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# Economic performance of sheep farms of the Local Stara Zagora breed

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***Abstract.*** *The purpose of the present study was to establish the economic performance of sheep farms of the Local Stara Zagora breed. Production and economic results of three private farms in southern Bulgaria were studied for 2022. Data were obtained from the farmers after filling in questionnaires. Sheep have been raised in stall-pasture system with grazing period lasting from March to November, and stall period from December to February, and one lambing per year. Revenues, costs, profit (BGN) and profitability (%) on the farms were calculated. Revenues from the sale of milk were estimated to account for 39% of gross production, and subsidies - 24% of total revenues, on average. Feed costs accounted for 56% of total costs on farms. Farm 1 and farm 3 yielded low profits estimated at BGN 8.90 and BGN 6.28 per ewe, respectively, while farm 2 operated at a loss of BGN -33.61 per ewe. Therefore, farms' survival is at risk, and due to increasing prices of feed, energy, labour and fuels they may not stay viable in the future. In such small sheep populations maintaining instead of targeted selection is performed and particular results in improving the level of the main selection traits cannot be expected. Measures for improving nutritional management and feed efficiency are considered fundamental for the future sustainability of the breed and also adequate support must be provided to maintain the population size in the future and its conservation as valuable genetic resource in the country.*

**Keywords:** Local Stara Zagora breed, revenues, costs, profit, profitability, subsidy

**Abbreviations:** EU – European Union, NSI – National Statistical Institute, BDSP – Bulgarian dairy synthetic population; LFAs – Less -favoured areas; BGN – Bulgarian monetary unit

## Introduction

The Local Stara Zagora sheep breed is named by the region it originated from - the district of Stara Zagora, and is currently spread in Sliven, Haskovo and Yambol as well (Dimov and Vuchkov, 2021). For a long period of time, mainly in the second half of the last century, it was one of the most valuable dairy breeds in the country (Kalaydzhiev et al., 2012a). The breed has been involved in a complex reproductive crossing scheme, contributing to the creation of the BDSP, which currently has the largest share of the dairy sheep population in Bulgaria (Stancheva et al., 2014, 2022). The breed has been the subject of study by a number of researchers in terms of improving selection traits such as milk yield and prolificacy (Djorbineva, 1984; Djorbineva et al., 1995, 2011; Kalaydzhiev et al., 2012a,b; Kalayzdiev, 2014). The local Stara Zagora sheep is one of the most phenotypically attractive sheep and is preferred in its areal due to its adaptability to natural and climatic conditions and its resistance to diseases. In recent years, this valuable genetic resource is on the verge of existence, due to the greatly reduced number of animals, which puts the breed at risk of extinction (Kalaydzhiev, 2022). According to the „Breeding Association of Local Stara Zagora Sheep Breed", at the moment, about 1500 sheep are bred in the country, of which 900 are under selection control.

The need for the preservation of local sheep breeds in the country, including Stara Zagora breed, is in

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accordance with the EU policy for support of in situ and ex situ conservation and sustainable use of animal genetic resources (AnGR) (European Regional Focal Point for Animal Genetic Resources - ERFP, 2001). Despite the efforts therein, the number of native sheep in Europe has declined, regardless of their unique characteristics and ability to adapt to harsh environmental conditions, and this decline exposes them to the threat of extinction due to the low profitability of farms (Kawęcka et al., 2022). In other words, the preservation of the autochthonous breeds, apart from being a subject of national and European policy for protection against unforeseen future climate changes and food insecurity, depends to a large extent on the willingness and opportunities of the farmers to continue to produce. In recent years, a large number of farmers who used to raise local Stara Zagora sheep have significantly reduced the flock size, and a couple of them even closed, due to a number of difficulties related to both the characteristics of the breed and the market situation in the country (Kalaydzhiev, 2022). Clarifying the specific reasons requires a production-economic analysis of the farms. In recent years, such research has been conducted for other local breeds such as the Pleven black-headed breed, (Stankov, 2019), Copper-red Shumen breed (Slavova et al., 2020) and Karakachan breed (Slavova and Staykova, 2021; Slavova et al., 2021). Studies of the kind provide information on the current state and trends in the studied populations and should be constantly completed in order to expand their scope and relevance in the current economic conditions.

The purpose of the present study was to establish the economic performance of sheep farms of the Local Stara Zagora breed.

## Material and methods

The objects of the study were the production and economic results for 2022 from three private farms raising sheep of the Local Stara Zagora breed, situated in the municipalities of Stara Zagora, Chirpan and Ihtiman. The applied production system was stall-pasture with grazing period lasting from March to November, and stall period from December to February. During the indoor period, animals were fed with grains, silage, alfalfa hay and roughage, and during the grazing period they were supplemented with concentrates and alfalfa hay (especially in the hot periods - July and August, due to the lack of green pasture grass).

Ewes and ewe lambs were naturally mated during the estrous season in August-September. Ewe lambs born in the previous year and reached 18 months of age, as well as part of those born in the current year and reached at least 10 months of age and the required live weight, were mated. Replacement in the flocks was about 15%. Conception rate was estimated 87%, and prolificacy - about 100%, on average. Only for farm 2, these traits were estimated higher - 90% and 120%, respectively, due to the use of implants for oestrus synchronization during the estrous season. The reported death rate of lambs was 2%.

Lambs were weaned at about 60 days of age, and after weaning ewes were milked twice a day. There was a variation on milking period in the farms, but usually it did not last more than 100 days, as the sheep dried out due to the summer heat. The milk yield per ewe and milking period was estimated 90-100 L, with larger part of milk intended for sale. The Breeding Association of Local Stara Zagora Sheep Breed was in charge of selection and productive performance control in the studied flocks. Table 1 shows the number of animals on the farms by category.

**Table 1.** Number of sheep on the farms

| Category | Farm 1 | Farm 2 | Farm 3 |
|---|---|---|---|
| Ewes | 93 | 80 | 200 |
| *-under selection control* | 91 | 78 | 95 |
| Rams | 2 | 3 | 5 |
| Replacements (from 6 months to 1,5 years of age) | 32 | 30 | 55 |
| Lambs born | 82 | 88 | 175 |

Based on financial information received from the farmers after filling out questionnaires, revenues and costs on the farms were calculated and profit and rate of profitability were established as follows:

- revenues (BGN) - received as the sum of the amount of production by type (milk, animals), multiplied by the purchase price per unit of production (L milk, kg live weight) and the amount of subsidies.

- costs (BGN) – represented as the sum of feed costs, veterinary costs, labor costs, consumables (electricity, fuel and transport, maintenance and repair), selection activities, rent for pastures etc.

- profit (BGN) – calculated as the difference between total revenues and total costs;

- profitability (%) – calculated as the ratio between profit and total costs

The economic indicators were presented per farm and per ewe. Data were processed using a mathematical-statistical model and Excel program.

## Results and discussion

Farm revenues came from the sale of sheep milk, lambs for slaughter and breeding, culled animals and subsidies (Table 2). Farmers did not report revenues from wool and manure, because due to a lack of market demand, the wool is stored or destroyed, and the manure is used to fertilize arable land and pastures. Milk and slaughter lambs were sold at prices, higher than the indicated in the official statistics of for 2022 – 1.80-1.90 BGN per L, and 8-10 BGN per kg live weight, given the average in the country – 1.76 BGN per L, and 7.48 BGN per kg live weight (NSI, Prices of agricultural products, 2022).

**Table 2.** Revenues on the farms (BGN)

| Type of revenue | Quantity (L, kg) | Unit price (BGN/ L, kg) | Value (BGN) |
|---|---|---|---|
| | **For farm 1** | | |
| **1.Gross production** | | | **31312.50** |
| **- *per ewe*** | | | **336.69** |
| From milk sales | 7000 | 1.90 | 13300.00 |
| From lambs for slaughter | 1100 | 10.00 | 11000.00 |
| From breeding lambs | 300 | 12.00 | 3600.00 |
| From culled sheep | 975 | 3.50 | 3412.50 |
| **2.Subsidies** | | | **12509.50** |
| **- *per ewe*** | | | **134.51** |
| **3.Total revenues (1+2)** | | | **43822.00** |
| **- *per ewe*** | | | **471.20** |
| | **For farm 2** | | |
| **4.Gross production** | | | **26734.00** |
| **- *per ewe*** | | | **334.18** |
| From milk sales | 5200 | 1.85 | 9620.00 |
| From lambs for slaughter | 1750 | 8.00 | 14000.00 |
| From breeding lambs | 32 | 12.00 | 384.00 |
| From culled sheep | 780 | 3.50 | 2730.00 |
| **5.Subsidies** | | | **8510.00** |
| **- *per ewe*** | | | **106.38** |
| **6.Total revenues (4+5)** | | | **35244.00** |
| **- *per ewe*** | | | **440.55** |
| | **For farm 3** | | |
| **7.Gross production** | | | **58970.00** |
| **- *per ewe*** | | | **294.85** |
| From milk sales | 13000 | 1.80 | 23400.00 |
| From lambs for slaughter | 3200 | 8.00 | 25600.00 |
| From breeding lambs | 300 | 12.00 | 3600.00 |
| From culled sheep | 1820 | 3.50 | 6370.00 |
| **8.Subsidies** | | | **14342.50** |
| **- *per ewe*** | | | **71.71** |
| **9.Total revenues (7+8)** | | | **73312.50** |
| **- *per ewe*** | | | **366.56** |

The farmers' purpose to ensure maximum return on the costs invested is related to providing favorable purchase price of products. The owner of farm 1 managed to sell lambs for slaughter at the highest price - BGN 10 per kg of live weight, which forms greater income per smaller amount of production. On all three farms, sales of lambs for breeding were reported at a price of BGN 12 per kg of live weight (in farms 1 and 3 – 10 lambs, in farm 2 – 1 lamb). The low demand for young breeding animals of the breed is primarily related to the lack of interest. A similar trend was observed for two flocks of the Karakachan breed in a study conducted in 2019 (Slavova and Staykova, 2021).

Revenues from sales ranged from BGN 294.85 to BGN 336.69 per ewe, as from milk being only 39%. Stankov (2019) also reported on the small share of milk revenues on a sheep farm of Pleven black-headed breed – 38.5% of total revenues. Pamukova and Momchilov (2017) found an opposite trend for a flock of BDSP - 45-52% share of milk sales in total farm revenues over a period of three years (2016-2018).

The milk productivity of animals directly influenced the level of this indicator. In a study, covering 9495 ewes of the Local Stara Zagora breed for the period 2011-2020, Kalaydzhiev (2022) indicated milk yield per ewe 98.37 L, 104.60 L and 108.80 L, respectively, on the I$^{st}$, II$^{nd}$ and III$^{rd}$ lactation. Compared to the milk yield of ewes of the specialized dairy breeds such as Lacaune and Assaf, which in recent years have been increasing their populations in our country (Panayotov et al., 2018; Stankov, 2020), it is relatively low. Panayotov et al. (2018) reported a milk yield of 213.29 L per ewe per 150-day milking period in Lacaune sheep in Bulgaria.

Most of the animals included in the study received subsidies according to the support scheme for ewes under selection control. Animals that did not meet the relevant criteria were paid a transitional national aid (the rate per ewe is lower). Only farm 1 received support according to Measure 10 „Agro-ecology and climate" for conservation of endangered autochthonous breeds. All three farms received subsidies under the Single Area Payment Scheme (SEPP) for maintaining pastures, as well as „De minimis" state aid.

Financial funds under the programs „Aid to support liquidity of farmers to overcome the negative economic impact of Russian aggression against Ukraine" and „Aid to support liquidity of farmers to overcome the negative economic impact of COVID-19" were not included in the calculations, since they occurred under „force majeure" circumstances, and can be treated as incidental.

Subsidies were estimated 24% on average of the total revenues of the farms. For the Copper Red Shumen breed (Slavova et al., 2020) and the Karakachan breed (Slavova et al., 2020), they were found significantly higher - 56-66% and 52%, respectively, making the farms extremely dependent on the support received.

The total revenues per ewe ranged from BGN 366.56 (for farm 3) to BGN 471.20 (for farm 1). The result obtained for farm 3 was due to the lower sale revenues, the lack of agri-environmental payments and the lower subsidies per ewes under selection control.

Production costs included costs for feeds, labour, veterinary care, shearing, consumables, selection, rent for pastures, etc. (Table 3). On farms 2 and 3, a large part of the feed came from their own production and was calculated at cost. On farm 1, 4000 kg wheat was provided for renting arable land, the rest of the feeds being purchased at market prices for 2022 (grains - BGN 0.65/kg; corn silage - BGN 0.23/kg, alfalfa hay - BGN 0.33/kg, wheat straw - BGN 0.20/kg; lambs starter - 1 BGN/kg). On farm 2, grains and alfalfa hay were of own production, but the farmer paid to a feed enterprise to prepare concentrates for the animals and the final price was estimated BGN 0.50/kg of concentrate. On farm 3 wheat and alfalfa hay were of own production and the price was at cost - BGN 0.30 and BGN 0.20 per kg, respectively. In addition, the farmer purchased corn (BGN 0.65/kg), peas (BGN 0.50/kg), wheat siftings (BGN 0.30/kg) and alfalfa hay (apart from own production – BGN 0.45/kg kg).

**Table 3.** Costs on the farms (BGN)

| Type of cost | Farm 1 | Farm 2 | Farm 3 |
|---|---|---|---|
| **1. Feed costs** | **24320.00** | **19479.00** | **43500.00** |
| **- *per ewe*** | **261.51** | **243.49** | **217.50** |
| Corn silage | 4140.00 | 2816.00 | |
| Red beet granules | | | 600.00 |
| Alfalfa haylage | | | 500.00 |
| Alfalfa hay | 6930.00 | 7000.00 | 14700.00 |
| Wheat straw | 600.00 | 600.00 | 1400.00 |
| Concentrates | | 5675.00 | |
| Corn - grain | 3900.00 | | 11050.00 |
| Wheat | 3900.00 | | 4500.00 |
| Barley | 1950.00 | | |
| Peas | | | 3500.00 |
| Wheat siftings | | | 1050.00 |
| Lamb starter | 2900.00 | 3100.00 | 6200.00 |
| Additives | | 288.00 | |
| **2.Veterinary costs** | **520.00** | **1180.00** | **920.00** |
| **3.Labour costs** | **10884.00** | **10884.00** | **16326.00** |
| **- *per ewe*** | **117.03** | **136.05** | **81.63** |
| **4.Consumables** | **5620.00** | **4850.00** | **9300.00** |
| Electricity | 1320.00 | 1220.00 | 2400.00 |
| Water | 1300.00 | 950.00 | 2100.00 |
| Fuels and transport | 1800.00 | 1700.00 | 3600.00 |
| Maintenance and repair | 1200.00 | 980.00 | 1200.00 |
| **5.Shearing costs** | | **392.00** | **940.00** |
| **6. Costs for selection issues** | **380.00** | **300.00** | **450.00** |
| **7. Pasture rent** | **320.00** | **400.00** | |
| **8.Other costs** | **950.00** | **840.00** | **1560.00** |
| **9.Total costs** | **42994.00** | **37933.00** | **72056.00** |
| **- *per ewe*** | **462.30** | **474.16** | **360.28** |

Feed costs per ewe were calculated as follows: for farm 1 - BGN 261.51, for farm 2 – BGN 243.49, and for farm 3 - BGN 217.50. On the first farm, feed was almost entirely purchased, which increased the cost per unit of production. Feed costs accounted for 56% of the total costs of the farms, which is significantly more than the calculated for the flock of the Pleven black-headed sheep – 44% (Stankov, 2019). In dairy sheep, feed costs are usually high, due to the nutrition requirements for milk production. For example, Papanikolopoulou et al. (2023) reported about 83.6% of the variable costs in dairy sheep in Greece.

The veterinary costs included disinfection, marking, disease prevention, treatment, ecarisage, etc. On farm 2, they were higher due to the additional costs (BGN 350) for purchasing and placement of implants in the female animals during estrous season. As a result, the farmer claimed conception rate and prolificacy incresed by 3% and 20%, respectively.

On farms 1 and 2, the labour costs (incl. salary and insurance) were calculated per 1 self-employed person at the minimum wage (710 BGN per month for 2022). On farm 3, the producer is also self-employed at minimum wage, but participates in a cooperative, so that three persons are in charge for taking care of the animals in the cooperative during the year. For some periods a seasonal worker is paid. For farm 2, the largest labor costs were reported - BGN 136.05, since the flock size is the smallest in the study and man hours per ewe were estimated the highest.

Costs for consumables included electricity (mainly for milking), fuels and transport, water and maintenance. The increasing fuel prices for 2022 affected costs, and on farm 3 they reached BGN 3600.

Shearing costs were reported only for farms 2 and 3 (about BGN 4 per animal), since on farm 1 the farmer shears the sheep himself.

The costs for selection issues included a membership

fee for the „Association for the Breeding of the Local Stara Zagora Sheep Breed", as well as expenses related to breeding activities on the farms. Almost all ewes on farms 1 and 2 are under selection control, while on farm 3, only 95.

Rent for pasture costs were reported only for farms 1 and 2, since on farm 3 pastures (20 da) are owned by the farmer.

In the farms studied, production costs totaled BGN 462.30, BGN 474.16, and BGN 360.28, respectively, with feed costs being the largest contributor.

The main indicators of economic efficiency on farms - profit and profitability, are presented in Table 4. Profit was calculated for farms 1 and 3 - BGN 8.90 and BGN 6.28 per ewe, respectively. Farm 2 was at a loss, and the rate of profitability was estimated -7.09%. The higher production costs on farm 1 were compensated by the higher revenues, based on milk and animal sales, on the one hand, and subsidies (including agro-environmental payments), on the other. For farm 3, the financial result was positive due to the lower feed and labour costs.

**Table 4.** Economic results on the farms

| Economic indicator | Farm 1 | Farm 2 | Farm 3 |
|---|---|---|---|
| Profit, BGN | 828.00 | -2689.00 | 1256.50 |
| - per ewe | 8.90 | -33.61 | 6.28 |
| Profitability, % | 1.93 | -7.09 | 1.74 |

A higher profitability was reported by Slavova and Staykova (2021) for two flocks of Karakachan sheep for 2019 – 23.79% and 15.1%, respectively, regardless of the lower productivity - 40 L milk yield per ewe and 0.97-1 lamb per ewe. However, costs on the farms were compensated by the large subsidies received. In the flock of Pleven black-headed sheep, profitability was estimated at 15.33% for a similar level of milk productivity - 92 L per ewe per milking period (Stankov, 2019). It should not be overlooked that in the last two years the prices of feed, electricity, labour and fuels have increased significantly, and this has had negative impact on the cost of production and hence on the farmers' income. On the other hand, in the last few years the rates of subsidies for coupled support for ewes under selection control have been fixed in the range of BGN 73 to BGN 80 per ewe (2018 – BGN 73.34; 2019 – BGN 80.11; 2020 – BGN 80.50; 2021 – BGN 73.03; 2022 – BGN 74.24, Agriculture State Fund, Ministry of Agriculture).

Declining profitability of sheep farms is an important issue in the EU as well. Papanikolopoulou et al. (2023) found losses in 31% (for 2019–2020) and 37% (for 2020–2021) of the studied dairy sheep farms in LFAs of North-Western Greece, for flocks with a significantly higher average milk yield per ewe - 218 ± 88.7 kg (for 2019–2020) and 239 ± 91.8 kg (for 2020–2021). The authors defined these farms as not economically viable, indicating an uncertain future for the sector. Economic losses were also reported by Ragkos et al. (2014) for transhumant sheep and goat farming in Greece. Papanikolopoulou et al. (2023) indicated the increasing energy and feed prices to adversely affect farm profitability, and highlighted the strong dependence of farms' economic viability on EU agricultural subsidies. In Poland, due to low profitability, many local sheep breeds were exposed to the risk of extinction, so that public awareness of indigenous breeds and their alternative use in environmental activities, as well as their role in preserving the cultural heritage of local communities should be raised. (Kawęcka et al., 2022).

## Conclusion

Based on the results of the study, it could be summarized that the survival of the farms is at risk, taking into account the low profitability of farms 1 and 3 and the loss on farm 2. The continuously increasing prices of feed, energy, labour and fuels become a big challenge to the farms' survival and affect autochthonous sheep at most due to the lower productive performance of the animals, compared to specialized dairy breeds. Moreover, in such small sheep populations maintaining instead of targeted selection is performed and particular results in improving the level of the main selection traits cannot be expected. Measures for improving nutritional management and feed efficiency are considered fundamental for the future sustainability of the breed and also adequate support must be provided to maintain the population size in the future and its conservation as valuable genetic resource in the country.

## References

**Dimov D and Vuchkov A,** 2021. Sheep genetic resources in Bulgaria with focus on breeds with coloured wool. Genetic resources, 2, 11-24. https://doi.org/10.46265/genresj.HXSV9592

**Djorbineva M,** 1984. Variability of the selection traits in local Stara Zagora sheep and opportunities for their improvement. Thesis for PhD, Agricultural Institute - Stara Zagora (Bg).

**Djorbineva M, Dimitrov T, Mihaylova G, Dimitrov I and Ivanov I,** 1995. Variability of milk yield, composition and properties of the milk from local Stara Zagora sheep and crosses with East Frisian rams in lactation II. Bulgarian Journal of Animal Husbandry, 3-4, 83-86 (Bg).

**Djorbineva M, Kalaydzhiev G and Dimitrov I,** 2011. Present and future perspectives for the local Stara Zagora sheep. Agricultural Sciences, 6, 47-51 (Bg). https://agris.fao.org/agris-search/search.do?recordID=BG2012000107

**Kalaydzhiev G,** 2014. Genetic and environmental variability of milk coagulation ability of different sheep breeds. Thesis for PhD, Agricultural Institute - Stara Zagora, Agricultural Academy, Sofia, Bulgaria (Bg).

**Kalaydzhiev G,** 2022. Future perspectives in breeding the indigenous local Stara Zagora sheep and improving the phenotypic and genetic parameters of the breed. Biotechnology in Animal Husbandry, 38, 17-30. https://istocar.bg.ac.rs/wp-content/uploads/2022/06/02.BAH-22-1-4-24.2.2022.-G.Kalaydzhiev-2.pdf

**Kalaydzhiev G, Angelova T, Yordanova D, Karabashev V, Oblakov N, Laleva S, Popova Y, Kassandro M and Krastanov J,** 2012a. Qualitative composition and coagulation ability of milk of sheep breed local Stara Zagora. Journal of Mountain Agriculture on the Balkans, 5, 1274-1287 (Bg). https://agris.fao.org/agris-search/search.do?recordID=BG20140098

**Kalaydzhiev G, Angelova T, Yordanova D, Karabasev V, Oblakov N, Laleva S, Popova Y, Fenerova Y, Kassandro M, Dimov D and Krastanov J,** 2012b. Phenotypic variation of the coagulation ability of milk of local breeds of sheep in Bulgaria. Bulgarian Journal of Animal Husbandry, 49, 54-58 (Bg). https://animalscience-bg.org/page/en/details.php?article_id=1079

**Kawęcka A, Pasternak M, Miksza-Cybulska A and Puchała M,** 2022. Native sheep breeds in Poland-importance and outcomes of genetic resources protection programmes. Animals, 12, 1510, 1-16. https://doi.org/10.3390/ani12121510

**Pamukova D and Momchilov H,** 2017. Analysis of revenues and production costs of dairy sheep farm. Trakia Journal of Sciences, 15 (S 1), 277-281. doi:10.15547/tjs.2017.s.01.050

**Panayotov D, Sevov S and Georgiev D,** 2018. Milk yield and morphological characteristics of the udder of sheep from the breed Lacaune in Bulgaria. Bulgarian Journal of Agricultural Science, 24 (S 1), 95-100. https://www.agrojournal.org/24/01s-14.pdf

**Papanikolopoulou V, Vouraki S, Priskas S, Theodoridis A, Dimitriou S and Arsenos G,** 2023. Economic performance of dairy sheep farms in Less-Favoured Areas of Greece: A Comparative analysis based on flock size and farming system. Sustainability, 15, 1681. https://doi.org/10.3390/su15021681

**Ragkos A, Siasiou A, Galanopoulos K and Lagka V,** 2014. Mountainous grasslands sustaining traditional livestock systems: The economic performance of sheep and goat transhumance in Greece. Options Mediterranean, 109, 575-579. https://om.ciheam.org/om/pdf/a109/00007774.pdf

**Slavova S and Staykova G,** 2021. Economic aspect of breeding Karakachan sheep in the lowlands. Bulgarian Journal of Animal Husbandry, 58, 24-31. https://animalscience-bg.org/page/bg/details.php?article_id=683

**Slavova S, Staykova G, Laleva S, Popova Y and Slavova P,** 2020. Economic effect evaluation of rearing sheep of the Copper-red Shumen breed. Bulgarian Journal of Agricultural Science, 26, 726-730. https://www.agrojournal.org/26/04-03.pdf

**Slavova S, Laleva S, Popova Y and Odzhakova Ts,** 2021. Economic efficiency of rearing Karakachan sheep in the mountain regions of Bulgaria. Bulgarian Journal of Agricultural Science, 27, 200-203. https://agrojournal.org/27/01-27.pdf

**Stancheva N, Raicheva E, Laleva S, Ivanova T, Iliev M and Kalaydzhiev G,** 2014. Present status, problems and development of the Synthetic population Bulgarian milk sheep from the herds of Agricultural academy. Bulgarian Journal of Animal Husbandry, 51, 3-11 (Bg). https://animalscience-bg.org/page/en/details.php?article_id=341

**Stancheva N, Angelova T, Yordanova D and Krastanov J,** 2022. Assessment of weight development of the sheep from Bulgarian Dairy Synthetic Population. Bulgarian Journal of Animal Husbandry, 59, 12-22. https://animalscience-bg.org/page/en/details.php?article_id=708

**Stankov K**, 2019. Economic evaluation of the sheep farm of Black-headed Pleven sheep in the village of Hitrino, Shoumen District. Trakia Journal of Sciences, 17, 133-137. http://tru.uni-sz.bg/tsj/Volume%2017,%202019,%20Supplement%201,%20Series%20Social%20Sciences/1/za%20pe4at/22.pdf

**Stankov K,** 2020. Economic efficiency of Bulgarian dairy synthetic population and Assaf sheep breeds. Agricultural Science and Technology, 12, 42-46. DOI: 10.15547/ast.2020.01.008

**European Regional Focal Point for Animal Genetic Resources - ERFP,** 2001. https://www.animalgeneticresources.net/

**NSI, Prices of agricultural production (data series),** 2022. https://www.nsi.bg/bg/content/843/%D1%86%D0%B5%D0%BD%D0%B8-%D0%BD%D0%B0-%D1%81%D0%B5%D0%BB%D1%81%D0%BA%D0%BE%D1%81%D1%82%D0%BE%D0%BF%D0%B0%D0%BD%D1%81%D0%BA%D0%B0%D1%82%D0%B0-%D0%BF%D1%80%D0%BE%D0%B4%D1%83%D0%BA%D1%86%D0%B8%D1%8F-%D0%BF%D0%BE-%D0%B3%D0%BE%D0%B4%