

***“AGRICULTURE AND
FOOD - CURRENT AND
FUTURE
CHALLENGES”***

AGRIFA

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CUPRINS

COMPARATIVE STUDY ON PHYSICO-CHEMICAL CHANGES DURING DRY AGING OF BLACK ANGUS AND ROMANIAN SPOTTED BEEF	4
Cristina Gliga, Adriana P. David, Giorgiana M. Cătunescu, Mihai Voevod, Maria Tofană.....	4
IODINE IN FOOD AND ENVIRONMENT IN AUSTRIA	5
Manfred Sager.....	5
EDIBLE FILMS BASED ON WHEY PROTEIN ISOLATE AND TARRAGON ESSENTIAL OIL: FORMULATION AND CHARACTERISATION	7
Maria-Ioana Socaciu, Melinda Fogarasi, Cristina Anamaria Semeniuc, Sonia Ancuța Socaci, Mihaela Ancuța Rotar, Vlad Mureșan, Oana Lelia Pop, Dan Cristian Vodnar*	7
POTENTIAL USE OF FLOWERS OF ROBINIA <i>PSEUDOACACIA L.</i>.....	8
Liana C. Salanță, Maria Tofană, Carmen R. Pop, Sonia S. Socaci, Anamaria Pop, Teodora E. Coldea, Anca C. Fărcaș, Melinda Fogarasi, Valentina Socaciu.....	8
DETERMINATION OF SOME HEAVY METAL PROFILES IN FOOD OF ANIMAL ORIGIN FROM VARIOUS REGIONS OF ROMANIA	8
Oana Cadar, Zamfira Dinca, Alexandra Hoaghia, Ana Gusan, Alexei Popa, Tatiana Stratulat.....	8
THE INFLUENCE OF HOMEOPATHIC TREATMENT ON THE GROWTH OF FRAGARIA PLANTS.....	9
Mornea Petrache Alina, Adela Hoble, Teodora Morar, Cristian Petrache, Camelia Scheau, Madalina Cosovanu, Emil Luca	9
COENZYME Q₁₀: HEALTH BENEFITS AND BIOAVAILABILITY.....	10
Andersina-Simina Podar, Cristina Anamaria Semeniuc, Sonia Socaci, Maria-Ioana Socaciu, Melinda Fogarasi And Anca C. Farcaș.....	10
TRANSYLVANIAN WILD EDIBLE MUSHROOMS ASSOURCES OF BIOACTIVE MOLECULES	11
Fogarasi Melinda, Socaci Sonia, Dulf Francisc, Semeniuc Cristina, Socaciu Maria, Țibulcă Dorin, Salagean Dan, Salanta Liana, Tofana Maria, Pop Carmen.....	11
CHLORPYRIFOS RESIDUE LEVELS IN LOCAL CROPS FROM THE REPUBLIC OF MOLDOVA AND ROMANIA.....	12
Tatiana Stratulat, Alexei Popa, Ana Gușan, Alexandra Hoaghia, Oana Cadar	12
POTENTIAL OF RAMAN ANALYSIS IN THE DETERMINATION OF MILK ADULTERATION.....	13
Becze Anca, Naghiu O. Mihai, Babalau Fuss Liliana Vanda, Cepoi Liliana, Simedru Dorina	13

DETERMINING THE EFFICIENCY OF ZEOLITE IN ELIMINATING THE SMELL OF TOBACCO	14
Becze Anca, Babalau Fuss Liliana Vanda, Lucian Dordai.....	14
ANTIOXIDANT CAPACITY OF FRESH PRUNUS SPINOSA OBTAINED BY SUPERCRITICAL CO₂ EXTRACTION TECHNIQUE.....	15
Vanda Băbălău Fuss, Anca Becze, Ana Moldovan, Maria Tofană	15
METHOD FOR DIRECT MERCURY DETERMINATION IN VEGETABLES USING THERMAL DECOMPOSITION - ATOMIC ABSORPTION SPECTROMETRY	16
Marin Șenilă, Bogdan Angyus, Alexandra Hoaghia, Oana Cadar	16
BEHAVIOR OF SOME GRAPEVINE VARIETIES FROM MURFATLAR VINEYARD IN THE SPECIAL CLIMATIC CONDITIONS OF THE WINE YEAR 2019-2020	17
Ionica Dina, Aurora Ranca, Anamaria Tănase, Ene Sergiu-Ayar	17
MICROALGAE BIOMASS AS BIOFERTILIZER IN AGRICULTURE FOR ENHANCING PLANT GROWTH	18
Zamfira Dincă, Anamaria Iulia Török, Emilia Neag, Cecilia Roman	18
NEW MATERIALS BASED ON NATURAL ZEOLITES USED FOR PETROLEUM PRODUCTS SORPTION AND WASTE RECOVERY.....	19
Maria-Alexandra Hoaghia, Ioan Aschillean, Eniko Kovacs, Cecilia Roman, Marin Senila.....	19
THE EFFECTS OF IRRIGATION REGIME AND NITROGEN RATES ON RAPESEED YIELD FOR BIOFUELS OBTAINING.....	20
Marius Roman, Lucian Dordai, Cerasel Varaticeanu, Lacrimioara Senila	20
ORGANIC FERTILIZATION METHOD TO INCREASE THE QUANTITY AND QUALITY OF CARROT (<i>DAUCUS CAROTA</i>) PRODUCTION USING NATURAL ZEOLITES.....	20
Lucian Dordai, Anca Becze, Marius Roman	20
<i>VITIS VINIFERA L.</i> – PHYTOCHEMICAL STUDIES AND BIOLOGICAL ACTIONS.....	21
Mirela Moldovan, Cătălina Bogdan, Sonia Iurian, Laurian Vlase, Daniela Benedec	21
EXPERIMENTAL DESIGN – APPROACH FOR THE FORMULATIONS OF ORAL CARE PRODUCTS CONTAINING <i>VITIS VINIFERA L.</i> EXTRACTS	22
Cătălina Bogdan, Sonia Iurian, Daniela Benedec, Mirela Moldovan	22
MONOCROP CULTURE LONG TERM STRAW RETURN IMPACT ON SOIL STRUCTURE, ABUNDANCE, AND MICROBIOTA CATABOLIC ACTIVITY: CONSEQUENCES ON SOIL FUNCTIONS.....	23
Kovacs Eموke Dalma, Roman Cecilia, Kovacs Melinda Haydee, Rusu Teodor, Szajdak Wojciecj Lech, Tian Di	23
PHARMACEUTICALS UPTAKE BY VEGETABLES: EXPOSURE ROUTE SIGNIFICANCE .	24
Kovacs Eموke Dalma, Silaghi-Dumitreseu Luminita, Roman Cecilia, Kovacs Melinda Haydee, Szajdak Wojciecj Lech	24

FOREST LITTER UNDER ALTERED FREEZ-THAW EVENTS DRIVE DIFFERENTIATION OF MICROBIAL COMMUNITY STRUCTURE AND FUNCTIONS IN THE LITTER HORIZON ACROSS MIXED FOREST ECOTONE.....	25
Kovacs Eموke Dalma, Roman Cecilia, Kovacs Melinda Haydee, Rusu Teodor, Szajdak Wojciecj Lech, Tian Di.....	25
CHLOROPYLL A AND B BIOMASS AS AN INDICATOR OF WATER QUALITY CONDITIONS. A STUDY CASE OF AN OLD MINE WATER DISCHARGE.....	26
Moldovan Ana, Hoaghia Maria-Alexandra, Băbălău-Fuss Vanda, Roman Marius, Micle Valer	26
FEATURE EXTRACTION METHODS FOR THE CLASSIFICATION OF GRAPE LEAVES ...	26
Stefania Barburiceanu.....	26
RESEARCH AND CONTRIBUTIONS IN HYPERSPECTRAL IMAGE CLASSIFICATION USING ARTIFICIAL INTELLIGENCE TECHNIQUES.....	27
Andreia Valentina Miclea	27
SENSOR SYSTEM FOR FOLIAGE DETECTION IN VINEYARDS	27
S. Meza, D. Petreus, E. Szilagyi, T. Patarau, R, Etz	27
CERCETĂRI PRIVIND INFLUENȚA METODEI DE FERTILIZARE ASUPRA NUMĂRULUI DE FRUCTE, MASEI ȘI PRODUCȚIEI DE ARDEI.....	28
Oana Corduneanu, I. Țenu, V. Stoleru, R. Roșca, P. Cârlescu, V. Arsenoiaia, M. Băetu.....	28

COMPARATIVE STUDY ON PHYSICO-CHEMICAL CHANGES DURING DRY AGING OF BLACK ANGUS AND ROMANIAN SPOTTED BEEF

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Introduction: The *Black Angus* (BA) meat is considered worldwide as the ideal choice for a successful, tasty and at the same time healthy steak. The Romanian spotted (Rs) is known as a mixed breed, but it is exploited almost exclusively for milk in Romania and rarely for meat. Therefore, few studies have considered the changes in the Romanian spotted beef during aging, a very commercially appealing technique.

Aims: The aim of this study was to compare the physico-chemical changes in Black Angus and Romanian spotted beef after a 21-day of dry aging period.

Materials and Methods: The both beef sirloin used in this research were bought from a Romanian farm, near to Cluj. Three cuts from each breed (BA and Rs) were sampled in day 0 and were preserved at -18°C until further analysis. The other 3 cuts of Rs and BA tenderloin were dry aged at 1-2°C and < 90% relative humidity for 21 days. At the end of the aging period, each sample was minced and analysed by Food Scan Lab. The measured parameters were: content of fat (%), content of protein (%), content of collagen (%), content of water (%) and collagen-protein ratio. The results were expressed as mean of 3 measurements \pm standard deviation. The data was statistically analyzed: Microsoft Office Excel and ANOVA.

Results: The physico-chemical changes during the aging period are similar for both breeds, respectively: the content of protein and water in the Rs and BA sirloins were significantly higher at the end of the aging period: $17.12\% \pm 0.51$ respective $16.9\% \pm 0.50$ compared to $15.18\% \pm 0.51$ and $15.6\% \pm 0.50$. The fat content and collagen to protein ratio significantly decreased in both case ($30.35\% \pm 1.98$ compared to $22.44\% \pm 0.91$ in Rs case and $31.08\% \pm 1.05$ compared to $27.23\% \pm 0.89$ in BA case).

Following the ANOVA analysis, in the case of both sirloin cuts, the p values recorded were >0.05 , which means that the changes that occur on the 21st day of aging are significantly different from the 0 day of aging.

Conclusion: In the current study, for both breeds, changes in physico-chemical parameters during aging period have the similar trend: decreasing for fat content and collagen-protein ratio and increasing for protein and water content, which means that changes in the elements analyzed, are not influenced by the breed of meat origin.

Keywords: dry aging, meat compounds, Romanian spotted

IODINE IN FOOD AND ENVIRONMENT IN AUSTRIA

Manfred Sager

Introduction Most of the iodine present in the earth crust is contained in deep sea sediments, clays and marine watersheds, thus mean crust abundance estimations vary between 0,2 and 0,8 mg/kg. Among the non-metals, iodine is the least occurring. Because almost all compounds are water-soluble, iodine minerals are evaporites and hardly mined, and main amounts are recovered from algae and brines. Main producers are Japan and Chile. Because of some affinity to humics and algae, iodine is enriched in coal seams with respect to chlorine. Iodine concentrations in oceans are variable due to salinity, water input and evaporation. In Europe, iodine levels in potable water decrease from the seaside towards the continental interior. In the sea, algae accumulate iodine and excrete excesses via methylation. At the water surface, gaseous I-O is formed by photoreaction with ozone, which evaporates together with water and precipitates together with rain, preferably in coastal areas. Due to affinity to humics, resp. positively charged iron oxide surfaces in acid soils, iodine mobility in soils is low, and it gets enriched in topsoils till ½ m depth. Its speciation can vary widely, like I⁻ (iodide; in anoxic waters), IO₃⁻ (iodate; in oxic limnic waters), I₂Cl⁻ (in brines), and organically bound iodine, but data usually refer to total iodine contents. Food and feed state control targets to I-enriched nutritional supplements (available in drug-stores, like algal preparations), additions to table salt (in Austria 15-20 mg/kg) and to composite feeds (upper permissible level 40 mg/kg). Apart from determination of tetra-iodo-thyroxine itself, control of iodine levels in urine and blood helps to indicate thyroid function status.

Analytcs: Analyses of additions of soluble iodides and iodates to feeds of plant origin have been standardized by extraction into tetramethylammonium hydroxide (German VDLUFA-method), which implies filtration/centrifugation as a separation from the main matrix. Similar to the analysis of trace metals, the best approach towards a suitable sample solution is to achieve complete dissolution and destruction of any organic material. In order to avoid volatilization losses, rapid transfer into the only non-volatile species iodate is favourable, which could be achieved by digestion in presence of excess chlorate (ClO₃⁻). Because chloric acid itself is explosive, microwave assisted pressure digestion has been performed using an almost saturated KClO₃-solution, acidified with nitric acid, which turned out to be suitable for almost all metals and non-metals, except Rb and Cs, apart from matrix K. Iodate and sulfate are formed immediately, the presence of water reduces pressure of CO₂ and NO_x by adsorption, and avoids volatilization of H₃BO₃ and GeCl₄, thus permitting 4 times the sample weight compared with nitric acid only. Limitations occur from limited solubility of siliceous acid, as well as formation of monochloro-nitro benzoic acids in case of aromatic compounds as the main sample matrix. Final determinations by ICP-OES or ICP-MS can be done either as the iodate from oxidizing acid solutions, or as the iodide from neutral reducing solutions. I₂ and HI evaporate as gases in the nebulizer and yield unspecifically higher signals. Apart from some signal depression of the salt matrix, in the optical system an adjacent P-line severely overlaps the most sensitive iodine-emission line at 178 nm, which necessitates non-linear corrections for low P-contents (like met in table salts), or suitable separation. In chlorate-containing digests, phosphate could be co-precipitated with Al-hydroxide by addition of aqueous ammonia, leaving the iodate in solution. In the ICP-MS, interferences occurred mainly from signal depression from the salt matrix, as well as from memory effects. Additions of Te or Br as internal standards, which have approximately the same ionisation

probability than iodine, led to different results, therefore standard addition combined with 4 intermediate washing blanks to clean the system from memory effects, was done throughout.

Data: The first project including analysis of iodine beneath other main and trace elements, dealt with chicken eggs, sampled together with feeds at chicken farms. Iodine content was found at rather high levels, but varied widely within 10-70 mg per egg. Thus, 4-5 eggs per day might contain the recommended daily intake of 150 µg, but need not. Chickens get their iodine via supplements in their (commercial) feeds, which was also variable (mean 1,10 mg/kg). Iodine moves preferably to egg yolk (mean 3,40 mg/kg in dry mass), and almost not to egg white (mean 0,59 mg/kg in dry mass). Correlations between concentrations met in egg yolk and egg white, resp. actual feeds, were rather weak. Another project targetted on tracing the local origin of cow milk via its trace element spectrum. Milk samples were got directly from the cow via a proportional sampler, and feeds collected on the farm at the same day in Lower Austria. In the crystalline region, basic cattle feeds (hay, grass silage, maize silage) contained significantly lower iodine levels than sampled in the Danube Lowlands and the limestone-containing pre-alpine region. A possible explanation is lower transfer of the anionic iodine because of positively charged adsorption surfaces at the local soil pH (about pH 5,5). But milk from the 3 regions, as well as commercially sold milk monitored all over Europe contained about the same iodine content. Iodine met in potable water was very low and contributed to the daily intake of the cows at about 0,8%. Salt lumps used for cattle were free of iodine. No significant trends of iodine contents in crude milk was noticed versus lactation period and milk fat contents, nor between milk from cows fed outdoor in summer, and the same cows fed indoor in winter time. During separation of the milk fat in the dairy, iodine (like most of the other main and trace trace elements) remains in the whey, and does not move into the milk fat layer. Sheep milk contains higher iodine concentrations than goat milk, and than cow milk, whereas levels met in soy drinks were negligible – important for nutrition of vegans. Due to inputs from milk powder, milk chocolate contains more iodine than dark chocolate and cocoa. In apple plants, leaves contain significantly more iodine than the fruits. The transfer from soil to fruits and leaves (variety Topaz, location Vienna-Jedlersdorf) did not depend on the genetics of the root system. In tomatoes, iodine was found enriched in samples containing the kernels also, like N, P, Mg and Mn, whereas Ca-Sr-Ba were depleted in the kernels. Iodine losses in the cooking process have not been investigated to the knowledge of the author. In commercially available ready-made food, higher iodine levels were found in dishes containing (marine) fish, and cheese. It can be assumed, that most of the ingested iodine in central and eastern Europe is from consumption of eggs and dairy products, and for vegans from leafy vegetables (unless it gets lost into the boiling water). Because the foetus is assumed to have high iodine needs during the 3rd and 4th month of pregnancy, the urine of pregnant women was analyzed in cooperation with the General Hospital. Ingestion of the recommended daily intake given as tablets did not increase renal iodine excretion, which is the main pathway in this case, indicating buffering of the thyroid. Renal excreted iodine only slightly correlated with P, Na, Ca, and Mg, possibly due to dilution effects and iodine storage in the thyroid. Iodine levels in urban biowaste, sampled in freely accessible containers, ranged at the levels met in soils, but some positive outliers of unknown origin appeared, which hardly correlated with other pollutants. Enrichments of European soils by application of biowaste would be beneficial.

EDIBLE FILMS BASED ON WHEY PROTEIN ISOLATE AND TARRAGON ESSENTIAL OIL: FORMULATION AND CHARACTERISATION

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Introduction: In recent years, research has focused on the development of edible films and coatings with antimicrobial activity to control microorganisms that can cause food spoilage or food poisoning. Essential oils are among the active agents used to enhance the functionality of edible films.

Aims: The aim of this work was the comparative characterization of whey protein isolate (WPI)-based edible films obtained from untreated (UNT) and heat-treated (HT) film-forming solutions with different levels of incorporated tarragon essential oil.

Materials and Methods: UNT films were prepared from native WPI solutions and HT films from heat-denatured WPI solutions. Film-forming solutions were obtained by dissolving 5% (w/w) WPI in distilled water. Glycerol was added as a plasticizer in filmogenic solutions, at a concentration of 5% (w/w). For HT films, solutions were subsequently heated for 30 min. at $90 \pm 2^\circ\text{C}$ while being continuously stirred using a magnetic stirrer with heating, then cooled at room temperature for 1.5 h and filtered. The essential oil of tarragon (0.5, 1.0, 1.5, 2.0, and 2.5%, w/w) was added both in native WPI and heat-denatured WPI solutions.

Results: Heat-treatment of the film-forming solution caused increases in thickness, moisture content, swelling degree, water vapor permeability (WVP), b^* -value, ΔE^* -value, transmittance values in the 200–300 nm region, transparency, and puncture resistance of the film, but decreases in water solubility, L^* -value, a^* -value, transmittance values in the 350–800 nm region, and puncture deformation.

Conclusion: HT film showed improved physical and mechanical properties being more transparent, less soluble in water, more light-protective in the range of 350-800 nm, and more resistant to mechanical penetration. Therefore, it is more suitable for certain end-use applications.

Keywords: antimicrobial properties, edible films, heat-treatment, tarragon essential oil, whey protein isolate

POTENTIAL USE OF FLOWERS OF *ROBINIA PSEUDOACACIA L.*

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The genus *Robinia L.* are shrubs characterized by white or pink flowers with an intensive, distinctive, and sweet aroma. The flowers of Acacia (*Robinia Pseudoacacia L.*) are used in the food and traditional medicine, due to their diuretic, sedative, and anti-inflammatory properties. The main bioactive compounds are robinina, acaciina, flavonoids, glycosides, sugars, tannins, various volatile oils, as well as chlorogenic and caffeic acid.

The purpose of this study was the determination of biologically active compounds from acacia flowers. Fresh flowers of *Robinia pseudoacacia L.* were collected by hand in June 2016 from Cluj county. The analyses were conducted on methanolic extracts from fresh and dry flowers. The antioxidant capacity (DPPH), the content of polyphenols, flavonoids, and vitamin C have been evaluated using UV-VIS spectrophotometry.

Based on the data obtained, the Acacia flowers could be used as a raw material in the preparation of cakes or functional products as sources of antioxidants.

Keywords: acacia flowers, bioactive compounds, functional

DETERMINATION OF SOME HEAVY METAL PROFILES IN FOOD OF ANIMAL ORIGIN FROM VARIOUS REGIONS OF ROMANIA

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The aim of this study was to determine some essential trace (Co, Cr, Cu, Mn, Ni and Zn) and toxic (Cd, Hg and Pb) elements in foods of animal origin (raw milk and eggs) by graphite furnace atomic absorption spectrometer (GF-AAS) and cold vapor atomic fluorescence spectrometer (CV-AFS), subsequent priority microwave-assisted digestion. The samples were collected from small-scale local producers living in rural areas in different parts of Transylvania, Romania. The investigated essential trace elements were found to have an important contribution to daily nutrition of consumers in accordance to Recommended Dietary Allowance (RDA). The toxic trace elements (Cd, Hg and Pb) were recorded in very low concentrations and do not present risks to the consumer's health. In addition, some element concentrations displayed distinct seasonal patterns, maxima occurring in summer (Cu and Zn) or winter (Mn).

Keywords: essential elements, toxic elements, milk, egg, Transylvania, Romania.

THE INFLUENCE OF HOMEOPATHIC TREATMENT ON THE GROWTH OF FRAGARIA PLANTS

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Intoduction: Agro-homeopathy can be a win-win solution for the farmers. The homeopathic method was introduced in agriculture as Agro-homeopathy, a system that permits to influence the biological activity of plants, to resolve the problems of nutrition and health of the plants. The agro-homeopathy treatments can diminish the costs of agrochemicals and it will not harm the surrounding plants the soil, the local farm land area or the water that is used as the solvent in the dynamization process (1,2).

Aim: The aim of the research was to investigate the way in which Schuessler's 12 tissue salts influence the development of *Fragaria Vesca* "Alexandria" and *Fragaria Viridis*. Applying homeopathic treatment with Schussler's salts proved to make a difference in the process of the development of *Fragaria sp.* plants. These types of treatment could be an alternative for plant growth without changing the quality of plants and soil.

Materials and methods: The design of the experiment was made with randomized blocks with two treatments and three repetitions. And the biological material used in the experiments is represented by the species *Fragaria vesca* var. *semperflorens* 'Alexandria' and *Fragaria vesca* commonly called wild strawberries.

Results: After applying homeopathic treatment with Dr. Schuessler's 12 tissue salts, there was observed a positive influence on the growth process and development of *Fragaria sp* in height and width of the plants. The homeopathic treatment had an impact between 47% and 65 % higher than the control plot on *Fragaria viridis* height and between 41% and 57 % higher than the control plot on *Fragaria vesca* Alexandira height. The homeopathic treatment had a significant impact between 24% and 54 % higher than the control plot on *Fragaria viridis* width and between 47% and 54 % higher than the control plot on *Fragaria vesca* Alexandria width.

Conclusion: It is concluded that Dr. Schuessler's 12 tissue salts promoted growth of *Fragaria sp* plants in natural conditions. Agro - homeopathic treatment of the 12 tissue salts proved to be beneficial, with notable differences for growth and development of *Fragaria vesca* "Alexandria" and *Fragaria viridis* plants.

COENZYME Q₁₀: HEALTH BENEFITS AND BIOAVAILABILITY

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Introduction: Coenzyme Q₁₀, is a lipophilic metabolite present in nearly all human tissues, being involved in the electron transport chain in the plasma membranes of prokaryotes and in the inner mitochondrial membranes of eukaryotes. This coenzyme participates in aerobic cellular respiration, which generates energy in the form of ATP (95% of the energy of the human body is generated in this way). Therefore, the organs with the highest energy requirements (heart, liver and kidneys) have the highest concentration of CoQ₁₀. After the age of 30-35, the organism loses the ability to synthesise CoQ₁₀ from food and levels of coenzymes deplete in the skin resulting in a reduced production rate of collagen and elastin formation.

Aims: This review focused on the health benefits of CoQ₁₀ dietary supplementation and its bioavailability for human body.

Materials and Methods: In order to achieve the set goal, a screening of the scientific literature from the last 20 years dealing with this theme, was conducted. The literature screening was performed using: National Centre for Biotechnology Information (PubMed), Science Direct, Web of Science, Nature and Elsevier databases.

Results: Stress, infections, poor eating habits and ageing are only a few disorders which affect the organism's ability to provide adequate amounts of CoQ₁₀. More than 200 clinical trials have investigated its use as a drug or dietary supplement and reported beneficial effects for human health.

Conclusion: Researches suggest that using CoQ₁₀ supplements alone or in combination with other nutritional supplements may help to maintain the health of elderly people or treat some of the health conditions and diseases.

Keywords: Coenzyme Q₁₀, dietary supplementation, health benefits

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TRANSYLVANIAN WILD EDIBLE MUSHROOMS ASSOURCES OF BIOACTIVE MOLECULES

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Introduction: Over the last decade, the proven health-promoting abilities of different food classes, especially wild foods originated from unpolluted areas (i.e. mountains) gain the attention of consumers and food industry. It is well known that, mushrooms are consumed as a delicacy for their texture and flavor and have an important nutritional value due to their high protein, essential amino acids and fibers content but a low fat content at the same time and proved to be effective mainly as antioxidant.

Aims: Thus, in order to emphasis the potential benefits of some transilvanian wild edible mushrooms (*A. bisporus*, *P. ostreatus*, *C. cibarius*, *B. edulis*, *L. piperatus*), the present study aims to determine the antioxidant activity and flavonoid content together with phenolic content and fatty acids profile of selected mushrooms species.

Materials and Methods: The methanolic extracts of dried wild edible mushrooms were analyzed for antioxidant activity in different assays, namely, ABTS radical cation decolorization assay, total phenolic content and total flavonoid content. The fatty acids profile were analyzed by gas chromatography–mass spectrometry (GC-MS) using a Perkin Elmer Clarus 600 T GC-MS system.

Results: The experimental results revealed that regardless the mushrooms species, 4-Hydroxybenzoic acid and cinnamic acid were the main phenolic compound present in all selected species. However, in terms of flavonoid content and antioxidant activity *Boletus edulis* greatly over performs the other mushroom species. the selected mushroom samples can be considered excellent sources of PUFAs due to their high contents of linoleic acid.

Conclusion: As an overall conclusion it can be stated that among the studied mushroom species *Boletus edulis* has the greatest potential to be used as a natural source of bioactive compounds for the production of functional foods.

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CHLORPYRIFOS RESIDUE LEVELS IN LOCAL CROPS FROM THE REPUBLIC OF MOLDOVA AND ROMANIA

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Chlorpyrifos (ChP) is a broad-spectrum, chlorinated organophosphorus (OP) insecticide, acaricide and nematicide. ChP is used on agricultural food and feed crops, cattle ear tags, golf course turf, industrial plants and vehicles, non-structural wood treatments including processed wood products, fence posts and utility poles, and to control public health pests such as mosquitoes and fire ants. Therefore, the population (adults and children) are widely exposed through occupational use, contact with treated surfaces, breathing air in treated buildings or near treated fields or orchards. Since 2019, ChP has been excluded from the list of active substances approved for use in the plant protection product. This study aims the determination of ChP contamination level in local most commonly consumed foods of plant origin from local producers, in the pilot districts of the Republic of Moldova and Romania, collected between May 2017 and August 2018. In the pilot areas with intensive use of pesticide, the number of samples contaminated with chlorpyrifos was 2.5 times higher than in the districts with low level of pesticide use. Considering that ChP residues have been detected in the most commonly consumed vegetables and fruits in Moldova and Romania, it can be assumed that one of the important sources of penetration of OP pesticides into the human body are products of plant origin, which may present a high risk to human health in acute and long-term perspective. It should be noted that 13% of the total number of analyzed samples contained chlorpyrifos residues above the MRL.

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POTENTIAL OF RAMAN ANALYSIS IN THE DETERMINATION OF MILK ADULTERATION

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Introduction Milk and dairy adulteration has come to global attention after the discovery of melamine contamination of dairy products in China in 2008. However, the history of milk adulteration is very old. In 1850 a scandal involving the adulteration of milk was reported, which resulted in the deaths of 8,000 children in New York alone. Milk is considered to be the "ideal food" due to the abundant nutrients needed by both infants and adults. It is one of the best sources of protein, fat, carbohydrates, vitamins and minerals. Unfortunately, milk is very easy to adulterate around the world. The motivation for food fraud is economic, but the impact is a real public health problem. The purpose of the study is to evaluate the capacity of the Raman technique to be used for the determination of milk adulteration.

Methodology: With the help of the PROGENY spectrometer, an analytical method has been developed that can be used both to detect the type of milk and to confirm the non-adulteration of cow's milk, by determining the change in the ratio between dry substances. Cow, goat and buffalo milk were used for testing. The samples were placed in a 4 ml bottle which was fixed in the special vial holder of the spectrometer which, in addition, allows the distance or proximity of the sample to the laser source.

Results: The analysis method developed has the following working parameters:

- Laser frequency: 1064 nm;
- Laser power: 380 mW;
- Exposure time: 6000 ms;
- Spectral range: 200-2000 cm⁻¹.

Conclusion: There is a significant difference between the results obtained from the analysis of the 3 types of milk, which demonstrates the adequacy of the method. The analysis can be done easily, it is only necessary to homogenize the sample. Cow's milk had the maximum with the highest value at 818, 1163 cm⁻¹. Goat's milk had the maximum with the highest value at 1441, 1179 cm⁻¹. Buffalo milk had the maximum with the highest value at 1441, 1362 cm⁻¹. The differences in the maximum values represent the profile of fatty acids, specific to each type of milk. Based on the results obtained, it will be possible to develop, using the PLS method, an equation for predicting adulteration.

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DETERMINING THE EFFICIENCY OF ZEOLITE IN ELIMINATING THE SMELL OF TOBACCO

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Introduction Tobacco smoke contains a number of toxicological chemicals such as: polycyclic aromatic hydrocarbons (benzopyrene), tobacco-specific nitrosamines (NNK, NNN), aldehydes (acrolein, formaldehyde), carbon monoxide, hydrogen cyanide, nitrogen oxides, benzene, toluene, phenols (phenol, cresol), aromatic amines (nicotine, ABP (4-Aminobiphenyl)) and harmful alkaloids. The purpose of the study is to evaluate the efficiency of zeolite in eliminating the tobacco smell by evaluating the total PAH and the burning gasses.

Methodology: A sealed chamber was considered a control, and no zeolite was introduced into it. In the rest of the sealed chambers, 5 grams of zeolites of different granulations were introduced which were activated by different treatments (calcination, acid and basic) (fig. 3): • Zeolite of dimensions 1-3 mm, activated by calcination; • Zeolite of 3-5 mm dimensions, activated by basic treatment. ► Flue gas analysis: Flue gas analysis was performed directly by reading from the screen of the portable gas analyzer equipment, model GA5000, Manufacturer: GEOTECH

► Analysis of polycyclic aromatic hydrocarbons: An extraction of both the filter and the chopsticks and the zeolites was performed with 25 ml of hexane as extraction solvent. The mixture of extraction solvent and sample was placed on an ultrasonic bath for 30 minutes so as to ensure optimal extraction. After filtration the extract was concentrated to dryness using a vacuum steam wheel. The extract was returned with 1 ml of acetonitrile.

Results and conclusion : No significant difference was recorded between the flue gases measured for each experiment, which shows that the values obtained for PAHs in the control sample can be used for comparison with the samples in which zeolite with different characteristics was introduced into the sealed chamber. In the control sample, the amount of PAHs deposited on the wall is higher than in the samples with zeolites, 20.74 ng / cm² compared to 2.73-3.38 ng / cm² in the samples with zeolites but significantly lower than the amount adsorbed by zeolites. This demonstrates that zeolites have the ability to adsorb PAHs and thus have the ability to purify the air in smoking rooms. The large difference between the amount on the bottom of the chamber in which zeolites were not introduced and the amount in which zeolites were introduced is due to the capacity and degree of adsorption of PAHs by zeolites. There is a significant difference between the amount of PAHs quantified on the PM10 filter in the control sample compared to the samples in which zeolites with different characteristics were introduced, 75.69 ng / m³ compared to 1.82-3.42 ng / m³. The zeolite with dimensions of 3-5 mm activated by basic treatment adsorbed in total the highest amount of polycyclic aromatic hydrocarbons, namely 89.56 ng / g. The smallest amount of PAH was adsorbed by zeolite with dimensions 1-3 mm, activated by calcination, 38.92 ng / g. Table 2 Results of Aflatoxin B1 determination

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ANTIOXIDANT CAPACITY OF FRESH PRUNUS SPINOSA OBTAINED BY SUPERCRITICAL CO₂ EXTRACTION TECHNIQUE

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Prunus spinosa is a perennial plant growing as a shrub on slopes of wide uncultivated areas, making a thick thorny mass, but it can also be found beside roads, along the channels and in shelterbelts against the wind. It grows in moderate continental climate in northern hemisphere. *P. spinosa* is used in phytotherapy for the treatment of many diseases. Medicinal characteristics were shown by blackthorn's fruit, flowers, bark and root of the plant.

The paper presents a study of the antioxidant properties of *Prunus spinosa*'s samples, in order to valorize these products as a source of nutrients and nutraceuticals.

Samples of *Prunus spinosa* (blackthorn) were collected, in October 2018, October and November 2019 from Chinteni, Floresti, Faget, Borhanci and Pata, area from Cluj County.

CO₂ extraction method uses ethanol as cosolvent, high pressure (56 bar) and an average temperature of 40°C. For the determination of the antioxidant capacity the PHOTOCHEM instrument from Analytic Jena was used along with the ACW kit which is designed for the determination of antioxidative capacity of the water-soluble compounds. These radicals are partially eliminated from the sample by reaction with the antioxidants existing in the sample. In the measuring cell the remaining radicals cause the detector substance luminol to luminescence and then the antioxidant capacity of the sample is determined. The measured results are compared to ascorbic acid calibration curve and the results are expressed as ascorbic acid equivalent (µg/mg AAE).

The results show a very high difference between the values obtained in different areas. The highest concentration of antioxidants was found in *Prunus spinosa* fruits from Borhanci, 11.26 µg/mg AAE in November 2019, the lowest was found in samples from Chinteni area, 2.03 µg/mg AAE in October 2018. All the samples from Borhanci area have a higher antioxidant capacity compared to the others areas.

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METHOD FOR DIRECT MERCURY DETERMINATION IN VEGETABLES USING THERMAL DECOMPOSITION - ATOMIC ABSORPTION SPECTROMETRY

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A variety of detection methods are used for mercury determination. The most popular method for determining mercury in almost any type of sample has been based on cold vapour atomic absorption spectrometric measurement (CVAAS). The way of liberating mercury from aqueous or digested samples is reduction, followed by volatilization and introduction of the mercury by aid of a gas stream. For solid samples, Hg determination is difficult due to the high volatility of this element, and the digestion methods suppose sample heating. Direct Hg determination from solid sample is very important to obtain accurate results. In this study a Hydra-C Direct Mercury Analyzer (Teledyne Leeman Lab, USA) based on combusting (decomposition) of sample at high temperatures and measurement of absorbance signal was used. Instrument calibration was completed using aqueous standards prepared in 10% HNO₃. Working standards were blank, 0.1, and 1.0 ppm at different injection weights. Soil (0-10 cm and 10-20 cm) and vegetables growing on this soil from eight sampling points were collected in from Baia Mare area, NW of Romania. The measured concentrations in soil exceed the alert threshold established by Romanian legislation (1000 µg/kg) in four samples. In the vegetables samples, the Hg concentrations ranged between 3.05 – 53.4 µg/kg. The calculated transfer factors for Hg from soil to vegetables were in the range of 0,003 – 0,062.

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BEHAVIOR OF SOME GRAPEVINE VARIETIES FROM MURFATLAR VINEYARD IN THE SPECIAL CLIMATIC CONDITIONS OF THE WINE YEAR 2019-2020

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Schimbările climatice înregistrate în ultimele decenii caracterizate prin repartizarea neuniformă a precipitațiilor în cursul anului și temperaturi ridicate, conduc la perturbări ale proceselor de creștere și maturare a strugurilor.

The choice of varieties resistant to thermal and water stress plays an important role in the fight against this phenomenon.

The wine year of 2019-2020 was a year with a pronounced dry climate due to the increase of the average monthly temperatures by 3.3 °C (14.8°C compared to 11.5°C the multiannual average); the high frequency of the number of days with maximum temperatures > 30°C (62 days); a relative air hygroscopicity below 60%, during budding phenophases and 51-53% during the period of growth and maturation of the berries (values below the average favorable for the growth of shoots and the development and maturation of berries - 60-80%) and a deficit of precipitation during the period of active vegetation of the vine (-112 mm compared to the multiannual average).

In this context, within the Research Station for Viticulture and Oenology Murfatlar were studied 3 varieties and 3 grapevine clones representative for the Murfatlar vineyard (Columna, Muscat Ottonel, Mamaia, Feteasca Neagra 9 Mf, Chardonnay 25 Mf and Cabernet Sauvignon 33 VI) in which the vegetation phases were noted and the elements of productivity and quality of the grapes were determined.

This year the vine suffered a strong water stress that led to the uneven start in the vegetation hindering the growth and development of shoots and grapes.

The obtained results showed a decrease of the average yields / ha for the Chardonnay 25 Mf and Cabernet Sauvignon 33 VI varieties (extremely low yields: 532 kg / ha and 1188 kg / ha respectively), and for the Columna, Muscat Ottonel and Fetească neagră 9 Mf. varieties, the production was 50% below the average of 2016-2019. For the Mamaia variety, the average production per hectare was 486 kg / ha higher than the multiannual average (4803 kg / ha), due to its location near the cattle school and benefited from irrigation.

The average weight of 100 berries in all varieties was below the multiannual average, while the quality of production in the varieties, Columna, Mamaia, and clones: Fetească neagră 9 Mf, Chardonnay 25 Mf and Cabernet Sauvignon 33 VI was higher than the multiannual average. The highest sugar concentration was recorded in Fetească neagră 9 Mf (256.6 g / l) and Chardonnay 25 Mf (246.9 g / l) clones, while in Muscat Ottonel the sugar concentration was lower by 17.0 g / l (217.2 g / l) compared to the multiannual average (200.2 g / l).

Under these conditions, the only variety that had a positive behavior was the Mamaia variety, which benefited from an additional water supply.

MICROALGAE BIOMASS AS BIOFERTILIZER IN AGRICULTURE FOR ENHANCING PLANT GROWTH

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Abstract

Biofertilizers gained considerable attention lately due to their ability to enhance crop productivity reducing the negative effect of the synthetic fertilizers on human health and environment [1]. The capability of the microalgae to produce bioactive compounds, with simple nutrient requirements makes them suitable as biofertilizers [1-2]. Beside their ability to produce bioactive compounds, such as growth hormones, polysaccharides and antimicrobial compounds to enhance plant growth, microalgae can improve the soil fertility and its quality [2]. Several studies demonstrated that the microalgae extracts can stimulate germination and seedling growth of different crops. Despite the fact that microalgae produce different active metabolites, its practical application in agriculture is limited [3].

An integrated approach of wastewater treatment and microalgae biomass production as a potential sustainable alternative for the enhancement of agricultural crops is needed. Thus, we developed a microalgae growth method for different species of microalgae, such as *Spirulina* spp., *Porphyridium* spp., *Chlorella* spp. or *Synechocystis* spp. The method represents the starting point for the use of algal culture and biomass as biofertilizers that can be applied in agriculture.

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NEW MATERIALS BASED ON NATURAL ZEOLITES USED FOR PETROLEUM PRODUCTS SORPTION AND WASTE RECOVERY

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Pollution with petroleum products is considered to be one of the significant issues present at global level due to the hard/irreversible recovery of the natural environments (rivers, lakes, soil). In order to reduce the pollution with petroleum products, different materials and methods are used, such as zeolites and their sorption capacity. Zeolites are natural microporous resources, minerals included in the aluminosilicate groups with the origin in volcanic activities. Zeolites are considered efficient adsorbent materials of different pollutants and toxins (heavy metals, nitrogen compounds, petroleum products), due to their specific and crystalline structure (cages and channels). Their sorption capacity can be improved by thermal, mechanical or chemical activations. The aims of this study were (1) to determine and to increase the sorption capacity of natural zeolitic materials from Rupea, and, (2) to determine their chemical composition (metals: Al, Ca, Fe, Na, Mg, Mn, K and oxides: K₂O, MnO, CaO, MgO, Fe₂O₃, Al₂O₃, Na₂O and Si₂O) and cations exchange capacity, having in view to be used as adsorbent for petroleum products. Also, the heat of combustion level of the obtained zeolitic material which adsorbed petroleum products (Diesel oil) was analysed. The studied zeolitic materials with two different particle sizes of 10 µm and 1-3 mm originated from Rupea, Brasov County deposits. The zeolitic materials were thermal activated at a temperature of 500 °C. After the thermal activation it was observed that the results regarding the metals content are slightly higher particularly in the case of the zeolitic material with the particle sizes of 10 µm, while the cations exchange capacity results range between 1.2 meq/g and 1.0 meq/g. The sorption capacity results range between 1.55 – 1.68 g/g for the zeolitic material with the granulometry lower than 10 µm and 0.20 – 0.30 g/g for the zeolitic material with the granulometry between 1-10 mm; certain results indicate a higher sorption capacity for the zeolitic material with particle sizes lower as 10 µm compared to the zeolitic material with higher particle sizes (1-3 mm). After the sorption of the Diesel oil, the zeolitic material was analysed for the heat of combustion level and the obtained results (25 kJ/g) present relatively high values, so that the wastes resulted after adsorbing the petroleum products can be reused in diverse heating processes.

THE EFFECTS OF IRRIGATION REGIME AND NITROGEN RATES ON RAPESEED YIELD FOR BIOFUELS OBTAINING

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Abstract: The paper aims to establish the role of interaction of irrigation regime and nitrogen rates on NOX emissions of rapeseed crop. Three N fertilizer rates 0 (N0), 150 (N150) and 270 (N270) kg/ha, two irrigation regime (non-irrigated (I0) and irrigated at 50% from IUA (I1)) and three cultivars (one variety and two hybrids) were established as feedstock treatments to obtain rapeseed. The experiments were conducted in a randomized complete block design arrangement in split factorial with three replications. Correlations between irrigation regime, nitrogen rates and cultivars regarding the nitrogen oxides emissions were established. The recorded results show that NOX emissions of the crop are for the irrigated variants lower than those of nonirrigated variants.
Key words: irrigation, rapeseed, biofuels.

ORGANIC FERTILIZATION METHOD TO INCREASE THE QUANTITY AND QUALITY OF CARROT (*DAUCUS CAROTA*) PRODUCTION USING NATURAL ZEOLITES

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Carrot is a vegetable and medicinal plant with a high content of vitamins and minerals such as potassium, calcium and magnesium. Regarding the culture of carrots, their capacity to acclimatize to the conditions of the area means their adaptation to the natural environmental conditions, specifically to the climatic and pedological ones. Obtaining superior quantitative and qualitative crops, while protecting the environment and maintaining a production cost as low as possible, involves the use of fertilizers rationally and the choice of the most appropriate method of fertilization. The use of natural zeolite as a fertilizer generated in experimental crops significant increases in the quantity and quality of production compared to the control groups. The application of natural zeolite is done directly on the soil in 2 phases of vegetation of the carrot culture, followed by an irrigation to incorporate the fertilizer in the soil as quickly as possible. The proposed method presents a high degree of originality and novelty by establishing correlations between fertilization with zeolites - classical fertilization and functional food characteristics of carrots fertilized classically and with zeolites, for the varieties chosen in this study. Due to its properties, natural zeolite being a regulator, dispenser, water and nutrients, which helps to keep plants healthy for a long time and to reduce the time and costs for their care, it is recommended to use it widely in all branches of horticulture.

VITIS VINIFERA L. – PHYTOCHEMICAL STUDIES AND BIOLOGICAL ACTIONS

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Vitis vinifera L. (Vitaceae) has been used for thousands of years as an important source of active compounds for the pharmaceutical, cosmetic and food industries. In this study, the phytochemical composition and the biological activity of the ethanolic extracts obtained from pomace, canes, leaves and tendrils, from the Fetească neagră variety cultivated in Romania, were assessed. Using spectrophotometric methods, the content of total polyphenols as well as of flavonoids, phenylpropanoic derivatives, tannins were determined, while a HPLC-MS method was used to identify and quantify the most important polyphenolic components. To evaluate the antioxidant activity of the extracts, two *in vitro* methods were used: FRAP and DPPH.

According to our results, the tendrils extract contains the greatest quantity of polyphenolic compounds (total polyphenols, flavonoids, phenylpropanoic derivatives and tannins), while the lowest quantity was found in the canes extract. A greater amount of flavonoids was determined in the leaf extract, as compared to the pomace extract, but a smaller amount of tannins and phenylpropanoic derivatives. The polyphenolic compounds, identified in all studied extracts using the chromatographic method were: catechin, epicatechin, gallic acid, procatechuic acid, isoquercitrin. Other components were particularly to certain extracts, as follows: vanillic acid for the pomace pomace, syringic acid in pomace and canes extract, while in leaves and tendrils the following flavonoids were identified: quercitrin, rutoside and hyperoside. The antioxidant activity was evaluated by the two methods, the results showed a variation in the antioxidant activity, as follows: leaves> pomace> canes> tendrils. The antioxidants activity did not present a direct correlation with the total polyphenol content due a different chemical composition of extracts.

In conclusion, all studied extracts contain valuable active compounds, but particularly the ethanolic extracts from *Vitis vinifera* tendrils and leaves, may represent a valuable source of active antioxidant principles, suggesting that they may be use as natural raw materials, in order to obtain final products for cosmetic of pharmaceutical applications, with antioxidant activity.

Keywords: *Vitis vinifera* , polyphenols, antioxidant activity

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EXPERIMENTAL DESIGN – APPROACH FOR THE FORMULATIONS OF ORAL CARE PRODUCTS CONTAINING *VITIS VINIFERA L.* EXTRACTS

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Background: The development of a cosmetic product using an experimental design represents a systematic approach that allows to set the best ranges for the formulation factors with a minimal number of experimental runs.

Aim: The aim of the present study was to obtain toothpastes and mouthwashes with optimal characteristics using the design of experiments to select the appropriate range of the quantitative and qualitative parameters.

Materials and methods: Two factorial experimental designs with three factors and two levels (Modde 12.1 software, Sartorius Stedim Data Analytics AB, Umea, Sweden) were developed. Texture analysis measurements (Brookfield CT3 Texture Analyzer) and viscosity measurements (Brookfield DV-III Ultra) were determined in triplicate for each formulation. The optimal characteristics of two commercially available products were set as restriction criteria for the optimization step.

Results: Regarding toothpaste analysis, it was observed that increased ratios of silica and sodium carboxymethylcellulose led to an increase of the Consistency, Firmness and Rigidity parameters while the Viscosity value was positively influenced by the powders ratio and the thickening agents increase. In addition, an interaction between silica and sodium carboxymethylcellulose and between silica and xanthan gum was observed.

According to the experimental data obtained for mouthwash formulations, the percentage of xanthan gum influenced the physical properties of the products, increasing the Firmness, Consistency, Cohesiveness, Resilience and Viscosity values. The increase of stirring rate increased Firmness and Consistency values and decreased Cohesiveness values. Finally, the validation of the model was carried out by preparing the optimal formulations; a good correlation between the model predicted and the experimental response was obtained.

Conclusion: The study showed the advantage of using the design of experiments to set the variables that impact the development of oral care products. The study achieved the optimal experimental conditions for the preparation of oral care products containing *Vitis vinifera L.* polyphenolic extracts.

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MONOCROP CULTURE LONG TERM STRAW RETURN IMPACT ON SOIL STRUCTURE, ABUNDANCE, AND MICROBIOTA CATABOLIC ACTIVITY: CONSEQUENCES ON SOIL FUNCTIONS

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Returning straw to soil is an effective way to sustain or improve soil quality and crop yields. However, a robust understanding of the impact of straw return on the composition of the soil microbial communities under field conditions has remained elusive.

The objective of this study was to investigate how straw-incorporating practices affect bacterial communities and carbon source utilization capacity. Therefore, we characterized the effects of wheat straw return on soil bacterial and fungal communities in a wheat–soybean rotation system over a 2-year period. Soil microbiota structure and abundance assessment was done using PLFA technique. Microbiota catabolic activity was performed with EcoPlate approach.

Our results have shown that wheat straw return affected the soil bacterial community especially gram-positive bacteria, gram-negative bacteria, and actinobacteria, but not fungal community. The carbon utilization ability of soil microorganisms in first year treatment was significantly higher than that of the second-year treatment ($P < 0.05$). The utilization ability of carboxylic acids, polymers, and other mixtures of carbon sources in the first year of treatment was higher than those from the second year.

These findings suggest that long-term straw incorporation affects the abundance and carbon utilization ability of soil microorganisms within 0–20 cm soil depths, among which, gram positive bacteria, gram negative bacteria, and actinobacteria may play crucial roles in bacterial communities and carbon source utilization capacity.

PHARMACEUTICALS UPTAKE BY VEGETABLES: EXPOSURE ROUTE SIGNIFICANCE

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Recycled wastewater reuse for agricultural land irrigation or use of organic manure for agricultural land fertilization are common practices in current agriculture. However, these practices use for crops and vegetables cultivation become a concern due to the potential prevalence of micro-contaminants as pharmaceutical products because they could represent a possible health hazards to consumers.

Through this study it was investigated how a commonly used pharmaceutical product as ibuprofen (a nonsteroidal anti-inflammatory drug which could be consumed without medical prescription) is uptake by tomato. Tomatoes artificial contamination were performed considering contamination of soil, water, and air (vaporization), respectively. Contamination level was chose considering the contamination level reported in literature. Tomato samples exposure level at ibuprofen were analyzed on GC-MS and evaluated considering their development stage (Zadok scale) and their anatomic compartments (root, leaf, stem, edible parts). Ibuprofen metabolites profile were also studied through these experiments in order to establish ibuprofen fate and pattern.

FOREST LITTER UNDER ALTERED FREEZ-THAW EVENTS DRIVE DIFFERENTIATION OF MICROBIAL COMMUNITY STRUCTURE AND FUNCTIONS IN THE LITTER HORIZON ACROSS MIXED FOREST ECOTONE

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The decomposition of plant litter involves a complex set of processes that include chemical, physical, and biological agents acting upon a wide variety of organic substrates. Mass loss and nutrient release of forest litter during the freeze–thaw season could play an essential role in C and nutrient cycling. Soil microbial communities play an important role in soil carbon functioning, particularly in forest ecosystems. Their variation in response to climate change may affect soil carbon processes, highlighting the importance of understanding how environmental factors affect microbial communities. Cellulose and lignin are the main polymeric components of the forest litter horizon.

We monitored microbial community composition using phospholipid fatty acid (PLFA) analysis and investigated the ligninolytic and cellulolytic enzyme activities of the litter horizon across an alpine treeline ecotone. This study aimed to determine to what extent an increase in the quantity of fresh litter may affect heterotrophic mineralization of organic carbon and bacterial community structure in soil and litter. A litter manipulation experiment was performed in situ in a temperate deciduous forest. The quantity of fresh litter seemed to affect soil and litter bacterial community structure and to interact with soil temperature and moisture to determine the temporal variation in the bacterial community on a month to season scale. In addition, this study highlighted the large temporal variability in soil and litter bacterial community structure and that this variability may affect our ability to relate bacterial community structure to respiration processes. In addition, the loss of mass, lignin, cellulose, and component bio-elements during the freeze–thaw season correlated closely with the initial substrate type and the levels of the individual bio-elements.

CHLOROPHYLL A AND β BIOMASS AS AN INDICATOR OF WATER QUALITY CONDITIONS. A STUDY CASE OF AN OLD MINE WATER DISCHARGE

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The Arieș River catchment is an area affected by the past mining activities. Valea Șesii is a tributary of Arieș River that links the main watercourse to Geamăna tailing pond. This study seeks to evaluate the quality of Valea Șesii stream and to find a connection between the quantity of the microorganisms and the quality status of surface water samples. In order to do that, a sample campaign has been done along the stream, during the hot season of 2019. Water quality constituents, like pH, EC, TDS, micro- (Zn, Mn, Cu, Ni, Co) and macronutrients (Mg, Ca, K, Na), chlorophyll α and β were analyzed. The water quality was assessed with the help of various indices, like, heavy metal evaluation index *HEI*, heavy metal pollution index *HPI* and water quality index *WQI*. *HEI* and *WQI* classified the first three stations into a poor quality class, due to an acid pH (4,5 – 4,9 pH units), high content of EC (1677 – 1234 mg/L), TDS (1742 – 1730 mg/L) and heavy metals (0,122 – 0,089 mg/L – Pb; 0,044 – 0,039 mg/L – Cr). Also, a correlation between *WQI* of the analyzed samples and the chlorophylls values was observed, while the chlorophylls values increase, the surface water quality decreases.

FEATURE EXTRACTION METHODS FOR THE CLASSIFICATION OF GRAPE LEAVES

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Supervised image classification includes two steps: training and actual classification, both involving two techniques: feature extraction and machine learning classification. With the scope of developing new feature extraction methods that work in the RGB color space and studying the potential contribution of color information for increasing the accuracy for the classification of grape leaf diseases a new operator - BM3DELBP (Block Matching and 3D Filtering Extended Local Binary Pattern) is proposed to be used together with the MRELBP (Median Robust Extended Local Binary Patterns) technique. This provided promising classification results and proved that textural information is relevant for this classification problem with color information bringing improvements in the accuracy of the process.

RESEARCH AND CONTRIBUTIONS IN HYPERSPECTRAL IMAGE CLASSIFICATION USING ARTIFICIAL INTELLIGENCE TECHNIQUES

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Precision agriculture benefits from the advancement of both sensor technology and interpretation and processing of newly available data. Such is the case of hyperspectral imaging. Since the hyperspectral data is characterized by information stored along the spatial and spectral dimensions, different methods can be integrated in a classifications chain in order to determine the different types of crops/materials/etc. with high accuracy. The paper focuses on two such methods, namely Hyperspectral Image Classification using Combined Spectral-Spatial Denoising and Deep Learning Techniques (HICSSDDL) and Hyperspectral Image Enhancement using Diffusion and Shock Filtering Techniques (HIEDSFT). It is shown that these provide an increase in performance of the proposed classification chain, but a deeper analysis on how the methods can be improved is required.

SENSOR SYSTEM FOR FOLIAGE DETECTION IN VINEYARDS

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Smart agriculture represents an inevitable trend in which ultrasonic sensors also play an important role. This paper presents a smart mapping system for vineyards. The system contains 14 ultrasonic sensors, two accelerometer and gyroscope modules, one stepper motor and an Arduino MEGA 2560 development board. Its aim is to map several vineyard parameters: the system will allow the determination of the distribution and density of the vineyard foliage horizontally and vertically. This work concentrates on the detection mode of the system for the vineyard, future work will present data processing techniques for the optimization of the application of phytosanitary substances in the vine culture.

CERCETĂRI PRIVIND INFLUENȚA METODEI DE FERTILIZARE ASUPRA NUMĂRULUI DE FRUCTE, MASEI ȘI PRODUCȚIEI DE ARDEI

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Cercetarea care face obiectul acestui studiu a fost efectuată la Universitatea de Științe Agricole și Medicină Veterinară „Ion Ionescu de la Brad” din Iași. Experiența a fost înființată într-un solar de tip tunel unde s-a urmărit influența metodei de fertilizare asupra numărului de fructe, masei și producției de ardei: fertilizarea concomitent cu irigarea prin picurare, fertilizarea cu îngrășăminte clasice, fertilizarea cu îngrășăminte pe bază de microorganisme și nefertilizare. În anii de cultură 2015-2017 s-au înregistrat valori medii ale numărului de fructe de ardei pe plantă, cuprinse între 12,27 fructe la varianta nefertilizată și 17,44 fructe pe plantă la varianta fertirigată. De asemenea, producția de ardei, la varianta fertirigată, a înregistrat o diferență față de martor de 28,64 t/ha, fiind considerată pozitiv foarte semnificativă. Aplicarea îngrășămintelor prin intermediul apei de irigație prin picurare s-a dovedit net superioară celorlalte metode de fertilizare aplicate în ceea ce privește producția la hectar.

Keywords: fertilizare, ardei, producție.