COMPARATIVE ANALYSIS OF PROCEDURES FOR PREDICTING BREEDING VALUE FOR TRAITS OF ECONOMIC IMPORTANCE IN A SHEEP POPULATION

Ph.D. Osamah Mahmood Abdulzahra MURSHEDI[1], Prof. Univ. Dr. Horia GROSU[1], Dr. Petruț-Lucian PARASCHIVESCU[2]

Introduction

Selection is an important aspect of animal breeding and is usually done on the basis of a collection of traits, determined by breeding value and economic value (Slavova, 2022).

The accepted method for genetic evaluation is best linear unbiased prediction (BLUP) applied to an animal model (Grosu & Rotar, 2015).

Best Linear Prediction (BLP) is a technique for calculating breeding values based on linear models, it is a fundamental strategy that takes into account individual relationships (descent) and phenotypic information (Mueller et al., 2021).

Estimates of heritability can be used to create selection indices, predict genetic response to selection, and assess how much an individual's own phenotype can be depended on for selection (Lalit et al., 2016).

Materials and methods

The study focuses on the evaluation of two groups of traits in the analyzed herd Milk production, expressed by the amount of milk, milk fat and protein, and reproductive traits, especially prolificacy. In the study carried out, totally 486 sheep from the Palas Milk Line were analyzed. The heritabilities used in calculating the breeding values were estimated by the REML method, using an animal model for the four traits analyzed. The three selection methods are represented by: selection based on own performance, selection based on the BLP method (Selection Indices) and selection based on the BLUP - Individual Animal Model methodology. The comparison of the three listed methods was carried out by means of the Spearman Rank Correlation.

Results and discussions

Table 1. The heritability (on diagonal) and genetic correlations (above the diagonal) between the four traits analized

Traits	Amount of Milk	Milk Fat	Milk Protein	Prolificacy
Amount of Milk	0.197 ± 0.263	0.836 ± 0.284	0.441 ± 0.757	0.473 ± 0.731
Milk Fat		0.209 ± 0.278	0.325 ± 0.839	0.451 ± 0.749
Milk Protein			0.263 ± 0.347	0.149 ± 0.915
Prolificacy				0.235 ± 0.311

Results and discussions

Table 2. Breeding values for the best 20 animals from sheep population for amount of milk

Animal	BV-BLUP	Rank-BLUP	BV-BLP	Rank-BLP	BV-OP	Rank-OP
453	26.09	1	25.91	1	27.60	1
29	20.75	2	20.66	2	20.66	3
481	19.59	3	19.47	3	19.47	5
253	18.01	4	18.07	4	16.08	8
370	16.66	5	16.38	5	15.78	9
139	16.40	6	16.09	6	15.39	11
335	16.26	7	15.81	7	13.37	21
340	15.30	8	15.09	8	15.57	10
221	15.20	9	15.01	9	11.95	31
452	14.73	10	14.41	11	21.96	2
31	14.50	11	14.27	12	9.64	53
258	14.38	12	14.46	10	13.61	16
99	14.00	13	13.70	14	12.19	30
350	13.89	14	13.78	13	13.58	18
25	13.83	15	13.65	15	20.07	4
445	13.70	16	13.45	16	9.07	57
23	13.46	17	13.20	17	11.53	32
32	13.30	18	13.11	18	7.32	77
321	13.14	19	12.72	20	10.61	43
298	12.90	20	12.45	21	10.78	38

Results and discussions

Table 3. Breeding values for the best 20 animals from sheep population for amount of fat

ANIMAL	BV-BLUP	Rank-BLUP	BV-BLP	Rank-BLP	BV-OP	Rank-OP
453	5.07	1	5.00	1	5.80	1
481	4.78	2	4.72	2	4.72	2
29	3.86	3	3.84	3	3.84	4
221	3.62	4	3.51	4	2.95	20
335	3.46	5	3.33	5	3.39	14
340	3.31	6	3.23	7	3.48	8
350	3.29	7	3.30	6	3.08	18
25	3.14	8	3.10	8	4.28	3
211	3.10	9	3.07	9	2.36	36
370	3.07	10	2.86	13	2.86	21
357	3.05	11	2.96	11	2.56	27
362	2.99	12	3.06	10	3.26	16
446	2.91	13	2.83	14	3.07	19
132	2.80	14	2.90	12	3.40	11
32	2.71	15	2.67	15	2.08	46
81	2.62	16	2.56	18	3.67	6
253	2.53	17	2.56	19	2.47	29
127	2.49	18	2.41	21	3.37	15
369	2.43	19	2.60	16	3.47	9
139	2.36	20	2.28	26	2.37	34

Results and discussions

Table 4. Breeding values for the best 20 animals from sheep population for amount of protein

ANIMAL	BV-BLUP	Rank-BLUP	BV-BLP	Rank-BLP	BV-OP	Rank-OP
139	3.05	1	3.03	1	3.19	1
298	3.02	2	2.93	2	3.14	2
321	2.95	3	2.87	3	2.56	6
394	2.62	4	2.68	4	2.58	5
168	2.55	5	2.56	5	2.31	9
482	2.20	6	2.22	6	2.52	7
388	1.98	7	2.05	7	1.73	15
370	1.93	8	1.95	8	2.13	11
25	1.91	9	1.90	9	2.71	4
312	1.87	10	1.79	12	1.12	47
212	1.86	11	1.87	10	1.87	14
423	1.77	12	1.85	11	2.75	3
178	1.72	13	1.74	13	1.72	16
284	1.69	14	1.70	15	1.70	18
481	1.68	15	1.70	16	1.70	19
395	1.67	16	1.73	14	2.19	10
241	1.63	17	1.63	18	1.63	23
69	1.60	18	1.59	19	1.37	31
393	1.58	19	1.66	17	2.49	8
51	1.53	20	1.52	21	1.29	34

Results and discussions

Table 5. Breeding values for the best 20 animals from sheep population for prolificacy

ANIMAL	BV-BLUP	Rank-BLUP	BV-BLP	Rank-BLP	BV-OP	Rank-OP
221	0.2603	1	0.2615	1	0.2016	10
219	0.2533	2	0.2542	2	0.2038	7
253	0.2510	3	0.2524	3	0.2014	11
31	0.2352	4	0.2320	5	0.1923	14
211	0.2350	5	0.2363	4	0.1681	38
235	0.2350	6	0.2363	4	0.1681	38
362	0.2216	7	0.2179	6	0.1791	24
271	0.2122	8	0.2134	7	0.2134	5
284	0.2122	8	0.2134	7	0.2134	5
32	0.2107	9	0.2078	8	0.1440	65
81	0.2049	10	0.2004	10	0.2021	9
327	0.2032	11	0.1968	13	0.1856	17
168	0.1988	12	0.2019	9	0.1729	30
249	0.1972	13	0.1982	11	0.2211	1
140	0.1960	14	0.1957	14	0.1225	82
258	0.1955	15	0.1971	12	0.2184	3
53	0.1932	16	0.1893	16	0.1497	56
88	0.1932	16	0.1893	16	0.1497	56
199	0.1897	17	0.1909	15	0.1762	27
365	0.1851	18	0.1616	27	0.1041	87

Results and discussions

Spearman Rank Correlation

Spearman rank correlation between couples: (BLUP and BLP), (BLUP and own performances), (BLP and own performances) for the amount of milk, milk fat, protein, and prolificacy. (table 6).

Traits	BLUP and BLP	BLUP and Own Performances	BLP and Own Performances
Amount of Milk	0.998	0.89	0.899
Milk Fat	0.996	0.907	0.919
Milk Protein	0.998	0.89	0.897
Prolificacy	0.953	0.837	0.912

Conclusions and recommendations

1. Heritability plays a pivotal role in predicting breeding values and advancing genetic progress. Understanding the heritability and genetic correlations of the traits under consideration in the breeding objective and selection index is crucial for accurate breeding value estimation.
2. Heritability estimates for the four examined traits were determined using the REML method within an animal model. These estimates were as follows: **0.197 ± 0.263, 0.209 ± 0.278, 0.263 ± 0.347 and 0.235 ± 0.311.** These findings emphasize that these traits exhibit an intermediate level of genetic determinism. Genetic correlations between milk components and prolificacy to be positive and significant, which may have important implications in the selection of animals for genetic improvement.
3. By conducting selection for sheep using three distinct approaches and subsequently comparing them-namely, selection based on own performance, selection based on the Best Linear Unbiased Prediction (BLP) method (Selection Indices), and selection based on the BLUP - Individual Animal Model methodology-we observed a high degree of agreement among the three selection methods. This suggests that any of these three methods could be effectively employed for candidate selection, the breeding goal should be to improve milk performance, particularly milk quality, taking into account prolificacy.as indicated by the strong Spearman's rank correlation between the pairs identified in this study.

References

Liu, Z., Fu, S., He, X., Liu, X., Shi, C., Dai, L., Wang, B., Chai, Y., Liu, Y., & Zhang, W. (2023). Estimates of Genomic Heritability and the Marker-Derived Gene for Re (Production) Traits in Xinggao Sheep. Genes, 14(3), 579.

Grosu, H., Rotar, C.M. (2015). Breeding Value Estimation in Dairy Cattle using Test Day Models. CERES Publishing House, Bucharest, Romania

Slavova, S. (2022). Bio-economic models for deriving economic values for sheep: a review. Agricultural Science & Technology (1313-8820), 14(3).

Mueller, J. P., Getachew, T., Rekik, M., Rischkowsky, B., Abate, Z., Goshme, S., Wale, Y., & Haile, A. (2021). Three easy fixes for sire use can enhance genetic progress in community-based breeding programmes. Journal of Animal Breeding and Genetics, 138(6), 719-730. https://www.researchgate.net/publication/353641548

Lalit, Z. S., Dalal, D. S., Dahiya, S. P., Magotra, A., & Patil, C. S. (2016). Genetics of growth traits in sheep: A review. Int J Rec Res Life Sci, 3, 12-18.

Thank you for your attention!
Vă mulțumesc pentru atenție!

Ph.D. OSAMAH MURSHEDI

Mobil: **0736283340**

E-mail: osamaalmurshedi66@gmail.com

Address: București Axinte Uricariul, nr.1, Bl.3 sc. B
Ap. 100 S.1