BREEDING WORK WITH THE UKRAINIAN BLACK-AND-WHITE DAIRY BREED IN THE SUMY REGION

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Researches were carried out in breeding farms for the breeding of the Sumy inbred type of the Ukrainian black and white dairy breed. The total experimental herd is 1150 cows, 1120 heifers and 62 bulls.

It has been established that the animals mainly come from breeders of four Holstein lines, such as Starbuck 352790 (28%), Bell 1667366 (27%), Chiff 1427381 (26%) and Elevation 1491007 (15%). In recent years, farms have mainly used breeders of three lines, unlike bulls of the Bell 1667366 line. The breeding value of breeders of different lines is slightly different. Bulls of two Holstein lines – Chiff 1427381 and Elevation 1491007 – have the advantage in terms of average breeding value in the amount of milk fat and protein.

The country of origin has a significant influence on the breeding value of breeding bulls. Animals of German selection make up the majority of those used in breeding farms for the breeding of livestock of the Sumy inbred type. A somewhat smaller number of breeders come from the United States of America. The latter are superior to German bulls in terms of average breeding value, both in terms of the amount of milk and the amount of milk fat and protein.

Progeny-descendants, which are more distant from the progenitor of the line, are characterized by a higher average breeding value in comparison with bulls, which are closer to the progenitor according to the pedigree.

In order to create micropopulations with the desired genotypes for beta- and kappa-caseins, homozygous breeders with the A2A2 and BB genotypes are used at the State Enterprise of the Northeast Institute of Agriculture.

The strength of influence of the researched factors on the breeding value is in the range of $\acute{\eta}^2=11.4\text{-}57.9\%$. The year of the bull's birth and the distance from the progenitor of the line have the greatest influence on this indicator (P<0.05-0.001).

In order to preserve the population of the Sumy inbred type of the Ukrainian black and white dairy breed, it is necessary to apply the proposed measures, which include the use of genetic material of breeders of the Ukrainian black and white dairy breed and a certain set of biotechnological measures.

Key words: bull-breeder, line, genealogy, breed, type

ПЛЕМІННА РОБОТА З УКРАЇНСЬКОЮ ЧОРНО-РЯБОЮ МОЛОЧНОЮ ПОРОДОЮ В СУМСЬКІЙ ОБЛАСТІ

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Дослідження проведені у племінних господарствах з розведення сумського внутрішньопородного типу української чорно-рябої молочної породи. Загальне піддослідне поголів'я складає 1150 корів, 1120 телиць та 62 бугаї.

Встановлено, що в основному тварини походять від плідників чотирьох голштинських ліній, таких як Старбака 352790 (28%), Белла 1667366 (27%), Чіфа 1427381 (26%) та Елевейшна 1491007 (15%). За останні роки в господарствах використовують головним чином плідників трьох ліній, а бугаї лінії Белла 1667366 майже не ні. Племінна цінність плідників різних ліній дещо різниться. Перевагу за середньою племінною цінністю за величиною надою, кількістю молочного жиру та білка мають бугаї двох голштинських ліній – Чіфа 1427381 та Елевейшна 1491007.

Значний вплив на величину племінної цінності бугаїв-плідників має країна походження. Тварини німецької селекції становлять більшість серед тих, що використовувалися у племінних господарствах з розведення худоби сумського внутрішньопородного типу. Дещо менша кількість плідників походять зі Сполучених Штатів Америки. Останні переважають німецьких бугаїв за показниками середньої племінної цінності, як за величиною надою, так і за кількістю молочного жиру та білка.

Плідники-нащадки, що більш віддалені від родоначальника лінії, характеризуються вищою середньою племінної цінністю у порівнянні з бугаями, які за родоводом знаходяться ближче до родоначальника.

З метою створення мікропопуляцій з бажаними генотипами за бета- та капа- казеїнами у ДП ДГ Інституту сільського господарства Північного Сходу використовуються гомозиготні плідники відповідно з генотипами A2A2 та BB.

Сила впливу досліджуваних факторів на величину племінної цінності знаходиться в межах $\acute{\eta}^2=11{,}4\text{-}57{,}9\%$. Найбільший вплив на даний показник мають рік народження бугая та віддаленість від родоначальника лінії (P<0,05-0,001).

Для збереження популяції сумського внутрішньопородного типу української чорно-рябої молочної породи необхідно застосовувати запропоновані заходи, які включають використання генетичного матеріалу плідників української чорно-рябої молочної породи та певний набір біотехнологічних заходів.

Ключові слова: бугай-плідник, лінія, генеалогія, порода, тип

Introduction. Dairy cattle breeding is an important component of the agro-industrial complex that ensures food security of Ukraine (Khmelnychyi S. et al, 2020).

In Ukraine, the number of cattle has been decreasing for a long time. At the same time, scientists note the growth of the average milk yield per cow, which currently equals almost 8,000 kg. The reduction of controlled herd leads to the complication of

breeding work with dairy breeds. The Ukrainian black and white dairy breed makes up almost 50% of the breeding livestock of Ukraine, the Holstein makes up a little more than 25%, and the Ukrainian Red-and-White dairy breed makes up 14% (Kruglyak O. V. et al, 2020).

The value of breeders based on certain breeding characteristics significantly affects the effectiveness of the breeding process in dairy cattle breeding. Therefore, scientists recommend the use of bulls-improvers. This is greatly facilitated by the development of biotechnological methods, which allowed intensive exchange of genetic material between different countries (Polupan, Y. P. and Bezrutchenko, I. M., 2022).

Scientists have proven that the effectiveness of selection and breeding work with the dairy breed depends significantly on the successful selection of the breeder. This is due to the fact that the role of heredity in the genetic improvement of the breed reaches more than 90%. This determines the use of breeders-leaders (Polupan Y. P. et al, 2019; Pryima S. V., 2022).

Domestic breeders note that purebred breeding should be the main method of improving local dairy breeds. Nevertheless, the use of the global gene pool of the Holstein breed can be an effective technique for improving breeds. This method is widely used in Ukraine. Scientists claim that animals of the same breed, which are bred in different countries, differ significantly in economic and useful characteristics (Kuziv M. I. et al, 2022; Voitenko S. L. and Sydorenko O., 2019).

The formation of the genealogical structure of domestic breeds was implemented through the theoretical provisions of the linear breeding method. For breeders, initially the development of lines took place through the so-called "long lines". These lines consist of five to six generations. After a certain time, implementation took place through "short lines" consisting of two to three generations. Over the past twenty years, the base of genetic resources is represented by a broad genealogical structure of breeders and their sperm production belonging to 26 lines of the Holstein breed. Moreover, scientists outline the narrowing of the genealogical structure due to the large number of breeders of the Chiff 1427381 and Elevation 1491007 lines (Pochukalin A. Y., et al, 2022).

Domestic scientists state a significant reduction in the genealogical lines of dairy breeds of Ukraine. Thus, only two lines out of twelve, which were approved during the creation of the Ukrainian Red-and-White dairy breed, remained at the beginning of 2023. Most cows of this breed today come from Holstein breeders. The authors note that breeders of the Holstein breed come from different countries. They are representatives of the lines: Astronaut 1458744, Ivanhoe 1189870, Bell 1667366, Bootmake 1450228, Valiant 1650414, Jocko Besn 5694028588, Elevation 1491007, Marshall 2290977, Maple 218036, R. Sovereign 19 8998, Citation 267150, Starbuck 352790 and Chiff 1427381. This indicates that the main method of breeding domestic dairy breeds is absorptive crossing, the consequence of which is an increase in conditional blood for the Holstein breed (Voitenko S. L. et al, 2022; Ilnytska O. Y. et al, 2018).

The effectiveness of the use of Holstein breeders in order to increase the level of milk productivity of local breeds has been proven. However, there is no consensus among scientists and breeders-practitioners regarding the level of desirable conditional blood of the Holstein breed in the genotype of domestic breeds (Pochukalin A. Y. et al, 2022; Sydorenko O. V., 2020; Khmelnychyi L. M., and Vechorka V. V., 2018).

It is known that as a result of purposeful breeding work, breeders in the United States of America, Canada and Israel have achieved the desired indicators of Holstein cattle both in terms of milk productivity and the milk type of animal body structure. However, with a high level of milk yield, low fat and protein content in milk was noted in most herds. Thus, the fat content of milk was in the range of 2.9-3.4%. We should

outline that the recognized record holder Alinde Elen, with an annual milking of 25,242 kg, had a milk fat content of 2.8%. Researchers also claim the influence of the country of origin on the level of milk productivity of cows. The milk productivity of cows in the countries listed above is 9.7-10.4 thousand kg of milk per lactation, which is higher by 1.5 thousand kg compared to cows of European breeding (Netherlands, Belgium, Italy, Germany). However, the content of fat and protein in their milk was lower and amounted to 3.50-3.60% and 3.05-3.10%, respectively. Therefore, scientists claim that milk productivity is genetically determined in each individual population (Krugliak A. P. et al, 2021; Krugliak A. P. and Krugliak T. O., 2021).

Today, the genealogical structure of the Holstein breed in Ukraine includes 16 lines. The most numerous lines are Elevation 1491007, Chiff 142781, Starbuck 352790. Their share is more than 70% (Pochukalin A. Y., and Pryima S. V., 2021).

The important issue is the presence of a breeding base with the necessary level of amplitude of genetic resources. Continuous monitoring makes it possible, if necessary, to analyze and adjust the breeding program of domestic breeds (Pochukalin A. Y. et al, 2022).

Hereditary factors that affect the level of selection traits include paternal origin and lineal affiliation. Conducting constant monitoring of the genealogical structure of the Ukrainian black and white dairy breed proves the influence on the heredity of animals of the world gene pool of the Holstein breed (Shuliar A. L. et al, 2020; Voitenko S. L. and Zheliznyak I. M., 2019). This is what determines the necessity of conducting our research.

The purpose of the work is to study the genealogical structure of the breeders of the Holstein breed, which are used in breeding farms for the breeding of cattle of the Sumy inbred type of the Ukrainian black and white dairy breed, and to establish the influence of lineal affiliation, country of origin and year of birth on the size of their breeding value.

Research materials and methods. The research was carried out at the breeding plant for the breeding of livestock of the Sumy inbred type of the Ukrainian black and white dairy breed of the State Enterprise "Experimental Farm of the North East Institute of Agriculture of of the National Academy of Sciences", the breeders "Pershe Travnya", "Iskra" of the Sumy district, Sumy region. The total experimental herd is 1150 cows, 1120 heifers and 62 breeders.

The influence of such factors as lineal affiliation, country of origin, degree of kinship with the progenitor of the line, and year of birth was determined. Relevant information was obtained when working with pedigree registration documentation (Form 2-Mol cards) and using the SUMS ORSEK database.

The amount of breeding value was determined according to the website https://www.cdn.ca/query.

Statistical processing was performed using the STATISTICA 10 application program package.

Research results. As a result of the conducted research, we found that over the past seven years, Holstein breeders were widely used for the insemination of cows and heifers in Sumy inbred cattle breeding farms of the Ukrainian black and white dairy breed. Accordingly, the genealogical structure of breeding farms of this type is represented by lines of the Holstein breed (Fig. 1).

Almost equal share of cows comes from three Holstein lines: Starbuck 352790, Bell 1667366 and Chiff 1427381 – 26-28%. The share of Elevation 1491007 line cows is somewhat smaller – 15%, less than 5% of the herd structure consists of animals of the Valiant 1650414 line. However, this structure has significant differences in individual

herds. Thus, in the breeding plant of the State Enterprise "Experimental Farm of the North East Institute of Agriculture of of the National Academy of Sciences", there are no animals of the Bell 1667366 and Valiant 1650414 lines at all. In this farm, animals of the Elevation 1491007 (38%) and Chiff 1427381 (34%) lines predominate in number.
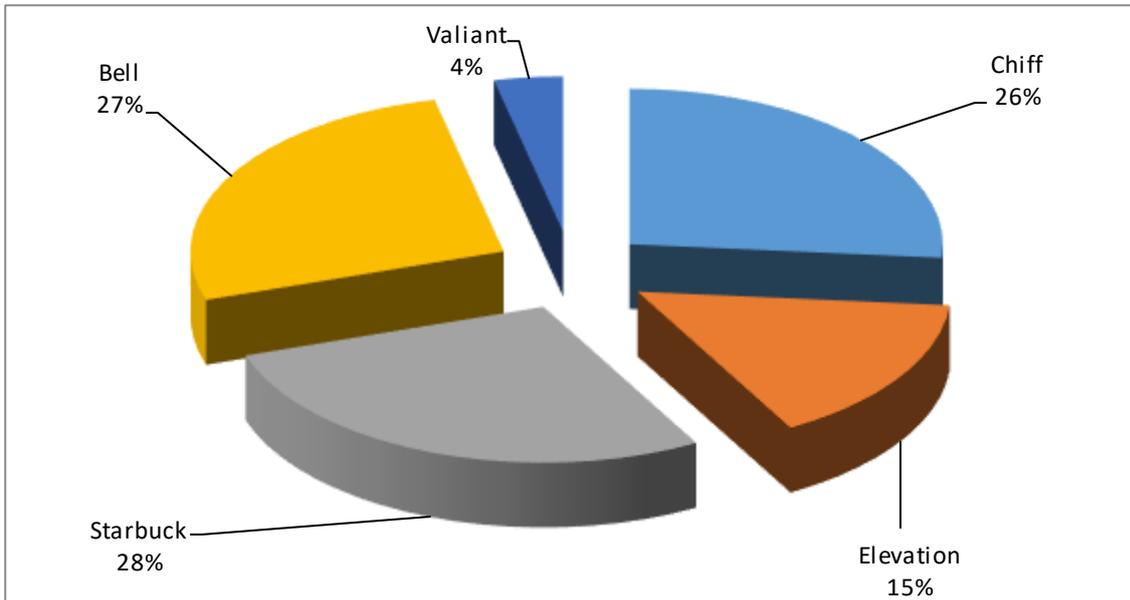

Fig. 1. **Genealogical structure of cows of breeding herds**

According to the level of milk productivity during the first lactation, there was no significant difference between animals of different lines. According to the analysis of the last completed lactation, we note the preference of animals of the Elevation 1491007 line, which have a productivity of more than 8.0 thousand kg of milk per lactation. The animals of the Chiff 1427381 and Starbuck 352790 lines are somewhat inferior to them (Fig. 2).
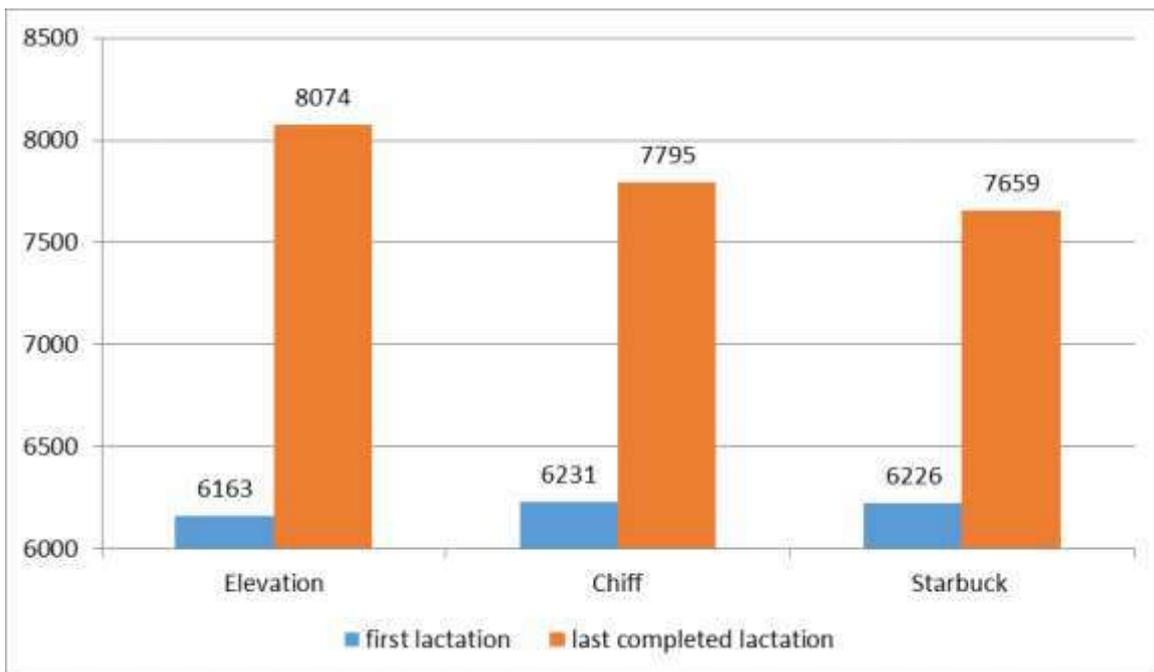

Fig. 2. **The amount of milk yield from cows of different lines**

In the breeding center "Pershe Travnya", the majority of animals come from breeders of the Starbuck 352790 (34%) and Chiff 1427381 (31%) lines, the cattle of the Elevation 1491007 and Bell 1667366 lines make up 17 and 12%, respectively, and the Valiant 1650414 line is only 6%.

Cows of Starbuck 352790 (32%), Chiff 1427381 (28%) and Bell 166366 (27%) lines have a larger share in the genealogical structure of Iskra LLC breeding center. Animals of the Elevation line 1491007 make up 11%, and Valiant 1650414 line – 2%.

Significant changes in the genealogical structure of the studied type were established as a result of the study of the genealogical structure of heifers kept in breeding farms. They do not have heifers that come from breeders of the Valiant 1650414 line, and the share of animals of the Bell 1667366 line has decreased by 25% and is only 2%. The share of animals of the Elevation 1491007 line, which is more than 40%, has significantly increased. The proportions of animals of the Chiff 1427381 and Starbuck 352790 lines did not change significantly (Fig. 3).
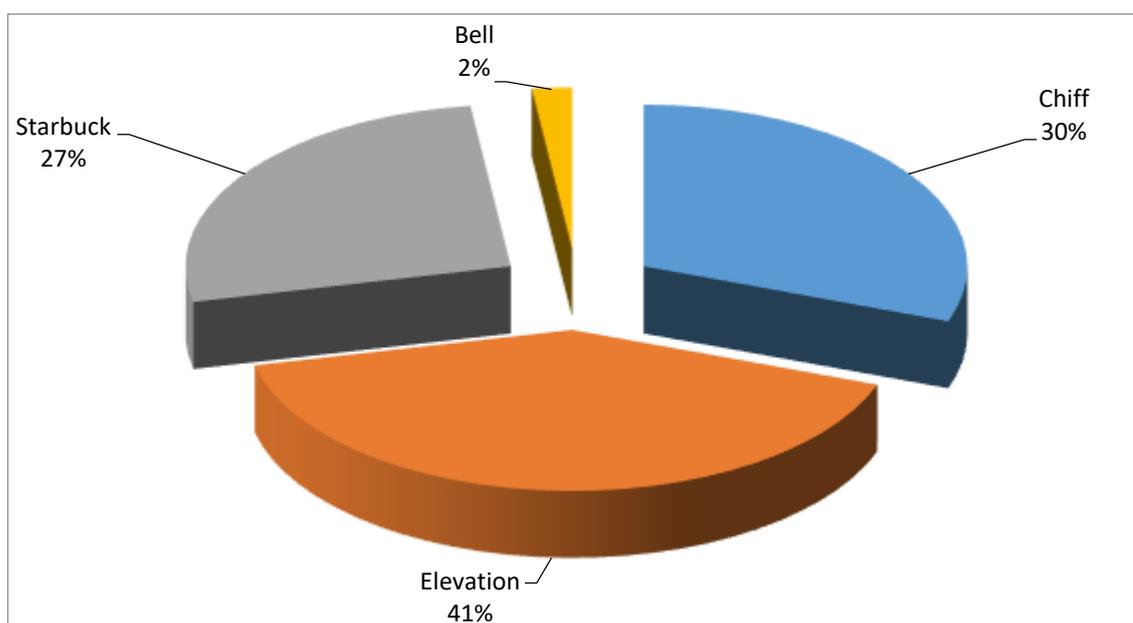

Fig. 3. **Genealogical structure of heifers of breeding herds**

In the breeding plant of the State Enterprise "Experimental Farm of the North East Institute of Agriculture of the National Academy of Sciences", in connection with the termination of the use of breeders of the Starbuck 352790 line, there are no heifers of this genealogical line. Heifers of the Elevation 1491007 and Chiff 1427381 lines have equal shares in the farm (50% each).

Heifers of the Chiff 1427381 line in the holding of "Pershe Travnya" dominated, which made up 48%. Almost the same number of heifers in the farm came from breeders of the Elevation 1491007 (25%) and Starbuck 352790 (22%) lines. Animals of the Bell 1667366 line make up a small share – 5%.

In the pedigree breeder of Iskra LLC, most of the heifers come from Elevation 1491007 line (43%). Animals of Starbuck 352790 and Chiff 1427381 lines accounted for 34% and 22%, respectively. Line Bell 1667366 is not developing in the farm, the number of heifers is only 1%.

According to the results of research, in general, in the studied farms, the most numerous lines of Chiff 1427381, Starbuck 352790, Elevation 1491007 in terms of the number of breeding stock were represented by a larger number of parent bulls, 19, 17,

21 heads, respectively. The number of parent bulls of the Valiant line was 3 heads, of the Bell 1667366 line – 2 heads.

The sires of the Chiff 1427381 line (448±166.6) are distinguished by the highest average breeding value in terms of the greatest milk yield. They prevail over the breeders of the Elevation 1491007 line (380±115.4), although no statistically significant difference was established between them. The average breeding value of bulls of the Starbuck 352790 line (-94±203.0) had a negative value and the difference with the sires of the Chiff 1427381 line was statistically significant (P<0.05). The significant difference was also established between the studied parameters of the breeders of the lines Starbuck 352790 and Elevation 1491007 (P<0.05). The breeders of the Bell 1667366 line had a negative value of the average breeding value (-79±229.3). The breeders of the Elevation 1491007 line (36±7.6) were distinguished by the higher average breeding value in terms of the amount of milk fat. The difference between them and bulls of Starbuck 352790 (-0.6±4.3) and Bell 1667366 (-16±19.4) lines was statistically significant (P<0.001; P<0.05, respectively). The average breeding value of the breeders of the Chiff 1427381 line was also higher than that of the breeders of the Starbuck 352790 and Bell 1667366 lines (respectively P<0.001; P<0.05). According to the amount of milk protein, the average breeding value was higher in breeders of the Elevation 1491007 line (32±5.7). Starbuck 352790 (-4.9±4.7) and Bell 1667366 (-7±8.2) lines were inferior to them with a statistically significant difference (P<0.001 and P<0.01, respectively). The average breeding value according to the qualitative characteristics of the milk productivity of the daughters of the breeders of the Chiff 1427381 line was 29±8.0 and 21±6.3, respectively, and in terms of the amount of milk protein, they exceeded the bulls of the Starbuck 352790 line with a statistically significant difference (P<0.01).

We should outline that the average breeding value of the bulls from which the heifers came was higher than that of the breeders that were the parents of the cows. By the amount of yield, it was 361±165.5 and 141±105.5, respectively; by the amount of milk fat – 13±4.7 and 31±7.9; by the amount of milk protein 26.3±6.2 and 7±3.9 (P<0.05).

By country of origin, the majority of breeders are representatives of European breeding, which make up more than 50% of the researched herd (Fig. 4).
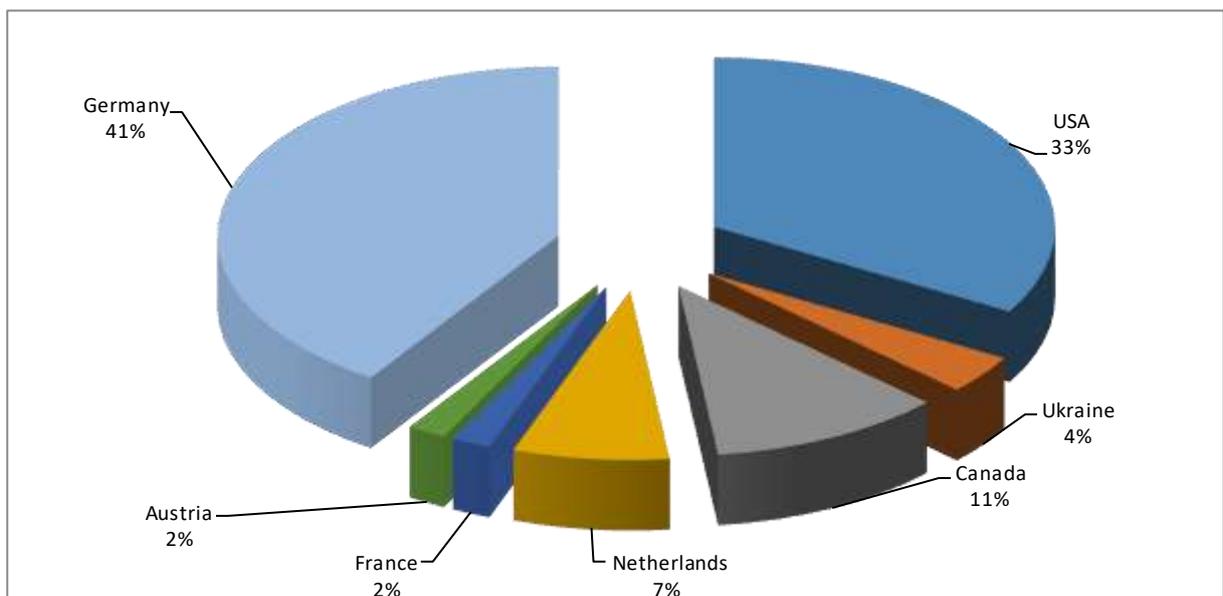

Fig. 4. **Distribution of breeders by country of origin**

In terms of the number of bulls, representatives of the German breed outnumber all others. But at the same time, they have a negative average breeding value by the amount of yield (-26±135.5). Breeders of North American selection make up a little more than 40%, among which the majority are representatives of the selection of the United States of America. They have higher than average breeding value for milk yield (599±137.7) and milk protein (31±5.6) among the studied bulls. They outperform German breeders in these characteristics with a statistically significant difference (P<0.01). By the amount of milk fat of German breeders, bulls of both American (34±7.9) (P<0.01) and Canadian breeding (38±16.9) (P<0.01) prevail.

The most numerous line, Starbuck 352790, originates from the son of the outstanding breeder Elevation 1491009. In the process of breeding the Sumy inbred type, this line develops through the branch of the son of the progenitor of the great Aerostar 383622. There are seven breeders in this branch. Two other branches, which are currently separated into separate lines by individual breeders – Mtoto 6001001962 and Jocko Besn 5694028588 – have a smaller number of used brooders – four and two heads, respectively (Fig. 5).
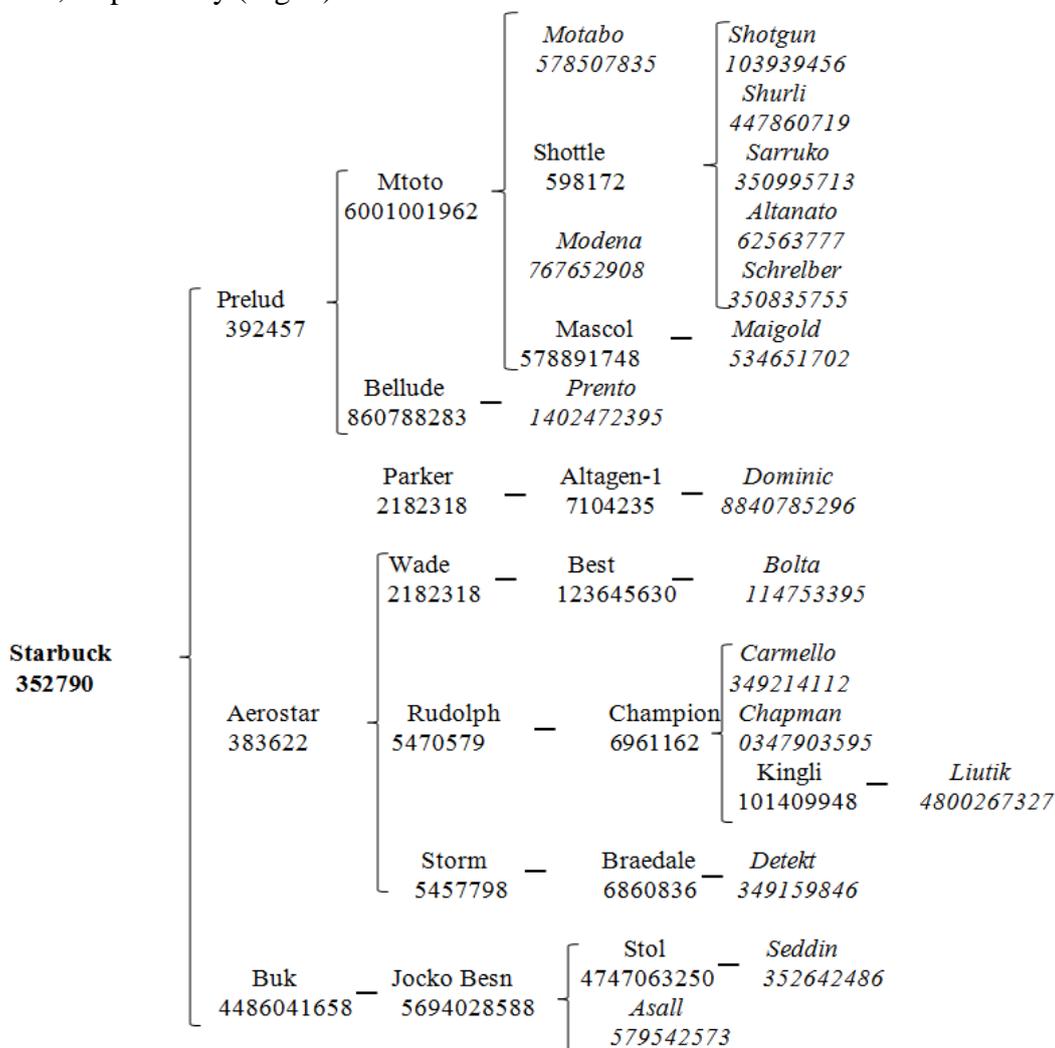

Fig. 5. **Genealogical scheme of the bulls of the Starbuck 352790 line**

Most of the researched breeders of this line are representatives of European se-lection, namely the countries: Germany, France, the Netherlands, and Ukraine. Only one representative of each represents the Canadian and American selections.

The progenitor of the Elevation 1491007 line is the great-grandson of the fa-mous breeder Vis Ideal 933122. In Ukraine, this is the second line in terms of the num-ber of breeders used in the selection process. Breeders of two lines are used in the breeding work with the brood stock of the Sumy inbred type: with the sons of Bova 1665634 and Tradition 1682485 and grandsons of Cletus 1879085 and Leadman 1983348. With the son of Bova 1665634, the line is represented by nine breeders, and with the line of Tradition 1682485 – by seven ones. Most of the bulls are of American origin – 50%, German – 31%, a small share is presented by Canadian and Dutch breed-ers (Fig. 6).

Chiff 1427381 line is considered the most numerous line in terms of the number of Holstein breeders in Ukraine (Fig. 7).

The development of this line during the breeding of livestock of the Sumy inbred type occurs similarly to the national Ukrainian through three sons: Mark 1773417, Chiff 1556373, Chiff 1578139.

However, there are differences. If it is considered that in Ukraine, a larger num-ber of breeders come from the Chiff 1556373 line, then this line is the least numerous when breeding the studied inbred type. The share of its bulls from all is only 12%. The most numerous is the group of breeders of the Chiff 1427381 line, which are descend-ants of the bull Blackstar 1929410. The share of these breeders used in the researched herd is 67%. By origin, the breeders of the Chiff 1427381 line were distributed almost equally among European and North American selections, respectively 47 and 53%. The largest number of bulls came from the United States of America (35%) and Germany (29%).
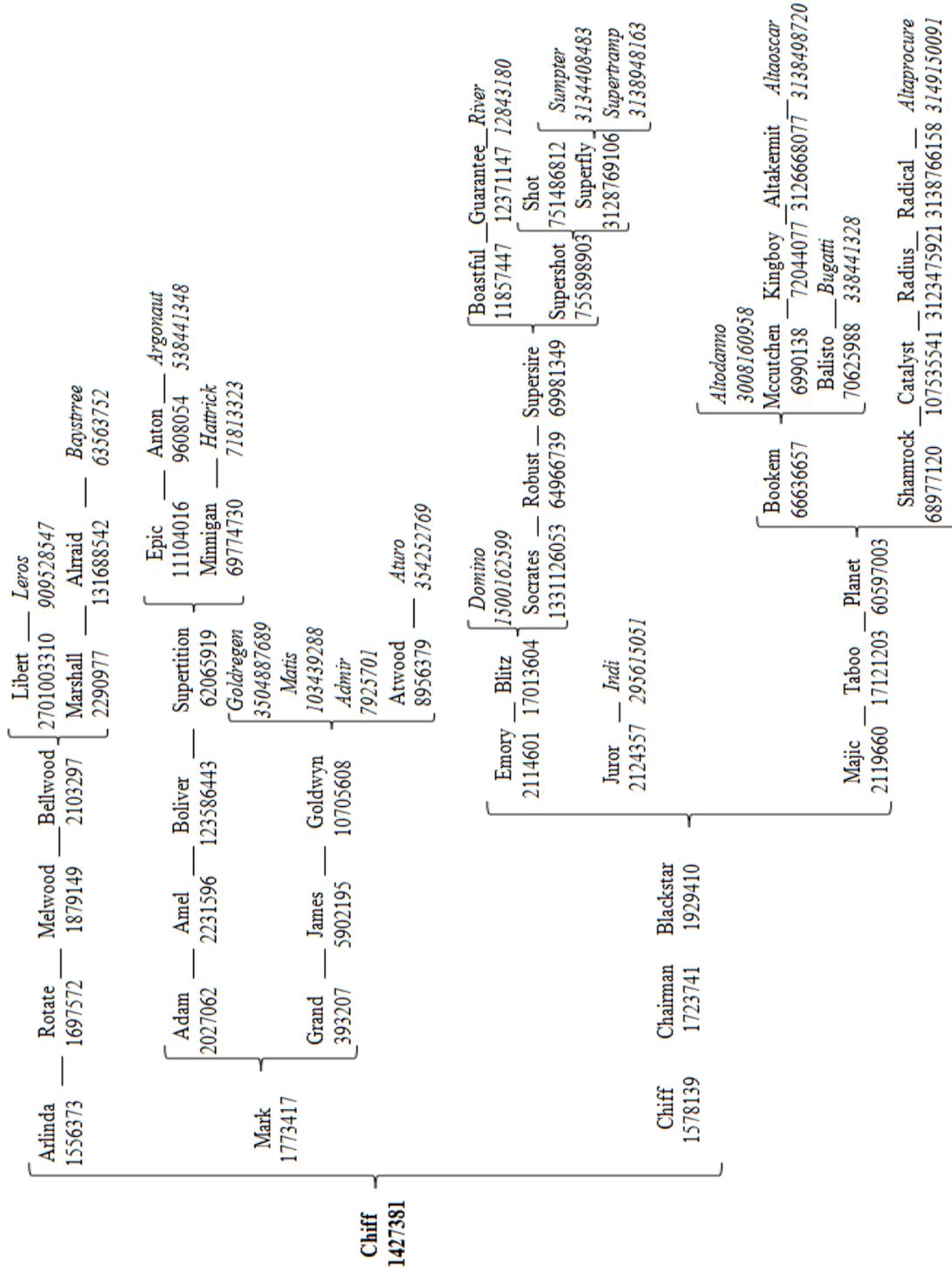
Fig. 6. **Genealogical scheme of the bulls of the Elevation 1491007 line**

Fig. 7. **Genealogical scheme of bulls of the Chiff 1427381 line**

The Bell 1667366 line is currently represented by three breeders, two of them are of German origin, in the work with the Sumy inbred type. Another bull is a representative of American breeding (Fig. 8).
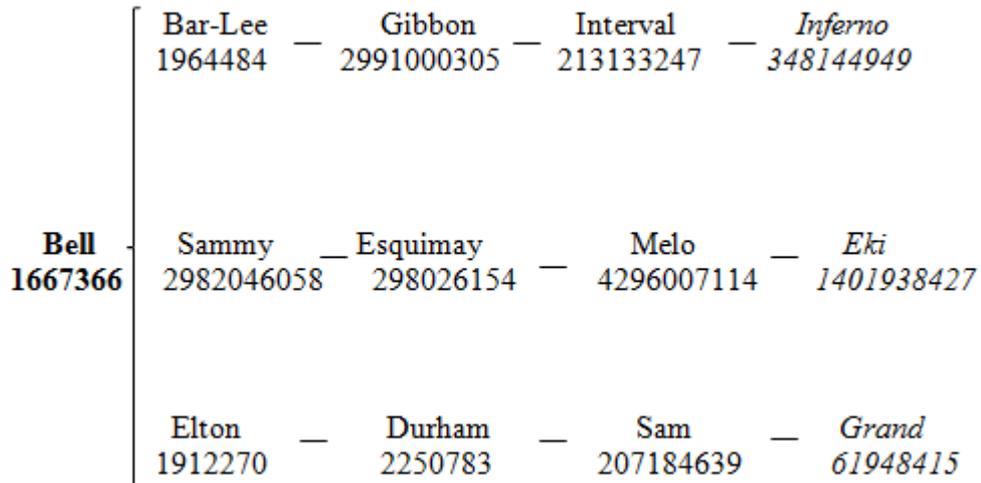
Fig. 8. **Genealogical scheme of bulls of the Bell 1667366 line**

The Valiant 1650414 line is represented by two bulls of the Ukrainian black and white dairy breed and is no longer used in breeding farms today (Fig. 9).
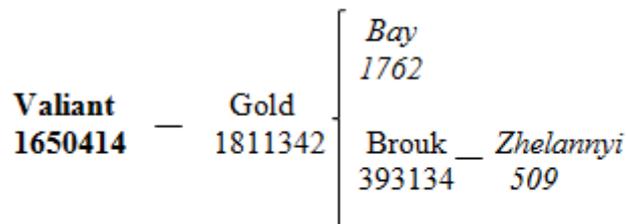

Fig. 9. **Genealogical scheme of bulls of the Valiant 1650414 line**

It was established that the breeders used in dairy herds were located in 2-11 rows from the progenitors of the lines (Fig. 10).

Bulls of the Valiant 1650414 line were in the 2nd and 3rd row from the progenitor, the Bell 1667366 line – in the 4th row. Most of the breeders of the Starbuck 352790 line were in the 4th row, although some moved away from the progenitor to the 5th and 6th rows. The offspring of the Chiff 1578139 and Elevation 1491007 lines were located in more distant rows from the progenitor – 5-11.

Having analyzed the average breeding value of breeders depending on the degree of kinship with the progenitor, we found out that there is a logical increase in this indicator as it was further from the latter. In our opinion, this is due to the fact that foreign breeders pay less attention to the genealogical origin of breeders, and more attention to their breeding characteristics. A statistically significant difference was established in the average breeding value by the amount of yield, considering the breeders located in the third and eleventh rows from the progenitor (1415; P<0.001), the fourth and eleventh (778; P<0.05), the fifth and eleventh (818; P<0.01), sixth and eleventh (858; P<0.05). According to the average breeding value for milk yield, a similar tendency of superiority over breeders of the third-sixth row is also characteristic of breeders located in the seventh-tenth rows.
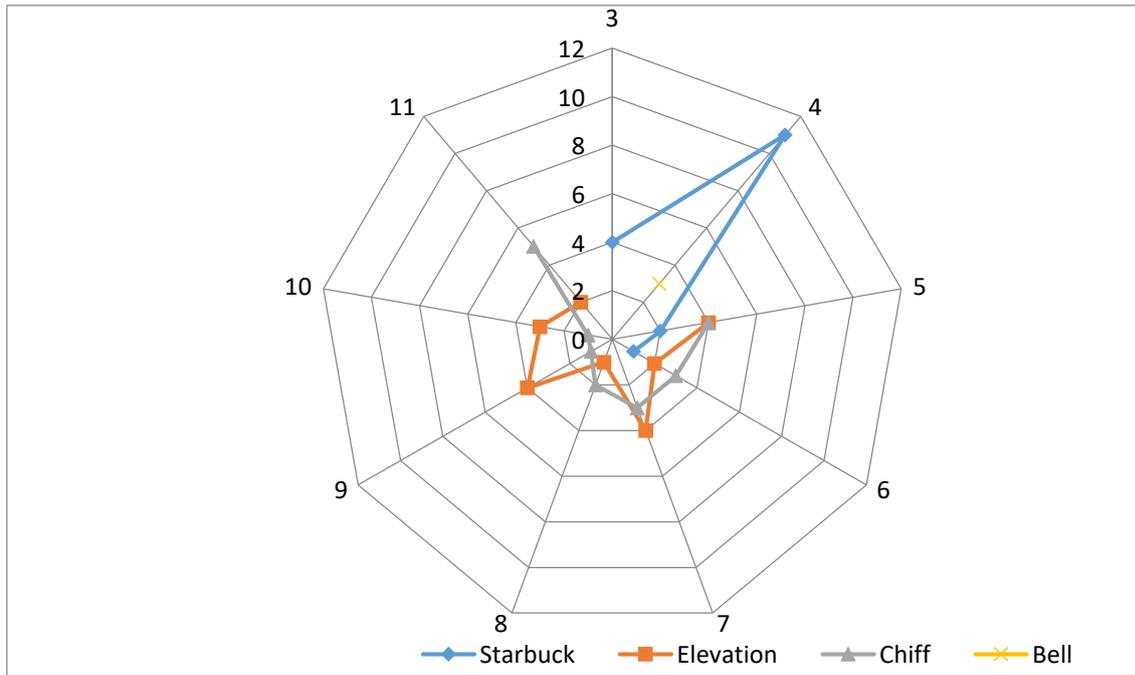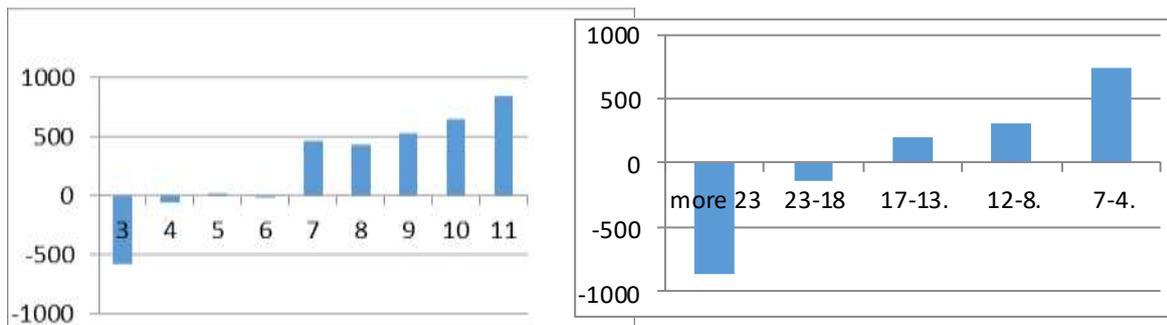
Fig. 10. **Degree of kinship with the progenitor of the line, generations**

This is confirmed by the results of research concerning the influence of the year of birth on the value of the breeding value of the breeder. Thus, we established that with a decrease in the age of the breeder (meaning the year of birth), there is a logical increase in its breeding value. The average breeding value of breeders aged 4-7 years is higher than the breeding value of breeders older than 23 years old by 1611 (P<0.01), aged 23-18 – by 891 (P<0.01), aged 13-17 – by 542 (P<0.05), 8-12 years old – by 433 (P<0.05) (Fig. 11).

The degree of kinship with the progenitor of the line, generations

Age of breeder, years

Fig. 11. **Dependence of the average breeding value on the relationship with the progenitor of the line and the age of the breeder** (age means the number of years from the date of birth of the breeder until 2023)

Similar trends regarding the growth of the value of the average breeding value with a decrease in the degree of consanguinity and the age of bulls are characteristic of the amounts of milk fat and protein.

Recently, domestic breeders began to pay more attention to the determination of the genotype of animals by genes that affect the formation of economically useful traits (Kulibaba R. et al, 2023).

Thus, domestic scientists conduct research on the formation of micropopulations of dairy cattle with the desired genotypes for beta- and kappa-casein. A similar purposeful company is also conducted in the Sumy inbred breeding farm. Such a farm is the State Enterprise "Experimental Farm of the North East Institute of Agriculture of of the National Academy of Sciences".

It was at this farm that a group of cows for the production of A2 milk was formed for the first time in Ukraine. And already in 2020, such milk was put on the shelves of shops in the city of Sumy.

Work on the formation of a herd of animals with the A2A2 genotype for beta-casein continues today. Among the breeders from which the heifers in this farm come, nine out of ten have the A2A2 genotype (one has the heterozygous A1A2 genotype), which is provided for in the selection and breeding plan for working with the dairy herd. In other farms, where similar work is not provided, breeders are used that have not been evaluated for beta-casein genotype. Practitioners may have a question about the breeding value of bulls (n=11) with the A2A2 genotype, from which heifers in farms come. According to the results of our research, these breeders have an average breeding value for milk yield of 854±181.1, the amount of milk fat – 57±10.3, and milk protein – 50±6.0. These values are higher than the average breeding value of breeders (n=26), from which the heifers in the Sumy inbred breeding farms of the Ukrainian black and white dairy breed originate (respectively, 493 (P<0.05); 26 (P<0.05); 24 (P<0.05). That is, the use of bulls evaluated by the genotype of the beta-casein gene will allow not only to obtain milk of the desired quality, but also ensure breeding progress in dairy herds.

Similar work is also being done at the State Enterprise "Experimental Farm of the North East Institute of Agriculture of of the National Academy of Sciences", on the formation of a dairy herd for the production of more pure milk. For this purpose, genotyping of cows for this trait was carried out on the farm, and breeders with the desired genotype of BB according to kappa-casein were assigned to the breeding herd (n=8). Their average breeding value for milk yield is 507±130.2, the amount of milk fat is 56±11.1, and milk protein is 42±7.6, which is higher than the average indicators of breeders with other genotypes for kappa-casein (n=26). A statistically significant difference was established in favor of breeders with the BB genotype in terms of breeding value according to the amount of milk fat in milk (P<0.05). It should be noted that in the breeder of Iskra LLC, bulls are used that have not been evaluated for the kappa-casein gene, and in the breeding center "Pershe Travnya" a proportion of the breeders are evaluated, but have AA, AB, AE and VE genotypes. Animals of these genotypes are considered to produce milk with the quality worse for obtaining cheese. Therefore, breeders of these genotypes (n=10) are not recommended to be used in the breeding stock. It should be noted that their average breeding value for milk yield is slightly higher (786±254.4) than experimental animals with the BB genotype, but they are inferior to them in terms of the average breeding value for the amount of milk fat (39±14.6) and protein (37± 10.3). No statistically significant difference was found.

According to the results of univariate variance analysis, we confirmed the presence of statistically significant influence of such factors as lineal affiliation, country of origin, year of birth and degree of kinship with the progenitor of the line on the breeding value of the breeders (Table 1).

Table 1

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The influence of individual factors on the breeding value of breeders

Indicator	Factor			
	linear belonging	country of origin	year of birth	degree of kinship
Yield	11.4	16.6*	27.7**	25.8*
Milk fat	26.3**	15.1*	47.6***	48.3***
Milk protein	31.6***	22.1**	57.9***	53.2***

*Note: * - P<0.05; ** - P<0.01; *** - P<0.001;*

It has been established that lineal affiliation does not have a statistically significant effect on the breeding value of bulls by the milk yield. In our opinion, this is due to the fact that selections for increasing the yield have begun to pay less attention to other economically useful traits. It should also be noted that in countries with developed dairy breeding, breeders are usually obtained with the help of interlineal crosses. On the contrary, linear belonging has a statistically significant effect on the indicators of breeding value of the amount of milk fat and protein. This confirms the opinion that breeders began to pay more attention to qualitative indicators of milk productivity. The country of origin of the bull probably influenced all the investigated indicators. The high influence of the year of birth and the degree of kinship with the progenitor on the breeding value of breeders in terms of the amount of milk fat and protein is confirmed by the breeders' interest in improving the quality of milk.

It should be mentioned that the widespread use of breeders of the Holstein breed on the brood stock of the Sumy inbred type of the Ukrainian black and white dairy breed led to a significant increase in conditional blood for the improving breed. The biggest share of first-borns and heifers in breeding farms have conditional blood of the Holstein breed above 95%. This creates a threat of the complete disappearance of the Sumy inbred type of the Ukrainian black and white dairy breed and its transformation into the Holstein breed. This can be prevented by using a family of breeders of the Ukrainian black and white dairy breed, which is stored in the Sumy Breeding Center LLC, for insemination of the brood stock. Another possible direction is the use of biotechnological measures to obtain and preserve biological material (egg cells, epididymal spermatozoa, embryos). However, this work requires financial support from the state.

Discussion. As a result of our research, we can determine that Holstein breeders are widely used in breeding cattle herds of the Sumy inbred type of the Ukrainian black and white dairy breed, which has led to a significant increase in conditional blood for the improving breed. These results fully coincide with the results of other researchers (Kuziv M. I. et al, 2022; Voitenko S. L. and Sydorenko, O., 2019). In recent years, there has been a narrowing of the genealogical structure of breeders of Holstein cattle due to the mass use of breeders of three Holstein lines Starbuck 352790, Elevation 1491007, Chiff 1427381, which is also noted by domestic researchers (Pochukalin A. Y. and Pryima S. V., 2021). The dependence of breeding value of breeders on country of origin and year of birth was also established (Kuziv M. I. et al 2022; Voitenko S. L. and Sydorenko O., 2019). Recently, breeders began to pay attention to the genotypes of breeders for milk proteins (Kulibaba R. et al, 2023). Therefore, we can claim to confirm the general trends regarding the use of breeders of the Holstein breed in Ukraine.

Conclusions 1. It was established that most of the cows originate from breeders of four genealogical lines of the Holstein breed: Starbuck 352790 (28%), Bell 1667366 (27%), Chiff 1427381 (26%) and Elevation 1491007 (15%). At the same time, the genealogical structure of the heifers is represented mainly by three genealogical lines: Elevation 1491007 (41%), Chiff 1427381 (30%) and Starbuck 352790 (27%).

2. The interlineal differentiation of the breeding value of breeders was established by the amount of milk yield, the amount of milk fat and protein. The statistically significant difference was established between individual genealogical lines according to the investigated indicators. The higher average breeding value in terms of milk yield is characteristic of breeders of the Chiff 1427381 line (448±166.6), and in terms of the amount of milk fat and protein – the Elevation 1491007 line (36±7.6) and (32±5.7), respectively.

3. A greater number of breeders are of German and American origin, with the latter prevailing in breeding value for milk yield, amount of milk fat and protein, respectively (599±137.7), (34±7.9), (31±5.6) (P<0.01).

4. There is an increase in the average breeding value of bulls with an increase in the indicator of the number of generations between the breeder and the progenitor. As the age of breeders decreases, the average breeding value increases.

5. In the experimental farm, heifers come from breeders with a genotype for beta-casein A2A2 and for kappa-casein BB, which contributes to obtaining animals with the desired genotypes according to these genes.

6. As a result of one-factor variance analysis, a statistically significant influence of linear affiliation, year of birth, distance from the progenitor, country of origin on the breeding value of the breeders was established.

7. In order to preserve the Sumy inbred type, we recommend using a family of breeders of the Ukrainian black and white dairy breed for insemination of the brood stock and applying biotechnological measures to obtain and preserve biological material.

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