

## ESTIMATES OF MORPHOLOGICAL STRUCTURE OF FLEECE AND VARIATION OF WOOL QUALITATIVE TRAITS ON DIFFERENT BODY REGIONS OF PALAS MEAT LINE SHEEP

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### Abstract

*The knowledge of the fleece morphologic structure and of the variation of the wool qualitative traits for hybrids and sheep population specialized for meat and milk production represents a necessity within selection activities in order to establish the body area of collecting wool samples representative for the whole fleece and also for elaboration of the wool classing and sorting norms. The study was made on the sheep effectives of the Palas Meat Line by determining the wool fineness, the absolute and relative length, the tensile strength, the extensibility and impurification degree on the wool samples randomly collected at shearing season on six body areas, calculating the statistic parameters and testing the statistic significance of the differences for each traits on body regions related to fleece average. The data thus obtained emphasized differences with statistical significances related to the ewes average wool diameter of 24.85 microns, on the thighs areas (with 2.75 % (\*) over the mean diameter), on the shoulder with 3.75% (\*\*\*) under the mean value and related to the rams average wool diameter of 25.67 microns, on the belly (with 2.59% \* under the mean value) respective with 3.75% (\*) on shoulder areas. The average tenacity of the wool fibers for the ewes of the Palas Meat Line was of 12.74 cN/tex, and for the rams of 13.72 cN /tex , the median area having over-average values and the neck, back and abdomen being inferior to it. The greater variability for all wool traits analyzed on the sheep body areas require a selection of wool production based on indexes established trough objective wool traits measurement for samples collected from the median body regions (shoulders, ribs and thigh).*

**Key words:** wool, diameter, length, tenacity, body region

### INTRODUCTION

The main features which directly action on the wool quantity: density, length and the extension of wool are specific to each breed and vary according to the body area. The body area also implies a different diameter of the fiber according to the growing area on the body surface [5]. The studies made by the Americans researchers [1;2] on Shropshire and Southdown sheep breeds evidenced differences between the qualitative parameters of wool per body areas, so that the diameter of wool increases anterior-posterior , the wool fleece density decreases in following the order: head, neck, shoulders, back, the rest of the body and abdomen, the length is bigger in the posterior area and decrease to the head (where the wool is the

shortest) and the scouring yield has the biggest values in the middle area of the body and has the smallest levels at abdomen and neck.

It is necessary to know the regional variation of physical-mechanical parameters of the wool fibers in order to establish the representative body area to measure these parameters and the probability that they to represent the general average of the individual for the feature analyzed within sheep selection activities. Also, the obtained results can be the base for elaborating some standardized norms of classification and sorting the wool obtained from the sheep of the lines specialized for other productions.

Even if in the case of the sheep specialized for meat and milk productions,

the wool is considered a secondary production, however it is a product of the sheep species on which base benefits are obtained and which, besides milk and meat can contribute to make the breeding and exploiting of this species efficient. Irrespective of the direction for sheep exploitation, it is also important to screen the qualitative level of wool and redirect it, depending on the requirements of the processing industry.

## MATERIAL AND METHOD

The works were made at I.C.D.C.O.C. Palas, on the sheep effectives from Line specialized for Meat production, being carried out on a period of 10 years, 1998 - 2007. The analysis of the differences between the qualitative parameters of the wool per body was made by determining the fineness, the absolute and relative length, the tensile strength, extensibility and impurification degree, on the wool samples randomly collected at shearing season on six body areas (neck, shoulders, ribs, thighs, back and abdomen), at homogenous categories of sheep in the point of view of age, conditions of breeding and exploitations. For each sample was calculated the statistic parameters, the correlations, regressions and tested the statistic significance of the differences related to the annual average and body regions

The main physical – mechanical traits of the wool, the methods of determining them and also the used equipment within the researches were the following:

➤ **The fineness** was determined at microscope using the Zeiss wool meter, 150 readings being made for each wool sample collected from the sheep of the Palas Meat Line [3; 6]. The way of preparing the

samples and measurement carrying out is that provided by SR ISO 137:2007

➤ **The length of the wool fibers** *The relative length* was established by measuring the length of the locks at the samples collected on shearing season, with the crimps present in the normal shape. *The absolute length* was determined using the FM 04/B (Sinus) semi-automat apparatus by measuring a number of 100 wool fibers from each sample, straightened until the complete disappearing of curls [3;6]. The way of preparing the samples and measurement carrying out is that provided by SR ISO 6989 :1998

➤ **The tensile strength of the wool fibers**– It was determined the absolute resistance expressed in force grams (cN) and extensibility (%), using the Eltens FM 27 micro-dynamometer, making 50 determinations on each collected sample and it was calculated the relative resistance (cN/tex - tenacity). The preparation of samples to establish the physical -mechanical parameters and the determinations were done according to STAS 8520-87

## RESULTS AND DISCUSSIONS

The analysis made regarding the morphologic structure of the fleece at the sheep belonging to the Palas Meat Line evidence white color of the hair coat and its extension on the head until the line between eyes or a little upper completing the posterior part of the maxillaries, goes down on the anterior members until a few centimeters up to the knee, covers well the chest and the abdomen, goes down on members until the articulation of the hock covering the superior and lateral parts of them and the upper part of the tendon in the posterior part, as it is shown in Figure no.1



Fig.no.1 Male of Palas Sheep Line specialized for meat production

The wool fleece has a compact texture, sufficiently well-closed, with an exterior aspect which varies between “rivers “ and little squares (“cauliflower”) shape Fig. no 2

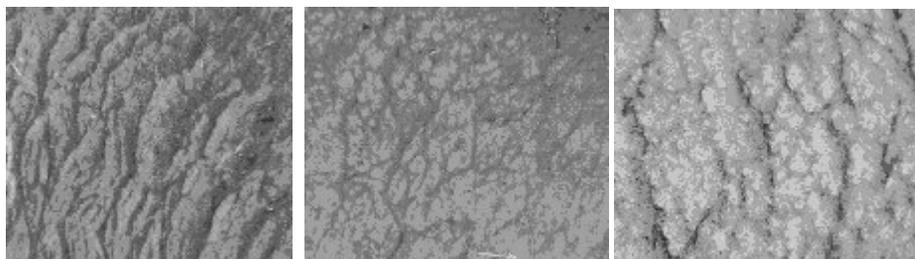


Fig. no.2 – Exterior aspects of fleece at the Palas Sheep Line specialized for meat production

In the point of view of structure, the fleece consists in bundles (locks) of intermediary shape (to prismatic) characteristic to the crossbred with fine wool (Fig. no 3). The interior aspect of the bundles is semi-clear, the average number of crimps being of 4.5 -6 /cm.

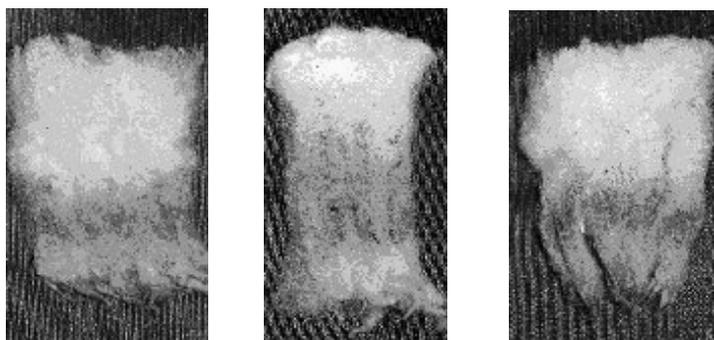


Fig. no 3 – The shape of wool bundle at the Palas Sheep Line specialized for meat production

The wool fineness variation over body areas at the adult sheep from Palas Sheep Line specialized for meat production is presented in Table no.1

Table 1

The wool fineness variation over body areas at the adult sheep from Palas Sheep Line specialized for meat production

| Categ. | Body region | number (heads) | $\bar{x} \pm s_x$ (microni) | CV (%)               | Differences related to mean value |              |              |
|--------|-------------|----------------|-----------------------------|----------------------|-----------------------------------|--------------|--------------|
|        |             |                |                             |                      | absolute (microni)                | relative (%) | Signif. dif. |
| Ewes   | Neck        | 20             | 24,28± 0,137                | 25,16                | -0,58                             | -2,35        | ns           |
|        | Shoulder    | 20             | 23,97± 0,128                | 23,83                | -0,89                             | -3,57        | **           |
|        | Ribs        | 20             | 25,17± 0,151                | 26,78                | 0,31                              | 1,23         | ns           |
|        | Thigh       | 20             | 25,54± 0,163                | 28,59                | 0,68                              | 2,75         | *            |
|        | Back        | 20             | 24,84± 0,163                | 29,39                | -0,02                             | -0,08        | ns           |
|        | Belly       | 20             | 25,36± 0,141                | 24,87                | 0,50                              | 2,01         | ns           |
|        | <b>Mean</b> |                |                             | <b>24,85 ± 0,147</b> | <b>26,42</b>                      | -            | -            |
| Rams   | Neck        | 5              | 25,37± 0,263                | 23,16                | -0,30                             | -1,18        | ns           |
|        | Shoulder    | 5              | 24,71± 0,241                | 21,83                | -0,96                             | -3,75        | **           |
|        | Ribs        | 5              | 25,49 ± 0,282               | 24,78                | -0,18                             | -0,71        | ns           |
|        | Thigh       | 5              | 26,18± 0,298                | 25,42                | 0,51                              | 1,98         | ns           |
|        | Back        | 5              | 25,85± 0,303                | 26,17                | 0,18                              | 0,69         | ns           |
|        | Belly       | 5              | 26,43± 0,270                | 22,87                | 0,76                              | 2,95         | *            |
|        | <b>Mean</b> |                |                             | <b>25,67± 0,276</b>  | <b>24,04</b>                      | -            | -            |

ns – non significant ( $P > 0.05$ ) \* - significant ( $P < 0.05$ ) \*\* distinctly significant ( $P < 0.01$ ) \*\*\* - very significant ( $P < 0.001$ )

The data presented in Table no. 1 evidence the following order of increasing the wool diameter per body areas:

➤ Ewes of the Line specialized for the meat production of Palas: shoulder, neck, back, ribs, abdomen, and thighs. The average diameter of the wool was 24.85 microns, the thigh had over the average with 2.75% (\*) and the shoulder under the average with 3.57% (\*\*). The other areas (neck, back, ribs and abdomen) had non - significant differences of the wool diameter related to the average value.

➤ Rams of the Line specialized for the meat production of Palas: shoulder, neck, ribs, back, thighs, and abdomen. The average diameter of wool was 25.67 microns, the abdomen had over the average with 2.95% (\*) and the shoulder under the average with 3.75 % (\*\*). The other areas (neck, back, ribs and thighs) had non - significant differences of the wool diameter related to the average value.

The previous researches regarding the variation of the wool qualitative parameters per body area made on all sheep categories of the breeds of Merinos de Palas, Merinos Australian, Merinos of Stavropol and

Polwarth [4] emphasized maximum differences of the wool finesse per studied areas in rapport with the fleece average finesse between 0.52 ÷ 1.18 microns, respectively maximum differences between body areas between 0.89 ÷ 2.07 microns. Comparatively to these data for the sheep categories of The Palas Meat Line there were obtained values of 0.69 ÷ 0.88 microns (for the amplitude of the fineness variation per areas in rapport with the fleece average) respectively 1.57 ÷ 1.72 microns (for the amplitude of variation of the fineness between the analyzed body areas).

The analysis of the data in Table no.2 regarding the variation of the length of the wool fibers per body regions at the sheep of Palas Meat Line emphasizes the following aspects:

➤ The absolute length of the wool fibers per areas for ewes increased in the following order: abdomen, neck, back, ribs, shoulder, thighs. In rapport with the average of 9.91 cm of the absolute length, the thighs and the shoulder had bigger values with 8.63 – 21.59% (\*\*\*) and the abdomen was with 34.70% under average (\*\*\*). The average

degree of impurification in the case of ewes neck, shoulder, back and abdomen (64.31 ÷ was of 63.97%, over this value being the 68.37%)

Table 2  
The wool absolute length variation over body areas of Palas Sheep Line specialized for meat production

| Categ. | Body region | no. | Absolute length (cm) |                                   |       |         | CV (%)       | Pro-yield (cm) | Impurif degree (%) |
|--------|-------------|-----|----------------------|-----------------------------------|-------|---------|--------------|----------------|--------------------|
|        |             |     | $\bar{x} \pm S_x$    | Differences related to mean value |       |         |              |                |                    |
|        |             |     |                      | %                                 | cm    | Signif. |              |                |                    |
| Ewes   | Neck        | 20  | 10,02 ± 0,051        | 1,40                              | 0,14  | ns      | 22,75        | 2,35           | 65,71              |
|        | Shoulder    | 20  | 10,73 ± 0,052        | 21,59                             | 2,13  | ***     | 21,54        | 2,36           | 64,31              |
|        | Ribs        | 20  | 10,18 ± 0,054        | 3,04                              | 0,30  | ns      | 23,82        | 3,02           | 58,46              |
|        | Thigh       | 20  | 12,01 ± 0,068        | 8,63                              | 0,85  | ***     | 25,47        | 2,96           | 61,87              |
|        | Back        | 20  | 10,06 ± 0,052        | 0,03                              | 0,15  | ns      | 23,35        | 2,27           | 65,11              |
|        | Belly       | 20  | 6,45 ± 0,033         | -34,7                             | -3,43 | ***     | 23,02        | 1,36           | 68,37              |
|        | <b>Mean</b> |     | <b>9,91 ± 0,052</b>  | -                                 | -     |         | <b>23,33</b> | <b>2,39</b>    | <b>63,97</b>       |
| Rams   | Neck        | 5   | 11,79 ± 0,114        | -3,27                             | -0,40 | ns      | 21,70        | 2,86           | 62,18              |
|        | Shoulder    | 5   | 13,22 ± 0,121        | 8,40                              | 1,02  | ***     | 20,42        | 3,97           | 51,94              |
|        | Ribs        | 5   | 13,18 ± 0,132        | 8,10                              | 0,99  | **      | 22,38        | 3,59           | 54,8               |
|        | Thigh       | 5   | 14,73 ± 0,157        | 20,82                             | 2,54  | ***     | 23,85        | 3,67           | 56,35              |
|        | Back        | 5   | 12,68 ± 0,132        | 4,04                              | 0,49  | ns      | 23,35        | 3,08           | 60,72              |
|        | Belly       | 5   | 7,55 ± 0,075         | -38,09                            | -4,64 | ***     | 22,15        | 1,86           | 63,5               |
|        | <b>Mean</b> |     | <b>12,19 ± 0,122</b> |                                   |       |         | <b>22,31</b> | <b>3,17</b>    | <b>58,25</b>       |

ns – non significant (P > 0.05) \* - significant (P < 0.05) \*\* distinctly significant (P < 0.01) \*\*\* - very significant (P < 0.001)

➤ The rams of the Palas Meat Line registered an absolute length of the wool fibers per areas which increase in the following order: abdomen, neck, back, ribs, back, thighs. In rapport with the average of 12.19 cm of the absolute length, the ribs, the back and the thighs had bigger values with 8.10 ÷ 20.82% (\*\*\*) , and the abdomen was with 38.09% under average (\*\*\*) . The average degree of impurification in the case of rams was of 58.25%, over this value being the neck, back and abdomen (60.72÷63.5%).

➤ The analysis of the variation of the average absolute length in rapport with sex emphasizes superiority with 2.28 cm (18.70%) of the rams comparatively to the ewes. Regarding the average degree of impurification for the analyzed sheep categories this was as absolute value with 5.69% lower in the case of rams besides ewes.

The previous researches regarding the variation of the qualitative parameters of

wool per body areas made on all categories of sheep from Merinos de Palas, Merinos Australian, Merinos de Stavropol and Polwarth breeds [4] evidenced an amplitude of variation of the length per studied body areas in rapport with the average length of the fleece between 1.48÷2.63 cm, respectively maximum differences between the body areas of 2.2÷3.75 cm. The maximum differences of the absolute length of the wool per body areas in the case of sheep from the specialized lines are bigger than those of the sheep breeds with fine wool, respectively of 2.1 ÷ 4.64 cm related to the fleece average length and 5.56 ÷ 7.18 cm between the analyzed body areas.

The wool mechanical traits variation over body areas of Palas Sheep Line specialized for meat production is showed in Tabel no.3

Table 3

The wool mechanical traits variation over body areas of Palas Sheep Line specialized for meat production

| Categ. | Body region | n  | Fineness microns | Relative tensile strength (cN) |        |              | Tenacity (cN/tex) |                                   |        |
|--------|-------------|----|------------------|--------------------------------|--------|--------------|-------------------|-----------------------------------|--------|
|        |             |    |                  | $x \pm S_x$                    | Signif | CV (%)       | x                 | Differences related to mean value |        |
|        |             |    |                  |                                |        |              |                   | %                                 | cN/tex |
| Ewes   | Neck        | 20 | 24,28            | 7,66 ± 0,079                   | *      | 32,78        | 12,73             | -0,03                             | 0,00   |
|        | Shoulder    | 20 | 23,97            | 7,55 ± 0,067                   | **     | 28,15        | 12,88             | 1,10                              | 0,14   |
|        | Ribs        | 20 | 25,17            | 8,42 ± 0,079                   | *      | 29,54        | 13,02             | 2,26                              | 0,29   |
|        | Thigh       | 20 | 25,54            | 8,81 ± 0,087                   | ***    | 30,07        | 13,69             | 7,46                              | 0,95   |
|        | Back        | 20 | 24,84            | 7,83 ± 0,073                   | ns     | 30,83        | 11,85             | -6,98                             | -0,89  |
|        | Belly       | 20 | 25,36            | 8,04 ± 0,079                   | ns     | 31,2         | 12,25             | -3,81                             | -0,49  |
|        | <b>Mean</b> |    | <b>24,85</b>     | <b>8,05 ± 0,080</b>            |        | <b>30,43</b> | <b>12,74</b>      |                                   |        |
| Rams   | Neck        | 5  | 25,37            | 8,71 ± 0,151                   | ns     | 27,35        | 13,26             | -3,38                             | -0,46  |
|        | Shoulder    | 5  | 24,71            | 8,68 ± 0,132                   | ns     | 24,04        | 14,17             | 3,25                              | 0,45   |
|        | Ribs        | 5  | 25,49            | 9,48 ± 0,143                   | ns     | 23,81        | 14,06             | 2,48                              | 0,34   |
|        | Thigh       | 5  | 26,18            | 10,25 ± 0,147                  | ***    | 22,74        | 14,78             | 7,68                              | 1,05   |
|        | Back        | 5  | 25,85            | 8,45 ± 0,142                   | **     | 26,63        | 12,92             | -5,89                             | -0,81  |
|        | Belly       | 5  | 26,43            | 9,00 ± 0,160                   | ns     | 28,18        | 13,16             | -4,13                             | -0,57  |
|        | <b>Mean</b> |    | <b>25,67</b>     | <b>9,10 ± 0,150</b>            |        | <b>25,46</b> | <b>13,72</b>      |                                   |        |

ns – non significant (P > 0.05) \* - significant (P < 0.05) \*\* distinctly significant (P < 0.01) \*\*\* - very significant (P < 0.001)

➤ Regarding the ewes, they had an average tensile strength of 8,05 cN, per body areas, as a significance of the differences, a bigger value was that of hams, of 8,81 cN (\*\*\*) and ribs of 8.42 cN (\*) and a smaller value was that of the back, of 7.55 cN (\*\*) and the neck, of 7.66 cN (\*). The ranking of the analyzed areas in the point of view of resistance is relevant when this parameter is compared as relative size, considering both the strength of the fibers and the diameter of the analyzed wool fibers. With this purpose it was calculated the tenacity of the fibers (cN/tex), as proportion of the tensile strength (cN) and of the fineness expressed in tex. The average tenacity of the wool fibers at the ewes of the Palas Meat Line was of 12.74 cN /tex, the median area (shoulder, ribs, thighs) having over-average values and the neck, back and abdomen being inferior to it. The ranking of the areas in the point of view of this parameter is: back, abdomen, neck, shoulder, ribs, and thighs.

➤ The average tensile strength of the rams had the value of 9.10 cN, per areas very

significant differences (\*\*\*) over the average being those of the rib (10.25 cN) and distinctly significant (\*\*) under average being those of the back (8.45 cN). The ranking of the areas in the point of view of wool tenacity is: back, abdomen, neck, ribs, shoulder, thighs, the median area (shoulder, ribs, thighs) having values over the average of 13.72 cN/tex of the wool tenacity.

➤ The analysis of the obtained results for the relative resistance of the wool per categories of sheep emphasizes the fact that the males adult sheep registered a superior relative resistance in comparison to the females with 0.98 cN/tex (7.14%).

## CONCLUSIONS

➤ Obtained results for the sheep belonging to the Palas Meat Line emphasized the fact that the finesse is bigger ( lower diameter) in the anterior part of the body and it decreases in the front – posterior and back –ventral way, the ribs’ region representing the average (at all analyzed categories the differences of

this zone beside the average were not significant).

➤ The analysis made concerning the variation per body areas of the physical-mechanical parameters evidenced at all the studied sheep categories significant differences besides the average calculated for the entire wool fleece. So the existence of these differences, respectively a number of up to 4-5 quality classes in a single wool fleece justifies the fragmentation of the fleece in the frame of the grading and classing operation and implicitly reduces the commercial value of the this wool. Taking into account the situation created by the inexistence of a standard for classifying the raw wool (STAS 844-80 being cancelled since 2008) it is necessary to establish certain criteria which to correspond to the actual structure of sheep breeds and populations which are raised and exploited in Romania and to the requirements of the external wool market.

➤ In the works selection of the sheep for the wool production there will be replaced the indicators which had been established on the basis of subjective appreciations with those based on objective determinations of the main qualitative parameters of the fibers. In this respect before the beginning of the shearing season especially at the hybrids and the new-created sheep populations (characterized by a higher variability of the wool parameters in the wool fleece) exploited

for the meat, milk productions and prolificacy it is recommended:

- catching of wool samples from the areas: shoulders, ribs and thigh and making the laboratory determinations in order to establish the average diameter, the absolute length, the resistance and extensibility of wool and their variation in the mentioned areas;

- establishing the degree of wool impurification by measuring the penetrating depth of the impurities in the fleece on the areas of neck, back, shoulders, ribs and thigh;

- identifying and mentioning the types of defects at wool respectively the types of vegetal impurities which are hard to be removed during processing, which can determine the declassification of the wool fleece.

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