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ABSTRACTS

Oral Session I:

Organic and non-organic cultivation practices to improve yield and quality

Organic Vegetable Production: Trends and Challenges

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The global population is growing rapidly, accompanied by a substantial increase in demand for food and non-food products. This trend has driven the expansion of large-scale monocultures and long-distance supply chains. At the same time, the need to increase agricultural production while enhancing the resilience of agri-food systems worldwide highlights an urgent requirement for transformative approaches in agriculture and value chains. Rather than focusing solely on yield increases, sustainable practices that ensure long-term soil and environmental health, social equity, and economic viability are increasingly essential. Organic agriculture represents a holistic approach to agroecosystem management, aiming to produce substantial quantities of high-quality food by placing ecological processes and ecosystem services at the core of production systems. In contrast to conventional agricultural practices, which often rely heavily on external inputs such as chemical fertilizers, synthetic pesticides, and genetically modified organisms, organic agriculture seeks to harness and enhance natural ecosystem processes to maintain productivity, stability, and resilience. In organic vegetable production, effective soil and crop management are central components of the production system. These encompass key sub-themes such as soil fertility management, water use efficiency, crop nutrition, pest and disease regulation, and the optimization of plant–soil interactions, all of which are critical for achieving sustainable and resilient production systems. This review synthesizes current scientific research on techniques and management practices employed in organic vegetable production.

Vigorous Rootstocks and Microbial Inoculation Enhance Organic Pepper Performance

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Organic pepper systems frequently experience nutrient constraints because organic fertilizer inputs depend on microbial decomposition and mineralization processes for nutrient release. As a result, plant growth and stress resilience depend heavily on both the physiological capacity of the root system and the activity of soil microorganisms. In these studies, we evaluated two strategies, grafting and microbial inoculation, aimed at enhancing transplant quality and stress tolerance in organic peppers (*Capsicum annuum*). In the first study, four rootstocks ('CM-334,' 'YC-207,' 'Keystone Resistant Giant,' and 'Scarface') were grafted with the hybrid Italian sweet pepper 'Mama Mia Giallo' and grown under summer greenhouse conditions in southwest Texas. Grafted plants showed similar or improved growth relative to non-grafted and self-grafted controls under normal and reduced fertilization. Notably, rootstock 'YC-207' exhibited higher nitrogen use efficiency, greater shoot nitrate and phosphorus content, improved stomatal conductance, transpiration, and electron transport rate, and lower malondialdehyde content, indicating enhanced stress tolerance. In the microbial inoculation study, three different pepper genotypes were subjected to water stress imposed as deficit irrigation. Inoculation with drought tolerant microbial consortia mitigated water stress but the responses were genotype specific. The heirloom variety 'Corne di toro' and 'Mama Mia Giallo' were more affected by water stress, while the improved breeding line 'Jal46' showed tolerant traits. In the non-inoculated plants, water stress caused shoot and root growth reduction, decline in photosynthesis rate and biochemical changes, responses that were mitigated in plants treated with microbial inoculation. Results from the studies suggest that vigorous rootstocks and microbial inoculants have the potential to improve nutrient efficiency, stress resilience, and overall plant vigor, offering a practical approach to support sustainable organic pepper production.

Keywords: Plant growth promoting rhizobacteria, PGPR, Beneficial microbes, Drought stress, Drought-tolerance, Pepper Grafting

Land Use Strategies During Organic Transition in Subtropical Vegetable Systems

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Subtropical environmental conditions create challenges for organic vegetable production, particularly during the initial three-year transition period. Effective land-use decisions in the first year are critical for crop performance, soil health, and profitability. This study evaluated the agronomic and economic outcomes of four land use treatments (i.e., growing tomato as a cash crop, planting sorghum sudan as a cover crop, constant tillage, and keep the soil fallow) during the first year of organic transition, with the goal to identify the best strategy of land-use in this period. A randomized complete block design was used at the Organic Unit of the E.V. Smith Research and Extension Center in Alabama, U.S.A. Data collection included weed population, soil physical properties, tomato yield, and economic performance. Tomato production, sorghum cover cropping, and tillage effectively suppressed weed population, while fallow ground had the highest weed population. Soil compaction was significantly lower under tomato production and sorghum cover cropping than under fallow and tillage. However, land use treatments had minimal effects on soil bulk density, saturation, and water retention properties. Tomato marketable yield averaged 21,057 kg ha□¹, with total production costs of $26,396.08 ha□¹ and net revenue of $3,313.97 ha□¹ at a market price of $16 per box, though profitability can vary significantly with yield and market price fluctuations. Results suggest that sorghum cover cropping may be the most viable strategy for improving soil health and weed suppression during the first year of organic transition, while tomato production requires careful financial risk management.

Keywords: tomato production; economic analysis; weed management; cover crops; tillage

Effects of zinc biofortification and triacontanol application on yield and quality of different mini-plum tomatoes

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Tomato is a key dietary source of health-promoting compounds and, owing to its extensive consumption and large-scale production, represents an ideal target for agronomic biofortification. Indeed, enhancing its micronutrient density through targeted fertilization strategies is particularly relevant given the known inadequacy of some micronutrients intake across European populations. On the other hand, biostimulants play a crucial role in Mediterranean protected cultivations, where low-tech greenhouses are often insufficient to prevent the crops' exposure to abiotic stressors during the winter months (low temperatures and reduced daily light integrals), thus limiting the full expression of the crops' qualitative performances. For these reasons, this study evaluated how foliar Zn-EDTA biofortification and triacontanol-based biostimulation, applied individually or in combination, affect yield and fruit quality of two different mini-plum tomato cultivars, i.e. 'Angelle' (red fruit) and 'Dolcenera' (brownish fruit). Compared to the untreated control, Zn biofortification significantly increased fruit dry matter content (+6%), whereas all treatments enhanced carotenoid accumulation, with the combined Zn-EDTA + triacontanol application producing the highest increase (+21.8%). The combined treatment also raised the fruit concentrations of K (+9.3%) and Fe (+28.2%), suggesting a synergistic effect between Zn-EDTA and triacontanol. As expected, Zn biofortification alone markedly boosted the fruit Zn content in both cultivars (+68.1%, on average), confirming the effectiveness of foliar Zn-EDTA applications in improving Zn assimilation and translocation in the edible tissues. Considering the central role of tomato in the human diet, the results of this study may provide a valuable contribution for producers aiming at enhancing the production diversification, as well as for consumers seeking products with improved nutritional quality.

Keywords: *Solanum lycopersicum* L., hidden hunger, micronutrients enrichment, plant biostimulants

The effect of grafting on the growth dynamics and yield of cucumber cultivated in nematode-infested soil

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The high nutritional value of vegetables has led to increased consumption, emphasising the importance of advanced production technologies. In greenhouse vegetable production, soil-borne diseases and pests often reduce crop yield, mainly due to limited crop rotation. Grafting plants onto resistant or tolerant rootstocks is an effective method to mitigate crop losses and offers a sustainable alternative to conventional breeding for improved resistance to soil pests, especially nematodes. The effect of grafting cucumber 'Lisboa' onto the 'Polyfemo' rootstock, grown in nematode-infested soil, was evaluated over two growing seasons (2021–2022). Field experiments were conducted in a greenhouse in the Goriška Region and arranged in a randomised block design with three replications. Each experimental unit consisted of 10 plants and . ungrafted plants served as the control. In both years, the harvest period lasted from early June until late September. In 2021, the harvest of technologically mature cucumbers from grafted plants began 12 days earlier than from ungrafted plants, whereas in 2022 it began 4 days later. At the end of the 2022 season, grafted plants produced a significantly higher marketable yield (59 fruits/plant and 14.9 kg/plant) compared with ungrafted plants (46 fruits/plant and 11.3 kg/plant). In 2021, the roots of grafted plants showed signs of nematode infestation. Nevertheless, the yield of grafted plants did not decrease during the second part of the harvest period and was up to 100% higher than that of ungrafted plants, whose roots showed symptoms such as tissue desiccation and rot, resulting in a reduced marketable yield.

Keywords: grafting, cucumber, yield, soil nematode, greenhouse

Oral Session II:

Climate change adaptation and stress resilience

How to mitigate the negative impact of climate change on vegetable production?

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Increasing temperatures, sun radiation, reduced water availability, and salinity will be the major limiting factors in sustaining and increasing vegetable productivity. Under changing climatic situations crop failures, shortage of yields, reduction in quality and increasing pest and disease problems are common and they render the vegetable production unprofitable. To mitigate the adverse impact of climatic change on productivity and quality of vegetable crops there is need to develop sound adaptation strategies. The emphasis should be on development of production systems for improved water use efficiency adoptable to the hot and dry condition. Development of genotypes tolerant to high temperature, salinity and climate proofing with new biotechnology are essentially required to meet these challenges. Therefore, the aim of this paper is to introduce new but also traditional techniques that are simple to apply and not too expensive (plant shading, grafting, intercropping, soil mulching and mycorrhiza application) to mitigate the negative effects of climate change on vegetable production.

Keywords: climate changes, vegetable production, shading, grafting, mulching, mycorrhiza

Accelerating Climate-Resilient Vegetable Systems in Southeastern Europe through Innovation

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Vegetable production systems in Southeastern Europe face increasing climate-driven pressures, including heat stress, irregular precipitation, and water scarcity, which challenge productivity, resource efficiency, and regional competitiveness. This study presents a systems-based assessment of technological and policy pathways to enhance climate resilience in the region's vegetable sector. We review innovations, including precision agriculture, protected cultivation, soilless hydroponic systems, integrated pest management, and breeding for stress tolerance, alongside measures to optimize the use of water, nutrients, and energy. Policy analysis highlights the role of instruments such as IPARD and the Green Agenda for the Western Balkans in supporting adoption, while also revealing gaps between policy intensity and observed agricultural practices. Large-scale implementation requires coordinated action across innovation, policy, and institutional frameworks, with emphasis on water efficiency, soil health, and market incentives for climate-smart production. Aligning technical solutions with supportive policy frameworks is essential to transform current vulnerabilities into sustainable, resilient, and economically viable vegetable production systems across Southeastern Europe. Future efforts should focus on the coordinated implementation and scaling of innovations to transform climate challenges into resilient and sustainable vegetable production systems across Southeastern Europe.

Keywords: Climate Change; Eastern European Vegetable Systems; Integrated Policy Design; Precision Agriculture; Resource Efficiency; Soil Health

Effect of mid-term exposure to flooding on cucumber seedling development

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Cucumber seedlings are particularly sensitive to flooding, a frequent condition following transplantation in heavy soils. This study examined the morpho-physiological responses of cucumber (‘Aisopos’) seedlings to mid-term flooding (five days). Leaf color (SPAD, RGB), photosynthetic pigment content, and chlorophyll fluorescence analyses (including OJIP transients), as well as seedling morphology, water status, and biomass accumulation, were evaluated. Flooding markedly reduced leaf chlorophyll content (–25%) and induced lighter foliage, as reflected by red and green intensities. Leaf expansion was strongly limited, with pronounced reductions in leaf length, width, and area (up to 40%). Stem diameter and total leaf number were also reduced, resulting in lower dry mass. Water content decreased in all organs, while specific leaf area declined by 24%, indicating thinner leaves. Chlorophyll fluorescence analyses revealed impairment in photosystem II efficiency, suggesting that photosynthetic machinery was compromised in parallel with structural and hydraulic constraints. Overall, transient flooding severely suppressed cucumber seedling development by disturbing water balance and leaf expansion, highlighting the need for improved drainage management especially in the early phase of plant growth.

Keywords: biomass accumulation, chlorophyll fluorescence, leaf expansion, nursery management, water relations

Evaluation of rhizobacteria applications on drought-stressed eggplant seedlings through physiological and biochemical stress indicators

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Drought stress, which is increasing due to global warming, negatively impacts eggplant production, as it does for other vegetable species, especially in arid and semi-arid regions. Reduced soil moisture often intensifies soil salinity, and excessive salinity or saline irrigation can lead to significant yield losses. The simultaneous presence of drought and salinity can severely affect plant growth, physiological stability, and yield. Therefore, sustainable agricultural strategies aimed at enhancing the tolerance mechanisms developed by plants under combined stress conditions are of great importance. Among these strategies, PGPR applications are known to have significant potential in improving plant tolerance under stress. In this study, the multidimensional responses to combined drought (60% irrigation) and salinity (50 mM NaCl) stress in eggplant were evaluated using stress indicators (MDA, H□O□), biomarkers (SOD, CAT, GR), and shoot dry weight. Correlation analysis and polar heat maps revealed strong relationships between shoot dry weight and MDA, H□O□, SOD, CAT, and GR. The polar heat map further demonstrated the magnitude and direction of interactions among the stress indicators and enzymatic biomarkers involved in stress responses. These findings suggest that these parameters are reliable indicators that reflect tolerance levels to combined stress in eggplant and may guide the selection of genotypes with high stress tolerance and the design of future studies.
Keywords: Ordinary Differential Equations, Vapor Pressure Deficit model, Model Calibration, Model Evaluation, High pressure misting system

Keywords: Biomarkers, eggplant, drought stress, rhizobacteria, stress indicators ROS scavenging, PGPR-mediated tolerance

The Effect of Different Irrigation Levels on Yield, Water-Yield-Quality Relationship in Pumpkin (*Cucurbita pepo* L.)

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Squash (*Cucurbita pepo* L.) is an important vegetable in human nutrition due to its low-calorie structure, high fiber content, and richness in vitamins (especially vitamins A and C) and antioxidant components. With increasing population and climate change, the efficient use of water resources has become one of the fundamental elements of sustainability in agricultural production. In this context, deficit irrigation practices are important both for saving water and for maintaining crop yield and quality. In this study, changes in plant growth, fruit yield, and quality characteristics of field-grown pumpkin (Cucurbita pepo L.) were investigated using different irrigation levels. Irrigation programs were arranged according to the amount of evaporation measured from a Class A evaporation pan at three-day intervals. Irrigation water was applied at rates of 100% (I100, control-field capacity irrigation), 75% (I75), 50% (I50), and 25% (I25). The study examined quality and physiological parameters such as soluble dry matter (SDM), titratable acidity, total phenolic content, chlorophyll amount, and leaf water content. The study examined quality and physiological parameters such as soluble dry matter (SDM), titratable acidity, total phenolic content, chlorophyll content, and leaf water content. According to the results obtained, statistically significant differences were determined between irrigation levels for all characteristics examined ($P < 0.05$). The highest fruit yield was obtained with the I75 and I100 irrigation treatments. The highest DSS value (3.43 °Brix) was measured in the I25 treatment, and a decrease in the Brix value was observed as the irrigation amount increased. The highest values for fruit firmness were determined in the I25 and I50 treatments, respectively. In conclusion, it was determined that the moderate water restriction irrigation application (I75) is a suitable strategy for sustainable pumpkin cultivation, as it increases water use efficiency while maintaining yield and quality.

Keywords: Climate change, *Cucurbita pepo* L., Deficit irrigation, Fruit quality, Sustainable agriculture, Water use efficiency

Oral Session III:

Biostimulants and non-chemical means to increase resilience to biotic and abiotic stress (Part I)

Optimisation of Seaweed-Based Biostimulant Application Timing and Concentration for Improved Yield and Quality in Bell Pepper using TOPSIS-Entropy Analytical Model

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Seaweed-based biostimulants are natural substances able to promote plant growth, yield and improve produce quality. The efficacy of these biostimulants is influenced by the concentration applied and the application timing. Few studies have objectively optimized these factors to make biostimulants cost-effective as they currently require continuous application. Thus, the aim of this study was to objectively optimize the concentration and application timing of seaweed-based biostimulant Kelpak® for improving yield and quality of bell pepper. A field experiment was conducted. Bell pepper plants were foliar sprayed with biostimulant Kelpak® at 0, 0.2, 0.4, 0.6, or 0.8%, (1) one day before transplanting (ODBT); (2) 14 days after transplanting (14DAT); (3) ODBT + 14DAT + fruit set (FS); (4) 14DAT + FS + 14 days before harvest (14DBH); (5) ODBT + 14DAT + 14DBH. The results showed that Kelpak® significantly influenced bell pepper yield and quality parameters. The highest (6.40 kg m²) yield was obtained with 0.4% applied at ODBT+14DAT+FS compared to all other treatments. TOPSIS-entropy analysis also showed that Kelpak® (0.4%) applied at 14DAT+FS+14DBH was the optimal treatment for improving yield and quality of bell pepper. Therefore, for bell pepper production, Kelpak® must be applied at 14DAT+FS+14DBH. These findings could be used to improve the efficacy of the Kelpak® and its cost-effectiveness, especially for resource-limited farmers, reducing the frequent application.

Keywords: *Capsicum annuum*, *Ecklonia maxima*, internal quality, optimisation, sweetness

Postharvest application of melatonin and seaweed extract to maintain tomato fruit quality during ambient storage

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Tomato fruit is highly consumed for its nutritional benefits. However, due to its perishability, tomato quality deteriorates rapidly at ambient storage. Conventional postharvest technologies used are often eco-unfriendly and cost-ineffective. Therefore, it is important to continuously search for eco-friendly and cost-effective technologies, especially those that would reduce the losses at ambient conditions. Research on the eco-friendly and cost-effective biostimulants alone or in the combination as postharvest technology is limited. Postharvest technologies are often effective when combined. Thus, we evaluated the effect of biostimulants based on melatonin and seaweed extract (SWE) on postharvest quality of tomato fruit. Mature-red fruit were treated with distilled water (control), melatonin (100 µM), 1% SWE, or melatonin + SWE for 5 minutes. Thereafter, fruit were stored at ambient conditions (**24 ± 1 °C and 65** ± 5**% RH**) for 12 days. During 3-day intervals, changes in quality variables were monitored. Analysis of variance showed the significant difference ($p < 0.05$) among treatments on fruit quality. The biostimulants (melatonin alone and melatonin + SWE) significantly reduced weight loss during 12-day ambient storage compared to the control and SWE alone. Biostimulant-treated fruit had significantly ($p < 0.05$) improved visual appearance compared to the control. Moreover, fruit treated with biostimulants (melatonin, SWE and melatonin + SWE) maintained relatively higher TSS, TA and BrimA levels compared to the control treated fruit after 12-day storage. These findings suggest that biostimulants alone or in combination delay ripening and maintain postharvest quality of tomato fruit at ambient conditions. Therefore, these biostimulants present a promising and eco-friendly approach for maintaining tomato quality during ambient storage.

Keywords: Biostimulant, fruit storability, postharvest technology, *Solanum lycopersicum*

Optimizing Sweet Pepper (*Capsicum annuum* L.) Productivity through Varietal Selection and Organic Manure Application in Makurdi, Nigeria

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A study was conducted at the Research Farm of the Federal University of Agriculture, Makurdi, during the 2020/2021 wet and dry seasons to evaluate the performance of three sweet pepper varieties as influenced by organic and inorganic fertilizers under a controlled environment. The experiment employed a 3×4 factorial arrangement in a Randomized Complete Block Design (RCBD) with three replications. The treatments consisted of three varieties—King Arthur (V1), X3R Red Knight (V2), and Poivron Yolo Wonder (V3)—and four nutrient applications: cattle dung at 10 t/ha (T1), 5 t/ha (T2), NPK 20:10:10 at 100 kg/ha (T3), and a control (T0). Results indicated that King Arthur recorded the highest plant height in both trials (41.72 cm and 28.42 cm), followed by Poivron Yolo Wonder and X3R Red Knight. King Arthur also achieved the significantly largest leaf area (83.00 cm² and 56.5 cm²). At 6 weeks after transplanting (WAT), Poivron Yolo Wonder produced the highest number of leaves (47.30 and 19.83) and branches (5.29). However, King Arthur proved superior in yield parameters across all trials, achieving the highest fruit yield (2,608 kg/ha and 1,712 kg/ha in the wet and dry seasons, respectively), followed by X3R Red Knight. The interaction between soil amendments and variety revealed that cattle dung had a more pronounced positive effect on growth and yield compared to NPK fertilizer and the control. Based on these findings, it is recommended that farmers in the Makurdi region adopt the King Arthur variety and utilize cattle dung at rates of 5–10 t/ha to enhance productivity and soil health.

Keywords: *Capsicum annuum* L., Cattle dung, Varietal evaluation, Guinea Savanna, Makurdi.

Yield and macronutrients uptake in potato plants grown with different seaweed-based biostimulants

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Potato (*Solanum tuberosum* L.) is an important crop in Peru, as it is a staple food in the Peruvian diet, with a per capita consumption of 92 kg per person. There are different biostimulants produced from seaweed, with stimulating properties for plants, recommended when plants are subjected to some type of biotic or abiotic stress. A trial was conducted to determine the yield and macronutrients uptake in leaves and tubers of two potato cultivars (Canchan and Unica), grown with nutrient solutions prepared based on organic biostimulants obtained from seaweed: 1) Fertimar (solid extract of brown seaweed), 2) liquid seaweed extract (LSE) and 3) solid seaweed extract (SSE plus organic and humic acids). Two doses of each product were evaluated: 0.05 and 0.1 g/L of Fertimar; 0.75 and 1.50 ml/L of LSE; 0.1 and 0.2 g/L of SSE. Plant nutrition was applied using nutrient solutions for potato crops, plus the biostimulant doses indicated above. Significant differences were observed in leaf ($P \leq 0.05$), tubers ($P \leq 0.001$), and total ($P \leq 0.001$) dry weight; also, in yield (kg/plant and kg/m2) ($P \leq 0.001$) and HI ($P \leq 0.05$) among the applied biostimulants. Unica cv significantly outperformed Canchan in yield (kg/plant and kg/m2) ($P \leq 0.001$) and HI ($P \leq 0.05$). P and Mg uptake ($P \leq 0.05$) in leaves was significant. In Canchan cv, Mg uptake in leaves was highly significant ($P \leq 0.001$). On the other hand, in tubers N, K and Ca uptake was significant ($P \leq 0.05$) and P, Mg and S uptake highly significant ($P \leq 0.001$) among the applied biostimulants. Higher K and Mg uptake ($P \leq 0.001$) was observed in tubers of Unica cv. Of the three applied biostimulants, the one that induced the highest growth, yield and macronutrients uptake in leaves and tubers was Fertimar with a dose of 0.1 g/L, and the one that induced the lowest response was SSE with both doses (0.1 and 0.2 g/L). The results support the hypothesis that the use of seaweed-based biostimulants stimulates a greater response in potato crops, as observed in Unica cv.

Keywords: Fertimar, brown seaweed, soilless culture, hydroponics, nutrient solutions

Physiological and molecular effects of exogenous strigolactone-like molecules in nutrient use efficiency in tomato

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Frequent extreme weather events increasingly stress crops, reducing productivity. Adequate nutrient supply—especially nitrogen—is essential for healthy plant growth. The phytohormones strigolactones play important roles in plant acclimation to abiotic stress and in improving nutrient use efficiency (NUE). Karrikins (KARs), strigolactone-like compounds derived from smoke of burning vegetation, are perceived by the KAR INSENSITIVE2 (KAI2) receptor and can enhance tolerance to several abiotic stresses. This study aims to identify the physiological and molecular mechanisms regulating tomato (*Solanum lycopersicum*) NUE under normal and nutrient-deficient conditions, as influenced by KARs. We conducted hydroponic experiments with tomatoes grown under varying nitrogen levels and treated with KAR1, "smoke water" (KAR-enriched), or water. Under nitrogen-deficient conditions (3.38 mM), both KAR1 and smoke water increased root NUE, and smoke water also enhanced leaf NUE. In contrast, under nitrogen-sufficient conditions (13.52mM), smoke water reduced root NUE. To further elucidate how KAR1 affects NUE, we employed virus-induced gene silencing (VIGS) to simultaneously target the putative KAR receptor paralogues KAI2a, KAI2b, and KAI2c. Silencing was achieved in both leaves and roots, with optimal efficiency maintained for at least three weeks. This system will be used to determine whether the effects of KARs on morphology and stress signalling depend on KAI2. We will assess morphology and quantify the expression of key genes in nitrogen uptake and transport in mock- or KAI2-silenced plants subjected to nitrogen-replete or -depleted conditions, with or without KAR1 or smoke water treatment.

Keywords: Karrikins; Nitrogen Deprivation; Nutrient Use Efficiency

Influence of Humic Acid–Based Biostimulant on Growth, Yield, and Quality of Chili under Saline Conditions

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Chili peppers (*Capsicum* spp.) are among the most widely cultivated vegetable crops on the planet, owing to their high nutritional value and distinctive pungency. However, changing environmental conditions and the degradation of cultivated areas have increased the importance of stress factors such as high salinity. In this context, humic acid–based biostimulants are gaining increased attention and importance in vegetable cultivation. In a hydroponic experiment, the potential of humic acids as a sustainable tool to enhance chili performance in terms of growth, yield quantity, and quality under salinity stress was examined. The application of humic acid resulted in a 40–60 % increase in yield when compared to the control treatment, under both normal and saline growing conditions. Furthermore, the application of humic acid resulted in enhanced relative fruit growth rate in comparison to the control group under both conditions (30 %). In the context of salinity stress, the incorporation of humic acids resulted in an increase (among 10 % to 30 %) of total organic acid and carotenoid content, while the effects on phenolic and capsaicinoid content were less pronounced. The findings of the present study demonstrate that when humic acids are applied under saline conditions, their influence is primarily observed to be exerted upon yield and primary plant metabolism. The efficacy of the biostimulant was more evident under saline conditions than under normal growing conditions. The findings under consideration demonstrate the potential of humic acid–based biostimulants as valuable tools for enhancing chili productivity and nutritional value under saline conditions.

Keywords: biostimulants, dendrometers, metabolism, pungency, vegetables

Oral Session IV:

Vegetable and potato propagation, new breeding lines, genomics, and nurseries

New vegetable products: from native genetic resources to innovative developments in high-consumption species

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Selecting the appropriate plant material for vegetable production is essential to ensure successful commercialization, as it directly influences the final product's quality, market value, and customer satisfaction. The main vegetable species have a guaranteed market, but a growing segment of consumers is eager for new, healthy, and sustainable vegetable products, which drives innovation in the sector. The aim of this study is to provide an overview of new vegetable products, ranging from native genetic resources to innovative developments in high-consumption species. It focuses on neglected crops, especially edible halophytes, which not only offer high nutritional value but also represent a promising alternative under climate change conditions. In addition, the study considers unconventional plants that are not typically consumed as vegetables, either partially or entirely, and that help boost local family economies. On the other hand, the vegetable industry is continuously innovating by developing new products derived from widely consumed species. This review examines the wide variability in size, shape, colour, taste, and other traits that these species offer to consumers on the market, with particular emphasis on miniaturization, such as miniature vegetables. Superfoods, characterized by their high nutrient content and health benefits, associated sometimes with landraces or local and newly selected species, are also assessed. Finally, the importance of branding in this sector is analyzed, as it is having a significant influence on consumer trends in recent years. Overall, the study synthesizes contributions from industry, farmers, and researchers to expand the diversity of vegetables available on the market, while fostering innovation, ensuring product quality, and promoting consumer satisfaction within the value chain.

Keywords: miniature vegetable, superfoods, neglected crops, unconventional plants, halophytes, branding

Suppression and over-expression of a prolyl 4 hydroxylase induces changes in fruit growth and ripening program in tomato

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Tomato is the main model plant species for fruit growth and ripening studies considering significant advantages in genetics, biotechnology and physiology. Proline hydroxylation is a major post-translation modification of hydroxyproline-rich glycoproteins (HRGPs) that is catalyzed by prolyl 4-hydroxylases (P4Hs). The tomato genome comprises 16 putative P4Hs indicating redundant function. However, tomato lines with suppressed expression and over-expression of SIP4H3 exhibited a pleiotropic effect with plethora of phenotypes in fruit growth, ripening and abscission programmes. SIP4H3 RNAi silencing lines exhibited smaller fruits of lower diameter compared to wild type while over-expression lines exhibited even smaller than RNAi lines fruits. The protein expression profiles of hydroxyproline rich glycoproteins were determined by quantifying AGPs (Arabinogalactan proteins)- and extensins-bound epitopes using western blot and immunolocalization analysis in three fruit growth stages indicating alterations in their content which might be responsible for the observed alterations in pericarp cell division and expansion progression. The SIP4H lines also exhibited phenotypes affecting fruit ripening progression, post-harvest life and their physiological parameters. These phenotypes might be attributed to previously well-demonstrated changes in AGPs content and structure in the ripening programme. Overall, alterations in the expression of tomato P4Hs might lead to agronomically important traits providing useful breeding targets.

Keywords: tomato, fruit growth, fruit ripening, proline hydroxylation, prolyl 4 hydroxylases, Arabinogalactan proteins, ethylene, fruit softening

Germination ecology and dormancy-breaking requirements of the Caucasian wild vegetable *Trachystemon orientalis*

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Trachystemon orientalis is a wild edible and medicinal plant of considerable nutritional and ecological value, traditionally consumed as a leafy vegetable and naturally distributed within a restricted geographic range across the Caucasus. Its potential as an alternative food source has gained global relevance under rising food security pressures. Despite this significance, scientific knowledge of its germination ecology remains limited, and seeds collected from wild populations often exhibit strong dormancy and low germination. Determining germination temperature requirements and identifying effective dormancy-breaking treatments is therefore essential for conservation, propagation, and future cultivation of the species. In this study, seeds collected from naturally growing populations were tested under controlled laboratory conditions to evaluate the effects of light regime, temperature, and gibberellic acid (GA□) on germination and early seedling development. Initial tests without any pre-treatment resulted in zero germination, indicating deep physiological dormancy. Treatment with 250 ppm GA□ induced germination exclusively under continuous darkness, with radicle emergence beginning on day 16 and reaching 20.5% by day 20. Germination in peat medium increased the rate to 26%, suggesting improved substrate suitability. Thermal germination requirements were determined using seeds stratified at +4 °C for four months. Minimum, optimum, and maximum germination temperatures were identified as 4 °C, 16 °C, and 28 °C, respectively. GA□ enhanced germination across all temperatures, with the strongest effect at the optimum temperature. Higher temperatures sharply reduced germination, consistent with the species' adaptation to cool, shaded forest-floor habitats. Overall, *T. orientalis* exhibits deep physiological dormancy responsive to cold stratification, GA□ treatment, darkness, and cool temperatures. These findings fill an important knowledge gap and provide a foundation for propagation, conservation, and potential domestication of this valuable Caucasian wild vegetable and medicinal plant.

Keywords: Wild edible vegetable, underutilized species, germination ecology, temperature requirements, dormancy-breaking treatments, photoblastic response

Breeding for Drought Tolerance in Eggplant: Evaluation of F5 Inbred Lines with *Solanum incanum* Introgressions

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Drought stress threatens agricultural production in many parts of the Mediterranean region. Sustaining eggplant cultivation in regions frequently exposed to drought has become increasingly critical, as prolonged water scarcity threatens both yield stability and the long-term productivity of cultivated areas. Crop wild relatives (CWRs) are widely recognized as valuable gene sources for enhancing the adaptive capacity of cultivated germplasm. As part of a drought-resistance breeding program, F□ inbred eggplant lines with *S. incanum* introgressions were assessed under 75% water-deficit conditions. Morphological and physiological traits were measured to compare line performance with parental genotypes and F□ hybrids. Under drought stress, plant height, stem diameter, chlorophyll content, and relative water content decreased, while canopy temperature increased, indicating strong physiological sensitivity. Significant correlations between proline accumulation and malondialdehyde (MDA) levels were detected, confirming oxidative stress responses among genotypes. Variation in drought-stress response was evident across the F□ lines, and those exhibiting moderate to high tolerance were selected for advancement to the F□ generation. This selection was based on combined physiological and morphological indicators consistent with improved drought adaptation. In conclusion, the findings demonstrate successful improvement of drought tolerance within the segregating population, confirming the effectiveness of integrating CWRs into eggplant breeding programs aimed at stabilizing production under water-limited conditions.

Keywords: Wild-relative utilization, screening and selection, drought-tolerance breeding, phenotypic selection, morpho-physiological screening, solanaceous crops

From Wild Edible to Cultivated Crop: Assessing the Cultivation Potential of *Sonchus oleraceus* L.

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Biodiversity is essential for maintaining resilient ecosystems, supporting sustainable agricultural systems, and ensuring long-term food security, particularly under the pressures of climate change and environmental degradation. Within this rich biological diversity, wild edible greens represent valuable plant resources that are traditionally harvested from natural habitats and consumed at the local level. *Sonchus oleraceus* L. is widely collected in Greece and across the Mediterranean region for use in salads, pies, and soups. The species is recognized for its high nutritional value and potential medicinal properties. Within the framework of developing cultivation guidelines, four distinct populations were evaluated to assess their suitability as a leafy vegetable crop. In vitro seed germination was investigated under different temperature regimes and salinity levels to determine optimal conditions and stress tolerance. Field experiments were conducted to define appropriate planting density, nitrogen fertilization requirements, and tolerance to saline irrigation water. Postharvest performance was assessed, and optimal storage temperature was established to determine shelf-life potential. Additionally, populations were compared for key agronomic traits under varying environmental conditions, and their nutritional profiles were analyzed. The results demonstrate that *S. oleraceus* exhibits significant potential as an alternative, nutritionally valuable crop, particularly suited to marginal or degraded agricultural areas. Notable variation among populations in agronomic performance and nutritional characteristics highlights the opportunity for targeted selection of genetic material according to specific cultivation objectives and environmental constraints. Overall, the findings support the potential use of *S. oleraceus* as an alternative vegetable crop.

Keywords: biodiversity, Asteraceae, neglected crops, unexploited species

Agronomic characteristics of tomato genotypes with modified polyamine metabolism

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The modification of the activity of polyamine oxidases (PAOs) is considered to induce resistance against abiotic stresses in several cultivated plants, including tomato. The aim of the present study was to evaluate some agronomic characteristics of tomato plants with altered levels of thermospermine-specific *PAO* genes, under commercial cropping conditions in a greenhouse. In particular, tomato plants overexpressing *SlPAO3* and *SlPAO4* (*SlPAO3over* and *SlPAO4over* plants), as well as loss-of-function mutants for the same genes (*slpao3* and *slpao4* mutants) were characterized, together with the cultivar Moneymaker as the reference genotype. It was observed that *SlPAO3over* plants were shorter and produced less both by fruit number and weight compared to all the other genotypes studied. By contrast, *slpao4* mutants and *SlPAO4over* plants produced more, but smaller and lighter fruits and therefore did not exhibit higher yields than cv. Moneymaker, which, together with *SlPAO3over*, showed an increased mean fruit weight compared to the other mutants. In all genotypes, except *SlPAO3over* plants, a lower percentage of "extra" fruits and a higher percentage of non-marketable fruits, as well as fruits with blossom end rot, compared to the cv. Moneymaker, was recorded. Furthermore, the total soluble solids content of *SlPAO4over* fruits was found to be higher than that of the cv. Moneymaker and *slpao4* mutants, while the fruits of *SlPAO3over* and *SlPAO4over* plants had increased titratable acidity compared to the other genotypes. By contrast, no genotype effect was observed on the fruit lycopene content. This study provides evidence that the tested tomato genotypes with modified polyamine metabolism have comparable or even improved agronomic characteristics in relation to the cultivar from which they originate. Therefore, they may serve as valuable genetic material in breeding programs aiming to produce more resilient tomato varieties to abiotic stresses.

Keywords: polyamine oxidases, thermospermine, abiotic stress, mutants, *Solanum lycopersicum*, greenhouse

Improving genetics for abiotic stress tolerance and beneficial phytochemical content in peppers (*Capsicum* spp.)

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Texas A&M University AgriLife Research has a 60-year history of developing new pepper cultivars to address industry needs. The primary goals have been resistance to diseases and high temperature stress tolerance. Currently, additional priorities have been emphasized, such as fruit quality, nutritional content and water-use efficiency. Interspecific families between *Capsicum annuum*, *C. chinense* and *C. baccatum* have been developed to enhance root traits, phytochemical content, flavor and disease resistance. Heat tolerance is moderately heritable and has been introgressed from some serrano and wild *C. chinense* accessions into jalapeno, bell, Anaheim, wax and Habanero breeding lines. In addition, an interspecific population of *C. annuum* x *C. chinense* has been phenotyped for root traits and multiple BC1 lines have been selected for improved root area, vigor and drought tolerance. High levels of heterosis have been observed for increased root area, suggesting some major, dominant genes may be involved. However, this trait is also quite sensitive to the irrigation regime, suggesting the importance of quantitative genetics as well. Several sources of high flavonoids, ascorbic acid, and capsiate have been identified through screening with HPLC and used as parents to develop novel pepper breeding lines. By comparison, most commercial pepper cultivars have low levels of flavonoids and no capsiate. New pepper breeding lines and F1 hybrids with elevated levels of these beneficial phytochemicals are currently being trialed to assess commercial potential. These include sweet wax, Anaheim, cayenne, serrano, jalapeño and Habanero types. Flavonoid levels have been increased from 0-20 ppm, to over 300 ppm on a dry weight basis. A few breeding lines with more than 450 ppm total flavonoids have been identified as well. The two predominant flavonoids in these peppers are quercetin and luteolin, but small amounts of myrcetin have also been found. Capsiate levels in the breeding lines ranged from 0 to 300 ppm, and fruit size is negatively correlated with content of this phytochemical. One F1 hybrid, no heat Habanero cultivar to be released soon has 100 ppm total capsiate.

Keywords: Peppers, genetics, abiotic stress, phytochemicals

Maintaining of Local Vegetable Genetic Resources in Republic of Srpska (Bosnia and Herzegovina) through Participatory On-Farm Approaches

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Agrobiodiversity in throughout Bosnia and Herzegovina is increasingly threatened by rural depopulation, the dominance of commercial seed systems, and the decline of traditional farmer-based seed practices. This study presents the outcomes of participatory activities aimed at conserving and sustainably utilizing local vegetable populations, with a focus on tomato, pepper, and lettuce. The project was implemented combining scientific and farmer-based knowledge systems. A total of 43 local populations (20 tomato, 17 pepper, and 6 lettuce) were retrieved from gene bank, reintroduced into farmer fields, and evaluated under on-farm conditions across multiple locations during 2019–2023. The methodology integrated farmer training, field-based morphological and sensory assessment, and participatory varietal selection. Farmers were actively involved in seed multiplication, characterization of agronomic and qualitative traits, and evaluation of crop performance, enabling the identification of locally adapted and high-quality populations. Results indicate that local varieties demonstrate strong adaptability to regional conditions and possess desirable sensory traits, making them suitable for sustainable production. The project also strengthened farmers' knowledge and capacity in seed production, contributing to the preservation of traditional practices and the development of farmer-based seed systems. However, the study highlights significant regulatory challenges, as existing seed legislation largely favors commercial varieties and does not adequately support the conservation, exchange, and marketing of traditional seeds. These constraints underscore the need for policy reforms aligned with international frameworks that recognize farmers' rights and promote agrobiodiversity conservation. The findings demonstrate that participatory on-farm conservation is an effective approach for safeguarding plant genetic resources while enhancing rural livelihoods and supporting agroecological transitions. The project provides a foundation for expanding local seed networks, increasing the availability of locally adapted planting material, and strengthening sustainable agricultural development in the region.

Keywords: accessions, farmer seed systems; community seed bank, agroecology, food sovereignty

Oral Session V:

Biostimulants and non-chemical means to increase resilience to biotic and abiotic stress (Part II)

Occurrence of Bacterial Spot of Tomato, Incited by Xanthomonas spp., in Illinois, USA and Managing the Disease

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Bacterial spot, caused by *Xanthomonas* spp., is one of the most important diseases of tomato in Illinois. This study was conducted to assess occurrence of bacterial spots in commercial tomato fields, identify the causal species, and develop effective management of the disease in Illinois. Field surveys were conducted for three years, and severity of foliage and fruit infection was recorded. Severity of symptomatic foliage ranged from 0% to 91% (average 36.7%) and incidence of symptomatic fruit ranged from 0% to 30% (average 10.8%). During the surveys, 266 *Xanthomonas* isolates were collected and identified as *Xanthomonas gardneri*and *X. perforans* using Xanthomonas-specific hrp primers. Eighty-six percent of the isolates from northern Illinois were identified as *X. gardneri*, whereas 73% of the isolates from southern Illinoi were *X. perforans*. Isolates from central Illinois were identified as *X. perforans* and *X. gardneri*, 53% and 47%, respectively. In vitro assays showed that both *X. perforans* and *X. gardneri* formed colonies when grown on Luria–Bertani agar medium containing low concentrations of copper hydroxide (Kocide-3000 46.1DF) and copper sulfate (Instill). Double Nickel, a biopesticide containing *Bacillus amyloliquefaciens* strain D747, was the most effective in preventing multiplication of copper-resistant isolates of both pathogens on the culture media. At present, foliage blight caused by *Xanthomonas* spp. is important, and fruit infection is negligible. Multi-year filed testing on 'Red Duce' and 'Mt. Fresh' tomatoes have shown that the lowest disease severity was in the plots with weekly spray-applications of Kocide-3000 46.1DF plus mancozeb (Manzate Pro-Stick), Kocide-3000 46.1DF plus chlerothalonil (Bravo Weather Stik 6F), and Regalia.

Keywords: Keywords: Tomato, bacterial spot, *Xanthomonas perforans*, *Xanthomonas gardneri*, copper hydroxide, mancozeb, Regalia

Selenium biofortification and an *Ecklonia maxima* seaweed extract-based biostimulant mutually control yield and quality of zucchini squash (*Cucurbita pepo* L.) cultivated under tunnel

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Selenium (Se) is a fundamental microelement for human health since it is involved in several metabolic processes. According to the data of the United States Department of Agriculture, the daily human Se requirement is 50–70 μg. However, an inadequate selenium (Se) intake has been linked to health disorders such as cancer, Keshan disease, diabetes, viral infections, hyperthyroidism and heart disease. To address these deficiencies, scientific community has suggested the consumption of micronutrient-enriched foods, such as those produced via biofortification techniques. Biofortification is a practice aiming to increase the concentration of micronutrients in plant tissues via agronomic or genetic approaches and it is considered one of the most viable tools to overcome mineral malnourishment in humans. However, since Se is not essential for plants, and considering its phytotoxicity at high dose application, a Se-stress alleviator is needed. In this scenario, among the eco-friendly techniques, biostimulants supply could be considered as a mean to face plant Se distress. As literature lacks information on the combined effect of biostimulants and Se supply on plants, specific research is required. The current experiment aimed to evaluate the combined effect of Kelpstar®, a commercial seaweed extract (SwE) (0 or 3 mL L□¹), and of different Se doses (0, 2, 4, or 8 μmol L□¹) on growth parameters, yield, fruit quality, mineral profile, and functional features of a F_1 hybrid zucchini squash (*Cucurbita pepo* L.) grown under tunnel. Outcomes revealed that the application of SwE increased productive and qualitative parameters, such as total yield, average fruit weight, solids soluble content and polyphenols. The application of Se, up to 4 μmol L□¹, significantly enhanced yield, polyphenols and fruit Se concentration. Remarkably, the application of SwE to Se-biofortified plots meaningfully enhanced Se concentration in fruits even at the highest dose (8 μmol L□¹), highlighting a mitigation effect against Se phytotoxicity in zucchini squash plants.

Keywords: protected cultivation, non-microbial biostimulants, Se, fruiting vegetables, Se phytotoxicity alleviator

The Role of Microalgae Fertilization in Enhancing Growth and Development of Pepper

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Capia pepper (*Capsicum annuum* L.) is a significant vegetable crop for Turkey. It is widely consumed both domestically and internationally, in fresh form and through various processed products. The aim of this study was to reduce the use of chemical fertilizers by utilizing microalgae, while preventing nutrient loss in the plant and fruit and positively influencing yield and quality parameters. The research was conducted under open-field conditions during the summer season in Bursa, Turkey. The capia pepper cultivar "AS-202", which is well-suited for open-field cultivation under Bursa's conditions, was used as the plant material. The microalgae (MA) species *Chlorella vulgaris* solutions were diluted to the desired concentrations and applied to the plants via soil application at two levels; 250 ppm (MA250) and 500 ppm (MA500). Additionally, a nitrogen-based chemical fertilizer (CF) was applied in accordance with the recommendations of the Ministry of Agriculture and Forestry of Türkiye, and a control group (C) without any fertilizer was included. The results showed that the MA250, MA250+CF, MA500, and MA500+CF treatment groups achieved better outcomes compared to the control group. The best results were obtained from the MA250+CF and MA500+CF treatment groups. This research revealed that the application of the microalgae treatments in Capia pepper production may increase the effectiveness of chemical fertilizers. Besides, the results of this study showed that the amount of chemical fertilizer used can be reduced, contributing to sustainable agriculture production.

Keywords: *Capsicum annuum* L., *Chlorella vulgaris*, fruit quality, sustainability

The Effects of Microalgae Treatments on Fruit Quality of Cucumber (*Cucumis sativus* L.)

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Excessive use of chemical fertilizers to boost yield and quality in cucumber *(Cucumis sativus* L.) may adversely affect plant and soil health in long-term vegetable production. Therefore, the utilization of biostimulants in plant fertilization has become significant for sustainable agriculture. In this study, the effects of fertilization with microalgae (*Spirulina platensis*) (MA) solutions on quality parameters in cucumber plants were investigated. A homogenized mixture of peat, perlite, and soil was used as the plant growth medium. Six treatment groups were established: Control, MA1 (250 ppm microalgae), MA2 (500 ppm microalgae), chemical fertilizer, MA1 + CF, and MA2 + CF. The initial application was achieved 15 days after seedling planting, with subsequent applications were conducted at 10-day intervals. Following the harvest of fruits, some fruit quality parameters were assessed, including fruit chlorophyll and total phenolic contents, pH, EC (electrical conductivity), fruit colour (L, a, b), titratable acidity, fruit flesh firmness, and water-soluble dry matter. The results demonstrated that microalgae treatments enhanced fruit quality of cucumber plants compared to the control group. In particular, microalgae treatments combined with chemical fertilizer yielded more efficacious outcomes. Consequently, *Spirulina platensis* solutions, when used with chemical fertilizers in cucumber can increase fruit quality while also potentially decreasing the reliance on chemical fertilizers.

Keywords: *Cucumis sativus* L., biostimulant, fertilization, fruit quality, microalgae, Spirulina platensis

The importance of environmental conditions for the effectiveness of biostimulants in lettuce production

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This experiment studied the effect of biostimulants on the quantity and quality of lettuce (*Lactuca sativa* L.) grown under different water supply conditions. The experiment was conducted at the Rozman farm in Križe near Tržič in 2024 on three consecutive dates: 13 May – 26 June, 21 June – 6 August, and 5 August – 16 September. We used the 'Champollion' lettuce variety and two biostimulants in the study: Delfan Plus, which contains amino acids, and Humistar, which contains humic acids. We carried out four treatments in the first period, six in the second, and eight in the third, incorporating biostimulants and different irrigation regimes. The lettuce was harvested when it reached a market weight of 350 g, after which the fresh weight of the samples was measured, the weight of the cleaned rosettes was determined, the SPAD value was measured, and the dry matter content was established. The results showed that, in irrigated plants, the combination of humic and amino acids increased yield compared to treatment with amino acids alone. In non-irrigated plants, however, yield was similar with the addition of both biostimulants and with amino acids alone. Using humic acids independently in the third term had no effect on yield. The effectiveness of the biostimulants varied between growth periods, which confirms the influence of environmental conditions. The best results were achieved in the second term, which had balanced temperatures and sufficient moisture. Amino acids were more effective in non-irrigated plants, though the effect of humic acids could not be clearly confirmed.

Keywords: lettuce, *Lactuca sativa*, biostimulants, water supply

Oral Session VI:

Greenhouse and indoor vegetable production

The combined effects of selenium application and CO_2 fertilization on mineral nutrients accumulation in each organ of cucumber plants

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Appropriate selenium (Se) application and CO_2 fertilization are considered as two beneficial factors that have positive effects on vegetable growth in greenhouse production. Hydroponic experiments were conducted in open-top chambers (OTCs) to investigate the combined effects of application of selenite and elevated CO_2 (eCO_2) on the accumulation of nine mineral nutrients in cucumber plants. Following a factorial design, four Se supply levels were applied 0 (Se0), 0.125 (Se1), 0.250 (Se2), and 0.500 (Se3) mg Se L^{-1}, and the atmospheric CO_2 concentration were set at 400 μmol mol^{-1} (ambient CO_2 (aCO_2)) and 1200 μmol mol^{-1} (eCO_2), respectively. Under both CO_2 levels, the accumulation of N, P, K, Ca, Mg, S, Mn, and Zn in root and stem reached the maximum value in Se1 and/or Se2 treatment, while the accumulation of N, P, K, Ca, Mg, S, Fe, Mn, and Zn in fruit slightly improved in Se1 treatment and markedly decreased in higher-concentration Se application. CO_2 fertilization significantly enhanced accumulation of P, Ca, Mg, S, and Mn in fruit in Se0 treatment and accumulation of N, Mg, S, Fe, and Zn in leaf in Se1 treatment. It was also observed that high-concentration Se supply combined with eCO_2 notably suppressed P, K, Mg, S, Fe, Mn, and Zn accumulation in root. These findings indicated that the combination of low-concentration Se application (0.125 mg Se L^{-1}) and CO_2 fertilization (1200 μmol mol^{-1}) significantly promoted mineral nutrients accumulation in cucumber organs, and provided guidelines for Se biofortification for greenhouse vegetables.

Keywords: *Cucumis sativus*; Selenium; elevated CO_2; biofortification; nutrient accumulation

The Use of Vertical Farming for Growing Seed Potatoes to De-risk Potato Production in Southern and Eastern Europe

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The majority of European seed potato production is in the cooler parts of countries to the North, the Nederlands, United Kingdom (Scotland), France, Germany and Denmark. This helps to reduce pest and disease pressures and the occurrence of aphids, a vector for virus diseases. However, rising temperatures from climate change and production pressures has increasing persistent pests such as Potato Cyst Nematode has reduced the land area available for seed potato production and increased the number of crops that fail inspection. As a result, the potato supply chain is at ever increasing risk from a lack of seed, with countries to the Soth and East most at risk.

Our paper reviews four years of research examining how vertical farming systems can derisk European seed potato production by providing a controlled, biosecure, and resource-efficient alternative to conventional field and greenhouse multiplication. Vertical farming enables year-round production independent of weather variability, significantly reducing exposure to drought, flooding, heat stress, frost, pests and disease. In addition, vertical systems allow for faster multiplication rates, precise environmental optimization, and reduced land and water use, which is particularly relevant in regions facing land competition and sustainability pressures.

By decentralizing seed production closer to end markets, vertical farming can also enhance supply chain resilience and reduce cross-border phytosanitary risk. Decentralisation also removes the risk that in the future, countries traditionally producing seed potatoes will ensure the best quality tubers are retained for local production.

Keywords: Vertical Farming Seed Potatoes Climate Change Sustainability

Preliminary results supporting the domestication of golden thistle (*Scolymus hispanicus* L.) through photoperiod and light intensity management

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Golden thistle (*Scolymus hispanicus* L.) is a traditional wild edible species of high culinary and medicinal significance in the Mediterranean region. Despite its recognized nutritional and gastronomic value, market availability remains limited and largely dependent on seasonal wild harvesting. A major constraint to its commercial cultivation is the early transition to reproductive growth, which results in leaf lignification, reduced turgidity, and textural deterioration, ultimately lowering market quality. In this context, the present study investigated the individual effects of photoperiod (8 vs. 16 h) and light intensity (PPFD: 40 vs. 240 μmol m□² s□¹) on yield, morphological development, and functional quality traits of golden thistle. The experiments were carried out in two growth chambers equipped with adjustable photoperiod and light intensity settings. In each chamber, fifteen *Scolymus hispanicus* L. plants were transplanted into 10 L pots and positioned on three gutters at a planting density of 9 plants m□². Plants received daily fertigation through individual emitters, supplying 0.4–0.7 L plant□¹ day□¹. The results showed that extended photoperiods promoted a larger rosette diameter (59.9 ± 1.8 cm) and increased root fresh and dry biomass (31.35 ± 2.19 and 3.65 ± 0.4 g, respectively), 120 days after transplant. However, regardless of photoperiod, plants grown under high light intensity produced greater shoot fresh and dry weights (115.4 ± 5.24 and 7.5 ± 0.38, respectively) than those under low light intensity (39.6 ± 5.24 and 2.2 ± 0.4, respectively), suggesting that biomass accumulation in golden thistle is governed more by light intensity than by photoperiodic sensitivity. These findings demonstrate the potential of controlled-environment cultivation to optimize both yield and product quality, supporting the domestication of golden thistle, reducing reliance on wild foraging, and enabling sustainable year-round production of this high-value leafy vegetable.

Keywords: wild greens, light, photoperiod, controlled environment, golden thistle

Effect of a cell-free supernatant biostimulant on qualitative and quantitative features of *Pisum sativum* L. microgreens

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According to the World Health Organization (WHO), access to a balanced diet is a fundamental human need. Indeed, following a proper diet plays an essential role in protecting health, contributing both to prevention and treatment of numerous diseases. Microgreens are classified as superfoods and/or functional foods due to their high nutrient content and rich presence of bioactive compounds, such as vitamins, minerals and antioxidant. These substances play an important role in promoting human health, as they contribute to antimicrobial, anti-inflammatory, antioxidant, and anticancer activities. In addition, focusing on the eco-sustainability of intensive agroecosystems has generated greater attention to the use of natural products, such as biostimulants. During the last 20 years, many studies have focused on the application of different biostimulant products on vegetable crops, comprising microgreens. However, to the best of our knowledge, there are no researches on the effect of novel non-microbial biostimulants, such as the cell-free supernatant (CFS), on microgreens performance. Thus, the aim of this study was to evaluate the effect of a CFS on the qualitative and quantitative traits of pea (*Pisum sativum* L.) grown as microgreens. The experimental trial was conducted in a controlled environment, maintaining a constant temperature of 17°C and artificial LED lighting. The biostimulant was administered every 7 days by fertigation using the recommended dose (3 mL L^{-1}). Results showed that the biostimulant treatment significantly improved growth and yield parameters, such as fresh weight and average hypocotyl length. In addition, biostimulant supply improved the concentration of soluble solids content, total polyphenols and ascorbic acid. Furthermore, the application of CFS significantly increased the antioxidant capacity (DPPH) of pea microgreens. In conclusion, our results confirmed the effectiveness of the CFS biostimulant as a modulator of the quantitative and qualitative traits of microgreens, prompting further research on the subject.

Keywords: CFS, pea, functional components, sustainability, controlled environment.

Oral Session VII:

Modelling, postharvest technologies and quality in vegetable production

Towards Climate-Resilient and Sustainable Vegetable and Potato Production: Innovations and Circular Solutions

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Climate change poses significant challenges to vegetable and potato production systems, threatening the stability of yields, nutritional quality, and resource efficiency. The transition towards climate-resilient and sustainable production requires integrated innovations that combine agronomic, physiological, and technological advances within the principles of a circular economy. This work presents a multidisciplinary approach aimed at enhancing resilience and sustainability in vegetable and potato cropping systems through optimized resource use, valorisation, and digital monitoring of plant performance under stress. The research integrates controlled-environment and open-field experiments to evaluate physiological responses, photosynthetic efficiency, and stress tolerance in key crops under variable climatic and nutrient conditions. Emphasis is placed on the role of secondary metabolites as functional indicators of stress adaptation and nutritional quality. Data-driven modelling and sensor-based phenotyping support real-time decision-making, enabling early detection of stress and optimizing interventions for resource efficiency. Collaborative innovation platforms further facilitate stakeholder engagement across the agri-food value chain, linking growers, researchers, and industry actors to co-develop scalable solutions. Overall, this integrated framework demonstrates how combining plant physiological insights, circular resource management, and technological innovation can drive the transformation towards climate-resilient and low-impact production systems for vegetables and potatoes. The results highlight key pathways to increase productivity, improve quality, and ensure sustainability in alignment with the European Green Deal and Farm-to-Fork objectives.

Keywords: circular agriculture; controlled environment; open field; precision crop management; secondary metabolites; sustainable production

Yield gap assessment revisited: combining the effects of unit operations and environmental impact

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One of the most relevant options for sustainable intensification of agricultural systems, especially in developing countries, is to bridge the yield gap. Estimating yield gap at crop level requires comparing farmers' actual yield to a reference of potential yield. To represent variation in time and space of fields in a defined geographical region, actual yield is defined by the most widely used management practices related to the availability of inputs, climate variability, technology level, and crop management. On the other hand, potential yield is the yield obtained without water, nutrient nor biotic stress. Potential yield is location specific because of the climate, but in theory not dependent on soil properties, fertilization, irrigation, pest and disease control or seed quality, assuming that these unit operations can be optimally managed. Under these optimal conditions, crop growth and development are determined by solar radiation, temperature, atmospheric CO_2 concentration, crop genetic traits, and management practices. As such, mechanistic crop models provide the means to capture spatial and temporal variation of potential yield to the extent that local-specific climate data are available and genetic traits and management practices can be modelled accurately. This involves local potential production experiments for calibration and validation. As a result, estimates of the yield gapat crop level can be computed for a predefined region. In general, the range of yield gap in a region can be quite large. When on top of actual- and potential-yield, all unit operations of the cropping systems under study are measured, decision trees can model the relation between yield gap and the underlying unit operations, gaining insight in possible options to bridge yield gap. Moreover, based on unit operations' and actual yieldknowledge a Life Cycle Assessment can be carried out and related to yield gap. As a consequence, this approach is not only able to identify the unit operations that close the yield gap, but in the same effort evaluates what the possible environmental impacts of bridging the yield gap are. Full input-output accountancy data of 68 potato fields in the Central Highlands of Peru, extended with potential production experiments to calibrate and validate the SUBSTOR potato model for the 68 plots are used to elucidate the methodology, linking yield gap to unit operations and LCA environmental impact categories.

Keywords: yield gap assessment, unit operations, LCA, environmental impact, potato

Towards Robust Disease Detection in Potato Tubers Without Model Training

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Reliable detection of tuber diseases is essential for potato quality control, storage management, and market value preservation. Current computer vision solutions are largely dominated by deep learning approaches that require extensive annotated datasets, repeated model training, and substantial computational resources. These requirements may limit their adoption in real production environments, especially when data are scarce or operating conditions vary.

This work presents a training-free image analysis framework for robust disease detection in potato tubers. Instead of learning disease patterns through model optimization, the proposed approach estimates the visual appearance of healthy tubers and identifies abnormal regions through pixel-level deviation analysis. The method combines background removal, healthy-color reference estimation, and error-map thresholding to classify tubers as healthy or diseased, while also providing localization of suspicious surface areas.

Experimental evaluation across publicly available potato image datasets showed that the proposed framework achieved competitive performance compared with widely used deep learning classifiers, while requiring no training stage. In cross-dataset scenarios, where images originate from different sources and conditions, the method demonstrated strong robustness and stable generalization. These findings suggest that simpler vision strategies may offer practical advantages over data-hungry black-box models in agricultural inspection tasks.

The proposed framework can support rapid deployment in grading lines, storage facilities, mobile inspection tools, and low-resource agricultural settings. More broadly, the study highlights the potential of lightweight and interpretable AI solutions for resilient digital agriculture systems.

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Keywords: Potato tubers; Disease detection; Computer vision; Quality assessment; Precision agriculture; Artificial intelligence; Automated inspection

Integrative understanding of chilling injury mechanism among structural alteration, antioxidant scavenging metabolism and lipidomics into cold-stored fruit of yellow paprika (*Capsicum annuum* L.)

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Chilling injury (CI) during cold storage is a major postharvest disorder that compromises the market quality and sustainable storability of paprika fruit. However, the tissue-specific progression of CI and its mechanistic association with antioxidant defense and membrane lipid metabolisms remain insufficiently characterized. Therefore, this study aimed to elucidate the integrative biochemical and structural metabolism of CI in four distinct pericarp tissues of yellow 'Volante' paprika fruit stored at 0.5 ^{o}C for 2 weeks and then transferred at 22 ^{o}C for 5 days: healthy (harvest), sound (asymptomatic CI), surface scald (mild CI), and pericarp browning (severe CI). SEM and TEM images revealed progressive epidermal disruption, cell wall disorganization, and organelle degeneration, whereas CLSM analysis confirmed localized ROS in sound tissue but widespread oxidative stress in pericarp browned tissue. Enzymatic antioxidant metabolism revealed that sound and surface scald tissues maintained partial ROS detoxification through compensatory increases in enzymatic activities of superoxide dismutase (SOD), peroxidase (POD), and glutathione reductase (GR) despite the decline of ascorbate peroxidase (APX) and catalase (CAT). However, pericarp browned tissues exhibited a collapse of APX-, GR-, and glutathione peroxidase (GPX)-mediated antioxidant defenses, resulting in uncontrolled ROS accumulation accompanied by enhancing the enzymatic activities of lipoxygenase (LOX), phospholipase D (PLD), polyphenol oxidase (PPO), and POD. The biochemical shifts were strongly associated with extensive lipid peroxidation, membrane disintegration, and the oxidation of phenolic compounds. Malondialdehyde (MDA) and browning degree confirmed oxidative damage, while lipidomic profiling demonstrated a marked depletion of polyunsaturated phospholipids and accumulation of sterol-conjugated lipid species. Therefore, the results indicated that CI progression in paprika fruit should be driven by the collapse of the antioxidant scavenging metabolism and membrane integrity, thereby linking biochemical dysfunction to structural deterioration in cold-stored fruit of paprika. [This work was supported by the Korea Institute of Planning and Evaluation for Technology in Food, Agriculture and Forestry (IPET) through 'Smart Agri Products Flow Storage Technology Development Program' funded by Ministry of Agriculture, Food and Rural Affairs (MAFRA) (grant No. 322052052HD030).

Keywords: Antioxidant scavenging metabolism, Bell pepper, Chilling injury, Cold storage, Lipodomics, Physiological disorder

Influence of preharvest Selenium biofortification on cherry tomato fruit quality during cold storage

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Tomato (*Solanum lycopersicum* L.) is one of the most consumed fruit vegetables worldwide, whose climacteric behavior progressively compromises several key quality traits during shelf life. Moreover, owing to their composition and high per-capita consumption, tomatoes represent an important dietary source of micronutrients and bioactive compounds. In recent years, the interest of consumers in supplemental dietary selenium (Se) has increased because of its beneficial role in preventing age-related diseases and its fundamental contribution to many physiological processes (e.g., antioxidant defense, thyroid hormone metabolism). Several Se biofortification protocols have been developed for tomato; however, evidence regarding the effects of Se biofortification on tomato quality during postharvest storage remains limited. The present experiment addressed the influence of preharvest foliar applications of Se (as Na□SeO□, 0.5 mmol Se L^{-1}) on key carpometric and compositional traits of cherry tomatoes (cv. Durillo) stored at 11.0 ± 0.5 °C for 0 (T_0), 10 (T_{10}), and 20 days (T_{20}). At harvest, compared to the untreated control, the Se-treated fruits showed higher fresh weight (FW; 10.6 vs. 11.9 g, +12%) and Se content (0.41 vs 13.71 µg 100 g^{-1} FW, +3243%). During storage, the Se-treated fruits showed increased dry matter (+10.1%), total sugars (+7.0%), titratable acidity (+4.4%), total phenolics (+8.0%), and antioxidant activity (+6.0%), along with reduced total carotenoids (-6.7%). Within the T_0-T_{20} interval, control fruits exhibited the greatest firmness losses (-54%), whereas Se-treated fruits showed a significant increase in ascorbic acid content (+29%). Overall, these results indicate that preharvest foliar Se application effectively biofortifies cherry tomato fruits while enhancing or maintaining several quality traits typically compromised during postharvest ripening, thereby supporting its potential to extend shelf life.

Keywords: *Solanum lycopersicum* L.; selenium biofortification; fruit quality, shelf life, functional traits.

Impact of the type of plastic film used for soil mulching in greenhouse-grown strawberry on fruit quality

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In Mediterranean countries, and especially in Greece and Spain, low-cost winter production of strawberry fruit in non-heated greenhouses using mulching is a highly profitable branch of commercial horticulture. In Greece, strawberry production exceeds 107,000 tn annually, with a cultivated area of 2,150 hectares and a total value exceeding 210 million euros (FAO 2023). To support out of season or early production of strawberries, growers typically apply soil mulching using plastic films, mostly made of low-density polyethylene. However, the type of the plastic film may have an impact on the quality of the produced fruits, including contamination with micro- and nano-plastics. In the current study, the impact of mulching on strawberry fruit quality attributes was studied. The tested quality attributes were fruit size, fruit colour, total soluble solids, titratable acidity, and fruit mineral content. Three types of mulching film were used: a multi-layer, long life, black film (KRITIFIL 6010) with a thickness of 80 microns (μ) ±5%, a biodegradable black film (BIOLENE+) with a thickness of 30 μ ±10% and a 7-layer, fume, barrier film for fumigation (KRITIFIL EV7103) with a thickness of 50 μ ±5%. Another objective of the current study was to test whether micro- and nano-plastics released from the mulching films during their use are absorbed by the plants and transported to the edible fruit. The first results obtained from this study are presented and discussed.

Keywords: strawberry; greenhouse; mulching; plastic film; fruit quality; micro-plastics

Poster Session I:

-Organic and non-organic cultivation practices to improve yield and quality

-Vegetable and potato propagation, new breeding lines, genomics, and nurseries

-Climate change adaptation and stress resilience

Co-application of Compost and Walnut Shells: Effects on Soil Fertility and Lettuce Yield

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Walnut (*Juglans regia* L.) production generates substantial quantities of shells, a lignocellulosic residue with potential agronomic use. The aim of this study was to evaluate the effect of the co-application of organic compost and triturated walnut shells on soil fertility, nutrient uptake, and lettuce growth. Four treatments were tested: unamended soil, walnut shells (9 t ha□¹), compost (20 t ha□¹), and compost (20 t ha□¹) plus walnut shells (9 t ha□¹). Lettuce seedlings (one per pot) were transplanted 20 days after emergence into 14 L pots filled with a loamy-sandy soil with low organic matter (1.2%) and an acidic pH (4.7). Compost application significantly increased soil pH and electrical conductivity, while walnut shells alone had no significant effect on these parameters. Compost and compost plus walnut shells similarly increased soil pH to ≈6.3, indicating no additional effect from the co-application. Co-applying compost and walnut shells enhanced both acid and alkaline phosphatase activities, with ACP (≈70 nmol min□¹ mg□¹) and ALP (≈13 nmol min□¹ mg□¹) reaching their highest values, evidencing a synergistic stimulation of soil P mineralization. The co-application of compost and walnut shells reduced peroxidase activity relative to the unfertilized control but was not different from the single amendments, indicating a similarly less oxidative soil environment. Co-applying walnut shells with compost did not alter macronutrient contents or lettuce head fresh yield (≈227 g plant□¹) or shoot dry weight (≈10 g plant□¹) relative to compost alone. At harvest, walnut-shell particles remained nearly intact; their recalcitrance, together with the improved soil fertility, may benefit subsequent crops.

Keywords: *Lactuca sativa* L, soil fertility, organic amendment, nutrient uptake, soil acid and alkaline phosphatases, peroxidases.

Domestication potential of two wild vegetables (*Rumex crispus* L. and *Astrodaucus orientalis* (L.)) under soil and soilless cultivation of the Ararat Valley

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Historically, wild vegetables have been used for both culinary and medicinal purposes. Recently, interest in them has increased due to their lower side effects and reduced risk factors compared to conventional medicines. Armenia, despite its small area, is distinguished by a biodiversity of wild edible plants with pharmacological significance, which constitutes about 8.4% of the total flora. This pioneering study, conducted in the Ararat Valley of Armenia, aimed to introduce the important wild vegetables *Rumex crispus* L. and *Astrodaucus orientalis* (L.) Drude into both hydroponic and soil culture, and to study their domestication potential. Data was collected between May and July. During this vegetation period for *R. crispus*, six hydroponic and four soil harvests were conducted, whereas *A. orientalis* had one harvest per cultivation type. Hydroponic plants were cultivated using the Ebb and Flow method with 1N Davtyan's nutrient solution, on volcanic slag (*R. crispus*) or a 1:1 mixture of volcanic slag and gravel (*A. orientalis*). Soil-grown control plants were irrigated with Ararat Valley artesian water. Results showed that growing conditions significantly affected yield for both species. Hydroponic cultivation greatly increased leaf wet and dry weight for *A. orientalis* by 4.3 and 4.2 times and for *R. crispus* by 4.4 and 3.7 times, and enhanced most biochemical components in *A. orientalis* (extractives, total phenolic and flavonoid content). A similar trend was observed in *R. crispus*, except for tannins, where no significant differences were recorded. Furthermore, hydroponic *R. crispus* exhibited a 1.2 times higher protein content than soil ones. Therefore, the study confirms the high domestication potential of *R. crispus* and *A. orientalis*, demonstrating their significant promise as cultivated vegetables with substantial nutritional and pharmacological value.

The work was supported by the Science Committee of RA, in the frames of the research project N 22RL-028.

Keywords: Flavonoids, Nutrient solution, Hydroponics, Phenolic acids, Tannins

Synergistic effects of crop rotation, reduced fertilization, and microbial inoculants on soil fertility and yield stability in a mediterranean horticultural system

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Sustainable agriculture requires strategies that maintain productivity while reducing dependence on chemical fertilizers. This three-year field study (2021–2023) evaluated the combined effects of crop rotation, reduced mineral fertilization, and microbial inoculants on crop performance and soil properties under semi-arid Mediterranean conditions. A four-crop rotation sequence (potato–broccoli–melon–potato) was established with four fertilization regimes: full-rate mineral fertilization (F100), 30–50% reduced fertilization (F70/F50), and reduced fertilization combined with bacterial (BA: *Azospirillum*, *Pseudomonas*, *Bacillus*) or bacterial–fungal (BAFU: *Azotobacter*, *Bacillus*, non-mycorrhizal fungi) inoculants. During the first two cycles (potato 2021 and broccoli 2022), no significant yield reductions were observed in reduced fertilization or inoculated treatments, indicating that fertilizer reduction did not compromise productivity. In melon (2022), fruit yield was stable across treatments, while °Brix was significantly lower in F50+BAFU (12.09 ± 0.45) compared to F100 (13.53 ± 0.30). In the final potato crop (2023), microbial inoculants significantly improved tuber traits: F50+BAFU achieved higher weight (244.3 ± 24.4 g) and firmness (16.0 ± 0.3 kg cm□²) than F100 (158.5 ± 6.7 g; 13.2 ± 0.1 kg cm□², respectively). Beyond yield and quality, inoculated treatments enhanced key soil physicochemical properties, with notable increases in soil organic matter and improved ammonium and nitrate availability, reflecting more active nutrient cycling and biological stabilization processes. Overall, integrating microbial inoculants into crop rotation under reduced fertilization maintained yield stability, improved product quality, and enhanced soil fertility. These findings underscore the potential of rotation–inoculant strategies as a sustainable and resilient alternative to conventional input-intensive systems in Mediterranean horticulture.

Keywords: nutrient cycling, organic matter, soil fertility, beneficial microorganisms

Purslane (*Portulaca oleracea* L.) wild edible vegetables -future superfood

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Purslane (*Portulaca oleracea* L.) as a weed species and one of the most widely consumed green vegetables and medicinal plants, it has recently been re-evaluated as a potential "new crop" due to the properties that differentiate it as one of the best vegetable sources of total extractive matter (TEM), phenols, flavonoids and antioxidants. UV–Vis spectrophoto metry was applied for the determination of total phenolic and flavonoid contents, as well as the antioxidant activity of the ethanolic and pigment extracts, using a VARIAN Cary 100 Conc. Spectrophotometer. The total phenolic and flavonoid contents of 70% ethanolic extracts from purslane varied considerably among plant parts. The leaf extract exhibited the highest total phenolic content (53.09 mg GAE/g d.e.), confirming that leaves are the primary reservoirs of phenolic compounds in purslane.In contrast, total flavonoid content was highest in the root extract followed by the stem, while the leaf (6.32 mgRE/g d.e.) showed the lowest flavonoid level. The leaf extract exhibited the strongest DPPH radical scavenging activity, followed by the root, while the stem showed the lowest activity. The β-carotene content in pigment extracts of *purslane* exhibited a pronounced organ-dependent distribution. Leaves contained the highest concentration of β-carotene (115.17 μg/g b.m.), followed by stems, while roots showed only trace amounts. A clear difference in antioxidant behavior was observed between pigment and ethanolic extracts of *purslane.* Ethanolic extracts exhibited the strongest DPPH radical scavenging activity in leaf samples (EC_{50} = 0.088 mg/mL), whereas pigment extracts showed the weakest activity in leaves (EC_{50} = 0.479 mg/mL). This contrast indicates that the antioxidant activity of ethanolic extracts is primarily driven by polar compounds, particularly phenolics, which are abundant in leaf tissues. In future research and studies, we plan to dry, marinate, and blanch purslane and to monitor its nutritional and medicinal properties after processing.

Keywords: *Portulaca oleracea*, bioactive components, phenolic, flavonoid, antioxidant activity

Weeds as natural reservoirs of plant viruses in pepper crops produced under different cultivation practices

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The aim of this study was to explore the relationship between virus occurrence in pepper crop and associated weed vegetation in three different cultivation settings. Samples of peppers and weeds were collected from three regions in Macedonia, during one production season in 2024, with total of 91 pepper samples and 93 weed samples. The presence of Cucumber mosaic virus (CMV) and Tomato spotted wilt virus (TSWV) was evaluated in the collected material by DAS-ELISA method. Out of the total pepper samples, 83 % tested positive for virus infection, mainly with CMV, while TSWV was registered in 25 % of the infections and only in samples from polytunnel production. Regarding the weeds, from the total number of weed samples (93), 82 % tested positive for viral infections. It is interesting to note that weeds were infected only with CMV. Chi-square tests revealed that for the polytunnel cultivation system there was significant relationship between the pepper and weed viral infections with p-value of 0.017. Our findings suggest that the infection of both weeds and crops is significantly related to polytunnel conditions, highlighting that weeds as virus reservoirs play an important role in virus transmission in this setting. However, this connection does not appear to extend to greenhouse or open-field conditions. The results obtained emphasize the need for broader research for effective and sustainable management of viral infections for this important crop.

Keywords: pepper, weeds, viruses, CMV, TSWV, cultivation practices

Marker-Assisted Evaluation of Virus Resistance Genes in Pepper (*Capsicum spp*.) Genotypes

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Pepper (*Capsicum* spp.) is one of the most important horticultural crops worldwide and exhibits high genetic and phenotypic diversity. Although originating from South America, Turkiye represents an important center of diversity for cultivated pepper types. In pepper breeding, resistance to viral diseases is a major objective alongside yield and fruit quality. Marker-assisted selection (MAS) is widely used to identify resistance genes independent of environmental conditions. Among these, the *Tsw* gene confers resistance to Tomato spotted wilt virus (TSWV), while the *L4* gene provides resistance against several Tobamoviruses, including TMV, ToMV, BePMV, TMGMV, and PMMV. In this study, a total of 45 pepper genotypes were evaluated, comprising 5 landraces, 10 open-pollinated varieties, 4 hybrid varieties, 20 F□ inbred lines, and 6 genotypes belonging to *Capsicum chinense* and *Capsicum baccatum*. The plant material was screened to determine the presence and distribution of major virus resistance genes relevant to pepper breeding. The results provide valuable information for the effective utilization of resistance genes in the development of virus-resistant pepper varieties.

Keywords: Capsicum; virus resistance; germplasm screening; marker-assisted selection; Tobamovirus

Pre-grafting tomato and watermelon scions' quality is affected by different LED light treatments

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Tomato and watermelon are vital crops of significant economic value. Vegetable grafting is widely used as a sustainable tool to overcome issues related to soil-borne diseases and environmental stresses, while promoting faster growth and increasing yields. Grafting begins with an initial stage aimed at producing robust scions and rootstocks. Previous studies have shown that scions play a crucial role in determining the quality of the final grafted seedlings, while light quality strongly influences plant growth in controlled environments. In this study, tomato (Elpida F1) and watermelon (Celine F1) scion seedlings were grown under four different LED light recipes in a plant factory with artificial lighting (PFAL). Two days after sowing and germination at 25 °C, complete darkness and 98% relative humidity, the seedling trays were transferred to the PFAL, where they were grown for 10 days. The treatments included one white (W) and three blue/red LEDs with different blue:red ratios: B1:R4, B3:R4, and B1:R4+G (green). The photosynthetic photon flux density was set at 200 μmol m□² s□¹, the photoperiod at 18 h, and temperature at 24/20 °C (light/dark). At the end of the experiment, 24 seedlings per treatment were evaluated for each parameter of shoot or root system. Statistical analysis was conducted at α=0.05 ($p \leq 0.05$) for each species separately. Shoot and root dry weights were enhanced under the B1:R4 in both tomato and watermelon, whereas W negatively affected these parameters in both species, except for watermelon shoot dry weight. The B1:R4+G differentially affected these parameters depending on species and plant part, while B3:R4 produced the highest watermelon root dry weight, which was significantly different than that under W. Dickson's quality index, widely used for seedling quality evaluation, was highest under B1:R4 for tomato and under B3:R4 for watermelon. Tomato seedling height was greatest under B1:R4 and B1:R4+G, whereas in watermelon the greatest heights were observed under W and B1:R4+G. Notably, B3:R4 resulted in the lowest seedling height, which differed significantly from all other treatments, in both species. In summary, the effects of different blue:red ratios were species- and parameter-dependent. The B1:R4 ratio appears to be a promising lighting strategy for tomato scion production in controlled environments. In watermelon, the higher B3:R4 ratio resulted in more robust seedlings; however, height requirements should be considered. If taller seedlings are desired, lower blue:red ratios, with or without the addition of green light, can provide satisfactory results.

Keywords: nursery; phytotron; controlled environment agriculture (CEA); photomorphogenesis

Wild vegetables as drivers of sustainability and resilience in Mediterranean bushlands: The MedSEVa Project

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Wild vegetables have traditionally been a vital component of Mediterranean food systems, closely linked to the ecological functioning and cultural identity of bushland and maquis ecosystems. Wild edible species harvested from Mediterranean bushlands contribute not only to dietary diversity and nutrition, but also to the sustainable use of multifunctional ecosystems that support biodiversity, carbon sequestration, water regulation, and rural livelihoods. However, these ecosystems and the traditional ecological knowledge associated with their valorization, are increasingly threatened by land abandonment, climate change, and socio-economic changes. The MedSEVa project (Cultivating Sustainable Economies in the Mediterranean through Valorization of Bushland Ecosystems) is an Erasmus+ funded initiative that explores pathways for conserving Mediterranean bushlands through education, knowledge transfer (science and tradition), and sustainability. The project emphasizes the integration of traditional knowledge with scientific approaches, aiming to empower students, professionals, and local communities to recognize and sustainably manage wild species of Mediterranean bushlands and maquis as valuable natural, cultural, and economical resources. By documenting wild vegetables and their uses across all Mediterranean-climate territories, MedSEVa highlights their role as a bridge between biodiversity conservation, food heritage, and sustainable local economies. In this presentation, selected wild vegetable species from different Mediterranean-climate regions will be showcased, illustrating their nutritional, ecological, and cultural importance in sustainable valorization of bushland and maquis ecosystems.

Keywords: agrobiodiversity; sustainable food systems

Agronomic evaluation of purslane (*Portulaca oleracea* L.) genotypes in low-input multiharvest field production system

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Purslane (*Portulaca oleracea* L.) is an underutilized leafy vegetable widely distributed in temperate and tropical regions. It is considered one of the richest plant sources of omega-3 fatty acids, and contains significant levels of phenolic acids, flavonoids, and vitamins, which contribute to its strong antioxidant capacity. In Slovakia, purslane is mainly regarded as an invasive weed species, however, its tolerance to drought, high temperatures, and low soil fertility makes it well suited to low-input and sustainable agricultural systems. A two-year field experiment (2024-2025) was conducted with the aim to evaluate the agronomic performance of two purslane genotypes (PO1 and PO2) cultivated from direct sowing under field conditions and evaluating the potential for purslane cultivation in Slovakia. Purslane was sown directly in the field at a seed density of 20 kg.ha^{-1} in experimental plots measuring 4.5 m². In each year, five harvests were carried out, and fresh yield and dry matter content (DMC) were determined. The results revealed distinct genotype and year dependent responses. In 2024, PO2 produced higher yields than PO1 in the early harvests, reaching a maximum of 21.10 t.ha^{-1}, while PO1 showed higher and more stable yield distribution in later harvests. In 2025, yield variability increased, with PO2 achieving the highest yield in the second harvest (29.55 t.ha^{-1}), whereas PO1 maintained high and more consistent productivity across all harvests. Dry matter content was consistently higher in PO2 compared to PO1 in both years, particularly in later harvests, where DMC values exceeded 11%. PO1 exhibited lower but more uniform DMC throughout the harvesting period. Overall, PO2 demonstrated higher individual yields and dry matter accumulation, while PO1 showed greater yield stability. These findings confirm the suitability of direct sowing for purslane cultivation in multiharvest field systems under Slovak conditions and highlight the importance of genotype selection.

Keywords: purslane, genotype, yield, direct sowing, multiharvest system

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Synergistic Effects of *Trichoderma harzianum* and Integrated Fertilization Regimes on Agronomic Performance and Fruit Quality of 'Amfora' Pepper (*Capsicum annuum* L.)

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The 'Amfora' pepper (*Capsicum annuum* L.), a commercially significant "kapiya" type cultivar in the Balkan region, is widely cultivated for the processing industry. However, reliance on synthetic mineral fertilization often degrades soil biological functionality. The application of beneficial soil fungi, specifically *Trichoderma harzianum*, presents a viable biological amendment to enhance nutrient use efficiency and mitigate biotic stresses, yet its interaction with varying fertilization matrices remains underexplored in specific agro-climatic zones. This study aimed to evaluate the interactive effects of *Trichoderma harzianum* application and three distinct fertilization regimes - Mineral (MIN), Organic (ORG), and Mixed (MIX) - on the morphological traits, yield components, and fruit quality of the 'Amfora' pepper variety. The investigation sought to determine optimal agronomic protocols for maximizing marketable yield while minimizing physiological waste. A field experiment was conducted during the 2021 growing season at two distinct agro-ecological locations in North Macedonia: Skopje (Dolno Lisice) and Kocani. The study employed a split-plot experimental design with *Trichoderma* application (With/Without) as the main-plot factor and fertilization type (MIN, ORG, MIX) as the sub-plot factor, replicated across two blocks. Data on fruit morphology (length, diameter, pericarp thickness) and yield parameters (marketable yield, fruit count, non-marketable percentage) were analyzed using Linear Mixed Models (LMM). The analysis revealed that the Mixed fertilization regime (MIX) significantly outperformed both Mineral and Organic regimes, achieving the highest marketable yield (800.5 g/plant) and the lowest percentage of non-marketable fruit (14.9%). *Trichoderma* application exerted a profound main effect, increasing marketable yield by 7.1% (773.8 g/plant vs. 722.6 g/plant) and significantly reducing the percentage of non-marketable from 22.5% to 16.7%. A significant *Trichoderma* × Fertilizer interaction ($p < 0.05$) was observed for fruit diameter. Mineral fertilization alone maximized pericarp thickness (4.46 mm), a key trait for processing efficiency, but at the cost of higher percentage of non-marketable fruits (25.0%).

Keywords: *Capsicum annuum*, Trichoderma harzianum, Integrated Nutrient Management, Marketable Yield, Fruit Morphometrics, Split-plot Analysis, Sustainable Horticulture, Amfora

Effects of cold plasma treatment on germination dynamics and early seedling development in common bean (*Phaseolus vulgaris* L.)

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The effects of cold plasma treatment on seed germination and early seedling development of common bean *(Phaseolus vulgaris* L.) were evaluated using two types of biological material: seeds from SCDL Buzău and commercially sourced seeds. Cold plasma was applied for 6, 9, and 15 minutes, with and without oxygen supplementation, and results were compared with untreated controls. Germination was assessed through standard developmental stages, including imbibition, radicle emergence, hypocotyl development, and cotyledon formation. Plasma-treated seeds showed accelerated imbibition and earlier radicle protrusion within the first 48–72 hours. After 3 days, the highest germination rate was recorded in variant A (6 min plasma), reaching 60.67%, compared to 34.67% in the untreated SCDL Buzău control. Variant C (9 min plasma + O□) showed a germination rate of 52.00%, while prolonged exposure (15 min) resulted in lower germination (48.00%). Commercial seeds exhibited limited responsiveness to plasma treatment, with germination increases of only 2.66% over the commercial control. At 10 days, final germination of the untreated SCDL Buzău control reached 92.67%, while plasma-treated variants showed smaller increases, indicating that plasma treatment mainly enhanced germination speed rather than final germination capacity. Mean germination time was reduced by 12–24 hours in plasma-treated variants. Morphological evaluations revealed that treated seedlings developed robust hypocotyls, vigorous radicles with early secondary branching, and healthy cotyledons, whereas control seedlings exhibited delayed growth and a higher proportion of affected germinants. Seedling length after 10 days was greatest in variant C (14.03 cm) and variant A (13.27 cm), exceeding control values. Analysis of germinated, non-germinated, and affected seeds indicated a reduced microbial impact in plasma-treated variants, although longer exposure durations increased the proportion of affected germinants. Overall, cold plasma treatments of 6–9 minutes improved germination rate, uniformity, and early seedling vigor, with treatment duration and seed origin being key determinants of the biological response.

Keywords: seed vigor; Imbibition rate; Plasma exposure time; Early plant growth

Agronomical potential and varietal screening of Mint and Shiso cultivars in controlled environment agriculture

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The economic feasibility of vertical farming depends on the diversification of high-value crops beyond standard leafy greens. In addition, vertical farming expands to meet the demand for fresh, locally sourced produce, optimizing crop genetics for indoor environment becomes essential. Aromatic herbs such as Mint (Mentha spp.) and Shiso (Perilla frutescens) offer high retail value but represent unique cultivation challenge. This study presents a screening of four mint cultivars and six shiso cultivars to determine their suitability for high-density hydroponic production.

The experiment was performed in a multi-layer ebb-and-flow system under LED lighting with 16-hour photoperiod. Parameters measured included yield, plant height, chlorophyll content, transpiration rate, mineral content and essential oil.

Significant genotypic variation was observed within both species. In the mint screening, 'Pepper' produced the highest fresh weight biomass (2.16 kg/m^2/layer) but this yield differed depending on provider. Conversely, 'Green' displayed better physiological traits and better-quality profile, though with 17% lower total yield. For shiso, "green" cultivar significantly out-yielded "purple" cultivar with stronger and more compact growth. Therefore "green" cultivars were well adapted to hydroponic cultivation conditions and suited to high density planting. Finally, germination may be irregular depending on the short viability of the seeds. This study provides a framework for selecting herb cultivars that balance yield with system compatibility.

Keywords: vertical farm, hydroponic, shiso, mint

Harvest Timing and Inflorescence Position Effects on Seed Germination of Golden Thistle (*Scolymus hispanicus* L.)

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Golden thistle (*Scolymus hispanicus L.*) is a Mediterranean wild edible species recognized for its nutritional value and adaptability to diverse environmental conditions. However, its commercial cultivation remains limited, largely due to insufficient knowledge regarding seed quality and germination performance. Since successful crop establishment depends heavily on seed viability and vigor, identifying the factors that influence these traits is essential for supporting the domestication and sustainable production of this species. The present study investigates the effect of harvest period and inflorescence position along the flowering stem on the germination capacity and physiological quality of *Scolymus hispanicus* seeds. The experiment was conducted in a controlled environemnt grow chamber. Seeds were collected from naturally growing plants during two maturation stages, early September and late October, and were further classified into four positional levels based on their development on primary, secondary, and tertiary flowering stem branches. Germination tests were carried out in both Petri dishes and seedling trays, while seed vigor, seedling growth, and biomass accumulation were evaluated. Seeds were collected from naturally growing plants at two maturation stages, early September and late October, and were further classified according to their position on primary, secondary, and tertiary branches, ranging from upper (central) to lower (basal) inflorescences. Germination tests were performed in Petri dishes and seedling trays, while seed vigor, seedling growth, and biomass accumulation were recorded. Seed viability was additionally assessed using the tetrazolium test, and treatment effects were determined using analysis of variance (ANOVA). Concomitantly, seeds harvested in early September exhibited significantly higher germination rate than those collected in late October, indicating that harvest timing plays a critical role in seed physiological quality. Moreover, germination performance varied markedly with inflorescence position. Seeds originating from lower (basal) inflorescences showed consistently higher germination, greater vigor, and increased viability compared to seeds from upper (central) inflorescences. Similar trends were observed under both laboratory and nursery conditions, confirming the influence of seed developmental position on early establishment success. Overall, the findings demonstrate that both harvest period and flower position are key determinants of seed quality in *Scolymus hispanicus*. Optimizing these factors can improve propagation efficiency and support the transition of golden thistle from wild harvesting to sustainable agricultural production.

Keywords: *Scolymus hispanicus*, seed germination, seed quality, harvest timing, inflorescence position, seed vigorreenhouse humidity, moisture absorption, greenhouse environment, crop transpiration

Growth, Nutritional and Antioxidant Responses of *Mesembryanthemum crystallinum* and *Amaranthus retroflexus* under Organic and Conventional Fertilisation

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The valorization of wild leafy vegetables with high adaptability and low input requirements represents a promising strategy for promoting more sustainable and biodiversified cropping systems. Within this framework, the present study evaluated the effects of organic and conventional fertilization regimes on yield performance, nutritional status, and quality attributes of *Mesembryanthemum crystallinum* and *Amaranthus retroflexus*, two underutilized species exhibiting distinct physiological and agronomic traits. Both species demonstrated satisfactory growth under reduced nutrient availability, underscoring their capacity to efficiently exploit limited soil resources. However, organic fertilization resulted in reductions in fresh biomass of 29% and 48%, and in dry biomass of 15% and 40%, for *Mesembryanthemum crystallinum* and *Amaranthus retroflexus*, respectively, relative to conventional nutrient management. Species-specific responses were observed in quality parameters across cultivation systems. Ice plants grown under organic conditions exhibited enhanced antioxidant capacity and increased accumulation of flavonoid compounds, responses associated with adaptive mechanisms and the stimulation of secondary metabolism under nutrient-limited conditions. In contrast, *Amaranthus retroflexus* cultivated with organic fertilization showed a fourfold reduction in nitrate accumulation in the edible biomass, attributable to the lower nitrogen input characteristic of organic management. Overall, these findings indicate that *Mesembryanthemum crystallinum* and *Amaranthus retroflexus* are well suited to low-input organic cropping systems, in which yield stability is coupled with improved product quality. Their integration into alternative production schemes may contribute to crop diversification, enhanced nutritional value, and increased sustainability of agroecosystems.

Keywords: Organic fertilization, underutilized crops, quality, ice plant, nutrient

Effect of Organic and Conventional Fertilisation on Yield and Quality of *Portulaca oleracea* Cultivated under Open-Field Conditions

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The introduction of underutilized leafy greens into sustainable and organic production systems has garnered increasing interest as a strategy to enhance agrobiodiversity. Portulaca oleracea (purslane) is a wild-edible leafy vegetable species characterized by high tolerance to abiotic stress and notable nutritional properties, positioning it as a promising crop for low-input cultivation systems. This study evaluated the effects of organic and conventional fertilization regimes on yield, mineral nutrition, and quality attributes of purslane grown under open-field conditions. Plant nutritional status, agronomic performance, and biochemical quality parameters of the edible biomass were assessed, including antioxidant capacity (TEAC and FRAP), total phenolic content (TPC), and total flavonoid content (TFC). Organic fertilization significantly reduced fresh and dry biomass yields by 48% and 34%, respectively, relative to conventional fertilization. However, plants subjected to organic nutrient management exhibited significantly higher antioxidant capacity and increased accumulation of flavonoid compounds. These findings suggest a pronounced upregulation of secondary metabolism under reduced nitrogen availability, reflecting a clear trade-off between yield and phytochemical quality. Moreover, nitrate content in the edible biomass was sixfold lower in organically fertilized plants. Despite lower nutrient inputs, purslane maintained a satisfactory mineral nutrient profile, underscoring its efficiency in nutrient uptake under limited availability. Collectively, these results demonstrate that organic fertilization enhances the nutritional quality of purslane at the expense of biomass yield. Portulaca oleracea thus emerges as a suitable candidate for low-input cropping systems where quality and biodiversity are prioritized, particularly within organic production contexts.

Keywords: Wild leafy greens, organic, antioxidant capacity, nitrogen, purslane

Poster Session II:

-Biostimulants and non-chemical means to increase resilience to biotic and abiotic stress

-Greenhouse and indoor vegetable production

-Postharvest technologies, Circular economy and Life Cycle Assessment

Browning inhibition and quality maintenance of fresh-cut broccoli (*Brassica oleracea* var. italica) by betel and holy basil essential oil treatment

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The symptoms of broccoli (*Brassica oleracea* var. *italica*) senescence are yellowing of florets and browning on the cut surface of the stem. This study examined the effectiveness of different concentrations of betel and holy basil essential oils (diluted with 5% ethanol) on minimizing browning incidence and maintaining quality characteristics of fresh-cut broccoli during a 12-day storage period at 10±2°C. During storage, parameters of visual quality, weight loss, browning index (BI) of stem cut surface, color values (*L*a*b** color space) of the florets and polyphenol oxidase (PPO) and peroxidase (POD) activities were measured. Dipping in betel and holy basil essential oils at 75 mgL^{-1} showed the optimal effect on the visual quality of postharvest broccoli and significantly delayed weight loss after 8 days of storage. The analysis of the BI of stem cut surface showed that application of betel and holy basil essential oils (75 mgL^{-1}) to broccoli exhibited lower BI than the other samples. Significant changes in color components of broccoli florets were observed among the essential oil treatments. At the end of storage, treatments with betel and holy basil essential oil (75 mg L^{-1}) showed slight increase in *L** values (lightness) and *a** values remained in green region. For *b** values, both treatments were in the yellow area with a slight increase. In addition, pre-storage betel and holy basil essential oil (75 mgL^{-1}) application to broccoli exhibited significantly lower PPO and POD enzyme activities after 4 days of storage, in contrast to the higher enzyme activities observed in the control broccoli. Based on these considerations, dipping in 75 mgL^{-1} betel and holy basil essential oils for 1 min could be a useful pretreatment for preserving visual quality of broccoli, significantly reducing the browning in stem cut surface and yellowing of the florets.

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Keywords: weight loss, cut surface, color, polyphenol oxidase, peroxidase, enzymatic browning

LED lighting spectra effects on yield and mineral composition of radish microgreens

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Vertical farming is a technique for growing plants hydroponically on multiple levels in a controlled environment to optimize plant growth. This technique is suitable for cultivating microgreens, which are plants at the stage of developed cotyledon leaves. The experiment was conducted to determine the effects of three different LED spectra (blue – 450 nm (B), red – 620 nm (R), and a B:R combination of 50:50) on the yield and mineral composition of radish microgreens. Microgreens were grown in a plant growth chamber under fully controlled conditions (25 °C, 60% RH), with a 14-hour photoperiod for 7 days. At harvest, the yield, dry matter content, and mineral composition of macro- and micronutrients were determined in the laboratory. Radish microgreens grown under various LED lighting spectra showed no significant differences in yield, dry matter content, or nitrogen content, with average values of 3172 g·m□², 9.09% DM, and 6.82% N/DM, respectively. The contents of other macronutrients (P, K, Ca, Mg) were highest under red LED lighting, with significantly higher values compared to the combined B:R and B lights (notably for P and Ca). Meanwhile, the combined B:R spectrum significantly increased the content of micronutrients (Fe, Zn, Mn, Cu) compared to blue light, and Zn content compared to red light. Based on these results, the application of red LED lighting can be recommended. In addition to light spectra, future research should also focus on photoperiod as one of the crucial factors in optimizing LED lighting for plant growth and quality.This work is part of the ECONUTRI project funded by the European Union's Horizon 2020 Research and Innovation Program under the Horizon Europe Grant agreement: 101081858

Keywords: *Raphanus sativus* var. longipinnatus, microgreens, light spectra, biomass, macroelements, microelements

The effect of vanadium on the growth of very early potato cultivars

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Recent years have seen growing interest in certain trace elements as plant growth stimulants. Although vanadium (V) is classified as a heavy metal, it is considered to be an element beneficial to plants, which, in small amounts, can stimulate plant growth. The effect of vanadium on the growth of very early potato cultivars was investigated. The source of vanadium was the biostimulant Vanadoo (Intermag Ltd., Poland). One liter of Vanadoo contains 21 g (1.8%) of bioavailable vanadium combined with an organic complex in innovative formula of eVadium, chemically similar to a chelate. The field experiment was carried out in east-central Poland in 2024, on a sandy loam soil (Haplic Luvisol). Vanadium was foliar-appied at dosages of 2.625 g V/ha or 5.250 g V/ha (0.125 L/ha or 0.250 L/ha of Vanadoo) once at the leaf development stage (BBCH 14-16) or at the tuber initiation stage (BBCH 41-43), and twice, at the leaf development and tuber initiation stages. Two very early potato cultivars (Piwonia, Werbena) were grown. Potato plants were measured 60 days after planting, when the canopy reached maximum growth. Potatoes were harvested 75 days after planting (the end of June). The potato plants treated with vanadium were taller and produced greater above-ground biomass, on average, by 21 g (14%) than the control plants. Vanadium caused enlargement of leaf area, on average by 340 cm^2 (12.5%) but did not affect the chlorophyll content in leaves. The plants produced greatest above-ground biomass and had a largest leaf area with two vanadium applications at 2.625 g V/ha in each treatment. Foliar-applied vanadium caused an increase in tuber number and tuber weight per plant. As a result, the tuber yield was higher, on average, by 3.5 t/ha (15%). The tuber yield was highest after applying 5.250 g V/ha in the tuber initiation stage.

Keywords: early potato, vanadium, foliar spraying, plant growth, tuber yield

Frequency of foliar treatments with calcium nitrate in combination with a stimulator on fruit and seed production and on the mass of 1000 seeds in round pepper

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Calcium is an essential element for plant health and development, having multiple important roles in various physiological processes. In addition, calcium plays a significant role in cell division, a fundamental process for plant growth and development. Its deficiency increases the risk of metabolic disorders in peppers, such as apical fruit rot. At the same time, stimulants have the potential to reduce stress induced by abiotic factors, such as drought or high temperatures. The purpose of this scientific work is to establish the optimal interval between the treatments applied with calcium nitrate and a stimulant, on fruit and seed production and on the 1000-seed mass in round peppers using the cultivar'Asteroid 204'. The experiment was carried out at the Research and Development Institute for Vegetable and Flower Growing Vidra, Ilfov county, Romania. Foliar treatments with calcium nitrate combined with the stimulant Sprintene were applied to the round pepper plants, at different time intervals. The studied time intervals were seven days between treatments, ten days and, respectively, fourteen days between treatments. The treatments applied at intervals of ten days had the ability to increase the amount of fruit per plant, and the amount of seeds and the mass of 1000 seeds were influenced by the application of treatments at seven days.

Keywords: seeds, calcium nitrate , stimulant, round peppers

Integrated pest control of *Tetranychus urticae* (Koch.) in melon crops under high plastic tunnel

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Melon (*Cucumis melo* L.) is an important vegetable crop that is widely cultivated all over the world and is frequently attacked by several pests including *Tetranychus urticae* (the two-spotted spider mite). This pest causes important economical loss to many crop species and the attack is frequent in dry and hot years. The pest is usually found on the underside of the leaves, and the attack is recognized by the drying of the tissue between the veins. The experiment done in 2023 in Romania, aimed to evaluate the efficacy of two products based on Neem oil and hexythiazox against the pest on melons crops. The Festiv variety and the Raymond F1 hybrid were used as biological material. Dynamic observations were made on 3 pre-marked plants, evaluating the infested areas according to the EPPO PP1/037(2) standard and during the experiments, the values of climatic factors (temperature and atmospheric humidity) in the high plastic tunnel were automatically recorded, using a CEM DT-172 thermohygrometer. Based on the obtained results, the efficacy (%) of products was calculated and was between 81.17 and 91.89% and the yield on variants and replicates was recorded.

Keywords: hexythiazox, neem oil, melon, two-spotted spider mite

Biological and conventional control of *Alternaria solani* and Fulvia fulva on tomatoes crops in greenhouses

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In Romania, tomato (*Solanum lycopersicum*) cultivation has the largest share of all vegetable species cultivated in protected areas and the field, with an area of 17540 ha and a production of 15480 kg/ha. In Europe, our country ranks 6 th in terms of area after Italy, Russian Federation, Ukraine, Spain and Portugal. The main objective of this experience was the control of the pathogens Alternaria solani and Fulvia fulva in tomato crops in conventional and biological systems. The main foliar diseases of tomatoes have a negative impact on fruit yield and quality.

The experiment includes 4 fungicides (Ortiva Top 0.1%, Cidely Top 0.1%, Amistar 0.1%, Dagonis 0.1%) and 4 biological products (Cavaler 600SL 0.3%, Amulet 40 l/ha, Zytron 0.15%, Mimoten 0.3%) for controlling Alternaria solani (Ellis & G. Martin) and Fulvia fulva (Cooke) Ciferri, pathogens, on Rozalux, Prekos F1, Reyana F1 and Pink Rock F1 tomato cultivars. The diseases infection rate of the plants and infection degree of the leaves were recorded and analysed. The conventional products achieved higher efficacy compared to the biological products.

Keywords: pathogen, early blight, leaf mold, greenhouse

Seaweed Extract Improved Yield of Parthenocarpic Cucumbers in an Organic High Tunnel System

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A study was conducted to evaluate the effect of seaweed extract (*Ascophyllum nodosum*) on yield performance of four parthenocarpic cucumber (*Cucumis sativus*) varieties: 'Diva' 'Corinto', 'Katrina', and 'Sweet Success' under an organic production. The experiment was carried out in a passive, organically managed high tunnel system. Seaweed extract was first applied as a root drench before transplanting, followed by three foliar applications after transplanting at 14-day intervals. Organic pest management included Spinosad sprays and the release of beneficial insects. A total of 18 kg□ha^{-1} nitrogen, 12 kg□h^{-1} phosphorus, and 20 kg□ha^{-1} potassium were applied in the growing cycle of two months. The application of seaweed extract increased total yield in 'Diva', Katrina' and 'Sweet Success' by 21 %, 15 % and 12 % respectively, compared to untreated controls, while no significant differences were observed for 'Corinto'. Among varieties, 'Katrina' produced the highest overall yield, whereas 'Diva' exhibited delayed fruiting and lower total harvest. Seaweed spray increased the average fruit length and weight in 'Diva' but not in other varieties. Similarly, 'Diva' fruits had higher total soluble solids/titratable acidity ratio compared to other varieties. 'Katrina' had the highest fruit moisture while 'Sweet Success' had the lowest. This study highlights the importance of variety selection and the integration of biostimulants such as seaweed extract to enhance productivity, fruit quality and sustainability in organic cucumber production systems.

Keywords: Kelp Green, Organic cucumber, Variety selection, Organic management

Some Biochemical Parameters of *Bilacunaria microcarpa* (M. Bieb.) Pimenov & V.N. Tikhom., cultivated under soil and hydroponic conditions in Armenia

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Wild plants have historically been vital sources of food and medicine. *Bilacunaria macrocarpa* (M. Bieb.) Pimenov & V.N. Tikhom., locally known as "Bokhi" in Armenia, is one of such perennial wild plants. Its young leafstalks are traditionally consumed cooked or pickled, yet the species remains undomesticated. The study aims to investigate the domestication possibility of *Bilacunaria microcarpa* under both soil and hydroponic conditions, and to examine its biometric and biochemical parameters. The hydroponic cultivation was conducted using an automated Ebb & Flow system with a 2 m² feeding area, with a substrate consisting of a volcanic slag and gravel mixture, and nourishing the plants with Davtyan's nutrient solution once or twice per week. Soil-grown control plants were irrigated weekly with artesian water. Irrigation was tailored to mimic the plant's natural arid habitat. All data were collected in late May to avoid it's the summer dormancy. The growing medium did not significantly affect the length of the longest leaf in two-year-old *Bilacunaria microcarpa* plants, but did significantly influence both leaf number and the thickness of the longest leaf. These growth differences disappeared by the third year. However, growing conditions consistently affected the leafstalk's biochemistry. Regardless of plant age, hydroponically grown plants had higher content of key bioactive compounds: extractives and flavonoids (1.1 times), phenolic acids (1.1-1.2 times), and tannins (1.2-1.4 times) compared to soil-grown ones. With age, biosynthesis of most compounds increased in both cultivation conditions.

In conclusion, *Bilacunaria microcarpa* can be successfully domesticated and cultivated in both soil and hydroponic conditions in the Ararat Valley. However, hydroponics is distinctly preferable for achieving a yield richer in valuable biologically active compounds.

The work was supported by the Science Committee of RA, in the frames of the research project N 22RL-028.

Keywords: Flavonoids, Hydroponics, Leafstalks, Phenolic acids, Soil

Postharvest Sanitizer Performance Against *Salmonella enterica* on Lettuce Roots

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Foodborne illness outbreaks caused by *Salmonella enterica* continue to be a major concern, particularly in fresh produce. Indoor-grown lettuce has recently drawn attention due to conditions that may favor pathogen persistence and cross-contamination during postharvest handling, especially when sold with intact roots. This study investigated the efficacy of two commonly used chemical sanitizers (200 ppm chlorine and 80 ppm peroxyacetic acid (PAA)) in reducing *Salmonella* populations on lettuce roots with and without media plugs. Microbial reductions were assessed immediately after treatment (0 h). Initial *Salmonella* loads in untreated samples averaged 5.01 log CFU/g for roots without media plugs and 6.88 log CFU/g for roots with media plugs. Compared to these controls, chlorine significantly reduced *Salmonella* by 2.05 log CFU/g in roots without plugs and 2.53 log CFU/g in roots with plugs. PAA achieved slightly greater reductions in roots without plugs (2.69 log CFU/g) but slightly lower reductions in roots with plugs (2.39 log CFU/g). Despite these reductions, roots with media plugs consistently retained higher bacterial loads across all treatments, indicating that substrate type has a strong influence on pathogen survival. These findings suggest that while chlorine and PAA are effective interventions, their efficacy may be compromised by the media plugs, which create conditions that facilitate microbial attachment and persistence. Incorporating a targeted root sanitation step into postharvest handling could enhance microbial safety without altering product integrity, particularly for lettuce marketed with intact roots.

Keywords: Postharvest, produce safety, Salmonella

Yield and Quality Traits of Off-Season Carrot as Affected by Nitrogen Supply and a Plant-Derived Biostimulant

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Nitrogen (N) fertilization is essential to ensure adequate yield and quality in early carrot cultivation. However, due to the specific growing period and the predominance of sandy soils where this crop is cultivated, in South Italy carrots can be prone to nitrate accumulation in the roots and N losses from the soil-plant system. The use of plant-derived biostimulants (PBs) represents a promising strategy to enhance the crops' performance under limited N inputs, but the combined effects of reduced N supply and PB application on carrot yield and quality is still unexplored. A two-year experiment (2021-2022 and 2022-2023, hereafter S_1 and S_2) was conducted in Sicily to evaluate the effects of two N fertilization rates (N_{75} and N_{150}, corresponding to 75 and 150 kg N ha^{-1}, respectively) and the application of a legume-derived PB (ILSAC-on®) on yield, partial factor productivity of nitrogen (PFP_N), and composition of carrot 'Dordogne'. Compared to N_{150}, N_{75} reduced total yield (by 16-10%) and marketable yield (by 19-9%) in both seasons. Differently, the PB improved the yield performances and PFP_N, particularly under N_{75} (by 23% and 11% in S_1 and S_2, respectively). Moreover, the PB decreased nitrate concentration (up to 98 and 108 mg kg^{-1} in S_1 and S_2, respectively) and increased carotenoid content of carrots (by 133 and 118 mg kg^{-1} in S_1 and S_2, respectively). These results highlight the potential of PBs to reduce the N inputs in early carrot cultivation while improving the quality traits of the product, mostly in terms of nitrate and carotenoid contents.

Keywords: *Daucus carota* L.; nitrogen rate; plant-derived biostimulant; partial factor productivity of nitrogen; root composition.

Concentration of Nutrient Solution in Outdoor Hydroponic Cultivation of Kale and Bok Choy in Armenia

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Background: Vegetables are an integral part of a healthy human diet. Curly kale (Brassica oleracea var. sabellica L.) and bok choy (Brassica rapa subsp. chinensis) are two popular leafy cabbages with nutritional properties that differ from many others. Rich in medicinal properties, these plants enhance the function of the cardiovascular and gastrointestinal systems, strengthen bone tissue, and improve vision. Regularly including these plants in your diet helps lower "bad" cholesterol and regulate body weight. They also possess antioxidant, anti-cancer, anti-diabetic, and antibacterial properties.

Objective: The goal of this work is to determine the optimal nutrient solution concentration for achieving high yields and high-quality plant raw materials of non-traditional crops in hydroponic conditions in Armenia.

Methods: The EBB & Flow hydroponic system was used in trials. Hydroponic plants were nourished twice a day with different concentrations of Davtyan's nutrient solution.

Results: To maximize yield, kale performs best with a nutrient solution density of 0.5 Davtian, which yields approximately 8.3 kg per square meter. In contrast, bok choy preferred a double-concentrated nutrient solution, which produced up to 17.9 kg of yield per square meter. According to biochemical research, kale plants fed a 0.5 concentration of Davtyan's nutritional solution had the highest concentrations of vitamin C, β-carotene, total flavonoids, and extractives. Different concentrations of nutrient solution had no significant effect on the content of β-carotene in the leaves of bok choy, while the maximum accumulation of vitamin C and extractives recorded in plants fed a 1.0 Davtyan’s nutrient solution.

Conclusion: Thus, the nutrient solution concentration was adjusted to ensure high efficiency in growing non-traditional crops such as bok choy and kale under controlled hydroponic conditions in Armenia.

Keywords: *Brassica oleracea* var. sabellica L., *Brassica rapa* subsp. chinensis L., Extractives, Flavonoids, Vitamin C

Sensory Evaluation of Fruit Juices Fortified with Aromatic Herbs

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Fruit and vegetable juices currently occupy a well-established position within the field of healthy nutrition. Commercial retail networks predominantly offer single-fruit juices, e. G. apple, orange, grape, carrot, or beetroot juices. Although these products have their regular consumers, contemporary consumers tend to prefer multi-fruit juices, often composed of various unconventional horticultural plant species. The aim of this study was to produce and perform a sensory evaluation of apple and grape musts fortified with different species and cultivars of aromatic herbs. The produced musts were enriched with peppermint (cultivars Chocolate, Mojito, Strawberry, Danica, and White grape), as well as sweet balm (*Melissa officinalis*), thyme (*Thymus vulgaris*), fennel (*Foeniculum vulgare*), marjoram (*Origanum majorana*), and hyssop (*Hyssopus officinalis*). Apple juices, both pure and fortified, achieved an average score of 76.56 points, whereas grape juices reached an average of 80.86 points. It can therefore be concluded that grape-based juices were more favorably evaluated by the assessors. In both grape and apple juices, the highest scores were assigned to samples containing peppermint. The lowest scores were recorded for juices with the addition of sweet balm (70.83 points). Below-average were also observed juices fortified with marjoram, thyme, and sweet balm. The study further examined whether statistically significant differences existed among juices with respect to the amount of added aromatic herb. Standard and double doses were compared; however, no significant differences were detected. All evaluated species and dosages formed a single homogeneous group, indicating that the applied doses and concentrations had neither a positive nor a negative effect on the sensory scores. Samples of sweeter grape juices (24°Brix) were rated higher than apple juices (13°Brix). The fortification and production of juices should therefore be guided by the preferences of assessors or consumers, a process that can be effectively supported by studies of this type.

Keywords: aromatic herbs, sensory evaluation, juices, peppermint, apple

Effects of *Portulaca oleracea* and *Salicornia europaea* on soilless tomato cultivation in saline conditions

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Soil salinity, defined as the high concentration of soluble salts in the soil, is a significant global issue that seriously affects agricultural productivity and environmental sustainability. The area of saline soils is increasing year by year, and this rate is expected to increase further due to climate change. Halophytes are plant species that can survive in saline soils and utilize water sources with moderate to high salinity. The edible parts of these species stand out due to their salty taste and high content of antioxidant compounds and essential nutrients. In this context, developing strategies for the effective utilization of saline lands that are unsuitable for agriculture and sustainable farming practices is of great importance. This study was conducted to determine the effects of cultivating tomatoes (*Solanum lycopersicum* L.) together with halophytes under saline conditions on yield and quality. The research was conducted in controlled greenhouse conditions with three replicates, each containing 12 pots. In the experiment, tomato plants were grown with purslane (*Portulaca oleracea* L.) and glasswort (*Salicornia europaea* L.); pots containing only tomatoes were considered as the control group. Equal amounts of saline nutrient solution were applied to all pots, and differences in plant development and yield were observed. According to the results, tomatoes cultivated with purslane achieved the highest yield; tomatoes cultivated with glasswort yielded lower but still higher than the control group. In purslane applications, an increase was observed in both the yield and quality characteristics of tomato fruits. The electrical conductivity (EC) values of tomatoes grown in saline conditions were approximately double those of the control group, which led to a significant improvement in the taste and flavor characteristics of the fruits. In conclusion, intercropping with halophytes has created positive effects on both yield and quality in tomato production under saline conditions. In particular, tomatoes grown with purslane were found to have high market value for both producers and consumers. This study offers an alternative approach to bringing saline agricultural lands into production.

Changes in Chlorophyll Content of Basil (*Ocimum basilicum* L.) Grown under Different Hydroponic Fertilization Regimes

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Chlorophyll content in plants is a key indicator of photosynthetic activity, which directly influences biomass production and is closely related to nutrient availability provided through fertilization. The aim of this study was to evaluate the effect of different hydroponic fertilizers on yield and photosynthetic pigment content in sweet basil (*Ocimum basilicum* L.), cultivar Lettuce Leaf, grown under hydroponic conditions. The experiment included an unfertilized control and five treatments with commercial fertilizers designed for hydroponic cultivation: Plagron Hydro A+B, Plagron Alga Grow, Advanced Nutrients Grow Bloom Micro, Canna Aqua Vega A+B, and Jungle Urban A+B+M. The contents of chlorophyll *a*, chlorophyll *b*, and the chlorophyll *a* to chlorophyll *b* ratio were assessed as indicators of photosynthetic performance and plant physiological status. Chlorophyll *a* value ranged from approximately 377 to 750 mg/kg (fresh matter - FM), while chlorophyll *b* ranged from about 193 to 336 mg/kg FM. The lowest pigment contents were observed in the control treatment, indicating limited nutrient availability in the absence of fertilization. The highest chlorophyll *a* content was recorded in the treatments with Advanced Nutrients Grow Bloom Micro and Canna Aqua Vega A+B, whereas the highest chlorophyll *b* content was found in the Advanced Nutrients Grow Bloom Micro treatment. The Jungle Urban A+B+M treatment showed the highest chlorophyll *a* to chlorophyll *b* ratio (3.3), corresponding to approximately 77% chlorophyll *a* of total chlorophyll content, suggesting plant adaptation to higher light intensity. In contrast, lower chlorophyll *a* to chlorophyll *b* ratios in the control treatment indicated a relatively higher proportion of chlorophyll *b* and reduced photosynthetic efficiency. Overall, the results demonstrate that the choice of hydroponic fertilizer notable influences basil pigment composition, thereby affecting the photosynthetic potential of plants.

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Keywords: chlorophyll content, hydroponics, sweet basil, fertilization regime, photosynthetic pigments

Effects of Nutrient Management on Growth Parameters of Basil (*Ocimum basilicum* L., cv. Purple Opal) Cultivated Hydroponically

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The evaluation of quantitative growth parameters is a key tool for objectively assessing plant performance and optimizing production in controlled hydroponic cultivation systems. This study aimed to assess the suitability of selected nutrient solutions for basil production in an autonomous hydroponic cultivation system. The experiment was conducted in 2025 using the basil cultivar 'Purple Opal', grown on a mineral wool substrate under controlled environmental conditions suitable for basil cultivation. Sowing was carried out by placing three seeds into each substrate cube with a volume of 64 cm^3. Plants were cultivated in an AI-assisted hydroponic system that continuously monitored and regulated key growth parameters, including nutrient solution delivery. The experiment was arranged in a completely randomized design with five replications per treatment. Five nutrient treatments using commercially available fertilizers were evaluated: T1 (Plagron Hydro A + B), T2 (Plagron Alga Grow), T3 (Advanced Nutrients Grow, Bloom, and Micro), T4 (Canna Aqua Vega A + B), and T5 (Jungle Urban A + B + M). Growth performance was assessed based on fresh biomass per cube, individual plant weight, plant height, and the number of leaves per plant. The results revealed significant differences among treatments, with fresh biomass—the key growth parameter—ranging from 0.13 to 4.07 g. The fertilizer Plagron Alga Grow (T2) was found to be unsuitable for hydroponic basil cultivation, whereas treatment T5 achieved the highest values across all evaluated growth parameters. These findings underscore the importance of optimized nutrient management for efficient basil production in AI-assisted hydroponic systems.

Acknowledgment: Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the project 09I05-03-V02-00085.

Keywords: Keywords: *Ocimum basilicum* L.; hydroponic cultivation; nutrient solutions; autonomous growing systems; plant growth parameters

Optimization of Growing Conditions in an Autonomous Hydroponic Cultivation System for Leafy Vegetables and Herbs

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The project “autoCULTIs”, implemented at the Slovak University of Agriculture in Nitra, focuses on the development of a fully autonomous, AI-controlled cultivation system designed to produce healthy crops with minimal human intervention, high efficiency, and an emphasis on sustainability and plant–environment interactions. The system addresses the growing demand for modern and environmentally friendly solutions in crop production and enables a wide range of users, from small-scale farmers and educators to ordinary consumers, to grow fresh vegetables with minimal effort from sowing or planting to harvest. The system is universal, with particular suitability for leafy vegetables and herbs. The tested system is based on the recirculation of a nutrient solution flowing through six vertical columns. The cultivation unit is monitored and controlled using sensors measuring temperature, humidity, light intensity, pH, electrical conductivity (EC), CO□ concentration, and photosynthetic activity of leaves. In initial experiments, garden cress and lamb’s lettuce were cultivated. Garden cress (*Lepidium sativum* L.) was grown using a water without nutrient supplementation. Differences among vertical columns were observed, with yield variability reaching 24.1% between the lowest and highest values. Variability was also detected in chlorophyll content (chlorophyll a: 15.8%; chlorophyll b: 25.8%). In lamb’s lettuce (*Valerianella locusta*), three commercially available hydroponic fertilizers (Plagron Hydro A+B, Advanced Nutrients Grow + Bloom + Micro, and Jungle Urban A+B+M) were tested. The applied fertilizer had a pronounced effect on plant fresh weight (28.6%) and significantly influenced chlorophyll content in leaves (chlorophyll a: 125.2%; chlorophyll b: 163.2%). During cultivation, technical issues included clogging of the irrigation hose in one vertical column and minor algal growth. Based on these initial results, several measures are recommended to optimize the cultivation of leafy vegetables and herbs.

Acknowledgment: Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the project 09I05-03-V02-00085.

Keywords: autonomous cultivation, hydroponics, leafy vegetables, herbs, cultivation, optimization

Biostimulant-Driven Improvements in Yield and Nutritional Quality of Hydroponic Spinach Grown in Floating Culture

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Biostimulants are increasingly applied in soilless cultivation systems to enhance crop performance while minimizing environmental impacts. Here, we investigated the effects of Vermicompost, Seaweed extract, and Chitosan on the growth, yield, and nutritional quality of spinach (*Spinacia oleracea* L.) in a hydroponic floating culture system. Seaweed extract was applied via the root zone at 250 and 500 mg L□¹, with a uniform foliar application of 0.4 g L□¹. Chitosan was applied at 0.3 and 0.6 mL L□¹, combined with a foliar dose of 1.5 mL L□¹, while vermicompost was applied at 1 and 2 mL L□¹ with a foliar application rate of 2 mL L□¹. Growth parameters, yield, physiological traits, chlorophyll content (SPAD), nitrate concentration, bioactive compounds, and mineral composition were assessed. Vermicompost applied by 1 mL L□¹ resulted in the highest total yield (6.34 kg m□²), leaf area (619.80 cm² plant□¹), and leaf length (18.48 cm), significantly outperforming the control treatment. The lowest nitrate concentration of 262.25 mg kg□¹ was recorded under Chitosan at 0.6 mL L□¹. Vermicompost application enhanced phosphorus, potassium, calcium, and zinc contents, while nitrogen concentration was highest under Vermicompost at 2 mL L□¹. Magnesium content peaked under Chitosan at 0.6 mL L□¹, whereas manganese accumulation was highest under Seaweed at 500 mg L□¹. Overall, spinach growth, yield, and nutritional traits were strongly influenced by both biostimulant type and application rate. Vermicompost primarily improved productivity and mineral nutrition, whereas Chitosan was particularly effective in reducing nitrate accumulation. These findings highlight the potential of tailored biostimulants in leafy vegetable production. Future studies should refine application strategies to maximize the efficiency of biostimulants in soilless culture.

Keywords: Chitosan, Hydroponic cultivation, Nitrate accumulation, Minerals in vegetables, Leafy vegetables, Seaweed extract, Soilless culture, *Spinacia oleracea*, Vermicompost

Automated drip irrigation strategy in a hydroponic greenhouse using a lysimetric control system

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Efficient water management represents a major challenge in greenhouse horticulture, particularly under Mediterranean climatic conditions, where water scarcity requires the adoption of precision irrigation technologies. Within the framework of the PRIMA project *Sun2Fork – Sustainable Greenhouse Farming Systems: From Sun to Fork*, an innovative automatic irrigation system was implemented for soilless cultivation. The irrigation frequency was determined using a lysimetric system, which continuously monitors the crop's water status and automatically manages irrigation events. Irrigation was triggered whenever the water level drops below a critical predefined threshold needed for optimal plant uptake.

The experiment was conducted in an unheated greenhouse located at Milazzo (Messina, Italy) using *Solanum lycopersicum L.* cv. Proxy F1 grown on coconut fibre slabs. Two irrigation strategies were compared: (i) a traditional timer-based system (TS) and (ii) a dynamic automatic irrigation system (AS). A drip irrigation system with self-compensating microflow emitters was used for both treatments. Both systems were supplied with the same nutrient solutions.

Fruits were harvested at commercial maturity from the first to the eighth cluster. After each harvest, fruits were detached from the rachis and classified as marketable or non-marketable. At the end of the trial, plants were separated into stems, leaves, and roots, and the dry biomass was determined. Preliminary results indicate that the AS reached higher total fruit number (104 vs 91 n plant^{-1}), marketable fruit number (100 vs 90 n plant^{-1}), and total production (3484 vs 2835 g plant^{-1}) compared to the TS, highlighting its potential for improving irrigation precision in hydroponic systems.

This study provides useful information for careful irrigation management that supports more sustainable greenhouse production models for Mediterranean horticulture.

Keywords: Precision irrigation, tomato, fruit production, sustainable cultivation

Agronomical evaluation of hydroponically grown coriander cultivars in vertical farming

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As vertical farming expands to meet the demand for fresh, locally sourced produce, optimizing crop genetics for indoor environment becomes essential. Traditionally, leafy greens and herbs have always been associated with indoor agriculture and continue to be extremely popular among vertical farmers. More than half of indoor and vertical farms produce leafy greens. Among the grown herbs in vertical farms, coriander (*Coriandum sativum* L.) represents one of the most popularly choices; however, its sensitivity to bolting and specific light requirements represent challenges in controlled environment agriculture (CEA). This study aimed to screen eleven cultivars to determine their suitability for hydroponic vertical farming based on yield, physiology, cultivation duration, mineral and essential oil content. Our objectives were to quantify productivity and characterize growth of coriander cultivars grown in stacked hydroponic production systems. Eleven cultivars were chosen using ebb-and-flow systems and grown for four weeks. Coriander cultivars differed greatly in fresh weight from 0.8 to 1.2 kg/m^2 after one cut. The fresh weight showed a correlation with transpiration rate. In addition, one cultivar displayed better quality with the highest concentration of mineral contents and essential oil. Further investigations are needed to analyze essential oil composition in order to determine cultivar with a positive nutritional value.

Keywords: vertical farm, coriander, hydroponic

Evaluation Impact of supplying a nutrient solution contaminated with microplastics in strawberry cultivated in rockwool or coir on plant development, fruit production and quality characteristics

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Micronutrient biofortification can be considered as a cost-effective and sustainable strategy, with a wide range of applications in various crops, aiming to enhance their nutritional status.

Keywords:

Effect of *Streptomyces violaceoruber* and different doses of zinc on eggplant grown in open field

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Eggplant (*Solanum melongena* L.) is an important crop in the Mediterranean region. In Sicily, thanks to the favourable cultivation conditions, eggplant is grown both in greenhouse (fall-winter period) and open field (spring-summer period). However, in open field conditions, eggplant performances are often altered by abiotic distresses. In this context, natural product, such as biostimulants, could be useful to increase plant stress tolerance and ameliorate nutrient uptake and assimilation, granting satisfying yield and qualitative traits. Specifically, several studies pointed out the beneficial effect of plant growth promoting bacteria (PGPB), such as *Streptomyces violaceoruber*, on vegetable crops underlining different plant responses based on the strain used. Nowadays, a large part of the world population suffers of micronutrient deficiency (hidden hunger), especially from iodine, zinc and vitamin A. Consequently, there have been efforts to improve the nutritional status of the world population via different strategies, such as crop biofortification. In the present study, we evaluated the productive and qualitative traits of eggplant (Gloria F_1) grown in open field, inoculated or not with *S. violaceoruber*, and treated with different Zn dosages (0, 1, 2 or 4 g L^{-1}). Plants were inoculated twice with PGPB, the first inoculation at the transplant phase and the second one 20 days after transplant. Inoculation was performed via the supply of 100 mL of PGPB solution per plant. The biofortification treatments started 7 days after transplant and were accomplished weekly via foliar spray, supplying 0.5 L m^{-2} of Zn nutrient solution. Results revealed that inoculation significantly enhanced plant growth (height and number of leaves) and productive features, as well as some qualitative traits like soluble solids content (SSC), chlorogenic acid concentration and fruit dry matter. Treatments with Zn up to 2 g L^{-1} enhanced growth traits, production and quality, as well as on the fruit Zn content. Interestingly, even at the highest dosages (4 g L^{-1}), the application of PGPB to biofortified plots significantly enhanced fruit Zn content compared to the control, suggesting an increase of plant tolerance to high Zn dose. The current work shed the light on the beneficial effect of *S. violaceoruber* on plant tolerance to high Zn dosages, laying the foundation for future studies with omic sciences.

Keywords: *Solanum melongena* L., soil cultivation, PGPB, zinc biofortification, vegetables.

Is Zn citrate less phytotoxic than Zn chelate when used in an agronomic biofortification program of curly endive grown in hydroponic system?

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Lignosulfonates (LS) are renewable materials derived from lignocellulosic biomass according to the sulfite process. It is recognized that LS act as biostimulant since modulate fertilizer behavior, with benefits in fertilizer-related applications. In particular, there are evidence that LS can improve plant growth and development. Therefore, new research efforts on the LS-derived biostimulants action could have a huge impact on sustainable agriculture. Thus, the aim of the current research was to appraise the effect of the LS-based biostimulant 'Statia' on yield and quality of parsley (*Petroselinum crispum* Mill.) cultivated either under shaded (50% black shade net) or unshaded greenhouse. 'Statia' treatments significantly improved the yield of plants grown under shade. The highest SSC were detected in non-shaded plants treated or not with the biostimulant, whereas non-biostimulated plants cultivated under shade revealed the lowest SSC. Shading negatively affected polyphenols concentration, whereas plants treated with 'Statia' increased polyphenols concentration. 'Statia' treated plants under shade had the largest leaf area, followed by those grown under shade and non-biostimulated. The lowest leaf area was observed in control plants (unshaded and non-biostimulated).

Keywords: biostimulant, sustainable horticulture, *Petroselinum crispum* Mill., greenhouse cultivation, green leafy vegetables.