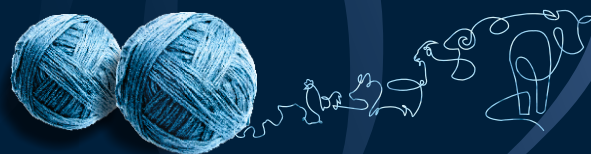


15th
INTERNATIONAL
SYMPOSIUM

MODERN
TRENDS
IN LIVESTOCK
PRODUCTION



BOOK OF ABSTRACTS

29 - 31 October 2025, Belgrade, Serbia

Institute for Animal Husbandry
Belgrade – Zemun, SERBIA

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CONTENT

ORAL PRESENTATION

<i>Lerica Le Roux-Pullen</i> NATURE-DERIVED INTERVENTIONS FOR MODERN LIVESTOCK: PROMISE, PRESSURE, AND THE PATH FORWARD (Netherlands).....	1
<i>Giuseppe Bee</i> PROTEIN EFFICIENCY AND ANIMAL WELFARE – IS THERE A TRADE-OFF? (Switzerland).....	2
<i>Marjeta Čandek-Potokar & EU CAP network focus group</i> THE NEED FOR ALTERNATIVE SOLUTIONS FOR LIVESTOCK PRODUCT DIFFERENTIATION (Slovenia).....	3
<i>Dušica Ostojić Andrić, Slavča Hristov, Branislav Stanković, Katarina Nenadović, Marko Pajić, Aleksandar Stanojković, Slobodan Dolašević</i> MULTIDIMENSIONAL ADAPTIVE STRATEGIES OF FARM ANIMALS FACING CLIMATE CHALLENGES (Serbia).....	4
<i>Vesna Gantner, Boris Ljubojević, Čedomir Radović, Kemal Celik</i> ANTIMICROBIAL RESISTANCE: A GLOBAL CHALLENGE AND IMPLICATIONS FOR DAIRY CATTLE PRODUCTION (Croatia, Serbia, Türkiye).....	5
<i>Urszula Latek, Joanna Polak, Marta Mendel</i> THE INFLUENCE OF PLANT EXTRACTS AND PHYTOGENICS ON THE INTESTINAL HEALTH OF FARM ANIMALS (Poland).....	6
<i>Yuriy Balji, Viktoriya Gaidukevich, Leila Sultanayeva, Meruyert Alyonova, Gulim Abakanova, Galia Zamaratskaia</i> DIETARY PLANT-BASED BIOACTIVE COMPOUNDS FOR SUSTAINABLE MASTITIS CONTROL IN LIVESTOCK (Kazakhstan, Sweden).....	8
<i>Dragovan Milićević, Ljiljana Samolovac, Miloš Lukić, Dragan Milićević</i> LIVESTOCK SECTOR IN SERBIA: CHALLENGES, POLICY GAPS, AND STRATEGIC OPPORTUNITIES FOR SUSTAINABLE DEVELOPMENT (Serbia)...	9
<i>Yalçın Bozkurt, Serkan Özkaya, Cevdet G. Tüzün</i> PREDICTION OF BW FOR GRAZING CATTLE FROM BODY MEASUREMENTS BY USING ARTIFICIAL NEURAL NETWORK LINEAR AND RANDOM FOREST REGRESSION APPROACHES (Türkiye).....	10
<i>Zlatan Sarić, Jelena Miočinović, Senada Čengić- Džomba, Miroljub Barać</i> VIEW AT SUSTAINABILITY IN DAIRY SECTOR: CURRENT STATE AND PERSPECTIVES (Bosnia and Herzegovina, Serbia).....	11
<i>Vladimir S. Kurćubić, Matija D. Munjić, Slaviša Stajić, Nikola Stanišić</i> FORTIFICATION WITH NATURAL PLANT-BASED ADDITIVES IN CHEESE PRODUCTION: SUSTAINABLE CONCEPTS (Serbia).....	12

<i>Miloš Marinković, Nenad Mičić, Dušica Ostojić- Andrić, Dragan Nikšić, Marina Lazarević, Slobodan Dolašević, Ljiljana Samolovac</i> PRODUCTION TRAITS OF SIMMENTAL BULL DAMS IN FIRST LACTATION ACROSS DIFFERENT DISTRICTS OF SERBIA (Serbia).....	13
<i>Nenad Mičić, Miloš Marinković, Dušica Ostojić- Andrić, Dragan Nikšić, Marina Lazarević, Slobodan Dolašević, Ljiljana Samolovac</i> FIVE-YEAR OVERVIEW OF THE SIMMENTAL CATTLE POPULATION IN CENTRAL SERBIA (Serbia).....	14
<i>Diyan Georgiev, Nikolay Markov, Miroslav Hristov, Tsvetan Markov</i> PERSPECTIVE DUAL-PURPOSE AND BEEF BREEDS ASSOCIATED WITH INCREASED BEEF PRODUCTIVITY IN CATTLE (Bulgaria).....	15
<i>Bogdan Cekić, Dragana Ružić-Muslić, Nevena Maksimović, Slobodan Dolašević, Nenad Stojiljković, Violeta Mandić, Jordan Marković</i> CHESTNUT TANNINS IN LAMB NUTRITION: BALANCING PROTEIN UTILIZATION AND FEED EFFICIENCY IN SUSTAINABLE FATTENING SYSTEMS (Serbia).....	16
<i>Nathalie Ketterle</i> WOOL AS A TOOL FOR THE CIRCULAR BIOECONOMY: REVITALISING A FORGOTTEN VALUE CHAIN (Belgium, Germany).....	17
<i>Dubravko Škorput, Ana Kaić, Danijel Karolyi, Marija Špehar, Zoran Luković</i> CHALLENGES IN BLUP-BASED GENETIC EVALUATION OF PIGS WITH HIGH LEVELS OF IMPORTED GERMPLASM (Croatia).....	18
<i>Nenad Stojiljković, Dragan Radojković, Čedomir Radović, Marija Gogić, Vladimir Živković, Bogdan Cekić, Slobodan Dolašević</i> GENETIC PARAMETERS AND ESTIMATION OF BREEDING VALUES FOR ECONOMICALLY IMPORTANT LITTER SIZE TRAITS IN PIG PRODUCTION USING ADVANCED STATISTICAL MODELS (Serbia).....	19
<i>Marjeta Čandek-Potokar, Martin Škrlep</i> LOCAL PIG BREEDS – THE MULTIFUNCTIONALITY ASSETS FOR SUSTAINABLE PORK PRODUCTION (Slovenia).....	20
<i>Martin Škrlep, Klavdija Poklukar, Bojana Savić, Marjeta Čandek- Potokar</i> STUDYING HUSBANDRY AND NUTRITION IN KRŠKOPOLJE PIG: IMPLICATIONS FOR FAT DEPOSITION AND MEAT QUALITY WITH INSIGHTS INTO METABOLISM AND GENE EXPRESSION (Slovenia).....	21
<i>M. Izquierdo, C. Becerra, F.I. Hernández-García, A. Gomez- Quintana, J.J. Ceron, MA. Pérez, C. Mateos, AI del Rosario, J. Matías, M. Botia</i> EFFECT OF PREWEANING SOCIALIZATION OF IBERIAN PIGLETS ON POSTWEANING SALIVARY STRESS AND INFLAMMATION BIOMARKERS AND GROWTH (Spain).....	22
<i>C. Becerra, F.I. Hernández-García, M. Izquierdo, A. Gomez-Quintana, J.J. Ceron, M.A. Perez, C. Mateos, A.I. del Rosario, J. Matías, M. Botia</i> EFFECTS OF NATURAL ADDITIVE SUPPLEMENTATION OF IBERIAN PIGLETS ON SALIVARY BIOMARKERS OF STRESS AND IMMUNE RESPONSE (Spain).....	23

<i>Władysław Migdał, Alicja Rutkowska-Mazur, Čedomir Radović, Vladimir Živković, Lukasz Migdał</i> COMPARISON OF THE CHEMICAL COMPOSITION OF WILD BOAR (SUS SCROFA) MEAT HARVESTED IN DIFFERENT EUROPEAN COUNTRIES (Poland, Serbia).....	24
<i>Teodora Popova, Evgeni Petkov, Krasimir Dimov, Desislava Vlahova-Vangelova, Desislav Balev, Nikolay Kolev, Maya Ignatova, Stefan Dragoev</i> POSSIBILITIES FOR UTILIZATION OF MALE LAYER- TYPE CHICKENS FOR MEAT AND MEAT PRODUCTS – STUDIES IN BULGARIA (Bulgaria).....	25
<i>Antonella Dalle Zotte, Bianca Palumbo</i> THE YELLOW MEALWORM (TENEBRIO MOLITOR L.): FROM FARM TO FEED (Italy).....	26
<i>Bianca Palumbo, Emanuele Pontalti, Marco Cullere, Márk Tóth, Antonella Dalle Zotte</i> DIETARY CAMELINA AND LINSEED CAKES MODULATE FATTY ACID CLASSES AND SENSORY TRAITS OF YELLOW MEALWORM LARVAE (Italy).....	27
<i>Slobodan Dolašević, Bogdan Cekić, Nenad Stojiljković, Nenad Mičić, Miloš Marinković, Maja Petričević</i> COMPARISON OF TIME CONSUMPTION BETWEEN TRADITIONAL AND INNOVATIVE METHODS OF PRODUCING QUEEN CELL CUPS (Serbia).....	28
<i>Slobodan Dolašević, Maja Petričević, Tamara Stamenić, Aleksandar Stanojković, Tanja Keškić, Sonja Mudri-Stojnić, Nela Jović</i> MONITORING WILD POLLINATORS IN SERBIA USING CITIZEN SCIENCE PRINCIPLES (Serbia).....	29
<i>Öznur Diler</i> ANTIPARASITIC EFFECTS OF ARTEMISIA ABSINTHIUM L. IN THE TREATMENT OF HEXAMITIOSIS IN RAINBOW TROUT (ONCORHYNCHUS MYKISS) CULTURE (Türkiye).....	30

POSTER SECTION

<i>Mirna Gavran, Nenad Mičić, Vesna Gantner</i> THE INFLUENCE OF SEASONAL FACTORS ON DAILY MILK PRODUCTION AND CHEMICAL COMPOSITION OF MILK IN DAIRY COWS (Croatia, Serbia).....	31
<i>Dušica Ostojić Andrić, Ljiljana Samolovac, Dragan Nikšić, Marko Pajić, Nikola Delić, Dobrila Janković, Slobodan Dolašević</i> A NOVEL METHOD FOR EFFICIENT WELFARE ASSESSMENT ON DAIRY CATTLE FARMS IN SERBIA (Serbia).....	32
<i>Ljiljana Samolovac, Miloš Marinković, Nenad Mičić, Dušica Ostojić Andrić, Dragan Nikšić, Danijel Milenković, Dragan Miličević, Slavča Hristov</i> ASSESSMENT OF AFFECTIVE STATES IN PRE-WEANING CALVES HOUSED IN INTENSIVE PRODUCTION SYSTEMS (Serbia).....	33

<i>Dragan Nikšić, Vlada Pantelić, Dušica Ostojić-Andrić, Aleksandar Stanojković, Predrag Perišić, Marina Lazarević, Miloš Marinković</i> REPRODUCTIVE PERFORMANCE OF SIMMENTAL COWS IN SERBIA IN RELATION TO PROVENIENCE AND MANAGEMENT SYSTEMS (Serbia).....	34
<i>Yalçın Bozkurt, Bogdan Cekić, Dragan, Nikšić, Serkan Özkaya, Cevdet G. Tüzün</i> ARTIFICIAL NEURAL NETWORK AND REGRESSION MODELS TO PREDICT BW OF HOLSTEIN AND BROWN SWISS CATTLE USING REAL-TIME BODY MEASUREMENTS (Türkiye, Serbia).....	35
<i>Dragan Dokić, Miroslav Nedeljković, Vesna Gantner</i> EVALUATING AND FORECASTING LIVESTOCK PRODUCTION TRENDS IN CROATIA: A SECTORAL ANALYSIS BASED ON ARIMA MODELING (Croatia, Serbia).....	36
<i>Omer Gurkan Dilek</i> CORRELATION BETWEEN ANIMAL ANATOMY AND HEALTH CARE IN VETERINARY PRACTICE (Türkiye).....	37
<i>Krasimir Dimov</i> EFFECT OF GAMMA IRRADIATION ON THE LIPID OXIDATION, pH AND COLOUR IN BEEF – A META- ANALYSIS (Bulgaria).....	38
<i>Maja Petričević, Slobodan Dolašević, Tanja Keškić Boris Pisinov, Veselin Petričević, Dragan Nikšić, Tamara Stamenić</i> NUTRITIONAL AND SENSORY ENHANCEMENT OF BEEF THROUGH DIETARY FLAXSEED IN SIMMENTAL CATTLE (Serbia).....	39
<i>Emil Mitev, Stayka Laleva, Yovka Popova</i> EFFECT OF PRECISE SYSTEM FOR NUTRITION MANAGEMENT IMPLEMENTED IN DAIRY FARM (Bulgaria).....	40
<i>Marija Gogić, Vladimir Živković, Nenad Stojiljković, Aleksandra Petrović, Violeta Mandić, Vesna Krnjaja, Čedomir Radović</i> RELATIONSHIP BETWEEN THE MORPHOMETRIC CHARACTERISTICS OF THE GONADS OF MANGALITSA, MORAVKA AND RESAVKA (Serbia).....	41
<i>Aleksandra Petrović, Branislav Stanković, Marija Gogić, Vladimir Živković, Nenad Stojiljković, Nikola Stanišić, Čedomir Radović</i> FERTILITY CHARACTERISTICS OF THE SWALLOW-BELLY MANGALITSA (Serbia).....	42
<i>F.I. Hernández-García, J. Matías, M. López-Parra, C. Becerra, A. Gómez, C. Mateos, M.A. Pérez, A.I. del Rosario, M. Izquierdo</i> USE OF LUPIN AGRONOMICALLY BIOFORTIFIED WITH SELENIUM AS A LOCAL AND SUSTAINABLE SOURCE OF PROTEIN TO INCREASE THE ANTIOXIDANT CAPACITY OF IBERIAN PORK (Spain).....	43
<i>Lei Li, Jie Zhang, Yinghui Guo, Guichuan Shang, Xing Li1, Jun Cong, Woldemariam Kalekristos Yohannes</i> UNDERSTANDING THE IMPACT OF MEAT RAW MATERIALS FROM CHINESE RONGCHANG PIG BREEDS ON QUALITY OF BOLOGNA-STYLE MORTADELLA (China).....	44

<i>Živković Vladimir, Gogić Marija, Stojiljković Nenad, Petrović Aleksandra, Stanković Branislav, Stanišić Nikola, Radović Čedomir</i> THE ROLE OF EXTENSIVE AND SEMI- EXTENSIVE PRODUCTION SYSTEMS IN PRESERVING LOCAL PIG BREEDS IN REPUBLIC OF SERBIA (Serbia).....	45
<i>Vladimir Margeta, Dalida Galović, Kristina Gvozdanović, Katarina Marić, Ivana Prakatur, Jakov Jurčević</i> APPLICATION OF ZEOLITE CLINOPTILOLITE IN DEEP LITTER FATTENING PIGS (Croatia).....	46
<i>Bogdan Cekić, Dragana Ružić-Muslić, Nevena Maksimović, Ivan Ćosić, Krstina Zeljić Stojiljković, Sara Kovačević, Zsolt Becskei</i> LIPA SHEEP: RESILIENCE, RECOVERY, AND CONSERVATION NEEDS (Serbia).....	47
<i>Josip Vidović, Manuela Košević, Tanja Keškić, Zlata Kralik</i> ANALYSIS OF FATTY ACID PROFILES AND CALCULATION OF HEALTH LIPID INDICES IN EGGS OF DIFFERENT POULTRY SPECIES (Croatia, Serbia).....	48
<i>Teodora Popova, Krasimir Dimov, Evgeni Petkov, Nikolay Kolev, Desislava Vlahova-Vangelova, Desislav Balev</i> CONSUMERS' ACCEPTANCE OF MEAT PRODUCTS DERIVED FROM MALE LAYER-TYPE CHICKENS - A PILOT SURVEY (Bulgaria).....	49
<i>Aleksandar Stanojković, Dragan Nikšić, Ivan Ćosić, Ivan Bošnjak, Violeta Mandić, Aleksandra Stanojković-Sebić, Jakov Nišavić</i> Ascophyllum nodosum EXTRACT AS A TOOL TO REDUCE AMMONIA CONCENTRATIONS IN POULTRY PRODUCTION (Serbia).....	50
<i>Brigita Popović, Darko Kerovec, Darija Petrović, Tanja Keškić, Marcela Šperanda, Mislav Djidara</i> DEVELOPING METHODS TO DETECT MICROPLASTIC CONTAMINATION IN LIVESTOCK FEED: IMPLICATIONS FOR SUSTAINABLE ANIMAL HUSBANDRY (Croatia, Serbia).....	51
<i>Vesna Krnjaja, Violeta Mandić, Slavica Stanković, Ana Obradović, Aleksandar Stanojković, Nenad Mičić, Miloš Marinković</i> ASSESSING AFLATOXIN B1 CONTAMINATION LEVELS OF DIFFERENT MAIZE SAMPLES (Serbia).....	52
<i>Tanja Keškić, Maja Petričević, Tamara Stamenić, Slobodan Dolašević, Boris Pisinov, Zlata Kralik, Brigita Popović</i> ASSESSMENT OF MAIZE FEED FLOUR QUALITY AND REGULATORY COMPLIANCE ON THE MARKET (Serbia, Croatia).....	53
<i>Violeta Mandić, Vesna Krnjaja, Aleksandar Simić, Milan Brankov, Bogdan Cekić, Marija Gogić, Dragan Nikšić</i> DEVELOPMENT PROSPECTS OF THE SILVOPASTORAL SYSTEM IN THE REPUBLIC OF SERBIA (Serbia).....	54
<i>Boris Pisinov, Tanja Keškić, Maja Petričević, Sanja Djurović, Gordana Kulić, Tamara Stamenić, Zoran Ž. Sekulić</i> STORAGE OF BUCKWHEAT PRODUCTS AS AN FACTOR AFFECTING COLOUR CONDITION AND IMPLICATIONS ON MEAT PRODUCTS (Serbia).....	55

NATURE-DERIVED INTERVENTIONS FOR MODERN LIVESTOCK: PROMISE, PRESSURE, AND THE PATH FORWARD

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Abstract: In the evolving landscape of livestock production, natural health-promoting substances—such as herbal supplements, essential oils, and clay minerals—are capturing growing attention as sustainable alternatives to conventional veterinary treatments. This surge in interest is fuelled by increasing consumer demand for residue-free animal products, regulatory restrictions on antibiotic use, and heightened awareness of antimicrobial resistance and environmental health. Europe stands at the forefront of this shift, leading a global phytogenic feed additive market valued at over €1.5 billion, while the continent's organic livestock sector, and is expanding at a rate of 5–7% annually. Yet, the integration of natural remedies into mainstream livestock systems is far from straightforward. Scientific validation remains a significant bottleneck, complicated by the inherent variability of natural compounds, species-specific responses, and the logistical hurdles of conducting robust trials in large animals. Challenges such as limited bioavailability, complex pharmacokinetics, and a lack of well-characterized models for chronic or subclinical conditions, hinder both reproducibility, and practical application. Moreover, ethical and regulatory constraints, high research costs, and the demand for field-ready solutions that preserve product quality and meet food safety standards, amplify the complexity. Bridging the gap between potential and practice, calls for interdisciplinary collaboration. How do we overcome the scientific and practical hurdles facing nature-derived interventions for livestock health? This presentation will delve into this pressing question as we explore the path toward scientifically grounded, sustainable solutions for livestock health.

Key words: phytogenic feed additives, sustainable livestock health, scientific validation challenges

PROTEIN EFFICIENCY AND ANIMAL WELFARE – IS THERE A TRADE-OFF?

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Abstract: Improving nutrient efficiency in pig farming is essential for promoting environmental sustainability and reducing reliance on imported protein sources. Reducing dietary crude protein content, especially in conjunction with precise amino acid balancing, has been shown to reduce nitrogen excretion and ammonia emissions while maintaining growth performance. Furthermore, genetic selection is a promising way to increase protein efficiency and provide an additional approach to alleviating the environmental impact of swine production. However, such dietary modifications require careful monitoring, as deficiencies in essential amino acids can disrupt natural behaviours, increase stress susceptibility and endanger animal welfare. Neurophysiological pathways, particularly those associated with serotonin and cortisol regulation, highlight the welfare implications of amino acid imbalances. This brief review highlights the importance of taking a tailored, multidisciplinary approach to enhance protein efficiency and safeguard animal welfare under practical production conditions.

Key words: Nitrogen excretion, Amino acid balance, Genetic selection, Behavioural responses, pigs

THE NEED FOR ALTERNATIVE SOLUTIONS FOR LIVESTOCK PRODUCT DIFFERENTIATION

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Abstract: The global livestock sector is facing mounting pressure due to changing societal expectations, evolving consumer preferences, growing environmental concerns, increased attention to animal welfare, and growing market competition. In this landscape, product differentiation has become a crucial strategy for maintaining competitiveness, ensuring transparency, and advancing sustainability across the livestock value chain. Today's consumers are more informed and demanding than ever. Basic assurance such as food safety is now considered standard and buyers increasingly seek products that align with their personal values, whether related to animal welfare, environmental impact, or production practices. Livestock products often face challenges related to price volatility and low profit margins, particularly within commodity markets. To address these issues and respond effectively to societal demands, innovative differentiation strategies are essential not only to create added value but also to support the sector's long-term sustainability. Alternative differentiation offers significant potential, especially for non-industrial farming like smallholders and traditional farmers. In alignment with the EU Common Agricultural Policy (CAP), this issue has been explored in depth by a dedicated expert focus group. Their work has resulted in the development of four thematic white papers addressing key areas for livestock product differentiation: 1) quality and innovation – to meet evolving market expectations; 2) labelling and certification – as tools to enhance visibility and consumer trust; 3) evidence-based environmental benefits – to support claims of sustainability; 4) information and communication technologies – to improve product traceability and market engagement.

Key words: animal product innovation; consumer demands; societal expectations; sustainable food system

BOOK OF ABSTRACTS

29 – 31 OCTOBER 2025, BELGRADE, SERBIA

4

MULTIDIMENSIONAL ADAPTIVE STRATEGIES OF FARM ANIMALS FACING CLIMATE CHALLENGES**Dušica Ostojić Andrić¹ , Slavča Hristov² , Branislav Stanković² , Katarina Nenadović³ , Marko Pajić⁴ , Aleksandar Stanojković¹ , Slobodan Dolašević¹ **¹ Institute of Animal Husbandry, Auto Put 16, 11080 Belgrade, Serbia² Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080 Belgrade, Serbia³ Faculty of Veterinary Medicine, University of Belgrade, Bulevar oslobođenja 18, 11000 Belgrade, Serbia⁴ Scientific Veterinary Institute “Novi Sad”, Rumenački put 20, 21113 Novi Sad, SerbiaCorresponding author: Dušica Ostojić Andrić, andricdusica.iah@gmail.com

Abstract: Modern livestock farming operates within increasingly challenging climatic boundaries, making adaptation the cornerstone of sustainable development. In confronting climate change, the innate adaptive abilities of domestic animals must not be underestimated or neglected, as they provide the essential biological foundation for survival and productivity in an ever more demanding environment. Alongside human interventions, understanding and enhancing animal adaptations lay the groundwork for developing resilient and sustainable livestock systems. The strategies through which animals respond to climate challenges encompass physiological, biochemical, immunological, morphological, and behavioral mechanisms—from panting and sweating, changes in blood composition and endocrine function, to modifications in body size, coat characteristics, and behaviors such as seeking shade or reducing feed intake. Interspecies and interbreed differences further underscore the critical importance of genetic diversity in fostering resilience. These insights offer a basis for designing strategies that support not only productivity but also animal welfare under global warming conditions. While human interventions may alleviate the immediate impacts of climatic stressors, it is the integration of animal adaptations that provides the long-term foundation for the stability and future of livestock farming.

Key words: climate change, livestock, adaptation, heat stress, biological mechanisms, animal resilience

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ANTIMICROBIAL RESISTANCE: A GLOBAL CHALLENGE AND IMPLICATIONS FOR DAIRY CATTLE PRODUCTION

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Abstract: Antimicrobial resistance (AMR), especially antibiotic resistance, currently is one of the most important public health challenges, with serious consequences for human, animal and environmental health. In the context of dairy cattle production, the frequent and often unnecessary use of antibiotics, especially in the treatment of mastitis, significantly contributes to the development and spread of resistant bacteria. The aim of this review was to analyse the occurrence and mechanisms of AMR development in dairy production, with a special emphasis on mastitis as a main model for understanding the connection between veterinary practice, public health and food safety. Furthermore, the paper also provides an overview of current national and European strategic frameworks for AMR control, including selective therapeutic approaches, rapid diagnostics and preventive measures on dairy farms. In conclusion, the need for an integrated approach based on the *One Health concept*, which includes the collaboration of policy, science, education and practice, is necessary in order to preserve the effectiveness of antimicrobials and ensure sustainable dairy production.

Key words: antimicrobial resistance, mastitis, dairy cows, food safety, responsible antibiotic use

THE INFLUENCE OF PLANT EXTRACTS AND PHYTOGENICS ON THE INTESTINAL HEALTH OF FARM ANIMALS

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Abstract: Numerous complex factors affect the condition of the gastrointestinal (GI) tract in animals, which is crucial for their overall health, growth, and well-being. This overview aims to examine and compare the effects of various medicinal plant extracts and phytogenics on gut health in farm animals. It focuses on two critical aspects: the motility of the GI tract and the permeability and integrity of the gastrointestinal barrier in monogastric animal species, specifically chickens and pigs. This review highlights the usefulness and potential of using ex vivo models to study these properties (Latek et al., 2020), illustrating intra-species differences, such as the impact of *Melissa officinalis* preparations on GI motility (Posłuszny et al., 2021; Posłuszny et al., 2023), as well as variations between complex compositions and single compound applications (Mendel et al., 2020; Heinle et al., 2006; Latek et al., 2023; Posłuszny et al., 2023). With the rapid growth of intensive livestock production, numerous challenges can negatively impact animal gut health. As the search for optimal solutions continues, there is increasing interest in the use of alternative feed additives and herbal products to enhance gut health and mitigate the adverse effects caused by various pathogens or contaminants. Plant-based products have gained social acceptance and are viewed as "safe" and environmentally friendly. Conversely, there is a growing necessity for an evidence-based approach to assess the potential of medicinal plants in the treatment of farm animals (Ayrle et al., 2016). Phytogenics hold significant potential due to their complex composition and multifunctional properties, such as antioxidant, anti-inflammatory, and immunomodulatory effects (Ayrle et al., 2016; Julián-Flores et al., 2025; Latek et al., 2022). Proper contractile activity and a strong intestinal barrier are fundamental to the effective functioning of the gastrointestinal tract. Research on the effects of plant extracts and phytogenics on gastrointestinal motility and intestinal barrier integrity suggests that these plant components can significantly modulate these functions (Crowley et al., 2024; Latek et al., 2022; Mendel et al., 2017). As a result, plant extracts may be beneficial for the prevention or symptomatic treatment of various diseases. This overview presents examples of how different plant extracts and phytogenics influence the aforementioned functions.

Key words: gut health, GIT motility, intestinal barrier, medicinal plant extracts, phytogenics

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BOOK OF ABSTRACTS

29 – 31 OCTOBER 2025, BELGRADE, SERBIA

7

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DIETARY PLANT-BASED BIOACTIVE COMPOUNDS FOR SUSTAINABLE MASTITIS CONTROL IN LIVESTOCK

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Abstract: The increasing antimicrobial resistance among mastitis pathogens necessitates alternative therapeutic approaches in dairy cattle. This study evaluated the antimicrobial efficacy of selected plant extracts against both reference and production strains of mastitis-associated microorganisms *in vitro*, and assessed the *in vivo* effects of an extruded feed additive (the wormwood–poplar extract additive) containing *Artemisia absinthium* and *Populus balsamifera* extracts, on udder health and milk quality in cows with subclinical mastitis. *In vitro* assays demonstrated significant antimicrobial activity of citrus peel (*Citrus* spp.) and spruce (*Picea abies*) extracts against *Candida* spp., *Escherichia coli*, and *Staphylococcus aureus*, including resistant field isolates. The 15-day *in vivo* trial involving 60 Holstein cows revealed a 68% reduction in somatic cell counts ($p = 0.017$) following supplementation, achieving compliance with top-grade milk standards without compromising milk composition or sensory attributes. These findings underscore the potential of phytochemical compounds as effective, natural alternatives for mastitis control, promoting sustainable dairy production and reduced antibiotic reliance.

Key words: Mastitis; *Artemisia absinthium*, antimicrobial activity, somatic cell count, milk quality, phytochemical feed additive

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Financial support for this study was provided by the Ministry of Science and Higher Education of the Republic of Kazakhstan within the framework of project AP23484620 “Development and implementation of phytochemicals and phytobiotics for prevention and treatment of animal mastitis with assessment of quality and safety of milk”. We would like to thank “NFT-KATU” LLP for providing the material and technical base for the production of extruded additives, and to “Agrofirma Rodina” LLP for providing animals for this experiment.

LIVESTOCK SECTOR IN SERBIA: CHALLENGES, POLICY GAPS, AND STRATEGIC OPPORTUNITIES FOR SUSTAINABLE DEVELOPMENT

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Abstract: The livestock sector in Serbia is facing a prolonged decline, characterized by falling animal numbers, stagnant productivity, and reduced competitiveness in both domestic and European Union (EU) markets. This study aimed to analyze the key structural, technological, and policy factors underlying these trends to identify strategic opportunities for sustainable development. The methodology integrated macroeconomic analysis, agricultural economic accounts, and international trade data, applying a regression model to examine relationships between food prices, exchange rate fluctuations, and agri-food import volumes. Results showed a persistent decrease in the share of livestock production in agricultural gross value added, weak utilization of export quotas, and a negative trade balance for animal products. Rising domestic food prices were found to increase imports, while real appreciation of the dinar reduced competitiveness, highlighting macroeconomic vulnerability. The analysis suggests that modernization of production systems, improvement of support measures, and strengthening of rural development policies – as envisaged in national strategies – could contribute to enhancing the competitiveness and sustainability of Serbia's livestock sector. These measures are in line with the priorities of national strategies for agricultural development, economic reforms, and digitalization, supporting Serbia's integration into EU markets and achieving the objectives of sustainable development.

Key words: livestock, economic sustainability, agricultural accounts, gross value added, Serbia

PREDICTION OF BW FOR GRAZING CATTLE FROM BODY MEASUREMENTS BY USING ARTIFICIAL NEURAL NETWORK LINEAR AND RANDOM FOREST REGRESSION APPROACHES

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Abstract: Prediction ability of Linear and Random Forest Regressions and Artificial Neural Network analysis was evaluated for relationships between body weight and body measurements such as Body Length (BL), Withers Height (WH), Heart Girth (HG), Body Depth (BD), Heart Height (HH), and Heart Width (HW), were studied using 232 data in total from 29 head Simmental beef cattle observed during a 4-month grazing performance in Kars in the east of Turkey. Body weight was regressed on the body measurements. Linear, quadratic and cubic effects of heart girth indicated that heart girth measurements would be useful in predicting body weight ($R^2 = 88.0, 89.8$ and 90.8% , respectively). However, quadratic effect was found statistically significant ($P < 0.05$). Similarly, regression of body length including linear, quadratic and cubic effects, R^2 values were obtained $82.2, 83.9$ and 84.0% , respectively and linear effect was found statistically significant ($P < 0.05$). The regression equation which is including all body measurements, R^2 value was found 95.1% . The regression of body weight on heart girth had high R^2 (88.0%), followed by body length (82.2%). The regression equations which is including both heart girth and body length was found high R^2 (93.8%). The correlation coefficient between body weight and body measurements were found the highest in HG and BL ($r = 0.94$ and 0.91 , respectively). Similarly, R^2 values for HG were found the highest among the other individual variables by RF, ANN and LR analysis while the determination coefficients of BL were lower for RF, ANN and LR ($50, 63$ and 62% respectively) while the same values for HG were higher and similar by RF, ANN and LR ($87, 87$ and 86% respectively). The results showed that heart girth and body length measurements were the best prediction parameters in predicting body weight in all methods. In terms of predictive ability of the methods used in this study, there was no superiority among them. However, it would be ideal to use the Random Forests algorithm with advantages in dealing with data complexity and non-linear patterns for prediction of body weight based on measurements from digital images of the animals on grazing conditions.

Key words: prediction body weight, Simmental, beef cattle, body measurements, Random Forest Regression

VIEW AT SUSTAINABILITY IN DAIRY SECTOR: CURRENT STATE AND PERSPECTIVES

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Abstract: Milk and dairy products are nutritionally rich foods, providing energy and high-quality proteins along with a number of essential micronutrients. In this way, the dairy sector supports the existence of people in food chains around the world. Human activities affect the Earth's climate because they cause the release of huge amounts of greenhouse gases, which are retained in the Earth's atmosphere along with the gases that are naturally present in it. Food and drink are considered to be responsible for 20 to 30% of the impact on the environment, in which meat and dairy products are the most important. Research and methodologies are mostly focused on the emission of greenhouse gases (GHG), but numerous other impacts on the environment must also be taken into account, such as impacts on land and water through various types of pollution. In addition, the consumption of scarce water reserves and energy resources is also taken into account. Therefore, a sustainable approach to food and beverage production has no alternative. The dairy sector faces challenges to which it responds with numerous organized and synchronized actions and projects in order to successfully restructure and fit into the overall human activities to reduce pollution. Sustainability itself has 3 dimensions, ecological, economic and social. The aim of this paper is to present the current situation of sustainability in the dairy sector in the world and numerous activities undertaken by various actors in the dairy sector, from farm entities and dairy companies to various associations and umbrella organizations such as the International Dairy Federation, the European Dairy Association as well as non-specific dairy-strictly unrelated bodies. All activities are carried out in coordination and under the auspices of the United Nations and its organizations, primarily the Food and Agriculture Organization.

Key words: milk, dairy products, sustainability, pollution, gas emissions

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FORTIFICATION WITH NATURAL PLANT-BASED ADDITIVES IN CHEESE PRODUCTION: SUSTAINABLE CONCEPTS

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Abstract: Fortification of cheese involves the addition of micronutrients, including them in the casein matrix and proper improvement of the cheese, making the final product more attractive to consumers. In the Agri-Food sector, it is possible to enrich cheeses by adding plants secondary metabolites and/or using by-products from the processing plants. Interest in fortification of cheeses with antioxidants and phenolics derived from plant extracts (PE), spices, and plant by-products has been increasing significantly and encourage the development of a sustainable, circular economy and create “greener” environmentally friendly compounds that improve consumer health. Synthetic additives have become undesirable in the food due to potential harmful effects on human health. Consumers are trying to consume healthier or functional foods, safer alternatives to foods with synthetic additives. Numerous plant-based preservatives have been tested for use in the food industry. These natural molecules increase the microbiological stability of food and the levels of bioactive ingredients (BAI), while exhibiting antimicrobial (AM) and antioxidant (AO) effects. Cheeses are generally susceptible to contamination by pathogens and spoilage agents. In the dairy industry (more often on smaller farms), several sources of contamination have been observed: use of raw milk as a raw material, the environment where milk is obtained, stored and processed, or due to the practice of milk curdling with vegetable coagulants. The use of preservatives in cheese production is imperative, but they can degrade sensory properties, which consumers will not accept. This review discusses an innovative approach, primarily focuses on the frameworks and procedures for cheese fortification.

Key words: natural plant additives, cheese making, functional properties, antimicrobial effects, antioxidative activity, shelf-life

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PRODUCTION TRAITS OF SIMMENTAL BULL DAMS IN FIRST LACTATION ACROSS DIFFERENT DISTRICTS OF SERBIA

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Abstract: Milk yield and composition are among the most important traits in cattle production. The aim of this study was to analyse the production traits of Simmental bull dams in their first lactation in Serbia and to evaluate the influence of the district (breeding region) on the variability of these traits. The study included 408 Simmental cows selected as bull dams from eight districts: Kolubara, Podunavlje, Braničevo, Šumadija, Zaječar, Rasina, Nišava and Belgrade. Milk production traits in the first lactation were standardised to 305 days and included milk yield (kg), milk fat content (%), milk fat yield (kg), protein content (%) and protein yield (kg). The data were analysed using one-way analysis of variance (ANOVA) with the district as a fixed factor. The average milk yield in the first lactation was 6093 kg, with an average milk fat content of 4.00% and protein content of 3.25%, confirming that these cows represent a highly productive segment of the Simmental population in Serbia. Highly statistically significant differences ($p < 0.001$) were found between the districts for all analysed traits. The highest average milk yield was recorded in the Nišava district (6792 kg), the lowest in the Podunavlje district (5735 kg). The highest milk fat content (4.30%) and the highest milk fat yield (288.89 kg) were recorded in the Zaječar district, while the highest protein content (3.35%) was recorded in the Šumadija district. The results presented indicate the need to optimise selection criteria and improve rearing conditions in districts with lower production levels in order to support the sustainable development of milk production in Serbia.

Key words: Simmental cattle, bull dams, milk yield, milk composition, first lactation, breeding regions.

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FIVE-YEAR OVERVIEW OF THE SIMMENTAL CATTLE POPULATION IN CENTRAL SERBIA

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Abstract: Serbia has a high potential for livestock production, which is suitable for breeding dual-purpose Simmental cows, both for milk and meat production. High quality animals with strong breeding potential registered in the main herd book are monitored for their production performance, reflecting the national authorities' commitment to the cattle sector. According to the reports of the Institute for Animal Husbandry and the results of the implementation of the main breeding programme in the past five-year period (2024–2029), not only the number of cows, but also the total number of all categories of Simmental cattle in the main herd has decreased in the territory of Central Serbia. Selection process in milk production is carried out through continuous cooperation between farmers-breeders of high-quality breeding cattle - and local breeding organisations, both at local and regional level. In central Serbia, there are over 150 registered local breeding organisations that take on the tasks of recording/registering and selecting the cattle in the herds. In this study, data from the main breeding organisation for livestock farming for the area of central Serbia, the Institute for Animal Husbandry in Zemun, and its annual reports were used. The tabular analysis and the five-year trend of animal numbers are presented according to the number of registered animals, the number of linearly evaluated cows after the first calving and the achieved lactation yield of milk, milk fat and milk protein (standardised to 305 days). Based on the analysed and discussed results of the selection work on Simmental cows, it can be concluded that there has been some progress in milk production, but also a reduction in the number of individuals. It is important to emphasise that these results have an impact on the overall productivity of the cattle population in central Serbia.

Key words: Simmental breed, herd book cows, milk lactation production, Central Serbia

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PERSPECTIVE DUAL-PURPOSE AND BEEF BREEDS ASSOCIATED WITH INCREASED BEEF PRODUCTIVITY IN CATTLE

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Abstract: A large part of the beef in Bulgaria comes from dairy breeds – about 40% of the total amount. Industrial crossbreeding is also used, with different bloodlines and types of crossbreeds being sold on the market. The main patterns in beef production have been identified, and the biological characteristics of cattle as meat producers have been analyzed. Some perspective, combined, and beef breeds are examined that can contribute to increasing beef productivity in the species and categories of cattle and solving the problem with beef in Bulgaria as a whole. A review of the technologies for breeding three dual-purpose and three beef cattle breeds in this regard is provided. Historical background, distribution, morphological and breed characteristics, productive types, weight development and growth, exterior, milk and meat productivity are described. Emphasis is placed on problems in the development of modern beef cattle breeding.

Key words: breeds, meat, combined direction, exterior

CHESTNUT TANNINS IN LAMB NUTRITION: BALANCING PROTEIN UTILIZATION AND FEED EFFICIENCY IN SUSTAINABLE FATTENING SYSTEMS

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Abstract: Tannins are complex plant-derived polyphenols that are increasingly being investigated in ruminant nutrition due to their protein binding capacity, bioactive properties and potential to support sustainable production goals. They can modulate fermentation in the rumen, reduce protein degradation and alter the dynamics of nutrient absorption dynamics — but their dual role as functional and potentially antinutritive agents requires differentiated evaluation. This paper discusses the broader functional importance of tannins in ruminant diets based on a comprehensive literature review, focussing on their mechanisms of action, influence on digestibility, animal performance and metabolic responses. Within this framework, a practical model of lamb fattening will be analysed to investigate the controlled use of chestnut tannins under different feeding conditions and protein balances. The model serves to illustrate the general challenges of implementing tannin research in commercial feeding systems. The importance of dosage, tannin type, feed matrix and animal-specific factors that determine efficacy and safety is emphasised. Whilst the integration of tannins offers promising routes to nitrogen efficiency and reduced environmental impact, practical implementation requires a clear understanding of the economic trade-offs and variability at farm level. The findings presented will serve as a basis for future research designs and practical implementation strategies for plant additives in small ruminant diets.

Key words: tannins, lamb fattening, protein utilization, feed efficiency, sustainable livestock

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WOOL AS A TOOL FOR THE CIRCULAR BIOECONOMY: REVITALISING A FORGOTTEN VALUE CHAIN

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Abstract: Sheep wool is a natural, renewable, and biodegradable fibre with profound cultural, ecological, and economic significance across Europe. Despite this, wool — particularly from native and coarse-wooled sheep breeds — is increasingly treated as a low- or no-value by-product, often discarded due to declining market demand, limited processing infrastructure, and inadequate classification under EU policy frameworks. In many pastoral regions, the cost of shearing now exceeds the price paid for greasy wool, turning it into an economic and environmental burden for farmers. This contribution offers a practice-informed perspective on revitalising Europe’s wool value chain through circular bioeconomy strategies. Drawing on recent interdisciplinary research and good-practice case studies collected through the European Wool Association AISBL, it examines the role of native sheep breeds in ecosystem management, biodiversity conservation, and climate resilience. Wool’s capacity to sequester carbon, suppress weeds, reduce fire risk, and enhance soil health positions it as a multifunctional material in agriculture, construction, and regenerative design—beyond traditional textile applications. Innovations in local processing, insulation materials, and biobased composites offer new markets for coarse and medium wools, aligning with the EU Green Deal and Farm to Fork strategies. Yet, regulatory gaps remain: under current Common Agricultural Policy (CAP) and animal by-product legislation, wool is not fully recognised as a renewable bioresource, limiting support for farmers and processors. This paper advocates for greater cross-sector collaboration, the development of regional value networks, and the recognition of wool’s ecosystem service contributions. Reframing wool as a strategic material—not waste—can strengthen rural economies, support native breed conservation, and accelerate Europe’s transition to a circular and climate-smart agriculture.

Key words: wool valorisation, ecosystem services, EU agricultural policy, native sheep breeds, circular bioeconomy

CHALLENGES IN BLUP-BASED GENETIC EVALUATION OF PIGS WITH HIGH LEVELS OF IMPORTED GERMPLASM

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Abstract: Accurate estimation of breeding values is essential for effective selection in pig breeding programs. The Best Linear Unbiased Prediction (BLUP) method integrates pedigree, phenotypic, and, when available, genomic information to estimate breeding value. However, in pig populations with a high proportion of imported germplasm, progeny of imported sires often receives underestimated breeding value in the early stages of evaluation. This bias primarily arises from the lack of local performance data and genetic connectedness between imported parents and the domestic reference population. Without domestic phenotypic records, BLUP tends to regress breeding value of such animals toward the population mean, leading to lower selection indices despite potentially high genetic merit. Several approaches can mitigate this underestimation. The use of genetic groups or phantom parent groups can account for differences in genetic level between imported and domestic animals. Genomic evaluations (GBLUP) provide an additional solution by capturing relationships through DNA marker information, increasing connectedness even in the absence of phenotypic records. Rapid accumulation of domestic performance data from progeny also reduces bias over time. International genetic evaluations allow the incorporation of foreign breeding value into national evaluations, aligning genetic bases between countries. Addressing this issue is particularly important in small or developing breeding programs where imported germplasm represents a significant proportion of genetic improvement. Properly accounting for imported genetic material ensures fair evaluation of all candidates, optimizes selection decisions, and accelerates genetic progress.

Key words: pigs, breeding values, accuracy, import

GENETIC PARAMETERS AND ESTIMATION OF BREEDING VALUES FOR ECONOMICALLY IMPORTANT LITTER SIZE TRAITS IN PIG PRODUCTION USING ADVANCED STATISTICAL MODELS

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Abstract: The aim of this study was to assess the phenotypic variability and genetic parameters for the economically most important litter size traits in sows, as well as to estimate the breeding values (EBV) of boars for these traits. Fertility data from sows and boars included 18,042 litters farrowed by 6,627 sows on 312 pig farms. Descriptive analysis showed that the Landrace and Large White genotypes expressed a similar average number of live-born piglets (NBA), with somewhat higher variability observed in the Large White population. The heritability coefficient for NBA, estimated using the repeatability model, was $h^2 = 0.098$. The low heritability of this trait confirms that it is a reproductive trait strongly influenced by environmental factors, which highlights the need for particular attention to the accuracy of parameter estimation. The accuracy of genetic parameter estimation is crucial for more reliable EBV, which is of great importance considering the effect of this parameter on EBV reliability and, consequently, on selection efficiency. Although low values were obtained, the inclusion of permanent environmental effects in the model contributed to a more precise estimation of variance components and more reliable EBV. The results emphasize the importance of selection based on EBV for increasing litter size, with a recommendation for continued data collection on progeny to improve estimation accuracy and ensure long-term genetic progress in pig populations.

Key words: pigs, reproductive traits, heritability, reproductive traits, modelling, EBV

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LOCAL PIG BREEDS – THE MULTIFUNCTIONALITY ASSETS FOR SUSTAINABLE PORK PRODUCTION

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Abstract: This presentation analyses the role of local pig breeds within sustainable food systems, with a particular focus on their contribution to sustainable pig production. It examines how these breeds respond to evolving societal and consumer expectations regarding intrinsic and extrinsic quality attributes of pig meat and pork products. The analysis addresses critical challenges related to sustainability in livestock systems, highlighting the multifunctionality of local breeds, their environmental impact, socio-cultural significance, consumer perspectives and market potentials of their products. Public funding plays an important role in maintaining local pig breeds; however, a lasting conservation requires their integration into sustainable systems that capitalize on their distinctive qualities.

Key words: breed valorisation, ecosystem services, quality attributes, pork value chain

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STUDYING HUSBANDRY AND NUTRITION IN KRŠKOPOLJE PIG: IMPLICATIONS FOR FAT DEPOSITION AND MEAT QUALITY WITH INSIGHTS INTO METABOLISM AND GENE EXPRESSION

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Abstract: The Slovenian autochthonous breed Krškopolje pig is receiving a growing interest from both society and consumers, as it represents an important element of agricultural biodiversity, cultural heritage and is valued for its meat quality. The present article summarizes recent studies on Krškopolje pig performance under various rearing and nutritional conditions, with comparisons to lean modern pigs. Investigations covered both intensive indoor and extensive outdoor systems, including assessments of growth, fat deposition, meat quality traits, tissue-specific enzyme activity, and gene expression related to fat metabolism. The impact of dietary protein reduction was also examined in both settings, with emphasis on physiological and molecular responses. These studies provide a comprehensive overview of how Krškopolje pig responds to different production environments and nutritional strategies, highlighting its relevance for sustainable and niche pig production.

Key words: Krškopolje pig, rearing systems, nutrition, fat deposition, gene expression, metabolism.

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BOOK OF ABSTRACTS

29 – 31 OCTOBER 2025, BELGRADE, SERBIA

22

EFFECT OF PREWEANING SOCIALIZATION OF IBERIAN PIGLETS ON POSTWEANING SALIVARY STRESS AND INFLAMMATION BIOMARKERS AND GROWTH

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Abstract: Weaning is a critical period for piglets due to dietary changes and regrouping stress, both resulting in diarrhea and decreased production. Socialization among piglets from different litters during the lactation phase could be a strategy to reduce the postweaning regrouping stress, thus improving animal welfare and reducing diarrhea. For this study, 56 Iberian piglets from 8 litters were used. Starting at 15 days of age (d), piglets were offered creep feeding using a commercial pre-starter without antibiotics or zinc oxide. Also from this time, 4 of these litters were allowed to mix (socialized piglets) by removing the dividing panels among the dams, while the other 4 litters remained unmixed (non-socialized piglets). Right after weaning (d ~30), 40 of these piglets (excluding those with lower weaning weight) were allotted by the 2 previous socializing treatments and housed in 8 cubicles (5 piglets / cubicle), which contained either males or females. Within each of the 2 socializing treatments, piglets were randomly assigned to 4 cubicles/treatment. Of these 40 piglets, 10 males and 10 females housed in 4 cubicles were the previously socialized ones (Treatment 1, Socialized; S; n=20), while the other 20 piglets (10 males and 10 females in 4 cubicles) were regrouped after weaning (Treatment 2, Non-socialized; NS; n=20). Piglets remained in these postweaning cubicles for 30 more days until the end of the experiment (on d 60). Piglets were weighed at birth and every 15 days up to d 60. At weaning (d 30) and one week later (d 37), saliva samples were collected to determine the levels of bioindicators related to stress or inflammation, namely cortisol, corticosterone, chromogranin-A (CgA), α -amylase (α A), oxytocin, and adenosine-deamylase (ADA). Body weight on d 45 was greater for the S group, but there was no effect of treatment on d 60. Average daily gain (ADG) at d 30-45 was greater for S piglets (210 g) than for NS piglets (130 g). In contrast, ADG at d 45-60 was smaller for S piglets (300 vs 390 g). Therefore, NS piglets seemed to have a compensatory growth phase at the end. There was no effect of treatment for cortisol on d 30 and 37, for corticosterone on d 30, for CgA on d 30, or for α A on d 30 and 37. The NS group had greater levels of corticosterone, CgA and ADA on d 37. The S group had greater levels of oxytocin on d 37. In conclusion, on days 0-7 post-weaning (d 30-37) socialized piglets had better growth parameters and less stress (lower corticosterone), less chronic stress (lower CgA), less inflammation (lower ADA), and a greater welfare level (higher oxytocin) than the non-socialized piglets. Nevertheless, non-socialized piglets appeared to undergo compensatory growth at the end of the experiment, from 45 to 60 days of age.

Key words: swine, behavior, welfare, Perinatology, antibiotic alternatives

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EFFECTS OF NATURAL ADDITIVE SUPPLEMENTATION OF IBERIAN PIGLETS ON SALIVARY BIOMARKERS OF STRESS AND IMMUNE RESPONSE

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Abstract: Post-weaning is a critical stage in piglet development, often leading to stress, diarrhea and impaired growth performance. Antibiotics and zinc oxide were used in piglet feed to prevent diarrhea, but current EU regulations restrict this practice. As alternative preventive treatments, this study aims to evaluate the effects of supplementation of Iberian piglets during the pre- and post-weaning periods with pulverized rice husk, microalgae-derived immunomodulators and encapsulated essential oils on growth performance and salivary biomarkers of stress and immune function. A total of 150 Iberian piglets from 25 litters were randomly allocated into 4 dietary treatment groups: 1) Base feed + essential oil (EO) blend; 2) Base feed + microalgae (MA) extracts containing beta-1,3-glucans; 3) Base feed + rice husk (RH); 4) Base feed + rice husk + essential oil blend (RH-EO). These diets started during lactation at 14 days of age (d) and were maintained up to weaning (30 ± 3 d) and up to the end of the experiment (30 days post-weaning; ~60 days of age). Right after weaning, 80 of these piglets continued the trial in cubicles (5 piglets / cubicle; 10 females and 10 males per treatment). Piglets were fed *ad libitum*. Body weight (BW) was recorded every two weeks from birth up to 60 days of age, and average daily gain (ADG) within 15-30, 30-45 and 45-60 d was calculated. Saliva samples were collected from each piglet at 30 d (weaning) and 37 d to evaluate stress and immune-related biomarkers. Between 15 and 30 d, ADG was similar for the 4 treatment groups. Between 30 and 45 d, RH showed the lowest growth. However, from 45 to 60 d, the RH and RH-EO groups grew as much as the other two groups. Regarding salivary biomarkers, MA piglets had the lowest cortisol and Chromogranin-A (CgA) levels, thus suggesting a lower stress level. In contrast, EO and RH piglets had the highest CgA levels, with EO surprisingly showing the highest oxytocin levels (indicating a higher welfare level), which may suggest a dual response to stress in this group. The RH group maintained elevated stress biomarker levels. Besides, the combined treatment (RH-EO) had moderate (intermediate) stress and immune responses. Adenosine- deaminase (Ada) salivary levels (related to immunocompetent lymphocyte function) remained similar across all treatment groups. In conclusion, the evaluation of salivary biomarkers in Iberian piglets suggests that different nutritional strategies showed diverse modulatory effects on the immune and stress responses, and also that piglets (at least the Iberian ones) have a great capacity for compensatory growth once the critical stressful period ended, plausibly after a reduction of the intestinal inflammatory response. Further analysis integrating behavioral, growth performance, and intestinal health data from this study will be essential to determine the overall efficacy of these nutritional strategies (as alternatives to antibiotics) in Iberian piglet management.

Key words: weaning, stress, immune response, rice husk, essential oils, microalgae

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COMPARISON OF THE CHEMICAL COMPOSITION OF WILD BOAR (SUS SCROFA) MEAT HARVESTED IN DIFFERENT EUROPEAN COUNTRIES

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Abstract: The wild boar (*Sus scrofa*) is a popular game animal throughout the world. Boar populations in Europe and Asia are numerous and widespread. However, these animals cause many problems - they cause damage to agricultural crops, spread infectious diseases dangerous to pigs, (African swine fever ASF), encroach on human settlements causing traffic accidents and are becoming an increasing threat to humans. Attempts to reduce the number of feral pigs have a low success rate, since, thanks to their rapid reproduction, their herds quickly recover after periods of intensive shooting. In addition, they do very well even in unfriendly environments and easily conquer new areas. Hunting and systematic culling of wild boars are aimed at reducing the numbers and reduce the population density of this species. In 2019 -2023, the annual harvest of wild boar carcasses ranged from 221,000 to 420,000. After mandatory veterinary inspection, wild boar meat can be a more environmentally friendly, low-cost alternative to pork. Previous studies show that wild boar meat is nutritionally valuable - among other things, it contains significantly more omega-3 fatty acids than pork. Despite its darker color and higher intramuscular fat content, it has a unique flavor. The purpose of the conducted research was to analyze the chemical composition of wild boar meat harvested in Poland and to compare the obtained results with those of other authors on the composition of wild boar meat harvested in other European countries, including Serbia. The aim of the study was to analyze the quality of meat of wild boars hunted in the Polish Carpathians (Subcarpathian, Lesser Poland and Silesian Voivodeships) in the autumn-winter season of 2021-2022. Raw meat (*m. longissimus dorsi lumborum*) from 20 carcasses of adult wild boars (boars) weighing approximately 100 kg was analyzed. The raw meat (*m. longissimus dorsi lumborum* between 13th and 14th rib) were minced and average samples obtained were subjected to physicochemical analyses. The content of dry matter, ash, total proteins and fats were determined according to AOAC International (2019), colour of meat samples were obtained in CIELab system (Konica Minolta CM - 600d spectrophotometer). The fatty acid and amino acid profile was determined. The results were analyzed with ANOVA and present as means with standard deviation. In the accredited laboratory of the Veterinary Inspectorate the contents of heavy metals (As, Cd, Pb, and Hg), were determined and concentration radioactive Cs-137 and Cs-134 radionuclides. In the fatty tissue of boars the content of PCB congeners and the content of plant protection substances. Wild boars are good indicators of environmental pollution, so monitoring wild boar meat seems justified. The results obtained show that the chemical composition of meat, especially the fatty acid profile of the fat of wild boars obtained in different countries differs and depends on the feed base the boars use.

Key words: wild boars, meat, chemical composition, quality, safety

POSSIBILITIES FOR UTILIZATION OF MALE LAYER - TYPE CHICKENS FOR MEAT AND MEAT PRODUCTS - STUDIES IN BULGARIA

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Abstract: In recent years, the problem for the culling of male layer-type chickens raised significant concern in society. This general practice applied to the birds so far largely contradicts the principles of animal welfare. Hence, additional public pressure rises from a number of non-governmental and non-profit organizations, whose main function is to control compliance with generally accepted animal welfare standards. In Bulgaria, studies on this problem began in 2010, as a search for an opportunity to utilize male layer-type chickens of Lohmann-Brown Classic hybrid. One of the possibilities to utilize this type of birds is their breeding for meat. Since it is known that this is not cost-effective due to the slow growth rates, experiments were conducted to increase growth intensity - the application of density fragmentation (DFM) to determine the suitable age for slaughter, and supplementation of carbohydrates in the diet. The positive results achieved gave reason to continue the research for breeding the male layer chickens for production of meat and meat products at a suitable age. After harvesting the meat and applying appropriate thermal and technological treatments, high-quality products were obtained – roasted chicken, smoked chicken and pâté, which were provided to consumers for a survey. The results of the survey showed high degree of approval of the solution proposed for raising male layer chickens for meat. The sensory evaluation made by the respondents of the three products was considerably higher than the one for the similar products offered in the retail market. These results encourage us to go further and experiment with other products from male layer-type chickens.

Key words: male layer-type chickens, growth, meat, meat products, consumers

THE YELLOW MEALWORM (*Tenebrio molitor* L.): FROM FARM TO FEED

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Abstract: In recent years, there has been growing interest in insect farming as a sustainable solution for feed production. Among insect species, the yellow mealworm (*Tenebrio molitor* L.), is one of the most studied and farmed in Europe. This review provides a comprehensive examination of yellow mealworm, from its farming to its processing into animal feed. The key factors influencing yellow mealworm productivity are analysed in detail, including temperature, relative humidity, photoperiod, farming density, and diet composition. Optimal environmental conditions and feeding substrates are crucial for maximising growth, development, and reproductivity. The review also addresses the challenges associated with harvesting, processing, and ensuring food safety of this insect species for use as animal feed. Techniques such as killing methods, drying processes, and microbial decontamination are discussed, as they significantly impact the quality and safety of the final products. The nutritional composition of yellow mealworm larvae is highlighted, emphasising their rich content of protein, essential amino acids, lipids, and other functional ingredients, positioning them as a promising alternative source of energy and nutrients for animal diets. Studies on the inclusion of yellow mealworm meal and oil in the diets of various livestock species, including fish, poultry, pigs and rabbits, are presented, demonstrating promising results in terms of healthiness, growth performance, feed efficiency, and product quality. The review wraps up by highlighting the potential role of the yellow mealworm as a sustainable and nutrient-dense option for feed. While insect farming comes with its own set of challenges, the advantages of cultivating yellow mealworms make them an appealing choice for meeting the demands of animal feed in the face of global population growth and resource constraints. Further research and development in this field are encouraged to fully harness the potential of this valuable resource. One key challenge is reducing production costs to be competitive with traditional low-cost feedstuffs used in formulating diets for livestock species for which insect products are intended as feed.

Key words: insect protein, circular economy, optimization, alternative feed ingredient, frass.

DIETARY CAMELINA AND LINSEED CAKES MODULATE FATTY ACID CLASSES AND SENSORY TRAITS OF YELLOW MEALWORM LARVAE

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Abstract: This study evaluated the effects of including 5% and 10% camelina and linseed cake in the diet of *Tenebrio molitor* L., on the fatty acid (FA) composition and sensory traits of dried larvae. Five isonitrogen and isoenergy diets were tested: a control diet (CON), a diet with 5% camelina cake (CAM 5), 10% camelina cake (CAM 10), 5% linseed cake (LIN 5), and 10% linseed cake (LIN 10). Larvae were fed the diets from the 4th to the 9th week of age, then euthanized by freezing at –60 °C and freeze-dried for FA quantification. A portion of larvae was microwave-dried to conduct consumer sensory evaluation. Visual, olfactory and overall acceptance was assessed by 141 employers or students of the University of Padova. Results showed that incorporating camelina and linseed cakes at both 5% and 10% increased the amount of polyunsaturated fatty acids (PUFA) of larvae ($P = 0.0053$) and reduced their n-6/n-3 ratio ($P < 0.0001$). In terms of visual, olfactory, and overall consumer acceptance, larvae from the CON group received the lowest ratings, while those from the LIN 10 group were rated most favourably by consumers (3.90 vs 5.42, respectively; $P < 0.0001$). In conclusion, this study demonstrated that dietary inclusion of camelina and linseed cakes enhanced the PUFA content and improved sensory acceptance of yellow mealworm larvae. Notably, the improvement in the n-6/n-3 ratio was proportional to the level of oilseed cake supplementation, with the lowest and most favourable ratio of 4.43 achieved in the LIN 10 group.

Key words: oilseed by-products, omega-3 fatty acids, polyunsaturated fatty acids, consumer preference, edible insects.

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COMPARISON OF TIME CONSUMPTION BETWEEN TRADITIONAL AND INNOVATIVE METHODS OF PRODUCING QUEEN CELL CUPS

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Abstract: The production of high-quality honey bee queens is one of the most important beekeeping operations, considering the key role of the queen in the colony. On the other hand, queen rearing is a highly challenging process, so the simplification of certain production segments would represent a significant advantage. In this paper, we examined and compared the traditional method of producing wax queen cell cups using a wooden mold with an innovative method that involves the use of a silicone mold together with a specially designed cell bar. The comparison of efficiency between the tested methods was carried out through the measurement of time consumption for both methods. Our results indicate that the production of queen cell cups using the innovative method is 2.66 times faster compared to the traditional method. In addition, we examined the differences in queen cell cup height obtained by the traditional method, which showed high variability, ranging from 8.1 mm to 15.9 mm, unlike the innovative method in which queen cell cups were uniform and measured 11 mm. On professional apiaries, where there is a high demand for the production of honey bee queens, queen cells, and royal jelly, our innovative method can significantly facilitate production by accelerating the process of producing queen cell cups, while at the same time ensuring the uniformity of the produced cell cups. Also, using a specially designed cell bar allows all queen cells to be added or removed at once from the grafting frame and provides the possibility of simple individual separation of the queen cells.

Key words: queen cup, queen cell, wax, queen production

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MONITORING WILD POLLINATORS IN SERBIA USING CITIZEN SCIENCE PRINCIPLES

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Abstract: As part of the two-year citizen science project “Bee is a Key,” the first phase of “wild” pollinator biomonitoring was conducted using bee hotels made of reed stems to attract native solitary bees. Over 100 hotels were distributed to schools, fruit growers, beekeepers, protected areas, and interested citizens across 26 districts in Serbia. Preliminary results show that more than 70% of the hotels were inhabited by at least one pollinator species, with detailed taxonomic analysis planned for the autumn. In addition, an online survey (with 91 respondents: 41.8% professionals and 58.2% amateur producers) assessed the use of managed pollinator use in fruit production. The current survey results show a noticeable trend in the last period of decreasing pollinator diversity, which has led to poor fruit pollination. Also, over 44% of fruit growers use managed pollinators, of which 80% are honey bees and 15% mason bees. The answers indicate that fruit yield is noticeably better (in terms of amount and fruit quality) by between 10% and over 50% when using pollinators. Some of the challenges related to the honey bee include pesticides and low temperatures during the early fruit blooming. On the other hand, mason bees offer an advantages of being more efficient pollinators of fruit crops, easier to breed, more active during colder weather and not exhibiting aggressive behavior. About 40% of respondents expressed interest in subsidized pollination services, and almost all responses were affirmative regarding their interest in learning more about controlled pollination in their orchards.

Key words: biomonitoring, wild pollinators, solitary bees, survey, citizen science

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ANTIPARASITIC EFFECTS OF *Artemisia absinthium* L. IN THE TREATMENT OF HEXAMITIOSIS IN RAINBOW TROUT (*Oncorhynchus mykiss*) CULTURE

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Abstract: In recent years, the inefficacy and adverse effects of synthetic drugs and therapeutic agents used against the increasing prevalence of diseases in aquaculture have highlighted the need for introducing medicinal plants with antimicrobial properties into the sector. The use of plant-based products in the treatment of cultured fish species holds significant potential, particularly in supporting organic aquaculture practices. In this study, the antiparasitic activity of the ethanol extract of *Artemisia absinthium* L. (wormwood) was investigated against Hexamitiosis disease caused by *Spironucleus salmonis* in juvenile rainbow trout. The plant extract was incorporated into fish feed at doses of 1.5, 2.0, and 2.5 g/kg and administered to infected fish with an average body weight of 1.5–2.0 g for both short-term (7 days) and long-term (21 days) treatment periods. The results revealed that the *A. absinthium* extract exhibited antiparasitic efficacy against *S. salmonis* on both the 7th and 21st days. Cumulative mortality rates decreased in all experimental and positive control groups, with the 21-day application proving more effective than the 7-day treatment. The highest antiprotozoal activity was observed with the 2.5 g/kg dose on the 21st day, showing a statistically similar effect to that of the positive control ($p < 0.05$). Based on these findings, it was concluded that ethanol extracts of *A. absinthium* could be used as a natural and alternative antiparasitic agent for controlling *S. salmonis* infections in rainbow trout aquaculture.

Key words: *Artemisia absinthium* L., *Spironucleus salmonis*, rainbow trout (*Oncorhynchus mykiss*), antiparasitic, treatment

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THE INFLUENCE OF SEASONAL FACTORS ON DAILY MILK PRODUCTION AND CHEMICAL COMPOSITION OF MILK IN DAIRY COWS

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Abstract: The production characteristics of dairy cows are subject to the influence of numerous environmental and management factors, among which seasonal changes play an important role. The aim of this study was to analyze the influence of the seasons on the amount of milk produced daily and the amount and proportion of milk fat and protein in the milk. Data collected during regular milk control were used, and statistical analysis was performed at the level of more than one million records for each characteristic. The results showed a pronounced seasonal variability of production parameters. The highest daily milk yields were recorded in spring and winter (23.50 kg and 23.00 kg respectively), while these values were lower in summer and autumn. The milk fat and protein content also varied depending on the season - the highest fat and protein contents were recorded in the colder months, while the lowest were recorded during summer, which can be associated with heat stress and reduced feed intake. Seasonal variability in production indicates the need for seasonally adapted herd management strategies, including ration optimization, thermal comfort, and technological adaptation. The research provides an important contribution to understanding the dynamics of production traits throughout the year and provides a basis for further modelling of effective management systems that would enable more sustainable and stable dairy farming under climate change.

Key words: dairy cows, seasonal effect, daily milk yield, milk fat, milk proteins

A NOVEL METHOD FOR EFFICIENT WELFARE ASSESSMENT ON DAIRY CATTLE FARMS IN SERBIA

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Abstract: Long-term challenges in the dairy sector regarding the implementation of systematic and practically applicable welfare monitoring have necessitated the development of a new, locally adapted assessment method in Serbia. International protocols such as Welfare Quality®, although recognized as the gold standard with scientifically validated indicators, remain inaccessible for routine use due to substantial time, personnel, and logistical demands. The reality of Serbian farms, mainly small and medium-sized operations with specific husbandry conditions, underscores the need for a rapid, reliable, and objective approach to welfare assessment, which is crucial for sustainability, food safety, and competitiveness. The novel methodology is based on a carefully selected set of basic, easily and rapidly measurable indicators that have been validated through comparison with the WQP protocol, thereby confirming both their reliability and practical value for commercial, advisory, and control purposes. This approach is tailored to limited resources and capacities, enabling standardized, rapid, and efficient welfare assessment, reducing costs, and increasing monitoring frequency. Integrating the new method into an innovative application will allow straightforward data collection, analysis, and display directly on-farm. This digital approach facilitates data entry and automatic processing, report generation, education, and personalized recommendations, resulting in significantly faster, more accurate, and more accessible welfare assessments for all stakeholders in the dairy sector.

Key words: welfare, dairy cows, locally adapted assessment method, monitoring, validation

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ASSESSMENT OF AFFECTIVE STATES IN PRE-WEANING CALVES HOUSED IN INTENSIVE PRODUCTION SYSTEMS

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Abstract: Emotional states are increasingly recognized as key indicators of animal welfare, especially in early life stages when young animals are highly sensitive to stress and environmental challenges. This study explored the emotional responses of pre-weaning calves (up to one month old) on two intensive farms, involving a total of 1,168 calves (596 on Farm A and 572 on Farm B). The main differences between farms were related to housing conditions during the first week and group size between days 8 and 30. Emotions were assessed using a 20-trait scoring system (scale 0–120), supplemented by behavioral tests such as approach and touch tests, and observations of both physiological (e.g., play, social interaction) and pathological behaviors (e.g., apathy, stereotypies, cross-sucking). Traits were categorized as positive (e.g., activity, calmness, curiosity, playfulness, sociability) or negative (e.g., indifference, fear, agitation, boredom, apathy). During the first week, Farm A calves were calmer but less active and more prone to negative emotions, while Farm B calves were more curious and socially engaged, though more irritable. By day 15, Farm A calves showed greater liveliness and satisfaction, while Farm B calves still exhibited more negative states. On days 22 and 30, Farm A calves demonstrated more activity and play, although some negative behaviors persisted. Despite fluctuations, overall emotional scores did not differ significantly between farms. Positive emotions generally dominated. These findings highlight the impact of housing on calf welfare and support the use of behavioral and physiological indicators to assess emotional well-being. Further research is needed to develop validated tools and improve husbandry in intensive systems.

Key words: calves, emotions, behavior, welfare, intensive farming

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BOOK OF ABSTRACTS

29 – 31 OCTOBER 2025, BELGRADE, SERBIA

34

REPRODUCTIVE PERFORMANCE OF SIMMENTAL COWS IN SERBIA IN RELATION TO PROVENIENCE AND MANAGEMENT SYSTEMS**Dragan Nikšić¹**, **Vlada Pantelić¹**, **Dušica Ostojić-Andrić¹**, **Aleksandar Stanojković¹**, **Predrag Perišić²**, **Marina Lazarević¹**, **Miloš Marinković¹**¹ Institute for Animal Husbandry, Belgrade, Zemun, Serbia² Faculty of Agriculture, University of Belgrade, Zemun, SerbiaCorresponding author: Dragan Nikšić, draganniksic84@gmail.com

Abstract: The enhancement of Simmental cattle productivity in Serbia has predominantly relied on pure breeding. Effective selection remains essential for substantial progress in improving the genetic foundation and increasing the overall efficiency of livestock production. In an effort to accelerate genetic improvement and expand herd size, Serbian farmers are increasingly importing Simmental cattle from countries with highly developed breeding programs-particularly Austria and Germany-where average milk yields reach 6,500–7,000 kg with over 4% milk fat. This study aimed to evaluate the influence of animal provenience on four key reproductive indicators: calf birth weight, age at first calving, calving interval, and service period length, comparing domestic versus imported Simmental populations. A total of 954 cows were observed, encompassing 3,641 completed lactations. Animals were raised either by individual farmers (tied housing system) or on commercial farms (loose/free housing system). Based on provenience and housing method, cows were categorized into four groups: group 1: domestic provenience, smallholder tied housing; group 2: imported provenience, smallholder tied housing; group 3: domestic provenience, commercial farm free housing; group 4: imported provenience, commercial farm free housing. The highest performance values across the studied traits were found in Group 4. All reproductive parameters varied highly significantly ($p \leq 0.001$) depending on the combined effects of housing system and animal provenience, except for age at first calving, which showed no statistically significant difference ($p > 0.05$).

Key words: reproductive performance, provenience, Simmental cows

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ARTIFICIAL NEURAL NETWORK AND REGRESSION MODELS TO PREDICT BW OF HOLSTEIN AND BROWN SWISS CATTLE USING REAL-TIME BODY MEASUREMENTS

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Abstract: In this study, it was aimed to evaluate the possible use of some morphometric body measurements to predict body weight (BW) of Holstein (H) and Brown Swiss (BS) cattle grown in a 12-month Intensive beef production system. Associations between bodyweight (BW) and some body measurements such as heart girth (HG), wither height (WH), body length (BL), body depth (BD), hip width (HW), hip height (HH) and pin bone length (PL) were examined for prediction ability, using the data with 1068 observations for each trait. The linear, quadratic and cubic regression models (REGR) were performed to predict BW for both breeds and since there were no statistically significant differences in body measurements between breeds. The data of these breeds were combined and found that BL and HG would be the most advisable traits in estimating BW ($R^2=95.8\%$ and 95.7% respectively) among the other measurements. Regression analysis showed that addition of quadratic and cubic terms provided little contribution in BW prediction. Therefore, linear terms of all variables were considered for analysis and they were significant and R^2 values for other body measurements WH, HW, BD, HH and PL were approximately 93.2, 79.9, 87.1, 90.9 and 79.2% respectively. The best predictors were the same to estimate BW by Artificial Neural Networks (ANN). The best predictive variables were HG and BL by ANN with $R^2=98.2$ and 98.1% respectively. In conclusion, BW can be estimated precisely by both REGR and ANN using BL and HG alone or both HG and even WH and different models may be needed to predict BW in different feeding and environmental conditions and breeds. However, ANN produced higher accuracy in prediction of live weights than REGR.

Key words: Artificial Neural Networks, body measurements, bodyweight, Brown Swiss and Holstein cattle, prediction, regression model

EVALUATING AND FORECASTING LIVESTOCK PRODUCTION TRENDS IN CROATIA: A SECTORAL ANALYSIS BASED ON ARIMA MODELING

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Abstract: The primary objective of this study was to develop a predictive model for the supply of live livestock in the Republic of Croatia for the period 2024–2029, based on the analysis of historical data. Livestock production has long been a strategically important sector in Croatia, supported by a strong tradition and a notable presence of indigenous breeds. Nevertheless, despite these advantages, the supply of live livestock per production unit has demonstrated persistent negative trends. The study applies the Autoregressive Integrated Moving Average (ARIMA) model to analyze time series data from 2019 to 2023 in order to identify structural patterns and forecast future supply dynamics. Supplementary statistical and econometric methods are employed to examine variation, autocorrelation, and the significance of fluctuations within the series. The analysis also highlights that the cost of production, as a key non-price determinant, plays a decisive role in shaping livestock supply trends. Findings indicate a regressive trend across most livestock sectors, emphasizing the need for targeted policy measures to stabilize and enhance future production.

Key words: Livestock supply, ARIMA model, time series analysis, production forecasting, agricultural economics

CORRELATION BETWEEN ANIMAL ANATOMY AND HEALTH CARE IN VETERINARY PRACTICE

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Abstract: Understanding the intricate relationship between animal anatomy and health care is essential for effective veterinary diagnosis, treatment, and disease prevention. Animal anatomy provides the foundational knowledge required to interpret clinical signs, perform surgeries, and administer therapeutics accurately. Structural variations among species—such as digestive tract complexity, respiratory adaptations, and musculoskeletal configurations—determine both physiological functions and susceptibility to specific diseases. In clinical practice, anatomical insights support targeted healthcare strategies. For instance, ruminants require specialized gastrointestinal care due to their complex stomach anatomy, while brachycephalic dogs are prone to respiratory complications owing to their shortened skulls. Anatomical landmarks guide imaging procedures, surgical interventions, and anesthetic administration. Furthermore, comparative anatomy across species assists in translational research, particularly within the One Health framework. Preventive health care, including vaccination and parasite control, is more effective when anatomical factors influencing pathogen entry, distribution, and immune response are considered. Anatomical abnormalities such as congenital malformations or breed-specific traits often necessitate tailored health management plans. Thus, a deep understanding of anatomy is indispensable for accurate diagnosis, effective treatment, and improved animal welfare.

Key words: animal anatomy, veterinary medicine, animal health care, anatomical variation, disease diagnosis, One Health.

EFFECT OF GAMMA IRRADIATION ON THE LIPID OXIDATION, pH AND COLOUR IN BEEF – A META-ANALYSIS

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Abstract: A meta-analysis of the effect of gamma irradiation on the accumulation of primary and secondary products of oxidation as well as pH and instrumental colour characteristics (lightness –L*; redness – a* and yellowness – b*) in beef stored at different temperatures and packaging was performed. A total of 15 studies were included each concerning one or more of the examined indicators. The number of the independent experiments according to the covariates (dose of irradiation, temperature of storage and packaging) varied between 16 and 25 for the individual traits. The high between studies heterogeneity determined the selection of the random effects model applied on the raw mean difference (effect size) on the analysis of the data. The results of the meta-analysis showed that the gamma irradiation of beef is associated with significant increase of the peroxide value (POV) ($P=0.033$) and content of thiobarbituric acid reactive substances (TBARS) ($P<0.001$), while pH decreased ($P=0.005$). The effect on the colour was towards increase in L* and decrease in a* and b*. The meta-regression showed that the studied indicators were not affected by the dose of applied radiation and the type of packaging, while the storage conditions affected only the TBARS content. In most of the studies included in the meta-analysis, the content of lipid oxidation products remained at acceptable levels and gamma ray treatment did not negatively affect the high nutritional value of the meat.

Key words: meta-analysis, gamma irradiation, beef, peroxide value, TBARS, pH, colour

NUTRITIONAL AND SENSORY ENHANCEMENT OF BEEF THROUGH DIETARY FLAXSEED IN SIMMENTAL CATTLE

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Abstract: Research on functional feed supplementation in beef cattle has focused on improving meat quality and nutritional value. This study evaluated the impact of dietary flaxseed on the fatty acid profile, lipid quality and stability, and sensory attributes of Simmental beef. Thirty animals were allocated into three dietary groups (n = 10): a control group (C) without flaxseed, and two experimental groups supplemented with 3% (L3) and 5% (L5) flaxseed, respectively. Analysis of the *M. semimembranosus* muscle showed that both L3 and L5 groups had significantly higher ALA concentrations, lower saturated fatty acid levels, and elevated unsaturated fatty acid content compared to the control (p<0.05). Accordingly, atherogenic and thrombogenic indices were significantly reduced, while the hypocholesterolemic/hypercholesterolemic ratio increased (p<0.05). Significantly higher juiciness and flavor scores were obtained in flaxseed-fed groups (p<0.05) as a result of sensory analysis. TBARS values increased during refrigeration, with L5 showing the highest level on day 35 (p<0.05). After declining until day 270, values gradually rose again, with significant differences at days 30, 90, 150, and 210 (p<0.05). Iodine value was significantly higher in the L3 group versus the control (p<0.05). The meat from supplemented groups was noticeably juicier and more flavorful, contributing to improved sensory acceptance and greater consumer appeal.

Key words: flaxseed supplementation, fatty acid profile, lipid indices, lipid oxidation, beef quality

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EFFECT OF PRECISE SYSTEM FOR NUTRITION MANAGEMENT IMPLEMENTED IN DAIRY FARM

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Abstract: The aim of the present study was to evaluate the effect of implementing precision system for nutrition monitoring and management in a dairy farm. The study was carried out in dairy farm with 200 cows, located in North Bulgaria. It has been established that after the introduction of precise technology for monitoring and managing nutrition in the dairy cattle farm, an increase in milk productivity was observed, as well as a decrease in the amount of bulky and concentrated feed used, and fuel consumed on the farm. Evidence shows that the integration of digital technologies in dairy farming can lead to more efficient use of resources, increase productivity and reduce some negative environmental impacts. Although the optimization process is likely to be slow, the data demonstrate the potential of digital technologies to transform modern dairy farming and its role in achieving sustainable development in the sector.

Key words: precision dairy farming, nutrition management, dairy farm, dairy cows

RELATIONSHIP BETWEEN THE MORPHOMETRIC CHARACTERISTICS OF THE GONADS OF MANGALITSA, MORAVKA AND RESAVKA

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Abstract: Mangalitsa, Moravka and Resavka are animal genetic resources and autochthonous breeds of pigs in the Republic of Serbia. Mangalitsa is the fatty pig breed, Moravka and Resavka are breeds with combined production. This research is related to the properties of the gonads of uncastrated males. Breed as a source of variation in the morphometric properties of the left testis affects the variation of several characteristics of the left testicle ($p < 0.05$; mass of the testes and epididymis, length, depth and circumference of testes). The regression coefficient shows that with an increase in body weight there is an increase in all properties. The breed influences the variation of some measures on the right testicle (volume and mass of testes and epididymis, length, depth and circumference of testes). Body weight shows a statistically significant influence on all properties of the right testicle. Comparing the three breeds for the morphometric properties of the left testicle, the highest value of the volume of testes was determined in the Moravka breed, which is higher than the Mangalitsa breed ($p < 0.05$). In the Moravka breed was higher mass of testes than in the Mangalitsa breed, and it is higher in relation to the Resavka breed. The average values for all morphometric properties are higher in the Moravka breed compared to the Mangalitsa. Resavka pigs showed the highest value of epididymis volume and length without epididymis, compared to other breeds. Statistically significant differences ($p < 0.05$) were found for the properties of epididymis volume and testicle length by comparing Mangalitsa and Resavka. By comparing the traits between the Moravka and the Resavka, the difference in the circumference of the testes is significant ($p < 0.05$). The morphometric properties of the right testicle, showed the highest values of all investigated measures in the Moravka pig. In relation to Mangalitsa, the highest value was found for the volume of the testicle ($p < 0.001$). The mass of the right testicle is greater in the Moravka breed compared to the Mangalitsa and Resavka. The only difference established between Mangalitsa and Resavka was in length of testes ($p < 0.05$). By comparing Moravka and Resavka, differences were found in a greater number of properties of the right testicle ($p < 0.05$). Higher values of morphometric measurements on the gonads in Moravka and Resavka are expected, given that they are breeds of combined production, which have better growth, compared to the fatty breed Mangalitsa. The low value of the coefficient of determination confirms that body weight as a source of variation explains very little of the variation in the properties of gonad masses. Immunocastration of Mangalitsa breed pigs was successfully because of regression of the testicular tissue, the cessation of aggressive behavior, and the level of androstenone and skatole below detection.

Key words: animal genetic resources, pig, fatty breeds, combined production, testicles, immunocastration

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BOOK OF ABSTRACTS

29 – 31 OCTOBER 2025, BELGRADE, SERBIA

42

FERTILITY CHARACTERISTICS OF THE SWALLOW-BELLY MANGALITSA**Aleksandra Petrović¹**, **Branislav Stanković²**, **Marija Gogić¹**, **Vladimir Živković¹**, **Nenad Stojiljković¹**, **Nikola Stanišić¹**, **Čedomir Radović¹**¹ Institute for Animal Husbandry, Autoput 16, 11080, Belgrade-Zemun, Republic of Serbia² Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080, Belgrade- Zemun, Republic of SerbiaCorresponding author: Aleksandra Petrović, apetrovic@istocar.bg.ac.rs

Abstract: The aim of this research was to examine the reproductive characteristics of Swallow-belly Mangalitsa sows from a herd located in Srem, Republic of Serbia. This indigenous strain, known as the Srem black Mangalitsa, originated in the village of Buđanovci. It is a late-maturing breed with typically low fertility and small litter sizes but is valued for its high disease resistance, adaptability to extensive systems, and longevity. The study included 1873 litters recorded from 2015 to 2024, with yearly distribution as follows: 2015 (75), 2016 (117), 2017 (141), 2018 (189), 2019 (232), 2020 (258), 2021 (248), 2022 (265), 2023 (296), and 2024 (46). The analyzed traits included gestation length, number of live-born piglets (by sex), stillbirths, and total number of piglets per litter. It investigated how the year of farrowing and parity order affected the variability of the mentioned traits. The average gestation period was 114 ± 1.78 days. The mean total number of piglets per litter was 4.15 ± 0.96 , with an almost equal sex ratio (males: 2.04 ± 0.87 ; females: 2.11 ± 0.95). The average number of stillborn piglets was very low (0.03 ± 0.24). Both year of farrowing and parity had a significant effect on litter size traits ($p < 0.0001$), indicating variability influenced by environmental and management factors. Despite lower reproductive output, the breed's resilience and adaptability justify its role in sustainable pig farming. Understanding these reproductive traits enables breeders to optimize management practices and improve productivity while preserving the genetic value of this autochthonous breed.

Key words: Swallow-belly Mangalitsa, reproductive characteristics, litter size variability

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USE OF LUPIN AGRONOMICALLY BIOFORTIFIED WITH SELENIUM AS A LOCAL AND SUSTAINABLE SOURCE OF PROTEIN TO INCREASE THE ANTIOXIDANT CAPACITY OF IBERIAN PORK

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Abstract: Recently, CICYTEX showed, in Iberian pigs, the successful use of lupins (*Orden Dorado* variety, developed by CICYTEX and very low in antinutritional factors) and the increase in antioxidant capacity of pork after feeding on concentrate with triticale agronomically biofortified with selenium (Se). The present study aims to evaluate the use of agronomically biofortified lupin with selenium as a differentiated and sustainable local source of protein in the diet of Iberian pigs, replacing imported soybeans, which have a high carbon footprint. Four treatment groups (G) were tested in 62 Duroc x Iberian pigs fed in large outdoor corrals with lupins (as the protein base of the concentrate), with and without organic selenium (SeO) (from agronomically biofortified, "selenized" lupin), with and without inorganic Se (SeI), during pre-finishing (December-February) or during pre-finishing and finishing (December-February and February-April, respectively), in males (M) and females (F), according to the following dietary scheme: **G1 (SeI-2;** n=16; 8 M and 8 F), supplemented with SeI (at the usual concentration) during pre-finishing and finishing. **G2 (SeI-1;** n=16; 8 M and 8 F), supplemented with SeI during pre-finishing and not during finishing. **G3 (SeO-2;** n=14; 7 M and 8 F), fed with selenized lupin concentrate during pre-finishing and finishing. **G4 (SeO-1;** n=16; 8 M and 8 F), fed with selenized lupin concentrate during pre-finishing and without Se supplementation during finishing. Slaughter took place at 14 months of age. Preliminary results indicated no effect of treatment on growth parameters. Data on growth, height, ultrasound fat deposition, selenium content in meat, blood plasma and erythrocytes, blood chemistry (including liver profile), and meat quality (antioxidant capacity, lipid profile, etc.) are currently being analyzed.

Key words: swine, meat quality, protein autonomy, finishing, *Lupinus albus*, organic selenium

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UNDERSTANDING THE IMPACT OF MEAT RAW MATERIALS FROM CHINESE RONGCHANG PIG BREEDS ON QUALITY OF BOLOGNA-STYLE MORTADELLA

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Abstract: Chinese Rongchang pigs have a breeding history of over 400 years and are the first of the three famous pigs in China and one of the eight famous pigs in the world. Lean hind leg and back fat of Rongchang pigs and different cross-breeds of pigs (Rongchang×Landrace, Duroc×Landrace×Yorkshire) are used as the main raw materials for the production of Bologna-style mortadella. Physico-chemical properties, textural profile, E-tongue, free fatty acids, volatile organic compounds, and sensory evaluation were used to assess the quality of Bologna-style sausage. The Bologna-style sausage made from Rongchang pigs' lean and fat was less oxidized, with lower thiobarbituric acid reactive substances (TBARS) levels (0.1 mg/kg) and a lower MDA content of 0.1 mg/kg. It also exhibited lower springiness (0.76 mm) and higher fracture (7.67 N) values in its texture profiles, with $P \leq 0.05$. Moreover, higher umami and richness for e-tongue evaluation were also observed in the Rongchang cross-breed group Bologna-style mortadella. The content of volatile aldehydes in Rongchang Bologna-style sausage was lowest, having a total concentration of 0.03 mg/kg as compared to DLY-RC with a total concentration of 5.857 showing a total of mg/kg significant difference at $P \leq 0.05$. The oiliness and wetness in the sensory evaluation of Rongchang Bologna-style sausage were the highest scoring 6.50 and 6.70, respectively. The highest composition of saturated fatty acids (29.25 mg/kg) and the lowest composition of polyunsaturated fatty acids (14.27 mg/kg) may be related to the lower oxidation and lowest volatile aldehydes in Rongchang Bologna-style mortadella. So, the hind leg and back fat from Rongchang pigs was the most favorable raw material for the production of Bologna-style mortadella.

Key words: Rongchang pig, Bologna-type mortadella, quality

THE ROLE OF EXTENSIVE AND SEMI-EXTENSIVE PRODUCTION SYSTEMS IN PRESERVING LOCAL PIG BREEDS IN REPUBLIC OF SERBIA

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Abstract: In recent years, traditional pig breeds have regained popularity in Serbia. Native breeds are once again common in rural households, enhancing the country's biodiversity. Their revival has given rise to diverse production systems and feeding practices, ranging from fully intensive methods with commercial feed mixtures to entirely extensive systems where pigs rely solely on natural forage. The purpose of this study was to investigate differences in these systems and to assess the role of extensive and semi-extensive production in conserving local pig breeds (Mangalitza, Moravka, and Resavka). We divided the production systems into four categories: semi-intensive systems based on commercial feed mixtures, semi-intensive systems relying on cereals, vegetables, and fruits, extensive systems where cereals, vegetables, and fruits are used as supplements, and fully extensive systems. The analysis focused on the main benefits and drawbacks of each approach, with special attention to economic aspects. Findings showed considerable differences in animal size, investment needs, and economic performance. Interestingly, farms with fully intensive systems required the lowest investments, since they often repurposed, old concrete facilities previously used for commercial breeds. In contrast, fully extensive farms faced the highest costs, largely due to land expenses. A clear link was observed between feed type and animal size: pigs fed commercial mixtures were nearly twice as large and heavy as those raised in extensive systems. Feed costs strongly influenced farmers' choices of cereals, vegetables, and fruits in the pigs' diets. In semi-extensive systems, animal health and welfare were notably poorer compared to fully extensive approaches. Beyond these welfare concerns, it remains unclear how different production systems influence the quality of products derived from these breeds. Moreover, it will be valuable to study how each breed adapts to the different systems, and how production methods affect the market value of the final products.

Key words: Mangalitza, Resavka, Moravka, feedstuff, welfare

Acknowledgement

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APPLICATION OF ZEOLITE CLINOPTILOLITE IN DEEP LITTER FATTENING PIGS

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Abstract: The aim of the study was to determine the effect of adding zeolite clinoptilolite to the diets of fattening pigs and treating the litter with the same on the production and slaughter characteristics of pigs and on the microclimatic parameters in the feedlot. The study was conducted on 200 hybrid pigs of both sexes, divided into 4 groups and kept on deep litter for 105 days of fattening. The control group (K1) received a standard diet without the addition of zeolite and without treating the litter with zeolite, the first experimental group (P1) received a diet with the addition of zeolite, the second experimental group (P2) was kept on deep litter treated with zeolite, and the third experimental group (P3) was kept on litter treated with zeolite and with the addition of zeolite in the diet. Pigs of the P1 and P3 groups had statistically highly significantly better ($P < 0.01$) production and slaughtering traits compared to pigs of the K and P2 groups, and pigs of the P3 group had statistically significantly better ($P < 0.5$) the listed properties compared to the P1 group. Also, the emission of harmful gases (NH_3 , CO_2 and H_2S) was statistically highly significantly ($P < 0.01$) lower in the pens where the fattening animals of the P1 and P3 groups were kept. The above results indicate a positive effect of the addition of clinoptilolite zeolite on the production and slaughtering traits of fattening pigs, their health status, the emission of harmful gases and the economy of fattening.

Key words: pigs, fattening, clinoptilolite, slaughter traits, microclimatic parameters

LIPA SHEEP: RESILIENCE, RECOVERY, AND CONSERVATION NEEDS

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Abstract: The Lipa sheep, an indigenous genotype from central Serbia, is an important part of the region's agrobiodiversity. This zackel strain, known for its adaptability, moderate productivity and suitability for low-input systems, has faced significant population decline in recent decades. However, targeted conservation programmes have led to a controlled increase in the population — from 520 animals in 2015 to almost 2,500 in 2024. Despite this growth, the recent plateau in numbers indicates challenges related to farm capacity, reproductive performance and economic constraints. This study combines demographic records, morphometric measurements and biochemical blood data to assess the current status and adaptive value of the breed. Adult ewes have a robust conformation with an average weight of 62 kg, a height at withers of 73 cm and a chest circumference of 93 cm. Blood profiling from three representative farms (n = 30) showed predominantly stable physiological indicators, with minor but statistically significant differences in protein fractions, glucose, cholesterol and mineral levels, probably due to differences in diet and terrain. Overall, the breed's metabolism remains stable under pasture-based management and limited supplementary feeding. These results underpin the role of the Lipa sheep in sustainable sheep breeding and highlight the need for improved breeding strategies, dietary optimisation and long-term genetic monitoring to ensure the breed's survival. This integrated assessment emphasises the importance of preserving this underrepresented Balkan genotype.

Key words: Pramenka, endangered sheep, blood biochemistry, conservation, sustainable livestock

Acknowledgement

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ANALYSIS OF FATTY ACID PROFILES AND CALCULATION OF HEALTH LIPID INDICES IN EGGS OF DIFFERENT POULTRY SPECIES

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Abstract: The study aimed to calculate qualitative and nutritional lipid indices in eggs of different poultry species based on the fatty acid profiles in egg yolks. The analyses included chicken, turkey, and duck eggs purchased from a family farm in the Osijek-Baranja County. A total of 70 eggs were analysed (30 chicken, 20 turkey, and 20 duck). A gas chromatograph was used to analyse the fatty acid profiles in egg yolks, while mathematical formulas were used to evaluate health lipid indices. The study presents qualitative indices ($\sum\text{PUFA n-6}/\sum\text{PUFA n-3}$; $\sum\text{PUFA}/\sum\text{SFA}$ and EPA+DHA) based on the ratio of polyunsaturated and saturated fatty acids and the sum of eicosapentaenoic (EPA) and docosahexaenoic (DHA) fatty acids. Nutritional indices (nutritional value index; NVI, atherogenic index; AI, thrombogenic index; TI, and hypo/hypercholesterolemic index; hHI) are calculated by including unsaturated, monounsaturated, and polyunsaturated fatty acids in relation to saturated fatty acids. The results of the study showed that there were significant differences in the content of $\sum\text{SFA}$, $\sum\text{MUFA}$, $\sum\text{n-6 PUFA}$, and $\sum\text{n-3 PUFA}$ between the eggs of different poultry species tested ($P<0.001$). Duck eggs had lower $\sum\text{PUFA n-6}/\sum\text{PUFA n-3}$ ratio values compared to eggs of other poultry species, while the most favourable $\sum\text{PUFA}/\sum\text{SFA}$ ratio was determined in turkey eggs ($P<0.05$). The sum of EPA and DHA was uniform in all tested eggs. The most favourable values of NVI, hHI, and TI were determined in turkey eggs ($P<0.05$). The values of AI were uniform in all tested groups ($P>0.05$). The presented data can serve as an information base for nutritionists when choosing eggs in the human diet to improve consumer health.

Key words: eggs, fatty acid profile, health lipid indices

CONSUMERS' ACCEPTANCE OF MEAT PRODUCTS DERIVED FROM MALE LAYER-TYPE CHICKENS - A PILOT SURVEY

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Abstract: A pilot survey was carried out aiming to get the idea of consumers' acceptance of products produced from meat of male layer-type chickens slaughtered at different age. Two products were prepared – pâté from 6 weeks-old cockerels and cooked smoked chicken from the birds reared until 9 weeks of age. The pilot survey covered a diverse group of people (n=50) who were relatively proportionally distributed according to gender, age, education, marital status, place of residence and income. The respondents' preferences for different types of meat and, in particular, chicken products were studied, such as place of purchase, weight, criteria for choosing products. The respondents strongly supported the solution to avoid culling the layer cockerels that we proposed, namely raising them for meat. The prepared products received a very high sensory rating - 8.10 for the smoked chicken and 7.94 for the chicken pâté. The comparison with other similar products in the market showed that the ones we offered received considerably higher rating. The attitudes towards the frequency of purchase and the price of smoked chicken and chicken pâté were studied, and the results showed that there was a real opportunity for market realization of the proposed products.

Key words: male layer-type chickens, meat products, survey, consumers' acceptance

***Ascophyllum nodosum* EXTRACT AS A TOOL TO REDUCE AMMONIA CONCENTRATIONS IN POULTRY PRODUCTION**

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Abstract: Ammonia is the most widespread alkaline gas in the atmosphere. Ammonia (NH₃) is a colorless, water-soluble gas that is generated in poultry housing facilities as a byproduct of the microbial decomposition of organic nitrogen compounds in manure. Due to its solubility in water, NH₃ readily penetrates mucous membranes and eyes, and it can also bind to dust particles (Wathes, 1994). Since NH₃ carries no ionic charge, it is easily released into the atmosphere in gaseous form. Elevated concentrations of ammonia in poultry houses exert harmful effects, including reduced feed intake, impaired growth rates in poultry, decreased egg production, damage to the respiratory tract, increased susceptibility to viral and bacterial infections, and overall disturbances in poultry welfare and human health (Ritz et. al., 2004). *Ascophyllum nodosum* (A. nodosum), an edible brown seaweed, contains high levels of total polysaccharides (up to 70%), including alginic acid, fucoidan, laminarin, and mannitol. A. nodosum also have the potential to serve as an excellent source of essential nutrients and valuable bioactive compounds, such as antioxidants, unsaturated fatty acids, proteins, essential amino acids, minerals, vitamins, and pigments such as carotenoids. Studies have demonstrated that seaweeds can absorb catabolic gases, particularly ammonia produced during digestion and nitrogen conversion. However, research is lacking on the application of environmentally friendly A. nodosum extracts for reducing the production of volatile inorganic compounds such as ammonia. In our study, supplementation with brown seaweed ultrasound extract at a concentration of 0.2% in drinking water resulted in a significant reduction in ammonia volatilization from animal manure, particularly after 20 days of poultry rearing, while the experimental group also showed improved production performance. Therefore, we consider A. nodosum extract a promising natural agent for mitigating environmental pollution by ammonia emissions from poultry facilities.

Key words: *Ammonia*, *Ascophyllum nodosum*, extract

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DEVELOPING METHODS TO DETECT MICROPLASTIC CONTAMINATION IN LIVESTOCK FEED: IMPLICATIONS FOR SUSTAINABLE ANIMAL HUSBANDRY

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Abstract: Microplastics, defined as plastic particles smaller than 5 mm, are increasingly detected in components of agroecosystems, including livestock feed. Their presence in animal feeding systems raises critical concerns related to food safety, animal health, and environmental impact. The aim of this study was to develop a method for the detection of microplastics in livestock feed as part of the IPA INTERREG Croatia–Serbia project “Pioneering ecosystem-based microplastics contamination reduction and climate change resilience in the cross-border region” (Eco(Re)Act). For this purpose, various combinations of procedures based on Fenton reactions and potassium hydroxide (KOH) digestion were evaluated. The final protocol, achieving extraction efficiencies of up to 85% for all tested microplastic types and feed matrices, consists of KOH digestion at moderate temperature (60 °C for 24 hours), followed by two to three cycles of Fenton oxidation. Microplastic detection was performed using the Bruker Lumos II system. The efficiency of the proposed method allows for the omission of additional density separation steps, significantly reducing processing time compared to existing protocols developed for other complex matrices (e.g., soil). Future methodological development will focus on the standardization of monitoring protocols and strategies for reducing microplastic exposure in livestock feed. This will help safeguard animal health and support environmental protection within the framework of integrated agroecological practices, while also contributing to a better understanding of the actual impact of microplastic contamination on livestock production.

Key words: microplastics, livestock feed, spectroscopic methods, animal health, environmental impact

ASSESSING AFLATOXIN B₁ CONTAMINATION LEVELS OF DIFFERENT MAIZE SAMPLES

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Abstract: Maize (*Zea mays* L.) belongs to the grass family (*Poaceae*) and is a staple food for human and animal nutrition. It is rich in carbohydrates, containing over 70% starch, as well as proteins, fibres, minerals, vitamins, and other nutrients. Under favorable conditions, high relative humidity and temperature, maize grains are often infected with various fungal species of the *Aspergillus* genus. Infected grains may be symptomless or covered with fungal mycelium, which can cause symptoms of grain rot. *Aspergillus* species synthesize various toxic secondary metabolites – aflatoxins, of which aflatoxin B₁ (AFB₁) is highly toxic and carcinogenic, posing a risk to human and animal health. In addition, aflatoxin M₁ (AFM₁) is a metabolite of AFB₁ and can be detected in the milk of ruminants. AFM₁ content increases with increasing AFB₁ intake. This research aimed to evaluate the level of aflatoxin B₁ (AFB₁) in 54 maize grain samples intended for animal feeding (32 samples) taken from the warehouse of the Institute for Animal Husbandry in the period 2015-2018, and in 22 maize silage samples from silo trenches of the Institute for Animal Husbandry, Belgrade-Zemun (Serbia) in 2015. The occurrence of AFB₁ was detected in 95.45% of the maize grain samples and 75% of the maize silage samples. The average AFB₁ level in maize grain samples was 2.68 µg kg⁻¹ (ranging from 1.13 to 4.42 µg kg⁻¹), while in maize silage samples, it was 2.07 µg kg⁻¹ (ranging from 1.10 to 3.36 µg kg⁻¹). According to the European Commission Directive (2003/100/EC), the maximum limit for AFB₁ is 20 µg kg⁻¹ for all feed materials, except for complete feedingstuffs for dairy animals (5 µg kg⁻¹) and young animals (10 µg kg⁻¹). None of the tested maize samples for animal feed exceeded the maximum AFB₁ level. Based on the results obtained, the maize samples tested were safe for feeding the farm animals of all categories. However, regular monitoring of aflatoxin contamination in maize grain samples is a prerequisite to ensuring feed safety and sustainable livestock production.

Key words: aflatoxin B₁, maize, risk assessment

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ASSESSMENT OF QUALITY AND REGULATORY COMPLIANCE OF CORN FEED FLOUR IN SERBIA

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Abstract: The aim of this study was to evaluate the quality and regulatory compliance of corn feed flour, one of the most commonly used energy components in feed production for monogastric animals (poultry and pigs), as well as its use in ruminant rations. A total of 56 samples of corn feed flour produced in Serbia were analyzed at the Institute for Animal Husbandry. The analysis included key physico-chemical parameters: protein, moisture, fat, starch, crude fiber (cellulose), total ash, and acid-insoluble ash. The results were compared with the legal limits defined by the *Rulebook on Animal Feed Quality* ("Official Gazette", No. 4/2010, 113/2012, 27/2014, 25/2015, 39/2016, and 54/2017) of the Republic of Serbia. Average values for the analyzed samples were: protein 8.87%, moisture 11.83%, fat 3.68%, cellulose 3.42%, starch 62.40%, total ash 1.61% and ash insoluble in HCl 0.13%. The most common inconsistencies of the examined samples were in the content of protein and total ash. In 8 samples of corn feed flour, the protein content was lower than the prescribed minimum value (8%), which may indicate the use of poorer varieties of corn, the removal of the germ during the grinding process, the addition of protein-poor components such as corn starch, or inadequate storage. Total ash content was higher than the permitted limit (more than 5%) in 3 samples. This may indicate poor technological processing, the presence of dirt or impurities (earth, dust, plant parts), or falsification of raw materials by adding cheaper mineral components. Two samples exceeded the 14% moisture limit, indicating a risk of spoilage and microbial growth. Other parameters complied with the limits prescribed by legal regulations. A total of 13 non-compliant results were identified, which contributed to the fact that 11 samples did not meet the requirements of the regulatory standards. This study indicates the importance of regular control of physico-chemical parameters of raw materials in order to ensure consistent quality and safety of animal feed.

Key words: corn feed flour, Serbia, feed quality, physical-chemical quality parameters, regulation compliance

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BOOK OF ABSTRACTS

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54

DEVELOPMENT PROSPECTS OF THE SILVOPASTORAL SYSTEM IN THE REPUBLIC OF SERBIA**Violeta Mandić¹, Vesna Krnjaja¹, Aleksandar Simić², Milan Brankov³, Bogdan Cekić¹, Marija Gogić¹, Dragan Nikšić¹**¹ Institute for Animal Husbandry, Autoput 16, 11080, Belgrade-Zemun, Serbia² Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080 Belgrade, Serbia³ Maize Research Institute „Zemun Polje“, Slobodana Bajića 1, 11185, Belgrade-Zemun, Serbia

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Abstract: According to the United Nations, agroforestry is the most important agricultural innovation in Europe in the 21st century. It is a land-use system that combines trees and shrubs with agricultural plants or pastures and livestock. Agroforestry is an integrated, planned, and targeted cultivation of trees and shrubs on an agricultural land. It has been practiced on over one billion hectares worldwide, and the area is constantly increasing. The silvopastoral system is the most common form of agroforestry and involves a planned use of woody plants, forage plants, and animals in the same place. The Republic of Serbia has a high potential for the development of this system as it has a large pasture area (2023 – 238163 ha) which accounts for 7% of the total agricultural land. The advantages of such a complex, multifunctional system are that it contributes to the preservation of biodiversity, water and soil quality, reduces land degradation and fire risk, adapts to climate change (by increasing drought resistance), preserves the welfare and increases the productivity of domestic animals, diversifies income, improves the ecological aspects and aesthetics of agricultural and forest landscapes, and contributes to the preservation of traditional cultural heritage. Its disadvantages are the high initial investment, the possibility of damage to trees and shrubs by animals, and the difficulty of applying mechanization. However, over 30 years, pasture productivity increased by 17% and forest by 53%. Trees in pastures can be planted widely spaced, in rows or groups, with planting density depending on the tree species, production objectives, and projected management intensity. The planting density should not exceed 150 trees per hectare, as a further increase reduces the productivity of the pasture. Trees planted on the pasture serve as shelter for animals by providing shade, thereby reducing the impact of heat stress on the animals, increasing animal productivity and improving animal welfare. Tall trees with a smaller crown can be planted for the production of timber, cork and firewood (beech, oak, birch, poplar, ash, maple, spruce, acacia and others) and fruit species for the production of fruits (apple, pear, olive, walnut, hazelnut, blackberry, raspberry, sweet chestnut and others). In Serbia, it is necessary to educate farmers about the potential of the silvopastoral system, give them guidelines for its establishment and maintenance, and conduct certain research. It is necessary to help livestock farmers transition to switch to such systems by providing funds through investment projects, favorable loans and constant technical support from experts. Also, livestock farmers should be informed with economic and ecological sustainability of such systems, supported by an adequate policy with adequate and financially strong measures of rural development which could solve the problem of abandonment and ageing of villages.

Key words: silvopastoral systems, pastures, livestock, trees, rural development, sustainability

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STORAGE OF BUCKWHEAT PRODUCTS AS AN FACTOR AFFECTING COLOUR CONDITION AND IMPLICATIONS ON MEAT PRODUCTS

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Abstract: Buckwheat is one of the traditionally high-quality crops recognized for its high nutritional and functional value. Buckwheat products (grain and flour) stored for 0, 3, 6, and 9 months and emulsion-type chicken sausages modified by adding those buckwheat flours (FB0, FB3, FB6, and FB9) were analyzed for instrumental colour parameters (L^* , a^* , b^* , C^* , h , S , ΔE). One- ($P < 0.05$) and two-way ($P < 0.001$) ANOVA tests were used to analyze the data, followed by Tukey's HSD post-hoc test ($P < 0.05$). In terms of storage, a slight decrease in hue angle was observed in grains, with the lowest value of 57.48 (6 months). In flour, trends of decreasing L^* and increasing a^* , b^* , C^* , and S values were observed to the end of storage. The values of hue angle and total colour difference decreased, with the lowest point at 73.92 for h and the largest significant change at 4.73 for ΔE in 6 months. In terms of product type, compared to grains, flour was lighter and yellowish on average 2.3 (L^*) and 1.3 (h) times. Grains consistently demonstrated significantly higher a^* , C^* , and S values. In composite products, added flour slightly affects L^* , and significantly a^* and b^* , where FB0 was lighter, redder and yellower than the other combined products. A significant decrease in C^* and increase in h values caused lower chromatic purity and a more yellow nuance in FB9 (20.66, 45.38). A decrease in S resulted in the greatest attenuation in overall colour perception at FB6, and FB9. An increase trend of ΔE indicating the differentiation of sausages with respect to effect on total colour ($\Delta E \leq 5.10$). The results could indicate the potential utilization of long-term stored buckwheat grains (flour) as a functional ingredient and valuable plant-based raw material in the production of enriched, composite meat products.

Key words: instrumental colour, enriched product, storage, buckwheat, meat products

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