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SIGNIFICANCE OF ANIMAL HYGIENE IN SHEEP BREEDING ON FARMS REGARDING TO ECOLOGICAL PRODUCTION

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Summary

Sheep breeding in Croatia has a long tradition based on the natural resources for intensive breeding of small ruminants such as geographical location, climate and quality pastures which can be found in all parts of the country. Sheep production is based mostly on lamb breeding and milk production for making autochthonous cheese well known in the country and abroad. Therefore, there is interest in extending current production capacities in order to export products on foreign markets. In order to increase the production, more raw materials is needed and, accordingly, one may expect the development of sheep breeding on small, or large farms. In such production animal hygiene is of great importance as a scientific discipline involved in studying of optimal sheep keeping conditions and accommodation, a prerequisites for successful sheep breeding. This study describes the most frequent breeding models and ongoing standards regarding accommodation applied in countries with developed sheep production. Besides, there is a growing tendency to direct sheep breeding towards ecological production where the sheep breeders in Croatia expect their prospect. Accordingly, the current study brings the most important standards for sheep breeding in an ecologically acceptable way, as well as the necessity to supplement the existing "Regulation on the ecological production of animal products" in the field relating to animal hygiene.

Key words: sheep breeding, sheep-pen, sheep houses, microclimate, pasture, ecological production.

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Introduction

Most sheep breeds have a seasonal reproduction rhythm and the mating season begins with the shortening of daylight. Thus the light is the main indicator, which can be considered to approximately determine the yearly reproduction rhythm. The biological significance of the yearly rhythm lies in the synchronization of reproduction, so that lambing may coincide with optimal weather conditions (spring) for lamb breeding. The sheep is a polyoestrus animal, but depending on the breed as well as on the place of breeding, for most European breeders the mating season is in late summer and autumn. However, it is a known fact, that oestrus synchronization (beside the use of hormone treatment) may be achieved by an artificial regime of alternative periods of short and long days in duration of at least 4 weeks. In such a way, three consecutive lambings per sheep may be achieved in two years (Hoy, 2002). In order to achieve such reproduction cycle, sheep must be kept in pens the entire year. The economic profitability of such keeping depends on the herd size and the current price of lamb meat, because costs of housing and feed are rather high. Accordingly, such sheep keeping, with the exception of Germany, is not very common. This type of sheep breeding is not adequate because they are typical pasture animals with a specific social instinct (herd instinct). In this respect behavioral disorders may occur and, hence, sheep must have the opportunity to be constantly active, and must be provided with the ethologic conditions to express the natural behavior characteristic for their species (Sambraus, 1978). Thus, sheep are more frequently kept in the open and are confined to pens only during the cold period of the year. However, regardless of the time spent in pens, sheep must be kept in suitable housing which enables optimal living conditions, expected production performance and well organized sheep breeding production. Besides, if we plan to achieve intensive and rational sheep production, we must build a technically and technologically adequate sheep-house and ensure appropriate organization with as little human labor as possible. For this reason the sheep-houses are mostly constructed as closed or semi-closed objects, depending on the type of sheep production, the breeding purpose and the climate characteristics of the region.

Sheep accommodation in closed pens

In the practice of animal keeping there are efforts to make pens proportional to the number of housed animals. The length of pens should not be

less than 10 meters and, usually, it ranges from 12 to 20 meters. The pen area must be spacious because when the sheep are crowded they will hustle, jump on each other causing injuries (Weischet, 1990). Besides, in such accommodation conditions, it is very difficult to maintain adequate microclimate conditions, which may be the cause of various health disorders. Accordingly, keeping an optimal number of animals per unit of space (Table 1) is one way of maintaining the hygienic conditions of a pen at the acceptable level.

Table 1. - NECESSARY PEN AREA AND THE WIDTH OF THE FEEDING LOT REGARDING SHEEP CATEGORY (BURGKART, 1991).

Sheep category	Pen area (m^2 per animal)	Feeding lot width (m per animal)
Pregnant sheep	0,8 – 1,0	0,4 – 0,5
Sheep with lamb	1,2 – 1,6	0,6 – 0,7
Fattening lambs	0,5 – 0,7	0,3
One – year - sheep	0,6 – 0,8	0,3
Ram	1,5 – 3,0	0,5

The areas provided in Table 1 must be enlarged by 15 - 20% if the herd is smaller (under 20 animals) or if the animals are housed in pens during the year (Burgkart, 1991).

Sheep are usually kept on concrete or firmly pressed clay floor, bedded with straw. At the beginning the sheep are placed on 0.2 m of straw and are gradually supplemented with clean straw. The necessary daily bedding amounts to 5 kg of straw per animal, so during winter time when the animals are kept indoors, the layer of deep litter may grow to the height of 0.6 to 0.8 m (Burgkart, 1991). The bedding represents good insulation from the floor, providing to be very good in simply built, non-insulated pens (so-called semi-open - cold pens). The purchase costs as well as the costs of labor for storing and placing straw are disadvantages. Besides, pens with deep litter, especially if their floor is not concrete, are very hard to clean and disinfect, thus creating a predisposition for infective sheep lameness. Latest recommendations suggest sheep keeping on the grated floor, especially on farms with a large number of animals. However, this can be applied only in pens which are thermally insulated (Hoy, 2002).

Below the grid is the 0.6 m deep dump for collecting urine and droppings, adequate for waste accumulation during the entire winter period while the sheep are kept in the pen. The dump is cleaned after the sheep are released for pasture and is used to manure tilled land. If sheep are housed in pens throughout the year, the dump must be at least 0.8 m deep (Čauševi ć, 1991).

When the sheep are kept on deep litter or grated floor, the height from the pen floor to ceiling should be 3.5 and 2.5 m, respectively. The ceiling is built in order to obtain attic space for the storage of straw and fodder. While living in the pen, sheep must have reserves of food and bedding stored in a space separated from them. Stored in this way the fodder will not absorb the pen smell, and will still be appetizing to sheep (Dobos, 1994).

The inside of a sheep-house is a large area, enabling animals to move around freely. A fixed division of the house into smaller areas is not only inappropriate for sheep, but also for the breeder when cleaning such an object. However, when housing sheep one must provide for the possibility of dividing the effective space into smaller compartments or boxes with the help of mobile partitions (Weischet, 1994; Hoy, 2002). This is primarily the issue when sheep are divided regarding age and sex, and also to separate healthy and sick animals. It can also be useful in separating pregnant ewes in lambing boxes prior to lambing and to place lambs in separate boxes. The optimal size of a compartment or a box for different sheep categories is determined on the basis of adequate space in m^2 per animal (Table 1). Wooden partitions of corresponding dimensions are used to make different sized compartments or boxes bound together or fastened with screws. The partition is usually 1-3 m long, and 0.8-1 m high. It is possible to make longer partitions but they are more difficult to handle and are not very stable. Fodder tables, for animal feeding, can also be used to separate animals inside the pen. Accordingly, it is desirable that they are light and functional, and recently the most used type of fodder table is the American type. This is, in fact, a double-sided fodder table with cribs for the combined feeding of concentrate and hay. It is built to the length of 2 m while the width of a feeding lot depends on sheep category (Table 1). The average daily water consumption of sheep is 2-3 l in the winter, 6-7 l in the summer, and when the ewes are in lactation it may rise to 10 l. Therefore, sheep must always have a sufficient amount of drinking water at their disposal. When sheep are housed in the pens, automatic drinkers supply water. One automatic drinker ensures enough water for 40-60 animals. They are firmly placed (grated floor system) approximately at 0.4-0.5 m from the floor and their height can be regulated (deep litter accommodation) by a flexible in- bringing hose (Hoy, 2002).

Microclimate conditions in sheep-pens

The optimal microclimate in the sheep-pen is a very important presumption for well-being and health of animals. It includes factors like temperature,

relative humidity, air draft speed and gas concentration. The optimal air temperature for accommodating various sheep categories is between 8 - 18°C (Table 2). One should, however, keep in mind that the temperature of a sheep pen usually depends on the construction type and is approximately from 2 to 5°C above outside temperature. This may cause some difficulties with winter lambs, lambed at temperature of below 10°C. In such cases, keeping the lambs warm with a 250-Watt infrared lamp may help (Weischet, 1990). An attempt to increase the temperature by closing all air vents in the pen is inappropriate for it will cause the rise of humidity as well as the concentration of harmful gasses affecting overall sheep health and wellbeing.

Air humidity arises by the evaporation of urine, water, and heat released by the animals. If air humidity is above optimal it may cause moistening and loss of wool as well as the incidence of the allergic skin reactions. Thus, it is desirable that the relative humidity of the pen does not exceed 80 percent (Table 2).

Table 2. - TEMPERATURE AND RELATIVE HUMIDITY IN SHEEP KEEPING PEN (DIN 18910, CIT. HOY, 2002)

Sheep category	Mass per individual (kg)	Optimal temperature (^{0}C)	Calculation values in winter	
			Temp. (^{0}C)	Rel. Humidity (%)
Lambs in fattening	10 – 40	18 – 10*	10	80
Animals for breeding	50 – 100	8 – 18	10	80

* The air temperature decreases gradually, as the animal grows from the higher to the lower value.

Among gasses present in the sheep-house, carbon dioxide (CO_2), hydrogen sulphide (H_2S) and ammonia (NH_3) are of mayor importance. The concentration of carbon dioxide in the pen depends on the number of sheep and intensity of ventilation. Therefore, elevated CO_2 concentration may indicate either the presence of too many animals per unit of space or the insufficient pen ventilation. However, the concentration of CO_2 usually emitted in pens (generally lower then permitted concentration of 0.3 vol.%) could not induce any negative effects on the health and production capabilities of the animals. Concentrations of H_2S and NH_3 in the pens should not rise to the levels that are harmful to animal health.

This may not be relevant for hydrogen sulphide because this gas is emitted only during long storage of liquid manure in anaerobic conditions, and it rarely rises above the allowed concentration of 5 ppm. On the other hand, ammonia levels can rise significantly if the sheep are accommodated on deep litter with

inadequate ventilation causing an increase in air temperature. The recorded concentration of ammonia during lamb fattening was 80 ppm. Ammonia is considered to be the etiopathogenic cause of lung disease (such as pneumonia) considering its irritating effect on the mucous membrane of the upper respiratory tract. Hence, the concentration of ammonia in the stable air should not be over 20 ppm (Hoy, 2002).

The basis for good microclimate, along with housing of an optimal number of animals per unit of space is adequate ventilation. The pen is ventilated by gravitation with the air supply system leading along the roof ridge. It has a capacity of about 2% of the pen volume together with the air ducts leading through wide windows 1/15 of their surface area (Asaj, 2003). If necessary, electric ventilators can be installed in the sheep-pens to pump out the contaminated air and pump in fresh air. In any case, it is important to keep the air draft speed in the pen within limits of 0.1-0.3 m/s (Hoy, 2002) because sheep are especially sensitive to drought.

Sheep accommodation in semi-open pens

Semi-open wooden pens containing three walls and roofing are built for sheep herds staying in the open for most of the year. They are usually built right next to the pasture grounds with the backside directed towards the bad weather (heavy rain, north wind, snow). The height of such pen is usually 2.5 m and the surface area is determined by a number of the animals. Considering the fact that the animals will seek shelter only during bad weather conditions it would be enough to ensure 0.7 m^2 for adults and 0.4 m^2 for their offspring. The animals are kept on firmly pressed floor with bedding, and the pen is equipped with cribs containing hay which are situated on the rear wall next to the drinking system (Kühnemann, 2000).

Outdoor sheep keeping

Outdoor sheep keeping can be divided into free grazing and grazing on the fenced pastures. In the first case the sheep are released to graze large unfenced areas not necessarily owned by the sheep breeder. The preconditions for such keeping are: herd size and its capability to find food, the absence of natural predators (wolves and bears) and a permit for grazing on pastures that are not owned by the breeder. The benefits of outdoor sheep keeping are very small financial investments for feed and accommodation of the animals (Hoy, 2002),

and a natural way of removing underbrush in order to prevent the forest fires. This way of sheep keeping is appropriate for the coastal parts of Croatia, including islands, and should be encouraged by the local and central government authorities.

Sheep keeping on the fenced pastures is used when it is not possible to organize free movement of the animals. Such pastures are fenced by outer (fixed) and inner (mobile) fences into smaller or larger paddocks. In this way the pasture ground is evenly exploited and rationally used by the grazing sheep. One meter high wire netting is used for outer fencing of the pastures. Netting is fastened to wooden poles, which are placed from 3 to 5 meters apart. Netting holes should not be too wide and must be narrower in the lower part in order to prevent the lambs from squeezing through and getting wedged. Plastic nets are used for inner fencing of the pastures. In the upper and middle part of the plastic fence there is metal wiring for conducting of electricity. Such fences are usually from 1.0 to 1.1 meter high and from 25 to 50 meters long, and are placed on wooden poles. The poles contain insulators, which carry the electrified wire. The fence holes are 15 x 13 cm, while the lower five rows are 6 x 6 cm in diameter. Fence electricity is supplied by 12V batteries and 9V dry batteries (Kühnemann, 2000). The necessary daily pasture area per sheep is estimated according to the pasture yield and animal category. Pasture yield is determined by weighing cut grass from $1m^2$ of pasture and the average daily needs for offspring and adults amount to 4-5 kg and 6 kg, respectively (Vukina, 1950).

Conclusion

Sheep breeding on farms is usually based on two mayor accommodation models. First model includes indoor accommodation during the entire year while the second model presents outdoor accommodation during which animals are kept in pens only in the winter. The sheep pens can be constructed as closed or semi-opened depending on the breeding model and climate. In Croatia sheep breeding is organized on small or large farms with the emphasis on ecological production. Most sheep are kept on pastures because breeding and exploiting of animals should be carried out according to as many natural laws as possible (Regulation of ecological production of animal products, 2002). Ecologically bred sheep can be accommodated indoors for a maximum of 3 months. The use of any hormones for oestrus synchronization is forbidden, except in cases connected with reproductive disorders. According to the noted regulation it is not allowed to keep more than 13.3 sheep per 1

hectare of agricultural area. It also estimates the minimum net area that indoor-housed lambs (0.35 m^2) must have. Besides, when animals are released for grazing they must have 2.5 m^2 per adult sheep, and 0.5 m^2 per lamb, as well as the shelter in case of bad weather. Regarding data listed above we can conclude that the regulation is insufficient regarding sheep (and other domestic animals) accommodation. Namely, the normative for a ram accommodation is left out and sheep categories are not clearly defined. In our opinion the conditions for sheep housing should be defined regarding sheep category as listed in Table 1. Besides that, the regulation should comprise the microclimate standards (temperature, relative humidity, air draft speed, harmful gasses, microorganisms and air dust) for housing of sheep and other domestic animal species. When speaking about serious ecologic production it is necessary to ensure by law the capability for monitoring microclimate in breeding objects, providing that excess production and emittion of air pollutants to the environment can be prevented on time. We assume that it is not enough for a regulation to state that microclimate of an object should be harmless for animals, because it is a broad and generalized term which can easily be a subject of misinterpretation. The same goes for the animal transportation, as the space size per animal in transport vehicles is not defined for sheep and other domestic animals in the ecological production. Therefore, the current regulation should clearly be revised on issues listed above following the consultation of veterinarian experts in the corresponding field. Croatia has great potential for ecological animal production and the veterinary profession should have unavoidable role in this segment of agricultural production.

REFERENCES

1. Asaj, A. (2003): Higijena na farmi i u okolišu. Medicinska naklada, Zagreb, s. 231 – 236.
2. Burgkart, M (1991): Tiergerechte Haltung beim Schaf unter Berücksichtigung unterschiedlicher Haltungs und Aufstallungsformen. In: Proc. Tagung »Tiergerechte Nutztierhaltung – Aufgabe und Ziel für Wissenschaft und Praxis«. Neubrandenburg, s. 101 – 108.
3. Čaušević, Z. (1991): Ovčarska proizvodnja. U: Stočarstvo (stručni redaktor Miljenko Brinzej), Školska knjiga, Zagreb, s. 321 – 362.
4. Dobos, G. (1994): Zeitgemässe Schafhaltung. Leopold Stocker Verlag, Graz, s. 123 – 135.
5. Hoy, St. (2002): Tiergerechte Haltung von Schafen. In: Umwelt und tiergerechte Haltung (Hrsg. W. Methling, J. Unshelm). Parey Buchverlag Berlin, s. 369 – 381.
6. Kühnemann, H. (2000): Schafe. Eugen Ulmer GmbH & Co., Stuttgart, s. 35 – 41.
7. Sambraus, H.H. (1978): Nutztierethologie. Verlag Paul Parey, Berlin., s. 128 – 149.
8. Vukina, R. (1950): Praktično ovčarstvo. Poljoprivredni nakladni zavod, Zagreb, s. 31 – 54.
9. Weischet, H. (1990): Milschafe halten. Eugen Ulmer GmbH & Co., Stuttgart, s. 39 – 52.
10. * Regulation of ecological production of animal products (org. Pravilnik o ekološkoj proizvodnji životinjskih proizvoda) Narodne Novine Republike Hrvatske 13/2002

ZNAČENJE ANIMALNE HIGIJENE PRI FARMSKOM UZGOJU OVACA UZ OSVRT NA EKOLOŠKU PROIZVODNJU

Sažetak

Ovčarska proizvodnja u Hrvatskoj ima dugu tradiciju, jer raspolaže s prirodnim resursima za intenzivan uzgoj malih preživača. Tome svakako doprinosi geografski položaj, klimatske specifičnosti naših krajeva i kvalitetni pašnjaci, kojima raspolažu svi dijelovi naše zemlje. Zbog toga se ovčarska proizvodnja temelji na uzgoju janjadi i proizvodnji mlijeka za preradu u autohtone sireve, koji su poznati izvan granice naše domovine. Zato postoji interes za proširenjem dosadašnjih kapaciteta proizvodnje i njihova plasmana na inozemno tržište. Za povećanu proizvodnju potrebno je više sirovine, zbog čega je moguće očekivati tedenciju razvoja ovčarske proizvodnje na manje ili veće farme. U tome osobito značenje ima animalna higijena, koja se kao znanstvena disciplina, između ostalog, bavi istraživanjem optimalnih uvjeta smještaja i držanja ovaca, što je i preduvjet za uspješnim bavljenjem ovčarskom proizvodnjom. Stoga su u radu opisani najčešći modeli uzgoja i aktualni normativi u pogledu uvjeta smještaja i držanja ovaca, koji se primjenjuju u zemljama s razvijenim ovčarstvom. Osim toga, danas postoji sve veća tedencija usmjeravanja uzgoja ovaca na ekološku proizvodnju u čemu uzgajivači ovaca u Hrvatskoj vide svoju perspektivu. Stoga su u radu navedeni bitni normativi za uzgoj ovaca na ekološki prihvatljiv način te potreba za dopunom postojećeg «Pravilnika o ekološkoj proizvodnji životinjskih proizvoda» iz područja koji se odnosi na animalnu higijenu.

Ključne riječi: uzgoj ovaca, staja, mikroklima, pašnjak, ekološka proizvodnja

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