

**FACULTY OF AGRICULTURE
GOCE DELCEV UNIVERSITY, STIP**



**4th INTERNATIONAL MEETING
AGRISCIENCE & PRACTICE
(ASP 2024)**

BOOK OF ABSTRACTS

**July 2024
Stip, Republic of North Macedonia**

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Publisher:
Faculty of Agriculture, Goce Delcev University, Stip

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The abstracts are technically edited according to the Template for Abstracts, without additional editing of the main text. The results and writing style are presented in the original form provided by the authors.

CIP - Каталогизација во публикација
Национална и универзитетска библиотека "Св. Климент Охридски", Скопје

631/635(062)(084.3)

INTERNATIONAL meeting agriscience & practice (ASP 2019) (4 ; 2024 ;
Stip)

Book of abstracts : Електронски извор / 4th International meeting
agriscience & practice (ASP 13 June 2024, Stip – Republic of North
Macedonia) ; [editor Liljana Koleva Gudeva]. - Stip : Goce Delcev
University, Faculty of agriculture, 2024

Начин на пристапување (URL):

<https://zf.ugd.edu.mk/index.php/mk/agronauka-i-praksa>. - Текст во PDF
формат, содржи VI, 48, илустр. - Наслов преземен од екранот. - Опис на
изворот на ден 02.07.2024

ISBN 978-608-277-064-2

а) Земјоделство -- Собири -- Апстракти

COBISS.MK-ID 64003845

**4th INTERNATIONAL MEETING AGRISCIENCE & PRACTICE
ASP 2024**

Organized by

**FACULTY OF AGRICULTURE
GOCE DELCEV UNIVERSITY, STIP, REPUBLIC OF NORTH MACEDONIA
13 June 2024, Stip, Republic of North Macedonia**

Faculty of Agriculture organizes the 4th International Meeting Agriscience & Practice (ASP 2024), giving an opportunity to the participants for presentation and discussion of original scientific and practical results in different fields of agriculture.

The 4th International Meeting Agriscience & Practice (ASP 2024) is organized with an intention to bring together all agricultural stakeholders for sharing their knowledge, experience and obstacles. One of the main aims is to link research and field work in agricultural sector in the country and abroad, giving it an international dimension.

The main goal of the Meeting was to connect and promote scientific achievements and practical knowledge presented in different thematic areas.

The scientific and applicative presentations are conducted in sections:

1. Agricultural economics, 2. Plant biotechnology, 3. Plant production, 4. Plant protection, 5. Quality control and food safety, 6. Soil science and hydrology 7. Viticulture, enology and fruit production

with a possibility for poster presentation. Nevertheless, the needs of the agricultural sector entail organization of plenary presentation on the most actual topic in the field of agriculture and panel discussions, where invited speakers and panellists have a possibility to share their experience with the Meeting participants.

Dear colleagues, let's again gather together in one place with one joint idea - to combine agricultural science and practice with a purpose to share information, knowledge, experiences and solutions to exceed the problems. The main objective of this Meeting is successful establishment of continuous and valid communication and collaboration among scientific, research and practical activities in agriculture sector in our country, neighboring countries and on broader international level. We will achieve the main goal of the Meeting as well as our common objective only by virtue of synergic connections on which we have been working intensively in the past years.

Every science has its significance and value in the given social context, but agricultural production has a special place of vital significance.

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

Emilija Arsov, PhD

**Dean of the Faculty of Agriculture
&
Chair of the Organizing Committee**

July, 2024, Stip, Republic of North Macedonia

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PLENARY PRESENTATIONS

DIGITAL TECHNOLOGIES – A STEP TOWARDS THE NEW ERA OF AGRICULTURAL PRACTICES IN THE BALKAN COUNTRIES Blagoj Mukanov^{1*}

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Abstract

While agriculture continues to become more knowledge intensive and high tech, the demand for more precise and timely information rises rapidly. Some of the world's newest industries have started to put money and talent into farming—the world's oldest industry. Digital soil maps, remote sensing, and GPS guidance are critical tools for modern farmers. Extensive data for precision agriculture increases yields and efficiency. These hightech tools mostly benefit big farms that can make large investments in technology. Smaller farms will often not have the capital to keep up. This may change as information access and delivery continue to become cheaper. But even in the short term there are innovative ways in which smallholder farmers with limited human and financial capital investments use digital technologies such as basic mobile phones and increasingly the internet to maximize returns. Digital technologies had an important impact in linking farmers to markets and key stages of the value chain. Digital technologies increase knowledge through new ways of providing extension services, and they provide novel ways for improving agricultural supply chain management as well. Moreover, better understanding of the interplay of what is automatable and what is not could help better explain why some technologies take off in the agricultural sector, while others seem to underperform expectations. Such insights could also help design better interventions that leverage technology for rural development.

AgFutura Technologies is a pioneering company in introducing digital technologies for agricultural production in North Macedonia and the region. The main issue corresponding to this lecture is "WHY DIGITALIZATION IN THE AGRI SECTOR?" The justifications included: a) Arable land as a limited resource; b) Climate changes and disruptions in agricultural production; c) Characteristics of farm size and farmer age for adopting digital technologies; d) Limiting factors and needs from different aspects such as inputs, markets, nature, and the state.

The present overview introduces the latest nomenclature for digital technological solutions available in agriculture and the decision-making process in agricultural production supported by digital technologies. More specifically, the presentation focused on how digital technologies generate different types of data (VRT maps, soil maps, NDVI maps, etc.) and how they affect each stage of food production (soil preparation, seeding, nutrition, protection, and harvest). Furthermore, special emphasis is given to the importance and benefits of using Farm Management Information Systems (FMIS).

Key words: digital technologies, remote sensing, limiting factors, FMIS.

PROFITABILITY OF INVESTMENT IN FIELD PRODUCTION AND EVALUATION OF SPONTANEOUS RESOURCES OF MEDICINAL PLANTS IN SERBIA Dejan Pljevljakušić¹

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Abstract

Misinformation in the media often tempts new producers of medicinal plants to make large investments that cannot later be justified by the profits made on the market. Based on collected information from the Institute's production and discussions with long-standing medicinal plant producers, a framework for cost analysis and profit projections for the six most commonly grown medicinal plants in Serbia was established. Based on extensive experience from two decades of field production, this overview could provide a comprehensive cost-benefit analysis for the cultivation of some medicinal plants. The profitability of growing peppermint, chamomile, lemon balm, marshmallow, valerian, and pot marigold was examined taking into account average production costs in today's labor, energy and raw material markets. In particular, fixed costs were deliberately not taken into account, as the availability of the necessary infrastructure was assumed. The costs were divided into the categories of labor (45-79%), drying (5-37%), material (9-16%) and machinery usage (4-13%). Valerian proved to be the most lucrative plant with an estimated profit of over 4000 euros per hectare. Lemon balm and marshmallow followed closely behind with around 3,500 euros per hectare, while peppermint and chamomile achieved significantly lower profits of around 1,500 euros per hectare. Marigold showed the lowest profitability at around 600 euros per hectare, which is due to the labor-intensive picking of the flowers. In terms of labor input, marshmallow, pot marigold and valerian were the most labor intensive at 365, 285 and 150 working days per hectare, respectively. This analysis underscores the importance of knowing the labor costs and labor input per unit area before engaging in production calculations for medicinal plant cultivation and highlights the need for growers to be well-informed about the associated costs and labor intensity in order to optimize profitability. The evaluation of the spontaneous resource of medicinal plants in Serbia is an integral part of understanding the potential for sustainable utilization and conservation of these valuable natural resources. Researchers from the Institute participated in KFW project „Support to Galičica National Park, which aimed to assess the diversity, abundance, and distribution patterns of medicinal plants in the region of Republic of North Macedonia“. Furthermore, this extensive field evaluation assessed the abundance levels of medicinal plant species by considering factors such as population density and biomass estimation. This helped us gain insights into their availability within specific areas and provided valuable information for sustainable harvesting practices.

Key words: medicinal plants, cultivation, wild growing, selection.

AGRICULTURAL ECONOMICS

THE APPLICATION OF CORPORATE SOCIAL RESPONSIBILITY IN THE TACTICS OF THE TOBACCO INDUSTRY Silvana Pashovska^{1*}, Trajko Miceski¹

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Abstract

Corporate social responsibility refers to the focus, to the voluntary corporate action of business entities, not only to profit, but also to respect for social goals and protection of the ecological environment, and thus above all the health of people, and the healthy maintenance of living and plant life in nature. In this regard, the framework convention on tobacco control also refers, where specifically in article 5.3 many specifics are highlighted, among which, that the tobacco industry carries out activities to distance its image from the deadly nature of the tobacco products it produces and sells, and at the same time, to influence the raising of awareness for the preservation of public health. According to the tobacco industry, growing tobacco promises high rates of return on investment in tobacco crops and long-term benefits for small farmers. British American Tobacco (BAT) claims that "tobacco cultivation plays an important and positive role in livelihoods, helping to improve well-being and increase resilience ie. the perseverance of tobacco farmers and workers." The large companies of the tobacco industry emphasize the application of the Strategy of Corporate Social Responsibility, in order to improve their reputation, image and credibility, and to present themselves as good corporate entities, which are also aimed at supporting projects in the field of art, highly education, reducing hunger and improving the nutrition of the poor population, certainly, by separating financial resources from their realized profits. In the paper, in addition to a brief elaboration of the significance of the application of corporate social responsibility in the tobacco industry, quantitative data on the production of tobacco in the world, individual countries and Macedonia are presented.

Keywords: corporate responsibility, tobacco production, health, ecology, measures.

PLANT BIOTECHNOLOGY

THE USAGE OF MODIFIED ATMOSPHERE PACKING (MAP) AS A USEFUL METHOD IN MAINTAINING THE QUALITY OF AGRICULTURAL PRODUCTS Liljana Koleva Gudeva ^{1*},
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Abstract

One of the most important technologies for preserving food quality and fruit shelf-life extension is modified atmosphere packing (MAP). MAP means changed gas environment in the product packaging. Fresh food products continued to “breathe” after the harvest, even when they are packed or because they contain microorganisms that “breathe”. In this process, the oxygen the present air is consumed, and carbon dioxide and water vapor are produced, which changes the gas environment.

When agricultural products are taken out of the natural environment after harvesting, a reversed reactions of decompositions (degradation) of carbohydrates, proteins and fats begin. They react with O₂ and release CO₂, water vapor and heat, which is the basic function of cellular respiration. Therefore, the concentration of O₂ should be reduced, the concentration of CO₂ should be increased, and the humidity and temperature should be regulated in the packaging. These parameters affect the development of various microorganisms as addition to primary decomposition processes.

MAP of fresh fruit and vegetables is based on changing the concentration of O₂ and CO₂ in the environment of manufactured package. Usually, MAP package is closed with a layer as polymer film. MAP successfully inhibits the chemical, enzymatic and microbial processes associated with the degradation of fresh food, thus it contributes to omitting the use of other chemical or thermal processes, such as freezing, dehydration and sterilization.

Key words: degradation of fresh food, modified atmosphere of gases, MAP, O₂ and CO₂.

BOOK OF ABSTRACTS
SECTION: PLANT BIOTECHNOLOGY

ASSESSMENT OF GENETIC DIVERSITY AMONG BARLEY VARIETIES WITH DIFFERENT ORIGIN USING SIMPLE SEQUENCE REPEAT (SSR) MARKERS

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Abstract

Barley (*Hordeum vulgare* L.) is one of the principal cereal crops in the world, because it's used as raw material in beer production, animal feed and human consumption. By area and production, barley is ranked as the fourth most important variety, followed by wheat, rice and corn. The primary goal in any breeding programme is the grain yield, but the basic requisite it is determine the distinguish among varieties of crop plants and establish their purity. The propose of this research was to determine the genetic diversity among barley genotypes developed in different counties using the SSRs marker. As an experimental material were used twenty-one two row barley varieties with different origin. Three varieties and two promising lines were Macedonian, two varieties were Serbian, two varieties had Croatian origin and the other twelve varieties were developed in Bulgaria. Nineteen SSRs markers were used to characterize the genetic diversity among the barley varieties. Nine of them showed monomorphic bands (Bmag13, GMS1, HVB23D, Bmac0213, Bmac0013, HVM 3, HVM 4, HVM 7 and HVM 9), three markers had high polymorphisms (MGB391, MGB402 and MGB318) and the rest of them didn't show bands. The calculated polymorphism information content (PIC) values range from 0.163 to 0.574 with an average of 0.380 which shows the importance of the markers for future diversity analysis of barley. Locus MGB318 show the highest PIC and locus MGB391 shows the lowest PIC in this characterized barley genotypes. These results can be useful for barley germplasm management and design of new crosses for future breeding propose.

Key words: barley, simple sequence repeat, genetic diversity, polymorphism information content (PIC), varieties.

PLANT PRODUCTION

PRODUCTION CHARACTERISTICS OF SOME *CAMELINA SATIVA (L) CRUNTZ* VARIETIES IN THE PRILEP REGION Daniela Pelivanoska – Dameska^{1*}, Ljupco Mihajlov¹

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Abstract

Wild flax *Camelina sativa (L.) Cruntz* is a cultural plant that belongs to the Brassicaceae family. Of the many economic and agrotechnical positive characteristics of this crop, the most significant for the Prilep region is that it can be grown on poor soils and in dry conditions. This crop is with short vegetation and gives good results without watering and without fertilizing. Wild flax has a high economic value because it can be used as a raw material for several purposes, namely: production of biodiesel, active substances for pesticides, feed for domestic animals, feed for fish, in the cosmetic industry, in the industry for the production of edible oil, thus obtaining an oil that is particularly recommended for consumption by people with heart diseases. In our country, this culture is still unknown, it is not cultivated and there are no literary data about it. Keeping this in mind, we set ourselves the goal of conducting investigations of some important morphological properties of several varieties of *Camelina sativa* in the Prilep area. The experiment was placed on a colluvial-deluvial soil type, low content of humus and nitrogen, medium availability of phosphorus and potassium and a moderately acidic reaction. Four varieties were placed: "NS Zlatka" and "NS Slatka" (varieties from the Republic of Serbia - Institute of Field and Vegetable Crops - Novi Sad), and "Bg 005" and "Bg 006" (Bulgarian varieties) in a randomized block system in three repetitions. The most important production characteristics were examined, namely: vegetation length, plant height, number of branches per plant, number of pods per plant, average number of plants per m² and average seed yield per unit area. Based on the obtained results, it can be concluded that the Novi Sad variety "NS Zlatka" stands out with the best production properties and an average seed yield per unit area of 1348 kg/ha.

Key words: wild flax, varieties, morphological properties, yield.

BOOK OF ABSTRACTS
SECTION: PLANT PRODUCTION

ANALYSIS OF SUB-SECTOR HERBS & SPICES: A CASE STUDY FROM NORTH MACEDONIA Fidanka Trajkova^{1*}, Liljana Koleva Gudeva¹

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Abstract

The agricultural sub-sector herbs and spices includes a variety of crops which are different by many means: botanical classification, production practices and utilization. This sub-sector is 'invisible' regarding the official data. One of the reasons for no data about production, yield and market of herbs and spices are small areas, small yields and variable production. The only official data available for herbs production is from organic cultivation with detailed presentation of cultures and area under cultivation, but no harvested quantities and yields. On the other hand, traditionally, medicinal and aromatic plants are foraged from wild populations for personal usage and for selling. Wild herbs collection is considered as work which generated additional income for rural population. The variation of the production size and number of producers show that this sub-sector is unstable and depends on many factors as market size, selling channels and state subsidies.

The herbs & spices sub-sector shall be seen as one of the most environmentally- and climate change- friendly of all agricultural sub-sectors because most of production is done under organic certification that is environmentally friendly by all means. Cultivation of wild autochthonous herbs and old varieties for paprika spice is in line with current recommendations to combat climate changes. All these facts speak about the need for the herbs & spices sub-sector to be further developed and supported as an advantageous one in terms of environment and climate protection.

Key words: medicinal and aromatic plants, MAPs, organic cultivation, value chain.

WEATHER CONDITIONS AS A FACTOR AFFECTING THE SEED WEIGHT OF TOBACCO VARIETY PRILEP 66 9 IN THE YEAR 2023

Karolina Kocoska^{1*}, Valentina Pelivanoska¹, Natasha Zdraveska¹, Silvana Pashovska¹, Jane Aleksoski¹, Marjana Glusheska¹, Kristina Hristovska¹, Stefan Tosheski¹

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Abstract

In 2023 tobacco harvest, seed plots of tobacco variety Prilep 66 9 were planted at two locations: the experimental field of the Scientific Tobacco Institute - Prilep and Disan - Negotino. Despite timely transplanting and field production, aimed at obtaining healthy seed material, the experimental field of Scientific Tobacco Institute experienced hail damage during the growing season. The seed pods were formed on the stalks, with the majority of the seeds in milk maturity and a smaller part in wax maturity. The leaves on the stalks were almost completely destroyed. The examination method consisted of taking 10 inflorescences with pods, which were taken randomly from three locations (variants) : Scientific Tobacco Institute - Prilep (glasshouse), Disan - Negotino (glasshouse) and seed taken directly from a plot from Disan-Negotino. The objective of this study is to gain insights into the average number of seed pods per inflorescence and the average weight of the seeds per inflorescence (g/stalk) in variety Prilep 66 9 in the specified three variants.

The obtained results were statistically processed, specifically for the parameter of standard deviation

Key words: tobacco seed, seed pods, inflorescence, variety.

COMPARATIVE TESTING OF BUTTERHEAD AND COS (ROMAINE) LETTUCE GROWN BY THE HYDROPONICS METHOD Plamena Yankova^{1*}, Pavlina Naskova¹

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Abstract

The experimental work was carried out in the period 2021 and 2022 on the technology of the thin nutrient film in the greenhouse of the Department of Plant production, TU-Varna. *Lactuca sativa* var. *capitata* and *Lactuca sativa* var. *romana* were grown using hydroponic method as well as conventional in soil-peat mixture. Both methods were tested in variants without additional fertilization (control) and with additional fertilization (NPK 15:15:15 + 11% S). Hydroponically grown plants have a higher values of root length longer root length than conventionally grown plants. A larger rosette diameter was recorded for plants grown hydroponically, exceeding the control by 18.2% compared to plants grown conventionally. They form a higher number of leaves and consequently a higher vegetative mass by 21.8 % compared to conventionally grown lettuces. The rate of leaf formation is faster in plants grown in hydroponics as opposed to those grown in by the conventional methods.

Key words: lettuce, hydroponics, conventional agriculture, *Lactuca sativa* var. *capitata*, *Lactuca sativa* var. *romana*.

INFLUENCE OF THE NON-WOVEN COVER CLOTH – AGRIL ON THE DEVELOPMENT OF SPRING CABBAGE IN THE OPEN FIELD Mite Ilievski^{1*}, Daniela Todevska¹, Dragica Spasova¹, Dusan Spasov¹, Biljana Atanasova¹, Natalija Markova Ruzdik¹, Boris Chapanov¹

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Abstract

Cabbage (*Brassica oleracea* var. *capitata* L.) is a very important garden crop. In Macedonia, cabbage is grown on significantly large areas, both in protected areas and in open fields. Producers are looking for new alternative ways and opportunities to increase production with cabbage in the open field with earlier sowing dates, but due to low temperatures, new opportunities are being sought to solve this problem.

With the use of agril in the production of early spring cabbage in the open field, the vegetation period on the KEVIN F1 hybrid was shortened by 12 days in the first year and 10 days in the second year compared to the control. The area covered with agril gave a higher yield compared to the control.

Key words: cabbage, temperature, vegetation, period, yield, cover, agril.

PLANT PROTECTION

BOOK OF ABSTRACTS
SECTION: PLANT PROTECTION

**OCCURRENCE AND DAMAGES IN RICE CAUSED BY RICE WATER WEEVIL
LISSORHOPTRUS ORYZOPHILUS KUSCHEL (COLEOPTERA: CURCULIONIDAE)** Biljana
Atanasova^{1*}, Ilija Karov¹, Dusan Spasov¹, Dragica Spasova¹, Mite Ilievski¹

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Abstract

The rice weevil *Lissorhoptrus oryzophilus* Kuschel (Coleoptera: *Curculionidae*) is an important and destructive pest of rice. Comes from the United States of America and remained confined to North America until 1976, when it was spread to Asia. In Europe, it was first detected in Italy in 2004, and in 2016 it was also observed in Greece. Throughout 2023, during the control of the rice fields in the Kochani region, Republic of North Macedonia, rice damages similar to that caused by the rice weevil were observed. The presence of the pest was established after a detailed examination. The identity of the pest was determined through the morphological characteristics of the larva and imago. Damages to the rice plants were both on the roots and the leaves. Further researches should be carried out to determine the prevalence of the pest, its abundance, the damage it causes and the protective measures need to be taken.

Key words: Rice weevil, *Oryza sativa*, occurrence, damages, pests.

BOOK OF ABSTRACTS
SECTION: PLANT PROTECTION

SUSTAINABLE USE OF MODERN BIOPREPARATIONS IN TOBACCO SEEDLINGS PROTECTION Biljana Konsuloska Gveroska^{1*}

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Abstract

Modern plant protection is aimed at the use of ecological, safe biopesticides, in accordance with the principles of sustainable agricultural production. The phytopharmaceutical industry has included numerous biopreparations that have various natural substances as active ingredients who act in a specific way against plant pathogens, but they also greatly induced resistance of the plant organism. The aim of research was to determine the biofungicidal effect of the tested biopreparations i.e. their effectiveness in protecting tobacco seedlings from diseases, primarily from damping off, as the most destructive disease in tobacco seedlings. Biopreparations were applied in an equal dose of 2 l (kg) / ha, in order to examine the effect of combined use with the GOTEIO biostimulator. It was used in a dose of 3 l/ha in combinations with biopreparations, but also alone, in a dose of 4 l/ha. The highest efficiency in protecting tobacco seedlings from damping off disease had ACTIVANE and CUORE CRYSTAL, followed by VACCIPLANT and SOFT GUARD. The achieved results, i.e. an insignificant occurrence of the disease, especially in competition with such a condition in the treated control (where there is no occurrence of the disease) is an excellent result. With a large number of biopreparations, their efficiency is higher when applied in combination with Goteio than when applied alone (except at Cuore Crystal). Goteio biostimulator showed quite good results in seedlings protection. It has a positive effect on the effectiveness of most of the biopreparations, and also, used independently (in a dose of 4 l/ha), it gave an excellent result. These researches allow to promote knowledge about biofungicides, their sources, production, formulation, commercialization, safety, but also their application not only in tobacco production, but also in other crops.

Key words: tobacco seedlings, damping off, biopreparations, efficiency, biofungicidal effect.

BOOK OF ABSTRACTS
SECTION: PLANT PROTECTION

DEVELOPMENT OF HYPOTHETICAL INFECTION MODEL BASED ON ENVIRONMENTAL VARIABLES FOR *PLASMOPARA VITICOLA* (Berk. & M.A. Curtis) Berl. & De Toni Gligor Bojkov^{1*}, Emilija Arsov¹, Sasa Mitrev¹

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Abstract

Development of a hypothetical infection model for *Plasmopara viticola* based on environmental variables was applied to the black grape variety Vranec. The infected leaves were digitally quantified using the software platform 'ImageJ' to determine disease severity. The resulting data, along with inputs of average temperature and leaf wetness duration, were used to establish a regression relationship. Based on polynomial and logistic equations, the regression model forms the foundation for a hypothetical infection model for *P. viticola*. This regression relationship was then used to describe the results, considering periodic fluctuations in environmental variables. Essentially, a hypothetical infection model for *P. viticola* consists of external environmental values that combine linear and oscillating trends. These trends impact the stimulation or reduction of disease intensity, causing the prediction model's curve to exhibit fluctuating characteristics.

Key words: *Plasmopara viticola*, hypothetical infection model, environmental variables, regression relationship, disease severity, fluctuating characteristics.

THE ROLE OF ESSENTIAL OILS IN PLANT PROTECTION: EFFECTIVE BIOPESTICIDES OR JUST A MYTH? Biljana Kovacevik^{1*}, Sasa Mitrev¹, Emilija Arsov¹, Natalija Markova Ruzdik², Daniela Todevska²

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Abstract

Essential oils (EOs) are naturally produced by higher plants in oil sacs or oil glands present in the leaves, flowers, and fruit peels. They are complex mixtures predominantly consisting of secondary metabolites such as terpenes, terpenoids, and phenylpropanoids and may also contain other compounds, such as fatty acids, alcohols, oxides, aldehydes, acyclic esters, lactones, or sulfur derivatives. Known for their antioxidant, antimicrobial, and anti-inflammatory properties, EOs are widely used in cosmetics, the food industry, and traditional medicine. The antimicrobial properties of essential oils have garnered significant scientific interest, positioning them as potential alternatives to synthetic and harmful pesticides. While the literature is rich with data demonstrating the effectiveness of essential oils against plant pathogens, pests, and weeds, their application in agriculture remains surprisingly limited. The most used and evaluated EOs for their bioactive properties against plant pathogens, pests, and weeds are citrus oils, lavender oil, thyme oil, peppermint oil, cinnamon oil, clove oil, eucalyptus oil, sage oil, tea tree oil and oregano oil. The aim of this review is to compile and discuss the latest scientific literature on the biological activities of essential oils (EOs) against plant pathogens, pests, and weeds, their chemical composition, as well as their mode of action. The positive and negative aspects of EOs as alternatives to synthetic pesticides have also been explored. Furthermore, the regulatory and approval procedures are discussed.

Key words: biopesticides, bioactive properties, chemical composition, mode of action, regulations.

BOOK OF ABSTRACTS
SECTION: PLANT PROTECTION

STROBILURINS – QUINONE OUTSIDE INHIBITORS: DEVELOPMENT, APPLICATIONS, AND RESISTANCE Biljana Kovacevik^{1*}, Sasa Mitrev¹, Emilija Arsov¹, Natalija Markova Ruzdik², Daniela Todevska²

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Abstract

Strobilurins are a class of fungicides mostly derived from natural substances produced by wood-decaying mushrooms, particularly from the genus *Strobilurus*. The discovery of strobilurins dates back to the 1970s when researchers identified their unique fungicidal properties. This discovery led to the synthesis of various strobilurin analogs. Thanks to their broad-spectrum activity and relatively low toxicity to humans and animals, strobilurins have become some of the most widely used fungicides globally. They are effective against a wide range of fungal pathogens, including those causing powdery mildew, rusts, leaf spots, and blights, and are used in various crops such as cereals, field crops, fruits, tree nuts, vegetables, turfgrasses, and ornamentals. These fungicides exhibit systemic properties, meaning they can be absorbed by plant tissues and translocated throughout the plant, which provides protection to both treated and new growth, enhancing their effectiveness in disease management. Strobilurins are compatible with many other agricultural chemicals, including insecticides and herbicides, allowing them to be integrated easily into existing pest management programs. This compatibility facilitates their use in tank mixes, reducing the number of applications needed and saving time and resources for farmers. In some cases, they are also found to enhance plant growth. In this review, the properties of strobilurins such as their synthesis, biochemical mode of action, fungicidal activity, resistance risk, and human and environmental safety are discussed in detail.

Key words: fungicides, natural substances, *Strobilurus* spp., plant protection, synthesis, mode of action, fungicidal activity, resistance, toxicity.

BIOLOGICAL CONTROL OF *PYTHIUM* SPP., THE CAUSAL AGENT OF TOBACCO ROOT ROT BY BACTERIAL STRAINS ISOLATED FROM COMPOST SAMPLES Marija Todorovska Ivkovikj^{1,2*}, Marija Karbeska¹, Teodora Dimova¹, Igor Pavlovski^{1,2}, Dzoko Kungulovski¹

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Abstract

Pythium spp. is fungal destructive plant pathogen that can wreak havoc on tobacco crops, causing significant economic losses for farmers and threatening global tobacco production. Understanding the characteristics and behavior of *Pythium spp.* is crucial for effective management strategies to mitigate their impact on tobacco cultivation. Additionally, employing resistant tobacco varieties and implementing biological control agents can enhance the resilience of crops against these pathogens.

The aim of this research is to study the growth kinetics of isolated fungi from tobacco. This isolate was monitored at a different medium, pH, temperature, and time of incubation. *Pythium* fungus culture 6 mm disks were inoculated on several media and the largest growth zone showed optimal media, Chapek. The optimal temperature for growth was 25 °C and the optimal pH is 7.

It has been discovered that isolates of the genus *Bacillus*, *Paenibacillus* and *Pseudomonas* have shown significant antimicrobial activity. Isolated strains from compost were identified as *Paenibacillus polymixa* isolate AA/11, *Paenibacillus polymixa* isolate AA/15, and *Pseudomonas spp.* AA/46. Next, a dilution and diffusion test were performed to determine which bacteria inhibited the growth of tobacco pathogen fungus. Further research involves determining the antifungal activity of isolates AA /11, AA /15 and AA/46 on solid agar plates with *Pythium spp.* It was determined that the bacterium *Paenibacillus polymixa* (AA-11) inhibited growth most successfully because it had the largest zone of inhibition.

This study has shown that implementing biological control agents can enhance the resilience of tobacco crops against *Pythium spp.* successfully and without using chemical agents.

Key words: *Paenibacillus polymixa*, *Pythium spp.*, optimization, antifungal activity.

IN VITRO EVALUATION OF SOIL *BACILLUS* STRAINS ISOLATED FROM THE BUCIM COPPER MINE FOR BIOCONTROL AGAINST GRAPEVINE DOWNY MILDEW

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Abstract

Plasmopara viticola, the disease that causes grapevine downy mildew, is a major and enduring concern for the grapevine industry globally. It is challenging to manage using chemical and agricultural methods. For the wine-growing industry, several countries, including North Macedonia, have reoriented their strategies in order to reduce chemical inputs, which have been shown to be toxic and to have a negative impact on the environment. Instead, they are replacing these chemicals with sustainable biocontrol regulations. *Bacillus* spp. is a well-known plant-protective bacteria with antifungal potential in biocontrol strategies. The aim of this study was to isolate and screen soil *Bacillus* strains from the Bucim Copper Mine in four seasons with potential applications for biocontrol of this disease. The highest number (3.2×10^5 CFUg⁻¹) of *Bacillus* spp. was found in autumn, while the lowest number (2.8×10^2 CFUg⁻¹) was found in winter. Out of 18 isolates, 4 showed antifungal activity against *Plasmopara viticola*. The intracellular metabolites of the isolates B₁₋₁₉, B₂₋₃, B₃₋₂, B₃₋₄ showed maximum inhibition of 20-32 mm, while only the extracellular extract of the isolate B₁₋₁₉ showed maximum inhibition of 25 mm against *Plasmopara viticola*. The moisture content values ranged from 0.9-8.5 % and the pH value ranged from 7.11 – 7.58. The total organic matter values ranged from 4.47 to 4.99 %. Due to the antifungal potential as biological control agents against grape downy mildew, the isolates are expected to enhance integrated pest management systems going forward and maybe reduce the quantity of chemical fungicides used in vineyards.

Key words: soil microorganisms, antifungal activity, phytopathogenic fungi, biocontrol.

QUALITY CONTROL AND FOOD SAFETY

SHADE NETTING ON RASPBERRY AND BLACKBERRIES PRODUCED FROM SOUTH-EAST REGION OF NORTH MACEDONIA: EFFECT ON MORPHOLOGICAL CHARACTERIZATION, CHEMICAL COMPOSITION AND ANTIOXIDANT ACTIVITY Sanja Kostadinović Veličkovska¹, Daniela Todevska¹, Zorica Temelkova², Dejan Pljevljakušić³, Jelena Živković³, Živko Davčev⁴, Petar Davčev⁴ and Fidanka Ilieva¹

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Abstract

Due to the presence of wide-range phytochemicals, particularly polyphenols, anthocyanins, proanthocyanidins and organic acids, raspberry and blackberry gained attention as functional foods or nutraceuticals. However, data on the effect of the shade netting on the morphological and chemical composition and "in vitro" antioxidant activity are very limited.

This study reports the effect on shade netting on the morphological and chemical composition (organic acids, sugars, total polyphenols, total and particular anthocyanins, proanthocyanidins) and "in vitro" antioxidant activity on raspberry and blackberries from the south-east region of Republic of North Macedonia. HPLC analysis confirmed significant effect on shading nets on the amount of the most dominant anthocyanin in blackberries. The amount of cyanidin-3-O-glucoside in blackberry covered with shading nets was significantly higher in comparison to the amount of the same anthocyanins in uncovered blackberries. The same tendency was observed for cyanidin-3-O-sophoroside for covered and uncovered raspberries from 2023. However, opposite relationship was noticed for total anthocyanin content in favor to uncovered blackberry and raspberry from 2023. From all examined organic acids, the amount of acetic acid was the most affected in covered raspberries.

The shade netting had significant influence on polyphenolic content (such as high molecular proanthocyanidins anthocyanins), the amounts of sugars and organic acids as well as the intensity of color in blackberry and raspberry from the south-east region of the Republic of North Macedonia. The difference in antioxidant activity was not linked to the effect of shading nets but, on variation of particular phenolic compounds presented in examined berry fruits.

Key words: Shading nets, blackberries, raspberries, anthocyanins, polyphenols, HPLC, antioxidant activity.

DETERMINATION OF ANTIOXIDANT ACTIVITY OF COLD-PRESSED EDIBLE OILS FROM REPUBLIC OF NORTH MACEDONIA BY HEMOGLOBIN ASSAY Sanja Kostadinović Veličkova¹, Saša Mitrev¹, Emilija Arsov¹, Daniela Todevska¹, Fidanka Ilieva¹, Augustin C. Mot² and Radu Silaghi-Dumitrescu²

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Abstract

In the present study a new approach, based on cell-free hemoglobin (Hb) analysis, is proposed to evaluate antioxidant activity of cold-pressed edible oils from sunflower, flax and sesame seeds. The new modified method is based on the spectrophotometric measurement of Hb concentration at specific wavelength (412 nm). Hemoglobin ascorbate peroxidase activity inhibition (HAPX) assay was applied for the first time in order to compare the antioxidant activity of cold pressed edible oils. HAPX assay shows the capability of an extract obtained from an oil to quench the HbFeIV resulted by hydrogen peroxide-induced damage upon HbFeIII. Transportation of oxygen via hemoglobin is possible by bonding of an oxygen molecule to iron in the ferrous state (Fe²⁺). Oxyhemoglobin produced by side reaction undergoes autoxidation forming methemoglobin (Fe³⁺) and in this oxidation state hemoglobin cannot bind any oxygen. In this case Fe³⁺ from methemoglobin activates hemoglobin and form ferryl Fe⁴⁺. Ferryl hemoglobin is produced in the body in case of stress, illness and induces peroxidation of lipids (Benedec, Vlase, Oniga, Mot, Damian, Hanganu, Duma & Silaghi-Dumitrescu, 2013). Hemoglobin ascorbate peroxidase activity inhibition (HAPX) assay measure the capability of the extracts from cold-pressed oils to quench the HbFeIV resulted by hydrogen peroxide-induced damage upon HbFeIII. The results showed the highest value of the antioxidant potential for extract from flaxseed oil (590.1±3.9 mg Trolox/L oil). The extract from sunflower oil showed a lower value and the lowest antioxidant potential measured by this assay was obtained for sesame seed oil (280.2±1.9 mg Trolox/L oil).

Key words: cold-pressed edible oils, sunflower, flaxseed, sesame, antioxidant activity, hemoglobin ascorbate peroxidase activity inhibition (HAPX) assay.

MONITORING OF ACTIVE AND TITRATABLE ACIDITY IN WHITE BRINED CHEESE DURING RIPENING PERIOD Borche Makarijoski^{1*}, Blagojche Najdovski¹

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Abstract

This study investigates the dynamics of active and titratable acidity in white brined cheese throughout its ripening period. Monitoring these parameters is crucial for understanding the biochemical changes that influence the cheese's flavor, texture, and overall quality. Using standard analytical methods, we measured pH and titratable acidity at regular intervals during the ripening process. The results indicated a significant decrease in pH, coupled with an increase in titratable acidity, reflecting the ongoing microbial and enzymatic activities. These changes were correlated with the development of desirable organoleptic properties. The findings provide valuable insights for cheese producers to optimize ripening conditions, ensuring consistent product quality. This research highlights the importance of acidity monitoring as a critical control point in cheese production.

Key words: white brined cheese, ripening, active acidity, titratable acidity, cheese quality.

INVESTIGATING SILAGE-DERIVED MICROBIAL ISOLATES FOR PROBIOTIC APPLICATIONS IN ANIMAL NUTRITION Igor Pavlovski^{1,2*}, Emira Zekiri², Natali Angeleska², Marija Todorovska Ivkovikj^{1,2}, Dzoko Kungulovski², Natalija Atanasova-Pancevska²

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Abstract

This research investigates the probiotic potential of microbial isolates obtained from silage sourced from three distinct producers in Tetovo, Kumanovo, and Prilep, Macedonia. A total of 36 aerobic bacteria, 35 Lactic Acid Bacteria (LAB), 7 Enterobacteria, 31 yeasts, and 7 molds were isolated and characterized for their suitability as probiotics for animal feeding. Subsequent analysis revealed that certain aerobic bacterial isolates exhibit extremophilic traits, demonstrating vigorous growth across a wide temperature range from 10 to 45 °C. These extremophilic aerobic bacteria, discovered within the silage microbial community, emerge as promising contenders for probiotic utilization in animal nutrition. Their capacity to flourish under varying temperature conditions implies adaptability to the fluctuating environmental conditions encountered in the gastrointestinal tract of livestock. Moreover, the existence of lactic acid bacteria, yeasts, and molds in the silage microbiota highlights the abundant diversity of potential probiotic candidates within this agricultural byproduct. Utilizing these native microbial resources found in silage presents a sustainable method for enhancing both animal health and performance. By integrating specific isolates into animal feed formulations, there exists the potential to enhance nutrient utilization, regulate gut microbiota composition, and strengthen immune function among livestock. Future research initiatives should prioritize a deeper exploration of the probiotic characteristics exhibited by these extremophilic aerobic bacteria. Additionally, conducting in vivo trials is essential to confirm their effectiveness in promoting animal well-being and productivity within farm environments.

Key words: silage, probiotics, extremophilic microorganisms, livestock nutrition.

BOOK OF ABSTRACTS
SECTION: QUALITY CONTROL AND FOOD SAFETY

THE IMPORTANCE OF MACRO AND MICRONUTRIENTS IN THE DIET Milena Magerovska^{1*}, Kristina Tomska¹, Elena Joshevska¹

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Abstract

The importance of macro and micronutrients in the diet Nutrition is a process that begins with the introduction of food into the body until the moment of its utilization of energy, building and protective substances. Proper nutrition should ensure a sufficient intake of energy nutrients, fats and carbohydrates in order to satisfy energy needs, a sufficient intake of building materials, proteins and a sufficient intake of protective substances, vitamins and minerals. Food can be of plant and animal origin and contain all essential nutrients such as: carbohydrates, fats, proteins, vitamins and minerals. Hence its division into: macronutrients and micronutrients. Macronutrients are the three basic components of our diet that provide us with energy and enable us to carry out our daily activities. Each macronutrient has a specific role in our body and their proper balance is essential for maintaining good health. Exactly because of their importance, in this paper emphasis is placed on the macronutrients represented in food, that is, the importance of proteins, carbohydrates and lipids, as well as the representation and importance of vitamins and minerals as the most important micronutrients in food.

Key words: food, nutrients, carbohydrates, proteins, vitamins.

BOOK OF ABSTRACTS
SECTION: QUALITY CONTROL AND FOOD SAFETY

FRESH HOMEMADE SAUSAGES WITH ADDED STABILIZERS OF NATURAL ORIGIN

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Abstract

Fresh home-made sausages are one of the most commonly produced meat products that are produced industrially or in individual artisan meat workshops. For the production of fresh sausages, it is used pork meat from I and II category, solid fatty tissue, spices and vegetables. Natural stabilizers are added to the sausage mixture, in order to maintain and improve the quality of the products. The purpose of this paper is to see the impact of the added natural stabilizers on the chemical composition of the sausages, and with the sensory analysis to evaluate the final effect of the stabilizers on the quality properties of the produced sausages. For testing, 4 production batches of fresh sausages were used, one of which is a control batch without additives, and in the other three batches of sausages, guar gum, corn starch and potato starch were added as stabilizers. Examinations of the chemical composition and sensory characteristics of all four batches were determined after 5 days of keeping the sausages in ambient conditions. During the analysis of the chemical composition, the content of: water, proteins, fats, carbohydrates, mineral substances and NaCl was determined. To evaluate the representative properties of the sausages, a corrected five-point scoring system and a ranking method were used. The sensory analysis covers the following quality properties of the sausages: (cut appearance, smell, taste, color, consistency). From the obtained results, it can be concluded that the fresh sausages with the addition of stabilizers have a preserved chemical composition and satisfactory sensory characteristics.

Key words: fresh sausages, natural stabilizers, chemical composition, sensory analysis.

BOOK OF ABSTRACTS
SECTION: QUALITY CONTROL AND FOOD SAFETY

ARESEARCH ON THE COMPOSITION OF MADŽUN (GRAPE MOLASSES) PRODUCED FROM TABLE GRAPE VARIETIES Violeta Dimovska¹, Biljana Vitanovska², Fidanka Ilieva¹, Aleksandar Piperevski³

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Abstract

Traditional food is considered a heritage passed down through generations and consumers expect specific sensory properties and high food quality. Grape molasses is one of the popular and traditional food in North Macedonia for the last 10 years. It is mostly produced in a traditional way under the name "Madžun". In this study, four samples of Madžun (grape molasses) were included, 2 samples were from the Afus ali variety and 2 samples were from the Cardinal variety. They are taken from well-known local producers from the Tikvesh vineyard, R. North Macedonia. The following were analyzed: the content of total and individual sugars (glucose, fructose, sucrose and maltose), total phenols and the content of hydroxymethyl furfural (HMF). Regarding the individual sugars, the analyzes showed that in all samples the content of sucrose and maltose was below the detection threshold (<0.15), which confirms that no glucose syrup was added. The content of total phenols ranges from 1060 mg/L (Afus alli) to 1105 mg/L (Kardinal). All Madžun samples are high in hydroxymethyl furfural. It ranges from 720.24 mg/L (Afusa Ali) to 802.89 mg/L (Cardinal), which is characteristic for the traditional way of production. Sensory analysis of the samples was carried out by a committee consisting of 7 members. The following parameters were evaluated: color, smell, taste, sweetness, acidity, texture and aftertaste. The maximum number of points is 20 (ISO 6564, ISO 8587 and ISO 11036).

Key words: madžun (*grape molasses*), sugar, total phenols, HMF.

BIOACCUMULATION OF HEAVY METALS IN FRUIT OF SOME NEW TOMATO HYBRIDS

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Abstract

In our study the focus was on determining the level of toxic heavy metals such as Pb, Mo, Cd and Hg in tomato fruit at one commercial hybrid - Adriatic F1 and nine new hybrids grown under identical conditions in greenhouse. Depending on their concentration and capacity for bioaccumulation, they can provide a range of health risks. The concentration of heavy metals in the research was determined by flame atomic absorption spectrophotometry. Average concentrations of heavy metals varied in factors from hybrid, the lowest concentration of lead (11.96 µg/kg), molybdenum (26.25 µg/kg) and cadmium (7.41 µg/kg) and mercury (0.86 µg/kg), is found in the hybrid marked as 140, while the highest concentration of cadmium (39.23 µg/kg) in the hybrid 116, while the maximum concentration of lead (40.99 µg/kg), molybdenum (96.64 µg/kg) and mercury (3.08 µg/kg) was measured in the commercial hybrid Adriatic F1. Pearson's correlation coefficient showed that there is a strong positive correlation between molybdenum and mercury (r 0.83), and a medium-strong positive correlation between molybdenum and lead (r 0.69), mercury and cadmium (r 0.52) and mercury and lead content (r 0.64) in fruit. The obtained results suggested that the increase of the metal concentration in tomato fruits can be conditioned by the genetic predispositions of the plants.

Key words: tomato, heavy metals, bioaccumulation.

ANTIFUNGAL ACTIVITY OF COMPOST-DERIVED BACTERIA AGAINST CHALKBROOD FUNGUS *ASCOSPHAERA APIS* Igor Pavlovski^{1,2*}, Teodora Dimova², Marija Karbeska², Marija Todorovska Ivkovikj^{1,2}, Dzoko Kungulovski²

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Abstract

Chalkbrood disease, caused by the fungus *Ascosphaera apis*, poses a significant threat to honeybee colonies worldwide. In this study, we investigated the antifungal potential of bacteria isolated from compost against *A. apis*, with a focus on identifying the most effective isolates. Eight bacterial isolates were obtained from compost samples, including *Bacillus velezensis*, *Paenibacillus alvei*, *Paenibacillus polymixa*, and *Bacillus spp.* These isolates were evaluated for their antifungal activity using agar well diffusion assays. Among the isolates tested, AA/15 identified as *Paenibacillus polymixa* exhibited the most potent antifungal activity against *A. apis*. This isolate demonstrated significant inhibition zones, indicating strong antagonistic effects against the chalkbrood fungus. Further characterization of the antimicrobial compounds produced by AA/15 revealed promising prospects for biocontrol strategies against *A. apis* in apiaries. Our results highlight the potential of bacteria obtained from compost, in particular *P. polymixa*, as natural agents to treat chalkbrood in beehives. Subsequent investigations ought to focus more on clarifying the precise mechanisms that underlie AA/15's antifungal activity and investigate its use in field tests to confirm its effectiveness as a biocontrol agent against *A. apis*. These initiatives have the potential to produce long-term remedies that lessen the negative effects of chalkbrood disease on the beekeeping sector.

Key words: chalkbrood disease, *Ascosphaera apis*, *Paenibacillus polymixa*, antibiosis

SOIL SCIENCE AND HYDROLOGY

BOOK OF ABSTRACTS
SECTION: SOIL SCIENCE AND HYDROLOGY

SOIL ELEMENT ANALYSIS IN TOBACCO CULTIVATION AREAS OF THE PRILEP REGION: ENVIRONMENTAL AND AGRICULTURAL PERSPECTIVES Bojana Dimovska Gonovska^{1*}, Biljana Jordanoska Shishkoska¹, Trajce Stafilov², Valentina Pelivanoska¹

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Abstract

Soil quality is pivotal to successful agricultural production, particularly in tobacco cultivation where high yields and superior quality are of paramount importance. The composition of soil, especially the content of macroelements and potentially toxic elements, has a significant impact on the quality and yield of crop. In this study, soil samples were collected from tobacco fields in Prilep agricultural region of North Macedonia in 2021 and 2022, which is the biggest region known for the cultivation of oriental tobacco. The analysis of soil samples using inductively coupled plasma - mass spectrometry (ICP-MS) enabled the determination of the content of numerous chemical elements, including macroelements (Fe, K, Mg, and Na) and potentially toxic elements (As, Cd, Cr, Cu, Ni, Pb, and Zn). Selected macro elements and potentially toxic elements are presented from soil samples from Prilep region. This work provides information on soil quality and the potential environmental impact of tobacco cultivation. Based on the analysis of the data presented in this paper, it can be concluded that the content of macro-elements in the Prilep region is linked to the geological and pedological characteristics of the soil. It has been determined that potentially toxic elements are present in lower concentrations than the reference values for heavy metals in soils.

Key words: soil, tobacco fields, Prilep region, macroelements, potentially toxic elements, ICP-MS.

BOOK OF ABSTRACTS
SECTION: SOIL SCIENCE AND HYDROLOGY

ANALYSIS OF GROUNDWATER QUALITY IN SHALLOW WELLS BEFORE AND AFTER DISINFECTION WITH PERACETIC ACID Ankica Anastasova¹, Dimitar Nakov^{1*}, Aleksandra Angjelevska², Aco Kuzelov¹, Fidanka Ilieva¹

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Abstract

Peracetic acid has garnered increasing attention as an alternative oxidant and disinfectant in water treatment due to the rising demand to reduce chlorine usage and control disinfection byproducts. The main aim of the research was to assess the well water quality before and after disinfection with peracetic acid. The water samples were taken from 5 wells in the rural areas of Probishtip and Kocani regions of North Macedonia. Sampling was conducted twice during the winter season, both before and after disinfection. Water samples from 5 private wells were analysed for physical, chemical, and microbiological parameters using referent methods. The results were compared with the quality of control water and permissible limited values according to the national legislation. Water quality parameters indicated that all well water samples failed to meet safe drinking water limits. Disinfection with 0.025% peracetic acid did not increase the groundwater quality. The paired sample t-test showed that there was no statistically significant difference in parameters for water quality before and after disinfection. These findings may be linked to permanent sources of faecal contamination in well water. In the subsequent research, the highest concentration of peracetic acid will be used to reach better results in water disinfection. Identification and management of groundwater quality are of utmost importance for maintaining freshwater resources, which is essential for sustainable development. Based on the groundwater quality in different areas, householders can allocate resources for either drinking or agricultural purposes.

Key words: well water quality, disinfection, peracetic acid.

BOOK OF ABSTRACTS
SECTION: SOIL SCIENCE AND HYDROLOGY

ECO-TOXICOLOGICAL RISK ASSESSMENT OF E-WASTE SOIL POLLUTION Biljana Balabanova^{1*}

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Abstract

Electronics have unique characteristics that make their production and distribution a source of high impact on the environment, as well as hazardous toxicological waste. In the past few decades, the need for e-waste management has significantly advanced by standardizing protocols for their treatment. However, huge amounts of e-waste do not succumb to such standardized protocols, which is why these landfills pose a serious threat to soil health. This study reviews recent reports on the environmental risks of e-waste, with a particular focus on routes of exposure and human toxicities. In general, the main environmental basin that deposits untimely treated electronic waste is the soil. It was determined that specific e-waste chemical elements and compounds are: a) toxic heavy metals (lead, cadmium, chromium and mercury) and b) organic pollutants (poly-brominated diphenyl ethers (PBDE), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), poly-brominated biphenyls (PBB), poly-halogenated aromatic hydrocarbons (PHAHs), biphenyl A (BPA) and others. This research also covers the mechanisms that mostly affect the retention and transformation of these components in soils exposure routes and toxicity effects in the human population are reviewed.

Key words: toxic substances, electronic waste, soil pollution, toxicological issues.

DATA EXTRACTION OF SIGNIFICANT SOIL CHEMISTRY MARKERS FOR SUSTAINABLE VITICULTURE Aleksandar Piperevski*, Biljana Balabanova¹

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The 21st Century soil science must deeply grapple with the enormity of the agricultural impact on soils, and the complex ways in which this impacts soil sustainability. There are several risks associated with unbalanced soil management, such as compaction, pollution, soil erosion, soil organic matter (SOM) depletion, and loss of biodiversity, that lead to a drop-in vine quality and quantity. Soil chemistry and sustainable soil management in vineyards are directly correlated with wine grape quality. A critical component of this approach is the thorough understanding of soil chemistry. This study provides an overview of baseline soil chemistry markers that are essential for sustainable viticulture. Improvement of these soil chemistry markers helps in the development of better soil management practices. Climate change impacts, showed doubts about its long-term sustainability in vineyard soil management. Main goal of the present investigation is to identify key soil chemistry markers, critical for sustainable viticulture, with certain emphasis on their roles and optimal levels. Key markers include pH levels, organic matter, macronutrients (nitrogen, phosphorus, potassium, calcium, magnesium and sulfur), micronutrients (iron, manganese, zinc, copper, boron and molybdenum), cation exchange capacity (CEC), electrical conductivity (EC), soil texture and structure. Moreover, maintaining an optimal pH value, balanced levels of micronutrients and micronutrients and a high content of organic matter significantly contribute to optimal agro-environment for viticulture. Regular control and monitoring of sustainable chemical markers can reduce the unnecessary use of chemical fertilizers, encouraging a more sustainable and ecological approach to viticulture.

Key words: soil chemistry, chemical markers, viticulture, soil management.

VITICULTURE, ENOLOGY AND FRUIT PRODUCTION

COMPARATIVE STUDIES OF SOME QUALITY FACTORS THAT AFFECT THE PLACEMENT OF SOME TABLE VARIETIES ON THE MARKET IN THE R. N. MACEDONIA

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Abstract

This paper shows several comparative studies of some factors, that is, several parameters for quality and resistance between certain table varieties that are represented at different times on the market in the R.N. Macedonia. The varieties tested were: muscat italia, cardinal, afus alli, victoria, palieri, red globe and kings ruby. The varieties are grown in certain vineyards in the Republic of North Macedonia, and some are imported from foreign markets. In the studied varieties, the most attention was focused on the characteristics - chemical composition of the grain, mechanical properties of the bunch and the grain (resistance and reaction strength), resistance to diseases and pests, resistance to frost and drought, storage in a refrigerator, tasting evaluation, etc. From the researches, it was concluded that on the ranking and placement of the varieties on the Macedonian market, in addition to the cost price and the use value, the individual evaluation of the consumer (taste and appearance of the variety) has a great influence. Some varieties still cannot be removed from the assortment, and based on the examined properties, a ranking is made of the representation and quality of the varieties on the market.

Key words: market, taste, ranking, quality, tasting rating.

BOOK OF ABSTRACTS

SECTION: VITICULTURE, ENOLOGY AND FRUIT PRODUCTION

ISOLATION AND CHARACTERIZATION OF NATIVE YEAST STRAINS FROM THE MACEDONIAN INDIGENOUS GRAPE VARIETY STANUSINA Marija Todorovska Ivkovikj^{1,2*}, Igor Pavlovski^{1,2}, Dzoko Kungulovski¹, Elena Petrovska¹

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Abstract

In North Macedonia, there are numerous indigenous (autochthonous) grape varieties. The cultivation of Stanusina grapes and the production of wines from this variety have been passed down through generations of Macedonian winemakers, contributing to the preservation of traditional winemaking practices and techniques. This study delves into indigenous wine yeasts found naturally on Stanusina grapes and their significance in winemaking. Throughout the ripening and processing of grapes, as well as during fermentation of the grape must, the distribution of individual yeast species undergoes changes. This study aims to cover topics including grape must fermentation, isolation of indigenous yeast microflora during spontaneous fermentation, microbiological and oenological characterization of isolates, and provides an overview of fundamental autochthonous yeast species and their unique winemaking potential. Different yeasts that naturally exist on the Stanusina grape varieties were isolated from vineyards in the Pelagonija-Polog region. A total of 18 yeast isolates were obtained. The morphological and physiological characteristics of the isolates were determined by their tolerance to glucose, alcohol, and temperature. 100% tested isolates were tolerant of 150 mg / L H₂SO₃ and showed growth on 50 % medium with glucose. 9 of the isolates are capable of fermentation, and yeasts S 06 and S 09 are tolerant up to 15% alcohol. Isolates signed S 06, 07, 08, 09 showed the best results. Isolates can participate in the production of Macedonian wine with personalized characteristics and also can contribute to the making of wine specific and unique to the local Macedonian regions.

Key words: autochthonous yeasts, Stanusina, indigenous grapes, tolerance.

FOURIER-TRANSFORM INFRARED SPECTROSCOPY FOR ANALYSIS OF STANUŠINA WINES PRODUCED BY HONEY ADDITION BEFORE FERMENTATION Elena Bogva¹, Štefan Ailer², Silvia Jakobová³, Violeta Dimovska¹, Sasa Mitrev¹, Violeta Ivanova-Petropulos^{1*}

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Abstract

In this study, two Stanušina wines were produced with addition of honey before fermentation (20 and 40 g/L added honey) in order to study the influence of the honey on the chemical composition of wine. In total, 14 parameters have been simultaneously determined in honey Stanušina wines applying fourier-transform infrared spectroscopy (FT-IR) and compared to the control wine (produced without addition of honey). Following parameters were determined: alcohol, density, glycerol, pH, total acidity, total sugars, individual carbohydrates (glucose, fructose and saccharose), as well as individual organic acids (tartaric lactic, malic, citric and acetic). It was noticed that wine fermented with 20 g/L honey added before fermentation presented increased content of almost all parameters, with exception of glucose and saccharose, which concentration was highest in the wine fermented with 40 g/L added honey. Concerning the organic acids, tartaric acid was the dominant organic acid in wines, as it was expected, followed by malic, citric and lactic acid, regardless the addition of honey. In general, wines presented satisfactory values for alcohol, pH, total acidity, glycerol and acetic acid, confirming the quality and stability of the wines.

Key words: honey, fermentation, alcohol, carbohydrates, organic acids, basic parameters, FT-IR, Stanušina wine.

Acknowledgements: This work was supported by the CEEPUS Network (SK-1516) BioScience, Food and Health, which is gratefully acknowledged.

BOOK OF ABSTRACTS

SECTION: VITICULTURE, ENOLOGY AND FRUIT PRODUCTION

MALDI-TOF-MS DETECTION OF PIGMENTS IN WINES DURING MACERATION Zorica Temelkova¹, Marko Stojakovic¹, Violeta Ivanova-Petropulos², Ferenc Kilar³, Klemen Lisjak⁴, Laslo Mark⁵

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Abstract

In this study, matrix-assisted laser desorption and ionization time-of-flight mass spectrometry (MALDI-TOF-MS) was used for qualitative analysis of anthocyanins and derived pigments in red Vranec wines (*Vitis vinifera* L.) [1, 2]. Wines were produced from whole and crushed berries, and samples were taken after maceration of 3, 5, 7, 9, 10, 12, 15, 18 and 20 days. Extraction of pigments was performed with Sep-PAK® Plus C18 cartridge columns. Sinapic acid was used as a matrix for analyses of the samples. Based on the targeted fragmentation of the ions of interest (their M⁺ signals), the pigment peaks were identified under positive ion mode. Polyphenolic compounds were detected as flavonoids (anthocyanins and derived pigments, flavonols, flavanones, flavones, isoflavonoids), phenolic acids (hydroxycinnamic acids), lignans and stilbenes. Glucoside, acetylglucoside and *p*-coumarylglucoside derivatives of anthocyanins were confirmed to be present in the wines.

Key words: red wine, polyphenols, anthocyanins, pigments, MALDI-TOF-MS.

Acknowledgments: This work was financially supported by the Central European Exchange Program for University Studies (CEEPUS) Program realized through the CEEPUS network (Teaching and Learning Bioanalysis) covering the study stay of Zorica Lelova at the University of Pécs, Hungary where the analysis were performed.

BOOK OF ABSTRACTS

**4th INTERNATIONAL MEETING
AGRISCIENCE & PRACTICE (ASP 2024) (13th June 2024, Stip)
Faculty of Agriculture, Goce Delcev University - Stip
July, Stip, Republic of North Macedonia**

BOOK OF ABSTRACTS

**4th INTERNATIONAL MEETING
AGRISCIENCE & PRACTICE (ASP 2024)
(13th June 2024, Stip)**

**Faculty of Agriculture, Goce Delcev University - Stip
July 2024, Stip, Republic of North Macedonia**