shelves (SS) and twin shelves (TS) rows layout was considered (December 2022 - March 2023). Shelves were placed in a mushroom cultivation facility and each shelf had 4 cultivation racks: G (ground), 1F (first floor), 2F (second floor) and 3F (third floor). This system quadrupled the typical cultivation density using 12 bags/m^2. The pinhead formation was monitored and during harvest time mushrooms were collected measuring the yield per bags and the number of families. Three families per bags were used to evaluate number, diameter, width and colorimetric parameters of fruiting bodies. Pinhead's appearance in the first flush showed a faster growth in 3F for both the species and for *P. ostreatus* the SS disposition showed a highest number of pinheads. In the second flush of *P. ostreatus* G and 1F showed the highest production of pinheads (78% and 70%). The yield of the first flush for *P. ostreatus* was higher in G (0.19 kg/kg substrate) and decreased in higher racks (0.15 kg/kg substrate). For *P. cornucopiae*, the yield was higher in 3F (0.04 kg/kg substrate) and lower in G (0.01 kg/kg substrate). During the first flush *P. cornucopiae* had a bigger diameter in G, whereas *P. ostreatus* showed the highest one in 3F. *P. cornucopiae* and *P. ostreatus* can be cultivated in a vertical farming but cultivation height can affect yields and other productive traits. Arranging differently the bags of the two species on the same shelf could be useful to optimize their yield.

S4 P90

TERRESTRIAL LASER SCANNER BASED METHODS FOR COMPLEX FOREST STRUCTURE AND INVENTORY EVALUATION IN A MEDITERRANEAN OAK STAND

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Forests supply several ecosystem functions and services that are currently threatened by climate change driven disturbances. Particularly, in the Mediterranean environment appropriate management practices are crucial to prevent forest degradation. In the last decades the "precision forestry", based on innovative approaches, methods and instruments contributed to a better understanding of ecosystem dynamics trough forest structure analysis. Site specific information on productivity, ecological processes, carbon allocation, and susceptibility to fire or other disturbances contribute tom fit the optimal management options and strategies to prevent forest degradation. Light Detection and Ranging (LiDAR) technology represent a suitable tool to assess forests structure parameters with a non-destructive, quick and more accurate measurements. Laser scanner functioning is based on time and distance principles to provide georeferenced point-clouds with high accuracy that produce a 3D structure of surrounding area. We used terrestrial laser scanner (TLS) and open sources processing software in order to evaluate complex forest structure and inventory in a Mediterranean oaks forest through a 3D forest model. We assessed main forest parameters including diameter at the breast height (DBH), height (TH), volume (V), basal area (BA) and stand density (d). The current availability of sensors provides opportunities for more in-depth analysis that could enable advanced and more precise estimates of forest attributes. Regional monitoring programs may take advantage to produce timely and cost-effective high precision forest analysis and inventories based on LiDAR applications.

S4 P91

MODELLING ECOSYSTEM SERVICES IN MEDITERRANEAN AGROSILVOPASTORAL SYSTEMS WITH YIELD-SAFE: CHALLENGES AND FUTURE PERSPECTIVES

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Because of the complexity of agrosilvopastoral systems, the study of dynamics and interactions among their components such as crop, trees and animals, is challenging. In agroforestry systems, quantifying the biophysical processes is difficult due to the long duration of tree growth and the low availability of experimental sites. As scientists, we are interested in increasing the knowledge about agrosilvopastoral systems aiming to maximize the provision of ecosystem services while reducing disservices. So far, models that simulate agroforestry systems are limited and are mainly calibrated for silvoarable systems, such as Yield-SAFE (YIeld Estimator for Long term Design of Silvoarable AgroForestry in Europe). Yield-SAFE model aims to simulate the development, growth and productivity of the tree and understorey crop components of an agroforestry system over the length of a tree rotation. The outputs include predictions of tree and crop yields. These biophysical outputs can then be used for financial and economic analyses. The data required are daily temperature, radiation and precipitation, planting densities, initial biomasses of tree and crop species, and soil parameters. Another advantage of Yield-SAFE is the inclusion of RootC model to model CO_2 fluxes and soil carbon storage. Currently, within the H2020 AGROMIX (n° 862993) and HE DIGITAF (n° 101059794) projects, we aim to predict long-term forage production and tree yields in agroforestry field experiments in several locations and under different climate-change scenarios. In the Mediterranean extensive livestock systems, the use of Yield-SAFE in predicting forage yield and quality, tree growth and microclimate conditions could help us to simulate the herbage allowance in the understorey layer and the effects of tree presence on animal productivity and welfare. We aim to understand if the agroforestry development can help to mitigate climate change effects on livestock production addressing the challenge regarding the uncertainty of the forage availability in the Mediterranean.

S4 P92

FORESTS MANAGEMENT IN THE METAVERSE: THE POTENTIAL OF FOREST DIGITAL TWIN AND BLOCKCHAIN FOR PREVENTING CRIMES

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Forest management is a crucial aspect to ensure environmental sustainability and ecosystem protection. The EU has noted that the forestry sector is frequently the object of crimes that damage and alter the single European market. The use of new technologies, such as the Forest Digital Twin (FDT) and the blockchain, can offer greater precision in forest management and ensure the traceability of forest products, creating a reliable chain of custody. The FDT makes it possible to reproduce a digital replica of a real forest area, providing a faithful and analytical description of the life cycle, of the entities and processes that compose it, to predict risks and opportunities for improvement. By implementing the FDT with the blockchain it is possible to provide a complete tamper-proof record of the state variables recorded at both the tree and forest level, allowing to create a just, robust and economically viable chain of custody of the wood supply chain. The objective of this work is to propose an innovative approach to guarantee environmental sustainability and transparency in the wood supply chain thanks to the integration of FDT and Blockchain with a view to preventing crimes. Thanks to the design of a digital forest, by integrating the state variables of the trees it will be possible to monitor the entire production cycle synchronously with execution. This approach makes it possible to collect a continuous flow of data before and after use, guaranteeing the prevention and repression of offenses and supporting the authenticity and integrity of the internal chain of custody, in compliance with European and national legislation, as well as the recent European law against counterfeiting. In conclusion, the proposed framework can represent an important innovation to ensure sustainable forest management, by advanced technologies, with a view to preventing and repressing crimes in the wood chain.

S4 P93

ADVANCED TECHNOLOGIES FOR SATELLITE MONITORING OF FRESHWATER ENVIRONMENTS

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Freshwater environments have undergone important changes in recent years; the various pressures on land use, the effects of climate change and the over-exploitation of water resources are significantly affecting water resource availability and biodiversity in these fragile ecosystems. Satellite remote sensed data provide the opportunity of observing freshwater with high resolution in space and time and covering wide areas. In this work satellite data were investigated in three pilot projects, dealing with the observation of wetlands (Albufera wetland in Spain), perennial rivers (Po River in Italy) and Non-perennial rivers (Cilento National Park in Italy). The first research question underlying this work was to develop a simple classification method to monitor wetland land cover and to map the temporal succession of flooding and drying and the vegetation dynamic by satellite data. This knowledge is the basis for understanding the relationship between the dynamics of flooding, its duration, extent and spatial continuity and the availability of habitat. The second research question focused on the possibility of exploiting satellite data to monitor the evolution of river morphology over time. Wet channel dynamics over time and information on morphological changes occurred in the past were extracted. The satellite dataset used made it possible to extend the analysis to the last 35 years. The third research question is related to the possibility of using satellite data to characterize the hydrological regime of non-perennial rivers. An innovative tool was developed, capable of reconstructing the daily occurrence of different flow phases. Remote sensed data can effectively help fill the knowledge gap on flooding extension and timing, morphological changes and flow regimes of freshwater environments. The resulting knowledge helps optimize the management and protection of freshwater ecosystems, as well as the assessment of ecological status, as required by the Water Framework Directive (2000/60/EC).

S4 P94

EVALUATION OF AUGMENTED REALITY AND ELECTRONIC ANIMAL IDENTIFICATION SYSTEMS IN ANIMAL HUSBANDRY

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The analysis and visualization of animal data represent a key activity in modern livestock farms. However, to consult a database, the operator is generally enforced to adopt PC or mobile handheld devices, losing time during on-fields activities. In this context, the use of augmented reality smart glasses represents a valuable solution to consult the information in real-time leaving the operator hands-free. Nevertheless, for the implementation of innovative technologies in animal husbandry, the views and needs of stakeholders must be carefully considered. Moreover, this kind of technology needs to interact and integrate with the most common technology used by farmers, as animal electronic identifiers. This study aims to evaluate breeders' needs for real-time information access on-field. In addition, a system to connect the animal electronic identification and on-field information access through augmented reality was developed. Finally, the system was evaluated by comparing its operating performance with conventional tools. Specifically, a semi-structured questionnaire with face-to-face interviews was used to analyze stakeholders' opinions and needs. Moreover, a smart wearable system, called SmartGlove, capable to link RFID tags and augmented reality smart glasses, was developed and tested. The breeders' feedback provides specific evidence on which are the most relevant information to be visualized on field. Additionally, livestock operators showed a positive attitude regarding augmented reality technology, highlighting specific on-filed activities for the implementation of this technology. The developed system showed promising operating performances during preliminary tests. Finally, the outcomes of this study showed the system's capabilities to reduce the required workforce while improving productivity in animal farm management. Future works will focus on upgrading the operating performances of the SmartGlove and developing a more integrated system for the management of specific animal data allowing breeders to make timely decisions on the farm.

S4 P95

FARMERS' PERCEPTIONS AND ATTITUDES TOWARD THE USAGE OF AUTONOMOUS GROUND VEHICLES

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Autonomous ground vehicles (AGVs) are one of the latest tools available to farmers within the context of precision agriculture. Despite the wide array of benefits, adoption rates by small farmers are low and the literature on the adoption of AGVs in agriculture has been significantly increasing with time. Thus, the aim of this study was to investigate the farmers' attitudes and perceptions to use AGV in agricultural on-field activities. Consequently, the extended Technology Acceptance Model (TAM) was applied to study which factors affect farmers' intention to adopt AGVs. The fundamental factors of the TAM, which include perceived ease of use (PEU), perceived usefulness (PU), attitude toward its use (AT), and intention to use (IU) were considered. Moreover, external variables were added to the model (perceived net benefit, compatibility, innovativeness) to improve its explanatory power. A sample of farmers, mainly from Italy and Lebanon, was involved in the study with an online survey. The results of the questionnaire were analyzed using the structural equation modeling (SEM) method to understand which factors affect the intention to use an AGV by farmers. The results underlined the capability of the TAM in predicting the factors influencing the intention to use this kind of technology. Moreover, raising awareness among farmers regarding AGV applications in agriculture and, the confidence level of utilizing a terrestrial drone, could raise farmers' intention to adopt this technology. Additionally, the results will be useful for research activities within the context of precision agriculture technologies.

S4 P96

COMPARATIVE PERFORMANCE OF *MACHINE LEARNING* ALGORITHMS FOR LAND COVER CLASSIFICATION USING ASI - PRISMA HYPERSPECTRAL DATA

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Remote sensing (RS) supports studies on land cover and land cover changes, agroforestry planning and helps in performing cross-checks in the framework of EU's common agricultural policy (CAP). Multispectral data (with limited number of spectral bands) and multi-temporal processing (sequence of scenes captured on different periods of time) were mainly used for RS. As a result, classification was limited to a small number of aggregate classes. PRISMA, the Italian Earth Observation (EO) hyperspectral mission funded by the Italian Space Agency (ASI), aims to evaluate the operational potential of the hyperspectral data, especially for land cover classification. The hyperspectral cube consists of 240 frames with bandwidth less or equal than 12 nm with a SWAT of 30 km at nadir and a GSD of about 30 m in the hyperspectral and 5 m in the panchromatic. This study aims at evaluating and comparing classification methods of the PRISMA product. For this purpose, the ASI pre-processed radiance level data (L2D) was used to investigate an area in the Lazio region (Italy), of which sufficient knowledge of land cover is available.All the classification approaches tested are advanced techniques based on machine learning. Experimentation was carried out using K-nearest neighbors (KNN), Support Vector Machine (SVM) and Random Forest algorithms, which were compared in terms of accuracy, number of ground control points (GCP) required and ease of implementation.The study showed that the Random Forest approach presents the best compromise among the three proposed approaches, also considering its applicability, which is related to the wider literature and established experimentation in the GIS environment.The research is one of the first studies with the purpose of using the PRISMA data and presents some methodologies for the operational use of this data.

S4 P97

COMPARISON OF TREE OUTSIDE FORESTS MAPS: THE CASE STUDY OF LAZIO REGION

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The term Tree Outside Forest (TOF) is used to describe tree elements in landscapes, such as isolated trees, forest patches smaller than 5000 m^2, and hedgerows. TOFs are a tool for climate change response and provide multiple ecosystem services and social benefits, including protection of soil and water resources and maintenance of biodiversity and landscape. The importance of TOFs is also recognized by the European Union as a tool for achieving the goals of the EU Biodiversity Strategy 2030, which addresses the global biodiversity challenge; therefore, the EU Common Agricultural Policy promotes and funds the establishment and maintenance of TOFs in agricultural areas. Mapping the distribution of TOFs on the land therefore becomes a necessary information. Using GIS and remote sensing tools, a map of TOFs was produced for the study area, the Lazio Region (17242 km^2). The aim of this study was to assess whether the TOF mapping produced identifies landscape features more reliably than other existing data as the Small Woody Feature map (SWF) produced by the Copernicus program and the Ecological Focus Areas class (EFA) of Land Parcel Identification System data. For this purpose, transition matrixes were produced with R software to evaluate the correspondence between the pixels of the different TOF maps. The main results showed that the TOF map product in the present study identifies a wider area of TOF in the study area (e.g., 1136 km^2 versus 244 km^2 in the SWF data and 79 km^2 in the EFA data) and with higher degree of accuracy. These data provide useful information for landscape assessments and for defining effective strategies for regional planning.

S4 P98

MONITORING WATER QUALITY USING REMOTE SENSING TECHNIQUE

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Today, droughts are among the main consequences of climate change. Reduced river flow strongly affects not only water stress, but also water quality. This has impacts on different uses of river water, such as agriculture. The use of remote sensing techniques, particularly satellite techniques, offers a valuable contribution to multi-scale freshwater monitoring. The aim of the work was to monitor river water quality and assess the impact of droughts on it, in order to draw up vulnerability maps identifying the areas most sensitive to drought phenomena. The proposed method involved three basic steps: the first step involved modelling the watercourse using LiDAR (Light Detection and Ranging) data of the “Ministero dell'Ambiente e della Tutela del Territorio e del Mare” (MATTM). The second step involved the assessment of water quality, estimated using the Enhanced Water Quality Index (EWQI), one of the main water quality indicators. The EWQI was calculated using several derived parameters: (i) chemical-physical parameters obtained by combining spectral bands of images acquired by the Sentinel-2 mission; (ii) hydrological and morphometric parameters obtained from LiDAR data; (iii) atmospheric parameters obtained by combining spectral bands of images acquired by Sentinel-5P mission; and (iv) meteorological parameters acquired from the weather bulletins of the "Protezione Civile – Regione Campania". The third step involved the assessment of drought using indices calculated from multispectral satellite images. In particular, the following were calculated: the Soil Moisture Index (SMI) to assess soil moisture, the Normalized Difference Water Index (NDWI) to estimate the water stress of vegetation, and the Normalized Difference Salinity Index (NDSI) to assess soil salinity. The maps thus obtained were integrated in a GIS environment to identify the macro-areas most vulnerable to drought within the river axis. The tests were carried out on one of Campania's main river courses for a period of five years (from 2019 to 2023).

S4 P99

REGIONAL-SCALE ASSESSMENT OF VULNERABILITY AND RESILIENCE SOIL INDICATORS: THE CASE STUDY OF CAMPANIA

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Quantifying the vulnerability and resilience of the ecosystem subject to natural and anthropogenic disturbances is still uncertain and under debate. Sustainable and efficient land management is entrusted to a reliable mapping of vulnerability and resilience to extreme climatic events and adverse human disturbances. The study area is the southern Italian region of Campania, which is renowned for its high-quality agricultural and dairy products but is increasingly subject to soil disturbance and degradation. Seven primary soil properties (sand and clay contents, oven-dry soil bulk density, calcium carbonate, rock fragment, soil organic matter, and pH) were estimated by analyzing 3,316 soil measurements. Two soil indicators were then assessed from the maps of these soil properties: 1) the soil organic carbon stock (SOCS) in the entire region of Campania, and 2) the recharge transit time in the Sele alluvial plain where information about the mean annual depth to groundwater is available. The distribution map of topsoil SOCS depends on soil organic carbon, bulk density and rock fragments. The zones in Campania with the presence of relatively low SOCS values are those of the inland (mainly clayey) hills. The shallow groundwater underlying the coastal plain zone on the right side of the Sele River is at high risk of nitrate contamination and salt intrusion. The assessment of vulnerability and resilience of the agroecosystem subject to natural and anthropogenic disturbances was done through the use of dynamic indicators found in this study (sometimes also referred to as “functional performance indicators”). This approach represents a step forward to replace existing empirical and static indicators influenced by a certain degree of subjectivity. In a final step, we will evaluate an array of nature-based solutions, to fully support the realization of sustainable management of water and land resources.

S4 P100

NEW TECHNOLOGY TO MONITOR LEAF PHENOLOGY IN TWO BEECH FORESTS IN THE APENNINES

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To deeply comprehend the dynamics of forests linked to the environment and its changes, tree physiological response parameters should be collected at high frequency in the long term. Recent technical development has made available monitoring systems, comprising multiple sensors, to accomplish measurements of tree functionality with detail and large datasets. The TreeTalker is one of these instruments. The TreeTalker technology was adopted to monitor trees in mountain beech forests at two altitudes in Molise. In particular, the light transmitted through the forest canopies, and its spectral components (measured by a spectrometer), were used to monitor the leaf phenological activity in two growing seasons. The aims of this study are to assess variations in leaf phenology in time (two years) and altitude (two elevations), comparing TreeTalker measurements and visual observations. We also tested the effects of environmental variables, such as temperature and precipitation, on phenological phases. The use of TreeTalker may help reduce visual in situ observations and monitor continuously leaf phenology and variation due to environmental changes.

S4 P101

ASSESSMENT OF THE SOCIO-ECONOMIC ASPECTS THAT INFLUENCE THE ADOPTION OF TECHNOLOGICAL INNOVATIONS BY ENTREPRENEURS: CASE STUDY ON DAIRY CATTLE FARMERS IN THE CALABRIA REGION

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The diffusion and adoption of innovative technologies in agriculture represent a growth opportunity for agribusinesses, promoting increased production, reduced environmental impacts and improved food security. As technology acceptance rates are lower for the agricultural sector than for other sectors (Adnan et al., 2019), programs aimed at increasing the sustainability of agroecosystems encourage farms to adopt innovations. In the context of smart agriculture, the use of precision sensing is a breakthrough from the usual crop and livestock monitoring techniques. However, adoption of innovations is challenging (Schulz & Börner, 2022); it depends on several interacting factors and the motivations that drive the choices of agricultural entrepreneurs. Many studies have been conducted on the effects of these factors on technology adoption in agriculture. They have highlighted the social, economic and psychological aspects acting in different production conditions. The objective of this paper is to identify and evaluate these factors for a specific case study. For this purpose, a questionnaire was submitted to a group of 52 dairy cattle farmers in the Calabria region. The technological innovation under study is the Alta Cow Watch collars, which are equipped with smart sensors capable of monitoring various animal-related parameters in real time. The economic and environmental effects related to the introduction of the sensors were analyzed with the motivational factors defined within a UTAUT model: performance expectations, effort expectations, social influence, facilitating conditions and risk expectations. The results of the analysis show that in addition to strictly economic aspects related to investment, the size of the company, the level of training, the quality of human capital, and reorganization needs related to innovation have a significant influence on the probability of innovation adoption.

S5 P102

PHYTOTOXIC EFFECTS OF BACCHARIS HALIMIFOLIA L. AQUEOUS EXTRACTS ON WEEDS GERMINATION AND GROWTH

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Baccharis halimifolia L. (Asteraceae) is a North American shrub that became invasive in Europe in the last decades. One of the reasons for its invasiveness may be the production of allelopathic substances that could give it a competitive advantage against other species. Considering the lack of natural herbicides, the search for allelopathic substances in plants plays an important role in the development of new plant protection products. For the first time, the phytotoxic potential of *B. halimifolia* leaf (BL) and root (BR) aqueous extract was investigated. Germination tests were conducted on Petri dishes using different aqueous extract concentrations (0, 2.5, 5, 10, 20, 40 and 100% v/v) to evaluate the phytotoxic effect toward germination and root elongation of the weeds *Abutilon theophrasti* Medik. (ABUTH), *Lolium rigidum* Gaudin (LOLRI), *Setaria pumila* Roem. & Schult. (SETPU) and *Solanum nigrum* L. (SOLNI). None of the tested extracts significantly reduced final germination % compared to the controls, apart from BL at 100% concentration, which reduced LOLRI seed germination by 50%. Concentration-dependent reduction in root length was instead noted for both extracts, with LOLRI and ABUTH being the most sensitive species showing relevant inhibition already at 20% BL and 10% BR concentrations. Overall, BR was more effective than BL; indeed, BR at 20% concentration provoked 50-75% reduction in root length for all species. Maximum reduction (>85%) in root length occurred at 100% concentration of both extracts for all species. Conversely, low concentrations (<5%) of both extracts increased germination % and root length of SETPU and SOLNI. This experiment underlines the potential use of *B. halimifolia* for the development of new natural herbicides. Nevertheless, considering the differences between laboratory and field conditions, further studies must be carried out to identify the active compounds and evaluate their herbicidal effects under field situations.

S5 P103

USE OF A NEW TECHNIQUE IN THE QUALI-QUANTITATIVE CHARACTERIZATION OF AIRBORNE POLLEN

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The possibility of monitoring the airborne components has been a source of a large amount of information in recent decades, both in the allergological and agronomic fields. The main routine observations of pollen have been historically based on invasive manual techniques developed in the 1960s, and particularly time consuming. Recent technological developments have revolutionized the sector, making high-resolution and real-time measurements possible. To deepen the current knowledge on hazelnut pollen and pollination, we used a last generation impedance flow cytometer (Ampha Z30 – Amphasys), recently validated as a solid on-chip label-free analysis methodology. This analysis was performed on five hazelnut cultivars (Tonda di Giffoni, Tonda Gentile Trilobata, Tonda Gentile Romana, Nocchione and Barcelona) associated with a wild type accession, all from the experimental station "Tetti Grondana", Piedmont – Italy, and analyzed during the season 2021/22 and 2022/23. The analysis with the impedance meter showed a great resolution and discrimination ability. In particular (I) we isolated viable, anomalous (sterile) and non-viable pollen by describing cultivar-specific trends in hazelnut. (II) The obtained results support the hypothesis of recurrent reciprocal translocation events in *Corylus avellana* cultivars, with consequent gametic semi-sterility. Considering that hazelnut pollen is partially hydrated at dispersal and particularly sensitive to dehydration, (III) we determined the best pre-hydration treatment by monitoring pollen status over time and (IV) we used viability and phenology information, together with genetic self-incompatibility data to create a 'compatibility map' among different cultivars to design new plantations and improve production. This high-resolution technology opens up new frontiers in studying plant reproductive biology with applicative spin-off on field productivity.

S5 P104

STEPWISE ASSEMBLING MICROORGANISMS IN CONSORTIUM TO CONTROL WILD ROCKET SCLEROTINIA ROT DISEASE

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Excessive use of synthetic fungicides is a factor of environmental pollution and impactful on the sustainability of the agricultural systems. Hence, it is necessary to find alternatives to guarantee a safer and eco-friendly production. In recent years, the use of beneficial microorganisms as biological control agents for plant disease management has continuously increased. Wild rocket (*Diplotaxis tenuifolia*) is largely produced in Italy to feed the high convenience food chain reaching economic relevance. *Sclerotinia sclerotiorum* is a soil-borne fungal plant pathogen able to infect over 400 species worldwide at all stages of growth; the pathogen also severely impacts on wild rocket yields. The overall purpose of the current work is to improve the shelf life, safety, and sustainability of this baby-leaf crop through the application of high-performing biological protectants. Specifically, the goal is to set up a multifunctional microbial consortium by combining both bacterial and fungal strains, selected for their capacity in controlling Sclerotinia rot. A set of biocontrol agents, including 10 bacterial strains belonging to *Bacillus subtilis*, *B. methylotrophicus*, *B. amyloliquefaciens* and *Pseudomonas fluorescens* and 2 fungal strains belonging to *Trichoderma longibrachiatum* and *T. atroviride*, was filtered by plate dual growing tests with the aim to identify the most compatible combinations. As result, the strains *B. amyloliquefaciens* 17S, *Pseudomonas fluorescens* CREA16 and *Trichoderma longibrachiatum* TL35, were selected and assayed for evaluating *in planta* functionality. The *in vivo* biocontrol activity assays showed higher significant reduction of disease symptoms (+50%, on average) when microbial consortium was used, in comparison with the single or pair strain(s) inoculations. On the other hand, with the same criterion (single, pairs and triple-microbe consortium), biostimulation effects incited by these microorganisms was also considered. Results suggested that the tri-component consortium can provide valuable protection and multitrophic support to wild rocket cropping system.

S5 P105

PLANT-BASED BIOFACTORIES FOR THE PRODUCTION OF EXTRACELLULAR VESICLES WITH THERAPEUTIC BIOACTIVITY

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Extracellular vesicles (EVs) are nano-sized lipid bilayer membrane vesicles released by cells to communicate each other. Moreover, plant-derived EVs carry bioactive molecules with anti-cancer, anti-inflammatory and antioxidant activities and therefore can also be considered as new nutraceuticals. Despite their therapeutic potential, the lack of standard protocols for purification, the relatively low yield as well as the variability of biomolecular cargo are the major limitations in the use of plant EVs for biomedical purposes. In the present work, we showed that hairy roots of medicinal plants represent an innovative biotechnological platform for the purification and characterization of plant EVs. Particle size distribution and morphology of HR-derived EVs were assessed by Dynamic Light Scattering (DLS), Nanoparticle Tracking Analysis (NTA) and Scanning Electron Microscope (SEM) showing that HRs secrete round-shaped EVs with a size between 100 - 200 nm. Proteomic analysis revealed the presence of typical EV-associated proteins. Metabolomics analyses showed that EVs deliver a plethora of diterpenes and triperpenes with interesting pharmacological properties. Remarkably, *Salvia dominica* HR-derived EVs showed a selective and dose-dependent pro-apoptotic activity in MIA PaCa-2 (pancreatic carcinoma) and MCF-7 (breast cancer) cell lines. Finally, the antimicrobial activity of such EVs was assessed on *Salmonella typhimurium* LT2 and *Staphylococcus aureus* 6538 strains. Interestingly, *S. dominica* HR-derived EVs did not affect *S. aureus* growth, whereas a strong and dose-dependent inhibitory effect was observed on *S. typhimurium.* Taken together, our results show that plant biofactories may provide reliable and scalable systems to produce EVs relevant for the nutraceutical and pharmacological sectors as well as for the control of microbial food-borne pathogens.

S5 P106

PULSED THERMOGRAPHY DETECTS PRESYMTOMATIC INFECTIONS OF BOTRYTIS CINEREA ON PLANT LEAVES

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Early detection of phytopathologies may help to mitigate significant yield losses and improve sustainability of crop protection strategies. Infrared passive thermography (IT) has been successfully introduced in plant pathology to detect diseases before the appearance of visible signs and symptoms. Herein, we explored for the first time the use of active pulsed thermography to detect in the presymptomatic phase the infection of Botrytis cinerea, the causal agent of grey mold, which is considered one of the most devastating diseases for many crops. For this purpose, pepper and tomato plants were inoculated with different concentrations of B. cinerea spores. As non-pathogenic control, Trichoderma harzianum was employed. Pulsed thermography, carried out up to seven days after infection, revealed characteristic thermal patterns with the presence of asymmetric cold areas in the infected leaves after a few hours (6 – 72 h) and much earlier than the appearance of the characteristic lesions caused by B. cinerea. Interestingly, in the same experimental conditions, passive thermography could not early detect gray mold infection. Diagnostic parameters, such as sensitivity, positive and negative predictive thermographic values and percentage of right previsions confirmed a superior reliability of the pulsed thermography technique in the early detection of B. cinerea infections. To better understand the mechanisms underlying the thermographic patterns caused by the fungus, stomatal conductance as well as expression of genes typically involved in plant-pathogen interactions were determined. Collectively, our data demonstrate that pulsed thermography imaging is a valid and reliable diagnostic tool for early detection of B. cinerea infection. The development of pulsed thermography approaches for other plant diseases is currently underway. To conclude, we expect that this technology might be applied in plant breeding, for a rapid phenotyping of resistance/tolerance to this kind of phytopathogens as well as for a more automatized and sustainable control of plant diseases in precision agriculture.

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NEW PERSPECTIVES FOR BIOLOGICAL CONTROL IN AGRICULTURE AND IN PHARMA RESEARCH: THE INHIBITORY EFFECT OF EXTRACELLULAR SELF-DNA

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The exposure to self-DNA (conspecific), inhibits root growth and seed germination in plants in a concentration dependent manner. Such findings provide a basis for autotoxicity among the mechanisms of plant–soil negative feedback. The inhibitory effect of self-DNA was later extended to organisms of other taxonomic groups. To shed light on the mechanisms underlying the response to self- and nonself-DNA in plants, it was recently analyzed the effect through transcriptomic and metabolomics analyses in the model plant *Arabidopsis thaliana*. The results highlighted that plants are able to discriminate self- and nonself-DNA particularly, nonself-DNA is capable to enter root tissues and cells, while self-DNA remains outside the cells. Transcriptomics revealed that the most notable biological feature was the cell cycle arrest [6]. In contrast, nonself-DNA activates hypersensitive response putatively evolving into systemic acquired resistance. Metabolomics profiling showed a progressive increase in the RNA constituents and nucleotide-based compounds only in self-DNA treatments that could be the consequence of the general reduction of genes expression. Differently, the reported uptake of nonself-DNA and its metabolic handling implies a reuse of RNA building blocks, which consequently can be expected to show no accumulation in the cells. These findings open new frontiers for the development of highly selective and innovative biotechnological strategies based on the production of self-DNA fragments to cope with pathogens in the perspective of a sustainable crop production with the aim to reduce or completely remove chemical pesticides, fertilizers, and insecticides .In our lab we have translated this approach on tomato crop (*Solanum lycopersicum* cv. Ailsa Craig) to evaluate the early response of to self- and nonself-DNA in term of transcriptomic, metabolomics and (moreover) epigenetic modifications. Hopefully, we will increase knowledge on the phenomenon and possibly find some practical application in the process of growing this important crop.

S5 P108

GENETIC AND GENOMIC RESOURCES TO DISSECT THE VARIATION OF ROCKET SALAD: INTEGRATIVE APPROACHES FOR CULTIVAR FINGERPRINTING AND GERMPLASM MANAGEMENT

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Rocket salad is a leafy vegetable crop member of the Brassicaceae, whose name refers to a set of species part of the *Diplotaxis* and *Eruca* genus characterized by leaves with a typical strong taste and pungent aroma due to the presence of glucosinolates. This crop, which has been originated in the Mediterranean area and is particularly appreciated as food condiment and in ready-to-use mixed salad packages. In Europe, Italy is the main producer and exporting countries thanks to its favourable geographical position and agroclimatic conditions for the cultivation of rocket salad. So far, few genomic resources are available for dissecting the diversity of these crops which are threatened by genetic erosion and weedy competition which may affect quality of wrapped products for the market with consequences for public health. To that end a double strategy for precise genetic fingerprinting is here presented. The former relies on the use of start codon targeted (SCoT) markers to discriminate *Diplotaxis tenuifolia* and *Eruca sativa* from alien species with similar leaf morphology. From the identification of polymorphisms, we describe the development of sequence characterized amplified region (SCAR) markers, through a biotechnological pipeline and sanger sequencing. Main results with 20 highly polymorphic SCOT markers in 16 leafy vegetable species are discussed. The implementation of next generation sequencing in large germplasm resources is the second adopted strategy. Double Digest Restriction Associated DNA (ddRAD) sequencing in ~ 300 accessions allowed detection of over 35 thousand SNP markers to be implemented for genomic diversity and population ancestry analysis. The big amount data are used to define specific groups of cultivars and for genome wide association analysis toward the dissection of the genetic basis of main agricultural traits. The findings and tools produced in this research represent a unique opportunity to revolutionize the breeding strategies in rocket salad.

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INTELLIGENT CHARACTERIZATION OF COMMON BEAN GENETIC RESOURCES FOR DEVELOPING CLIMATE-RESILIENT CULTIVARS FOR EUROPEAN AGRIFOOD SYSTEMS

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Common bean (*Phaseolus vulgaris* L.) is the second most important cultivated legume species in the world (33 million ha, FAOSTAT 2020) and the most important legume for human consumption. Beans are a traditional food crop grown widely over Europe for grain (dry bean, 202,182 ha in 2017) and as a vegetable (green bean, 96,230 ha). In fact, 18 European traditional high quality dry bean production chains are protected by PGI and PDO. However, despite our substantial research base in Europe, the growing market for beans for sustainable healthy diets will be met from low cost imports unless the European crop is revived. In this study, two field experiments were conducted in Sarconi (Basilicata, Southern Italy) in 2021 and 2022. A total of 450 common bean accessions from different countries and genebanks around the world were grown in small plots and evaluated according to a standardized set of vegetative and reproductive descriptors for common bean. Morpho-agronomic and phenological traits related to adaptation were assessed in order to identify stable and high-yielding genotypes suitable in changing environments and for European agrifood systems. The data can provide the genetic foundation for a revival of common beans in Europe.

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INNOVATIVE 3D PLANT MODEL TO EFFECTIVELY MONITOR PIEZO1 DRIVEN MECHANOTRANSDUCTION

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Background: Mechanosensitive Piezo1 and Piezo2 receptors sense and translate mechanical signals into cell stimuli in mammals having a pivotal role in many fundamental biological processes. Piezo receptors are also present in plants, where they are involved in root growth and mechanotransduction. In plants, one gene ortholog of the mammalian mechanosensitive ion channel PIEZO1 and PIEZO2, has been identified in the genome of *Arabidopsis thaliana.* PIEZO1 in functionally conserved as mechanosensitive ion channel in plant roots. Its activity is required for proper roots penetration in compacted environments in response to mechanical forces, in fact, the roots of Arabidopsis *piezo* mutants lose the ability to penetrate compact soil generating a precise and measurable phenotype. Here we developed an innovative system based on plant 3D models to study the rooting function of Piezo receptor in plants that can be useful to screen and identify natural compounds that promote plant rooting through the interaction with these mechanoreceptors. **Methods:** Arabidopsis *in vitro* grown plants were used as model systems. Root penetration assay was performed to study the mechanisms underpinning Piezo modulation. It was therefore compared the ability of Piezo knock-out Arabidopsis plant roots to penetrate in hard medium respect to wild type plants.

Results: Piezo knock-out plant roots lose the ability to penetrate in hard medium confirming the importance of Piezo for plant root penetration ability. Therefore, this phenotype can be used as an *in vitro* model for the screening of Piezo regulators.

Conclusion: Our results provide evidence that PIEZO1 mediates a mechanosensory function in *Arabidopsis.* We developed a biological platform for the study of Piezo mechanoreceptors. Data obtained in the *in vitro* plant system highlights the potential of this model to screen natural compounds associated with Piezo activity in living organisms. This assay could represent a robust and cost-effective method for the screening of compounds that interact with Piezo receptors.

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HIGHLY EFFICIENT TRANSIENT EXPRESSION OF FUNCTIONAL RECOMBINANT COLLAGEN PEPTIDE IN LETTUCE

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Background: Current systems of recombinant protein production include bacterial, insect and mammalian cell cultures. These platforms are expensive to build and operate at commercial scales and have limited abilities to produce complex proteins. In recent years, plant-based expression systems have become top candidates to produce recombinant proteins as they are highly scalable, safe, and can produce complex proteins due to having a eukaryotic endomembrane system. The transient expression systems allow high throughput production and straightforward manipulation permitting the rapid validation of expression constructs and the production of large amounts of recombinant protein within a few weeks. The aim of this study was to transiently express a human-derived collagen peptide in lettuce plants and to investigate the biological activity of the plant extract enriched in collagen peptide on human dermal fibroblasts (HDF).

Methods: Agroinfiltration was the selected method to perform the transient expression of the collagen construct in 8-week-old *Lactuca sativa* plants. A suspension of *Agrobacterium tumefaciens* harboring the desired gene was introduced into plant leaves by vacuum infiltration. Immunoblotting analyses were performed to verify the correct production of the collagen peptide into the plant leaf and to estimate its accumulation based on total soluble protein. ELISA experiments on HDF were performed to analyze the activity of the plant extract enriched in collagen peptide.

Results: Leaf extracts of agroinfiltrated plants were analyzed by western blotting which indicated the effective expression of the collagen construct in lettuce. ELISA experiments, performed on HDF cells, demonstrated the ability of the recombinant collagen to induce pro-collagen accumulation in HDF cells.

Conclusion: Our results provided evidence that the transient expression of lettuce plants was a suitable and effective strategy to produce a vegan collagen peptide which resulted stable and active in inducing the pro-collagen production in human skin cells.

S5 P112

STABLE WATER ISOTOPES TO TRACE STEMFLOW INFILTRATION AND SUBSURFACE FLOW PATHS: A SIMPLE EXPERIMENT IN A FORESTED CATCHMENT

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Forests are closely connected to the hydrological network and also protect water bodies and watercourses. In this view, stemflow has a relevant role in forested catchments because it affects the amount of precipitation reaching the soil, and how water infiltrates and interacts with soil particles. The role of stemflow in subsurface processes depends on the infiltration area and its size is currently a topic of interest in ecohydrological studies. Stemflow infiltration area (SIA) is generally estimated based on the ratio between stemflow input rate and the mean soil infiltration capacity, whereas direct observations of SIA are rare. Direct observations of SIA are usually made by the application of dye tracers, useful for monitoring double-funneling. On the contrary, few direct observations are based on the application of isotopically-labelled water to assess SIA and subsurface flow paths. Therefore, in this study, we present a simple experiment carried out in a forested catchment in the Italian pre-Alps to simulate stemflow by using isotopically-labelled water and to quantify SIA and volume. The experiment was conducted during a dry period to observe the water isotopic signal in the soil water. Stemflow was simulated with a rainfall depth and intensity similar to typical summer storms in the catchment. The isotopically-labelled water was applied to a beech tree monitored by electrical resistivity tomography during different wetness conditions, as well as during this stemflow experiment. Soil samples collection for isotopic analysis was carried out after the experiment, at different distances from the stem and at different depths (e.g., 0-15, 15-30, and 30-45 cm). Soil moisture was also measured at 0-6 and 0-12 cm depths at different distances from the stem. Preliminary results showed a rapid infiltration of stemflow along the root system of the beech tree and the usefulness of isotopically-labelled water to simulate stemflow and trace double-funneling.

S5 P113

APPLICATION OF A DEVICE FOR DOSING INERT GAS COMBINED WITH THE VERTICAL CENTRIFUGAL SEPARATOR FOR EXTENDING THE SHELF LIFE OF EXTRA VIRGIN OLIVE OIL

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Oxidative stability is an important indicator of the quality of extra virgin olive oil (EVOO) and its shelf life. EVOO producers aim to ensure that the quality of the product remains stable over time. The operations to achieve this objective include the use of vertical centrifugal separators. However, some studies have established that using a vertical centrifuge allows oxygen to dissolve in the olive oil. The increase in dissolved oxygen is reflected in a potential deterioration in the quality of EVOO due to the decrease in antioxidant compounds and the increase in parameters related to oxidation. The objective of this study concerns the improvement of the shelf life of extra virgin olive oils and includes the application of a device that allows the introduction of a technical gas inside the vertical separator. The device reduces/avoids the addition of dissolved oxygen to the extra virgin olive oil, stopping the oxidation of the phenolic compounds and unsaturated fatty acids present and thus delaying the appearance of the rancid defect. The EVOO produced had lower dissolved oxygen content, along with an enriched volatile fraction and higher biophenol concentration. It was thus possible to increase the shelf-life of the oil and increase the period in which an oil can be marketed as extra virgin.

S5 P114

ACCURATE DETECTION AND QUANTIFICATION OF QUARANTINE PHYTOPATHOGENS THROUGH NANOPLATE-BASED DIGITAL PCR AND NANOPORE-BASED SEQUENCING

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Quarantine pests are those that can create unacceptable social, environmental, and economic damage if introduced into a new environment. Quarantine measures prevent this scenario but are based on effective and early detection of the pathogens, especially as the rise of global trade increases their risk of introduction to new areas. Currently, diagnostic tests are often unable to provide broad, sensitive detection and genetic characterization, while both may be necessary for quarantine pathogens. Also, accurate quantification of pathogens can be hard to achieve with the current methods. This study presents two different approaches to circumvent these limitations: nanoplate-based digital PCR and nanopore sequencing. The first adapted qPCR methods for the detection of several pathogens (*Xylella fastidiosa*, *Erwinia amylovora*, *Ralstonia solanacearum*, *Phytophthora ramorum*. *Tomato Spotted Wilt Virus*) to use with the new dPCR technology. The second is an all-in-one assay based on nanopore sequencing for the detection and simultaneous characterization of the abovementioned bacterial pathogens, providing sequencing and relative quantification at the same time. Pathogen detection using digital PCR or nanopore sequencing showed comparable results to the golden standard of qPCR for most of the investigated pathogens. Results of dPCR assays provided absolute quantification and a higher throughput, possibly reducing both time and cost diagnosis. The results of the nanopore sequencing allowed certain recognition of the target pathogen, corroborated by sequencing of the target's DNA: for *X. fastidiosa*, the sequences obtained allowed discrimination between subspecies, even when more than one was present in the same sample. Quantitative results were in accordance with those obtained through qPCR. These results indicate that both methods are promising and could become soon included in the next-generation of diagnostic assays, promoting an efficient monitoring of dangerous plant pathogens that can pose a threat to agriculture and biodiversity.

S5 P115

THE CHRYSANTHEMUM VIROME IN LIGURIA: A HIGH-THROUGHPUT SEQUENCING INVESTIGATION

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Chrysanthemum (*Chrysanthemum sp.*) is one of the major cut flower ornamentals commercialized in the italian market and is considered a notable crop for the Liguria region. The agamic propagation procedure, ordinarily used for chrysanthemum, has led to unintentional accumulation of viral/viroidal infections, causing a meltdown in the crop yield and quality of several notable varieties for the Liguria area. The CRIREC project aimed to recover the Dilana, Snowdon and Turner notable varieties, still cultivated and appreciated in Liguria but unavailable from Dutch and Danish breeder's catalogues, in order to increase their commercial value, both quantitatively and qualitatively. In Italy, there are several viruses reported to infect chrysanthemum: chrysanthemum virus B (CVB), tomato aspermy virus (TAV), and tomato spotted wilt virus (TSWV) among the most spread. A viroid, chrysanthemum stunt viroid (CSVd), is also reported. Plant samples of the varieties under study, showing viral-like symptoms, were collected in Liguria area between 2017 and 2021 in order to shed light on their "virome" through High-Throughput Sequencing (HTS) techniques, and set up specific molecular diagnostic assays. HTS analysis performed on collected samples highlighted the presence of CVB and TSWV infection, already reported; moreover, sequences related to *Avsunviroidae*, *Bromoviridae, Caulimoviridae*, *Tombusviridae* and *Virgaviridae* families were identified, and are currently under study. The three chrysanthemum varieties were then treated to rescue virus/viroid-free material through application of *in vitro* plant tissue culture techniques and apical meristems cultivation associated to termotherapy; specific molecular diagnosis will be also used to assess the absence of infective agents. Overall, our study has shown that a combined approach of HTS, molecular assays and *in vitro* techniques can be successful in supporting the production of virus free propagative material.

S5 P116

IDENTIFICATION AND CHARACTERIZATION OF PATHOGENIC FUNGI IN STRAWBERRY PLANTS (*FRAGARIA X ANANASSA*) SHOWING ROOT ROT SYMPTOMS BY SEQUENCE ANALYSIS OF PCR-AMPLIFIED RIBOSOMAL DNA

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Strawberry (*Fragaria × ananassa*) is an economically important crop, mainly cultivated in China (43.3%), USA (26.9%) and Europe (23.8%). Pathogenic fungi causing root and crown rot represent a serious threat to the crop, significantly reducing fruit quality and yield. In this field, the identification of etiological agents affecting plants is extremely important to plan adequate control strategies, especially when crops are grown in greenhouse or tunnel. In this study, the presence of fungi associated with root rot in 3 strawberry varieties (Candonga, Dina and Marimbella) collected in a nursery located in Campania (Italy) were investigated. Symptom severity of plants was assessed according to severity classes from 0-5. Detection analysis was carried out amplifying the fungal ribosomal DNA by using the primer pairs ITS5-ITS4, followed by ITS1/ITS4. Nucleotide sequence of the ribosomal DNA and phylogenetic analyses were carried out to obtain a preliminary molecular characterization of the detected isolates. The presence of fungi in symptomatic tissues was observed only in plants showing mild symptoms. In Candonga and Dina varieties, nucleotide sequence analysis unveiled the presence of 2 fungal strains belonging to the species *Plectosphaerella plurivora* and sharing the highest sequence similarity with the isolates already found in artichoke in Apulia (Southern Italy). In the variety Marimbella, nucleotide analysis identified strains belonging to *Dactylonectria torresensis* and sharing the highest sequence similarity with an fungal isolates identified in China in grapevine. Based on our evidences, it can be possible associate the mild symptom of root rot with the presence of *P. plurivora* and *D. torresensis*. Previous studies have reported *D. torresensis* as a pathogen inducing root rot in strawberry, while *P. plurivora* in strawberry plants was found for the first time in this study, providing new interesting insight in the strawberry pathology. Further investigations will be carried out, fulfilling Kock's postulates.

S5 P117

EFFECTS OF THE APPLICATION OF PLANT PROTECTION PRODUCT ON PRUNING WOUNDS ON STILBENES COMPOSITION OF GRAPEVINE SHOOTS

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Grapevine Trunk Diseases (GTDs) are attributable fungal pathogens which cause wood discoloration and necroses, foliar symptoms, yield reduction, and death of the whole vine. GTDs cause severe economic losses to the vine-wine industry, reducing plant life and increasing costs for replacing dead vines. The increasing incidence of GTDs may be linked to the lack of effective control and mitigation strategies providing adequate protection; in the field, the most common cultural practices for the containment of these diseases are preventive, such as the application of plant protection products on pruning wounds. However, plant protection products can influence the secondary metabolism of treated plants, and this interference can be decisive in countering pathogen attacks. Our aim was to understand whether and how fungicides may affect the accumulation of stilbene compounds in fruiting-cane pruning wounds. Therefore, we evaluated the plant-fungicide relationship from the point of view of the plant ability to activate natural defense mechanisms in response to treatments. In winter 2021, in the DISAFA vineyard, we pruned one-year-old shoots of Cabernet Sauvignon and Syrah; we treated the pruning wounds with Cuprocol (copper oxychloride), Tessior (0,95 % (w/w) boscalide, 0,48 % (w/w) pyroscstrobin), Esquive (*Trichoderma atroviride*), sodium bentonite and deionized water as control. We sampled at three different sampling time: (1) dormant bud, (2) second leaf stretched, (3) sixth leaf stretched and visible inflorescences. We then evaluated the concentration (g kg^{-1} dry weight) and the profile of the accumulated stilbenes. The total stilbene accumulation detected was slightly higher in Syrah with concentrations from 0.6 g to 2.4 g kg^{-1}, compared to Cabernet Sauvignon, which reached concentrations from 0.4 to 1.8 g kg^{-1}. Significant differences between the cultivars ($P \geq 0.01$) emerged. Differences were found among treatments and sampling times ($P \geq 0.0001$), and also the bipartite interaction treatment * sampling time ($P \geq 0.0001$) and the tripartite treatment * sampling time * cultivars ($P \geq 0.01$) individuated significant differences. Therefore, the accumulation of stilbenes was cultivar-dependent, but it was also affected by the phenological stage and by the applied treatment, that may interfere with the accumulation of stilbenes in grapevine wood. At the first sampling, in both Syrah and Cabernet Sauvignon regardless the treatments, the prevalent compound was *trans*-resveratrol (60%), followed by ε-viniferins (22%), piceatannol (17%) and polydatin (1%). At the third sampling time the percentage of *trans*-resveratrol (26%) and piceatannol (7%) decreased whereas ε-viniferins (62%) and polydatin (5%) increased (62 and 5 %, respectively). Other investigations are ongoing to determine the direct role of plant protection products used to treat pruning wounds on the accumulation of wood stilbene compounds.

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NEW TECHNOLOGICAL TOOLS AS A PROMISING STRATEGY FOR SUSTAINABLE FUNGAL DISEASE MANAGEMENT IN ROSE

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In this study, we investigated the potential of technological tools to detect *Sphaerotheca pannosa* infection in rose plants, cv. 'Iceberg®', cultivated in pots under open field conditions in 2020. For this purpose, 150 leaves were randomly sampled in October during a fungal infection. The Infected Area (IA) was measured by Fiji software and each leaf was labelled in accordance with a Disease Index (DI) with 4-factor levels of increasing fungal coverage (0=health, 1, 2, 3). Spectral reflectance was taken on each leaf with a portable spectroradiometer (FieldSpec 4 Hi-Res®) equipped with a contact probe; data were preprocessed (first derivative and Savitzky Golay smoothing), cleaned from outliers, and after randomly sorting a calibration and a validation set with a 70:30 ratio, used for PLS-DA (R software). A set of leaves (30) was used to evaluate the pathogen DNA abundance using RT-PCR. The remaining leaves (120) were assessed for photosystem II efficiency (Fv/Fm, qP, NPQ) and pigment concentrations (SPAD and biochemical quantification). The quantification of pathogen DNA showed a high correlation ($r = 0.80$, $P < 0.001$) with IA, confirming the accuracy of DI labelling. A small amount of pathogen DNA was also detected in healthy leaves highlighting the supremacy of molecular biology tools for pathogen detection. PLS-DA accuracy reached 0.69 when DI factors were reduced to 2 (DI=0 and DI=1-3). The qP and NPQ were able to detect differences only for DI=3. Significant differences in pigment concentrations were observed at DI≥2, while SPAD measures were able to discriminate differences between DI of 0 and 1. In conclusion, the reflectance discriminated an early infection of *S. pannosa* (DI=1) but not the symptom progression. Photosystem II efficiency and pigment quantification were able to detect fewer early symptoms, while SPAD detected both early and late symptoms.

S5 P119

EXOGENOUS APPLICATION OF DSRNA FOR PROTECTION AGAINST TOMATO LEAF CURL NEW DELHI VIRUS

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Tomato leaf curl New Delhi virus (ToLCNDV) is an emerging plant pathogen, fast spreading in several Asian and Mediterranean regions, considered the most harmful geminivirus infecting cucurbits in the Mediterranean. ToLCNDV infects plant and crop species belonging to several families, including *Solanaceae, Cucurbitaceae, Fabaceae, Malvaceae and Euphorbiaceae*. Up to now, the introgression of ToLCNDV resistant traits in crops is still challenging. Plant protection by the delivery of dsRNA molecules homologous to a target pathogen is a cutting-edge biotechnological approach based on the natural phenomenon of RNA interference (RNAi), already shown to be effective against different RNA viruses and viroids. On the contrary, the efficacy of this approach against DNA viruses is still controversial. In the present study we focus on Cucurbita pepo (zucchini), among the most affected crops by ToLCNDV infection; the protection induced by exogenous application of a chimeric dsRNA targeting all the coding regions of the DNA-A of the ssDNA virus ToLCNDV was evaluated, in terms of percentage of infected plants, symptoms appearance and viral titer. Our results indicate that the treatment with exogenous dsRNAs has limited efficacy against ToCVNDV. Limitations and possible optimizations for the use of RNAi-based approaches against DNA viruses are discussed.

S5 P120

NOVEL HUMIC-BASED NANOCONJUGATES: CHEMICAL CHARACTERIZATION AND ENCAPSULATION OF DOUBLE-STRANDED RNA

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Compost-derived Humic Substances (HS) are well known plant biostimulants. However, technologically advanced uses of HS could be imagined, like in the synthesis of nanoconjugates (NC) for the delivery of agrochemicals. For example, humic-NC might function as a carrier of double-stranded RNA (dsRNA) molecules, that can be used in RNAi-mediated insect pest control strategies. Since the dsRNA stability is affected by several environmental biotic and abiotic aspects, its encapsulation is expected to preserve its structure and function. We hereby produced NC from three different HS and characterized them. Then, we selected one nanoproduct to entrap dsRNA molecules able to silence a well-known immune gene of *Spodoptera littoralis* larvae. The HS were isolated from different composts, wherein fennel wastes (FEN), artichoke residues (CYN) or coffee husks (COF) were used as composting materials. The NC were produced by reacting HS with chitosan and characterized by thermogravimetry, dynamic light scattering and electron microscopy. While all NC showed similar molecular and morphological features, those from HS-FEN had the largest thermal stability, followed by NC obtained from HS-CYN and HS-COF. The NC from HS-FEN also showed the largest size (254 nm), while the smallest was found for HS-CYN (231 nm). The highest ζ potential was detected for NC from HS-COF, followed by HS-CYN and HS-FEN. The dsRNA was entrapped in NC from HS-COF, and its silencing efficiency evaluated in *in vivo* experiments. Our results showed an encapsulation efficiency > 90%. Also, the dsRNA was successfully released in the gut of *S. littoralis* larvae, hence silencing the target gene similarly to naked dsRNA. We hereby showed the feasibility of synthesising novel nanocarriers from compost-derived HS, with a high dsRNA encapsulation efficiency and a successful releasing into the insect gut lumen. More research is needed to unravel the mechanism of dsRNA release from NC and extend the application of the obtained humic-based nanoproducts to other pests.

S5 P121

FULVIC ACID AND CDPH SYNERGISTIC ACTION IN FE DEFICIENCY

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Iron (Fe) deficiency is considered one of the limiting factors in crop production. Iron is a key element in plant nutrition, due to its involvement in several biochemical reactions. However, its bioavailability is extremely low and dependent on the chemical and physical characteristics of soils. Currently, Fe is provided to plants in different ways, involving the use of synthetic chelates such as Fe-EDTA or Fe-EDDHA, not without environmental and economic issues. Recently, biostimulants have been developed as low-impact tools to promote plants abiotic stress tolerance, nutrients use efficiency and bioavailability. In these terms, we employed commercial fulvic acids (FA) and animal-derived protein hydrolysates (PHs) to evaluate their biostimulatory effects on plant growth improvement and resistance to nutritional stresses. Thus, FA and PHs have been applied individually and together to treat Fe-starved plants under controlled conditions in hydroponic systems. The evaluation of morpho-physiological traits, SPAD index, root acidification and Fe^{3+} reducing activities suggested an enhanced biostimulatory effect when the two products were supplied together. Expression analyses of genes involved in Fe acquisition are also in progress. Finally, to better understand the mechanisms underlying the action of these biostimulants, the physical interaction in solution between FA and PHs has been analysed by circular dichroism spectrophotometry and isothermal titration calorimetry. Taken together, the results could shed light on the modulation caused by FA and PHs when applied alone or together on plant mechanisms involved in Fe acquisition and they could give information for the optimization of new biostimulant formulations.

S5 P122

COMBINED METABOLOMIC APPROACHES TO EVALUATE THE ACTIVITY OF SUSTAINABLE BIOACTIVE PRODUCTS ON PRODUCTION OF NUTRACEUTICAL COMPOUNDS IN *OCIMUN BASILICUM* PLANTS

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Industrial exploitation of natural substances requires a preliminary extraction and refining of specific metabolites compounds from plant tissues. The low concentration and the striking sensitivity to retrieving conditions of the secondary metabolites, drives the research work to develop novel methodologies aimed at eliciting the target synthesis and thus facilitate the subsequent isolation steps, minimizing the alterations, and improving the extraction yield (1). In this context, the natural organic fraction obtained from recycled biomasses, such as humic substances (HS) and compost teas (CTs) have been identified as valuable potential abiotic effectors or biostimulants due to their ability to influence directly and indirectly the plant metabolism (2,3). In this study, humic substances (HS) and compost teas (CTs) extracted from artichoke (ART) and coffee grounds (COF) as recycled biomasses were employed on *Ocimum basilicum* plants to optimize the yield of specific metabolites with nutraceutical and antibacterial features by applying sustainable strategies. The molecular characteristics of compost derivates were elucidated by Nuclear Magnetic Resonance spectroscopy to investigate the structure–activity relationship between organic extracts and their bioactive potential. Additionally, combined untargeted and targeted metabolomics workflows were applied to plants treated with different concentrations of compost extracts. Combined Untarget and Targeted metabolite quantification further highlighted the eliciting effect of HS-ART and CT-COF on the synthesis of aromatic amino acids and phenolic compounds for nutraceutical application such as caffeic acid, ferulic acid, rosmarinic acid but also narigenin and resveratrol. Furthermore, treatments by HS-ART and CT-COF improved both antioxidant activity and the antimicrobial efficacy against some human multi drug resistance bacterial strains of basil metabolites. In conclusion, combination of molecular characterization, biological assays, and an advanced metabolomic approach, provided innovative insight into the valorization of recycled biomass to increase the availability of natural compounds employed in the nutraceutical field.

S5 P123

MULTIELEMENT FINGERPRINTING FOR DETERMINING THE GEOGRAPHICAL ORIGIN OF POMODORINO DEL PIENNOLO DEL VESUVIO PDO

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The Pomodorino del Piennolo del Vesuvio (PPV), awarded by Protect Designation Origin (PDO) since 2009, is a tomato characterized by a long shelf-life that shows up assembled by hand in bunches. It is cultivated in Campania region (south Italy) on the slopes of Somma-Vesuvius volcanic complex, where the peculiar cultivation environment influences its quality and organoleptic properties. The PPV corresponds to several ecotypes of which farmers conserve traditional cultivation management and biodiversity. Due to the high typicity, the PPV is a high economic value agriproduct susceptible to origin fraud. Tomato Trace 4.0 project, founded by the Rural Development Programme 2014-2020 of Campania, aims to authenticate and valorise the PPV by geochemical traceability methods, among which is multielement fingerprinting. This is one of the most widely used techniques to discriminate the geographical provenance of food. This is because the mineral element uptake and composition of plants depends on the mineral composition of cultivation soils in addition to other factors of the cultivation environment (i.e., climate, management, etc.). In this work, the multielement fingerprinting of three PPV ecotypes from five PDO farms were investigated in two years (2021-2022) and compared to that of the same ecotypes from two NO-PDO farms (i.e., farms located outside PDO area). In addition, the PPV multielement fingerprinting was correlated to the bioavailable and readily available amounts of the same elements in cultivation soils. Chemometric applied to data evidenced a natural grouping according to farms and little differences among ecotypes from each farm. The discriminant analysis showed differentiation between PDO and NO-PDO tomatoes. Therefore, the multielement fingerprinting of the PPV proved to be a useful tool to protect PDO productions from provenance frauds. This work is also part of METROFOOD-IT project (NextGenerationEU, PNRR) for the realization of an integrated system of research and innovation infrastructures, IR0000033 (D.M.120, 21/06/2022).

S5 P124

NMR SPECTROSCOPY TO IDENTIFY THE PRIMARY METABOLOME, TRACE AND EVALUATE THE SHELF-LIFE OF DIFFERENT VARIETIES OF STRAWBERRIES FROM CAMPANIA

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In Italy more than 6000 hectars of soil are employed to grow strawberries (Fragaria × ananassa), with the production primacy held by the Campania region. Advanced investigations may help to valorize the most promising cultivars. Therefore, we evaluated the quality of strategic strawberry cultivars, aiming to identify and highlight their peculiar compositional and chemical properties. The studied samples consisted in 8 cultivars (DINA, AN 150753, AN 165354, AN 124460, ARWEN, MELISSA, MARIMBELLA, ELIDE) which were selected and supplied by "Montella Bio" farm of Frignano (Caserta). Strawberry plants were grown in greenhouse, by considering 4 field-replicates per cultivar. The fruits were collected within February and May 2023, at different phases of production, by sampling 10 fruits per plant and parcel. For each cultivar, and as a function of the production phase, the fruit quality was assessed through chemical (pH, titratable acidity, dry weight) and nutraceutical (ascorbic acid and total anthocyanins) analyses. In addition, the primary metabolites were extracted and examined through liquid-state 1H nuclear magnetic resonance (NMR) spectroscopy. Specifically, for each cultivar, it was identified the profile of the primary metabolome (amino acids, carbohydrates, alcohols, organic acids) and the molecular fingerprint enabled a neat discrimination among different strawberries types, which was successfully validated through multivariate statistical analyses. Finally, NMR analyses further permitted to systematically appreciate changes in metabolites content and the onset of molecular compounds as a function of the storage period at 4 °C (after 1, 2, 5 and 7 days after the sample collection) thus representing diagnostic biomarkers of freshness decay and enabling the extrapolation of a cultivar-specific shelf-life index. The results candidate the 1H NMR based metabolomics as a powerful methodology to recognize, trace and reveal both quality and freshness of strawberries, hence serving as a tool to promote strawberry producers and protect consumers from frauds.

S5 P125

HAIRY ROOTS: A BIOTECHNOLOGICAL STRATEGY TO INCREASE METABOLITE SYNTHESIS IN *SALVIA* SPECIES

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Salvia is the largest genus in the Lamiaceae family, with around 1000 species of shrubs, perennials, and annuals. The current research sought to cultivate the hairy roots of various *Salvia* species to enhance the production of secondary metabolites with pharmacological activity. Hairy root cultures are made by utilizing the special ability of the soil-dwelling bacterium *Agrobacterium rhizogenes* to produce hairy roots at infection sites. Transformed roots are potential biotechnological systems that generate large amounts of secondary metabolites due to their quick growth and genetic and metabolic stability. *Salvia karwinskii* and *Salvia oxyphora* hairy root lines were created by co-cultivating explants with a suspension of two different *Agrobacterium rhizogenes* strains (ATCC and LB9402). The formation of hairy roots was observed 3-4 weeks following inoculation in both nodal and leaf explants under dark conditions. When compared to the ATCC strain, the LB9402 strain grown on Yeast/Mannitol/Broth (YMB) medium supplemented with acetosyringone developed noticeably more roots on each explant. These roots showed strong development and an abundance of lateral branching in Murashige and Skoog media free of phytohormones. Cefotaxime was added at decreasing concentrations from 300 µg/l to 50 µg/l to totally eradicate the bacterium. We continued the research using various clones to establish biomass for the examination of secondary metabolites (diterpenoids, triterpenoids and phenolic acids) from the developed roots. Examining the virC1 and rolC genes using the polymerase chain reaction allowed us to confirm the transformation.

S5 P126

EXPLOITATION OF SOURDOUGH SACCHAROMYCES CEREVISIAE STRAINS FOR THE PRODUCTION OF A RASPBERRY FRUIT BEER

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The fruit beer market represents a growing segment in the beverage industry. These beers are obtained by adding fruit flavours, extracts or raw fruit during different phases of the brewing process. The addition of fruits and the choice of the *Saccharomyces cerevisiae* strain to inoculate are of great interest, as more emphasis is given to flavour and peculiar characteristics, especially of craft beers. Hence, this study was aimed to select *S. cerevisiae* strains, isolated from sourdoughs and wineries, for the production of a fruit beer with the addition of raspberry puree. The *in vitro* tests and the wort fermentations in flasks allowed the selection of two sourdough strains, showing high maltose and maltotriose consumption, high ethanol and high viability, comparable to that of the commercial strain US-05 used as control. Fruit beers (FB) and control beers (CB) without raspberry addition were prepared. Fruit addition accelerated sugar consumption (7 days compared to 13 days), increased ethanol (above 5% in FB) and glycerol (above 2.45 g/L in all the FB samples, whereas it did not exceed 2.0 g/L in the CB) production by yeasts. Raspberry addition affected the pH (which was lower in FB compared to CB) and the volatile organic compounds (VOCs) profile of beers, leading to a significant enrichment in higher alcohols and esters with some differences based on the inoculated strain. FB inoculated by the SD12 strain showed the highest VOCs concentration (507.33 mg/L), followed by US-05 (423.90 mg/L) and SD19 (291.03 mg/L) strains. This work demonstrated the suitable application of a non-brewing *S. cerevisiae* strain in the brewing process that, together with fruit addition, can be exploited for obtaining a beer with peculiar and typical features.

S5 P127

DIFFERENCES IN THE ENDOPHYTIC MICROBIAL COMMUNITY OF TOMATO PLANTS AT DIFFERENT GROWTH STAGES

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Healthy soil microbiomes are crucial for achieving high productivity in combination with crop quality, moreover it rules the biogeochemical cycles of essential elements for plant growth. On the other hand, plant species could influence soil microbial diversity and vice versa. In this study, a high-throughput sequencing approach was used to investigate the endophytic microbiome associated with tomato plants with the aim to identify relevant microbial taxa that could be potentially used to develop an innovative microbial biostimulant. Tomato plants were cultivated in two areas of the southern Italy (Campania and Sicily region) under different conditions and sampled at different growth stages (post-transplant, flowering, and harvesting). Bioinformatic analysis has identified 11 bacterial genera (*Bacillus, Streptomyces, Pseudomonas, Devosia, Agrobacterium, Lechevalieria, Variovorax and Sphingobium*) able to colonize the rhizosphere of tomato plants. It was interesting to note that the relative abundance of different taxa was affected by the plant growth stage. in particular, the genera Cellvibrio and Salinibacterium were found at post-transplant stage, whereas *Pseudonocardia, Stenotrophomonas, Lechevalieria, Variovorax, Flavobacterium and Pseudomonas*, known for their plant growth promoting traits, were mainly present at latter stages indicating their possible participation in plant development. Exploring the fungal diversity, the class *Sordariomycetes* was present in all the samples. However, in this context, no relevant differences based on the phenological plant stage were found. Overall results showed that the innovative approach used for the exploring the endophytic microbiome is useful to identify the microbial taxa particularly adapted to this environment and able to colonize tomato root in order to isolate microbial species with high potential plant growth promotion activities to develop an innovative microbial biostimulant.

S5 P128

EFFECT OF SELECTED PECTINOLYTIC MICROBIAL CONSORTIUM ON THE HEMP RETTING

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Hemp fiber is one of the most popular natural fibers because of its high production potential and versatility of use in textiles, yarns, paper, construction materials, auto parts, and composites. Proper retting process, in which efficient separation of cellulose fiber from the rest of the stem is promoted by indigenous microorganisms able to degrade pectin, is essential for hemp fiber production and quality. This research aimed to improve the bio-extraction of hemp fiber during retting process by using a selected pectinolytic bacterial consortium. A lab-scale system was developed simulating tank for water retting to test the effect of the inoculated microbial consortium on three hemp cultivars. Bacterial strains constituting the maceration consortium were chosen based on their high pectinolytic activity and low or absent endoglucanase activity. Culture-dependent and molecular techniques were used to assess the effect on the microbiota during the maceration as well as several features (decortication, odor, color and weight of fiber) were evaluated during water retting process to assess the quality of fibers. The results indicated that the optimal retting time should be between 7 and 14 days when an increase in pectinolytic activity and a lower endoglucanase activity occurred. Moreover, data obtained from microbiota monitoring indicated that *Bacillus subtilis* AT2SB-87-P and *Stenotrophomonas pictorum* ET2SB-711-P were the two strains of the maceration consortium probably able to drive the hemp water retting process. In conclusion, overall results suggested the effectiveness of using a selected pectinolytic bacterial consortium to improve the bioextraction of hemp fiber during water retting process, which could have significant impact to produce environmentally friendly natural fibers.

S5 P129

DYNAMICS OF VEGETATIVE CELLS AND SPORES OF *BACILLUS CEREUS* ARTIFICIALLY INOCULATED IN FLAT BREAD CONTAINING CRICKET (*ACHETA DOMESTICUS*) POWDER

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Edible insects represent a valuable source of proteins, vitamins, and minerals. Based on the nutritional potential of this novel food, the research sector has already started to explore its exploitation to produce fortified foods. However, prior to commercialization the use of edible insects must be authorized since it is demonstrated that edible insects and edible insect-based ingredients can be vectors of physical, chemical, and biological hazards. Regarding the latter, spore-forming bacteria represent one of the biggest challenges that the food industry is facing. In the present study, the dough used to produce a flat bread containing 20% cricket (*Acheta domesticus*) powder was deliberately contaminated with *Bacillus cereus*. More in detail, one batch was spiked with 6 log CFU/g *B. cereus* viable cells and one batch with 6 log CFU/g *B. cereus* spores. The survival and dynamics of cells and spores were studied soon after flat bread baking and during storage of bread at different conditions (both in presence of oxygen and under vacuum at three different temperatures: room temperature, 4° C and 30° C). The results suggested that the target pathogen is not able to survive in the flat bread inoculated with the viable cells. On the contrary, in the baked product contaminated with spores, *B. cereus* was detected in the samples stored at room temperature and at 30° C both in presence of oxygen and under vacuum (after 14 days of storage). Based on the results overall collected, when *B. cereus* is present at high level in the raw material, it could represent a threat for consumers. However further research is needed to test the behaviour of the pathogen during a longer shelf-life.

S5 P130

PHYSICO-CHEMICAL COMPOSITION OF MARE'S MILK OF THE MURGESE BREED

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In recent decades, mechanisation in agriculture has led to a significant decline in the populations of several indigenous livestock breeds, of which the Murgese horse is threatened with extinction risk. In this context, although valorisation of milk of Murgese mares has been mentioned as a promising strategy to promote this horse breed, few studies have been conducted on the composition of the milk. Therefore, this study investigated the physicochemical composition and antioxidant activity of the milk of this breed. Fifteen pluriparous Murgese mares (age 4-8 years and body weight 500-650 kg) reared in the Natural Biogenic Reserve "Eastern Murge" were included in the study. The mares grazed on a natural pasture and were provided with concentrated feed. Milk samples (350 ml) were taken 20, 40, 60, 80, 100, and 120 days after foaling. The mares were milked by hand in the presence of the foal. The milk samples always taken at the same time of day (between 10 and 11 am) and stored at 4°C until the analytical determinations, done in triplicate, were carried out. The content of protein, fat, lactose, dry matter and lysozyme, as well as the pH value were determined on the milk samples. Data were submitted to ANOVA. During the experimental period from 20 to 120 days of lactation, a significant decrease in protein content (2.75 vs 2.25 g/100g; $P < 0.05$) and fat content (1.16 vs 0.44 g/100g; $P < 0.01$) were observed. Conversely, the lactose content increased from 6.28 to 7.02 g/100g in the same period. The lysozyme content varied significantly ($P < 0.01$) during lactation: the highest content was observed at 20 days, the lowest at 120 days of lactation, decreasing from 300 to 260 mg/l.

S5 P131

FATTY ACID COMPOSITION OF MILK FROM MODICANA AND HOLSTEIN COWS UNDER THE SAME MANAGEMENT PRACTICES

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In Sicily, the achievement of high production levels in dairy farms promoted the expansion of Holstein cows replacing less productive breeds. This study aimed to assess the influence of breed on milk fatty acids profile in a local breed, mid lactating Modicana (Mo) and Holstein (Ho) cows. 21 Mo and 17 Ho cows, balanced for days in lactation and housed in the same farm, were enrolled and individual milk sample were collected. FAs were extracted, methylated, and separated with a gas-chromatographer fitting a CP-Sil88 column. Data were analyzed with the PROC GLIMMIX of SAS. Regarding long-chain FA (LCFA, from C13:0), milk C14:1 (Ho:1.96 vs. Mo:1.06 %), C15:0 (Ho:1.94 vs. Mo:1.51 %), C16:1 (Ho:2.65 vs. Mo:1.52 %), C18:1t9 (Ho:4.02 vs. Mo:1.27 %) and C18:2n6 (Ho:2.65 vs Mo:1.77 %) were greater in Ho than in Mo group ($P < 0.05$). Milk C18:0 was greater in Mo compared with Ho breed (8.89 vs. 4.97 %, respectively; $P<0.05$). Regarding very long chain FA (VLCFA) Mo group had greater amount of C20:0 (Mo:0.22 vs. Ho:0.03 %). Interesting, only in milk of Mo cows were identified and quantified C18:3 n6 (0.05 %), C20:4 (0.12 %), C22 (0.10 %), C22:2 (0.07 %), C24 (0.05 %), and C20:5n3 (0.04 %). The higher presence of VLCFA in Mo than in Ho group, is an interesting result since they have anti-inflammatory activity and are associated to lower the risk of coronary heart disease; their presence in Mo group should be thoroughly investigated to evaluate if it is related to the different capacity of this breed to better metabolize and transfer in milk these FAs. Thus, from these results, we could assume that identifying breed has a significant influence of FA profile and the use of Mo milk could be one way of revitalizing this indigenous breed.

S5 P132

EXPERIMENTAL MOBILE LABORATORY FOR PROCESSING *MUGILCEPHALUS* ROE(*BOTTARGA*)FOR SARDINIAN LAGOONS (ITALY)

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Grey mullet (*Mugil cephalus* Linnaeus, 1758) is a fish species living in the coastal waters of the tropical, subtropical and temperate zones of all seas. The roes, included in the original ovarian sac are extracted from the fish abdomen and manufactured through a salting and drying process to obtain a highly prized seafood called *Bottarga*, considered a delicacy in the southern Mediterranean. Sardinia region is one of the main Bottarga production areas in the Mediterranean basin where this seafood is recognized as a traditional product obtained from both local and imported (frozen) roes. The Sardinian coastline is characterized by the presence of 26 lagoons, covering about 9.000 ha, which are managed by fishermen cooperatives as consequence of the Sardinian Region public grant. Currently, only 3 out of them are equipped with laboratories for processing and production of Bottarga. Data from the available literature show that the average weight of Bottarga from these cooperatives ranges from 250 to 350 g, and the total production could ranges between 4 and 5 tons per year with an average value of about 1 million €. As a pilot study, this work aimed to design and develop a mobile laboratory that would allow every cooperative to produce Bottarga in its own lagoon. The laboratory is 6.16 m length x 2.55 m width x 2.90 m height and is provided with a working room, a ventilated, dehumidified and thermostated chamber, a bathroom, and a little dressing room in order to respect all relevant current regulations. This laboratory could be positioned in the lagoons during the reproductive period of *M. cephalus* (August –October), allowing the processing of the mullet gonads in perfect sanitary conditions. The final purpose of this work is to avoid to build permanent structures in areas subjected to landscape constraints and to improve the production.

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PHYSIOLOGICAL AND BIOCHEMICAL ALTERATION BEHIND A POSSIBLE PRIMING EFFECT INDUCED BY SUPPLEMENTAL RED LIGHT ON STRAWBERRY PLANTS

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Alteration of light quality can stimulate photoreceptor responses, reactive oxygen species (ROS) production and antioxidative defenses in plants. These responses could represent a "positive stress" (namely eustress) especially if accessory defense lines, consisting of secondary metabolites, are concurrently activated. In a previous study, we observed an increased fruit yield, anthocyanin accumulation and reduced *Botritys cinerea* symptoms in strawberry plants due to the application of supplemental red light. Thus, in this work we provide an in-depth overview of antioxidant enzymes activity and scavenging compounds in *Fragaria × ananassa* after two months of 5 h d^{-1} supplementation with narrowband red (R), green (G), blue (B), or polychromatic (W–R:G:B; 1:1:1) LED lights (250 µmol m^{-2} s^{-1}). Rlight supplementation induced greater physiological and biochemical alterations at the end of the experiment, compared to the other treatments. Rlight reduced net photosynthesis (P_n) and decreased the activity of the photosynthetic apparatus highlighted by a lower performance index (PI_{ABS}). Despite that, biometric parameters (leaf biomass, leaf area) were not significantly affected by physiological changes, suggesting that those alterations were not the result of a distress, but rather an efficient eustress to stimulate plant antioxidative defenses. Accordingly, R-enriched plants showed the highest level of oxidative stress markers (i.e., greater H_2O_2 and MDA levels) that induced the greatest enhancement of SOD, CAT, and APX activities. The above is supporting for the role of R light enrichment as a priming eustress able to promote plant resistance against *B. cinerea*, and at the same time to increase the nutraceutical value of strawberry fruit, thereby suggesting its use in strawberry indoor cultivation as a mean to promote fruit quality whilst reducing agrochemical inputs.

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ITALIAN CONSUMER AND INSECT CONSUMPTION: SUSTAINABILITY, NEOPHILIA AND INTENTION OF INSECT-EATING

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The rapid growth of the world's population together with the climate change problem are contributing to the formation of new challenges for the agri-food sector, which will have to face a rapid evolution in an ecological transition and resilience perspective in order to ensure the availability of safe and low-impact food. In this scenario, the FAO promotes, as a use of alternative resources with a lower environmental impact, the use of insects as raw materials for human nutrition and animal feed. While the practice of entomophagy is a consolidated reality in many countries of the world, in Europe, and particularly in Italy, it is still taboo. On the basis of these premises, this research aims to assess the acceptance of insect-based foods by Italian consumers in relation to individual's socio-demographic variables, neophilia and eating styles. To achieve this objective, a nationwide choice experiment was developed based on an online survey. The answers obtained from 1405 individuals were analyzed using Principal Component Analysis and Correlation Analysis. The main results showed that the target consumers most in favor of insect consumption were male, young, open to new cultures. The main barriers to entomophagy were neophobia and disgust. It also emerged that, while the sample was highly sensitive to sustainable issues, information on the environmental benefits of introducing insects into the diet had a marginal effect on the propensity to consume them. Results interpretation therefore allows the definition of consumer drivers that would overcome the psychological barrier and facilitate greater willingness to entomophagy.

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COMMUNICATION AND MARKETING STRATEGY OF BEEKEEPING COMPANIES: APPLICATION OF CONTENT ANALYSIS

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Today for agri-food companies the most important marketing strategies are played online through companies' website and social network. Study web communication and promotion of the products offered can help to identify trend in communication strategies in term of innovation, creation of value and differentiation of products and brands. The present case study investigates on the beekeeping company communication providing environmental impact information of bees and production of honey. To this end, after a web scrapping of websites, Web Content Analysis (WCA) was applied considering all variables such as Domain authority (DA), Organic monthly traffic (OMT), backlinks and company presence (or absence) on Instagram and Facebook. With content analysis is possible identify many words of text into fewer content categories based on explicit rules of coding in systematic and replicable approach; in this research, was used software MAXQDA (Version 2022). Important features on beekeeping market are revels low differentiation and lack of important information through beekeeping communication. This level of communication is not sufficient and doesn't follow general trend of being active online to build competitiveness but, considering the structure of honey market in term of business and territorial distribution, is not difficult to understand the reasons.

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COMPETITIVENESS OF THE SHEEP DAIRY SECTOR: A STRUCTURE-CONDUCT-PERFORMANCE APPLIED ON THE SARDINIAN (ITALY) INDUSTRY

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The sheep dairy sector is one of the most representative agro-food practices in the Mediterranean area. Indeed, the agro-pastoral tradition has widely characterized this region from economic and social points of view. On the one hand, sheep dairy highly contributes to determining the agricultural gross domestic product in Mediterranean countries. By another hand, the culture of several local communities is strictly related to this activity. However, cyclically the sector suffers from heavy crises that jeopardize the economic performance of the sheep industry. A common opinion is that the magnitude of that crisis derives from structural weaknesses (e.g., small dimension of dairy firms), lack of power market exercise (e.g., any firm is a price-maker), and low coordination among the different actors of the system. The main objective of the study is to evaluate the main factors of competitiveness of the sheep dairy sector. The purpose is to individuate the main leverages able to increase the ability of the firms to be resilient and competitive in the market. The analysis was carried out in Sardinia because it is among the most representative region in terms of sheep grown, dairy production, and market share. The theoretical reference used is the Structure-Conduct-Performance (SCP) paradigm, which allows us to assess the variables and forces that affect the entire supply chain. To our knowledge, it is the first application of the SCP paradigm in the Mediterranean sheep dairy industry. The analysis is articulated in two phases: a desk analysis was conducted to grasp information about the economic dimension and characteristics of the sector using data collected f rom the AIDA database; a semi-structured interview was administered to a sample of 12 sheep dairy firms (both privates and cooperatives; both relatively small and big) for having information on perceptions about market structure, firm conduct, and performances. Finally, the study provided useful suggestions to decision-makers.

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READY-TO-EAT INNOVATIVE LEGUMES SNACK: HEDONIC PRICE APPROACH AND CHOICE EXPERIMENT FOR ASSESSING THE ALIGNMENT BETWEEN SUPPLY AND DEMAND

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Quality and sustainability guide the behavior of today's consumers, who are more responsible and attentive to the impact that food production and distribution have on everyday life, social ties and environment; in fact, there's a rediscovery of legumes in different forms that fit perfectly into the trend of green proteins. Among the various references of foods based on legumes are found snacks, whose global supply has increased considerably in recent years, but, to date, few studies have focused on the relationship between supply and demand and on the importance of the attributes that influence both the market price and preferences, perceptions and choice by Italian industrialists and consumers. So the Hedonic Price Model approach was used to evaluate the premium price of "Credence attributes" and revealed that package size, presence of rice (+2,33€), presence of lentils (+2.26 €), presence of nutritional information (ed. without oil (+2.31€), source of fiber (+2.12€)) and discount stores as place of purchase (-1.86€) are the attributes that have the greatest impact on the final price of the innovative snack. This was followed by a Discrete Choice Experiment to assess consumers' willingness to pay which revealed that the certification of origin (+3,85€), recyclability (+3,64€) and use of extra virgin olive oil (+1,87€) provide them with a high utility. Unlike, sunflower oil decrease utility of function, demonstrating the high attention of the consumer to quality and health. In conclusion, the matching of the results obtained with the two approaches shows that demand and supply, of this highly innovative product, are not exactly aligned, so this is the starting point for further investigation and to direct the industry in the development of product combinations more in line with the preferences and ethical needs of the consumer, which has been strongly influenced by the issues of sustainability and traceability.

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METHODS, TOOLS AND THEORIES TO MEASURE INNOVATION IN THE AGRIFOOD SECTOR

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The agrifood system is the object of a radical process of innovation, with research, businesses and consumers involved in setting up difficult relationships between supply and demand. In the dynamics of building such relationships, policy plays an essential role, funding research and promoting information, training and network building. Therefore, the Farm to Fork strategy reaffirms the importance of the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI), a measure already pivotal to the Europe 2020 strategy, designed to build a link between research and sector-specific needs. EIP operational groups were targeted by measure 16.2 of the 2014-2022 Apulia RDP, designed to support projects and activities to develop the innovation. The study of projects financed from this measure allowed for an analysis of the innovative offer in the agri-food sector in Apulia, regarding: who invests on innovation, in which sector and what type of innovation they propose. The results gave input to such research questions, the focus of this study. A systematic search of the current literature was necessary to identify what methodologies have been adopted to measure the phenomena that encourage the adoption of innovation and its impacts. The keywords: agricultural, agri-food, innovation and assessment, were chosen to structure the literature survey within the Scopus database. 1185 studies responded to the search criteria used, but a selection process is currently underway with the aim of identifying those most relevant to answering the questions posed. The study of the literature will allow to propose a conceptual framework useful for policy makers to understand which determinants affect the business choices about the implementation of innovation and to better structure implementation measures. In addition, the study of the methodologies and indicators related to economic, social and environmental impacts will enable the measurement of the effectiveness of innovation implementation.

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EVALUATING EX-POST IMPACTS OF WILDFIRES IN AGRO-SILVO-PASTORAL SYSTEMS OF SARDINIA ISLAND (ITALY)

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Agro-silvo-pastoral systems represent an important garrison of rural and mountainous areas. They support numerous ecosystem services and provide employment, especially in inland areas characterised by low population density and high nature-value farming systems. Traditional land uses of woody pastures and/or grazed forests, often coupled with forest and no forest wood productions, also offer the opportunity to enjoy those related traditional landscapes for recreational uses. Many Mediterranean rural regions suffer from depopulation and land abandonment trends. This causes evolutive phenomena of natural vegetation (encroachment) in no more cultivated or grazed lands, in favour of the development of shrublands, with biodiversity losses and increased fire risk, primarily related to the impacts of the current climate emergency. These factors could contribute to extreme wildfires and severely affect the ecosystem services that provide food security and quality of life for rural communities. This study aims at:

- understanding the magnitude of fire impacts in agroforestry areas; Specifically, datasets of economic land use values (2010-2020) before and after fire and ISTAT data, will be take into account to map through GIS tools the economic impacts of rural and forest fires and agri-food related productions;

- understanding the socio-economic impact by the application of banning grazing forests by law, after fires.

The study was carried out in Sardinia, a good point of reference to analyse the phenomenon given the significant impact of wildfires in this region that cause devastating damage to the environment, heritage, and agricultural activities, endangering the future of present and next generations. Although previous studies investigated the abandonment of inland areas and related land use change impact, or the causes and modelling on the development of rural and forest fires, to our knowledge, no previous studies investigated the ex-post incidence of wildfires concerning the challenge of manning and living sustainably agro-silvo-pastoral territories.

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CONSUMERS PERCEPTION TOWARD COMMERCIAL MILK LABELLED WITH DIFFERENT QUALITY SEALS

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On the Italian retail market different milk quality seals are used to communicate consumers specific features linked to milk origin and to the production practices employed along the entire supply chain, from farms to dairy companies. In this research, we evaluated consumers perception toward four different milk labels: high-quality conventional milk (HQ), high-quality milk labelled as "mountain milk" (MM), "extended shelf life" conventional milk (ESL), and ESL milk labelled as "hay milk" (HM). Each respondent evaluated just one type of milk, following a randomized design, and evaluations were given either before and after receiving information about the type of milk assigned. Between-treatment (*milk label*) and within-treatment (*before* and *after info*) comparisons were tested by mixed ANOVA and Tukey's post hoc tests. Results showed that no differences were found between HQ, MM and HM, neither before or after *info*. Regarding within-treatment comparisons for these milk labels, *info* had a significant effect on consumers perception, since quality perception after info was significantly higher than before info. Actually, the info treatment improved perception of healthiness for HQ, MM and HM, naturalness for HQ and HM, suitability to daily consumption for HQ and MM, plus tastiness and willingness to pay for MM. These results suggested that currently few knowledge about these milk labels exists among milk buyers, highlighting the importance of giving consumers proper information as a tool to improve their awareness to valorise and differentiate milk products on the market. On the other hand, the *info* treatment did not improve any of the evaluated parameters for ESL milk, which was perceived as less natural and less tasty when compared to the other milk labels, and even as less healthy and poorer in valuable nutrients after *info*. This result suggested that respondents' perception toward ESL milk was worse than for the other milk types due to due the production practice employed, which implies the pasteurization treatment of milk at higher temperatures than conventional ones, even if no evidence of lower quality for ESL milk was given. Interestingly, the information about the ESL practice did not influence consumers perception in the same way when the milk type evaluated was labelled as "hay milk".

S6 P141

ANALYSIS OF THE PRODUCTION CHAIN AND FORMATION OF THE VALUE WITHIN THE SUPPLY CHAINS OF CONVENTIONAL AND ANCIENT GRAINS

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The present research has been carried out within the PSR POIGA Project, in which the economic evaluation of the impact of introducing ancient grains in different farm contexts is planned. So, the estimation of the *just price* of grain from conventional and ancient grains has been calculated, followed by the estimation of the *just price* of flour from conventional and ancient grains. In order to put these values into a supply chain framework, in the last step of the research, for two farms belonging to the project partnership, the supply chains, and how they create value at different stages, were schematized. The *just price*, understood as the ability of the production process to ensure an adequate remuneration for the inputs (Tosco, 2014), is calculated using the following formula: Just Price= Explicit Costs + Implicit Costs (remunerated at opportunity cost). If the ratio of total revenues to total cost of production (CPR/RI) is equal to 1 the price is called JUST, if less than 1 it does not remunerate all implicit costs. The project results then show how the just price changes for different grains, modern and ancient, for the two companies. These farms have extremely different characteristics, as one is capitalistic with a production capacity of more than 10,000 tons of milled grain per year and the other has a capacity of less than 1,000 tons per year. Thus, the calculated fair prices give an estimate of farm performance and provide a reference for the price to be set to properly remunerate all the inputs input by the producer and contribute to the growth of farms that are very important to the rural economies of Southern Italy.

S6 P142

THE GREEN COMMUNITIES AS A MODEL TO PROMOTE THE QUALITY OF LIFE IN MARGINAL INTERNAL AREAS

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Quality of Life (QoL) is a multidimensional and integrated concept that involves economic, social, cultural, political and ecological aspects. It is determined by both endogenous (subjective) and exogenous (objective) factors. An exogenous factor par excellence is one's living environment, able to guarantee essential services and an environment that is not able to guarantee these services can be defined as marginal. Many internal areas have diversified their economies beyond agriculture by utilizing context-specific immobile assets, such as forests, national parks, and high amenity landscapes. These rural areas have done this by promoting new forest products (Zivojinovi'c et al., 2020), tourism (Randelli and Martellozzo, 2019), and the production of renewable energy (Clausen and Rudolph, 2020), all of which have a significant positive impact on development. For the public decision-maker, the main objective is to make the territory more resilient and sustainable and, at the same time, develop policies to improve the QoL in marginal areas (identified by the Italian National Strategy for Internal Areas, SNAI), to reduce and -where possible- prevent episodes of youth emigration, avoid the emergence of new categories of people at-risk and ensure that marginal areas and communities become attractive places to live and work. In such an outlined context, a new model is represented by the Green Communities (Cfr. GC Italian Strategy), that want to promote the sustainable development of the territories through the enhancement of endogenous resources. In this context, the Agro-Forestry-Pastoral Systems can play a decisive role. For this reason, the goal of the research project is to identify the most effective policies for improving QoL through the identification of its ex-ante determinants, the realization of focused and articulated interventions, and the identification of targets and stakeholders to involve. In this way, any critical issues are to be identified and fixed, because a low standard of QoL can compromise any possibility of development.

S6 P143

MICROBIAL BIOSTIMULANTS: AN ENVIRONMENTAL SUSTAINABLE APPROACH TO BOOST THE QUALITY AND SAFETY OF FOOD CROPS

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Plant biostimulants (PBs) are defined as products that stimulate plant nutritional processes, with the aim of improving nutrient use efficiency (NUE), tolerance to abiotic stress, crop quality traits or availability of limited nutrients in the soil and rhizosphere. In particular, the use of microbial PBs, such as plant growth promoting bacteria (PGPB), arbuscular mycorrhizal fungi (AMF) or fungi of the genus *Thichoderma*, represents a promising eco-friendly approach to increase the yield and quality of food crops. In our study, a meta-analysis based on the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) method, , to identify, select and evaluate all relevant literature studies from 2010 to 2022 dealing with the application of microbial PBs, as allowed by Regulation (EU) 2019/1009, was applied. A critical assessment and an overview of the main qualitative and quantitative beneficial effects exerted by the treatments described in the analyzed literature was provided. Among the papers reviewed, there were our studies regarding morphological and metabolic profile analyses of different tomato varieties treated with PBs of different microbial composition,. Mainly, treatment with the microbial PBs resulted in positive effects on yield, fruit number, essential amino acid content, γ-aminobutyric acid (GABA), monoethanolamine (MEA) and secondary metabolites with antioxidant activity such as polyphenols and lycopene. These results demonstrate that microbial PBs could represent a valid eco-sustainable strategy, as they are able to influence the physiological mechanisms of plants by increasing their yield and/or quality. Furthermore, understanding their mechanism of action is crucial for designing more efficient PBs which may allow to perturb the physiological process in the plant in such a way that plant crops' resources use efficiency, yield and quality may be improved through mechanisms present in the plant. while reducing environmental impacts.

S4 P144

EVALUATING COVER CROP MIXTURES IN ORCHARDS: A MULTI-FUNCTIONAL APPROACH

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The use of grassing in orchards is a technique that has been used for several years and provides some fundamental functions for the sustainable management of the orchard. It improves soil physical properties, such as structure and water infiltration capacity, and limits the erosion of the soil organic matter. Moreover, the grass biodiversity present in the field allow the protection and presence of pollinating insects and entomofauna useful in the agroecosystem. Considering the increasingly restrictive policies by the European Union, that are reducing the use of pesticides, the complexity of the agroecosystem is fundamental to permit its self-regulation. This translates into greater efficiency and resilience of the system itself. Despite the wide range of potential benefits deriving from the use of grassing, its actual effectiveness depends mainly on the right species choice. The current trend is to move towards the use of mixed cultures, which should provide a higher variety of functions and higher resilience to perturbations rather than a single crop. However, evaluating and comparing different plant combinations may be challenging, since each species contribute to the final mix functionality in relation to its abundance within the mix. The present work describes the development of a vegetational index that would allow to evaluate and optimize inter-row plant covers, starting from information on the species found in the field and their abundance. The index has been designed to be rapid and easy to use, relatable to the culture and inter-row management strategy applied, and targeting different aspects such as the degree of coverage, biodiversity, and functionality. Here, a first field validation performed on a limited number of cases including spontaneous and sown plant mixtures, is presented, highlighting the potential and the current limits of the index.

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NITROGEN IN APPLE ORCHARDS UNDER INTEGRATED AND ORGANIC FARMING

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The European Farm to Fork strategy demands a 50% reduction in nutrient losses, a 20% reduction in fertiliser use and the attainment of at least 25% of the European agricultural land under organic farming by 2030. The use of organic matrices in organic farming is a valid strategy to rationalise external inputs and reduce their negative impact on environment and the health of organisms. The aim of this study was to analyse nitrogen in a Gala apple orchard in Trentino over a five-year trial period (2018-2022), under two agronomic managements: integrated (INT) fertilised once a year with mineral products and organic (ORG) amended with mature manure every three years. During the growing cycle, the dynamics of mineral nitrogen in the soil was analysed colorimetrically after extraction in K_2SO_4. Total nitrogen in leaves and apples was determined by elemental method. Soil mineral nitrogen dynamics showed a higher average value in INT than in ORG, although the letter exhibited values equal to or above the apple tree requirement level. Furthermore, in INT, mineral nitrogen measured at different periods of the growing cycle was found to be in very high concentrations, exceeding the plants' needs and susceptible to leaching and pollution. Total nitrogen in leaves was higher in INT than in ORG from 2018 to 2021, whereas in 2022 was similar between the theses. However, over the five-year period, the leaf nitrogen content in both theses had values in the characteristic range for apple trees. The nitrogen in the fruit showed comparable values between theses after two e three years from the start of the trial. In contrast, in 2021 and 2022, INT and ORG differed in this parameter. Foliar fertilisation applied in INT probably led to an increase in nitrogen in the plant's storage organs. The use of organic matrices in organic farming, in addition to having an amendment effect, has also been shown to act as a fertiliser in apple orchards, reducing the impact on the environment.

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GENOVESE BASIL IN HYDROPONICS: EFFECTS ON PRIMARY AND SECONDARY METABOLISM OF ZINC BIOFORTIFICATION

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Basil (*Ocimum basilicum* L.) is an aromatic plant rich in secondary metabolites beneficial for human health and highly valued by the agribusiness industry particularly for pesto production. Increasing the concentration of trace elements through specific biofortification programs could boost consumer interest in basil and its derivatives. Our research evaluated the effects of biofortification through the use of nutrient solutions with increasing concentrations of Zn (12.5, 25.0, 37.5 and 50 µM) on production, physiological indices (net CO2 assimilation rate, transpiration, stomatal conductance and chlorophyll), quality and Zn concentration in two basil cultivars 'Aroma 2' and 'Eleonora' grown in floating raft system. At harvest, phenolic acid concentrations were also determined in plant tissues by mass spectrometry (Q Extractive Orbitrap LC-MS/MS) and Zn concentration by plasma mass spectrometry. The significant positive correlation between Zn in the nutrient solution and Zn in plant tissues confirms the success of the biofortification program. The use of the highest dose of Zn (50 µM) increased the concentration of carotenoids, polyphenols and antioxidant activity by an average of 19.8, 14.6 and 33.7 %, respectively, compared to the control. However, increasing the concentration of Zn in the nutrient solution significantly reduced production, although the reduction was less noticeable in "Aroma 2."

S6 P147

OPTIMIZING NITROGEN FERTILIZATION STRATEGY TO INCREASE YIELD AND QUALITY IN BROCCOLI *FRIARIELLO* ECOTYPE (*BRASSICA RAPA SUBSP. SYLVESTRIS*)

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Broccoli rabe or rapini (*Brassica rapa* L. subsp. *sylvestris* L. Janch. var. *esculenta* Hort.), a cruciferous inflorescence/buds vegetable with growing commercial importance and nutritional/taste claim, is widely cultivated in Central-Southern Italy and especially in Campania Region (named "*friariello*" or "*broccolo friariello di Napoli*"). To optimize N fertilization on broccoli rabe local variety "Novantino" (90 days-cycle length) a two-year trial (2020-2021) was performed in winter season at Cimitile (Naples, Italy) comparing four N levels (N0, N1, N2, and N3 = 0, 80, 160, and 240 kg ha^{-1}, respectively) applied as three different fertilizer formulas (A = 33% NH_4NO_3, 66% $Ca(NO_3)_2$; B = 100% NH_4NO_3; C = 50% NH_4NO_3, 50% $Ca(NO_3)_2$), with a randomized complete block design with 4 replicates. The marketable yield (green corimbs, 10 cm-length) was 5.49 t ha^{-1}, on average. Simple correlations between each biometric trait and the rate of applied nitrate suggested a direct relationship between NO_3^- and biomass, and axillary corimbs production. In detail, N fertilization increased biomass with respect to N0, in terms of plant height (+45.2%), leaf area (+142.5%), leaf and total dry weights (+158.5% and +122.8%, respectively). N3 resulted in the highest axillary corimbs yield (+201.3%) representing a negative quality trait of *friariello* crop. Considering rate × formula interaction, the sigmoid dose-response curve traced on the total aerial biomass reached the plateau just at N2 × B, which also ensured the highest marketable yield (6.14 t ha^{-1}). These findings give valuable insights into the fertilization management of broccoli rabe *friariello di Napoli*. In the studied area, on average, increasing NO_3^- applications enhanced plant growth and biomass, and rate in the range 80-160 kg NH_4NO_3 ha^{-1} could be optimal to harvest compact corimbs as required in the fresh market consumption.

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EFFECT OF SALINITY STRESS ON PHYSIOLOGICAL FACTORS AND PHYTOCHEMICAL COMPOUNDS IN LETTUCE (*LACTUCA SATIVA L.)*

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Salinity is one of the most common abiotic stresses reducing crop growth and yield. Plants deal with salinity by activating an antioxidant defence system based on the overproduction of antioxidants, such as polyphenols. To evaluate the response to salinity, we exposed lettuce plants to increasing salinity levels under controlled conditions. The lettuce seeds (Lactuca sativa L. var. longifolia) were sown in the nursery and transplanted with a density of one plant pot^{-1}. Salinity was imposed starting from the transplant until the end of the experimental period (28 days after sowing). Following a complete randomized block design with 6 replicates, we compared 0, 50, 100, 150, 200 and 250 mM NaCl salinity levels (0_S, 50_S, 100_S, 150_S, 200_S, and 250_S). Relative water content (RWC) and electrolyte loss (EL) were determined according to Brès et al. (2022) and Ibrahim et al. (2016), respectively. Chlorophyll and carotenoid content were determined following the method described by Lichtenthaler and Buschmann (2001). The total phenolic (TPC) and flavonoid (TFC) contents were determined spectrophotometrically following the procedures described by Hasan et al. (2021). Spectral leaf reflectance (350-2500 nm) was recorded with a spectroradiometer (FieldSpec® 4 Hi-Res, ASD Inc.) using a contact probe. Three spectral vegetation indices (VIs) were calculated from the reflectance data. Statistical analysis was performed by one-way ANOVA, using R software (R Core Team, 2022). As expected, salinity significantly increased the EL, reducing the growth performance of lettuce, except for 50_S. VIs, chosen based on their ability to estimate plant vegetative state and pigment content, were able to discriminate between salinity treatments. Salinity also significantly affected the phytochemical contents, leading to TFC, TPC and pigment values below 0_S at the highest salinity levels (200_S and 250_S). In conclusion, moderate salinity (50_S) induced the highest phytochemical content in lettuce tissues without affecting yield.

S6 P149

IMPROVING ORGANOLEPTIC QUALITY IN SOILLESS TOMATO CULTIVATION THROUGH SOLUTION SALINITY INCREMENT

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The aim of this study was to optimize fertigation management of tomatoes, to obtain fruits with high organoleptic and nutritional quality, testing three different levels of salinity. The trial was conducted on cherry tomato plants (cv. Mozia, Axia Sementi) in an unheated greenhouse located in South Italy, in a summer-autumn cycle, under closed soilless system. Plants were grown on coconut fibre slabs and subirrigated with saline waters by adding 10 (control), 40 (medium salinity) and 70 mM (high salinity) of NaCl, in the nutrient solution, with 2 replicates per treatment. Each gutter contained 8 coconut fibre slabs, with three plants per slab (2.5 plants m-2). The fruit organoleptic quality was measured at harvest and after 10 and 20 days of storage conditions (10-12°C, 40% RH).For the chemical quality, on the juice were determined: electrical conductivity (EC), pH, titratable acidity (TA), and total soluble solids (TSS). Fruit appearance was measured determining fruit firmness, calyx freshness and calyx persistence, and number of rotten and stained fruits. All quality parameters (chemical and appearance) contributed to a single global quality index. The chemical quality measured on the fruit juice improved by about 5 % for each 10 mM increase of NaCl added to the nutrient solution for EC, TA, and TSS, while it had no effect on the pH. On the other hand, the fresh and dry fruit weight was reduced, respectively, by about 4.5 and 8.5 % for each 10 mM NaCl increase. The salinity increments in the nutrient solution improved the global quality index of the fruit but reduced the production both as fresh and dry weight. After 10- and 20-days storage under shelf condition the fruit quality was reduced, due to an increase of rotten fruit, a lower firmness, and worse chemical parameters.

S6 P150

SELENIUM BIOFORTIFICATION OF DILL MICROGREENS, GROWN IN INDOOR FARM AND IN GREENHOUSE

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The quality of vegetables is a feature increasingly requested by the market. The concentration of secondary metabolites or specific bioactive molecules, healthy for the consumers, can be increased and standardized through soilless cultivation systems, even in the presence of LED lighting. In plants, the light is one of the main factors responsible for the modulation of the biosynthesis of metabolites. In recent years, in addition to this, there is an increasing demand for tailor-made food, and enriched with key microelements. The present research aimed to investigate quantitative and qualitative aspects in dill (*Anethum graveolens* L.) microgreens, biofortified with Se through nutri-priming, cultivated indoor or in greenhouse. The indoor cultivation was carried out in a commercial Vertical Hydroponic Module, model Radix, equipped with LED lights, adaptable for different hydroponic growth systems ("MitTech"). The biofortification was carried out by testing two different concentrations of Na_2SeO_4 (1.5 and 3 mg L^{-1}), compared with an untreated control. The evaluation of extrinsic quality, yield, fresh weight, and dry weight was carried out at harvest, 25 days after sowing. Subsequently, the concentration of mineral elements and phytochemicals was determined on fresh tissues. The results of these preliminary trials revealed that Sodium selenate biofortification affected the content of dietary minerals (Se), with increasing levels proportionally to the Se concentration used, and of other of the analyzed parameters. In particular, an interesting effect on the nitrate levels has been observed. The two cultivation environments influenced the results in a different way: indoor farming appears as a promising cultivation system to enhance product quality and yield.

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AUTONOMOUS MOWERS FOR PERMANENT GRASSLAND MANAGEMENT: A CHALLENGE FOR THE NEXT FUTURE

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The agricultural lands not included in the crop rotation of a farm are permanent grassland. They play a key role in the maintenance of European biodiversity and in the natural resources for animal feed. In fact, permanent grassland covers almost 34% of European agricultural territory providing 25% of the total food intake for European livestock. The practices used in the intensification of the grassland operations can be seen from different points of view, which are involved at the same time in three aspects: increasing the herbage production per unit area, increasing the portion of herbage mowed and the control of environmental risks. The mowing activity, with the plant height and the number of mowing times, highly influences the forage yield and the stability of the forage nutritional value. The aim of this research was to investigate how the application of innovative autonomous mowers, able to cut at constant heights with random trajectories, could be utilized in an agricultural context. In this specific trial the trajectories, the soil compaction and the height trend of a warm-season grass species were investigated by using a battery-powered Husqvarna Automower® 535 AWD 4-wheel drive model at different cutting times (30, 60 and 90 minutes daily cutting time on 25 m2 plots for 30 days). The results showed that the autonomous mower with random trajectories covered nearly the entire area in 30 minutes without significant soil compaction and high energetic consumption maintaining a constant grass height. Due to these results, a challenging topic could point out how the effects of simulated grazing with robot mowers could be considered as a possible way to avoid the effects of land use intensity on the soil, the plant, and the final yield of forage. Moreover, further research is needed to develop a specific autonomous machine with systematic trajectories and high cutting height for permanent grassland livestock agroecosystem management.

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INTERDISCIPLINARY STUDY OF RIPARIAN SOIL MONITORING BY MEANS OF AMPHIBIANS ALONG MEDJERDA RIVER IN SOUK-AHRAS PROVINCE (ALGERIA)

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Riparian ecosystems are very peculiar, characterized by soils with large variation in physical and chemical composition due to flooding events, standing at the transition boundary between terrestrial and aquatic compartments. The raise of urbanization and agriculture to sustain the growing population in rapid urban expansion of northern Africa poses high anthropogenic pressure also on riparian soils, by affecting biota, besides water. The assessment of soil characteristics, especially heavy metals, can estimate the gravity of those factors, with the need of combining soil and water together by means of a biological indicator. In this view, the amphibian *Bufo spinosus* D. is suggested as a potential bio-sentinel of both soil and water quality, for its life cycle and ability to accumulate pollutants in its tissues without significant adverse effects. Therefore, the main goal of this research was to study riparian soils collected at the banks of Medjerda river, Souk-Ahras province (Algeria) along an increasing gradient of anthropogenic pressure (NU, non-urban; PU, peri-urban; U, urban areas) in terms of heavy metals (Cd, Cu, Fe, Pb and Zn) and variables, including soil organic matter-SOM, pH and electrical conductivity-EC. Individuals of spiny toads (skin biopsy) were studied for the same metals in order to highlight strict correspondences with the investigated areas. The results highlighted high metal contamination of Cu, Fe, Pb and Zn in PU, and Cd and Pb in U sites as possibly related to urban expansion and use of fertilizers. These trends reflected on high EC in PU and high pH in U sites. More SOM seemed to limit animal uptake of heavy metals, as reflected for NU soils. Toads better responded to elevated levels of Zn in PU and Pb in U sites. This investigation evidenced the importance of soil monitoring and the contribution that spiny toads can give to ecological studies.

S6 P153

EARTHWORMS AS ECOLOGICAL ENGINEERS ENHANCING THE PHYSICO-CHEMICAL SOIL PROPERTIES

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Earthworms represent the most relevant component of the soil macrofauna for their capacity to improve the soil fertility and quality, playing a crucial ecological role in maintaining its health through the bioturbation and microbial interactions processes, which increase the porosity and aeration, as well as the nutrients availability. This work aims to shed light on the epigeic earthworms (*Eisenia* sp.) effects on the development of two plant species (*Brassica oleracea*, broccoli; *Vicia faba*; faba bean), by changes in the soil chemico-physical properties induced by them. Using mesocosm techniques, plants were grown outdoors for four months with or without earthworms. Earthworms abundance and soil chemico-physical properties (temperature and water content throughout the experiment; macroporosity, water holding capacity, pH, organic carbon and total nitrogen at the beginning and at the end of the trial; bioturbation) were determined. Plants morphometric parameters were also measured at the end of the experiment. Earthworms' number and total weight doubled during the trial. They induced changes in the soil chemico-physical properties. Their presence increased the soil macroporosity (+16%, mean value) and water holding capacity (+9%, mean value), as well as the bioturbation level. A significant decrease of soil organic carbon in presence of earthworms on both species were detected at the end of experiment, probably related to the higher organic matter mineralization processes; whereas the significantly higher total nitrogen in the controls of both species compared to the treatments with earthworms suggested that they can promote the readily available N uptake by roots. Finally, earthworms significantly improved the shoots and roots growth of both species. These results confirm earthworms soil enhancing and plant growth supporting action, useful to make more sustainable the soil management in agroecosystems.

S6 P154

SOIL QUALITY AND FOOD SAFETY IN HORTICULTURAL SYSTEMS OF CAMPANIA

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Soil quality is the result of multiple interactions among mineralogical, chemical, physical and biological soil attributes, but its assessment can vary according to land uses. For agro-ecosystems, soil quality is mainly related to productivity and food quality, while for natural ecosystems the key factors are the maintenance of environmental quality and biodiversity conservation. In Campania region, horticulture is a strategic and high-tech sector, mainly developed in the Sele and Campana plains. Indeed, many horticultural systems are placed in strongly human-impacted areas, such as urban and peri-urban environments, where soil quality and food safety are constantly affected by anthropic activities. This work, carry out in the framework of *Agritech National Research Centre – Spoke 3, funded by the European Union Next-GenerationEU (Piano Nazionale di Ripresa e Resilienza (PNRR) – Missione 4, Componente 2, Investimento 1.4 – D.D. 1032 17/06/2022, CN00000022)*, aims to assess soil quality and food safety in horticultural contexts of Campania, where agricultural productivity and human life coexist and are strictly linked. In the study areas, mainly located in the metropolitan area of Naples, we are assessing: i) the physicochemical indicators of soil quality; ii) the total and bioavailable/bioaccessible contents of nutrients and contaminants, to appraise soil fertility and identify possible soil contamination; iii) the mineral elements and bioactive compounds in food products to evaluate their nutritional value, and possible chemical contaminants to gauge food safety; iv) the environmental and health risks, related to the possible exposure to soil particulate matter and intake of potentially contaminated water and food. The outcomes of this study will aid to define specific quality indicators for soils of strongly human-impacted areas. The cultivation techniques and management of the study areas will be oriented toward sustainable/resilient and site-specific models, leading to a better use of resources and the enhancement of soil fertility, biodiversity and food quality/safety.

S6 P155

HUMAN BIOACCESSIBILITY OF POTENTIALLY TOXIC ELEMENTS FROM POLLUTED SOILS

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In accordance with the Legislative Decree 152 of 2006, this work aims to assess the effects of anthropic activity on the environment quality and human health. Legislative Decree 152 of 2006, together with the recent Italian Ministerial Decree 46 of 2019 on agricultural soil, establish that when the concentration of potentially toxic elements (PTEs) in a soil exceed threshold concentrations of contamination (CSC), further analytical tests must be applied to evaluate the bioaccessibility/bioavailability of these PTEs in the soil. Thus, nowadays, there is a growing need for an approach based on the assessment of the real risks for humans and environment in potentially contaminated agricultural soils. In this work, we studied the distribution and oral, lung and dermal bioaccessibility pf PTEs in particle-size fractions (<2.5, 2.5-10, 10-50 µm) of soils collected from an agricultural area of Acerra, in Campania, formerly employed as shooting range and potentially contaminated by Pb and Sb, and polycyclic aromatic hydrocarbons. After physical separation of soil samples in particle-size fractions, by consecutive cycles of shaking, centrifugation (particles <2µm) and sedimentation (coarser fractions), we extracted the samples of each particle-size fraction with: i) Unified BARGE method, to assess the gastric (G) and gastro-intestinal (GI) bioaccessibility; ii) Artificial lysosomal fluids (ALF) and simulated epithelial lung fluid (SELF), to evaluate the bioaccessibility in the lower and upper respiratory tracts, respectively; iii) simulated acid skin liquid (NIHS) secreted from eccrine glands, to study the dermal bioaccessibility. Through the analysis of these data, we are assessing the non-carcinogenic (NCR) and carcinogenic (CR) health risks for the local citizens, potentially exposed to soil particulate matter which can be eroded by the wind and dispersed in the atmosphere, especially in the dry seasons when the soil is not adequately protected by a green capping.

S6 P156

THE SUITABILITY OF LUNAR AND MARTIAN REGOLITH SIMULANTS FOR THE GROWTH OF FOOD PLANTS

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Space farming based on in situ resource exploitation is a promising strategy for food production on extra-terrestrial habitats, as it can allow water recycling, organic waste composting, and oxygen production or CO_2 consumption. Using the local regolith as "soil" for plant growth would be a viable way to grow food, even though "extra-terrestrial soil" is very different from vital and fertile "terrestrial soil". Since Lunar and Martian regolith are not available on Earth, space research studies are commonly carried out on regolith simulants, which tend to replicate the physical and chemical properties of extra-terrestrial regoliths, assessed during the past manned missions to Moon or by rover and robotic spacecrafts landed on Mars. This work intends to provide a brief overview of the physicochemical properties and mineralogical composition of Lunar and Martian regolith simulants, currently produced and available on the market. Then, it aims to describe possible strategies and sustainable practices for creating regolith simulants akin to terrestrial soil, including amendment with composted organic wastes, which can turn nutrient-poor and alkaline crashed rocks into efficient life-sustaining substrates equipped with enhanced physical, hydraulic, and chemical properties. In this regard, we present main results from our recent scientific works focusing on exploitation of regolith simulant-based substrates as plant growth media and carried out within the Italian Space Agency project *In-situ REsource Bio-Utilization for life Support system (ReBUS)*. Discussion will identify the main critical aspects and future challenges related to the in situ agricultural use of Lunar and Martian soil.

S6 P157

ONOPORDUM TAURICUM (WILLD.) AS A VEGETABLE MILK COAGULANT FOR CHEESE-MAKING: THE CASE OF CACIOFIORE

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Onopordum tauricum is a cardoon species native to Southern Europe and Central Asia, which grows spontaneously in Italy, especially in high-marginal lands. The adaptation capacity, low-required inputs, and high yield suggest its sustainable cultivation as herbaceous crop for industrial and technological use. For this latter aspect, the milk clotting activity of aqueous extracts prepared by maceration of purple tubular flowers of this thistle species has recently been shown. In this context, the present work was aimed at exploring the use of extracts obtained from spontaneous and cultivated *O. tauricum* flowers as new milk coagulants in cheese-making trials, in comparison with a commercial coagulant obtained from *Cynara cardunculus*. Caciofiore, a raw ewe's milk cheese traditionally manufactured with thistle rennet in a family-run dairy located in the National Park of Sibillini Mountains (Marche, IT) was selected as a case study. Two cheese-making trials were conducted using two different batches of milk. Mature cheeses (60 day-ripened) were subjected to physico-chemical (composition, pH, total titratable acidity, color, texture), microbiological (viable counting), metagenomic (Illumina sequencing), volatile organic compounds (VOCs) and sensory analyses. As a general trend, a high similarity was observed between control and experimental cheeses, with most of the differences found being ascribable to the batch of milk. However, significant differences were seen in color (lower *L**and *a**, higher *b** values in experimental vs control cheeses) and content of soluble nitrogen (5% lower in experimental cheeses) and a few VOCs (ethyl esters, acetic esters and branched-chain fatty acids). Data overall collected suggested that the extracts from *O. tauricum* flowers are a valuable alternative for manufacturing of Caciofiore cheese, and more in general, ewe's milk cheeses. The study is part of the project "Valorization of thistle-curdled CHEESEs in MEDiterranean marginal areas" (PRIMA-2018) and "Dottorati Innovativi con caratterizzazione industriale" (PON 2014-2020).

S6 P158

SAFETY ISSUES IN LACTIC ACID BACTERIA: THE CONTRIBUTION OF THE VERONA UNIVERSITY CULTURE COLLECTION (VUCC-DBT)

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The Verona University Culture Collection – Department of Biotechnology (VUCC-DBT) was established in 2021 and it is a member of the Microbial Resource Research Infrastructure Italian Node (MIRRI-IT;www.mirri-it.it). VUCC-DBT holds about 500 microbial resources (yeasts and bacteria) with biotechnological potential in the agro-food, environmental and industrial sectors. Considering the microbial groups of industrial interest, lactic acid bacteria (LAB) are widely used as food cultures and probiotics, but could also present some safety issues, that deserve attention. To target these aspects, VUCC-DBT includes 32 LAB strains characterized by undesirable characteristics such as antibiotic resistance and biogenic amines production. These strains belong to *Lactiplantibacillus plantarum, Levilactobacillus brevis, and Leuconostoc citreum* and were isolated from spontaneous fermentations of dairy and bakery products. More in detail, *Lpb. plantarum* (10) and *Ln. citreum* (12) strains are resistant to erythromycin and chloramphenicol, respectively, with the detection of *ermB* gene at the basis of erythromycin resistance, while the chloramphenicol resistance is under study; further, 10 strains of *Lvl. brevis* were tyramine producers and present the tyrosine decarboxylase gene. Although these strains are unsuitable for industrial purposes, they can be used as references for diagnostics (e.g., positive controls for MIC determinations and/or for genetic screening) and in research studies on the evolution of antimicrobial resistance in LAB, and therefore will be subjected to genome sequencing. These safety-related bioresources set VUCC-DBT at the crossroad between the scientific community, industrial stakeholders, and policy makers, as highly characterized strains and the associated know-how for phenotypic as well as genome-based safety assessment can be a valuable expertise in the risk assessment of beneficial microbes with broad application potential. For this reason, the collection is also open for deposit of food-unapplicable LAB strains.

S6 P159

HEAVY LAMB SARDA X ILE DE FRANCE CROSSBREED MEAT QUALITY

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The aim of this work was to evaluate the carcass yield, meat quality and sensory profile of Sarda x Ile de France crossbreed heavy lamb (F1), raised at pasture. After weaning, 56 F1 were divided in two treatments balanced for sex and live weight (LW), and were allotted to two different pastures: *Lolium italicum* (L) and *Sulla coronaria* (S). Each group received a supplement of alfa-alfa hay (230 g/head/d) and of commercial concentrate (150 g/head/d). After slaughter (82 ± 7 days of age; mean±st.dev), the carcasses were classified, according with the PGI "Agnello di Sardegna", into three LW categories: 8.5 - 10 kg (A), 10 – 13 kg (B) and >13 kg (C). Carcass yield, pH, color, and proximate composition of *Longissimus dorsii* muscle (LD) were analyzed. Furthermore, A and B categories were sensorially evaluated using a Quantitative Descriptive Analysis (QDA) with a trained panel. Data were analyzed with ANOVA procedure of SAS. Carcass yield was not affected by treatment whereas it resulted lower in male than in female (51.2 *vs* 52.5 %, $P<0.01$) and in A than in the others categories (48.5, 52.2 and 53.5% in A, B, C respectively, $P<0.001$). Proximate composition was influenced by treatment, sex and categories. L showed higher protein and cholesterol content but a lower value of Vitamin A and FRAP (Ferric reducing ability of plasma) than S. Fat, protein, Vitamin E and FRAP content were higher in female than in male lambs. Between categories, a lower value of fat content was detected in A that showed a higher cholesterol content than B and C. The main significant differences showed by sensory analysis were found in the textural attributes for sex and categories. Treatment affected meat quality, in particular *Sulla coronaria* seems to improve antioxidant properties (Vitamin A and FRAP). The heaviest lambs had better carcass yield probably due to a greater muscle development.

S6 P160

SMART LIVESTOCK STRATEGIES AND TECHNOLOGIES FOR SUSTAINABLE BEEF CATTLE MANAGEMENT IN PASTURE-BASED SYSTEMS – A REVIEW

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Livestock productions constitute a very important component of the agricultural economy, generating several ecosystem services especially in marginal area. In this context, animals' pasture-based systems represent a fundamental resource for beef production. The traditional methods do not optimize the exploitation of pastureland resources, which are now increasingly exposed to the climate change. The Precision Livestock Farming (PLF) represents a new opportunity for maximizing the utilization of available pastureland, avoiding over – or undergrazing detrimental effects. This review analyses the most recent PLF applications, especially those applied to beef cattle farming, in the perspective to a sustainable strategy to improve the grazing management. The articles have been divided into four main categories: PLF, Machine Learning, Environmental Evaluation and Genetic Selection. ''Individual animal management by continuous real-time monitoring of health, welfare, production/reproduction, and environmental impact" is one of the most used definitions for PLF. Animal identification, feed intake, reproduction aspects are just some of the parameters monitored through specific digital sensors like ear tags, collars, accelerometers used in the smart farming. Geographic Information Systems and Geographic Positioning Systems are adopted for the evaluation of pasture productivity, optimizing the balance between available forage and stocking rate. Unmanned aerial vehicles and virtual fencing are also employed to ensure better management of herds and pasture in real time. Recently, Internet of Thing and Machine Learning have been implemented for the efficient management of livestock. The literature also reports technologies to reduce Greenhouse Gas emissions intensity of pasture-based cattle systems. PLF derived data, such as welfare indicator traits, could be also included into selection breeding schemes to enhance livestock robustness and resilience. However, the accuracy and robustness to confirm sustainability of these types of systems is still lacking. Further efforts are needed to promote and disseminated the use of PLF for beef cattle farming in marginal area.

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CHEMICAL, PHYSICAL AND SENSORY PROPERTIES OF PDO MOZZARELLA CHEESE PRODUCED FROM MILK OF BUFFALOES FED WITH HYDROPONIC FORAGE

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The development of alternative techniques for forage production is becoming increasingly crucial in the Mediterranean, due to the resource scarcity, climate change and population growth. Maize cropping system is highly demanding for water and non-renewable sources, and its economic convenience is decreasing due to the increase in production input costs. Recently, hydroponic cultivation system has emerged as a new soilless cultivation method for growing quality-constant fresh forage, offering advantages such as better environmental sustainability, reduced labour costs, lower resource and space requirements. Moreover, hydroponic forage can improve the nutritional composition of dairy products. The aim of this study was to investigate the sensory properties of PDO mozzarella cheese produced with milk from buffaloes fed with hydroponic barley forage (FORIDRO Project: UNINA_CdA_75_2021_FRA_LINEA_B). Thirty-three buffaloes (Italian Mediterranean breed) were divided into three groups. The control group (C) was fed maize silage and concentrate (60:40). In the first experimental group maize silage was replaced at 50% (LH) by hydroponic barley forage, while in the second group at 100% (HH). Mozzarella samples, produced in three differentiated cheese-making trials, were analysed by sensory (triangle test and QDA), texture profile, colour and SPME-GC/MS analysis. Triangle tests showed a difference in each of the three cheesemaking periods between C and HH. These differences were attributed to the sensory texture descriptor "hardness", which achieved a higher intensity in the control sample, while no differences in the intensity of the olfactory and taste descriptors were found. The instrumental texture corroborated the results obtained from the QDA. Colour did not differ between samples. C sample had a greater abundance of volatile fatty acids, while HH had a higher amount of 1-octen-3-ol. In conclusion, the inclusion of hydroponic forage in lactating buffalo diet determines slight differences in the sensory properties of the PDO buffalo mozzarella cheese while improving its nutritional characteristics.

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DIFFERENCES IN MILK PRODUCTION PERFORMANCE BETWEEN LOCAL VS COSMOPOLITAN GOAT BREEDS

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The aim of the work was to carry out a descriptive analysis of milk performances (e.g., milk yield, fat, protein and lactose percentages and somatic cell score) in a cosmopolitan goat breed (Saanen) and in a local one (Camosciata). The trial was performed in eight farms located in Basilicata region on 3357 test day recorded in two years on 849 goats. Goats were separated in two different groups according to breed: Saanen (test day n= 2811) and Camosciata (test day n= 995). The statistical analysis was performed on R software version 4.2.2. A P-values < 0.05 was considered statistically significative. To compare the milk production of the two breeds the fat correct milk (FCM) was estimated. The results showed that Saanen had higher milk production (in terms of FCM) compared with Camosciata goats (3.25kg ± 0.03 vs 2.21kg ± 0.03, P< 0.001). Regarding milk quality, Saanen goats showed higher protein and lactose values compared to Camosciata. The protein content was 3.39% ± 0.01 vs 3.29% ±0.01, (P<0.001), and the lactose content was 4.49% ± 0.01 vs 4.38% ± 0.01, (P< 0.001) respectively in Saanen and in Camosciata goats. Regarding the total fat the Camosciata's milk had higher values compared to Saanen, but this result was not statistically significant (3.90% ± 0.05 vs 3.73% ± 0.02 respectively in Camosciata and Saanen). Finally, regarding the somatic cell score, Saanen milk had higher values than Camosciata (6.68 ± 0.03, 6.05 ± 0.10, P< 0.001). In conclusion, the Saanen breed achieved higher performances compared to Camosciata in terms of FCM and protein and lactose percentages but, since the most intensive production, Saanen goats had also higher values of somatic cell score. Regarding the total fat percentage, future works should be focused on investigating fat composition and fatty acid profile to assess any differences.

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A NEW FLOATING POCHE SYSTEM FOR BREEDING OYSTERS (*CRASSOSTREA GIGAS*) IN SARDINIA LAGOONS (ITALY)

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Sardinia Island, with its 9000 ha of lagoons, represents one of the main Italian producers of oysters with a local production of about 140 tons per year. In the last 20 years, the region has been showing big potential for the breeding of oysters (especially pacific oyster *Crassostrea gigas).* The technique used by farmers foresees the rearing of oysters inside a basket or poche kept in suspension in the water column (1-2 m depth) on the surface using polystyrene or frames made of watertight tubes in PVC. An important problem in the brackish waters breeding of the *C. gigas* concerns the shell colonization by a worm known as Polydora, which penetrates the thick shell causing damage, with a consequent reduction in the commercial value of the oyster. In Sardinia, the systems used to eliminate or reduce the presence of this polychaete determine an important increase in costs linked to the cleaning practices applied to farmed mollusks. The aim of this work was to test a new poche floating system composed of two-part: a float of polyethylene high-density linked to a plastic poche that allows the oysters to be exposed to the air, to eliminate or significantly reduce the presence of Polydora, while reducing the workload of the operators and energy expenditure. The results show how these mollusks reached the commercial size and that their farming with the AGRIS floating system were completely free of Polydora. The manpower required for breeding operations has been reduced by 50% compared to the traditional systems in use in the Sardinian lagoons. Growth and mortality were not negatively affected by the rearing system. This breeding system is a valid alternative to traditional ones in a basket or lantern, particularly for shallow brackish water.

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MICROBIAL COMMUNITIES IN KEFIR PRODUCED USING AMIATA DONKEY MILK

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Donkey milk contains a higher content of high-quality fats (e.g., polyunsaturated fatty acids – PUFAs) and lactose comparted to cow milk. Despite the low production, the number of studies on its properties is increasing, and production of kefir can be a suitable strategy to further valorize its characteristics. In this work the microbial communities in kefir produced using Amiata donkey milk were characterized in detail for the first time. Donkey milk was fermented 24 h at room temperature alone (DK), or in combination with sheep milk (DSK, 50% each) or cow milk (DCK, 50% each). At the end of the fermentation, samples were collected, and the fatty acids (FAs) profile was analyzed by GC-FID. The microbial communities were characterized by sequencing of 16S rRNA gene amplicons. To evaluate the stability, the microbial communities were characterized also after a 5-day storage (4 °C) of kefir. The sequencing was performed using an Illumina MiSeq platform, and the Amplicon Sequence Variants (ASVs) were generated using DADA2. The content of n3 and n6 PUFAs was higher in DK (9.60% ± 2.12% and 22.76% ± 6.11% of the lipid fraction, respectively) compared to DSK (1.89% ± 0.11% and 2.07% ± 0.12% of the lipid fraction) and DCK (0.89% ± 0.28% and 2.17% ± 0.29% of the lipid fraction). At the end of the fermentation, the relative abundance of the genus *Lactococcus* was 44.79% ± 1.31%, 29.49% ± 2.37% and 46.93% ± 1.67% in DK, DSK and DCK, respectively, and it decreased to ~1%, or lower, at the end of the storage. The relative abundance of the genus *Lactobacillus* was lower in DK (8.62% ± 0.23%) compared to DSK (17.3% ± 2.38%) and DCK (20.44% ± 2.03%). Overall, the composition of the bacterial communities and the FAs profile in DK was different compared to the other conditions.

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SPENT MUSHROOMS SUBSTRATE AS ORGANIC FERTILIZATION FOR BABY LEAF PRODUCTION

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The cultivation of *Pleurotus spp*. produces a significant amount of spent substrate (SPS) that is mainly composed by cereal straw already degraded by mycelium and could be used as organic fertilizer. In a greenhouse tunnel, the effect of SPS for the organic fertilization of two varieties of baby leaf lettuce (Imperiale and Doge), in two cycles of cultivation was evaluated. Five treatments were managed: T0 (unfertilized control), TMIN (100% nitrogen supplied with mineral fertilizer), T100+50 (100% nitrogen supplied by SPS plus 50% of the crop needs with mineral fertilizer), T200 (double nitrogen requirement supplied with SPS) and T200+50 (as T200 plus 50% of the crop needs with mineral fertilizer). During both cycles SPAD index, crop soil covering index, plant height, total biomass and commercial yield were measured. Total nitrogen and mineral profile were analyzed on produce, whereas nitrogen, organic carbon and the enzymatic activity in the soil were evaluated at the end of each cycle. A different effect of the variety was often observed. Lower values of SPAD were observed with T200. At the end of the growing cycle, crop coverage was less than 80% in T200 and T200+50, while it was almost 100% in the other treatments. In the first cycle, the plant biomass was the highest for T0, TMIN and T100+50 with respectively 2.1, 2.0 and 1.7 kg/m^2 for Imperiale and 2.4, 2.3 and 1.8 kg/m^2 for Doge; the same trend was observed in the second one. Nitrate content of marketable produce was affected by the variety: Doge showed the highest content (2000 mg/kg fw) with T200 and T200+50, whereas in Imperiale with Tmin and T0 (2500 mg/kg fw). SPS could be a suitable resource as organic fertilizer of baby leaf lettuce, with T100+50 that yielded as much as the mineral treatments.