Influence of Natural and Temporary Pasture on Milk Production of Sheep

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Abstract: Bulgaria is a country with moderate continental climate and sheep, bred primarily for milk are grazing from April to October, and in the winter they are feeding in stallon ration based on hay and compound feed. The purpose of the experiment was to compare milk production of sheep grazed on natural and temporary pasture. For this 30 ewes of Pleven Blackface breed were used divided into three groups of 10 animals each, by the method of analogues. The experimental grazing period of 91 days (13 weeks), began after 42 days winter ration period. First group was to grazing on natural pasture, the second group remained in stallfed on ration based on alfalfa hayand compound feed, and the third group was to grazing on temporary pasture. The total milk of the group grazing throughout the grazing period on temporary pasture was respectively 42.3% and 26.2% higher than that of the first group of sheep grazing on natural pasture and those of a second group left in stall nutrition and last 28 days grazing on temporary pasture. The content of fat in the milk during the grazing period for sheep grazed on natural pasture was 19% and 23% more higher than the sheep fed on winter ration and these grazed on temporary pasture. The yield at first growth of temporary pasture increased from 1 497 kg·hm^{-2} to 6 480 kg·hm^{-2} dry mass or an average of 1 620 kg·hm^{-2} per week while in natural pasture increased from 967.6 kg·hm^{-2} to 2 668.8 kg·hm^{-2} dry mass. During the first vegetation growth, the proportion of legume in temporary pasture decreased from 64.4% to 43.4%, while grass increased from 32.3% to 51.0%, while in the natural pasture the grass varied from 94% to 77% and legume increased from 1.0% to 13.5%.

Keywords: sheep; milk production; milk composition; natural pasture; temporary pasture; yield and composition
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Sheep farming is a traditional livestock subsector in Bulgaria, which enables the economic development of rural areas and the satisfaction of market with sheep cheese and meat. In the 80 years of the last century the sheep in the country have reached 10 million, but during the period of transition from planned to market economy, due to strong disintegration and chaotic liquidation of large cooperative farms the number of sheep decreased more than 6 times.

The sheeps are raised mainly for milk and the feeding systems are available depending on forage resources [1]. Bulgaria is a country with moderate continental climate and sheep, bred primarily for milk are grazing from April to October, and in the winter they are feeding in stall on ration based on hay and compound feed. The grazing is predominantly on natural pastures, which occupy 30% of the agricultural area in the country [2]. Traditionally the period of sheep lambing and milking is during the winter months, and the milking period coincides with the grazing period and vegetation of grasses.

The purpose of this study is to compare milk production of sheep grazed on natural and temporary pasture.

1 Material and methods

For this 30 ewes of Pleven Blackface breed were used divided into three groups of 10 animals each, by the method of analogues. The lambs were weaned 25 days after the birth[3]. The grazing period lasted 91 days and started after 42 days winter ration period. During the winter period, the first group received *ad libitum*

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corn silage, the second group-hay of alfalfa and the third group-silage of alfalfa. The sheep in the three groups received compound feed of sunflower meal, rapeseed meal, maize grain, triticale and vitamin-mineral supplement to cover the needs of daily milk yield of 1.5 L[4]. The second group fed on winter ration based on alfalfa, while the other two groups were on grazing, received compound feed of: sunflower meal(5.15%), maizegrain (61.90%), triticale(30.95%) and vitamin-mineral supplement(2%).

After winter period the first group was moved from corn silage to grazing on natural pasture, second group remained on winter ration and the third group-from alfalfa silage to grazing on temporary pasture of cocksfoot (*Dactylis glomerata*) and sainfoin (*Onobrychis viciifolia*), when initial height of the grass was 8～10 cm. The natural pasture near the sheep farm had been used and temporary pasture was created for this purpose in 2012 by equal amounts cocksfoot and sainfoin in 50% of the sowing norm. During grazing both groups received 0.4 kg of grain maize per sheep. On the natural pasture, the grazing was freely (unsystematic grazing) and the temporary pasture was divided into parcels surrounded by a fence for grazing by sheep of trial group. After finishing the designated place grazing, the ewes were moved on the next parcel and after 21 days they returned to the first place grazing when the height of the grass was 15 cm. The second group of sheep lasted another 63 days fed on winter ration based on alfalfa hay and compound feed; the remaining 28 days of experimental periodthe same group was moved to grazing on temporary. The ewes had free access to drinking water and salt licks. During the grazing period the milking was twice per day. During the experimental period the daily milk yield from each group was controlled and on two consecutive days of the week the individual milk yield per ewe was also controlled. The dairy milk during the trial was calculated by the daily milk yield during the week. Individual samples of sheep milk were determined by milko scan, model 133 in the laboratories of Institute of Mountain Livestock and Agriculture, Troyan. The content of fatty substances, protein, lactose, non-fat solids, casein and dry matter in the milk were determined.

The changes in yield, botanic and chemical composition of natural and temporary pasture were determined during the grazing period. For this purpose, every week samples were taken-from 0.5 m^2 in 8 reps of the pasture. The weight and calculated yield of green mass ($kg \cdot hm^{-2}$) were determined. The dry matter and calculated yield on dry matter($kg \cdot hm^{-2}$) were determined. Samples for determining the yield and composition were taken from natural pasture every week, where the sheep grazd freely. Botanical composition was determined of two samples of them, by splitting them into grass, legumes and other. The individual components were weighed and their proportion was calculated by weight.

The chemical analysis of the taken and dried to constant weight samples of forages and pasture was determined in the laboratory of IFC-Pleven. Before analysis the samples are ground through a sieve having a mesh of 1 mm by mill Retsch SM100. The dry matter (DM), crude protein(CP), crude fiber(CF), fat, ash and nitrogen free extract substances (NFE) in the forages were determined of Weende method[5].

2 Results and Analysis

2.1 Changes in milk yield and milk composition

Total milk for the entire grazing period were 55.990, 63.150 and 79.670 L, respectively for first, grazing on natural pasture, second on winter ration and third group-grazing on temporary pasture (Table 1). The milk of the group grazing throughout the grazing period on temporary pasture were respectively 42.3% and 26.2% higher than that of the first group of sheep grazing on natural pasture and those of a

second group left in stall nutrition and last 28 days grazing on temporary pasture. Differences between groups were statistically significant ($P \leqslant 0.05$).

Table 1 Milk production during the grazing period

Week, No. from April 1, 2013	Group Ⅰ (Natural pasture)		Group Ⅱ (Winter ration)		Group Ⅲ (Temporary pasture)	
	Average milk yield/L	Total milk yield from sheep/L	Average milk yield/L	Milk from sheep/L	Average milk yield/L	Milk from sheep/L
1	0.894±0.104	6.258±1.113	0.951±0.118	6.657±0.998	1.115±0.103	7.805±1.121
2	0.887±0.108	6.209±0.941	0.943±0.110	6.601±0.989	1.082±0.094	7.574±1.102
3	0.881±0.106	6.167±0.986	0.932±0.111	6.524±0.932	1.042±0.088	7.294±1.112
4	0.807±0.101	5.649±0.991	0.734±0.097	5.138±0.863	1.010±0.080	7.070±0.986
5	0.654±0.063	4.578±0.963	0.635±0.059	4.445±0.821	0.912±0.075	6.384±0.774
6	0.551±0.039	3.857±0.563	0.578±0.044	4.046±0.723	0.847±0.057	5.929±0.624
7	0.521±0.038	3.647±0.432	0.571±0.042	3.997±0.523	0.834±0.053	5.838±0.575
8	0.497±0.032	3.479±0.452	0.562±0.039	3.934±0.520	0.827±0.052	5.789±0.541
9	0.487±0.028	3.409±0.385	0.534±0.033	3.738±0.498	0.815±0.048	5.705±0.443
Average/ Total, 63 days	0.686 a±0.058	43.245 a±0.553	0.716 a±0.072	45.079 a±0.533	0.942 b±0.079	59.382 a±0.330
			Temporary pasture			
10	0.470±0.026	3.290±0.351	0.617±0.051	4.319±0.421	0.789±0.044	5.523±0.424
11	0.454±0.025	3.178±0.311	0.655±0.059	4.585±0.374	0.736±0.045	5.152±0.389
12	0.448±0.022	3.136±0.256	0.663±0.065	4.645±0.342	0.697±0.042	4.879±0.365
13	0.442±0.019	3.094±0.223	0.671±0.066	4.700±0.274	0.674±0.043	4.718±0.311
Average/ Total, 91 days	0.615 a±0.051	55.990 a±0.357	0.696 a±0.040	63.150 a±0.291	0.875 b±0.040	79.670 b±0.283

Different letters mean significantly difference at $P \leqslant 0.05$. The same below.

It was observed a trend to increase the fatty substances and protein in milk with the transition from winter to grazing period (Table 2). The lactose content remains almost unchanged in the three experimental groups during the trial period. According to Dimova[6] lactose in sheep milk ranged from 4.3% to 5.3%, as its content on average 4.6% and changes in a narrow range during the lactation[7]. Different types of feed did not influence especially on the lactose content[8-9].

Table 2 Changes in the composition of milk during the grazing period

Treatments	Fat/%	Protein/%	Lactose/%	Total solids/%	Dry matter/%
1～9 weeks					
Group I, Natural pasture	8.461 c±1.042	5.636 a±0.331	4.870 a±0.130	10.947 a±0.335	19.408 a±1.127
Group II, Lucerne hay	7.134 b±0.767	6.382 c±0.314	5.070 a±0.257	11.594 b±0.455	18.728 b±0.512
GroupIII, Temporary pasture	7.136 b±0.592	5.873 b±0.364	5.080 a±0.230	11.354 ab±0.443	18.490 b±0.703
10～13 weeks					
Group I, Natural pasture	8.551 c±0.667	5.850 a±0.217	4.722 a±0.197	11.071 ab±0.257	19.622 a±0.624
GroupII, Temporary pasture	7.430 b±0.689	6.410 c±0.207	4.835 a±0.090	11.346 b±0.160	18.776 b±0.554
GroupIII, Temporary pasture	7.465 b±0.245	5.986 a±0.361	4.838 a±0.157	11.128 ab±0.378	18.593 b±0.481

When comparing the composition of milk from the three groups during the grazing period, there is a significantly higher fat content in the milk of the first group grazed on natural pasture (8.5%) than the second on winter ration (7.1%) and the third group-grazed on temporary pasture (7.1%) ($P \leqslant 0.05$) (Table 2). During the grazing period the proportion of fatty substances in the milk in the first group was 19.7% more higher than it in the second and the third group, which influence the contents of the dry matter in milk. The proportion of the fatty substances in the milk of sheep, increased by reducing the quantity of milk and the highest content of fat in the milk was observed in months at the end of lactation [10] or with increasing of crude fiber with advancing the maturation stage of a plant [7]. It is observed a slight tendency for an increase of the protein in the milk, that was in accordance with the results of Greyling [11] that with advancing lactation the protein content of the milk increases.

2.2 Changes in yield and composition of the pastures used by sheep

Weather conditions during the vegetation of natural and temporary pasture of sainfoin and cocksfoot in 2013 were given in Table 3. Rainfall during the growing season, from April to July was 332.1 L·m^{-2}. At the beginning of the grass grow, in April and May, there was almost no rainfall economic value. There was more abundant rainfall in June and July.

Table 3 Temperatures, rainfall and humidity of the air during the period April to July 2013 in the region of Pleven

Months	Average daily temperatures/℃	Max	Min	Humidity/%	Rainfall/mm
April	14.2	21.2	7.9	65	50.7
May	19.6	26.7	13.0	60	63.7
June	21.3	28.0	15.5	66	111.6
July	22.9	29.6	16.5	61	106.1
Average	19.5	26.37	13.22	63	332.1

Results of observations on the dynamics of changes of some indicators of the development of temporary pasture, subject to grazing by sheep are given in Table 4. The height of the grass in the first growth in early April was 10～15 cm, while in the fourth week up to 45～50 cm height. The height of the plants was increased by 8～9 cm per week or average by 1.0～1.5 cm per day. The relation between yield and height of the plants could be described by the equation $y = 0.010\ 9x + 10.434$; ($R^2 = 0.980$), where x is the height of the plants. There was no difference at the heights of cutgrasses after the first and next growth used for grazing (second-quarter growth) because the samples were taken at 21th day, after the previous mowing, the day when the sheep started to grazing on them.

Dry matter content on the first growth from the beginning of growth to the phase of button of legumes and to the phase of flowering of grasses vary in a narrow range from 17.15% to 18.93%. At the beginning of grazing there was a gradual increase in the content of the DM from 19.59% to 26.20% in the four types of cut grasses at 3 weeks.

The results for the changes in the yield and composition of temporary pasture, subject to grazing of sheep were given in Table 4. In the first growth yield of green mass increased from 8 632 kg·hm^{-2} to 34 286 kg·hm^{-2}, or an average of 8 571.5 k·hm^{-2} per week. During the same period the yield of dry mass increased from 1 497 kg·hm^{-2} to 6 480 kg·hm^{-2} or an average of 1 620 kg·hm^{-2} per week. In the second, third and fourth growth of grass, it was not observed any serious differences, because all cut grasses was at

Table 4 Changes in yield and composition of temporary pasture used for grazing

Week, No.	Date	Height/cm	Phase, description	DM/%	Yield, green mass/ ($kg \cdot hm^{-2}$)	Yield, dry mass/ ($kg \cdot hm^{-2}$)	Ratio of grass: legume: other
First growth							
1	04-02	15～20	Without generative stalks	17.15±0.55	8632±18.4	1497±18.4	32.3:64.4:3.3
2	04-09	20～25	Without generative stalks	17.76±0.21	9210±34.1	1637±17.7	41.3:56.2:2.5
3	04-16	30～35	Appearance of generative stalks	18.27±0.13	19639±138.4	3594±26.8	43.4:50.4:6.2
4	04-23	45～50	Appearance button-start flowering	18.93±0.12	34286±308.8	6480±56.9	51.0:43.4:5.4
Second growth-cut grass at 21 days							
5	04-30	15～20	Without generative talks	19.59±0.15	8730±23.1	1710±12.4	34.3:57.0:8.7
6	05-07	15～20	Without generative stalks	20.15±0.14	8963±25.6	1806±18.4	34.9:61.7:3.4
7	05-14	15～20	Without generative stalks	21.19±0.16	9104±27.3	1835±19.5	38.2:55.3:6.5
8	05-21	15～20	Without generative stalks	22.14±0.17	9231±31.2	2044±24.4	38.5:52.2:7.3
Third growth-cut grass at 21 days							
9	05-28	15～20	Without generative stalks	24.46±0.18	8945±29.4	2188±23.8	36.8:56.2:7.0
10	06-04	15～20	Without generative stalks	24.99	8736±27.3	2183±22.2	36.6:55.6:7.8
11	06-11	15～20	Without generative stalks	25.50	8469±26.7	2164±21.2	34.8:57.0:8.2
12	06-18	10～15	Without generative stalks	26.00	6768±36.1	1762±19.4	32.5:58.5:9.0
Fourth growth-cut grass at 21 days							
13	06-25	10～15	Without generative stalks	26.20	5845±18.2	1534±17.5	30.0:60.9:9.1

Table 5 Presents the chemical composition of four growth of grass, subject to grazing by sheep

	CP	CF	Fat	Ash	NFE	Ca	P
First growth							
2013-04-02	28.67	11.01	4.55	8.39	47.38	1.00	0.509
2013-04-09	25.47	13.39	5.08	9.32	46.74	0.764	0.534
2013-04-16	22.87	22.15	4.77	12.47	37.74	0.579	0.664
2013-04-23	20.56	23.46	3.92	12.08	39.98	0.515	0.547
Second growth							
2013-04-30	21.38	19.87	4.05	9.95	44.75	0.789	0.502
2013-05-07	21.20	21.62	3.82	10.93	42.43	0.799	0.543
2013-05-14	20.85	21.94	3.59	10.98	42.64	0.771	0.591
2013-05-21	19.69	22.51	3.51	10.53	43.76	0.780	0.467
Third growth							
2013-05-28	18.53	24.28	3.49	10.47	43.23	0.786	0.451
2013-06-04	18.21	25.12	3.71	10.32	42.64	0.765	0.442
2013-06-11	17.53	25.86	3.52	10.79	42.30	0.772	0.438
2013-06-18	17.10	26.75	3.75	10.35	42.05	0.759	0.382
Fourth growth							
2013-06-25	15.42	27.02	3.82	9.41	44.33	0.712	0.346

21 days. There is a tendency to reduce the yield of cut growthgrasses over the past two weeks 12

and 13 weeks of experimental period, respectively 6 768 kg·hm^{-2} and 5 845 kg·hm^{-2}. At the beginning of period the proportion of legume is high and decreased from 64.4% to 43.4%, for the same 4 week period the grass was increased from 32.3% to 51.0%. This phenomenon was characteristic for grass-legumes mixtures in view the fast pace of growing and the biology of sainfoin as a legume plant. At the beginning cocksfoot start with slower growth and its share in the grass mix was low, then its share increased. High proportion of legume component in the mixture, subject to grazing by sheep, was retained in all cut grasses at 21 days (second, third and fourthgrowth) and it was from 61.7% to 52.2% of the total mass of the grass. It was found that in the four growth the weeds or theother grasses have an insignificant share of the total mix, though, which was typical for mixtures of grass and legume[12].

Table 6 Changes in yield and botanical composition of natural pasture

Date of sample	Dry matter/%	Yield, green mass/(kg·hm^{-2})	Yield, dry mass/(kg·hm^{-2})	Ratio of grass:legume:other
2013-04-02	17.80±0.64	5435.9±26.78	967.6±14.89	94:1:5
2013-04-09	18.79±0.99	5322.5±22.63	1000.1±10.71	92:4:4
2013-04-16	19.78±0.95	5950.4±26.42	1177.0±13.40	87:7:6
2013-04-23	22.00±0.63	5980.0±34.56	1315.6±18.10	83:10:7
2013-04-30	28.40±0.55	6771.1±32.15	1923.0±10.94	80:11:9
2013-05-07	29.40±0.57	7229.9±37.87	2125.6±17.02	78:12:10
2013-05-14	29.55±0.96	7461.9±53.11	2205.0±14.2	75.5:13.5:11
2013-05-21	32.25±0.74	7603.10±41.18	2452.0±17.45	77:10:13
2013-05-28	32.44±1.55	8226.9±29.32	2668.8±18.43	78.9:10.6:11
2013-06-04	34.85±0.96	7642.0±35.56	2663.2±19.69	83.5:7:9.5
2013-06-11	34.97±0.78	7224.1±31.63	2526.2±16.24	86:6.5:7.5
2013-06-18	35.78±0.84	6425.3±30.27	2298.9±17.02	89:4.5:6.5
2013-06-25	36.95±0.96	5764.7±23.68	2130.0±14.21	85.8:4.2:10

Table 6 presents yield and botanical composition of natural pasture used for grazing of sheep. It was observed that with advancingat of vegetation the dry matter increase from 17.8% at the beginning of grazing in April, to 36.95% at the end of June. The yield of green mass increased from 5 322.5 kg·hm^{-2}, in early April, to 8 226.9 kg·hm^{-2} at the end of May, and then decreased to 5 764.7 kg·hm^{-2} at the end of June. The yield of dry mass per decare was from 967.6 kg·hm^{-2} in early April to 2 668.8 kg·hm^{-2} at the end of May, and then decreased to 2 130 kg·hm^{-2} at the end of June. There was a higher proportion of grass in natural pasture throughout the grazing season (from 94% to 77%). The proportion of legume was moving in the range from 1.0 to 13.5%, as higher values for legume are observed in May to June. The content of other plants throughout the grazing period is from 4% to 11%.

The content of CP in natural pasture in early grazing is high-average 21.22% and decreases over the next 13 weeks to 8.85% and the content of CF increased from 19.63% to 36.2%(Table 7). Dry matter increased from 17.8% to 36.95%. The relation between the dry matter content and crude fiber can be described by the equation: $y=0.855\ 8x+3.680\ 7$; ($R^2=0.888\ 7$), and between the dry matter and crude protein by the equation: $y=31.644x-0.549\ 2$; ($R^2=0.850\ 4$), where x is the dry matter content.

Table 7 Changes in the chemical composition of natural pasture

Date of sample	CP	CF	Fat	Ash	NFE	Ca	P
2013-04-02	21.22	19.63	4.45	13.10	41.60	1.075	0.518
2013-04-09	21.06	20.08	4.21	11.96	42.69	0.998	0.563
2013-04-16	19.18	22.16	4.13	11.78	42.75	0.975	0.512
2013-04-23	19.09	22.54	4.09	9.65	44.63	0.778	0.503
2013-04-30	18.34	22.52	3.30	8.35	47.49	0.533	0.378
2013-05-07	17.63	25.87	3.46	10.21	42.83	0.541	0.313
2013-05-14	16.96	31.24	2.79	10.01	39.00	0.513	0.312
2013-05-21	15.48	31.69	3.18	9.95	39.70	0.523	0.304
2013-05-28	13.64	31.75	2.72	10.92	40.97	0.515	0.309
2013-06-04	13.50	32.87	3.49	11.01	39.13	0.502	0.308
2013-06-11	11.63	34.63	3.42	8.11	42.21	0.465	0.270
2013-06-18	9.95	35.86	3.13	7.76	43.30	0.421	0.233
2013-06-25	8.85	36.20	3.63	8.19	43.13	0.425	0.209

Contents of CP in a natural pasture used for grazingdecreased more than doubled, compared with it at the beginning of the grazing period, and crude fiber for the same period increased almost twofold. These changes are associated with a decrease in the nutritional value of natural pasture, which corresponds to the lower milk yield of sheep grazing on natural pasture.

3 Conclusion

During the 63 day period of grazing, the milk yield of sheep grazing on temporary pasture was 59.382 L, which was 37.3% and 31.7% more compared to sheep grazing on natural pasture and these on winter ration. The total milk of sheep for the entire 91 day grazing period of experience was: 55.990, 63.150 and 79.670 L, respectively for a first group, grazing on natural pasture, for a second group on winter ration and after that grazing on temporary pasture for last 4 weeks, and for a third group grazing on temporary pasture. The milk of the group grazing throughout the grazing period on temporary pasture is respectively 42.3% and 26.2% higher compared with that of the first group of sheep grazing on natural pasture and those of a second group left in stall nutrition and last 28 days grazing on temporary pasture.

Daily milk yield of sheep increased by 26.4% after it was moved from 15-week winter ration period, to grazing on temporary pasture.

During the grazing period it was observed the trend of increasing the fat content and the protein in milk. The content of fatty substances in the milk during the grazing period for sheep grazing on natural pasture was 19.7% more higher compared to the sheep on winter ration and these grazed on temporary pasture.

The dry matter of temporary pasture at first growthchange from 17.15% at the beginning of growth to 18.93% in the button phase in legumes and start flowering in grasses, while in the regrowth at 21 days (at second, third and fourth regrowth), the dry matter increased from 19.59% at the beginning of May, to 26.20% at the end of June. During the same period dry matter content in natural pasture increased from 17.80% at the beginning of April to 36.95% at the end of June.

The yield at first growth of temporary pasture increased from 1 497 kg · hm^{-2} to 6 480 kg·hm^{-2} dry mass or an average of 1 620 kg·hm^{-2} per week while in natural pasture increased from 967.6 kg·hm^{-2} to 2 668.8 kg·hm^{-2} dry mass.

During the first vegetation growth the proportion of the legumes components in temporary pasture decreased from 64.4% to 43.4%, while the legumes in the natural pasture varies from 1.0% to 13.5%.

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自然和临时草地对羊奶产量的影响

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摘要: 保加利亚是一个具有温和大陆性气候的国家, 饲养绵羊主要是为了获取羊奶, 放牧期从四月到十月, 冬季需配给干草和复合饲料进行喂养。为了比较自然放牧和临时的牧场放牧状态下, 羊的产奶量的差异。在 91 d 的试验放牧期, 用类似的方法, 将这 30 只黑面母羊物种分成每 10 只一组。冬季口粮期开始后的 42 d, 第一组在天然牧场放牧, 第二组每天喂苜蓿干草和复合饲料, 第三组在临时牧场放牧。试验期最后的 28 d, 与在天然牧场上放牧的羊和冬季在临时牧场上放牧相比较, 发现在临时牧场上放牧的羊的产奶量增加了 42.3% 和 26.2%。放牧期间, 在天然的牧场上放羊, 羊奶的脂肪含量比冬天饲料喂养和在临时牧场上放牧的这些羊高 19%和 23%。临时牧场干重年产量首次从 1 497 kg·hm^{-2} 增长 到 6 480 kg·hm^{-2} 或者每周平均 1 620 kg·hm^{-2}, 然而天然牧场中从 967.6 kg·hm^{-2} 增加到 2 668.8 kg·hm^{-2}。在营养生长期间, 临时牧场豆科作物的比例从 64.4%降低到 43.4%, 草类从 32.3% 增长到 51.0%。然而在天然牧场中草类占的比例变化范围是从 94%到 77%, 豆科作物所占比例从 1.0% 到 13.5%.

关键词: 绵羊; 羊奶产量; 羊奶组成; 天然牧场; 临时牧场; 年产量和组成