

**Goce Delcev University – Stip
Faculty of Agriculture**



**5th INTERNATIONAL MEETING
AGRISCIENCE & PRACTICE
(ASP 2026)**

BOOK OF ABSTRACTS

**16 APRIL 2026
Stip, Republic of North Macedonia**

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(ASP 2026)

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**5th INTERNATIONAL MEETING AGRISCIENCE & PRACTICE
ASP 2026**

**Organized by
FACULTY OF AGRICULTURE
GOCE DELCEV UNIVERSITY, STIP, REPUBLIC OF NORTH MACEDONIA
16 April 2026, Stip, Republic of North Macedonia**

The Faculty of Agriculture is organizing the 5th International Meeting *Agriscience & Practice (ASP 2026)*, providing participants with the opportunity to present and discuss original scientific and practical results in various fields of agriculture.

The 5th International Meeting *Agriscience & Practice (ASP 2026)* brings together agricultural stakeholders to share their knowledge, experience, and challenges. Its main goal is to connect research and fieldwork in the agricultural sector, both nationally and beyond, giving it an international dimension.

Over the past years, we have been fully committed to building exactly these kinds of bridges—bridges between science and practice, between institutions and producers, and between experience and innovation. Moreover, we strive to build bridges that transcend borders and connect us with the region and the world.

Scientific and applied presentations will be organized into the following sections:

1. Agricultural Economics
2. Animal Sciences
3. Plant Sciences
4. Food Science and Nutrition
5. Soil Science and Environment
6. Enology

Poster presentations will also be available. In addition, in response to the needs of the agricultural sector, panel discussions will be organized, where invited speakers and panelists will have the opportunity to share their experience with meeting participants.

Dear colleagues, partners, and friends, let us once again gather in one place, united by a common idea—to bring together agricultural science and practice in order to share information, knowledge, experiences, and solutions to overcome existing challenges. The main objective of this meeting is the successful establishment of continuous and meaningful communication and collaboration among scientific, research, and practical activities in the agricultural sector at the national, regional, and international levels. We will achieve this goal, as well as our shared objectives, through the synergy we have been actively building over the past years.

Every scientific field has its significance and value within a given social context, but agricultural production holds a particularly vital place.

Our shared task is not only to improve production, but also to strengthen the importance and dignity of agriculture in society. Above all, we must inspire young people to recognize their potential right here, because faculties and universities exist first and foremost for them—the younger generation. They are our future, but also our most important connection to society.

With great joyfulness we thank you for active participation in the Meeting

Prof. Emilija Arsov, PhD
Dean of Faculty of Agriculture
&
Chair of the Organizing Committee

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PLENARY PRESENTATIONS

ANTIMICROBIAL RESISTANCE AS A GLOBAL CHALLENGE WITHIN THE ONE HEALTH FRAMEWORK Iskra Cvetkovikj¹

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Abstract

Antimicrobial resistance (AMR) has emerged as one of the most pressing global health threats, demanding coordinated action across human, animal, and environmental sectors within the One Health framework. The agrifood system plays a central role in shaping resistance dynamics, as antimicrobial use (AMU) in livestock and crop production exerts selective pressure that fosters the development and spread of multidrug-resistant (MDR) bacteria. Key zoonotic pathogens such as ESBL-producing *Escherichia coli*, *Salmonella* spp., and methicillin-resistant *Staphylococcus aureus* circulate along the farm-to-fork transmission route, using food chains and shared environments as efficient pathways for transmission to humans.

Environmental compartments, including soil and aquatic ecosystems, function as reservoirs and mixing zones for the resistome. Within these settings, horizontal gene transfer, mediated by mobile genetic elements, accelerates the dissemination of resistance traits among diverse microbial communities. These interconnected pathways underscore the need for harmonized and integrated multisectoral surveillance capable of capturing emerging trends in both AMU and AMR.

Integrating genomic tools with traditional monitoring systems strengthens early detection of resistance hotspots and supports evidence-based antimicrobial stewardship across sectors. Advancing such collaborative, cross-disciplinary efforts is essential for reducing the ecological load of resistance genes and protecting the effectiveness of existing antimicrobials. Recognizing antimicrobial efficacy as a finite and shared global resource is critical for preserving public health and sustaining resilient food and health systems.

Key words: *antimicrobial use, multisectoral surveillance, multidrug-resistant bacteria.*

GRAPEVINE BREEDING AND ADAPTATION OF VITICULTURE TO CLIMATE CHANGE

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Abstract

Grapevine breeding and viticulture adaptation are the primary long-term responses to climate change, which threatens traditional wine-growing regions with increased heat, drought, and erratic weather. Grapevine breeding strategies are primarily aimed at creating resistant varieties (PIWI) against fungal diseases (downy mildew and powdery mildew) and abiotic stresses (drought, heat and frost), with high quality grapes and wine. For this purpose, by applying hybridization methods, breeders increasingly use wild *Vitis* species (eg *V. amurensis* for cold tolerance or *V. rotundifolia* for disease resistance) as genetic reservoirs for introducing resistant traits into cultivated varieties. In many breeding programs, the revitalization of old autochthonous grapevine varieties is also successfully carried out using the clonal selection method. Among the new techniques used in grapevine breeding are marker-assisted selection (MAS); genetic transformations (cisgenesis and transgenesis); genomic selection (GS); and genome editing (CRISPR/Cas). The adaptation of vineyards to climate change, in addition to selecting more resistant varieties and rootstocks, also includes soil management (grassing between rows, especially in vineyards on slopes); changes in ampelotechnics (increasing vine height; adjusting pruning to reduce yield and achieve a better balance between vegetative growth and yield; proper removal of lateral shoots); introduction of irrigation systems; installation of anti-hail nets and frost protection systems; use of different fertilisers, especially organic fertilisers; monitoring of disease and pest infections; and relocating vineyards to higher altitudes or latitudes. Properly set breeding goals and all the adaptation measures mentioned above are crucial for the sustainable production of grapes and wine under increasingly prevalent climate change conditions.

Key words: *Vitis vinifera* L., breeding, climate change, adaptation.

3D TECHNIQUES OF CELL CULTIVATION IN AGRICULTURE RESEARCH Petr Slama^{1*}

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Abstract

Three-dimensional (3D) cell cultivation techniques are increasingly recognized as powerful tools in agricultural research, particularly in studies involving animal-derived cell systems. Compared to conventional two-dimensional cultures, 3D models better replicate the structural and functional complexity of native tissues, providing more physiologically relevant environments for *in vitro* studies. This conference paper presents an overview of current 3D cultivation approaches applied to animal cells, including scaffold-based systems, spheroids, organoids, and bioprinting technologies. These systems enable improved cell–cell and cell–matrix interactions, supporting more accurate modelling of tissue organization, metabolism, and cellular responses. In the context of agricultural research, 3D animal cell cultures have emerging applications in livestock science, including muscle and adipose tissue modelling, cultured meat development, disease modelling, and evaluation of feed efficiency and toxicity. They also offer valuable platforms for studying host–pathogen interactions and immune responses in a controlled environment, reducing reliance on *in vivo* animal experiments. Overall, 3D animal cell culture technologies hold significant promises for advancing sustainable and ethical agricultural practices, improving animal health, and supporting innovation in food production systems.

Key words: *cell culture, organ-on-chip, mammary gland, mastitis, epithelial cell.*

PANEL DISCUSSIONS

**PANEL DISCUSSION 1
LEADING THE FUTURE OF FOOD SAFETY:
GLOBAL RISK AND FOOD INDUSTRY RESILIENCE IN THE 21ST CENTURY**

PANEL PURPOSE AND BACKGROUND

The need for civilizational and cultural advancement is driven by the habits and quality of food as an existential need of humans and animals. Food quality and safety are the foundation of public health, progress and the survival of life on earth.

Food safety today is more than a technical issue. It is a global strategic priority that affects us all. Rapid climate change, disruptions in supply chains, increasing consumer demands and the increasing interconnectedness of the world's food systems create new, complex and often unpredictable risks. The need for food and its processing is increasing every day, and the standards for its production are becoming stricter, which ultimately means the production of quality, health-safe, controlled and certified food, which meets the needs of the modern consumer. Today, the concept of safe food is developed based on the latest scientific knowledge, but also on ecological principles, which at the same time means economy in production, protection and maintenance of agroecosystems and the environment.

Very often we put food safety in the context of locally produced, healthy, organic and ecological. However, we must be aware that no country in the world can independently provide all the necessary raw materials for the production of the necessary food products. However, each country must have a strategy for meeting the needs of the population for basic food products. The globalization of the market contributes to raising consumer awareness of diversity in food choices, as well as the quality and safety of available food. The development of new technologies, new agricultural and industrial processes in which food is produced, increasingly contribute to food being of high quality, safe, BUT ALSO SUBJECT TO FRAUD AND COUNTERFEIT. Products with different sounding names and labels, with more or less marketing campaigns: "healthy food", "ecological food", "safe food", etc., BUT IS IT REALLY THAT? THEREFORE, International, national and even local institutions have an increasing responsibility towards people and animals when it comes to food quality and safety. Policies, plans, programs and legislation of society turn in detail to the regulation of the food sector and the supervision of this sector. The central place in these activities is occupied by the consumer, who has the right to quality, healthy and safe food, as well as all the necessary information about its composition, the method and the consequences of its use on him and his offspring. Taking into account all that has been stated above, it can be concluded that there are two aspects, no less important for the consumer, and these are **the price of the food product** and **protection against fraud**.

Among food safety risks, antimicrobial resistance stands out as one of the most urgent and complex challenges of our time.

The plenary lecture at this conference set the scientific context clear: antimicrobial resistance is not just a health problem. It is deeply embedded in the way we produce, process and distribute food. Through the One Health approach, science shows us that human health, animal health, plant health and the environment are inextricably linked. There is a common saying among the people: Health enters through the mouth. This is not just an academic thesis, it is a reality that scientists, researchers, veterinarians, food industry technologists, inspectors and managers in the animal food production chain face every day.

The questions before us are not only related to "How big is the food safety risk?", but also "How do we deal with risks in the food production chain?", How does the food industry from the meat and meat products, milk and dairy products sector deal with real problems, can we build systems that are robust enough to withstand future food safety risks, yet flexible enough to adapt to new scientific knowledge and regulatory requirements? How can science more effectively transfer its knowledge to the real sector and regulatory policy? Can regulators create a legal framework that simultaneously protects public health and supports a competitive and innovative food industry?

BOOK OF ABSTRACTS

PANEL DISCUSSIONS

DEAR ALL, IT IS A GREAT PLEASURE TO ANNOUNCE MY PANEL PARTNERS TODAY ON FOOD SAFETY, EACH OF THEM REPRESENTING A RESPONSIBLE PARTY IN THE FOOD PRODUCTION CHAIN AND CONSUMER HEALTH PROTECTION.

This panel discussion is a space for open, critical and constructive conversation between stakeholders in the food safety chain, policymakers and the business sector. The participants in the panel discussion unite stakeholders in the food safety chain and will try to answer the question: Can we build a food sector at the national level that is safe, sustainable and resilient to the challenges of the 21st century? It is a shared responsibility of all of us.

Plenary context	Plenary lecture: Antimicrobial resistance as a global challenge in the "One Health" - Prof. Iskra Cvetkovikj, PhD, Faculty of Veterinary Medicine, Ss. Cyril and Methodius University - Skopje, Republic of North Macedonia
Format	Plenary lecture and moderated Panel discussion with questions from the audience
Auditorium	Scientists, young researchers, representatives from responsible institutions, representatives of the food industry and policy makers
Key goal	Connecting science, policymakers and the business sector through targeted dialogue to address food safety risks and build the capacities of the real sector

PANEL PARTICIPANTS

Prof. Dimitar Nakov, PhD	Panel moderator Faculty of Agriculture, Goce Delcev University, Stip
Mrs. Verce Micevska, MSc., DVM	National Coordinator for Food Safety, Veterinary and Phytosanitary Policy 1. Regulatory policy, Risk assessment, national food control 2. Control mechanisms and stakeholders
Q1	How would you describe the current state of food safety in Macedonia and the national framework for risk assessment in the area of food safety? Do the citizens of Macedonia consume quality and safe food?
Q2	Are food safety policies evidence-based and practically applicable? How coordinated are the relevant ministries, agencies and bodies to implement activities when a food safety incident occurs?
Mrs. Svetlana Kolarikj, DVM	State Food Advisor at the Food and Veterinary Agency 1. International regulatory frameworks, food safety monitoring and One Health policy 2. Alert system
Q1	What is the role of the Food and Veterinary Agency as the government body responsible for monitoring food safety, implementing food safety legislation and generally what challenges do you face?
Q2	Let's talk about the monitoring, inspection and control of food entering Macedonia, further the Agency as part of the rapid food notification and warning system, and whether the Agency is keeping up with the latest scientific achievements when it comes to food safety and innovative solutions in food production?
Mrs. Ivana Grozdanovska	General Manager of the Meat Industry Grozdanovski LLC, Kumanovo 1. Current status of supply chain security, traceability, vulnerability in meat production and meat product processing 2. Industry adaptation and future trends

BOOK OF ABSTRACTS
PANEL DISCUSSIONS

<p>Q1</p>	<p>How do you as a company deal with the challenge of raw material safety for the needs of the meat industry? Here I am primarily thinking of the traceability in the meat supply chain and additives used in the production process of final meat products and which are the most challenging critical points, including the presence of antibiotics?</p>
<p>Q2</p>	<p>Looking ahead, what adjustments will you have to make within your company to increase your level of resilience to future threats to the safety of meat and meat products?</p>
<p>Mr. Krste Gjorgiev</p>	<p>General Manager of Gjorgievi Dairy and Bestfood LLC, Radovis 1. Current status of supply chain security, traceability, vulnerability in milk production and dairy product processing Industry adaptation and future trends</p>
<p>Q1</p>	<p>What is most important in the supply chain of safe raw milk for the needs of the dairy industry? How does the dairy industry integrate sustainable production practices without compromising the safety and quality standards of dairy products, including antimicrobial resistance?</p>
<p>Q2</p>	<p>How is the dairy industry responding to regulatory and consumer pressure to reduce antibiotic use, especially in dairy animals? In that context, what adjustments will you need to make within your company to increase your resilience to future threats to the safety of milk and dairy products?</p>

**PANEL DISCUSSION 2
CLIMATE CHANGE AND THE FUTURE OF VITICULTURE:
CHALLENGES, INNOVATIONS, AND SUSTAINABLE SOLUTIONS**

PANEL PURPOSE AND BACKGROUND

The viticulture sector is an important economic sector that is primarily export-oriented through the export of wine and table grapes. It contributes about 15% to the gross domestic product. According to the Strategy for the Development of Viticulture and Winemaking (2023-2033), and statistical data:

- The sector includes 21,400 family agricultural households with an average of less than 1 ha and 163 registered wineries with a total capacity of 170 million liters;
- 90% of the plantations are located between 150 and 350 m above sea level;
- Only 30% of the areas are under irrigation systems;
- It accounts for 3% of the total arable agricultural area;
- 70%-18,000 ha of wine and 3,500 ha of table wine (30%);
- Age structure – 80% are over 15 years old;
- Assortment structure – according to the variety list: 81 wine varieties and 20 table varieties;
- Wine varieties: recommended and allowed.

Official data about areas and grape production

Year	ha	kg/ha	thousand tons
1991	33,000	13,700	
2021	23,968	11,300	116,606
2022	23,074	11,522	93,000
2023	21,972	6,782	70,000
2024	21,534	9,546	100,000
2025	21,400		110,000

The sector is quite vulnerable to the impact of climate change, which is manifested primarily through unstable yields and variability in grape quality from year to year.

Climate change:

- Increasing air temperature
- Increasing the intensity of sunlight radiation
- Occurrence of extreme temporal conditions (thermal waves)
- Precipitation deficit during the growing season period and uneven distribution throughout the year
- Onset of drought
- Reduced occurrence of late spring frosts and low winter temperatures (last 5-6 years).

Impact of climate change:

- Earlier beginning of vegetation (phenophase: opening of the eyes and budding)
- Earlier beginning of the harvest and shortening of the growing season period
- Compression of harvest dates between different varieties
- Reduction in the quantity and quality of grapes

**BOOK OF ABSTRACTS
PANEL DISCUSSIONS**

DEAR ALL, IT IS MY HONOR AND PLEASURE TO MODERATE THIS PANEL, AND AT THE SAME TIME, I WOULD LIKE TO THANK ALL THE PANELISTS WHO WILL CONTRIBUTE FROM A SCIENTIFIC PERSPECTIVE AND SHARE THEIR EXPERIENCES FROM PRACTICE.

This panel discussion is a space for open, critical and constructive conversation between stakeholders in the viticulture and wine sector. The participants in the panel discussion will try to answer the question: Can we build a viticulture sector at the national level that is resilient, innovative and sustainable in the face of climate change? It is a shared responsibility of all of us.

Plenary context	Plenary lecture: Grapevine breeding and adaptation of viticulture to climate change - Prof. Dragan Nikolic, PhD, Faculty of Agriculture, University of Belgrade, Serbia
Format	Plenary lecture and moderated Panel discussion with questions from the audience
Auditorium	Scientists, young researchers, agronomists, oenologists, representatives of the wine industry and policy makers
Key goal	Connecting science, industry and practice through targeted dialogue to address the challenges of climate change in viticulture and build sector resilience

PANEL PARTICIPANTS

Prof. Violeta Dimovska, PhD	Panel moderator Faculty of Agriculture, Goce Delcev University, Stip
Riste Gjorgiev, MSc.	Specialist Agronomist in Vineyard Management, VV Tikvesh; PhD student at the Faculty of Viticulture Vineyard management, climate adaptation, production challenges, integrated approach
Q1	As a young agronomist with extensive experience in vineyard management in the Tikvesh Vineyard, dealing with large areas of around 850 ha – what challenges do you face in grape production as a result of climate change and what solutions do you take or propose in order to maintain or increase production and improve grape quality? Does a unilateral approach (one measure) or an integrated approach (multiple measures) yield better results?
Q2	Do you think that existing varieties are being degraded (changes in genetic potential) as a result of climate change, and when renewing vineyard plantations or establishing new plantations, do you think that new varieties and rootstocks resistant or adaptable to climate change should be introduced?
Aleksandar Klincharov, MSc.	Association of Macedonian Family Wineries Digital technologies, climate risk prediction, small wineries, innovation and adaptation
Q1	How can the application of digital technologies (soil sensors, satellite tracking, artificial intelligence) help small wineries predict climate risks, and can small wineries afford the application of digital technologies to survive?
Q2	Will climate change force small wineries to abandon traditional varieties and switch to varieties more resistant to drought and extreme temperatures, or should they focus on traditional varieties by applying new production methods and technologies adapted to changing conditions?

**BOOK OF ABSTRACTS
PANEL DISCUSSIONS**

<p>Prof. Violeta Ivanova Petropoulos, PhD</p>	<p>Faculty of Agriculture, UGD Impact of climate change on grape composition, sugars, acids, aromas, anthocyanins, and overall wine quality; oenological strategies</p>
<p>Q1</p>	<p>What is the impact of climate change on sugars, acids, aromas and anthocyanins in grapes, and how do these changes affect the overall wine quality?</p>
<p>Q2</p>	<p>What chemical changes occur during vinification and what oenological strategies and new technologies should oenologists apply to preserve the character and quality of wine?</p>
<p>Prof. Darko Dimitrovski, PhD</p>	<p>Faculty of Technology and Metallurgy, UKIM Climate change and microbiology in wine; microbial communities, fermentation, nutrient cycling, wine style and quality</p>
<p>Q1</p>	<p>How does climate change affect microbiology in wine? Climate change can significantly influence microbial communities and their interactions with the environment. Microorganisms play a key role in various ecological processes, including nutrient cycling, decomposition and symbiotic relations. Changes in environmental conditions caused by climate change can directly and indirectly affect microbial populations, diversity and activity.</p>
<p>Q2</p>	<p>What practical advice would you give to wine producers to manage the impact of climate change on the style of wine? (Including new products with different nutrient content that also affect fermentation and the final quality of wine, and a brief mention of vine protection products.)</p>

PLANT SCEINCES

EFFECT OF NUT WEIGHT ON KERNEL PERCENTAGE AND YIELD IN *Corylus avellana* L. cv. Ennis IN THE POLLOG REGION Alirami Saliji^{1*}, Zejnedije Ademi¹, Bardhyl Limani¹, Hirijete Idrizi¹, Bardha Ibishi¹

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Abstract

This study evaluates the relationships among nut weight, kernel percentage, and yield in the hazelnut cultivar Ennis (*Corylus avellana* L.) under conditions in the Pollog Region, North Macedonia. The experimental material comprised 180 nuts, divided into six groups by weight, with measurements conducted in three replications. The analysis was based on descriptive statistics, Pearson correlation, and linear regression.

The results showed a consistent increase in kernel percentage (47.06–49.73%) and yield (2.43–3.42 t/ha) with increasing nut weight (1.4–3.7 g). A very strong positive correlation was observed between nut weight and kernel percentage ($r = 0.994$, $p < 0.01$), as well as between nut weight and yield ($r = 0.938$, $p < 0.01$). Regression models indicated that each increase of 1 g in nut weight increases the kernel percentage by 1.239% and yield by 0.423 t/ha.

In conclusion, nut weight is an important indicator of hazelnut productivity. Selection for larger nuts represents an effective strategy for increasing kernel percentage and yield in commercial hazelnut cultivation.

Key words: hazelnut, *Corylus avellana*, Ennis cultivar, yield, correlation, linear regression, productivity.

PRECISION VITICULTURE PRACTICES FOR ADAPTATION TO CLIMATE CHANGE AND MAINTAINING GRAPE PRODUCTION AND QUALITY Riste Gjorgjiev^{1*}

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Abstract

Precision viticulture represents a modern approach to managing agricultural production, enabling optimal use of resources and improving product quality. This paper examines modern precision agriculture tools and their application in viticulture, including Global Navigation Satellite Systems (GNSS), unmanned aerial vehicles (drones), soil moisture sensors, vine water stress monitoring, decision support tools for irrigation, and tools for determining optimal harvest timing. These technologies enable the detection of variability in soil and vine vigor, precise irrigation, targeted application of fertilizers and pesticides, and improvement of uniformity, phenolic maturity, and aroma potential of grapes. The conclusions show that the integration of these technologies, along with a systematic approach in vineyard management, significantly enhances the efficiency, sustainability, and quality of Vranec grape production.

Key words: *Vranec, precision viticulture, water stress, digital tools, sensors.*

EFFECT OF BIOLOGICAL SEED TREATMENTS ON SEED ASSOCIATED MYCOBIOTA AND GERMINATION Slobodan Vlajić^{1*}, Emil Rekanović², Ana Vlajić³, Vukašin Popović¹

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Abstract

High-quality seed is a key prerequisite for sustainable crop production. In addition to ensuring successful crop establishment, seeds may serve as an important pathway for the dissemination of plant pathogens over long distances, both between countries and within production areas of a single country. Therefore, the use of pathogen-free seed is of major importance for reliable and sustainable crop production. The aim of this study was to evaluate the effects of seed treatments on seed-associated mycobiota and seed germination. The study included seeds of bean, pepper, tobacco, cabbage and tomato. The following treatments were applied: 0.2% (v/v) Ekstrasol® (*Bacillus subtilis*); 0.02% (v/v) Organiko® (solution containing humic, fulvic acids, and micronutrients); a combination of Ekstrasol® + Organiko®; 0.02% (v/v) sodium hypochlorite (NaOCl), and an untreated control (sterile distilled water). Seeds were immersed in the respective solutions for 30 min and subsequently placed in Petri dishes in three replicates of 100 seeds each. Treatment effects were assessed by recording the number of infected seeds associated with fungi of the genera *Fusarium*, *Rhizopus*, *Aspergillus*, and *Penicillium*, as well as by determining seed germination according to the ISTA protocol based on the number of normal seedlings. Seed treatments had a favorable effect on germination, which was generally maintained or improved compared with the control, particularly in the Ekstrasol® + Organiko® treatment. The highest germination rates were recorded in tomato (93%), tobacco (92%), and cabbage (82%), accompanied by a simultaneous reduction in fungal incidence. The most pronounced treatment effect on seed-associated mycobiota was observed in tomato and cabbage, especially in the Ekstrasol® + Organiko® treatment, where the incidence of *Fusarium*, *Rhizopus*, and *Aspergillus* was reduced in tomato, while *Fusarium*, *Aspergillus* and *Penicillium* were reduced in cabbage, compared with the untreated control. The tested treatments show potential for improving seed health, preserving or enhancing seed germination, and supporting the development of more sustainable approaches in crop production.

Key words: *seed treatment; seed-associated mycobiota; seed-borne pathogens; germination.*

Acknowledgement: This research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, grant number: 451-03-33/2026-03/200032 and 451-03-33/2026-03/200214

BIOMASS FROM VINEYARD OBTAINED BY WINTER PRUNING Violeta Dimovska^{1*},
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Abstract

During vineyard management, an essential agrotechnical practice is winter pruning. It is carried out once a year with the aim of maintaining the training system and keeping yields at an optimal level, resulting in the production of a large amount of plant biomass in the form of pruning residues. The obtained biomass represents a burden and makes movement through the vineyard more difficult, but on the other hand, it is also a significant source of energy. Biomass energy can be transformed in several ways or returned to the vineyard through mulching. In vineyards in our country, the most common practice is to collect and burn the biomass obtained from pruning within the vineyard itself, while mulching and returning it to the vineyard is less common. In this way, large quantities of biomass are lost both in terms of energy value and as an important source of thermal energy. Our research included 17 varieties, of which 12 were wine grape varieties (red and white) and 5 were table grape varieties, cultivated at two vineyard locations (Lepovo and Dolni Disan). The results of our research showed that the biomass obtained from grapevine pruning depends on the variety, the age of the vineyard, and the growing conditions. In the vineyards at the Lepovo vine locality, it ranges from 890 kg/ha for the Petit Verdot variety to 2,087 kg/ha for the Gewurztraminer variety, and from 1,176 kg/ha for the Smederevka and Muscat de Hambourg varieties to 2,789 kg/ha for the Cardinal variety at the Dolni Disan vine locality.

Key words: *grapevine, variety, biomass.*

EVALUATION OF GRAIN YIELD AND QUALITY TRAITS IN ADVANCED WINTER COMMON WHEAT LINES Zlatina Uhr¹, Violeta Bozhanova², Evgeniy Dimitrov¹, Teodora Angelova¹, Boryana Hadzhiivanova²

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Abstract

Improving grain quality is a major objective in wheat breeding programs, particularly under climate change. Effective quality testing is essential for the recent release of new varieties, which must have consistent end-use quality in addition to high grain yield. In this regard, 22 advanced breeding lines from the winter common wheat breeding program of IPGR – Sadovo, Bulgaria, were studied for grain yield and several important quality traits during three growing seasons (2019–2021).

The majority of the lines (14) were obtained via interspecific hybridization, while the remaining eight lines were derived from inter-varietal hybridization. All lines were grown in a comparative field trial using the block method in four replications and compared with two standard wheat varieties: Sadovo 1 and Enola. The following groups of quality traits were investigated: physical characteristics, grain quality, rheological properties of flour, and baking parameters.

The results were processed statistically via analysis of variance (ANOVA), correlation analysis, and PCA. The analysis of variance reveals that genotype and environment have a statistically significant influence on the variation of grain yield and most of the quality traits studied.

Based on the coefficients of variation (CV %), the most stable quality parameters and the most stable genotypes for each trait were determined.

The breeding lines MX 268/1008, MX 270-28, MX 270-27, MX 270-86, and D-611-4 are distinguished by very good, stable quality traits and high yield. Their rheological properties classify them as suitable filler wheats, making them promising candidates for future breeding and variety development.

Key words: *common wheat, interspecific hybridization, advanced breeding lines, quality parameters, yield.*

RESISTANCE MANAGEMENT STRATEGIES FOR THE COLORADO POTATO BEETLE (*Leptinotarsa decemlineata*) IN POTATO PRODUCTION Biljana Kovacevik^{1*}, Sasa Mitrev¹, Emilija Arsov¹, Dusan Spasov¹, Biljana Atanasova¹, Marija Taskova Kukutanov¹, Natalija Markova Ruzdik¹

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Abstract

The colorado potato beetle (*Leptinotarsa decemlineata*) is one of the most destructive pest of potato crops, known for its remarkable ability to rapidly develop resistance to insecticides, particularly neonicotinoids such as acetamiprid. This paper focuses on resistance management strategies through an integrated approach that combines chemical and non-chemical control measures. Special emphasis is given on the rotation of insecticides with different modes of action (IRAC groups) in order to reduce selection pressure on pest populations. Recommended rotation programs include active substances from IRAC 1B, IRAC 3A, IRAC 4, IRAC 5, IRAC 6 and IRAC 28 code, such as lambda-cyhalothrin, emamectin benzoate, chlorantraniliprole, cyantraniliprole and spinosad. Furthermore, control efficacy is significantly improved when treatments are applied during early larval stages (I-II), when the insects are most susceptible. Integrated pest management (IPM), including mechanical control, crop rotation, biological agents such as *Bacillus thuringiensis*, and regular population monitoring, plays a key role in sustainable pest control. Adherence to recommended application rates and treatment only when the economic threshold is exceeded further reduces the risk of resistance development. Combining these strategies ensures effective and long-term control of the colorado potato beetle, while minimizing environmental impact and preserving insecticide efficacy.

Key words: colorado potato beetle, *Leptinotarsa decemlineata*, insecticide resistance, resistance management, IRAC groups, integrated pest management (IPM), acetamiprid, crop protection, potato production.

EVALUATION OF OOMYCETE-TARGETED FUNGICIDES FOR CONTROLLING DOWNY MILDEW IN VEGETABLE CROPS Biljana Kovacevik^{1*}, Sasa Mitrev¹, Emilija Arsov¹, Dusan Spasov¹, Biljana Atanasova¹, Marija Taskova Kukutanov¹, Natalija Markova Ruzdik¹

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Abstract

Currently, 56 distinct fungicide modes of action are recognized and classified by the Fungicide Resistance Action Committee (FRAC), including compounds with unknown mechanisms. This diversity supports effective resistance management. However, the availability of fungicides is often limited by regional registration and economic factors, restricting their use in certain crops. Consequently, key crop–pathogen systems may have few control options. Furthermore, many fungicides exhibit a narrow spectrum of activity, with a large proportion targeting specific pathogen groups such as oomycetes or even single species. Oomycetes are phylogenetically distinct from true fungi such as phytopathogenic Deuteromycetes, Ascomycetes, and Basidiomycetes, exhibiting significant biological and biochemical differences that influence their sensitivity to fungicidal compounds. These pathogens are responsible for severe diseases in economically important crops, causing substantial yield and quality losses. In this study, the efficacy of oomycete-targeted fungicides against downy mildew are evaluated, with emphasis on compounds from diverse modes of action (MoA) such as antitubulin agents affecting microtubule assembly, compounds interfering with cytoskeleton-associated proteins, carboxylic acid amides (CAAs) targeting cell wall biosynthesis, and novel inhibitors of oxysterol-binding proteins. Field and controlled environment assessments demonstrated that fungicides with specific activity against oomycetes provide effective disease suppression, especially when applied preventively or during early stages of infection. Variability in efficacy among MoA groups highlights the importance of strategic selection and rotation of fungicides to delay resistance development. The integration of these target fungicides within an integrated disease management framework is essential for sustainable control of downy mildew in crop production systems.

Key words: *oomycetes, downy mildew, fungicides, mode of action, carboxylic acid amides, oxysterol-binding protein inhibitors, disease management, resistance management.*

ASSESSMENT OF MORPHOLOGICAL VARIABILITY IN DIFFERENT DRIED PEPPER GENOTYPES Daniela Todevska^{1*}, Natalija Atanasova-Pancevska², Pece Sherovski³, Biljana Kovacevik¹, Natalija Markova Ruzdik¹, Mite Ilievski¹

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Abstract

Morphological analysis of pepper fruits (*Capsicum annuum* L.) represents a valuable source of information on phenotypic traits of genotypes, which constitute important genetic resources for adaptation. This study evaluated key morphological characteristics in 10 local and domesticated varieties of dried pepper, including fruit length, fruit width, fruit index, peduncle length, and calyx length. The morphological characterization revealed significant phenotypic variability among the analysed fruits, allowing classification into two main groups. The first group comprised long pepper types, with fruit lengths ranging from 15 to 17.5 cm, widths from 1.6 to 3 cm, and a fruit index between 5.1 and 10.6. Capsaicin was absent in two varieties, while four exhibited its presence. The second group included medium-length peppers, with fruit lengths ranging from 5 to 10 cm, widths from 1.5 to 3.5 cm, and a fruit index between 1.43 and 3.3. The shortest peduncle length (2 cm) was observed in a sweet medium-length variety, while the longest (4.5 cm) was recorded in the “bukovka” type. These findings highlight the dual agronomic and nutritional value of traditional pepper varieties and emphasize the importance of conserving and utilizing local germ plasma as a sustainable approach for improving productivity, nutritional quality, and resilience across diverse cultivation systems.

Key words: *pepper (Capsicum annuum L.), morphological analysis, fruit lengths, fruit widths, fruit index.*

IMPACT OF WEED FLORA ON APHID AND THIRPS OCCURRENCE IN PEPPER (*Capsicum annuum* L.) IN THE STRUMICA REGION Dusan Spasov¹, Dragica Spasova¹, Sasa Mitrev¹, Emilija Arsov¹, Biljana Atanasova^{1*}, Biljana Kovacevik¹, Mite Ilievski¹

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Abstract

This study was conducted during 2024 and 2025 in pepper fields, at two localities in the Strumica region (Kuklish and Borievo) to determine weed species composition, their density, and their role as reservoirs of aphids and thrips.

A total of ten weed species belonging to nine botanical families were identified in Kuklish and eight species in Borievo, in and around pepper fields. The most dominant species in both localities in 2024 were *Galinsoga parviflora*, *Chenopodium album*, and *Amaranthus retroflexus*. In 2025, the dominant species in Kuklish were *G. parviflora*, *C. album*, and *Cyperus rotundus*, while in Borievo they were *G. parviflora*, *C. album*, and *Capsella bursa-pastoris*.

Weed density was higher in Kuklish compared to Borievo, reaching 81.6 and 62 plants/m² in 2024, and 83.4 and 70.8 plants/m² in 2025, respectively.

Aphids and thrips were recorded on both weeds and pepper plants. The number of infected pepper plants varied during the growing season. In both years, infestation by aphids and thrips was higher in Kuklish than in Borievo. In both years and at both locations, thrips were more abundant than aphids.

The results indicate a strong relationship between weed presence and pest occurrence, suggesting that weeds act as reservoirs for aphids and thrips. Effective weed management should therefore be considered an essential component of pest management strategies in pepper production.

Key words: weeds, *Galinsoga parviflora*, *Chenopodium album*, pepper, aphids, thrips, weed density.

INTEGRATIVE STATISTICAL APPROACHES TO EVALUATE FUNGICIDE EFFICACY AGAINST BOTRYTIS CINEREA IN THE WHITE GRAPE VARIETY GRENACHE BLANC
Gligor Bojkov¹, Emilia Arsov¹, Sasa Mitrev¹

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Abstract

The present study evaluated the effectiveness of different fungicidal treatments against *Botrytis cinerea* in *Vitis vinifera* cv. *Grenache blanc* using agro-climatic data were obtained from the ERA5-Ag reanalysis dataset, providing high-resolution, bias-corrected meteorological variables. Bunches wetness duration was used as a key predictor of infection. Three treatments were tested: control (untreated variant), the synthetic fungicide combination fludioxonil + cyprodinil, and the biological formulation *Bacillus amyloliquefaciens*. Disease occurrence were analyzed using multiple regression approaches. Results showed that disease risk was most strongly associated with the untreated control ($r = 0.894$), followed by *Bacillus amyloliquefaciens* ($r = 0.831$) and Fludioxonil + Cyprodinil ($r = 0.725$). Multiple regression analysis explained 92.2% of disease variability ($R^2 = 0.922$, $p < 0.001$). The findings indicate that fungicide treatments disrupt the natural progression of disease, with Fludioxonil + Cyprodinil showing the highest efficacy. Environmental conditions remained a dominant driver of infection, highlighting the importance of integrating climate-based risk models into disease management strategies.

Key words: *agro-climatic data, ERA5-Ag, fludioxonil + cyprodinil, Bacillus amyloliquefaciens.*

THE EFFECT OF PLANT GROWTH REGULATORS ON *IN VITRO* CUCUMBER (*Cucumis sativus* L.) REGENERATION Izabela Andonova¹, Fidanka Trajkova^{1*}, Liljana Koleva Gudeva¹

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Abstract

The main objective of this study was to establish a culture of apical buds, hypocotyls and cotyledons from cucumber (*Cucumis sativus* L.) to determine their efficiency for regeneration into a whole plant. The genotypes SV0091 and Nomia F1 were used as source for apical buds, hypocotyls and cotyledons as starting explants. The starting explants from both genotypes were cultured on MS medium enriched with different combinations and concentrations of plant growth regulators: MS1 (MS+0.1 mg/l IBA+0.5 mg/l IAA+3.0 mg/l KIN), MS2 (MS+0.5 mg/l IAA+3.0 mg/l BAP), (MS + 0,1 mg/l IBA + 1,5 mg/l BAP + 0,5 mg/l KIN) and MS4 (MS + 0,1 mg/l NAA + 1,0 mg/l BAP). The cultures were grown in a climate chamber under controlled conditions at a temperature of 25 °C and a photoperiod of 16 hours light and 8 hours dark. The *de novo* plants and shoots in different percentages were obtained from apical buds grown on MS1, MS3 and MS4 media from both genotypes. The hypocotyls and cotyledon segments responded mostly with roots and callus on MS1, MS3 and MS4 media. The MS2 medium proved unsuccessful for micropropagation from all initial explants from both genotypes. After 60-70 days, *de novo* plants and well-rooted shoots were transferred to plastic pots filled with sterilized peat mixed with perlite and they were put through acclimatization process.

Key words: *genotypes, MS medium, phytohormones, de novo plants, shoots, roots, callus.*

ROLE OF FOREST WINDBREAK SYSTEMS ON AGRICULTURAL PRODUCTION IN OVCHE POLE REGION Jordanco Dimitriev^{1,2*}, Ljupco Mihajlov², Natalija Markova Ruzdik², Fidanka Trajkova²

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Abstract

The subject and primary objective of this study is to analyze the role of windbreaks in the protection of soil resources, the stabilization of agricultural production, and the improvement of microclimatic conditions. In this context, the agroecological effects of windbreaks on agricultural production in the Ovche Pole region are systematically examined. The research was conducted within a defined section of the Ovche Pole valley, located in the Municipality of Sveti Nikole with coordinates ranging from 21°92'27" to 21°92'81" East Longitude and from 41°87'18" to 41°88'44" North Latitude, where predominantly unfavorable agroecological conditions prevail. Data collection and analysis were carried out through precise geospatial positioning of the windbreak belts, combined with field observations and measurements using GPS devices, as well as the assessment of orthometric characteristics of the terrain. The results obtained during the 2023–2024 research period are synthesized and presented in the form of a SWOT analysis. The findings indicate a predominance of strengths and opportunities, alongside fewer identified weaknesses and a limited number of threats, highlighting the significant benefits associated with the existence, proper management, and maintenance of windbreak systems in the Ovche Pole region.

The general conclusions emphasize the substantial importance and implications of windbreak belts for agricultural production. Furthermore, the study proposes the selection of suitable forest and fruit tree species capable of ensuring the full multifunctional role of windbreaks within the Ovche Pole agroecosystem. Accordingly, their revitalization and sustainable management are strongly recommended.

Key words: *Ovche Pole, windbreaks, soil protection, agroecology, sustainable management, crop production.*

ORGAN SPECIFIC WILD YEAST POPULATIONS ON CEREAL CROPS IN NORTH MACEDONIA – VARIANCE AND CORRELATION Nikola Radmanovik¹, Sofija Kostandinovska¹, Natalija Atanasova - Pancevska¹

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Abstract

Wild Yeasts are widely considered to be ubiquitous members of plant-associated microbial communities; with the consensus that their population dynamics are regio-specific and host dependent. However, despite Wild Yeasts being present in every segment of the plant host, the literature favours exploring those present in the flowering and fruiting parts. In order to explore the relationship of Wild Yeast populations and the previously cited factors of variance, we sampled Cereal crops, including Triticale, Hordeum and Avena samples, across 18 sampling points in North Macedonia, including from the southwest (600m altitude), the east (1100m altitude) and the Skopje valley (250m altitude). We proceeded to analyse the viable count of wild yeasts using decimal dilutions prepared from the root, stem, leaf and flowering portions of each sample. The analyses were carried out in triplicate, for ANOVA and Pearson correlation. We looked for statistically significant differences between regions, crop types, agricultural activity (maintained cultivar or unkempt migrated subpopulation) and organs. The data showed no statistically significant differences in cultivable wild yeast populations between regions, nor between different crop types and agricultural status. However, the data did show that Wild Yeast populations differ significantly ($p < 0.0005$) between organs in the case of all evaluated samples. Furthermore, the organo-specific Wild Yeasts populations did not show strong linear correlation amongst each other, pointing towards an even more fascinating field of exploration. The ecological interactions behind these observations merit further study and may point towards substrate specific microbe-tissue interactions as the key factor in Wild Yeasts Population dynamics.

Key words: *wild yeasts, cereal crops, microbial ecology, population dynamics.*

FOOD SCIENCE AND NUTRITION

SEASONAL VARIATIONS IN THE PHYSICO-CHEMICAL QUALITY OF WELL WATER IN THE PROBISTIP AND KOCANI REGION Ankica Anastasova^{1*}, Dimitar Nakov¹, Elena Tortevska Danilov², Aleksandra Angjeleska³, Aco Kuzelov¹, Fidanka Ilieva¹

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Abstract

Groundwater quality is influenced by multiple factors, including recharge water composition, atmospheric precipitation, surface water interactions, and subsurface geochemical processes. This study aimed to assess seasonal physicochemical variations in well water quality and evaluate the effect of disinfection with peracetic acid (PAA). Water samples were collected from three wells in the Probistip region and two wells in the Kocani region. Sampling was conducted twice per season across all four seasons, both before and after PAA disinfection. Nine physicochemical parameters were analyzed: electrical conductivity (EC), pH, color, KMnO₄ consumption, NH₄, NO₂, NO₃, Fe, and Cl. Results were compared against control water quality and national legislative standards. A General Linear Model (GLM) with repeated measures was applied to assess the influence of risk factors on water quality. Physical parameters consistently fell within maximum permissible limits. Most chemical parameters were also within acceptable ranges, with the exception of NO₃ levels, which served as an indicator of organic matter oxidation. Regression analysis revealed that season and disinfection significantly affected physicochemical quality. PAA disinfection had a statistically significant effect on physical water quality ($p < 0.05$), but did not significantly alter the chemical composition of the water. These findings suggest that systematic monitoring combined with regression analysis offers a practical and efficient approach for ongoing well water quality assessment.

Key words: *physico-chemical parameters, seasonal variations, well water quality.*

ANALYSIS OF ORGANIC MOLECULES AND PHYSICOCHEMICAL PARAMETERS AS INDICATORS OF AUTHENTICITY AND QUALITY OF FLOWER HONEY SAMPLES Ariona Lubishtani¹, Blerona Gavazi¹, Miribane Dërmaku-Sopjani¹, Arleta Rifati-Nixha^{1*}

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Abstract

Flower honey is a natural product derived from the nectar of flowering plants. Its composition, aroma, color, and flavor are directly influenced by the botanical sources visited by bees, which makes it a unique reflection of local biodiversity and seasonal change.

Measuring honey quality is important to confirm its authenticity, ensure safety, and maintain its nutritional value, which helps protect consumer health.

The aim of this paper is to compare changes in the quality analysis based on parameters such as moisture content, the determination of hydroxymethylfurfural (HMF) and sugars through chromatography in three samples, from the region of Kosovo, Turkey and Croatia.

Moisture content is one of the most important quality parameters in honey. High moisture can lead to fermentation, affecting the taste, aroma, shelf life, and marketability of honey. We have used refractometer to measure the refractive index of honey.

HMF is a key indicator of honey freshness, heat exposure, and quality deterioration. For the determination of HMF we have prepared honey solutions, then we added solutions Carrez I and Carrez II. We treated filtrate with barbituric acid solution and p-tuloidine. We performed measurement with UV-Vis spectrophotometer.

To separate and identify sugars present in a honey sample using Thin-Layer Chromatography we used honey solution, water:butanol:acetic acid as eluent in a 1:4:1 ratio and iodine chambers for visualizing spots on chromatographic plates. Our results align with standard norms, demonstrating good quality and reliability of honey.

Key words: *flower honey, moisture content, HMF, chromatography, spectrophotometer, refractometer.*

CHANGES OF ANTIOXIDANT POTENTIAL OF COLD-PRESSED EDIBLE OILS FROM SUNFLOWER AND SESAME DURING STORAGE Borjanka Veselinova¹, Sanja Kostadinović Veličkowska², Sasa Mitrev²

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Abstract

Cold pressed edible oil consumption has risen worldwide due to its health benefits over the refined oils. However, these oils have a tendency to be oxidized by temperature, light and oxygen resulting in unpleasantness and formation of toxic materials. The main object of our study was the changes of antioxidant activity of sunflower and sesame oil after 2 months storage in dark glass bottles. The antioxidant activity was determined by measuring the inhibition of conjugated diene hydroperoxides arising from linolenic acid oxidation. For the DPPH assay, the antioxidant activities of the oils were expressed as percentage of decolorization of a solution of the stable radical DPPH (2,2-diphenyl-1-picrylhydrazyl radical) at 517nm. The Trolox equivalent antioxidant assay (TEAC) employed in this study gives a measure of the antioxidant activity of methanol extracts against ABTS (2,20-azino-bis(3-ethylbenzothiazole-6-sulphonic acid radical). The oxidation of sunflower oil was the most evident by application of DPPH radical assay. The antioxidant potential of sunflower oil was decreased by more than four times while antioxidant potential of sesame seed oil was almost half which can be lined to decreased activity of vitamin-E-active compounds. Hb assay in human blood indicated higher instability of sesame seed oil and the same tendency was noticed for TEAC assay. From the results presented in this work we can conclude that DPPH assay is strongly dependent on the amounts of tocopherols, while TEAC assay is more dependent to polyphenols and lignans which are dominant in cold-pressed sesame seed oil.

Key words: *cold -pressed sunflower oil, cold -pressed sesame oil, antioxidant potential, DPPH, TEAC, haemoglobin assay, effect of storage time.*

QUALITY EVALUATION OF COLD-PRESSED EDIBLE OIL FROM PEANUT PRODUCED FROM MACEDONIAN "VIRGINIA" VARIETY Borjanka Veselinova^{1*}, Sanja Kostadinović Veličkovska², Sasa Mitrev²

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Abstract

The conventional processing of peanuts in the food industry involves mechanical pressing during which the temperature does not surpass 40-°C. This process yields cold-pressed peanut oil and low-value peanut cake. Peanut seeds are a good source of protein, lipids and fatty acids. Peanut seeds contain 45–50% oil. The physicochemical characterization and quality of cold pressed peanut edible oil from the "Virginia" variety, organically produced from the region of Macedonia, were examined in this work for the first time. The fatty acid composition of the oil showed almost equal levels of oleic and linoleic acids with an abundance of 34.19±0.01 and 36.13±0.01%, respectively. The most dominant saturated fatty acid was palmitic acid with a level of 10.06±0.00%. The level of tocopherols and other vitamin-E-related compounds was in strong agreement with the antioxidant activity of the oils measured by the DPPH assay. Almost equal amounts of α and γ tocopherols indicated an antioxidant potential of 288.63±59.78 mg/L α -tocopherol. Phytosterols, as minor compounds present in the oils, can be additional antioxidants responsible for the health benefits of this oil in human nutrition. The four major phytosterols were β -sitosterol (1812.21±22.17 mg/kg oil), campesterol (320.55±17.07 mg/kg oil), Δ 5-avenasterol (236.16±14.18 mg/kg) and stigmasterol (133.12±12.51 mg/kg oil). Induction time, Peroxide number, FFA and specific extinction (K232 and K270, values 1.82 and 0.22) gave us an indication of the oxidative stability of cold pressed peanut oil.

Key words: cold -pressed peanut oil, β -sitosterol, α -tocopherol, Induction time, Peroxide number, FFA and specific extinction.

ISOLATION OF ANTHOCYANINS BY HIGH-SPEED COUNTERCURRENT CHROMATOGRAPHY AND APPLICATION OF COLOR ACTIVITY CONCEPT TO DIFFERENT RED GRAPE POMACES Dejan Pljevljakusić^{1*}, Sanja Kostadinović Veličkovska²

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Abstract

Anthocyanins are natural pigments responsible for orange, pink, red, violet and blue colours in the flowers and fruits of many plants which are used as colorants in food and beverages industry. Anthocyanins (of the Greek anthos=flower and kyanos=blue) are under huge investigation due to the growing interest of substitution of the potential cancerogenic synthetic colors which are still used in food industry. Anthocyanins of grape pomace from three varieties "Pinot noir", "Merlot" and "Vranec" were isolated by high-speed counter current chromatography. After purification of the fractions by means of preparative high performance liquid chromatography the structures of isolated pigments were elucidated by electrospray ionization multiple mass spectrometry (ESI-MSn) and nuclear magnetic resonance (NMR) spectroscopy. The major anthocyanin malvidin-3-glucoside and the minor pigments delphinidin-3-glucoside, cyanidin-3-glucoside, petunidin-3-glucoside, and malvidin-3-p-coumaroyl-glucoside were isolated. NMR structure elucidation confirmed the most abundant anthocyanins responsible for the color of the grape pomace. Furthermore, the color activity concept of isolated anthocyanins was performed for investigation of particular contribution of isolated pigments to the color of three different varieties of grape pomace. The "Color activity concept" was applied and visual detection thresholds of isolated anthocyanins were determined. The results of the "color activity value" of the isolated pigments and their detection thresholds were in good agreement with the color shade of the different varieties of red grape pomace.

Key words: *grape pomace, HS-CCC, anthocyanins, HPLC-MS, NMR, colour activity concept.*

RESVERATROL IN WINES – POTENT ANTIOXIDANT RESPONSIBLE FOR “FRENCH PARADOX” Dejan Pljevljakusić^{1*}, Sanja Kostadinović Veličkowska²

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Abstract

Stilbenes belong to the non-flavonoid class of wine phenolic compounds and resveratrol is the major stilbene present in grapes and wines. Resveratrol occurs in two isomeric forms, the trans- and cis-configured isomers. Trans-resveratrol or trans-3,5,40-trihydroxystilbene is the most abundant form being mainly located in grape skins. Glucoconjugated forms of *trans*- and *cis*-resveratrol are known as piceids. Generally, stilbenes are known as phytoalexins which can be biosynthesised from grapevines as a defense to fungal diseases, such as Botrytis cinerea, or abiotic stress and UV irradiation. The antioxidant and antimicrobial efficiency of resveratrol provide health benefits, such as the prevention of cardiovascular diseases, arteriosclerosis and cancer. Originally, epidemiological studies indicated an inverse relationship between moderate wine consumption and the risk of coronary heart disease, the so-called “French Paradox”. The proposed therapeutic attributes and the mode of molecular actions of resveratrol are not established yet. The recent pharmacologic efforts emphasized the poor bioavailability of resveratrol which influences the transition between body systems in humans. Red wines can be good source of resveratrol, but Resveratrol-enriched supplements might be suitable to allow daily uptake of therapeutically relevant doses (currently presumed to be 1 g) that are not obtainable by conventional foods or beverages.

Key words: *resveratrol, stilbenes, red wines, HPLC-MS, antioxidant, bioactivity, “French paradox”.*

EFFECT OF FERMENTATION TIME ON THE SENSORY QUALITY OF COMPOSITE WHEAT BREAD Durim Alija^{1,2*}, Viktorija Stamatovska¹, Vezirka Jankuloska¹, Joanna Harasym^{3,4}, Gafur Xhabiri², Daniela Nikolovska Nedelkoska¹

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Abstract

Fermentation time is widely recognized as a critical technological parameter in breadmaking, influencing yeast activity, gas production, and the development of structure and sensory attributes. In this context, the present study investigated the effects of pumpkin flour substitution and proofing time on the sensory properties of composite wheat bread. Bread samples were prepared using soft wheat flour as the control, and with 5%, 10%, 15%, and 20% pumpkin flour substitution, followed by proofing for 1 h and 2 h. Sensory evaluation included volume, external appearance (crust), internal appearance (crumb), aroma, and taste, with a relevance coefficient applied to weight the contribution of each attribute to overall quality. The results demonstrated that sensory acceptability was strongly influenced by both substitution level and proofing duration. Under 1 h proofing, the control and the 5% pumpkin flour bread achieved the highest total sensory scores (89.43 and 89.86, respectively), indicating that low-level substitution preserved or slightly improved sensory quality. At 10% substitution, the bread remained acceptable, although a reduction in volume was observed. In contrast, 15% and 20% substitution caused a significant decline in all evaluated sensory attributes, particularly volume, crumb structure, aroma, and taste. Extending proofing to 2 h improved the sensory profile of breads with lower pumpkin flour incorporation, increasing total scores to 96.43 for the control, 94.25 for 5%, and 88.64 for 10% substitution. However, prolonged proofing did not offset the negative effects observed at higher substitution levels. Overall, 5% pumpkin flour was optimal for maintaining high sensory quality, while 10% may be acceptable with extended fermentation.

Key words: *pumpkin flour, wheat flour bread, sensory analysis, proofing time, flour substitution, bread quality, sensory acceptability.*

DIETARY PATTERNS OF CEREAL CONSUMPTION AND THEIR ASSOCIATION WITH THE HOMA-IR INDEX AMONG ADULTS WITH HYPERINSULINEMIA Eleonora Delinikolova^{1*}, Vezirka Jankuloska¹

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Abstract

Insulin resistance represents a complex metabolic disorder, the development of which is closely associated with dietary habits, particularly the intake and quality of carbohydrates. The present study aims to analyse the relationship between the consumption of bread, pasta, and bakery products, whole grain intake and HOMA-IR index values as an indicator of insulin resistance.

The study included 175 participants (71 men and 104 women), aged over 25 years, with increased body mass index (BMI >25 kg/m²) and diagnosed hyperinsulinemia. Data were collected using a structured questionnaire, which included questions related to the type, quantity, and frequency of consumption of these products. Statistical analysis was performed using Pearson's chi-square test of independence at a significance level of $\alpha = 0.05$. The results indicate that there is no statistically significant association between the type and quantity of consumed bread, pasta, and bakery products and HOMA-IR index values ($p > 0.05$). The majority of participants consume products from this category in moderate amounts, most commonly between 50 and 100 g per day, with a higher prevalence of products made from whole grain flour. In contrast, a statistically significant association was observed between the frequency of whole grain consumption and HOMA-IR index values ($\chi^2 = 10.75$; $p = 0.013$), where more frequent consumption was associated with a more favourable metabolic profile.

In conclusion, the findings suggest that the quality and regularity of carbohydrate intake, particularly through whole grain products, may have greater relevance for insulin sensitivity than the type or quantity of commonly consumed cereal-based products.

Keywords: *insulin resistance, HOMA-IR, carbohydrate intake, whole grains, dietary habits, hyperinsulinemia.*

LACTIC ACID BACTERIA COUNTS IN GOAT MILK AND TRADITIONAL GOAT MILK CHEESES Hava Miftari^{1,2*}, Tatjana Kalevska¹, Tatjana Blazevska¹, Ismail Ferati², Vezirka Jankuloska¹, Daniela Nikolovska Nedelkoska¹

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Abstract

Lactic acid bacteria are vital for goat milk fermentation and the production of traditional goat cheeses, influencing their microbiological and sensory character, as well as their nutritional value. The lactic acid bacteria population in goat milk depends on multiple factors, including environment conditions and animal husbandry practices. In raw goat milk, the counts of lactic acid bacteria usually range from approximately 3 to 8 log cfu mL⁻¹, with variations that may be due to differences in region, milking and storage conditions, as well as the applied cultivation methods. During traditional cheese production, the microbial community undergoes dynamic changes due to fermentation conditions like temperature, pH, and salt concentration, influencing microbial succession and the final sensory characteristics of the cheese. The counts of lactic acid bacteria in ripened cheeses are higher and often exceed 8 log cfu g⁻¹, which is expected due to the active proliferation of these bacteria during ripening. Raw milk utilization in traditional cheese-making encourages the development of autochthonous lactic acid bacteria strains, that are primarily responsible for the typical organoleptic properties of the cheese. This study focuses on the counts of lactic acid bacteria in raw goat milk and traditional goat milk cheeses, offering insight into microbial load and its variability within dairy systems. These counts reflect the influence of production, handling, and ripening conditions, serving as key indicators of process control and product quality. Understanding LAB population levels can support improved consistency and optimization in goat milk and cheese production.

Key words: *lactic acid bacteria, raw goat milk, goat cheese, traditional cheese-making.*

BOOK OF ABSTRACTS
SECTION: FOOD SCIENCE AND NUTRITION

THE PRESENCE OF MYCOTOXINS IN VARIOUS DOMESTIC AND EXPORTED FOOD PRODUCTS Ismail Ferati^{1*}, Daniela Nikolovska Nedelkoska², Hava Miftari¹, Durim Alija¹, Rejhana Luma¹, Mirsade Tairi¹

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Abstract

Mycotoxins are toxic secondary metabolites synthesized by numerous filamentous fungi including members of the genera *Fusarium*, *Penicillium*, *Drechslera*, *Aspergillus*, *Claviceps*, *Monascus*, *Alternaria*, *Cephalosporium*, *Nigrospora* and *Trichoderma*. Among them, *Aspergillus* and *Fusarium* species are the main plant pathogens known to cause infection and produce mycotoxins in food crops. In this study, we focused on the analysis of mycotoxins in various food products. The focus of our analysis was both domestic and export products. The study was conducted in collaboration with the Institute of Public Health, Skopje, RNM in the period 2018 to 2022. A total of 3,235 food samples were analyzed during this study, only four samples (0.12%) resulted in exceeded levels of mycotoxins. This indicates a good state of food safety control and surveillance in the Republic of North Macedonia, for both domestic and imported products. According to a report by EFSA (European Food Safety Authority, 2020), the average percentage of food samples in the European Union exceeding the maximum permitted limits for mycotoxins is around 1–2%, with higher percentages reported in cereals, spices and dried fruits. Therefore, the results of this study place the RMV below the European average for exceeded contamination.

Key words: *mycotoxins, food samples, domestic food products, exported food products.*

COMPARATIVE ANALYSIS OF NATURAL ANTIOXIDANTS ON THE OXIDATIVE STABILITY OF DIFFERENT COLD-PRESSED SUNFLOWER OILS UNDER VARYING FILL VOLUMES Katerina Temelkowska Ristevska^{1*}, Vezirka Jankuloska¹, Valentina Velkovski¹, Viktorija Stamatovska¹, Tatjana Blazhevaska¹, Tanja Stojanovska¹, Gorica Pavlovska¹

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Abstract

Cold-pressed sunflower oil is highly valued in human nutrition for its biological and sensory properties; however, due to the absence of refining, it exhibits lower oxidative stability. Recently, there has been a growing interest in the use of natural antioxidants derived from herbs and spices to enhance the oxidative stability of these oils. Two types of cold-pressed sunflower oils were analyzed in their native form (control samples) and with the addition of fresh rosemary, garlic, parsley, and mint. The study used samples with varying fill volumes to assess the impact of headspace oxygen. Following six weeks of dark storage, the peroxide value (PV) was determined via the Wheeler method.

The results showed a significant increase in the PV of all control samples in both oil types, especially in those with smaller oil volumes, where values exceeded the legal limit of 7.5 mmol O₂/kg. In contrast, garlic and rosemary exhibited the strongest antioxidant activity, maintaining PV levels below 1 mmol O₂/kg across all volumes. While parsley and mint also inhibited oxidation, their effectiveness was more dependent on the fill volume, with PV levels staying below 2.5 mmol O₂/kg.

In conclusion, the addition of natural antioxidants, particularly garlic and rosemary, significantly enhances the oxidative stability of cold-pressed sunflower oils. The results confirm that all tested additives maintain the oil within safe consumption limits after six weeks, effectively mitigating the negative impact of headspace oxygen regardless of the packaging's fill volume

Key words: *cold-pressed sunflower oil, oxidative stability, peroxide value, natural antioxidants.*

ADVANCED APPROACHES FOR DETECTION OF MYCOTOXINS IN FOODS Marija Taskova Kukutanov^{1*}, Sasa Mitrev¹, Emilija Arsov¹, Biljana Kovacevik¹

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Abstract

Mycotoxins are contaminants in food and feed produced as secondary metabolites by various fungi. In the literature, more than 500 mycotoxins are identified and described as toxic but the most frequently occurring are aflatoxins, ochratoxins, fumotoxins, zearalenone and deoxynivalenol. Unknown consumption may cause mycotoxicosis resulting in hepatotoxicity, neurotoxicity, carcinogenicity etc. Consequently, it is crucial to develop detection methods for mycotoxins that are sensitive, reliable, available and cost effective. Conventional approaches for detection of mycotoxins in food include chromatography techniques such as high-performance liquid chromatography (HPLC) or liquid chromatography–tandem mass spectrometry (LC-MS/MS) and antibody-based immunoassays such as enzyme-linked immunosorbent assay (ELISA). These techniques have certain limitations connected to the high cost, time consumption, technical complexity and the need for skilled personnel. On the other hand, with the use of nanotechnology, biosensors are proposed and explored as advanced analytical tools for detection of mycotoxins. They have high potential into enhancing sensitivity and selectivity identifying trace amounts of mycotoxins in compound matrices. Biosensors consist of sensing element (receptor) attached on a nanomaterial with transducer to the readout system. They may employ optical, electrochemical and electrochemiluminescence (ECL) principles. In the literature, aptamer-based biosensors are highlighted as a new tool for food mycotoxin assessment. They are non-toxic, offer high efficiency because of the high surface density, have high stability compared with antibodies and hold possibility for customization. The future efforts in the field will be on improving biosensor robustness, size, integration with digital technologies and machine learning methods for predicting the presence of mycotoxins.

Key words: *mycotoxins, biosensors, nanotechnology, chromatography, aptamer-based biosensors.*

CURRENT ANALYTICAL METHODS FOR MYCOTOXIN DETECTION IN FOODS AND FEEDS: A COMPARATIVE REVIEW Marija Taskova Kukutanov^{1*}, Biljana Kovacevik¹, Emilija Arsov¹, Sasa Mitrev¹

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Abstract

Mycotoxins are potent toxins that accumulate in the food chain and pose a great risk for acute and chronic health complications. Therefore, there are various methods developed and in use for their qualitative and quantitative analysis. Current approaches for mycotoxin detection consist of three phases. The first is sampling. It is a crucial step because the contamination of natural products is often non-homogenous. Therefore, the use of standardized protocols is important to avoid false negative results. The next phase is sample preparation, which includes grinding, extraction, and purification. The most commonly used extraction methods are solid-liquid extraction, solid-phase extraction and QuEChERS. The final phase is detection with analytical methods among which the chromatography techniques are the most established. The thin-layer chromatography (TLC) is one of the earliest analytical methods and is still in use due to its low cost. A more specific, sensitive, and automated technique than TLC is liquid chromatography–tandem mass spectrometry (LC-MS/MS). It advantage the identification of multiple mycotoxins in a single run, regardless of their chemical composition. Gas chromatography–tandem mass spectrometry (GC-MS/MS) is also used. However, since the mobile phase is a gas, it is not the method of choice for mycotoxin analysis. High-performance liquid chromatography (HPLC) is considered a gold standard for the analysis of mycotoxin contamination in various foods. It is often combined with UV visible or fluorescence detector to increase efficiency and sensitivity. It offers advantages in terms of availability and reliability. On the other side, the antibody-based immunoassays with their promptness and ability for screening of many samples of mycotoxins are worth noting. The most often used are enzyme-linked immunosorbent assay (ELISA) and lateral flow immunoassay (LFA).

Key words: *mycotoxin detection, thin-layer chromatography, liquid chromatography–tandem mass spectrometry, high-performance liquid chromatography, antibody-based immunoassays.*

SENSORY EVALUATION OF DIETARY SAUSAGES INTENDED FOR CHILDREN'S NUTRITION Nadica Bajraktarova^{1*}, Dimitar Nakov¹, Aco Kuzelov¹

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Abstract

In recent years, there has been an increased interest in the development of food products with improved nutritional composition, especially those intended for specific population groups such as children. The aim of this research was to perform a sensory evaluation of dietary sausages intended for children's nutrition and to assess their acceptability among consumers. The sensory analysis was conducted with a panel of 20 respondents, who evaluated the product based on its organoleptic characteristics. A structured questionnaire was used for the assessment, which included the parameters' appearance, color, odor, chewing consistency and general assessment of the product. The assessment was carried out using a five-point scale. The results of the research showed that dietary sausages were positively evaluated by the respondents, with most of the ratings being in the "very good" and "excellent" categories. None of the characteristics analyzed were evaluated with negative ratings. In addition, most of the respondents expressed a willingness to pay a higher price for a product with such characteristics.

Based on the results obtained, it can be concluded that dietary sausages intended for child nutrition show good sensory acceptability and potential for application as an improved meat product with improved nutritional composition.

Key words: *sausages, nutrition, sensory properties, children, acceptability, meat products.*

FATTY ACID PROFILE OF 16 COLD-PRESSED SUNFLOWER OILS FROM THE REGION OF NORTH MACEDONIA Sanja Kostadinović Veličkowska^{1*}, Saša Mitrev¹

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Abstract

Virgin oils are very popular foodstuff as 100% natural oils produced only with cold pressing without any step of rafination. Edible oils produced in this way usually had higher concentrations of antioxidant compounds such tocopherols, carotenoids and chlorophylls and stronger impact on human health in comparison to refined oils. Traditional Balkan cuisine, as well as the other cuisines of South-East European countries, includes sunflower oil as the most used cold-pressed and refined oil for cooking and frying. Abundance of oleic and linoleic acids divide the sunflower oils into two types: high oleic sunflower oils with percentage of oleic acid around 50%. and high linoleic sunflower oils with abundance of linoleic acid higher than 80%. Hence, the main object of this study is fatty acid composition of 16 cold-pressed sunflower oils produced from the region of North Macedonia. Sunflower oils 1 and 10 had the lowest percentage of palmitic acid (3.90%) and the highest percentage had the sunflower oil 3 (7.10 %). Also, sunflower oil 1 and 10 are high-oleic oils with abundance of 83.35% and 81.82% respectively. The abundance of stearic acid in all 16 samples of sunflower oils was in the range between 4.38% and 6.30%. Behenic acid was present in percentages less than 1% in all 16 samples of sunflower oils. All other samples belong to the high linolenic type of oils with percentage of linolenic acid between 52.32 and 65.61%.

Key words: *cold -pressed sunflower oil, fatty acid methyl esters, saturated fatty acids, unsaturated fatty acids, oleic acid, linoleic acid and α -linolenic acid.*

BOOK OF ABSTRACTS
SECTION: FOOD SCIENCE AND NUTRITION

VOLATILE PROFILE AND SENSORY EVALUATION OF COLD-PRESSED SUNFLOWER OILS
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Abstract

Vegetable oils are divided in two types. The first one belongs to the oils in terms of energy storage in plants as fatty acids bond in triglycerides, typical for oils derived from different plant seeds. The second one belongs to essential oils which are produced as self-defense or attractant compounds. Most of essential oils are used in flavour industries such as food, beverage, traditional medicine and perfumery because of their terpenic nature. Virgin sunflower oil seems to be link between those two types of oil. The sunflower seeds contain fixed oil as the major oil which is mixture of saturated and unsaturated fatty acids mainly bonded as triglycerides and minor quantity of terpenic oil with predominant fraction of monoterpene hydrocarbons. Volatile profile and sensory evaluation of 16 cold pressed sunflower oils were object of this study. Low abundance of monosaturated oleic acid and very high abundance of polyunsaturated linoleic fatty acid (presented in abundance more than 60%) can cause faster oxidation in comparison to high oleic sunflower oils which can induce unpleasant 'rancid', 'sour' or 'bitter' taste. The quantity of α -pinene can be used as also marker for the process of cold-pressing of sunflower oil. This monoterpene hydrocarbon is very volatile and extremely low level of α -pinene as well as significant lower concentration of all other monoterpenes can lead us to conclusion that the quality of the seeds is very poor or incorrect pretreatment of the seeds was applied.

Key words: *sunflower oil, fixed oil, essential oil, volatile profile, sensory analysis, monoterpenes, α -pinene.*

BOOK OF ABSTRACTS
SECTION: FOOD SCIENCE AND NUTRITION

**FORMULATION OF LIP BALMS FROM ESSENTIAL OILS Xheneta Gashi¹, Edona Ismajli¹,
Miribane Dërmaku-Sopjani¹, Arleta Rifati-Nixha^{1*}**

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Abstract

Essential oils are highly concentrated, volatile plant extracts containing the natural scent and "essence" of flowers, leaves, bark, and roots. Essential oils are used for aromatherapy, inhalation for stimulating the limbic system of the brain, for massage, lotions etc. Oils like lemon and tea tree are used as natural cleaning agents and disinfectants.

We have used the essential oils of lemon, ginger, jojoba, chamomile and cinnamon to create lip balms. This along with coconut oil and shea butter, honey extracted from different parts of our country in Kosovo, vitamin E, beeswax. Different lip balm samples were formulated using various essential oils. Different parameters were taken in order to see which combination is the best and most suitable in terms of durability on the lips, texture, hydration they offer, and also the aroma. To evaluate the quality of our formulations, samples from commercial cosmetic brands were used as benchmarks for comparison. We made the comparison with them using the Thin Layer Chromatography method (TLC). The determination of pH is done for the safety of these products in contact with the skin, since the pH of human skin is 4.7 - 5.75, so if these have a pH that is too acidic or too basic, they cause skin irritation. Ours have performed very well. The melting point was determined using a Büchi Melting Point B-545 apparatus. This determination is made to determine the stability of lip balms on the lips and when they are left in different environments.

Keywords: *essential oils, lip balm, coconut oil, shea butter, beeswax, melting point, TLC.*

FATTY ACID PROFILE AND QUALITY OF YOGURT FROM LOCAL SHEEP BREEDS RAISED IN THE SOUTHWESTERN RILA MOUNTAIN REGION Yuliya Koyundzhijiska¹, Silviya Ivanova², Vasil Nikolov²

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Abstract

The fatty acid composition and physicochemical quality of sheep milk are key indicators of its nutritional value and potential health effects. This study aimed to evaluate the physicochemical properties and fatty acid profile of milk obtained from local sheep breeds raised in three farms located in the southwestern part of the Rila Mountain region.

Milk samples were analysed for basic physicochemical parameters (fat, protein, dry matter, and pH), as well as detailed fatty acid composition, including saturated (SFA), monounsaturated (MUFA), and polyunsaturated fatty acids (PUFA), and conjugated linoleic acid (CLA). Lipid quality indices such as the atherogenic index (AI), thrombogenic index (TI), and hypocholesterolemic/hypercholesterolemic ratio (h/H) were also calculated. Statistical comparisons were performed to determine differences among the three farming systems. The results revealed significant variations among the studied farms. Milk from Farm 1 showed the highest fat content and CLA levels, indicating high nutritional density. Farm 2 exhibited the most favourable fatty acid profile, characterized by higher PUFA and omega-3 fatty acids and the lowest atherogenic index, suggesting the best health-related lipid quality. In contrast, milk from Farm 3 showed higher levels of saturated fatty acids and less favourable lipid indices, indicating lower nutritional quality.

In conclusion, the results demonstrate that farming conditions significantly influence the fatty acid composition and nutritional quality of sheep milk. Among the studied systems, milk from Farm 2 showed the most beneficial health profile, while Farm 1 was characterized by high nutritional richness.

Keywords: *sheep milk, fatty acid profile, physicochemical composition, lipid quality indices, nutritional value.*

**IMPLEMENTATION OF TRACEABILITY SYSTEMS IN THE IMPORT OF WHEAT FLOUR
IN THE REPUBLIC OF KOSOVO Zenun Krasniqi^{1,2*}, Biljana Trajkovska²**

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Abstract

This paper addresses the issue of traceability of imported wheat flour in Kosovo, focusing on the analysis of existing practices, challenges and opportunities for system modernization. The literature review showed that the current traceability system relies primarily on manual and administrative documentation, which provides a basic level of control but limits the tracking of the product along the supply chain and delays response in cases of food safety concerns.

The experimental part of the study included interviews with customs officials and the analysis of five samples of imported wheat flour. Physico-chemical analyses were performed at three different points in the supply chain: at the customs terminal, at distributor warehouses and in retail markets, highlighting the impact of storage and transport on product parameters. Additionally, a pilot mobile application for flour traceability was developed, based on QR code technology. The application allows the registration of samples, integration of laboratory data and real-time alerts for products that do not meet safety criteria. The results showed that using the application can significantly reduce response time from several days in the traditional system to just a few hours, increasing transparency and improving risk management efficiency.

The thesis concludes with recommendations for the gradual adoption of digital traceability systems, integration of laboratory results, improvement of inter-institutional coordination and staff training. This study provides an important basis for enhancing food safety and modernizing traceability practices for imported flour in Kosovo.

Key words: *imported flour, traceability, food safety, physico-chemical analysis, digital system.*

SOIL SCIENCE AND ENVIRONMENT

DISTRIBUTION AND FACTOR ANALYSIS OF SOIL ORGANIC CARBON IN SOILS FOR GRAPEVINES FROM SELECTED MICROLOCATIONS IN THE OVČE POLE VINE DISTRICT Aleksandar Piperevski^{1*}, Biljana Balabanova¹

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Abstract

Soil organic carbon (SOC) represents a fundamental indicator of soil quality, directly influencing nutrient cycling, structural stability, and long-term sustainability in viticultural systems. This study evaluates the distribution of SOC and its controlling factors in vineyard soils from six microlocations within the Ovče Pole wine-growing district (North Macedonia). A total of 18 composite soil samples were collected from the surface layer (0-30 cm) and analyzed for SOC using the Walkley-Black titrimetric method, a validated and widely applied procedure for routine soil carbon determination. The obtained SOC values ranged from 0.76% to 1.32%, with a mean value of 1.13%, indicating predominantly low to moderate organic carbon status. These levels are typical for soils under semi-arid climatic conditions and intensive agricultural use, where organic matter inputs are limited and mineralization processes prevail. The relatively narrow variability of SOC suggests a degree of uniformity in soil management practices across the studied microlocations, but also points to inherent constraints in carbon accumulation related to soil type and environmental conditions.

Multivariate statistical analysis (factor analysis) revealed two dominant factors explaining the majority of variability in soil properties. The first factor (45.7% of total variance) showed strong positive loadings for organic matter (OM) and total nitrogen (N), representing a fertility driven component and confirming the tight coupling between carbon and nitrogen cycles in vineyard soils. The second factor (24.2% of total variance) was associated with soil pH and CaCO₃ content, highlighting the influence of alkaline and calcareous conditions on SOC dynamics and nutrient availability. Overall, the results underscore the importance of targeted soil carbon management strategies to enhance SOC levels, contributing to improved soil health, climate resilience, and sustainable viticulture in the Ovče Pole region.

Keywords: *soil organic carbon, organic matter, factor analysis, grapevine soils, soil properties, Ovče Pole vine district.*

Acknowledgment: *The authors acknowledge the support provided by the UNILAB Laboratory, Faculty of Agriculture, Goce Delcev University – Stip.*

SOIL CARBON DYNAMICS IN BARLEY AND CHICKPEA UNDER CARBON-FARMING AND CONVENTIONAL PRACTICES: EVIDENCE FROM PILOT SITES IN NORTH MACEDONIA Biljana Balabanova^{1*}, Verica Ilieva¹, Sasa Mitrev¹, Blagoja Mukanov², Mario Petkovski², Jovana Milosavljeva²

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Abstract

Soil organic carbon (SOC) represents a key indicator of soil health, fertility, and the capacity of agroecosystems to contribute to climate change mitigation through carbon sequestration. Within the framework of the CARBONICA project, this study evaluates SOC dynamics in barley (*Hordeum vulgare L.*) and chickpea (*Cicer arietinum L.*) cultivated under contrasting management systems, carbon farming (CF) and conventional practices, across representative pilot sites in North Macedonia.

Soil sampling was conducted from the 0-20 cm layer using a stratified composite approach that accounted for crop type and management regime. SOC content was determined using the validated Walkley-Black method, focusing on the biologically active organic carbon fraction. Experimental setups included four treatment variants: chickpea under CF (B2) and conventional management (B3), and barley under conventional (B4) and CF practices (B5).

The results revealed distinct temporal and management-dependent patterns in SOC dynamics. In barley systems, SOC exhibited a mid-season decline in both treatments, followed by a marked increase under CF conditions at the end-point (1.45%), while continuing to decrease under conventional management (1.05%). In chickpea systems, SOC dynamics were comparatively more stable, with CF leading to a moderate increase (1.38%) and conventional practices resulting in a decline (1.00%). These findings highlight the combined effect of reduced soil disturbance, residue retention, and enhanced biological activity under CF systems. Additionally, the role of legumes in stabilizing SOC through biological nitrogen fixation and stimulation of microbial processes was evident.

Overall, carbon-farming practices demonstrated a consistent potential to enhance SOC levels compared to conventional systems, emphasizing their relevance as climate-smart agricultural strategies. The study provides region-specific evidence supporting the implementation of regenerative practices for improving soil quality and promoting sustainable land management in North Macedonia.

Key words: *soil organic carbon, carbon farming, barley, chickpea, sustainable agriculture, climate-smart practices, North Macedonia.*

**ASSESSMENT OF ORGANOCHLORINE PESTICIDE RESIDUES IN FISH FROM
BATLLAVA LAKE Ilirjana Osmani^{1,2}, Anja Babić², Arben Haziri^{1*}, Aurel Nuro³**

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Abstract

This study evaluates the presence of organochlorine pesticides (OCPs) in fish samples collected from Batllava Lake, Kosovo. A range of OCP compounds, including HCH isomers, heptachlor and its metabolites, aldrin-related compounds, endosulfan compounds, and DDT derivatives, were analyzed to determine contamination levels and variability. The results indicate that several OCPs are present in fish tissue, with varying concentrations. Among the detected compounds, endosulfan-related pesticides were dominant, with mean concentrations of 0.257 µg/kg for endosulfan I, 0.317 µg/kg for endosulfan II, and 0.319 µg/kg for endosulfan sulfate. Heptachlor also showed notable variability, with a mean value of 0.130 µg/kg and a maximum concentration reaching 0.386 µg/kg, indicating possible localized contamination sources. Aldrin and its related compounds were present at moderate levels, while HCH isomers were detected at relatively low concentrations. DDT and its metabolites were either absent or detected at very low levels, suggesting limited recent input or advanced degradation processes. Overall, the findings highlight the persistence and bioaccumulation potential of organochlorine pesticides in Batllava Lake, raising concerns about ecological impacts and potential risks to human health through fish consumption. Continuous monitoring and effective environmental management strategies are recommended to mitigate pesticide pollution in the lake ecosystem.

Key words: *organochlorine pesticides (OCPs), bioaccumulation, Batllava Lake, gas chromatography (GC), high-performance liquid chromatography (HPLC).*

BOOK OF ABSTRACTS
SECTION: SOIL SCIENCE AND ENVIRONMENT

ATMOSPHERIC DEPOSITION OF NITROGEN AND SULFUR IN KOSOVO USING MOSSES AS BIOINDICATORS Musaj Paçarizi^{1*}, Flamur Sopaj¹, Trajče Stafilov^{2,3}, Robert Šajn⁴, Valon Sadiku⁵, Riccardo Fedeli⁶, Stefano Loppi⁶

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Abstract:

For the first time in the Republic of Kosovo, atmospheric deposition of nitrogen and sulfur has been studied using mosses as bioindicators. A total of 39 moss samples (*Homalothecium sericeum*, *Hypnum cupressiforme* and *Pseudoscleropodium purum*) were collected throughout Kosovo from June to September 2019. Nitrogen was determined using the Kjeldahl method, while sulphur was determined using the XRF technique. Basic statistics, cluster analysis, and distribution maps were used for data analysis. Nitrogen concentration ranged from 0.81% to 1.47%, with a median value of 1.13%. The results are comparable to those of neighboring countries. The highest nitrogen values were found in agricultural areas due to the anthropogenic use of fertilisers, while the lowest values were found in open natural spaces and forest locations far from anthropogenic sources. Sulphur content ranged from 0.04% to 0.99%, with a median value of 0.061%. The highest sulfur values were found near industrial areas as a result of coal mining activities and power plants (Kosova A and Kosova B) in Obiliq, as well as industrial and mining activities in the Mitrovica area.

Key words: *nitrogen, sulfur, moss, Kjeldahl, XRF, Kosovo.*

ENOLOGY

**DETERMINATION OF ORGANIC SELENIUM COMPOUNDS IN KRATOŠIJA WINE
APPLYING HPLC-ESI-MS/MS Violeta Ivanova-Petropulos^{1*}, Elena Bogeva¹, Aleksandra
Sentkowska²**

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Abstract

Organic selenium compounds, specifically selenomethionine (SeMet) and Se-methylselenocysteine (MeSeCys) are the major selenium-containing amino acids in dietary sources. SeMet is a bioactive form of selenium with antioxidant properties, playing a significant role in cardiovascular health, autoimmune conditions, and the prevention of certain cancers, while Se-methylselenocysteine is a naturally occurring organoselenium compound found in certain plants and is known for its high peroral bioavailability in humans. Selenomethionine oxide (SeMetO) is the oxidized form of the amino acid selenomethionine and possesses a protective mechanism against oxidative stress. In this study, SeMet, SeMetO and MeSeCys were determined in Kratošija wines by applying a rapid and sensitive HPLC-ESI-MS/MS technique. The HPLC method was optimized and validated through the determination of slope, R² (correlation coefficient), LOD (limit of detection) and LOQ (limit of quantification). Wines were produced by inoculating two commercial *Saccharomyces cerevisiae* yeasts: Zymaflore™ Xpure (Laffort) and Lalvin ICV D80 (Lallemand) in order to study the effect of yeasts on the selenium compounds content in the final wines. It was observed that wine fermented with Lalvin ICV D80 contained higher amounts of SeMet and MeSeCys, probably due to a better ability of the yeast to transform the inorganic selenium into organic selenium compounds (especially selenomethionine). Both wines contained high levels of SeMetO, produced as a result of the oxidation of SeMet during wine fermentation and/or storage. The results obtained are preliminary and provide a basis for future studies using various varieties and vinification processes.

Key words: *organic selenium compounds, SeMet, SeMetO, MeSeCys, HPLC-ESI-MS/MS, Kratošija wine.*

BOOK OF ABSTRACTS

MEETING SIDE EVENT: CARBONICA: Building a national stakeholder network for carbon farming and sustainable soil management

MEETING SIDE EVENT

CARBONICA: Building a national stakeholder network for carbon farming and sustainable soil management

ALL DAY EVENT

**PRESENTATION OF AGRICULTURAL COMPANIES WITH
EXHIBITION STANDS**

- ❖ **AGROFILA DOOEL Stip**
- ❖ **AGROSTART Kumanovo**
- ❖ **AGROUNIJA DOOEL Skopje**
- ❖ **BIOGENESIS, Belgrade, Serbia**
- ❖ **EKO OAZA SAMANDOV Stip**
- ❖ **FARMAHEM Skopje**
- ❖ **LION DOO Sveti Nikola**
- ❖ **MIK Sveti Nikole**
- ❖ **Mlekarnica GJORGIEVI Radovis**
- ❖ **UNI SERVIS AGRO DOOEL Stip**
- ❖ **Vinarija IZVORNO**
- ❖ **Vinarija KIEVO Stip**
- ❖ **Vinarija KUKUTANOV Radovis**

**THE 5TH INTERNATIONAL MEETING
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BOOK OF ABSTRACTS

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