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## **METHODS OF SELECTION AND CHARACTERISTICS OF PRODUCTIVE TRAITS OF UKRAINIAN CARPATHIAN MOUNTAIN SHEEP**

## **METODY HODOWLI I CHARAKTERYSTYKA CECH PRODUKCYJNYCH UKRAIŃSKICH KARPACKICH OWIEC GÓRSKICH**

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**Streszczenie.** W 1993 roku zakończono prace nad stworzeniem w strefie górskiej ukraińskich Karpat nowej rasy o wysokiej jakości mieszanej okrywie wełnistej – ukraińskiej karpackiej owcy górskiej poprzez krzyżowanie miejscowych grubowłnistych maciorek z trykami rasy cygaj. Pod względem wydajności mlecznej i jakości wełny owce nowej rasy znacznie przewyższają lokalne rasy owiec i równie dobrze przystosowały się do specyficznego górskiego klimatu i systemu gospodarowania. W aktualnej sytuacji gwałtownego spadku popytu na wełnę owczą nowe rasy owiec okazały się konkurencyjne dzięki uniwersalnemu kierunkowi produkcji i wykorzystaniu nie tylko wełny dobrej jakości, ale także mleka i mięsa baraniego. Obecnie aktualnym kierunkiem doskonalenia jest zwiększenie wydajności mlecznej owiec tej rasy.

**Key words:** breed, Carpathian region, sheep, Ukraine.

**Słowa kluczowe:** hodowla, owce, region Karpat, Ukraina.

## **INTRODUCTION**

Cultivation of sheep in the mountain areas of Carpathians in Ukraine and the neighbouring countries, including Poland, Romania, Slovakia and Czech Republic has a lot in common due to the specific natural and climate conditions as well as the management system (Molik et al. 2006). It is common there to graze sheep on distant mountain grasslands – poloninas, during the summer. Carpathian sheep grazing in total is about 1.400 km. Grazing here includes sheep, shepherd dogs, donkeys and horses being overseen by Polish, Czech and Slovakian shepherds, Romanian herdsmen and Ukrainian hutsuls. The tradition of high-mountain sheep grazing and cheese production has been common for all these countries for many generations and has spread over vast areas of the Carpathians. The temperature fluctuations as well as frequent rainfalls requires animals to be well adapted. They have to be especially highly immune to common colds (Molik et al. 2006; Kawęcka 2009). Local sheep

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bred in Carpathians are well protected against humidity and cold during common rainy weather due to their long wool cover, consisting mainly of thick coarse hairs. In terms of technology such wool was not a good material for the textile industry. Therefore, a research to improve the utility of wool of the local sheep breeds was initiated in the countries of the Carpathians region in the middle of the last century. This included crossing the local sheep with other breeds. In Slovakia the local Walaszka sheep was crossed with Texel, Lincoln and Leicester rams to obtain a new zošľachtená valaška breed (Laurincik and Longauer 1982). In Poland in the middle of XX century the Podhale Zackel sheep breed was crossed with Friesian and Transylvanian Zackel rams to obtain Polish Mountain sheep (Czaja 1952; Węglarzy and Skrzyżala 2015). The best impact on the improvement of wool and milk production had sheep Transylvanian and the Friesian race, and gave rise to the emergence of Polish Pogórze sheep (Kaczor et al. 2010). In Ukraine the best results in improving the traits of local sheep breeds were obtained when crossing them with Tsigai breed rams. The outcome included achievement of better wool quality and usability. The sheep retained the same good health and immunity traits and remained well adapted to the local conditions. They also had high milk yield and good quality meat.

The aim of the study was to present the methods of creation of the new sheep breed (Ukrainian Carpathian Mountain Sheep) well adapted to the local environmental conditions.

## HISTORY OF THE ORIGIN OF THE CARPATHIAN UKRAINIAN MOUNTAIN SHEEP

The new breed of Carpathian Ukrainian sheep was based on the local Zackel breed, which included small animals with very long and thick wool, very well adapted to the local conditions. The ewes' mass did not exceed 30–35 kg and rams were no heavier than 45–60 kg. Yield of grease wool in ewes reached 1–1.5 kg and full-growth wool came to 28–30 cm on average, but sometimes it reached even 50 cm or more. The wool was thick, consisting of 73% coarse hair and 27% undercoat:

- the mean length of wool coat is 96  $\mu\text{m}$  and of the undercoat – 44.6  $\mu\text{m}$ ;
- more than third of sheep was black or grey. Milk yield in the summer reached 50 kg. The meat traits and its quality were relatively good.

The research leading to creation of Carpathian Ukrainian mountain sheep can be chronologically divided into the stages:

- selection of appropriate parent breeds according to the breed standards;
- obtaining hybrids in order to determine the most effective crossing options;
- mating of the wanted animals (avoiding inbreeding).

During the first stage the researchers decided to create a sheep with a homogenous cover, adapted to mountain conditions. The classic pattern of crosses using English long-hair Lincoln and Kent rams appeared not to be effective. The obtained hybrids were not adapted to the breeding system or to climate conditions. Also, the financial aspects did not prove to be profitable.

The best results were obtained when crossing local ewes with Tsigai breed rams (Fig. 2).

However, it appeared that breeding the hybrids with homogenous cover is not possible in traditional farms in Carpathians. Such sheep often got ill and died in the harsh conditions of mountain grasslands.

The animals showing the best adaptations were the ones with mixed three-fraction, carpet-type wool. They had significantly higher productivity traits and wool quality than local Zackel sheep.

In terms of adaptation to the local environmental conditions, fertility and milk yield the hybrids did not differ from the Zackel breed.

The first generation of hybrids included some sheep with wool type similar to that of the local breed. Such ewes with very thick wool from the first generation were again crossed with Tsigai rams until hybrids with 3/4 noble blood were achieved. The rams with the desired wool type from the second generation were crossed with similar ewes from the first generation.

The next step was to inbreed the animals with the desired white carpet-wool cover, using mainly hybrids with 1/2–5/8 of Tsigai blood. The sheep with cover that differed from the desired wool type were culled.

### THE NEWLY CREATED BREED

The new breed, called Ukrainian Carpathian Mountain sheep, was acknowledged by Ukrainian Ministry of Agriculture in 1993. In Poland, the requirements habit and productivity of Polish Mountain sheep determines Reg. Minister of Agriculture in 1962.

The breed contains two local types: trans – and fore – Carpathian that differ in the structure and quality of wool. Transcarpathian sheep have thicker wool and higher pure fibre yield (over 70%). Foreland sheep have thinner wool with perfect uniformity of wool fibres and the yield of pure fibre reaching 65–68%. Both types of Carpathian Ukrainian mountain sheep are bred in the mountain areas of Transcarpathian, Ivano-Frankivsk, Lviv and Chernivtsi regions (Petryshyn 1995).

Ukrainian Carpathian Mountain sheep are relatively small, have strong constitution and proportional body structure. The head is light, rams usually have horns. Sheep are white, although sometimes they have black spots on the ears, around the eyes and at the tip of the nose. The neck is of average length and width, the wither is high and narrow. The torso is long and straight and the rump is narrow and poorly muscled, sometimes sloping. The limbs are strong and high, the rear ones usually positioned closely in the ankles. The wool area reaches the head and the limbs up to wrists and ankles. Sometimes limbs are covered with coloured hair, which is not considered a defect. The tail is long and thin (Fig. 1, 2).



Fig. 1. A ram of the new breed with desired characteristics

Ryc. 1. Tryk nowej rasy pożądanego typu

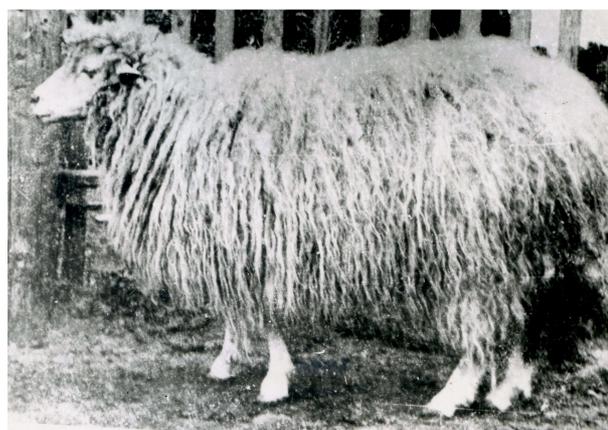


Fig. 2. An ewe of the new breed with desired characteristics

Ryc. 2. Maciorka nowej rasy pożądanego typu

The basic body measurements of Ukrainian Carpathian Mountain sheep are presented in Table 1.

Table 1. Body measurements of Ukrainian Carpathian Mountain sheep  
Tabela 1. Wymiary ciała ukraińskich karpackich owiec górskich

Measurement Wymiary [cm]	Rams Tryki	Ewes Maciorki
Height at the wither Wysokość w kłębie	68.7	63.4
Rump height Wysokość zadu	69.3	64.6
Diagonal torso length Skośna długość tułowia	76.7	69.1
Chest depth Głębokość klatki piersiowej	32.9	29.7
Chest width Szerokość klatki piersiowej	29.4	26.4
Chest circumference Obwód klatki piersiowej	102.8	99.4
Rump width Szerokość zadu	16.8	15.8
Foreshank circumference Obwód nadpęcia	9.2	8.8

Ukrainian Carpathian Mountain sheep have relatively low body mass, depending especially on feeding level, age and gender. The mean body mass of adult rams ranges between 60 and 65 kg and of adult ewes – between 40 and 45 kg. For the Polish Mountain sheep run books are preliminary, main and elite. Rams and ewes Polish Mountain sheep entered into the elite must obtain a minimum of 80 points. for the construction. Polish Mountain sheep is of similar weight and in the annual regrowth produces 3.5–5.5 kg of rams and ewes 2.5–4.0 kg of greasy wool, depending on the type of books.

The slaughter efficiency indices greatly depend of a level of feeding. After the period of grazing on natural mountain grasslands 8–9-months old lambs achieve mean body mass of 28–30 kg while after the period of extensive feeding – 36–38 kg. The slaughter efficiency comes to 43–45% and the meat content in carcass – 70–75% (Hanciak 1974). Small private farms breed lambs in small groups so their maintenance is easier, therefore the lambs born in the autumn can reach mean body mass of 40–45 kg.

Sheep of the new breed have higher wool quality and yield compared to the local sheep. Mean pure wool yield of rams ranges from 2.4 to 2.9 kg and of ewes between 1.4 and 1.6 kg. Pure fibre rendement yield ranges from 60 to 75%.

The wool is white and the grease is white or crème colour, with 9.9% lipid (wax) content. The length of wool at the side of sheep is 18–20 cm, and the down hair is 9 to 10 cm long. The wool thickness parameters and ratio of its different morphological types are presented in Table 2.

The wool of Ukrainian Carpathian Mountain sheep is a valuable material for the light industry and for craftsmanship. It is used to manufacture carpets, high quality clothes, knitwear and artificial furs (Sulyma 1989, 1993, 1995; Petryshyn 1995; Chokan et al. 2009).

Table 2. Thickness of individual anatomical types of wool fibres from annual regrowth in Ukrainian Carpathian Mountain sheep  
 Tabela 2. Grubość poszczególnych typów anatomicznych włókien wełnianych z rocznego odrostu owiec ukraińskiej górskiej rasy karpackiej

Parameter Wyszczególnienie	Rams Tryki	Ewes Maciorki	14-months old ewes Maciorki w wieku 14 miesięcy
Fibre diameter Średnica włókien [ $\mu\text{m}$ ]	34.2	35.4	
Standard deviation Odchylenie standardowe [ $\mu\text{m}$ ]	12.0	12.3	12.1
Variation coefficient Współczynnik zmienności [%]	35.6	34.9	35.4
Hair type Typ włosów*			
Down hair Włosy puchowe [%]	40.5	39.2	42.1
Transition hair Włosy przejściowe [%]	49.9	49.4	46.5
Core thin hair Włosy rdzeniowe cienkie [%]	9.1	10.3	10.8
Medium Średnie [%]	0.4	1.1	0.5
Thick hair Grube włosy [%]	0.1	–	0.1
Total Razem [%]	100	100	100

\*according to fibre diameter – według średnicy włókna: down hair – włosy puchowe  $\leq 30 \mu\text{m}$ , transition hair – włosy przejściowe  $30,1-2,5 \mu\text{m}$ , core thin hair – włosy rdzeniowe cienkie  $52,6-75 \mu\text{m}$ , medium – średnie  $75,1-90 \mu\text{m}$ , thick hair – grube włosy  $> 90 \mu\text{m}$ .

Reproductive performance of this breed is relatively low, which results from its genes but most importantly from environmental factors. Mean fertility of ewes ranges from 105 to 116%, but in favourable feeding conditions it can reach 130–150%. The farmers in Carpathians are reluctant to twins being born as taking care of such requires more work and feed, which is not always profitable.

The sheep have good maternal features, the amount of raised lambs usually reaches 94–97%.

In the eighties of the last century in order to increase fertility of Ukrainian Carpathian mountain sheep a research was carried out on the effect of their crossing with rams of fertile breeds – Romanov breed and Finnish Landrace.

The results showed that in poor feeding conditions in collective farms the hybrids from the first generation did not differ from Carpathian Mountain sheep in terms of fertility, however, the yield and quality of wool were poorer. In contrast, in small private farms, where feeding and maintenance conditions were better, sheep more often gave birth to twins. For the ewes with 1/2 fertile breeds blood the frequency of twins being born was significantly higher than in Carpathian mountain sheep (Petryshyn 1989).

Milk yield in sheep from small private farms comes to 50–60 kg per 120–140 days per ewe. This amount is sufficient to produce 10–12 kg of cheese. Certain sheep are able to produce even 80 kg or more milk per lactation. For comparison, in the past in collective farms only 25–30 kg of milk was yielded per one sheep per lactation. It was observed that milk yield increased until 3rd and 4th lactation and after that it decreased significantly. There is a direct

relation between sheep body mass and their milk yield – larger animals show higher yields. Similarly, sheep with thick wool (fibre diameter > 36  $\mu\text{m}$ ) also produce more milk than those with thin wool. Milk contains 6.5–7% fat and 5–5.5% protein, on average, however, its chemical content changes with regard to the month of lactation. The content of fat and protein increases to 8 and 6 %, respectively. Lactose content is virtually constant and equals approximately 5%. Mineral content in milk is greatly dependent on feeding (Sulyma 1986; Sulyma 1995; Burda 2008).

For comparison, in Poland there is about 40 thousand of milk sheep while in Romania – 7.5 million. Lactation in mountain sheep is relatively short, which is a result of the breeds being kept for milk production. Lactation in these sheep lasts only 150 days for Valaska sheep and 180 days for Cygaj breed. Therefore, the milk yield does not exceed 133.9 kg per individual (Węglarzy and Skrzyżala 2012).

Between 1991 and 2015 sheep population in Ukraine as well as in other former Soviet bloc states decreased significantly. However, in the Carpathians region the decrease was not as rapid, mainly due to local customs and traditions as well as universal mode of economic use of Ukrainian Carpathian Mountain sheep. In Ukraine the total count of sheep decreased nine times whilst in the Carpathians region – only 3.6 times. In 2015 21.4% of Ukraine's entire sheep population was bred in the Carpathians, of which 14.6% in Transcarpathian region alone (Derzhavna sluzhba statystyky Ukrainy 2016).

Currently, due to decreased demand for light industry products most of Carpathian mountain sheep wool is used in local craftsmanship. The traditional Hucul craft allows using both white and naturally coloured wool. Therefore the demand for natural black and grey-coloured sheep increased, although the breed standards do not provide further crossing of such sheep. Comparative study of Ukrainian Carpathian Mountain sheep with different wool colours (white, grey, black) did not find any significant differences. This fact was the basis for development of recommendations regarding Ukrainian Carpathian Mountain sheep breeding management (Makar et al. 2004).

At the present stage of breeding Ukrainian Carpathian mountain sheep, it is important to emphasize milk production. The main method to increase milk yield is to maintain pure-bred breeding and introduction of the value assessment of ewes according to ICAR (2015).

Crossing Carpathian Mountain sheep with zošľachtená valaška breed may also be an efficient method of increasing milk yield of the breed. Such hybrids from F1 have significantly higher milk yield (by 11.6%) in their first lactation than Carpathian Mountain sheep. At the same time the yield is comparable to that of the local breeds, providing the hybrids are adapted to the specific local weather, environmental and economic conditions (Martyshyn 1993). This is connected to the fact that both Ukrainian Carpathian Mountain sheep and zošľachtená valaška originate in local Carpathian Zackel breed, the objectives of their breeding are the same and their maintenance do not differ significantly.

Crossing Ukrainian Carpathian Mountain ewes with Bukovina-type rams of Askanijski Crossbred resulted in a herd of improved Carpathian mountain sheep yielding 79.1 kg of milk in 141st day of lactation, which was sufficient to produce 20 kg of sheep cheese (Chernomyz 2013).

## RECAPITULATION

The work leading to creation of a new breed – Ukrainian Carpathian Mountain sheep with high quality mixed carpet wool cover came to an end in 1993. It was achieved by breeding local ewes with thick wool cover with Tsigaj breed rams. In terms of milk yield and wool quality the new breed was significantly more valuable than sheep of local breeds. At the same time they adapted well to the specific mountain climate and management system. In the current situation of rapid decrease in demand for wool, the new breed is still competitive due to universal production objectives (wool, meat, meat) and therefore it is popular among farmers.

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**Abstract.** The work leading to creation of a new breed - Carpathian Ukrainian mountain sheep with high quality mixed carpet wool cover came to an end in 1993. It was achieved by breeding local ewes with thick wool covers with Tsigai breed rams. In terms of milk yield and wool quality the new breed was significantly more valuable than sheep of local breeds. At the same time they adapted well to the specific mountain climate and management system. In the current situation of rapid decrease in demand for wool, the breed is still competitive due to universal production objectives and possibility of using not only its good quality wool but also milk and sheep meat. The current direction of improvement is raising milk yield in the sheep of this breed.