Original Paper

Prospects of use of genetic resources of sheep in Ukraine

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Our research aimed to analyse the current state of the sheep industry in Ukraine, to highlight the geographical location of genetic resources, to describe the state of the breeding work, and to form the proposals for the development of this branch in the future. The date from the State register of breeding farms for 2005–2019 and statistical reporting were used for analysis. It is shown that over the last 14 years, the sheep industry in Ukraine has undergone significant changes: the form of ownership has changed, the number of livestock has decreased and the breed composition of sheep has changed. Currently, there are 0.7 million sheep in Ukraine, of which 26.7 thousand are registered like breeding animals belonging to 10 breeds. The largest number of sheep is concentrated in the south and west of the country, where the climatic conditions are favourable for this branch in the past. The leaders in terms of numbers are Odesa and Transcarpathia, Chernivtsi and Zaporizhia regions. Breeding pedigree animals are concentrated in Odesa and Kherson oblasts. The most numerous breeds are the Askanian meat-wool breed with crossbred wool and the Askanian Karakul breed. Taking into consideration the big potential of the sheep breeding, it is proposed to perform some steps to stimulate its development in Ukraine.

Keywords: sheep breeding, breed, local breeds, sheep milk production

1   Introduction

In the current economic environment, the sheep industry remains one of the most promising for development, from the standpoint of improving effective land use, employment, providing processing industry with raw materials and population with food (meat, milk, cheese, etc.). Also, sheep is the least energy-intensive industry. Sheep, due to their biological characteristics, can use pastures with a minimum cost of almost 8–9 months a year, and therefore it is advisable to breed them in all climatic zones of Ukraine (Bojko et al., 2013; Vdovychenko et al., 2013b).

Over the past twenty years, the sheep industry has undergone tremendous changes in Ukraine. This primarily concerns the number of sheep and its breed composition. Compared to 2005, breeding farms for such breeds as Charollais, Texel, Polwarth, Caucasian fine-wooled, North Caucasian, Crimean type and Azov types of Tsigai breed have disappeared. Some breeding farms remained on the territory of the annexed Crimean Peninsula. The prolific type of Karakul breed has not been bred since 2006 (Vdovychenko et al., 2016; Vdovychenko et al., 2019).

Therefore, the goal of our research was to analyse the current state of breeding sheep in Ukraine, considering these large-scale changes, to present the characteristics of existing breeds of sheep, which are the basis for breeding, as well as to define some measures, needed for supporting of sheep breeding industry. On the other hand, it was important to explore the experience of other countries, which have successfully performed the transformation from planned to marked oriented economy building and implementing the new breeding strategy and ensuring farmers access to modern market place with high quality novel products.

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2   Material and methods

To analyse the state of the art of sheep breeding in Ukraine, date of Statistical yearbooks on animal production in Ukraine were used (Animal production of Ukraine, 2011; Animal production of Ukraine, 2019), as well as the State registers of the breeding farm for 2005–2018 (Pryjma, 2015; Pryjma, 2016; Pryjma, 2017; Pryjma, 2018; Pryjma, 2018; State Tribal Register, 2006; State Tribal Register, 2007; State Tribal Register, 2008; State Tribal Register, 2009; State Tribal Register, 2011). Methods of system generalization, graphic, analytical and comparative-statistic were used for the research.

3   Results and discussion

Although sheep breeding in Ukraine has a long tradition, in general, the number of animals has been declining for many years in a row. If in 1961 there were 10.1 million animals in Ukraine, at the time of the collapse of the USSR there were 7.9 million sheep in Ukraine (Figure 1). A particularly significant reduction in livestock occurred between 1991 and 2001. In recent years, the population has stabilized, and at the beginning of 2019 comprised of 0.7 million heads (Animal production of Ukraine, 2019).

It should be noted that traditionally in Ukraine there were 2 types of producers, namely agricultural enterprises and households. The reform of the agricultural sector, which was carried out after the collapse of the USSR, caused a reduction in livestock in agriculture enterprises.
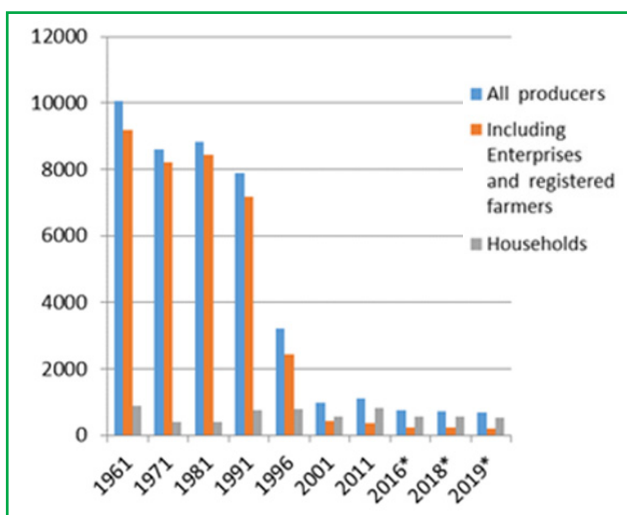

Figure 1   Number of sheep in Ukraine in different years (thousand heads)
Source: Vdovychenko et al., 2016; Vdovychenko et al., 2019
* Data exclude the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol; as of the 1st January 2015–2019 and a part of temporarily occupied territories in the Donetsk and Luhansk regions

At the same time, the number of sheep in households was decreased not so much, from 0.9 million in 1961 to 0.5 million in 2019. Beginning from 2001, households began to breed even more sheep than agriculture enterprises.

The existing sheep population is not evenly distributed throughout Ukraine (Figure 2). Traditionally, livestock are concentrated in the southern regions (Odesa, Zaporizhia) and in the mountains (Chernivtsi and Transcarpathia). In general, the distribution of livestock coincides with the location of natural and climatic zones in Ukraine: most animals are situated in the steppe zone with decreasing in the direction of Polissya (livestock in Donetsk and Luhansk regions are considered only from the part of the controlled by Ukraine area). The leader in sheep breeding in Ukraine is the Odesa region, which has 197.4 thousand heads, or more than 20% of the total population.

The concentration of livestock by zones depends on the availability of fodder resources, pastures, which are difficult for use for other species of farm animals. The largest number of sheep is in areas that are unsuitable for intensive agriculture due to climatic, relief conditions, etc. Today in the main areas of sheep breeding the specialization in the production of different types of cost-effective sheep products can be observed. Along with the natural and climatic conditions the important factors are the composition of the population in the region and its cultural traditions, associated with sheep breeding (Pomitun, 2000). This is extremely important under the condition of market instability, which has led to the almost complete elimination of sheep in some other areas, where cultural habits were not too strong related to sheep.

The steppe zone is historically considered as a sheep breeding zone. Favourable factors for sheep breeding in the steppe zone include the presence of large areas of agricultural land, a long period of grazing – up to 10 months, the presence of a large amount of by-products from the processing of crop products, which can be used as a feed. Among the unfavourable factors for sheep in the southern and steppe regions – a high degree of ploughing, remoteness of natural forage lands from existing farms, lack of available passes to them, a short period of availability of green grass (the grass dries in July).

Positive factors for the Carpathian zone are the presence of large surfaces of mountain pastures, which for 5 months provide sheep with a variety of green fodder. The local population has a steady demand for sheep products (cheese, butter), developed folk crafts for processing sheep wool for producing blankets, "bedspreads", etc., as well as a developed resort and tourist infrastructure. The restraining factor of this zone is the remoteness
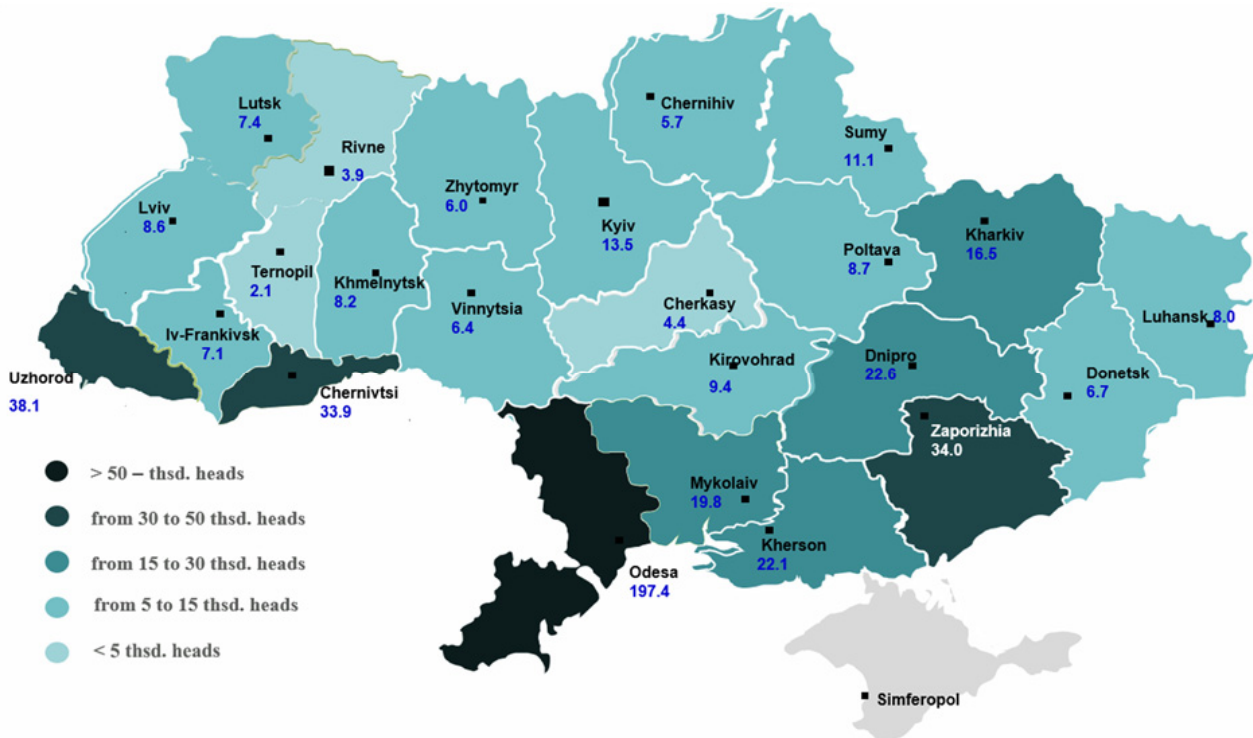
Figure 2 The number of sheep in the regions of Ukraine as of 01.01.2020 (thousand heads) according to the State Veterinary and Phytosanitary Service of Ukraine
* Data exclude the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol; as of the 1st January 2015–2019 and a part of temporarily occupied territories in the Donetsk and Luhansk regions

of pastures from settlements, unsatisfactory living conditions of workers during the "summer" in the distant pastures, difficulties in the process of harvesting and delivering of fodder for the winter (inability to use machinery), high price and insufficient quantity of concentrated fodder produced locally.

In Ukraine, a program for the development of sheep breeding has been worked out (Vdovychenko et al.,

2013a), but any kind of support from the state has not been provided to producers in recent years.

The basis for the further development of sheep breeding is genetic resources and breeding farms. In general, the situation with the breeding (pedigree) sheep population reflects the development of sheep breeding in Ukraine (Figure 3).
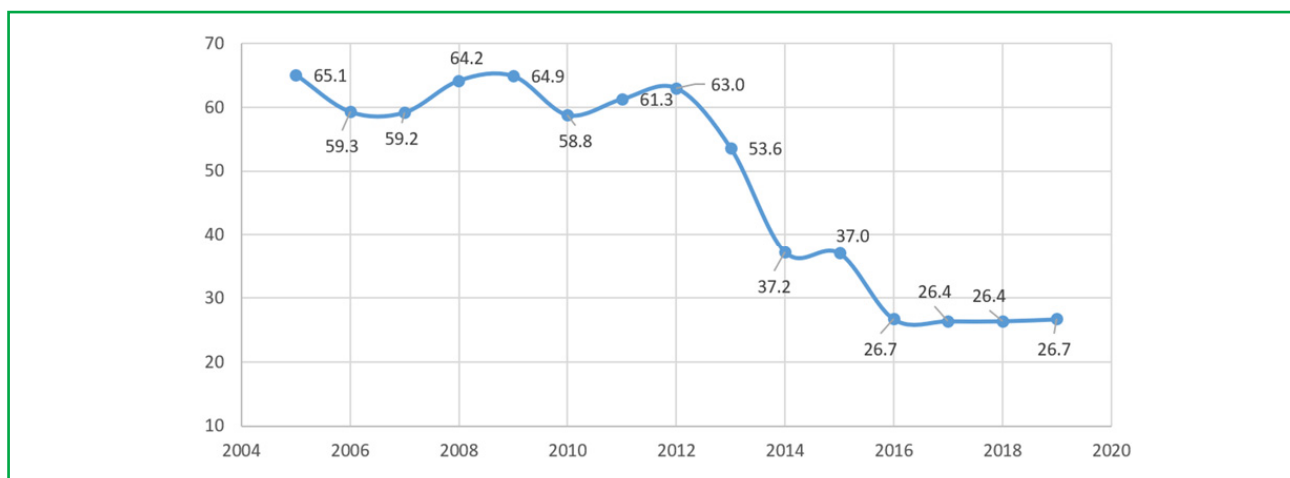

Figure 3 Number of breeding sheep in Ukraine for the period 2005–2019 (thousand heads)
Source: Pryjma, 2015; Pryjma, 2016; Pryjma, 2017; Pryjma, 2018; Pryjma, 2018; State Tribal Register, 2006; State Tribal Register, 2007; State Tribal Register, 2008; State Tribal Register, 2009; State Tribal Register, 2011

It should be noted, that according to the legislation of Ukraine, breeding stock is considered to be that which is located only on specially registered agricultural enterprises, and not in other agricultural enterprises and households. Given the fact that the total number of sheep in agricultural enterprises has been decreased, it becomes clear that the number of breeding stock has also been decreased. The most significant reduction in breeding stock took place before 2005. From 2005 to 2013, the breeding sheep population remained relatively stable, decreasing from 65.1 thousand to 53.6 thousand heads in 8 years. In 2014, part of the breeding stock remained in the uncontrolled territory of Donetsk and Luhansk regions and the Crimea, so the official statistics of breeding sheep in Ukraine for one year decreased by 16.4 thousand heads. Since 2016, the number of breeding stock has stabilized at above 26 thousand heads.

As of the 1st January 2019, there are 36 breeding farms in Ukraine where 26.7 thousand heads of breeding sheep are bred, including 901 breeding rams and 16.8 thousand ewes and female yearlings. The number of breeding sheep in Ukraine in different regions, natural and climatic zones differs significantly (Figure 4).

Thus, most breeding sheep are bred in the southern steppe regions of Ukraine. Today, there are the most numerous breeding sheep in the breeding farms of Kherson and Odesa regions: 8,584 heads, and 5,743 heads, respectively.

The leader of the western region of Ukraine in the number of breeding stock is the Lviv region, where over the past 5 years the increase in the number of breeding sheep (by 19%) has been observed. At the same time, in Rivne, Ternopil and Vinnytsia regions, breeding herds have disappeared at all.

Breeding farms in the north of Ukraine also were closed: in Chernihiv and Sumy regions.

In eastern Ukraine, most breeding sheep remained in Dnipropetrovsk and Kharkiv regions. Unfortunately, in this region for the last 5 years breeding farms have disappeared in Donetsk, Luhansk.

In the central region of Ukraine, sheep breeding is mostly developed in the Poltava region – 1.2 thousand heads, while in Cherkasy and Kirovohrad regions breeding herds are not bred.

In general, the situation with breeding sheep is critical. The state system of organization of breeding work is essentially outdated. In fact, the state recognizes as breeding animals only those placed in specially certified approved farms, which must be entered in the state register. This approval should be repeated every 5 years. These farms must meet the minimum criteria
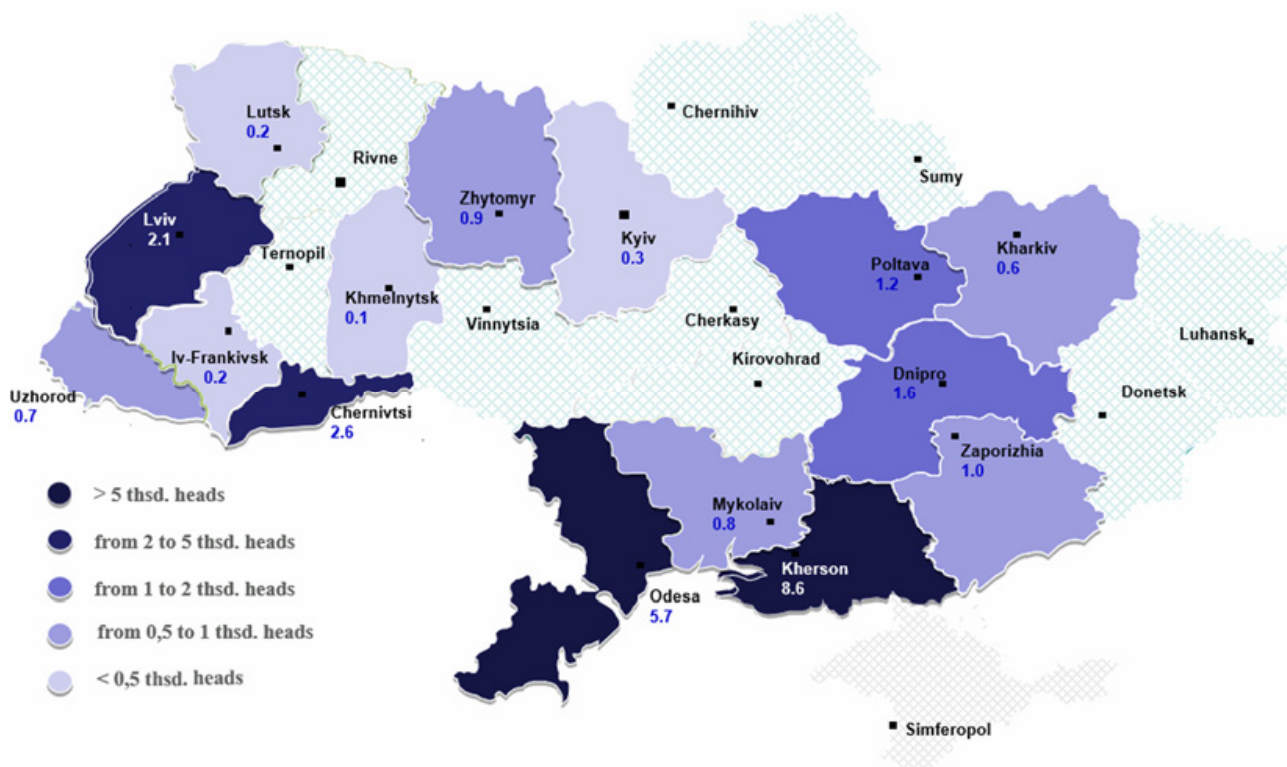

Figure 4   The number of breeding sheep in the regions of Ukraine as of the 1st January 2019 (thousand heads)
Source: Pryjma, 2019

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for livestock and livestock productivity, depending on the breed. The procedure for confirming all the requirements is quite complicated for farms, so they do not want to go through it. As the state does not have any tools to stimulate the sheep industry, the costs of participation in the state scheme of organization of breeding work are not reimbursed in any way. Under such conditions, a commercial farm that has not been registered as a breeding farm, but bought breeding animals, can perform breeding activity within their herd without informing the state and without coordinating their work with government agencies and other farms. The breeding value of livestock in commercial farms may be higher than in breeding farms, which discredits the whole system.

The procedure for registration of new economically interesting breeds in Ukraine is quite complicated. Farms import animals of new breeds (here under the term "new" we understand not registered in Ukraine) that are of interest to them, but do not register them in the breeding register. Thus, the official list of breeds in Ukraine looks somewhat archaic and does not correspond to reality. The state register and the state system of breeding work live their lives, and breeding farms – their own.

As for the official breed structure of breeding stock, today in Ukraine sheep of 10 breeds are bred: Askanian meat-wool with crossbred wool, Askanian karakul, Askanian fine-wooled, Merinolandshaf, Prekos, Romanov, Dnieper meat, Latvian dark-headed, Ukrainian mountain Carpathian, Sokilska (Table 1). The majority of breeding stock belongs to the breeds of the multipurpose productivity: meat-wool and wool-meat.

Among the breeds, the largest share in the number has Askanian meat-wool breed with crossbred wool. This multipurpose breed of sheep was registered in

Ukraine in 2000. Sheep are sensitive to high levels of feeding, effectively use the nutrients of feed and maximally transform them into products. Animals meet the requirements of intensive technology (Polska, 2006; Pomitun, 2000; Pomitun, 2010), so they are bred in all regions of Ukraine. The average productivity in the breed is as follows: the average yield of lambs per 100 ewes is 71–101 heads, the average yield of pure wool is 56–68%.

The Askanian Karakul breed was registered in 2009. Sheep of this breed are bred in Odesa, Kherson, and Chernivtsi regions. Average productivity: yield of lambs per 100 ewes – 100 goals, average yield of karakul of the first grade – 92–120%.

Askanian fine-wooled breed of sheep was bred by soviet researcher Ivanov in the period 1925-1935. To improve the wool quality in 1980 the crossing of Askanian fine-wooled breed with Australian merino breed was performed (Paşca et al., 2018; Scales et al., 2000; Zonabend et al., 2017). Today the Askanian fine-wooled breed of sheep is bred in Zaporizhia, Poltava, and Kherson regions.

Merinolandshaf sheep are kept in the western part of Ukraine in Lviv and Chernivtsi regions. They are characterized by good housing conditions, endurance, high growth rate, good meat, and wool qualities (Iovenko, 2017). Sheep are suitable for year-round grazing on both cultivated and poor wild pastures. Yield of lambs per 100 ewes at the beginning of 2019 was 124 heads. Ewes of this breed are successfully used both for purebred breeding and for industrial crossing with meat breeders to increase the production of high-quality meat.

In recent years, the number of Prekos sheep (fine-wool direction) has significantly decreased. It is bred only in 3 breeding farms of Lviv and Kharkiv regions. Sheep belong to the multipurpose breeds, combining high wool productivity with high growth intensity. They have

Table 1   Distribution of sheep in Ukraine by breed

Breed	Number of animal (heads)	Share (%)
Askanian meat-wool with crossbred wool	7,967	30%
Askanian karakul	5,926	22%
Askanian fine-wooled	5,593	21%
Merinolandshaf	1,941	7%
Prekos	933	4%
Romanov	1,947	7%
Dnieper meat	756	3%
Latvian dark-headed	206	1%
Ukrainian mountain Carpathian	1,288	5%
Sokilska	110	0.5%

good meat qualities and high fertility. The average yield of lambs per 100 ewes in 2018 was 89 heads, the yield of pure wool is 50–52%.

Romanov breed is bred in different regions of Ukraine. Romanov ewes are polyestrous, with good milk productivity. In Ukraine, the average yield of lambs per 100 ewes at the beginning of 2019 was 145 heads. The yield of pure wool is 55%.

Sheep of the Dnieper meat breed are bred in the Dnipropetrovsk region. The breed was bred in Ukraine as the first Ukrainian meat breed. For this purpose, Askanian meat-wool breed and Meat Merinolandshaf were used like parent forms (Eroxyn, 2000; Kolosov et al., 2012; Polska, 2006; Pomitu, 2010). Sheep of this breed are characterized by good meat performance and precocity. Ewes have high reproduction rates. At the beginning of 2019, only one breeding farm was registered in Ukraine for their breeding: in the Dnipropetrovsk region. The yield of pure wool was – 52%.

The Latvian dark-headed breed are precocious animals with pronounced meat forms. Ewes are characterized by high milk quality. Breeding sheep of this breed in Ukraine at the beginning of 2019 are registered only in the one breeding farm of Volyn region. The yield of lambs in this farm was 145 heads per 100 ewes, the yield of pure wool – 55%.

Ukrainian mountain Carpathian breed is bred in the western regions of Ukraine. The breed is a local breed and was historically created based on the crossing of local rough-haired mountain Carpathian sheep with semi-fine-wool Tsigai sheep. The yield of pure wool is 65–72%, and the yield of lambs per 100 ewes – 102 heads. Ewes are characterized by high milk productivity and are well adapted to the humid and cold climate of the Carpathian mountains. Animals are characterized by wool with high-fat content and the presence of under hair.

The Sokilska breed is a local breed that belongs to rough-haired breeds of multipurpose use (lambskin and dairy). It was bred in the 17th century in the Poltava region due to the selection of local sheep with a grey lambskin and their improvement by crossing with the Karakul breed. Sheep are characterized by endurance, they are unpretentious, highly productive. The main type of product from them is to obtain lambskin from slaughtered lambs at 1–3 days of age. The splitting of colours in the breed is 80% grey to 20% black. Breeding sheep are bred in the Kharkiv region, where the yield of lambs per 100 ewes is 90 heads. Now this breed lost on importance and kept only as heritage.

In addition to these breeds, Ukraine also breeds more than 10 different breeds (Suffolk, Tsigai, Hissar, Dorper,

Lacaune, Charollais, Texel, etc.), which are not currently officially registered. The belonging to these breeds is determined based on the appearance of the animals and the information from the owner. The largest number of such animals belong to the Hissar and the Lacaune breed.

At present there are different opinions how the sheep production will be and need to be developed.

It is obvious that some producers will continue to keep sheep of wool breeds and use natural pastures, trying to follow the traditional technologies.

The other producers, analysing the situation on the world market in terms of consumer demands, will shift to sheep meat production. Some steps to develop a population of meat sheep by long-term crossing of ewes of wool breed and multipurpose breed with meat rams in Ukraine has already been taken. The increasing of popularity of meat breeds and the import of purebred meat animals for crossbreeding are expected in the near future.

It is expected the increasing of production of lamb and sheep meat on hybrid basis, with the specialisation of breeds to maternal and paternal.

Along with the change in the structure of the breeds, the farm management system will be changed, new technologies for keeping and feeding, and accounting will be introduced. The sheep industry can move from extensive pasture production technologies to indoors animals housing, avoiding the effects of seasonal feeding and reproduction factors.

The combination of suitable genetics and intensive technologies will allow producers to get high quality meat products at reasonable cost.

An example of a successful transformation of breeding systems and implementation of a new breeding strategy can be sheep breeding in Slovakia. A period in the Slovak territory, during the planned economy in the second half of the 20th century, was characterized by zoning of sheep breeding. There were three zones established: fine-wool breeds (FWB) zone, medium-wool breeds (MWB) zone and carpet-wool breeds (CWB) zone. In the late 1980s, the proportion of total sheep population in zones was as follows: the 33% in the FWB zone, the 44% in the MWB zone and the 23% in the CWB zone (Višňovský and Malík, 1987). The FWB zone was located in the Slovak lowlands, used for breeding merino breeds, particularly: Askanian, Stavropol, Caucasian and German (Merinolandschaf) merino. The MWB zone was based in the foothills, up to 500 metres above sea level. Mostly the triple-purpose breed Tsigai (Ts) was used in the MWB zone. A triple-purpose breed, Improved Valachian sheep (IV) and in the small extent the Valachian sheep, were used in mountain

pastures, which formed CWB zone. Sheep breeding was focused particularly on wool production. The Ts, IV and V were also milked, however the production system was extensive. Suckling lambs of the Ts and the IV breeds were finalized as light carcass lambs and the Merino lambs were finished in the intensive feedlots and finalized as heavy carcass lambs.

The sheep population in Slovakia significantly decreased from 699 thousands heads in 1988 to 417 thousands in 1998 as a result of the social changes and onset of the market economy. This situation was caused largely due to the disintegration of the wool industry and the raw wool price drop. A new conception in sheep breeding was created. Since 1993 the sheep milk performance recording (MPR) has been implemented under the methodology of International Committee for Animal Recording (ICAR). The Slovak republic was first of the post-socialist countries, which started an intensive breeding of local sheep breeds (Ts and IV) for milk production. In the first phase of sheep breeding, the selection was performed in pursuance of the phenotypic values. The selection of animals in the second phase was realized on the basis of the breeding values estimated using the Multivariate best linear unbiased prediction – animal model, based on milk yield and content of fat and protein. The milk performance testing using the AC method and it has been routinely recorded by the Breeding Services of the Slovak republic (BS SR). The breeding values of each ewe in the performance recording were estimated also for reproductive parameters (fertilization rate, fertility rate and fertility rate per ewe lambed) and own performance (gains).

The outcome of breeding local breeds in Slovakia for milk production is that the milk yield (in the standardized milking period of 150 days) increased from 81.8 l in 1993 to 110.9 l in 2019 for IV breed. The milk yield of Ts breed increased from 86.0 l to 117.0 l in the same period. Likewise, the Lacaune (Lc) and the East Friesian Sheep (EF) were imported in the 1990s. These two dairy breeds were used for crossbreeding with local breeds, which resulted in the creation of the new composite breed Slovak Dairy Sheep (SD). The creation and characteristic of SD described Margetín et al. (2017). The progress in sheep milk production of the Ts, IV, Lc and SD is in Figure 5. The progress is caused by breeding as well as by improving the production systems from the extensive system to the semi-intensive system. Except of pure breed ewes and crossbreeds, the small population of Assaf is used for milk production. In present time, the dairy sheep represent 77% of 329 thousands sheep, which are bred in Slovakia. Approximately 12.5% sheep are the meat breeds, which have been imported in the beginning of the 2000s. Heavy carcass lambs of the meat breeds, namely in particular: Suffolk, Ile de France, Merino, Romney Marsh, Charollais and Berrichon du Cher are mostly produced in the semi-intensive pasture system. Only few stakeholders produce lambs in the intensive feedlot system. The performance recording of meat breeds covers the reproductive parameters and the gain of lambs since birth to weaning. The prion protein genotyping of the all pure breed rams used for mating
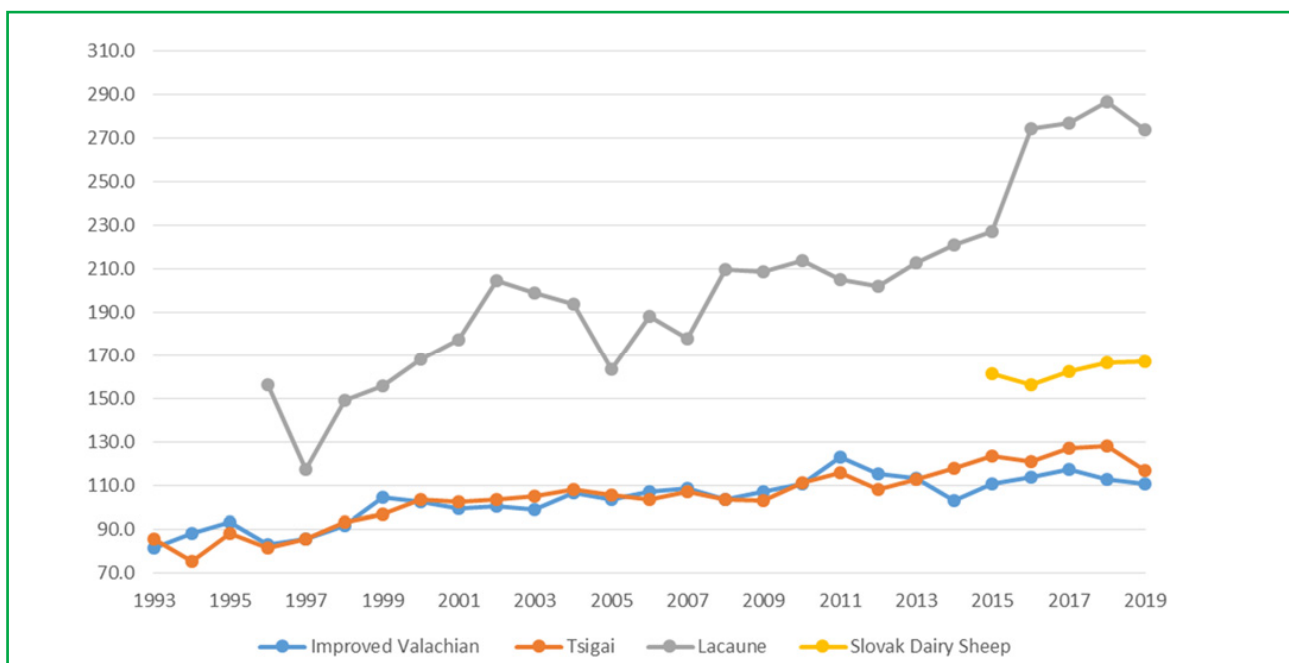

Figure 5 The standard lactation (150 days) milk yields (L) of dairy breeds in Slovakia

is provided for fixation of ARR allele and elimination of undesirable genotypes carrying alleles VRQ and ARQ. All sheep in the Slovak republic have to be registered in the Central Evidence provided by BS SR.

Experience of Slovakian breeders can be seen as an example for Ukrainian farmers. Unfortunately, creating of such system requires the cooperation of different stakeholders and changing of thinking strategy of farmers. Introduced in Slovakia sheep milk performance recording (MPR) cannot be realized at present in Ukraine form different reasons: farmers still believe that the state has to support financially all breeding activities, including milk performance recording. The mobilization of private money for breeding purposes in restricted only by the purchasing of genetic resources. This situation is typical for all farm animals (Ukraine does not have milk performance recording even in the dairy cattle); Ukraine does not have one strong sheep breeders' association, so the farmers breed animals separate in every farm and don't allow other breeders to get access to database; farmers believe that the economic effectiveness of breeding measures is low, so it is better to invest money into new high productivity breeding animals from abroad instead trying to improve local stock. But at the same time there are many sheep breeders, which would like to develop local breeding strategy and need experience from other countries, which have successful story, like Slovakia.

4   Conclusions

Ukraine has good natural and climatic preconditions, as well as customer demands for the development of the sheep industry. In addition to the domestic market, it is necessary to look for opportunities to enter foreign markets. Breeding work in the sheep industry in Ukraine does not meet modern requirements. The total number of breeding stock of 26.7 thousand is insufficient for production needs. The situation is critical for such breeds as the Latvian dark-headed, Ukrainian mountain Carpathian and Sokilska and the number of farms engaged in sheep breeding has critically decreased. In Ukraine there is no organized breeding work regarding many popular breeds of sheep, which are popular among producers and are already available in the country. Ukrainian mountain Carpathian and Sokilska breeds belong to local breeds, but due to the lack of organized selection work they may be lost. To improve the sheep industry in Ukraine it is necessary to implement a set of measures, in particular: extend the system of state support to the sheep industry; promote the construction of slaughterhouses, including the use of the slaughter system HALAL; assist in finding new markets for fattened animals or meat in abroad, especially in countries with

Muslim population; use state support mechanisms to facilitate breeding work; allow to keep registers of breeding animals by producer associations and other interested organizations; simplify the procedure for registration of production facilities for the production of local cheeses and other products; impose a duty on the export of adult animals not for breeding purposes. The implementation of these measures will promote the development of sheep breeding in Ukraine and will serve as a basis for the production of a sufficient amount of high-quality food products and the preservation of traditional food preferences of different regions of the country.

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