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ECONOMIC WEIGTHS OF PRODUCTION AND FUNCTIONAL TRAITS AND THEIR IMPORTANCE IN SETTING UP BREEDING PROGRAMS WITH A POSITIVE IMPACT ON DAIRY SHEEP GROWING PROFITABILITY: A REVIEW

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Abstract

This article is a review of studies carried out in relation to calculation of the economic impact of various productive and functional traits in dairy sheep in connection with setting economically reasoned breeding goals in the breeding programs. Milk yield was found to be considered the main selection trait ensuring the sustainability of dairy sheep farms, subsequently complemented by quality traits such as protein and fat content, and somatic cell score (SCS). It has been also established that improving the reproductive performance of animals, fertility, survival and growth rate of lambs are also important for modern breeding programs, given that a large part of the farm income comes from lamb sales. In Bulgaria, economic values and weights for dairy sheep have been calculated only for two separate flocks of the Bulgarian dairy synthetic population and so far they have not been taken into account in the breeding programs. Calculation of economic weights of productive and functional traits for this dairy population would provide valuable information on which traits are of greatest economic importance and which should be emphasized in the breeding programs.

Key words**:** *sheep, breeding goals, genetic progress, economic weights, bio-economic models*

INTRODUCTION

Sustainability of livestock production systems is a fundamental issue of scientific debate, especially in the last decades, in view of the global concern about climate change, the negative impact of greenhouse gas emissions, the population emigration, the declining profitability of farms, the preservation of natural resources and biodiversity etc. (Bernués et al., 2011) [7]. According to the commonly accepted understanding of „sustainability“ of livestock systems, they should be environmentally friendly, economically viable, and socially acceptable, with emphasis on animal welfare (Lebacq et al., 2013) [22]. Therefore, the concept of “sustainability” has three main aspects, defined as economic, social, and environmental. Thus, to study and analyze such a complex system, it is necessary to consider the different perspectives of the relevant stakeholders (Belanche et al., 2021) [6], This, in turn, requires cooperation and exchange of knowledge between scientists, as well as the relevant institutions that are involved in making decisions in this direction, etc. (Francis and Goodman, 2010) [12].

Sustainability of European Small Ruminant (i.e. sheep and goats) Sector (ESRS) attracts the attention of science, as it is socially, economically and environmentally beneficial in many countries, although it accounts for a small share of the total livestock production in the EU (Belanche et al., 2021; The future of the EU's sheep and goat sector, 2018) [6, 50].

According to Belanche et al. (2021) [6] the small ruminant production represents only 6% of meat production and only 3% of dairy production in the European Union (EU), based on FAOSTAT statistic database, but even so it makes a significant contribution to achieving

the sustainability goals set by the United Nation (Animal Task Force - ATF, 2019) [4].

In 2013, sheep were reared in 850,000 farms and goats – in 450,000 farms in EU, and more than 1.5 million people in rural areas, including those in marginal zones, were engaged in raising them, thereby ensuring their livelihood (The future of the EU's sheep and goat sector, 2018; Paraskevopoulou et al., 2020) [50, 33]. Additionally, the sector provides multiple ecological benefits such as forest fire protection through sheep grazing during the summer, especially in the areas characterized by a dry and hot climate, as well as maintaining of the landscape and species diversity (Rook et al., 2004; Milán et al., 2003) [39, 27]. However, economic and structural difficulties interfere with the development of the sector, which makes it one of the most vulnerable in Europe (Pulina et al., 2018) [35] and led to a steady decline in livestock number and farms (mainly in sheep farming) (FAOSTAT, 2020) [61].

Inadequate prices of production at the farm-gate and increased production costs are typical for the sector (Vouraki et al., 2020) [55], which results in working below the profitability threshold (Report on the Current Situation and Future Prospects for the Sheep and Goat Sectors in the EU, European Parliament., 2018; Paraskevopoulou et al., 2020) [38, 33]. Thus, the sheep sector was one of the first to receive public support from the Common Agricultural Policy (CAP) as a compensation for income's drop down (Milán et al., 2003) [27].

Even though sheep and goat farming are of secondary importance in comparison to other sectors in EU, CAP measures always give priority to small ruminant farms, in which a significant percentage of the EU workforce is employed (Tzouramani et al., 2019) [54].

However, regardless of direct payments, the sheep and goat sector needs to adopt sustainable practices to be more resilient and competitive in the future (Paraskevopoulou et al., 2020) [33].

In the Mediterranean countries, dairy sheep farming plays an important role in livestock sector. The milk production of the countries in this region provide 45% of total world dairy production from sheep. It also provides employment for part of the population, and income for the farmers and employees, as well as social cohesion in rural and disadvantaged areas (Papanikolopoulou et al., 2023; Tzouramani et al., 2019; Carta et al., 2009) [32, 54, 10]. In general, in the Mediterranean and Black Sea regions, dairy products are traditional for consumers and are an important component of the diet of the population, which is why dairy sheep populations have a strong concentration (Pulina et al. 2018) [35]. In Bulgaria, as a country in the Black Sea region with centuries-old traditions in raising sheep and consuming dairy products from them, dairy sheep account for about 75% of the total population (Slavova and Stancheva, 2023) [44]. In recent years however, dairy sheep sector is facing difficulties, which Papanikolopoulou et al. (2023) [32], for example, explains with the continuously increasing feedstuff and energy costs during the last decade, which strongly affected profitability of farms. However, some authors suggested that dairy sheep sector is expected to overcome them applying appropriate management practices (Pulina et al., 2018; Mazinani and Rude, 2020) [35, 25], due to the growing global demand for dairy sheep and goat products, in relation to the constant world population increase (Papanikolopoulou et al., 2023) [32].

Papanikolopoulou et al. (2023) [32] also highlighted that economic performance of dairy sheep farms and factors affecting their profitability are of great interest especially to less-favoured areas. When it comes specifically to economic sustainability of sheep enterprises economic efficiency of farms is essential for sheep industry progress (Krupova et al., 2012) [20]. An option for increasing the revenues on sheep farms and reducing production costs in order to keep sheep enterprises competitive in the future is by achieving genetic progress, set as a goal in a breeding program (Wolfová et al., 2007, 2009a; Krupova et al., 2012) [57, 58, 20]. Due to the fact that high selection can negatively impact animal robustness (Rauw et al., 1998) [37], breeding objectives must achieve a balance between production, health and welfare (Theodoridis et al., 2018) [51].

Livestock breeding programs require precisely set breeding goals, the focus of which falls on the traits with the greatest impact on farm management and economic results (Theodoridis et al., 2018) [51]. The correct determination of breeding goals is related to the estimation of the economic values of the traits that influence the profitability of the farm (Ponzoni, 1986; Tozer and Stokes, 2002) [34, 53]. Therefore, selection is aimed at improving those productive and functional traits that could ensure sustainability of sheep farms in economic aspect.

The object of this paper is to make a review of conducted research focused on calculation of economic values (weights) of traits in dairy sheep, which to be taken into account for the breeding goal as a specific tool for creating conditions for farms to stay viable and profitable in the future. The results in this review are presented on the basis of structuring the obtained data on the values of the main productive and functional characteristics under study into separate meaningful parts, with summary statements being made.

MATERIALS AND METHODS

In accordance with the aim of the current research, namely a thorough and detailed review of conducted studies related to the possibilities of increasing the sustainability of dairy sheep farms by using economic weights of traits to determine the breeding goal, we performed a selection of articles that met the criteria in relation to the title of the article. We used keywords such as “dairy sheep farms”, “profitability”, ”sustainability of sheep” “economic values”, “economic weights”, “production and functional traits in dairy sheep”. The search was carried out by accessing the databases Web of Science, Elsevier; Scopus, CAB Abstract etc., as well as an advanced search on Google platform. Since the concept of “sustainability” of livestock farming is briefly presented, planning, statistical and fundamental documents of the UN and the European Commission were also cited, as well as statistical data of the Ministry of Agriculture and Food in Bulgaria. The subject of consideration are two studies conducted in Bulgaria to calculate economic weights in dairy sheep, using one and the same methodology - a program for calculating economic weights for sheep, which is generally accepted and applied by some of the other authors whose publications are presented in this review. The results and discussion are presented on the basis of structuring the obtained data on the values of the main productive and functional characteristics under study into separate meaningful parts, with summary statements being made.

RESULTS AND DISCUSSIONS

Economic Goals of the Breeding programs

According to Islam et al. (2013) [16] modern genetic selection technologies for farm animals provide considerable opportunities for improving productive performance, profitability of farms and production quality. Genetic selection has already achieved a significant progress in increasing levels of production in livestock (Rauw et al., 1998) [37], but when it comes to increasing profitability, it is necessary to know which variables are influencing the production system and how they affect profit (Michaličková et al., 2016) [26]. The establishment of these variables is directly related to the definition of breeding objectives, which has a leading role in creating breeding programs for farm animals (Ponzoni, 1986) [34].

To a large extent, breeding goals are oriented towards increasing the economic result by increasing the volume and quality of production (Ramon et al., 2010) [36], which very often requires the simultaneous improvement of several traits (Tolone et al., 2011; Simianer et al., 2023) [52, 40]. This goal could also be interpreted as increasing the biological potential of the animals, which is a function of the additive genetic values of the traits considered, measured by economic values (Michaličková et al., 2016) [26]. Selection, being a a very important part of livestock breeding, is usually based on a traits complex, each of which is characterized by its breeding (BV) and economic value (EV) or weight (Krupova et al., 2008) [18]. Economic value of a given trait represents the change in

the profit, resulted from one unit change in the genetic merit of that trait (Charfeddine, 2000) [11].

Economic value and economic weight can be considered as the absolute and relative results of increasing the level of a certain trait (Amer et al., 2001) [3]. For a common selection index to be created, the relative share of the economic value of each trait should be estimated (Fuerst-Waltl and Baumung, 2009) [13]. Therefore, the economic weight of a given trait, which is included in the selection index, must be calculated on the basis of an overall assessment of the economic contribution of each trait (Krupová et al., 2009) [19].

Economic weights (EW) of traits have a leading role for defining of the breeding goals in the breeding programs (Groen et al., 1997) [14] to guarantee that selection focus is in accordance with the economic importance of each trait (Amer et al., 2001) [3]. According to Bytyqi et al. (2015) [8] all traits that are related to farm profit should be taken in account in the breeding programmes for farm animals.

Therefore, economic values can be defined as the net economic benefit of genetic improvement of traits that affect farm profit (Krupova et al., 2008; Krupova et al., 2012) [18, 20]. They have been calculated for many farm animal species and farming systems under specific economic circumstances (Ramon et al., 2010; Krupova et al., 2008; Krupova et al., 2012) [36, 18, 20].

Due to the many aspects of livestock that should be considered when estimating economic weights in farm animals, the most appropriate and widely applied approach is the bio-economic modeling of the production system (Michaličková et al., 2016) [26]. In addition, to achieve results from the implementation of a particular breeding program, it is important to accurately assess the economic value of those traits that have an economic impact on farm performance. (Theodoridis et al., 2018) [51]. Bio-economic models consist of a set of equations, which characterize biological relationships, simulate management and economic situations and determine profitability (Krupová et al., 2008) [18]. The main advantages of bio-economic models are related to precision, flexibility, inclusion of a number of biological data and more accurate reflection of variation in genetic values on profitability (Krupova et al., 2008) [18].

Economic values of traits in dairy sheep

Economic weights for various production and functional traits in dairy sheep have been estimated and published by a number of authors (Ramon et al., 2010) [36]. Legarra et al. (2007a) [23] calculated economic weights for the traits milk yield, prolificacy, fertility, and productive lifetime for dairy sheep of the Latxa and Manchega breeds. In addition, Legarra et al. (2007b) [24] studied the economic importance of somatic cell score (SCS) for Latxa sheep. Fuerst-Waltl and Baumung (2009) [13] presented estimation of economic weights for dairy, meat and functional traits in Austrian dairy sheep. Ramon et al. (2010) [36] calculated economic weights of fat and protein content in sheep of the Manchega dairy breed. Wolfová et al. (2009a) [58] developed a bio-economic model for dairy or dual-purpose sheep aimed to estimate the effect of variation in production and functional traits on profit. Wolfová et al. (2009b) [59] applied this bio-economic model for deriving economic values in sheep in a research for the dairy Slovakian Improved Valachian breed and calculated the economic values of 15 production and functional traits. Applying the bio-economic model approach, Krupová et al. (2009) [19] estimated the economic values - marginal (MEV) and relative (REV), of 14 important traits for two Slovak dairy sheep breeds - Improved Valachian and Tsigai. Krupová et al. (2012) and Krupová et al. (2013) [20, 21] studied the influence of various production strategies and economic parameters on the REV of most important traits in Slovak dairy sheep. Tolone et al. (2011) [52] made an estimation of economic values of production and functional traits for the Italian dairy sheep breed - Valle del Belice. Bytyqi et al. (2015) [8] presented their calculation of economic values for dairy and meat traits for 4 dual purpose sheep breeds in Kosovo – Bardhoka, Balusha, Sharri and Kosova. Theodoridis et al. (2018) [51] applied a profit function model in order to derive economic values of the following traits: milk

production, prolificacy, fertility, milking speed, longevity and mastitis occurrence. Selection in dairy sheep is primarily aimed at increasing milk yield, so over the years they have been primarily bred for large milk production, thus making animals on farms more profitable (Theodoridis et al., 2018) [51].

Economic values of traits related to milk production and quality

In dairy sheep systems, increasing the economic result through a larger volume of production mostly means increasing milk production and improving its quality characteristics (Ramon et al., 2010) [36]. A number of genetic programs for different breeds have been established with the primary, and sometimes sole objective of improving milk traits (Barillet, 1997) [5], among which milk yield has been treated as the leading trait, object of selection (Othmane et al., 2003; Carta and Ugarte, 2003; Carta et al., 2009; Smulders et al., 2007; Oravcová et al., 2005) [31, 9, 10, 45, 29]. This is most certainly due to the fact that in dairy sheep farms, milk is considered as the main source of revenues and farmer's income. Improving milk yield is still perceived as the leading breeding objective from the point of view of economic benefit (Carta et al, 2009) [10]. Consequently, researchers began to pay more attention to milk composition (Barillet, 1997; Othmane et al., 2002) [5, 30]. This is due to the fact that almost total amount of milk produced is sold to dairy industry for cheese production (Carta et al, 2009) [10], so that its composition is currently the subject of great interest (Othmane et al., 2003) [31]. In such case as for Manchega sheep, discussed in the paper of Ramon et al. (2010) [36] the importance of milk composition is even greater because the cheese is produced under the mark of origin "Manchego", which is adding value to the final product.

Since much of the milk production is used as a raw material for dairy industry, especially in the countries from the Mediterranean region, the traits related to its composition become very important. The genetic improvement of milk composition must be tailored to the characteristics determining the yield and quality of the final product (Othmane et al., 2003; Carta et al., 2009) [31, 10].

The most important traits, related to milk composition, are considered to be fat and protein content and SCS (somatic cells score). The SCS is calculated as an indicator of the ewes' health. Fuerst-Waltl and Baumung (2009) [13] found that milk yield, fat and protein content have the highest economic importance for Austrian dairy sheep. They indicated a proportion between dairy, meat and functional traits as follows: 68.8: 9.2: 22.0, where dairy traits had a significant advantage over the other studied traits.

Legarra et al. (2007a) [23] calculated economic weights for Latxa and Manchega – Spanish dairy breeds, taking in account milk yield (litres) as a major trait. The authors emphasize the need for conduction of an additional studies in which other traits - somatic cell score (SCS), milk composition and udder characteristics to be included. Regarding the economic weight of the somatic cell score in the Latxa breed, however, Legarra et al., (2007b) [24] considered it to be of low economic importance and recommended the inclusion of SCS in the breeding program of the breed only if controlling the trait is not a costly undertaking and for animal welfare considerations.

Ramon et al. (2010) [36] calculated economic weights of the major milk components - fat and protein content for the Spanish dairy sheep breed - Manchega. The estimated values were very close, giving a slight advantage to protein content. Economic weights for milk carrier were calculated negative, since an increase in carrier accompanied by no changes in fat and protein content is related to increasing animals' energy demands but the product price being constant. Given the estimated economic importance of the traits, authors recommend fat and protein content to be taken into consideration for the breeding goal in dairy sheep.

Theodoridis et al. (2018) [51] in their study of Chios sheep in Greece, besides the usual traits such as milk production, prolificacy, fertility, longevity, included the occurrence of mastitis, which is indirectly related to milk yield. Authors concluded that breeding for clinical mastitis will have an insignificant effect on farm profitability and is not recommendable, and highlighted the importance of the

calculation of economic values of traits when developing a breeding program. Furthermore, estimation of the economic importance of traits other than milk yield, will help farmers and breeders in making correct breeding decisions (Abdallah and McDaniel, 2000) [1].

Economic values of traits related to lamb production

In dairy sheep, next in importance after milk yield and milk composition traits is that of lamb production, the income from which represents a significant part (e.g. 35 to 45% in Slovakia or Austria) of the total output on farms (Krupová et al., 2009; Wolfová et al., 2009 a,b) [19, 58, 59]. In Slovakia, breeding programmes for dairy sheep breeds give priority to the traits milk production, reproduction of ewes, intensity of growth of lambs, and a simple selection index focused on milk yield and litter size is widely applied (Krupová et al., 2009) [19]. Milk production and fertility had the highest economic values for Greek Chios dairy sheep as well (Theodoridis et al., 2018) [51]. Bytyqi et al. (2015) [8] pointed out that the economic importance of two main traits - milk yield and daily gain was investigated for the breeds Bardhoka, Balusha, Sharri and Kosova in Kosovo, since the main revenues on farms came from the sale of milk and fattened lambs. Therefore, improving reproduction traits, growth abilities and survival rate of lambs until weaning occupy an important place in the modern breeding programs for dairy sheep (Legarra et al., 2007a; Fuerst-Waltl and Baumung, 2009) [23, 13]. According to the estimations of Krupová et al. (2009) [19] for the Slovak dairy sheep breeds - Improved Valachian and Tsigai, milk production has a leading role in the complex of studied traits with relative economic values of 26% and 32%, respectively, with productive lifetime of ewes and conception rate of females on second and third place of importance. Conception rate of ewes and female lambs indirectly correspond to prolificacy, which is of great importance to lamb production. Tolone et al. (2011) [52] used a deterministic model for deriving economic values of production traits, such as milk production, weight of lambs at birth, and average daily gain of lambs, as well as functional traits, including survival of adult animals and lambs, fertility rate, prolificacy and mature weight of ewes in dairy sheep of the Valle del Belice breed. In general, functional traits are increasingly important to the effectiveness of breeding programs in dairy sheep farming (Barillet, 2007) [5], and are the subject of study in a number of studies. This was confirmed by Tolone et al. (2011) [52] – conception rate of females and prolificacy have the greatest impact on profit. Authors suggested that genetic improvement of milk yield in ewes, survival of lambs and ewes, fertility rate and prolificacy will positively influence the farm profitability of Valle del Belice breed in Italy.

Legarra et al. (2007a) [23] recommended the relative share (in %) of inseminated and lambed ewes to be included in the breeding programs of the breeds Latxa and Manchega. According to Krupová et al. (2012, 2013) [20, 21] the traits milk production, fertility rate, litter size per ewe and longevity of production for ewes were of great importance for the economic results in the Improved Valachian breed in Slovakia. In authors' opinion, a calculation index of the traits that have mostly affected genetic gain and economic profitability should be used for effective selection.

As Tolone et al. (2011) [52] noted, it is important to understand that economic values and weights estimated for a breed are specific for it and for the production system considered, which means they will be different for another production system or for a breed as well.

Economic values for dairy sheep in Bulgaria

The total number of sheep in Bulgaria as of November 1, 2023 amounts to 1072.8 thousand of which 718.3 thousand dairy ewes, according to the information database of the Agrostatistics Department of the Ministry of Agriculture and Food (MAF) (Agrostatistics, Ministry of Agriculture and Food, 2024) [2]. In the annual report of MAF, the Executive Agency for Selection and Reproduction in Livestock (IASRG) provided data that in 2022, 356,926 sheep under selection control of 34 breeds were reflected in the Vetis (veterinary) database. Of them, 178,393 sheep were from the Bulgarian Dairy Synthetic Population

(BDSP). Due to their ability to adapt easily to different environment and their genetic potential for achieving high milk production and prolificacy, while providing optimal raising and feeding conditions, they are widely spread all over the country.

The number of representatives of local and imported dairy breeds is significantly smaller. Sheep from BDSP and local dairy breeds are mainly raised in low-investment, semi-intensive and extensive production systems. The average suckling period is within 55-65 days, thus limiting the amount of milk produced (Miteva, 2022; Stancheva et al. 2018; Zhelyazkova et al., 2014) [28, 47, 60]. In such production system, a high level of milk production is limited to attain (Slavova and Stancheva, 2023) [44].

Despite the long-term efforts of breeders, milk production in BDSP is still the subject of many questions. According to a number of studies, the average milk yield for a standard 120-day period varied widely within 150 to 200 l and did not correspond to the genetic capabilities of animals for milk productivity (Iliev et al., 2022; Ivanova, 2013; Slavova and Stancheva 2023; Stancheva et al., 2014; 2018, 2021, 2022; Zhelyazkova et al., 2014) [15, 17, 44, 46, 47, 48, 49, 60]. In all studies, the authors conclude that the realization of the genetic potential of BDSP sheep depends mostly on the provided conditions of nutrition, breeding, and management of the production system. The synthetic population is in a continuous process of development, improvement and genetic renewal, which is particularly pronounced in the private sector. The aspiration of the new farmers to accelerate genetic progress has increased interest in the possibilities of introducing a new genetic variance from the highly productive breeds Assaf, Lacaune, Awassi and Chios, which are successfully adapted in our country. The selection in these herds is conducted by four non-governmental breeding organizations whose activity to date, regardless of the efforts made and the breeding goals set, has not developed in the desired direction - improvement of the population and increase of milk productivity.

In the breeding programs of the breeding organizations for sheep from BDSP, the leading breeding and selection trait is milk yield. Contrary to the breeding goal, in some recent studies, it has been found that in herds of the population, farms had a greater income from lambs than from sold milk (Slavova et al., 2015 a, b) [41,42]. In Bulgaria, economic values for dairy sheep have been calculated using a bio-economic model (Wolf et al., 2011) [56] only for two separate flocks of a Bulgarian dairy synthetic population – BDSP, raised in the Agricultural institutes of Stara Zagora and Shumen (Slavova and Laleva, 2021; Slavova and Stancheva, 2023) [43, 44]. Economic values of the production and functional traits have not been taken into account in the breeding programs of the relevant breeding organizations so far. In both institute herds, object of study of Slavova and Laleva (2021) [43] and Slavova and Stancheva (2023) [44], the number of lambs born per ewe showed the highest economic importance of the trait complex – 22.27% and 28.74% (Table 1).

Although milk production is a main selection trait in the breeding programs for BDSP, the economic weights of the milk yield trait is second in economic importance. Still it should be taken into account that milk yield is a leading trait, but this is valid for situations in which nutrition is of the highest quality and ad libitum, since feeding is the most important factor as the genetic potential to be expressed.

Fertility of females and productive lifetime of ewes also had a significant contribution to profit.

The conception rate is estimated to have a REV of about 17% and 16%, and production longevity – about 10% and 11%, respectively. The complex of traits related to lamb survival from birth until weaning also showed high economic importance – about 13% and 15%. According to the authors, these traits require more in-depth evaluation in other herds of the population because so far they are not the subject of selection in breeding programs for dairy sheep in Bulgaria.

Moreover, modern methods for developing defined breeding goals, guaranteeing an increase in profitability of dairy sheep farms breeding are still not applied.

Table 1. Relative economic values (REV%) or weights of main production and functional traits in two flocks of BDSP studied by Slavova and Laleva (2021) and Slavova and Stancheva (2023)

Traits	REV% of traits in studied flock 1 of BDSP (2021)	REV% of traits in studied flock 2 of BDSP (2023)
Milk yield per standard milking period of 120 days, L/ewe	16.79	14.30
Live weight at birth, kg	1.65	1.36
Growth rate from birth to weaning, g/day	6.94	5.76
Growth rate of breeding lambs in rearing, g/day	0.64	0.87
Mature weight of ewes, kg	8.71	6.23
Wool yield, kg	3.39	2.10
Conception rate of ewe lambs, %	5.75	6.47
Conception rate of ewes, %	11.02	9.02
Number of lambs born per ewe, for 1 lamb/ewe	22.27	28.74
Survival rate of lambs from birth to 24th hour, %	7.07	7.46
Survival rate of lambs from 24th hour of birth till weaning, %	5.67	6.29
Productive lifetime of ewes, years	10.10	11.39
Sum of the absolute values	100.00	100.00

Source: Slavova and Laleva (2021); Slavova and Stancheva (2023) [43, 44].

This necessitates conducting a larger-scale study of various traits, related to production and functional characteristics in dairy sheep in Bulgaria.

It is recommendable to use a bio-economic model that covers all components of the production system (biological and economic), both the dynamics in the level of productivity for a certain period of time (extremely important for updating the breeding programs) and the profitability of the studied farms as a factor for achieving economic sustainability should be established.

The marginal (absolute) and relative economic values (weights) of a complex of traits directly related to the profit on farms should be established and the most important of them will be clarified, which will serve as a basis for economically effective selection and breeding activity.

CONCLUSIONS

Breeding programs for livestock are an important tool for improving farms' performance, and they require clearly defined breeding goals focused on the traits with leading importance to the profit. In dairy sheep milk yield is considered the main selection trait, providing great share of revenues and farmer income. It is subsequently complemented by quality traits such as protein and fat content, and somatic cell score (SCS). The improvement of the animals' reproductive characteristics, their level of fertility, the rate of survival and growth of lambs are also important for modern breeding programs, given that a large part of the income comes from lamb sales on farms. The last is particularly true for the widespread dairy synthetic population in Bulgaria, as lamb revenues predominates in milk yield, according to some research conducted. In Bulgaria, economic weights for dairy sheep have been calculated only for two separate flocks of a Bulgarian dairy synthetic population and so far, economic values of the traits have not been taken into account in breeding programs. Calculating economic weights of productive and functional traits for this dairy population would provide valuable information on which traits are of greatest economic importance and which should be emphasized in the breeding program.

This requires a larger-scale study of specific economic indicators, related to farm profit, as well as estimation of economic values of production and functional traits, which may lead to adjustments to the breeding programs if necessary.

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