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GROWTH OF FEMALE CALVES OF THE ABERDEEN ANGUS CATTLE BREED REARED IN AN ORGANIC FARM

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Abstract

The growth of female calves of the Aberdeen Angus cattle breed was studied in a certified organic farm. The animals were weighed on a monthly basis. It was ascertained that the calves are born with a live weight of approximately 31.6 ± 0.81 kg, upon weaning at 210 days they weigh 204.0 ± 5.93 kg, at 15 months - 363.7 ± 13.04 kg, and at 18 months - 433.0 ± 11.57 kg. The average daily individual gain widely varies reaching up to 2.090 kg. The growth of the animals as a whole and within the different age groups is influenced by the year, season and month of birth. Upon joint examination of the age-year-season and age-year-month factors, however, the effect of the separate factors "dillutes" and the complex influence may be considered unreliable. The female calves which are bred naturally under the conditions in Bulgaria, regardless of the gain fluctuations during the different periods, reach an optimal servicing live weight (330-360 kg) at an optimal age (15-16 months).

Key words: *Angus, growth calves, organic farm.*

INTRODUCTION

It can be observed that in search of solutions aimed at reducing the negative consequences of the industrialisation and intensification (Steinfeld, 2006; Chávez-Fuentes et al., 2017; Kamilaris et al., 2018; Zhang et al., 2018), more and more attention is paid to the organic farming which is considered a foundation for a sustainable animal production (Nikolov, 2003; Nikolova, 2006; 2013; 2020; Von Keyserlingk et al., 2013). In the recent years it has developed from a practical farmers movement to a serious business (Nikolova, 2020) practiced in 179 countries; in 88 of them there has already been effective national legislation (Zhou, 2018).

Breed selection is of extreme importance in the organic livestock breeding. Pointing out that the purpose of organic farming is the animals' welfare, Nikolov (2012) indicates that this deeply humane approach has a large scope and must be applied to all types and breeds of animals, otherwise the whole idea is pointless. The author believes that each breed has its advantages and disadvantages which make it more or less suitable for organic farming, and that none should be deprived of the chance to be bred in such way.

According to Hörning (2008) upon selection of a breed for beef cattle organic farming, one should not look for intensive growth, but choose a breed which is feasible with reference to small farms and is able to satisfy a special niche market with its unique produce. The Aberdeen Angus Cattle breed has a good adaptability and is suitable for organic farming. This breed's quality produce may have a specific marketability related to the region of breeding (Savić et al., 2013).

The Aberdeen Angus Cattle breed in Bulgaria has not been sufficiently studied yet. It was not until 2015 when a breeding program for the breed was approved. At the same time the import of animals which have different origin and are bred under different production systems continues. The aim of the present study is to examine the growth of female calves of the Aberdeen Angus Cattle breed under organic farming system.

MATERIALS AND METHODS

The study was carried out during 2016-2018 in a certified organic farm "Thraca Angus Farms" LTD. The farm is located in low mountainous, slightly hilly area between the West Predbalkan and the West part of the Danube Plain which is

suitable for breeding special beef animals. There are enriched pastures in the immediate vicinity of the farm which are used about 8 months of the year. Calving is all year round.

The study includes 54 female calves which were monthly weighed from their birth until attaining the age of 22 months.

The weighing is performed in a specialised crush with a weighing platform, and the reporting and registering of the live weight is automatic. The initial live weight is standardized in compliance with ICAR (2016) recommendations.

The data were processed via analysis of variance. Two models with the following statistical type were used: $Yijkl = \mu+AGi+YBij+SBijk+eijk(l)$; $Yijkl = \mu+AGi+YBij+MBijk+eijk(l)$, where: Yijkl - observation vector; μ - population average; Agi - age group fixed effect (i = 22); Ybij - year of birth random effect (j = 3); SBijκ and MBijk - a random effect of respectively the season (3) and month (11) of birth within the year and the season, eijkl - residuals. The data is processed statistically via SPSS 21.

RESULTS AND DISCUSSIONS

The live weight at birth is obligatory registered in the farm examined by us and serves for management of the factors affecting the embryonic and post embryonic growth of the calves. One of the leading factors is the physical condition of the mother which is related to the sustainable feeding during pregnancy (Funston et al., 2010).

Berger et al. (1992), consider that the birth weight is of significance with reference to the calving ease and the calves' survival during the first 24 hours after birth. They have ascertained that the new born calf live weight of 29 kg is the most suitable for the Aberdeen Angus cattle breed at a first calving age between 22-29 months. The average live weight at birth of the female calves studied by us is 31.6 ± 0.81 kg (Table 1).

Table 1. Live weight at birth, absolute and average daily gain of organically bred female calves of the Aberdeen Angus Cattle breed

Age, months		Live weight			Absolute gain			Average daily gain		
	N	LS	Sx	Sdev	LS	Sx	SDev	LS	Sx	SDev
At birth	54	31.6	0.81	5.96						
Standardized at birth	54	33.1	1.26	9.23						
1	54	54.3	1.61	11.85	21.20	1.122	8.245	0.713	0.039	0.286
2	53	74.6	1.95	14.21	20.54	1.004	7.306	0.711	0.028	0.205
3	52	98.7	2.69	19.36	24.09	1.338	9.647	0.756	0.036	0.263
4	51	123.2	3.52	25.13	24.58	1.336	9.540	0.834	0.039	0.281
5	50	149.3	3.99	28.24	26.18	1.617	11.437	0.912	0.041	0.287
6	46	172.8	5.22	35.41	25.18	2.069	14.035	0.836	0.043	0.289
7	46	204.0	5.93	40.21	31.12	1.985	13.466	0.951	0.046	0.309
8	44	225.7	6.31	41.85	22.21	1.587	10.530	0.714	0.051	0.338
9	40	244.2	6.65	42.06	20.66	1.853	11.719	0.681	0.064	0.405
10	35	261.1	7.46	44.14	19.62	2.193	12.972	0.629	0.072	0.426
11	31	278.1	9.11	50.70	16.75	2.645	14.729	0.541	0.091	0.509
12	27	301.6	9.94	51.63	19.07	3.432	17.832	0.631	0.110	0.572
13	27	322.9	9.88	51.34	21.27	2.802	14.560	0.667	0.086	0.447
14	25	346.1	12.13	60.67	23.27	3.102	15.508	0.764	0.102	0.510
15	23	363.7	13.04	62.53	17.49	2.418	11.596	0.570	0.081	0.390
16	21	387.8	9.69	44.41	13.47	3.145	14.413	0.423	0.106	0.487
17	17	407.6	11.60	47.82	27.28	2.503	10.319	0.902	0.083	0.341
18	16	433.1	11.57	46.27	22.40	3.809	15.238	0.704	0.116	0.463
19	16	458.8	13.03	52.12	25.75	3.968	15.872	0.835	0.140	0.561
20	13	481.9	14.14	50.97	26.38	5.258	18.958	0.866	0.163	0.589
21	11	475.5	12.53	41.57	-2.91	6.174	20.477	-0.051	0.204	0.675
22	5	458.2	16.93	37.86	1.40	5.870	13.126	0.094	0.209	0.468
Total	703	224.1	4.82	127.90	22.13	0.505	13.369	0.726	0.016	0.410

Similar live weight for the breed has also been ascertained by Jakubec et al. (2003) in Czech Republic - 29.22 kg, and lower was reported by Kolisnyk et al. (2018) in Ukraine - 26.5 kg for the females and 29.4 kg for the males. Apart from the mother, other factors influencing the weight at birth are the herd, year and season of calving, the breed, the gender of the calf, the pregnancy duration, the age of the mother, the genetic group of the cows (Holland et al., 1992; Waheed et al., 2003; Krupa et al., 2005; Pilarczyk et al., 2011) and so on.

We ascertained that under the conditions of organic farming and natural breeding, the year ($P<0.01$) and month of birth ($P<0.05$) affect the live weight at birth but the influence of the latter is specific during the different years ($P<0.05$). The difference in the average live weight at birth between the separate years is from 6.1 to 22.7% (Table 2). The season, both as a whole and within the year, is not a reliable source of variation in the live weight at birth. Thus, in 2017, the calves born in the spring are 3.8% heavier than those born in the winter while in 2018, they are 3.9% lighter - such differences are close to the statistical mistake.

Table 2. Influence of the year and the season of calving on the live weight upon birth of female calves of the Aberdeen Angus cattle breed

Year	Season	N	LS	Sx	Sdev
2016	Summer	11	37.28	0.85	2.68
	Autumn	6	32.33	2.20	4.93
	Total	17	35.47	1.05	4.21
2017	Spring	6	30.00	3.35	7.48
	Summer	7	28.86	0.98	2.41
	Autumn	11	27.91	2.02	6.38
	Winter	6	29.67	3.17	7.09
	Total	30	28.90	1.09	5.86
2018	Spring	3	32.67	1.47	2.08
	Winter	4	34.00	3.23	5.60
	Total	7	33.43	1.71	4.20
Total	Spring	9	30.89	2.18	6.15
	Summer	18	33.94	1.18	4.87
	Autumn	17	29.47	1.54	6.14
	Winter	10	31.40	2.19	6.59
	Total	54	31.56	0.82	5.96

In 2016 and 2017 the calves born during the summer were heavier than those born in the autumn with the difference during the first year reaching 15.3%.

Forster (2010) indicates that during the suckling period the growth of the calves from the Aberdeen Angus Cattle breed is strongly connected to the mothers' milk yield, which in turn depends on the season of calving and the live weight of the cow. Law et al. (2013) have found out that cows of Aberdeen Angus Cattle breed with higher live weight at calving and higher and sustainable milk yield had calves with higher live weight at weaning. Toušová et al. (2015) point out that during their third or fourth lactation, cows have: the highest milk yield, no problematic calvings, and good maternal instinct. Furthermore, the calves' death rate after birth is low. On the other hand, Gabidulin et al. (2018) have ascertained that the Aberdeen Angus cows had the highest milk yield at the age of 5 years.

After their birth and by reaching 3 months, the female calves studied by us increase their live weight almost twice (Table 1). Taking into account the fact that with the increase of the age, the growing needs of the calves may not be met by the mother's milk only, the farm provides access to individual feeder with a starter feed as early as the first month after birth. This provides the opportunity for maintenance of intensive growth during the entire suckling period (up to the age of 7 months) with a gradually expanding daily growth. During the first three months it is within 0.700-0.750 kg, during 4-7 months is 0.830-0.950 kg per month. It increases by 33.3% from the beginning until the end of the

suckling period. Similar gain during the suckling period was reported by Kolisnyk et al. (2018) upon examination of the Aberdeen Angus cattle breed in Ukraine.

As a whole the gain increase during the suckling period is gradual, with the exception of some fluctuations, due to which the absolute monthly gain is within 20-26 kg. At 7 months old the female calves reach approximately 32% of the live weight of the adult cows from the breed, at 12-50%, at 16-67%. This may be used to forecast the age of first service and first calving of the Aberdeen Angus Cattle breed heifers bred in the conditions of our country.

The growth of the beef cattle breeds' calves during the suckling period depends on the breed, gender, the father (Hoppe et al., 2010; Jakubec et al., 2003; Toušová et al., 2015) and so on. Thus, when comparing the growth of calves from the Aberdeen and Limousin cattle breed up to 3 months old in Belarus, Loban et al. (2018) found higher average daily growth in the former (97.7 g). On the other hand, Sukhanova et al. (2018) in Russia claim that during the respective period, the Aberdeen Angus had higher growth than that of the Hereford Cattle breed with a difference of 263 g, 309 g and 225 g for the first, second and third month respectively. Szabó et al. (2006) report that the year and season of calving, the breed, the age of the mother and the gender have influence on the weight upon weaning at the age of 205 days for the beef cattle calves.

The average live weight upon weaning of the cows studied by us is 204 kg. Higher live weight, 224-255 kg, depending on the year, is reported by Efimova (2018).

In the month following the weaning, the average daily gain of the calves examined by us diminishes by approximately 25%. While studying the growth of Aberdeen Angus cattle breed calves weaned at 205 days, Hassen et al. (2004) have found out that the average daily gain has continually increased from birth to the age of 250 days, and after that it starts to decrease. The same authors have ascertained that the female calves at the age of 261 days reach an average live weight of 271 kg.

In the case of the calves examined by us, the growth after weaning changes inconsistently. In the first three months it diminishes, then in the next three months it increases, and at 14 months it reaches the level which it had after weaning.

Taking the free access to concentrated feeds into account, we can explain the growth decrease after weaning only by the weaning stress which is probably strongly affected by the ecological factors of the season. As we already mentioned, in the farm examined by us the calving, and respectively the weaning of the calves is made all year round due to which the separate individuals are subjected to the influence of different factors during the different age periods.

Table 3 clearly shows that the year and the season of birth affect the growth of the calves

Table 3. Influence of major paratype factors on the growth of female calves of the Aberdeen Angus cattle breed bred organically (F - criteria and degree of reliability)

Factor	Absolute gain	Average daily gain
Year	2.228	6.511**
Season	3.550*	3.991**
Year*Season	0.047	0.016
Year	2.049	5.469**
Month	2.12*7	2.189*
Year*Month	1.281	1.656
Age*Year	2.132**	2.288**
Age*Season	4.479***	5.511***
Age*Year*Season	0.975	0.936
Age*Year	3.089***	2.577**
Age*Month	3.785***	3.520***
Age*Year*Month	2.525***	0.759

***P<0.001; ** P<0.01; * P<0.05

and during the different age periods the season has specific (age*season) and more reliable influence than the season as a whole.
Specifically strong influence, within the age, is also exercised by the month of birth but its effect on the growth is not taken into account.

Figure 1 shows that during the first 3-4 months after birth no significant differentiation is observed regarding the live weight of the claves born in different seasons. The calves born during the autumn have negligibly higher mass.

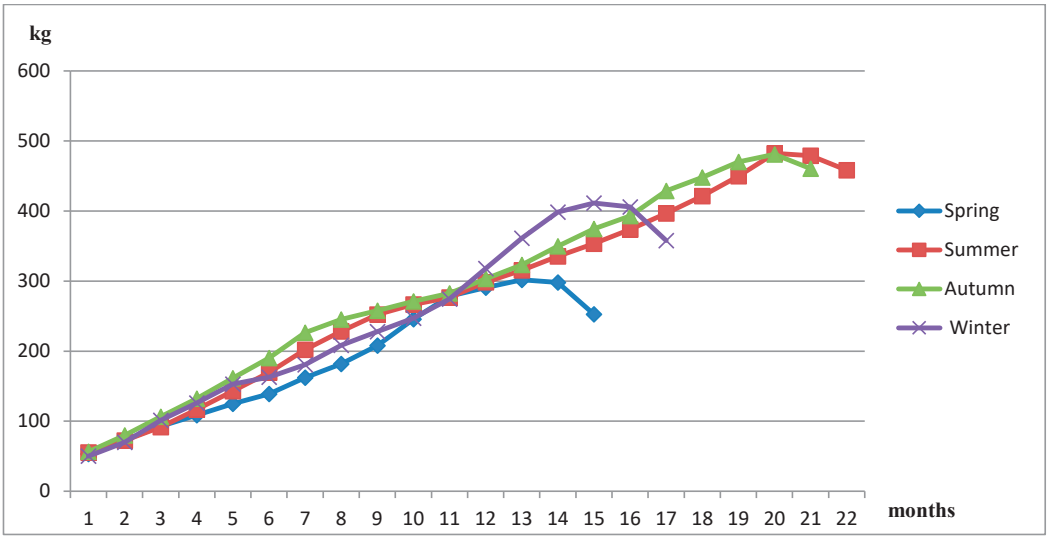

Figure 1. Influence of the season on the growth of the female calves of the Aberdeen Angus cattle breed

More considerable differences are observed after the fifth month. The calves born in the spring have the lowest weight until the tenth. This seems illogical at first sight but is not at all surprising for the conditions in Bulgaria. The calves born in the spring months (March-May) are weaned in September- November. These are the most unfavourable months in terms of feeding of the pasture animals. In this period, the natural pastures are entirely dry, and the feeding with winter feeds has begun. The figure shows that after the respective period there is a certain compensation of the growth slowdown and at one year old, the calves born in different seasons basically have the same live weight.
Until reaching the age of one year, the calves born in the autumn (September-November) show the highest growth rate. The first months of the suckling period coincide with the most unfavourable feeding period for the mothers but it is then that the needs of the calves are the fewest. The period of growth of the needs coincides with the transition to winter feed which is significantly more favourable than the autumn one. The weaning is in the spring when the pastures are at their best. The calves born in the autumn have become strong during the first year and develop better in the following months.
The cows born in the winter (December-February) indicate higher growth rate after reaching one year. The feeding of the one-year-old calves born in this period coincides with the beginning of the spring season which is favourable for the growth and development in the conditions of grassland feeding.
The calves born in the summer mark the most stable growth during the entire observation period. The weaning of these calves coincides with the beginning of the winter season during which the animals consume high-quality mixed ration which is balanced for the respective category.
After a relative stabilisation around 14 months, at 15 and 16 months the growth once again sharply decreases to approximately 0.420-0.570 kg. This period coincides with the reaching of commercial maturity and service of the heifers.

So that heifers of the Aberdeen Angus cattle breed be fit for breeding, they need to reach a minimum of 65% of the adult cows live weight so as to reach 85% of that mass upon first calving (Hall, 2006). The calves studied by us reach 65% of the live weight of the cows at exactly 15-16 months old. Obviously, regardless of the growth fluctuations, the female calves bred organically under the conditions in Bulgaria reach commercial maturity at the optimal breeding age.

CONCLUSIONS

In conclusion, it can be noted that under the conditions of a certified organic farm in Bulgaria, the female calves of the Aberdeen Angus cattle breed are born with live weight of 31.6 ± 0.81 kg, upon weaning at 210 days old they weigh 204.0 ± 5.93 kg, at 15 months - 363.7 ± 13.04 kg, and at 18 months - 433.0 ± 11.57 kg.

The average daily gain of the individuals varies greatly reaching up to 2.090 kg. The growth of the animals both as a whole and within the separate age groups is influenced by the year, season and month of birth, and the calves which were born in the autumn develop the best.

Irrespective of the growth fluctuations during the different periods, the female calves reach an optimal breeding live weight (330-360 kg) at an optimal (15-16 months) age.

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