Analysis of external features and live weight of woolly-meaty sheep (ovis aries)

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Abstract. This article addressed the development and the growth of offspring, the external characteristics and the productivity at different breeding periods of woolly-meaty sheep of Uzbekistan. It was observed that wool productivity was higher in sheep rich in wool-meat than ordinary sheep; sheared wool was 1.26 kg (49.6%), after washing it was 0.97 kg (67.8%), wool length was 2.13 (19.2%) higher. Live weights of lambs from ewes in the experimental groups were determined at birth, at 30 days of age, and 3 months of age. From September 1 to September 20 of the year, the live weight, body size and wool productivity of early inseminated ewes were higher than those of inseminated ewes from late October to November 10. The live weight of lambs obtained from artificially inseminated sheep with frozen semen of typical rams in world gene pool considered semi-fine wool in the meat-wool direction was higher than sheep naturally inseminated with pedigree rams. Accordingly, it was heavier by 0.04 kg (9.3%) at the first day of birth, followed by 0.5 kg (6.8%) at 10 days, and 0.4 kg (1.3%) at 3 months of age.

1. Introduction

Development of animal husbandry, which is one of the agricultural sectors, is key factor in improving the food supply of the world population, and increasing the efficiency of agricultural productions [1]. It is stated that the urgent tasks in sheep husbandry are to create productive breeds, apply the world experience in science and implement research results in practice, introduce breeds and hybrids of high-yielding meat and wool-type sheep that meet the requirements of international standards, and resistant to external environmental conditions, create a reserve of frozen semen of rams, and formulate gene pool herds of sheep rich in wool-meat in mountainous and foothill areas [1, 2]. Furthermore, sharp increase and development in the modern market are requiring to breed high-yield breeds of sheep, building our own high-yielding breeds of fast-growing meat-producing sheep, creating high-yielding breeds of high-yielding sheep, improving the breeding traits of their offspring. preservation and reproduction of the gene pool [3, 4]. The scientific work on the creation of pedigree groups of meat-bearing sheep in Uzbekistan began in the second half of the last century, in 1953-1954, and was carried out by scientists of the Livestock Research Institute. One of the most well-adapted breeds of sheep in the mountains and foothills of the
country is the carnivorous sheep, which differs from other breeds of sheep by its good adaptation to the external environment (rainy, snowy and humid cold). These breeds of sheep have the ability to produce high genetic potential in terms of their productivity in good pasture conditions [5].

Purposeful hybrids reflect the characteristics of the first three different breeds, the color was white, thick semi-soft wool, the beak was shiny, covered with wool, the hair growing on the head falls to the eyes, and the ears were of average size [6]. The neck was thick, relatively short, the skin was not wrinkled [7, 8]. The chest was deep, broad and slightly protruding anteriorly, the ribs were rounded, the fat was broad, the shoulders were straight with the dorsal line, the thighs were slender, the legs were moderately strong, the hooves were not hard, the trunk bones were not rough [9]. Thus, the Ahangaron and Park type of semi-fine-wool sheep with high growth, slightly larger body and vital force as a result of combining three different hereditary genotypes of native dumb sheep of the east, soft-wool of the lower west (North Caucasus), meaty Lincoln breeds of England and later breed groups of meaty sheep were created. One of the most important economic characteristics of this breed was its rapid maturation, large size, extreme cold resistance, uniform appetite and the ability to digest large amounts of feed, as well as a high level of feed coverage [10].

Effective use of selection methods plays an important role in the creation and improvement of high-yielding sheep herds [11]. In this case, the role of purebred breeding and crossbreeding methods is very important, along with the selection of the best sheep for breeding and the removal of unfit ones from the herd, targeted selection of high-yielding sheep to strengthen their genetic characteristics [12]. Improving the productivity of sheep using the method of insemination at different times in the formation of such herds is also important in the development of the industry and increases its efficiency [13]. The Stavropol Territory is one of the most favorable areas for sheep breeding, which is important in creating new selection achievements [14, 15]. All conditions for the development of sheep breeding in the country are sufficient, there is a large pasture land with natural grasses and opportunities for high-intensity production of agricultural products. The breeds bred in the country are those with high genetic potential for reproduction in different natural climatic conditions, adaptability to environmental conditions and productivity [16, 17]. However, today sheep breeding in the country is going through a difficult period, as a result of the cultivation of agricultural crops, the area of pastures is declining, leading to a decrease in the number of sheep [18]. The Stavropol Territory maintains a high-quality gene pool with a pedigree base of fine and semi-fine wool sheep breeds, which will allow to improve the breeding and productivity of sheep in this area, not only in the country but also in the Russian Federation [19].

The live weight and body size of woolly-meaty sheep were slightly lower than those of ordinary purebreds, but they showed high genetic potential in terms of wool productivity [20]. Incomplete use of the genetic potential of woolly-meaty sheep, unplanned insemination and loss of attention to the breed has led to a decrease in the number of sheep and, in turn, a decrease in their genetic potential. Subsequent selection work should be aimed at preserving the gene pool of sheep, increasing the number of heads, using different methods of insemination, crossbreeding, the highly valuable biological characteristics and genetic potential of these sheep [21]. Additionally, it is economically viable to expand the range of sheep in mountainous and foothill areas [20].

According to the outputs of such research [17, 18], a new breed of Russian merino sheep with a fineness of 21.5 microns and high meat productivity through using the world's most valuable pedigree sheep has been created. Sheep is characterized by their strong constitution, the ram lessness of the ram and mother sheep, the thinness, thickness and softness of the wool, the fleshy shape of the body, and the high growth. In terms of meat and wool productivity, new breeds of cattle were 20.8-46.8% and 36.2-87.5% higher than the minimum standard requirements for sheep of all ages in the field of meat and wool productivity. The yield of wool during washing was 62.3-65.0%, which was 11.0-14.5% higher than the minimum requirements for sheep of this breed. The length of ewes' fur was up to 9.3 cm, and 11.9 cm in
rams. The wool thickness of pedigree rams was 20.9 μm, and that of a ram that fills a herd was 19.1 μm, followed by ewe with 21.4 μm, yearling with 19.6 μm.

One of the most important issues in the industry was to increase the productivity of sheep, the efficiency of their genetics, improve product quality and, ultimately, improve the living standards of the population of the desert region through the introduction of effective selected methods [2, 15]. There were ample opportunities across the industry to achieve this level. Firstly, there were selection methods that allow sufficient use of the potential of sheep, which can be selected and expanded through the formation of groups of animals with high genetic characteristics on the farm and the implementation of appropriate mating and evaluation of several generations. Secondly, use of the potential of high-yielding plant types of Karakul sheep created on a pedigree scale in the direction of specialization [21]. From the above results, it can be concluded that the high level of use of effective selection methods allows to achieve the desired efficiency.

In order to increase competitiveness in sheep breeding, in 1976, scientists of the Uzbek Livestock Research Institute created the high-yielding groups of meaty-woolly sheep using the pedigree rams of the world gene pool. These sheep, which are adapted to year-round grazing in mountainous and foothill pastures rich in natural vegetation in harsh continental climates with dry and hot climates, are called meaty-woolly sheep of Uzbekistan [20]. The optimal type of Ahangaran meaty-woolly (ewe) sheep can be characterized by its high wool productivity: wool diameter was 28.82, wool length was 10.69 cm, and wool shearing was 3.5 kg [7]. Kuku [13] stated that in order to expand the breeding area of fast-growing meaty-woolly sheep in the dry and foothill regions of Uzbekistan, including Jizzakh province, it was proposed to mix hybrids with genotype of fine and coarse wool breeds with meaty-woolly sheep type, Ahangaran. Makhmatkulov [6] conducted research on Hisar breed of sheep in Surkhandarya province in 1971, and accordingly, it was proposed to feed ewe sheep during gestation period with high quality hay, silage and other food rich in calories towards improving their breeding characteristics, and obtaining healthy offspring. Muhammeturozov [12] stated that one of the key factors in creating a solid feed base in sheep farming was to raise the yield of the Sagittarius grass to a higher level, and for the efficient use of the Sagittarius, it was important to properly carry out the planting of the Sagittarius grass, which gives high yield and more nutrition. The results of the research conducted in central Kazakhstan [10] showed that the living weight of hybrid sheep obtained from mating rams of Lincoln breed with ewes of Edilbay breed was 5.1% higher at age of 3.5-4.0 than the pure Edilbay breed, and these results were observed even in the difficult winter periods.

Melkonyan [11] stated that in order to increase the rates of improving the hybrids quality obtained from mating fine and coarse woolly sheep in the high mountainous provinces of Armenia, mating these one with semi-fine woolly meaty-woolly sheep, and then mating them within their breeds. Consequently, productivity in the field of sheep husbandry would increase by twofold. The research outputs showed that the living weight of female hybrids obtained from mating of three breeds, such as ordinary, merinos and Lincoln, was 4.2-4.6 at birth; at the age of 4 months 29-32, at the age of 1.5 years 50-52 and at the age of 2.5 years 56-63 kg. In hybrids obtained from complex chatting, further breeding work should be aimed at creating a type of fast-ripening carnivorous sheep based on high requirements. It was considered that it was financially viable and important to expand the aerial of the crossbred type of fast-ripening meaty-woolly sheep in the mountainous and Foothill provinces [1]. The Dohne Merino breed of sheep was created in the Republic of South Africa under the leadership of J. Kotze [14]. The new breed is distinguished by its high wool and meat qualities and competitiveness to market requirements. This sheep quickly became popular among shepherder at sheep farms, and in the places where the new breed was bred, the number of pedigree herds increased, and the South African Association of this breed was established.
The use of artificial insemination in sheep breeding significantly increases the use of the genetic potential of high-value cattle. Compared to the natural insemination method, artificial insemination of sheep allows for the insemination of more than a hundred ewes from the seeds of breeding rams in one season. When artificially inseminated during the breeding season, one head of pedigree ram corresponds to a norm of 500-700 head of ewe sheep. With the seeds of famous pedigree rams with high pedigree value, it is possible to artificially inseminate 5-6 thousand ewes in one season. However, it is possible naturally to inseminate only 40-50 ewes with one pedigree ram [19]. Ruzibaev [21] stated that the live weight of ordinary ewes was 2.3 kg (4.5%) higher than the live weight of meaty-woolly sheep, as well as the height of fat - 3.5 cm (4.9%), breast height-3.8 cm (5.2%), oblique body length 4.3 cm (5.8%), breast circumference 1.9 cm (2.0%) and breast depth 2.2 cm (6.9%). These data are important for the selection and maintenance of the gene pool of meaty-woolly sheep, and to improve the number and quality of sheep, and in the future it would be pivotal to improve the selection traits of these breeds.

In the mountainous and foothill provinces of Uzbekistan, meaty-woolly sheep do not have feel food shortages when they are adequately fed on hot summer days. In the cold days of winter, when the ewes are fed at full value by supplementary feeding, the suckling ewes do not lose weight, and when the lambs are separated from their mothers, their live weight reaches 32-36 kg. This will play an important role in improving the existing breeds by creating more productive herds in the future. Meaty-woolly sheep differs from other breeds of sheep by its resistance to external environmental conditions, rapid maturation, multi-generational, tender, loose and juicy flesh, high wool productivity. However, in recent years, no scientific studies have been conducted to improve the selection traits of these sheep and to study the effect of different breeding seasons on the productivity characteristics of their offspring. Therefore, this research aimed at analyzing different methods of hybridizing sheep breeds during 2019-2021 towards creating new meaty-woolly sheep as well as increasing overall productivity of sheep husbandry.

2. Methods

The breeding farm "Kholturaev Oybek-XM" in Ahangaron district of Tashkent province was selected for this research, where all research experiments were performed on different type of sheep breeds. Live weight of lambs at birth, one month and three months of age was studied by generally accepted methods in zootechnics. External indicators of sheep in the experimental groups were calculated by measuring body parts and body composition indices by the methods of Veniaminov A.A., Buylov S.V., Khamitsaev R.S. [9]. Features of wool productivity of sheep were studied by the method of V.V. Kalinin [8]. The correlation coefficients between the main selection traits of sheep were calculated in Shiller R., Vahal J., Vinsh J. [5]. Furthermore, live weight of sheep and wool yield were studied in comparison with the requirements of the 1st class minimum standard of meat-fed sheep. The obtained data were processed by the method of Merkureva E.K. [4]. The studies were performed on meaty-woolly sheep through considering similar breed, pedigree, and age. In both groups, two-year old 50 ewes, which were lamped for the first time, were selected. In first experimental group, the period, 1-20 September was taken, whereas in the second one, 10-30 October was selected. Importantly, in those experiments mating periods were different.

3. Results and Discussion

In the study, the feeding of experimental pregnant ewes and newly lamped ewes was carried out according to a strict plan. They were fed on pastures, and in the morning and evening they were supplemented with 1.5-2.0 kg of quality alfalfa or natural grass hay, 300-400 grams of mixed fodder and mineral feed, salts, that is, 1.4-1.5 feed units. In determining the effect of different fertilization periods on the productivity characteristics of ewes, it was important to study the exterior performance of ewes in the experimental groups (Table 1).
Table 1. External indicators of ewes in experimental groups

| Indicators            | Units | I group (n=50) | II group (n=50) | I group (n-50) | II group (n-50) |
|-----------------------|-------|---------------|----------------|---------------|---------------|
|                       |       | \(\overline{X} \pm S\) | \(CV, \%\)  | \(\overline{X} \pm S\) | \(CV, \%\)  |
| Whiter height         | cm    | 68.45±0.341   | 3.52           | 68.15±0.287   | 2.98          |
| Rump height           | cm    | 70.4±0.307    | 3.08           | 70.21±0.375   | 3.77          |
| Body length           | cm    | 71.7±0.580    | 5.72           | 71.05±0.659   | 6.55          |
| Chest width           | cm    | 28.65±0.402   | 9.91           | 26.8±0.345    | 9.10          |
| Chest depth           | cm    | 32.25±0.532   | 11.66          | 31.5±0.394    | 9.79          |
| Chest circumference   | cm    | 100.2±0.462   | 3.26           | 97.3±0.515    | 3.74          |
| Cannon circumference  | cm    | 8.5±0.068     | 5.65           | 8.46±0.068    | 5.67          |

The data in the table 1 showed that the external indicators of early fertilized group I ewes were characterized by slightly higher values than those of group II ewes. In particular, in group I, these indicators; whiter height was by 0.3 cm higher, followed by rump height with 0.19 cm higher, body length 0.65 cm (0.91%), chest width with 1.85 cm (6.9%), chest depth was higher by 3.75 cm (13.16%), and chest circumference was 2.9 cm (3.0%) higher than the group II. Thus, it was found that the external indicators of group I ewes were slightly higher than those of group II ewes, which indicates that ewes with a high body structure come to the tune early.

The proportional development of the body structure of sheep can be assessed by analyzing the body indices of sheep (Table 2).

Table 2. Body indices of mature ewes, %

| Body indices | I        | II        |
|--------------|----------|-----------|
| Number of heads | 50       | 50        |
| Long legs    | 52.9     | 53.7      |
| Elongation   | 104.7    | 104.3     |
| Chest        | 88.8     | 85.0      |
| Density      | 139.7    | 136.9     |
| Bony         | 12.4     | 12.4      |

According to the table 2, group I sheep have a slightly larger body, which was confirmed by the fact that their length index was 0.8% lower than that of their peers in group II. However, in group I, the elongation was 0.4 times higher than in group II; chest was 3.8, and density was higher by 2.6%. The results of the study showed that the carcasses of the ewes in all groups were proportionally developed, the chest is well developed, and the sheep have an elongated body and a meat type. In the study, the live weight and wool productivity of meaty-woolly and ordinary ewes were studied (Table 3).

Table 3. Live weight and wool productivity of meaty-woolly and ordinary ewes

| Indicators             | Units | Ordinary ewes n-100 | Meaty-woolly ewes n-100 | Ordinary ewes | Meaty-woolly ewes |
|-----------------------|-------|----------------------|-------------------------|---------------|------------------|
|                       |       | \(\overline{X} \pm S\) | \(CV, \%\)  | \(\overline{X} \pm S\) | \(CV, \%\)  |
| Live weight           | kg    | 58.3±1.23           | 21.1        | 52.5±1.06   | 20.2           |
| Weight of wool after shearing | kg    | 2.54±0.072         | 12.75       | 3.8±0.126   | 14.78          |
| Weight of wool after washing | kg    | 1.43±0.04          | 12.37       | 2.4±0.051   | 9.54           |
| Wool length           | cm    | 11.07±0.163        | 6.59        | 13.2±0.034  | 10.14          |
According to Table 3, the live weight of ordinary ewes was 5.8 kg (11.0%) higher than the live weight of meaty-woolly ones. In terms of wool productivity, the meaty-woolly sheep achieved higher results than the ordinary ewes: the amount of wool at shearing - 1.26 kg (49.6%); weight after washing - 0.97 kg (67.8%); wool length - 2.13 cm (19.2%). It should be noted that these sheep were found to exceed the minimum standard requirements of the breed in terms of wool productivity of mature sheep of this meaty-woolly direction. This indicates that carnivorous sheep have fully retained their genetic potential for wool productivity.

Newborn lamps consume an average 5 kg of breast milk per kilogram of extra weight, and at 2.0-2.5 months of age they need to suckle 1.2-1.5 liters of breast milk per day to gain an average of 250-300 grams per day. By the middle of the lactation period, breast milk gradually decreases, and the lambs’ demand for nutritious food increases. Therefore, lambs are taught to concentrate, hay and succulents from 15-20 days of age, from the best mixed feeds for lambs - oats, barley; One of the succulents is crushed root vegetables, which are fed as much as you want with high-quality alfalfa. Furthermore, the live weight of lambs, born from ewes in the experimental group in 2020, at the age of 30 days and 3 months was researched (Table 4).

### Table 4. Live weight of lamps

| Age group | Sex       | Ordinary lamps I | Meaty-woolly lamps II |
|-----------|-----------|-------------------|-----------------------|
|           | n         | X ± S x           | Cv, %                 | n         | X ± S x           | Cv, %                 |
| At the birth | Ram       | 26                | 5.3 ± 0.17            | 16.8     | 24                | 5.0 ± 0.08            | 8.4                  |
|           | Ewe lamps | 24                | 4.9 ± 0.04            | 4.08     | 26                | 4.7 ± 0.07            | 8.1                  |
| 30 days   | Ram       | 26                | 17.7 ± 0.263          | 7.57     | 24                | 17.2 ± 0.357          | 10.2                 |
|           | Ewe lamps | 24                | 17.2 ± 0.54           | 15.4     | 26                | 17.0 ± 0.322          | 9.7                  |
| Three months | Ram      | 26                | 34.0 ± 0.45           | 6.73     | 24                | 32.5 ± 0.694          | 10.5                 |
|           | Ewe lamps | 24                | 31.6 ± 0.577          | 8.95     | 26                | 31.2 ± 0.314          | 5.13                 |

Analysis of the data in the table showed that the live weight of lambs born from purebred ewes of group I was 0.3 kg (6.0%) and ewes - 0.2 kg (4.3%) compared to the ewes of group II. At the age of 3 months, rams - 0.5 kg (2.9%) and ewes - 0.2 kg (1.18%), at the age of 3 months, rams - 1.5 kg (4.6%) and ewes - 0.4 kg (1.28%). This data indicates that the live weight of lambs born from purebred ewes is higher than that of ewes.

Obviously, the practice of artificial insemination of meaty-woolly ewes with frozen semen of rams typical of the world gene pool was performed, and this year they obtained lamps. The difference between artificial insemination of sheep and natural insemination was described in Table 5.

### Table 5. Live weight of lamps obtained from the artificial insemination

| Age           | Lamps obtained from artificial insemination | Lamps obtained from natural insemination |
|---------------|---------------------------------------------|-----------------------------------------|
| n             | X ± S x                                     | Cv, %                                  | n             | X ± S x                                     | Cv, %                  |
| At the birth  | 10                                          | 4.7 ± 0.134                            | 9.44          | 10                                          | 4.3 ± 0.125            | 9.16                   |
| 10 days       | 10                                          | 7.8 ± 0.238                            | 9.65          | 10                                          | 7.3 ± 0.153            | 6.62                   |
| Three months  | 10                                          | 32.8 ± 0.513                           | 5.09          | 10                                          | 31.4 ± 0.592           | 5.95                   |
Table 5 showed that the live weight of lambs obtained from artificial insemination of lambs with frozen semen of breeding rams was 0.4 kg (9.3%) at birth compared to the live weight of lambs obtained from natural insemination of rams with pedigree rams, 0.5 kg at 10 days (6.8%) and at 3 months of age 1.4 kg (4.5%). This depicted that the introduction of artificial insemination with frozen semen of rams specific to the world gene pool in ewes was an effective method.

The study of the interrelationships between the main selection traits of lambs obtained from artificial insemination and the systematic conduct of selection work on the identified positive correlation coefficients is important practical role in improving selection traits. Therefore, study on the correlation coefficients between the selection traits of the lambs was conducted (Table 6).

### Table 6. Correlation coefficients between selection traits of lambs

| Signs of cross-linking | Lamps obtained from artificial insemination | Lamps obtained from natural insemination |
|------------------------|--------------------------------------------|----------------------------------------|
| Groups                 | I                                          | II                                     |
| Live weight at 10 days of age with live weight at birth | 0.699                                      | 0.724                                   |
| Live weight at 3 months with live weight at birth | 0.486                                      | 0.646                                   |
| Live weight at 3 months with live weight at 10 months | 0.526                                      | 0.591                                   |

According to Table 6, high positive correlation coefficients were found between live weight at birth of lambs obtained from artificial insemination in group I, natural insemination in group II, live weight at 10 days and 3 months of age, and live weight at 10 days and 3 months of age. This data showed that the selection work on the positive correlation coefficients identified between the selection traits of the lambs increased the selection efficiency.

4. Conclusions

In this study, the live weight and body size of early-fertilized ewes were slightly higher than those of late-inseminated ewes, indicating that the ewes in all groups had a well-developed body, well-developed chest, and sheep had an elongated body and meat type. The data showed that effective fertilization of ewes with a good level of live weight and exterior characteristics is effective.

Meaty-woolly ewes achieved higher results than ordinary ewes: the amount of wool when shearing was 1.26 kg (49.6%); weight after washing - 0.97 kg (67.8%); wool length - 2.13 cm (19.2%). This creates high efficiency in the breeding of high-quality sheep in terms of wool productivity in meaty-woolly sheep, in the improvement of the breed and in the production of wool raw materials for the textile industry.

Live weight of lambs obtained from artificial insemination of meaty-woolly sheep than the live weight of lambs obtained from natural insemination with pedigree rams was a bit higher as: - 0.4 kg at birth (9.3%), 0.5 kg (6.8%) at 10 days and 3 months at the age of 1.4 kg (4.5%). This showed that the introduction of artificial insemination with frozen semen of rams belonged to the world gene pool in ewes was an effective method.

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