9. Sheep - farm animals with a very diverse use - their importance both in the natural environment and in the food economy of the society

The topic of today's lecture is Sheep - farm animals with a very diverse use - their importance both in the natural environment and in the food economy of the society. The lecture is part of Module 4: Precision Livestock Farming, that is a part of the ISAGREED project. This presentation was supported by Erasmus+ KA2 Cooperation Partnerships Grant "Innovation of the content and structure of study programmes in the field of management of animal genetic and food resources using digitalization".

As part of the lecture, we will first talk about domestication and worldwide distribution of sheep. Then we will explain sheep breeds classification with examples. Next, we will briefly talk about sheep production traits and finally we will talk about environmental importance of sheep.

The domestic sheep belongs, together with the goat, to the oldest domesticated species of animals used for economic purposes. The area of the so-called Fertile Crescent is considered to be the center of domestication, from where sheep then spread throughout the world, and the beginnings of domestication are dated to the period approximately 10 - 11,000 years before the present.

The conclusions of the studies are not entirely uniform on the origin of the domestic sheep. Previously, a so-called polyphyletic origin was assumed, meaning several possible wild ancestors species. According to the latest studies, there was probably only one ancestor, Ovis Orientalis. The two different Latin names given here are related to the fact that the taxonomy of sheep is still somewhat confusing, and the taxonomy has changed several times over the years.

From the above figure, it is clear that sheep farming is currently most widespread in the developing countries of Asia (with 446 mil. pcs) and Africa (with 305 mil pcs). Approximately 127 million animals are bred in Europe, of which 97 million are in the European Union. The countries with the highest number of sheep include China, with 139 mil. pcs, India with 75 mils. pcs and Australia with 73 mils. pcs.

Worldwide, the number of sheep is estimated at 1.2 billion.

The main products of sheep breeding are meat, milk, wool, skin, and fur. Among the by-products is lanolin, a yellow gooey substance secreted by the sebaceous glands that protects the sheep from getting the wool wet. It is used in the cosmetics industry to produce ointments and creams. Its water-resistant properties were also used, for example, to produce shoe creams. Other by-products include sheep fat, blood, hooves, and horns, intestines, and foreguts. Sheep casings are used in the meat industry for the production of e.g., sausages and, in the past, they were even used for the production of condoms.

Currently, the agrotechnical and ecological importance of sheep breeding for manure production, the use of pastures, and landscape maintenance are very important, especially in less accessible areas. Sheep also serve humans as model and experimental animals. Some of you may have heard of a sheep named Dolly, the first mammal cloned from a somatic cell. This

happened on April 5, 1996, at the Rosslyn Research Institute in Scotland, where Dolly also died at six years of age.

Breeds represent the basic taxonomic unit of animal breeding. A breed is a specific group of domestic animals having a homogeneous appearance (phenotype), homogeneous behavior, and/or other characteristics that distinguish them from other organisms of the same species. These characteristics are genetically determined, therefore, are passed to the progeny.

We can classify breeds according to various criteria. Here is a classification of sheep breeds according to their performance presented.

We distinguish between meat breeds, which include, for example, Suffolk, Charolais, Texel, Oxford Down, and dairy breeds, such as Awassi or Lacaune. Then breeds with high reproduction performance as Romanov or Olkuska sheep, and last but not least, there are many dual or multipurpose breeds, for example, the Merinolandschaf, Bergschaf, Kent-Romney or Tsigai sheep. In the pictures, you always see representatives of the breed listed first in the given category, i.e., Suffolk, Awassi, Romanov sheep, and the Merinolandschaf.

Scherf and Pilling report that there are approximately 1,200 breeds of sheep in the world, the most of any livestock species, excluding poultry.

In the so-called genetic resources, similar to other species, mainly local, let us say more primitive breeds are included. In the Czech Republic, it is the Šumavka and Wallachian sheep, which is also a genetic resource in Slovakia. There are 17 native breeds in Poland; you can get to know them in more detail in the study of Kawecka et al. from 2022, possibly in other presentations of this module.

So now we will move on to the production traits of sheep.

Reproduction can be considered sheep's primary and essentially most important trait. This is because other production traits, such as meat and milk production, are directly dependent on reproduction, and if reproduction does not go well, there cannot be good results in other areas either.

From the point of view of reproductive biology, sheep belong to seasonally polyestrous species, which means that estrus repeats several times a year; however, estrus cycles are influenced by photoperiod, the estrus cycle begins with the shortening of the day (i.e., the fertile period usually lasts from July to December). With specific husbandry interventions (mainly by adjusting the light regime), the fertile period can be extended practically for the whole year if more frequent lambing is needed. The average length of the estrus cycle is 18 days. Rams are fertile all year round, but the composition of the ejaculate may vary depending on the season.

Regarding the number of offspring, sheep can be classified as multiparous species, which means that females give birth to several young at once. However, there are significant differences between breeds, where large meat breeds usually give birth to 1-2 lambs, while so-called fertile breeds (e.g., Romanov or Olkuska sheep) have even four lambs. Pregnancy in a sheep lasts an average of 150 days, and the ideal frequency of lambing is three times in 2 years. From a practical point of view, the decisive indicator of fertility is the number of reared lambs.

There are several different mating systems used in sheep.

The methods of natural reproduction are: free mating (the advantage is good conception, the disadvantage is the unknown origin of the lambs and the necessary replacement of rams), group mating (the advantage is the partial application of selection when dividing the herd into groups and selecting the most suitable rams). In so-called harem breeding, each ram has its group of females - the disadvantage is the demandingness of care, and the advantage is the known origin of the lambs. The last method of natural breeding is individual mating, so-called "by hand". This method is most commonly used in herds where performance control is made.

Teaser rams, which are young active rams with an apron, vasectomized, or with penis deviation, are used for heat detection.

Fresh or frozen insemination doses can be used for artificial insemination. The advantage is the maximum use of the potential of rams with the highest breeding value and the possibility of importing genetic material from foreign breeders. The disadvantage is the low percentage of fertilization.

Meat production

Meat is currently the most important product of sheep breeding. Worldwide production of lamb or mutton is approximately 8 million tons per year. As for consumption, it varies significantly from country to country. While worldwide consumption of lamb or mutton has been calculated at 2 kg per capita per year, in New Zealand, where sheep farming has a great tradition, this consumption is more than ten times higher. Conversely, in the Czech Republic, lamb or mutton is among entirely minority types of meat.

The best quality production is provided by young animals, slaughtered at the age of 4-6 months. Lamb meat is considered very healthy and easy to digest. The proportion of fat and protein is favorable. It is also valued for its low cholesterol content, or lower energy content, if it were to be used in a reduction diet, for example.

The dressing percentage, which is determined as a percentage of the weight of the processed carcass body from the animal's live weight, is approximately 50% for sheep.

Milk production

The duration of lactation, the period during which the female produces milk, lasts between 100 and 250 days in sheep. The yield varies significantly depending on the genetic background, i.e., breed and, also external conditions. It can be up to 600 kg of milk (exceptionally, around 1000 kg per lactation values have been recorded), corresponding to 0.5 - 3 kg of milk per day. Sheep are usually milked twice a day. Either manual milking is possible; at larger farms, machine milking is used.

The worldwide production of sheep's milk is approximately 8 million tons annually.

As for the composition of sheep's milk, there are differences from cow's milk, which you can see in the table. Sheep's milk contains approximately 19% solids, 6% protein, 7% fat, and 5% lactose. Its energy content is approximately 4200 kJ per liter. It is, therefore, significantly more nutritious than cow's milk.

The high content of solids and milk components predisposes it, especially to producing various kinds of cheese. Sheep's cheeses have a long tradition, especially in France, where, for example, the milk of Lacaune breed is used exclusively to produce the original Roquefort. Other well-

known sheep's cheeses are, for example, Greek feta or Italian pecorino. To give you an idea, 1 kg of fresh cheese requires approximately 5 liters of sheep's milk.

Other possible utilization of sheep, which I will briefly mention, are wool and leather production.

Worldwide production of sheep's wool is approximately 2 million tonnes annually, with Australia, China, and New Zealand traditionally the largest producers.

The covering of the sheep body is called fleece, and the wool fiber is the oldest natural fiber of animal origin with some unique properties, for which it is valued and used even today. The fineness of the fiber is particularly important for determining the quality of the wool, which then determines its price. Merino breeds of sheep are mainly used for the production of high-quality, fine wool.

On the contrary, practically all breeds can be used for leather production. The so-called fur sheep include, for example, the Romanov sheep and the Karakul breed, from which a unique product known as Persian is obtained. This is fur obtained from lambs only a few days old, so the ethical aspect of this production is sometimes questioned nowadays.

Worldwide production of sheepskin is approximately 1.6 million tons per year.

In addition to the benefit they provide directly to their breeder, sheep also have ecological and landscape-forming importance. Historically, pastoral culture significantly shaped the character of a landscape and helped ensure the livelihood of residents.

Maintaining traditional sheep farming practices can contribute to preserving cultural heritage and the associated biodiversity.

Nowadays well managed sheep grazing helps to ensure the maintenance and recovery of vegetation, especially in:

protected areas,

difficult to access areas,

areas unsuitable for other animal species.

Last, sheep breeding can also have social and educational significance in maintaining people's contact with living nature.

At this moment I would like to thank you for your attention. If you have any questions, you can use the email listed here.