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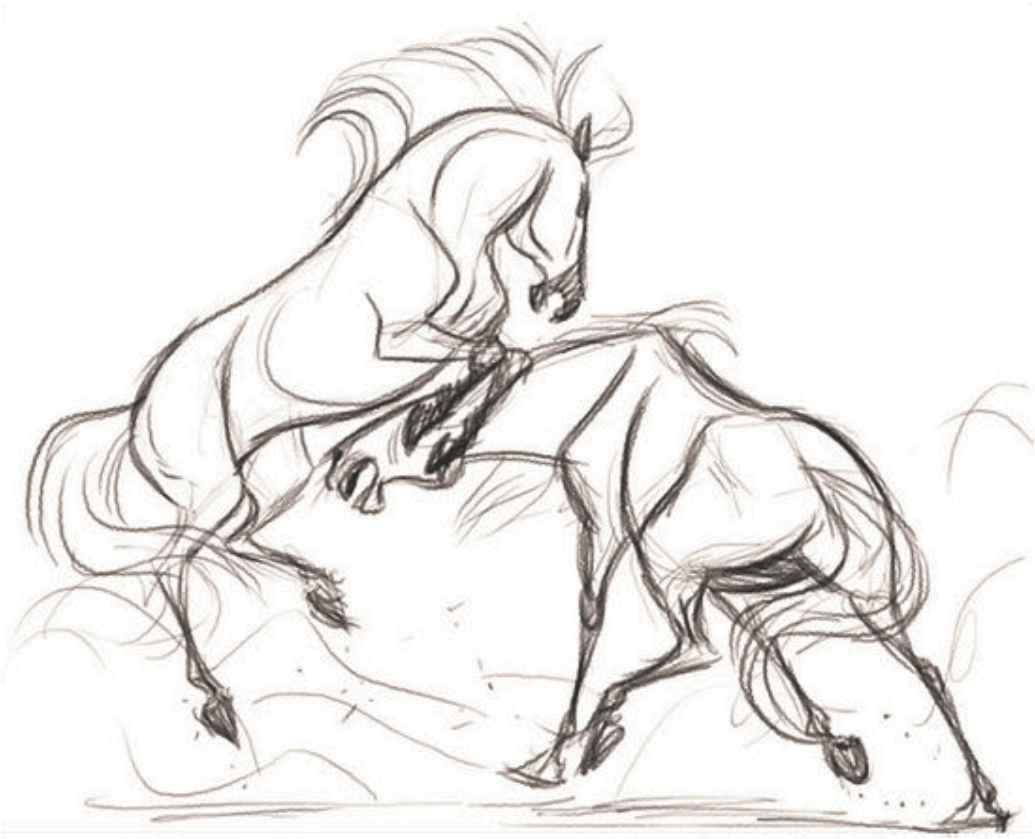

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HEALTH CARE AND MEDICATION USE

IN ORGANIC LIVESTOCK PRODUCTION

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*Abstract:*The basic principle of animal health care in organic production is the prevention of diseases, because according to legal regulations in this area, treatment of animals is by far more restrictive compared to conventional breeding. In the context of prevention (as the primary aspect of health control) two main groups of measures can be distinguished. The first group relates to breeding local, autochthonous, and evolutionarily adapted breeds/strains. Current experience on health problems in organic production of dairy cows and sheep showed that particular attention should be focused on favoring cows that show resistance to mastitis pathogens and sheep resilient to parasitic infections. The choice of local, adapted and more resistant animals, can significantly reduce the negative effect of stress in the interaction of the genotype and environmental factors (GxE), which is of great importance for the performance of production. Another group of preventive measures include adequate accommodation, food from local sources, movement, pasture management, and zootechnic measures.

In addition to the preventive measures, in organic production the diseased animals undergo strictly defined procedures regarding the implementation of therapy. In the treatment of animals in organic production, preference is given to phytopreparations, homeopathic and immunological products. Only if their use is not effective conventional drugs may be included. In this case, the legal regulations require a protocol, which gives special importance to the number of treatments and withdrawal period.

The safety of the antimicrobial and antiparasitic drugs, in general, is one of the most important factors in the treatment of animals, especially in animals that are found in organic production. Unfortunately, today there is no absolutely safe drug. Therefore, the correct drug selection and the manner of its application, should contribute to a safer and more efficient action.

Keywords: Organic livestock production, health care, drugs, legal regulation

Use of drugs in the conventional animal production

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In intensive conventional breeding of animals the use of drugs reached levels that can be considered alarming (Call et al., 2008). At the first place are antimicrobial agents, which are used in the therapy or prevention of bacterial diseases, and often, as growth promoters (Giguere et al., 2006). The non-rational use of antimicrobial drugs inevitably led to the development of resistance in pathogens, and more and more reports that speak of a possible transfer of bacterial resistance from animals to humans through residues of antibiotics in animal products. Not only antibiotics, but in conventional breeding other drugs whose residues can also seriously threaten people's health are often used (Cupic 1997; Mitchell et al., 1998). In addition to these harmful effects of residues, an important objection to conventional breeding of animals is the absence of animal welfare. All of this led to the strengthening of a new concept in the production of foodstuffs of animal origin, favoring "healthy" and ethically acceptable food, while preserving and protecting the ecosystem. This concept contains organic animal production (Pol et al., 2007; Roesch et al., 2006; Savić et al., 2009; Jovanovic et al., 2011). At the same time, the intention of this method of breeding animals is not a tendency to change the conceptual system of intensive livestock production, nor to be identified with extensive livestock breeding. The orientation of organic products is to represent a specific (alternative) production system, directed to a specific target group of consumers.

EU regulations of animal health protection in organic production

Principles and standards in the field of organic production legislation were first established in the EU in 1991 (Council Regulation No 2092/91). However, because there are areas that are not yet specified, including the chapter on animal health, this regulation is continually in the process of revisions and additions in the form of amendments (Council Regulation No 2092/91, Council Regulation No 834/2007). The objective of these revisions is the harmonization of regulation No 2092/91 with national and international standards of organic farming in Europe. Also, there is an initiative that the standards of organic farming in the EU should comply with the relevant standards in the United States. The National Committee on Organic Standards (National Organic Standards Board - NoseBETA) within USDA (United States Department of Agriculture - USDA), prescribed standards that differ from the EU legislation. To ensure the best possible trade exchange of organic products between Europe and America, the European Commission discussed new changes in the context of organic farming, which should be implemented in the year 2018, or 2019.
In Serbia this area is regulated by the "Law of Organic Production" (Sl. glasnik RS br. 30/10), which was adopted in 2010 and "Regulations on Control and Certification in Organic Production and Methods of Organic Production" (Sl. glasnik RS br. 48/11 and 40/12), which specifies conditions for organizing and conducting such a production of plant and animal origin. Legislation in Serbia is harmonized with EU regulations.

Disinfectants and drugs in organic livestock production allowed in the EU

Since the basic principle of animal health in organic production - prevention of diseases, particular importance belongs to hygiene and sanitary measures, which must be implemented only with legally approved agents for use in organic livestock production.
Allowed means for cleaning and disinfection of equipment and facilities for the production of organic livestock are: 1. potassium and sodium soap, 2. water and steam, 3. milk of lime (calcium hydroxide), 4. lime, 5. quicklime (calcium oxide), 6. sodium hypochlorite, 7. caustic soda (sodium hydroxide), 8. caustic potash (potassium hydroxide), 9. hydrogen peroxide, 10. plant natural essences, 11. citric, formic, lactic, oxalic and acetic acid, 12. alcohol, 13. nitric acid (dairy equipment), 14. phosphoric acid (dairy equipment), 15. formaldehyde, 16. sodium carbonate (Regulations on control and certification in organic production and methods of organic production. Sl. glasnik RS br. 48/11 i 40/12).
In relation to the mechanism of action by which it kills microorganisms, all listed disinfectants can be classified into the following groups: agents that act with a high temperature and pressure (water steam), agents that act by changing the pH (bases and acids), oxidizing agents (hydrogen peroxide), reducing agents (formaldehyde), agents that act by coagulating proteins (sodium hypochlorite), and surface active agents (soaps) (Ćupić et al., 2014).
Agents that act with a high temperature and pressure.- Using water vapor as a mean for cleaning and disinfecting antedates from the distant past (18th century). Today this type of disinfection is irreplaceable in various industries, especially food, as well as cleaning and disinfecting transport vehicles. The development of modern technologies improves the possibilities of application of steam for this purpose. This is primarily related to the use of the so-called "dry steam", which contains less than 5% water. The advantages of this method are multiple, and special place and the importance occupies in organic livestock production. Equipment for the application of "dry steam" is mobile, easy and safe to handle, because it is adapted for non-professional use. Low and adjustable pressure (4-10 bar) does not cause physical damage to the material. The output temperature of dry steam is from 160°C to over 180°C, which ensures the destruction of the majority of pathogenic microorganisms. Steam is efficient for the removal of solid fats and fatty deposits and other solid impurities. During cleaning it avoids raising dust, or smaller solid particles in the environment. Particles of dust bind to steam into larger particles, which then due to their weight quickly fall to the ground. In the same way it prevents "lifting" allergens, as well as fumes of various gases and thus eliminates unpleasant odors. On porous materials (concrete, brick), dry steam achieves an in-depth effect. Due to the high temperature, the surface quickly dries so that it leaves no traces of moisture and corrosion of metal parts. Dry steam also enables efficient cleaning and disinfection of hardly accessible places. Components of different machines and devices can be effectively cleaned and disinfected without disassembly, which significantly shortens the time needed to carry out these procedures. Due to the low percentage of water, the dry steam is not electrically conductive and therefore can be applied for cleaning sensitive components. This is undoubtedly a confirmation of its multi-purpose use, as in the facilities housing animals, as well as in organic processing industries (slaughterhouses, dairy) (Benjamin, 2008; Bagattini et al., 2015).
Agents that act by changing the pH of the environment (bases and acids) .- This group consists of disinfectants based on limestone (milk of lime) and a strong base such as caustic soda (sodium hydroxide) and caustic potash (potassium hydroxide). Their

disinfecting action is based on an extremely high pH value (pH = 12-14). In contrast with these agents, organic acids with a very low pH (pH = 2-4) can be used: citric acid, formic acid, lactic acid, acetic acid and oxalic acid (which gives pH = 1). From inorganic acids are allowed nitric and phosphoric acid (dairy equipment).

Oxidizing compounds.- Hydrogen peroxide releases nascent oxygen, which exerts a bactericidal activity. The disinfecting effect of hydrogen peroxide is very strong, but is short-lived, and the presence of organic compounds decreases its effect.

Reducing compounds.- Formaldehyde is a gaseous compound which is soluble in water. It is kept dissolved in water under the name of formalin (37% formaldehyde). It has a very strong disinfectant effect suitable for the disinfection of premises and objects. This bactericidal disinfectant acts on the vegetative forms of bacteria and effectively kills the spores of some fungi (Arsenault, 2015).

Essential oils.- Essential oils such as: clove oil, oregano oil, pine oil, basil oil, cinnamon oil, eucalyptus oil, helichrysum oil, lemon and lime oils, peppermint oil, and thyme oil, belong to the class of natural disinfectants. Aloe vera contains six antiseptic agents active against fungi, bacteria and viruses. There is considerable research on essential oils as disinfectants that could be useful to organic producers (Janssen et al., 1987; Kalemba and Kunicka, 2003; Deans and Ritchie, 1987).

Regarding the use of drugs in preventive purposes, in organic livestock production chemically synthesized (allopathic) veterinary medicines, antibiotics, hormones, as well as substances which promote growth or production performance (including antibiotics, coccidiostatics and other compounds for stimulation of growth) cannot be used.

In prophylactic purposes vaccines may be used, provided that they are not genetically modified.

The next level of animal health protection is the treatment of sick animals. These animals are marked, if necessary, isolated and immediately begin treatment. Preference is especially given to herbal remedies and homeopathic medicines. Only if they are not effective, chemically synthesized (allopathic) veterinary drugs or antibiotics can be used. However, this approach showed to be a problem in practice because of the lack of efficient phytopreparations. An even greater objection exists for homeopathic medicines. In Sweden is even prohibited to use homeopathy in the treatment of animals, and there is a similar initiative in the Netherlands (Hammarberg, 2001), as the two main reasons that challenge homeopathic drugs are insufficient scientific foundation and delayed treatment of acute conditions if the first therapy begins with these drugs.

The application of synthetic drugs or antibiotics in organic production is limited. Animals whose life span is several years can receive a maximum of three treatments for a period of 12 months, and for animals whose life cycle is up to one year - a maximum of one therapy. After the application of the synthetic veterinary drug, the withdrawal period for the animal products is twice as long compared to the withdrawal period in conventional production. When the withdrawal period is not provided by the manufacturer's instructions, it is considered to be 48 hours.

In contrast to the European regulations, the American National Standard unconditionally does not allow antimicrobial use in organic farming. Also, the use of antiparasitic drugs has greater restrictions. Another key difference is that the US national standard prescribes a limited list of permitted synthetic drugs that can be used in organic livestock production, which does not exist in the EU legislation. These are the most important factors limiting the trade exchange of organic products between the EU and the US. The next section

presents the most important principles of the American National Standard regarding the use of drugs.

Livestock health care practice standard *(USDA National Organic Program)*

When preventive practices and veterinary biologics are inadequate to prevent sickness, a producer may administer synthetic medications: provided, that, such medications are allowed under §205.603.

Parasiticides allowed under §205.603 may be used on:

- breeder stock, when used prior to the last third of gestation but not during lactation for progeny that are to be sold, labeled, or represented as organically produced; and
- dairy stock, when used a minimum of 90 days prior to the production of milk or milk products that are to be sold, labeled, or represented as organic.

The producer of an organic livestock operation must not: sell, label, or represent as organic any animal or edible product derived from any animal treated with antibiotics, any substance that contains a synthetic substance not allowed under §205.603.

Synthetic substances which are allowable in the organic livestock production *(USDA National Organic Program - NOP, Synthetic substances allowed for use in organic livestock production, §205.603)* are listed in Table 1.

Table 1. Synthetic substances allowed for use in organic livestock production *(USDA National Organic Program – NOP,* §205.603*)*

Drug	Indication/Drug effects	Restrictions
Aspirin	anti-inflammatory effect, analgesic effect	Allowed without additional restrictions.
Flunixin	anti-inflammatory effect, analgesic effect	Milk discard: 72 hours Meat withdrawal: 8 days
Butorfanol	opioid analgesic	Milk discard: 8 days Meat withdrawal: 42 days
Lidocaine	Local anesthetic	Milk discard: 7 days Meat withdrawal: 90 days
Procaine	Local anesthetic	Milk discard: 7 days Meat withdrawal: 90 days
Xylazine	sedative, muscle-relaxant effect	For emergency use only. Milk discard: 4 days Meat withdrawal: 8 days
Tolazolin	reversal of sedation induced by xylazine	Milk discard: 4 days Meat withdrawal: 8 days
Atropine	preanesthetic medication, Antidote for poisoning by organophosphates	Milk discard: 12 days Meat withdrawal: 56 days
Chlorhexidine	antiseptic for preoperative skin preparation	Allowed for surgical procedures Allowed for use as a teat dip Prohibited for intra-mammary use
Furosemide	diuretic for reduction edema	Milk discard: 4 days Meat withdrawal: 4 days
Magnesium hydroxide	Antacid and laxative	Must be used by licensed veterinarian
Poloxalene	Non-ionic surfactant for bloat control	For emergency bloat treatment only.
Oxytocin	Hormone that facilitates passing of the placenta	For post-parturition therapeutic applications only. Prohibited for routine milk let-down.

Table 2. Synthetic substances allowed for use in organic livestock production *(USDA National Organic Program – NOP,* §205.603*)* (continued)

Drug	Indication/Drug effects	Restrictions
Fenbendazole	anti-endoparasitic	For emergency treatment only. Prohibited for use on slaughter stock. In breeder stock, treatment cannot occur during the last third of gestation if the progeny will be sold as organic. Prohibited for use during the lactation period for breeding stock. Milk discard: 90 days.
Ivermectin	anti-endoparasitic	
Moxidectin	For control of internal parasites only.	

Conclusion

Organic livestock production is increasing in the world. However, a limiting factor in the trade exchange of organic products is a difference in the standards of the EU and the United States that regulate the organization and implementation of this method of food production. As the main imposed factor is a different approach in the treatment of sick animals in organic production. This especially relates to the use of antibiotics and antiparasitic drugs. In practice, as a major problem proved to be the inadequate efficiency of phytomedicines, and particularly of homeopathic preparations. Therefore, the biggest challenge for the improvement of organic farming represents an intensification of the research on the efficiency of phytopreparations and further on, to achieve harmonization in the field of prohibited synthetic drugs, which would further strengthen the concept of organic production and global environmental protection.

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