

THE ANALYSIS OF CORRELATIONS BETWEEN THE MAIN TRAITS OF WOOL PRODUCTION ON PALAS SHEEP LINE FOR MEAT, MILK AND HIGH PROLIFICACY

ANALIZA COEFICIENȚILOR DE CORELAȚIE ÎNTRE PRINCIPALII PARAMETRI AI PRODUCȚIEI DE LÂNA LA OVINELE LINIILOR SPECIALIZATE PENTRU CARNE, LAPTE ȘI CU PROLIFICITATE RIDICATA PALAS

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The aim of this paper was to analyze the coefficient of phenotypic correlation and regression between main wool production traits for the sheep belonging to the Palas line specialized for meat, milk and with high prolificacy. The study was performed on a 10 years interval, the phenotypic correlation and the regression being determined for age groups and body weight classes for the following traits: raw wool production, the staple length, wool diameter and body weight at shearing. The obtained results are showing that for the specialized sheep lines the efficiency of wool production is also higher for the sheep with moderate body weights but for these sheep lines the selection for body weight will be done based on the morpho-productive parameters specific to the purpose of exploitation (milk production, meat production or high prolificacy).

Key words: wool production, wool diameter, staple length, body weight at shearing, phenotypic correlation, regression

Introduction

In the breeding activity, the assessment of the correlations between different characters is of great importance, being able to show the way in which the selection for a certain morpho-productive character may influence other parameters. The existence of a phenotypic correlation shows that the organism has a certain balance, meaning that the evolution of one trait can influence either the evolution or the regression of another. A correct understanding of the direction and intensity of these correlations is important for the selection plans, for the prediction of the evolution of one trait based upon another associated trait and for designing the synthetic selection indexes [1, 2, 3] . Having as target the improvement of the wool production the selection by fleece weight must not be detrimental to the wool quality. For that reason an estimate of the correlations between the level of wool

production and the main physico-mechanical wool fiber traits becomes necessary in order to improve the selection criteria.

Materials and Methods

The study was performed for the period 1998-2007 and was focused on the quantity and the quality traits of the wool on the sheep effectives of the Palas Meat Line, Palas Milk Line and Palas High Prolificacy Line. The production of wool was determined by individual weighing of fleece for all the sheep effectives during the shearing season. To evaluate the quality of the wool, randomized samples for each category of sheep were collected. On these samples the fiber diameter (fineness), sample (relative) length and scouring yield were measured and the values were processed through statistical methods. The researches made on a 10 years interval on the specialized sheep lines effectives, displayed a great variation of the wool production level (especially for males). For that reason, the analysis of the age of sheep on the main production traits was done for the years when the differences of the average wool production were statistically not significant. For each year taken into account the statistical parameters, the phenotypic correlation and the regression were determined for age groups regarding the following traits: raw wool production, the staple length, wool diameter and body weight at shearing.

Results and Discussions

For the three sheep lines that make the object of this study, the calculated values for the phenotypic correlation and regression coefficients between wool production and staple length related to the age of the sheep (shearing season, clip) are presented in Table no1. For the adults, the upper and lower limits of the two analyzed coefficients are mentioned. The resulting values are revealing the following aspects:

➤ For the female yearling of all three lines, the calculated values for phenotypic correlation and regression between the wool production and staple length are statistically very significant, varying in the interval $r = 0.177 \pm 0.049$ (***) $\div 0.322 \pm 0.043$ (***) and $b = 0.059 \pm 0.016$ (***) $\div 0.207 \pm 0.018$ (***). The correlation coefficient between the two traits was higher only for the Palas Meat Line, compared with the presented values for the Palas Merinos female by Ursescu Al. [5] $r = 0.262$ (***) and Patape M. [2] $r = 0.134$ (ns) and by Safari A. [4] for other Merinos female yearling breeds $r = 0.24 \div 0.27 \pm 0.02$. The regression coefficients for all three specialized sheep lines were lower than the values calculate by the above mentioned authors for Palas Merino female yearlings ($b = 0.617$ (***) [5], $b = 0.275$ (ns) [3]).

➤ For ewes of the Palas Meat Line and Palas Milk Line the wool production has a positive and very significant correlation with wool staple until the fifth clip and distinctively significant until the sixth clip for the prolific ewes, respectively. After these ages these two traits have a positive but not significant correlation. The

greatest values of the correlation coefficients are: for the Palas Meat Line at the fourth clip $r = 0.318 \pm 0.062$ (***) , for the Palas Milk Line at the fifth clip $r = 0.438 \pm 0.074$ (***) and for the Palas High Prolificacy Line at the sixth clip $r = 0.304 \pm 0.087$ (**), respectively. For other breeds, the phenotypic correlations and the regressions calculate by other authors were: $r = 0.221$ (***) , $b = 0.116 - 0.175$ (***) for Palas Merino ewes, $r = 0.25 - 0.30$ for Australian Merino ewes [5] , for Stavropol Merino ewes $r = 0.52$ (***) , $b = 0.529$, other Merinos ewes $r = 0.25 \dots 0.60$ [1].

Phenotypic correlation and regression coefficients between wool production and staple length related to the age of the sheep (shearing season)

Table 1

Sheep category	Line	Shearing season (age)	$r \pm sr$	$b \pm sb$
Female yearlings	Meat	1	0.322 ± 0.043 (***)	0.207 ± 0.018 (***)
	Milk	1	0.224 ± 0.054 (***)	0.087 ± 0.016 (***)
	Prolific	1	0.177 ± 0.049 (***)	0.059 ± 0.016 (***)
Male yearlings	Meat	1	0.252 ± 0.093 (*)	0.173 ± 0.028 (***)
	Milk	1	0.257 ± 0.106 (*)	0.182 ± 0.036 (**)
	Prolific	1	0.269 ± 0.116 (*)	0.078 ± 0.035 (*)
Ewes	Meat	2 - 10	0.134 ± 0.076 (ns) 0.318 ± 0.062 (***)	0.066 ± 0.069 (ns) 0.183 ± 0.026 (***)
	Milk	2 - 10	0.073 ± 0.217 (ns) 0.438 ± 0.074 (***)	0.047 ± 0.086 (ns) 0.167 ± 0.029 (***)
	Prolific	2 - 10	0.032 ± 0.378 (ns) 0.304 ± 0.087 (**)	0.021 ± 0.016 (ns) 0.104 ± 0.038 (**)
Rams	Meat	2 - 5	0.097 ± 0.495 (ns) 0.209 ± 0.151 (ns)	0.047 ± 0.328 (ns) 0.182 ± 0.137 (ns)
	Milk	2 - 4	0.042 ± 0.446 (ns) 0.162 ± 0.184 (ns)	-0.053 ± 0.024 (ns) 0.122 ± 0.109 (ns)
	Prolific	2 - 5	-0.029 ± 0.017 (ns) 0.297 ± 0.221 (ns)	-0.055 ± 0.029 (ns) 0.173 ± 0.133 (ns)

ns – not significant ($P > 0,05$) * - significant ($P < 0,05$)
 ** - distinctly significant ($P < 0,01$) *** - very significant ($P < 0,001$)

➤ The males of the three specialized lines have significant positive values of phenotypic correlations between wool production and staple length only for the first clip (male yearlings) $r = 0.252 \pm 0.093$ (*) ÷ 0.269 ± 0.116 (*). For other

shearing seasons this is statistically not significant. The negative values of the correlation and regression found for the last clip for the rams of the Palas High Prolificay Line show that the wool production decreases with the increase of the relative staple length, after a certain age the two parameters tend to become independent.

Table no. 2 shows the phenotypic correlation and regression coefficients between the wool production and the fiber fineness (diameter) related to the sheep age for the analyzed lines.

Phenotypic correlation and regression coefficients between wool production and fiber diameter related to the age of the sheep (shearing season)

Table 2

Sheep category	Line	Shearing season (age)	r ± sr	b±sb
Female yearlings	Meat	1	0.434±0.039 (***)	0.373±0.037 (***)
	Milk	1	0.187±0.055 (***)	0.117±0.022 (***)
	Prolific	1	0.143±0.049 (**)	0.057±0.021 (**)
Male yearlings	Meat	1	0.321±0.089 (**)	0.336±0.028 (***)
	Milk	1	0.204±0.109 (ns)	0.185±0.098 (*)
	Prolific	1	0.173±0.120 (ns)	0.116±0.048 (*)
Ewes	Meat	2 - 10	-0.035±0.301 (ns) 0.370±0.059 (***)	-0.018±0.239 (ns) 0.282±0.0235 (***)
	Milk	2 - 10	-0.043±0.218 (ns) 0.361±0.071 (***)	-0.035±0.099 (ns) 0.125±0.025 (***)
	Prolific	2 - 10	-0.049±0.377 (ns) 0.293±0.087 (**)	-0.027±0.013 (ns) 0.115±0.053 (*)
Rams	Meat	2 - 5	0.276±0.462 (ns) 0.456±0.198 (ns)	0.152±0.029 (ns) 0.380±0.137 (**)
	Milk	2 - 4	0.081±0.442 (ns) 0.257±0.176 (ns)	0.065±0.028 (ns) 0.196±0.113 (ns)
	Prolific	2 - 5	-0.119 ± 0.569 (ns) 0.237±0.153 (ns)	-0.078 ± 0.067 (ns) 0.129±0.059 (*)

ns – not significant (P > 0,05) * - significant (P < 0,05)

** - distinctly significant (P < 0,01) *** - very significant (P < 0,001)

These values are leading to the following conclusions:

➤ For the Palas Meat Line and Palas Milk Line, the female yearlings have very significant values of phenotypic correlation and regression between the wool production and fiber diameter, $r = 0.187 \pm 0.055$ (***) ÷ 0.434 ± 0.039 (***) , $b = 0.117 \pm 0.022$ (***) ÷ 0.373 ± 0.037 (***) . For the Palas High Prolificay Line the

female yearlings have statistically distinct values of these coefficients $r = 0.143 \pm 0.049$ (**), $b = 0.057 \pm 0.021$ (**). The values determined for these coefficients were superior only for the Palas Meat Line, compared to those reported by other authors for Palas Merino female yearlings $r = 0.187$ (***) , $b = 0.211$ (211g/micron) (***) [5] , $r = 0.251$ (***) , $b = 0.353$ (***) [2] , for Corriedale female yearlings $r = 0.37 \pm 0.02$, Coopworth breed $r = 0.34 \pm 0.03$, other Merino breeds $r = 0.13 \div 0.32 \pm 0.02$ [4] .

➤ For the Palas Meat Line and Palas Milk Line, the ewes have very significant values of correlations and regressions only for clips II-IV, the greatest values for these coefficients being found for the third clip $r = 0.370 \pm 0.059$ (***) - Meat Line and for the fourth clip $r = 0.361 \pm 0.071$ (***) - Milk Line. The data presented for these two lines are higher than those calculate by various authors for the ewes of different breeds, Palas Merino (3-5 age) $r = 0.233$ (***) , $b = 0.273$ (***) , Merinolandschaf $r = 0.25$, Australian Merino $r = 0.13$ [5] , Stavropol Merino $r = 0.14$ (*) , $b = 0.099$, other Merino breeds $r = 0.13 \dots 0.29$ [1]. Regarding the Palas High Prolificay Line, the ewes showed distinct significant values of correlations and regressions, with a peak at the sixth clip $r = 0.293 \pm 0.087$ (**). The negative values of the correlation and regression ($r = -0.049 \pm 0.377$ (ns) \div -0.035 ± 0.301 (ns)) found for all the three lines at the last shearing season show an 18 – 35 microni increase of the fiber diameter associated with one kilo decrease of the wool production.

➤ The male yearlings showed significant distinct values for correlation only for the Meat Line ($r = 0.321 \pm 0.089$ (**)), for the other two line the coefficient not being statistically significant, $r = 0.173 \pm 0.120$ (ns) \div 0.204 ± 0.109 (ns).

➤ The rams of the studied sheep lines have positive but not significant values of the correlation between wool production and fiber fineness $r = 0.081 \pm 0.442$ (ns) \div 0.456 ± 0.176 (ns). The greatest values of the correlation coefficients are: for the Palas Meat Line at the thirth clip $r = 0.456 \pm 0.198$ (ns), for the Palas Milk Line at the second clip $r = 0.257 \pm 0.176$ (ns) and for the Palas High Prolificay Line at the second clip $r = 0.237 \pm 0.153$ (ns), respectively.

The increase of the body weight in order to achieve a higher wool and meat production represented a goal of the local sheep breed selection. Under these circumstances the question is to what extent the increase of body weight is justified in order to obtain the greatest sheep production level. Because the relative wool production, reported to the unit of body weight does not increase proportionally with the body weight it is not recommended the indirect selection based on body weight in order to increase the wool production without knowing the level at which the two parameters correlate significantly. For the sheep belonging to the specialize lines created at Palas, the analysis was done for the years (between 998 – 2007) when the differences of the average wool productions were not significant. For each category of sheep that made the object of this study a grouping by body weight class at shearing was done. For each class the average values of the analyzed traits were calculated together with the phenotypic correlation, regressions and their statistic significance. The values are presented in Table 3.

CORRELATION BETWEEN BODY WEIGHT AND WOOL PRODUCTION

Table 3

Sheep category	Weight class	Line	r ± sr	b±sb
Ewes	31-40	Meat	0.108 ±0.082 (ns)	0.011± 0.008 (ns)
		Milk	0.089 ±0.105 (ns)	0.016± 0.0087 (ns)
		Prolific	0.130 ±0.082(**)	0.031 ±0.014 (*)
	41-50	Meat	0.137±0.039 (***)	0.024± 0.01 (*)
		Milk	0.107±0.052 (*)	0.013± 0.012 (ns)
		Prolific	0.128±0.048 (**)	0.026 ± 0.01 (**)
	51-60	Meat	0.283 ±0.053 (***)	0.035±0.014 (*)
		Milk	0.245± 0.050 (***)	0.029±0.011(**)
		Prolific	0.269± 0.056 (***)	0.063± 0.028 (**)
	61-70	Meat	0.094±0.136 (ns)	0.020±0.019 (ns)
		Milk	0.052±0.106 (ns)	0.0089±0.018 (ns)
		Prolific	0.082±0.122 (ns)	0.014 ± 0.0074 (ns)
Rams	61-70	Meat	0.164±0.281 (ns)	0.031±0.029 (ns)
		Milk	0.171±0.280(ns)	0.014±0.008 (ns)
		Prolific	0.412±0.196 (ns)	0.081±0.06 (ns)
	71-80	Meat	0.353±0.175 (ns)	0.054±0.056 (ns)
		Milk	0.366±0.289 (ns)	0.048±0.027 (ns)
		Prolific	0.361±0.199 (ns)	0.036±0.016 (*)
	81-90	Meat	0.377± 0.168 (ns)	0.077±0.069 (ns)
		Milk	0.227± 0.245(ns)	0.072±0.048 (ns)
		Prolific	0.182± 0.395 (ns)	0.012±0.0064 (ns)
	91-100	Meat	- 0.107±0.313 (ns)	-0. 089 ± 0.047 (ns)
		Milk	-0.118±0.329 (ns)	-0.039 ± 0.015 (ns)
		Prolific	-0.086±0.314 (ns)	-0. 089 ± 0.057 (ns)

ns – not significant (P > 0,05) * - significant (P < 0,05)
 ** - distinctly significant (P < 0,01) *** - very significant (P < 0,001)

Based on the analysis of the value in Table no. 3, the following conclusions are resulting:

➤ The ewes of the Palas Meat Line with weights between 41-60 kg showed very significant values of the phenotypic correlation between body weight at shearing and wool production $r = 0.137 \pm 0.039 \div 0.283 \pm 0.053$ (***). Below 40 kg and over 60 kg, the two traits are not significantly correlated. The regression coefficients had significant positive values $b = 0.024 \pm 0.01$ (*) $\div 0.035 \pm 0.014$ (*) for the ewes with body weight between 41-60 kg and not significant for the other classes of weight. Thus for the Meat Line ewes with body weights between 40-60 kg the wool production increases by 24-35 g in correlation with the increase of the body weight at shearing by 1 kg. For the Palas Milk Line ewes with weights between 41-50 kg showed the phenotypic correlation were statistically significant $r = 0.107 \pm 0.052$ (*) and very significant $r = 0.245 \pm 0.050$ (***) of ewes between 51-60 kg. The regression coefficient were also distinctly significant for the ewes weighing between 50 and 60 kg, $b = 0.029 \pm 0.011$ (**). Regarding the ewes of the Palas High Prolificacy Line with weights between 31-50 kg, these showed distinctly significant values of the phenotypic correlation between body weight at shearing and wool production $r = 0.128 \pm 0.048$ (**) $\div 0.130 \pm 0.082$ (**) and very significant values $r = 0.269 \pm 0.056$ (***) for ewes weighing 51-60 kg. The Palas Merino ewes of 51-60 kg had a value of the regression of $b = 0.069$ (***) [5], superior to the ewes of the same body weight class belonging to the specialized sheep lines $b = 0.029 \pm 0.0064$ (**) $\div 0.034 \pm 0.0068$ (*). For all the specialized lines, the efficiency of wool production is higher for the ewes weighing below 60 kg. Thus the ewes of the Meat Line are producing $59.233 \div 75.555$ g wool / body kilo, $51.910 \div 70.083$ g wool / body kilo ewes of the Milk Line and $52.063 \div 73.330$ g wool / body kilo ewes belonging to Palas High Prolificacy Line.

➤ For the rams belonging to the three studied sheep lines, the values of the phenotypic correlations between body weight at shearing and wool production are as ranging as follows $r = -0.118 \pm 0.329$ (ns) $\div 0.412 \pm 0.196$ (ns). The greatest correlation coefficients were obtained for the weight classes 61-70 kg at the Prolific Line ($r = 0.412 \pm 0.196$ (ns)), 71-80 kg at the Milk Line ($r = 0.366 \pm 0.289$ (ns)) and 81-90 kg at the Meat Line rams ($r = 0.377 \pm 0.168$ (ns)), respectively. The regression coefficients for the rams between 60-90 kg ranged between $b = -0.089 \pm 0.057$ (ns) $\div 0.081 \pm 0.06$ (ns). For body weights exceeding 90 kg, all the lines are showing negative values of correlations and regressions as a result of the decrease in wool production with 39-89 g for every 1 kg increase in body weight at shearing. The efficiency of wool production measured as wool quantity per unit of body weight is also superior for all the three lines at the rams weighing less than 90 kg ($57.115 \div 61.986$ g wool / body kilo – Palas Met Line, $57.414 \div 63.211$ g wool / body kilo – Palas Milk Line, $51.180 \div 65.024$ g wool / body kilo Palas High Prolificacy Line)

Conclusions

- The greatest values of the phenotypic correlation between the wool production and staple length of the ewes are: for the Palas Meat Line at the fourth clip $r = 0.318 \pm 0.062$ (***), for the Palas Milk Line at the fifth clip $r = 0.438 \pm 0.074$ (***) and for the Palas High Prolificacy Line at the sixth clip $r = 0.304 \pm 0.087$ (**)
- The greatest values of the correlation coefficients between the wool production and fiber diameter of rams are: for the Palas Meat Line at the third clip $r = 0.456 \pm 0.198$ (ns), for the Palas Milk Line at the second clip $r = 0.257 \pm 0.176$ (ns) and for the Palas High Prolificacy Line at the second clip $r = 0.237 \pm 0.153$ (ns)
- The analysis of the average values of the wool production per 1 kg of live body weight obtained by the Meat Line sheep is showing an advantage of 3.60 g wool per kilo of body weight (5.59 %) for the ewes compared with rams. For the Palas Milk Line the rams are producing with 2.95 g wool per kilo of body weight (5.52 %) more than the ewes. Regarding the Palas Prolific Line the analysis of the average values of wool production per 1 kg of live body weight shows the superiority with 1.83 g wool per kilo of body weight (3.18 %) of rams compared to ewes.
- The obtained results are showing that for the specialized sheep lines the efficiency of wool production is also higher for the sheep with moderate body weights but for these sheep lines the selection for body weight will be done based on the morpho-productive parameters specific to the purpose of exploitation (milk production, meat production or high prolificacy).

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