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

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Abstract

The growth of male calves of the Aberdeen Angus cattle breed was examined in a certified organic farm. The animals were weighed on a monthly basis. It was ascertained that the male calves were born with a live weight of 33.9 ± 0.31 kg, and upon weaning at 210 days they weigh 197.5 ± 7.86 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. The calves born in the autumn are the ones to develop the best until attaining one year of age, after that it is those born in the spring but the most sustainable growth is displayed by the calves born in the winter. The male calves of the Aberdeen Angus cattle breed, reared in an organic farm reach an optimal slaughter age of 16 months and an average live weight of 453.1 ± 47.21 kg.

Keywords: Aberdeen Angus, growth, organic farm.

INTRODUCTION

In the recent years the organic agricultural production has been considerably increased, however, the tendency in Europe for the ’bio’ market to expand at a faster rate when compared to the bio production areas comes to indicate that that the production itself still has not been in line with the consumer demand (Willer et al., 2019). The organic livestock production, being part of the entire production, not only has increased its share in the food security, but it also soared in significance for the overall sustainability of the agri-ecosystems (Escribano, 2016). Nikolova (2020) considers the establishment of sustainable agri-ecosystems which function harmonically in the environment to be the basis for the development of the global agricultural production. According to the author, the sustainable agriculture pursues three major goals: environmental stability, economic efficiency and social justice.

The organic production is considered a potential means of beef commercial value increase (Napolitano et al., 2010). It secures higher income while having a lower environmental harm and lower or similar antibiotic resistance probability (Van Wagenberg et al., 2017). It is also more attractive for the consumers due to the humane treatment of the animals (Zanoli et al., 2013). The organically produced meat is richer in polyunsaturated, including -3 fatty acids (Cozzi et al., 2010).

The optimal functioning of the production system requires the selection of the appropriate breed, manner of rearing and feeding so that optimal fattening periods are achieved, which in turn will lead to economic efficiency increase (Kamilaris et al., 2020). The Aberdeen Angus cattle breed displays very good results in meat production via organic

rearing in mountain and high hills regions (Macuic et al., 2019).

The organic farming in Bulgaria has a relatively short history but it is a question of time more and more farmers to embrace its philosophy (Nikolova, 2013). The aim of the present study is to trace the growth of male calves of the Aberdeen Angus cattle breed reared in an organic farm.

MATERIALS AND METHODS

The study was carried out in the period 2016-2018 in the certified organic farm "THRACA ANGUS FARM" LTD. The farm is located in a low mountainous slightly undulating area. It has improved pastures which are used approximately 8 months a year. The region and the conditions for own production of feeds are suitable for fattening of calves from specialised meat breeds. The calving is all year round. During the suckling period the calves are reared together with their mothers. After weaning until the end of the fattening, the male calves are reared freely in groups in semi-open building with a yard for walks in the open air. The finishing fattening period is at the age of 15-17 months.

The study includes 34 male calves which are weighed monthly from birth to the age of 17 months. The weighing is performed in a specialised crush with a weighing platform, and the reporting and registering of the live weight are automatic. The initial live weight is standardized in compliance with the recommendations of ICAR (2016).

The relative growth is also calculated in view of the same recommendations following the formulae: O = logW1-logW0 / (t1 – t0) 0.4343 where W0, W1- live weight; t1, t0- age of the animal (days), respectively at the beginning and the end of the period.

The data are processed through analysis of variance and the models have the following statistical image: Yijkl = +AGi+YBij+SBijk+eijk(l); Yijkl = +AGi+YBij+MBijk+eijk(l); where Yijkl- look vector; - total average constant; AGi, age group fixed effect (i=17), YBij- random effect of the year of birth within the age group (j=3), SBijk and MBijk- are random effects of the season (4) and respectively the month (11) of birth within the year and the age, eijkl- residuals. The statistical processing is performed via SPPS 21.

RESULTS AND DISCUSSION

The average live weight at birth of the male calves examined by us is 33.9 ± 0.31 kg. (table 1). Similar live weight of the breed is also ascertained by Muizniece and Kairisa (2018) in Latvia- 38.2 kg, Jakubec et al., (2003) in the Czhech Republic- 29.22 kg, and lower by Kolisnik et al., (2018) in Ukraine- 29.4. According to Gociman et al., (2019), the calves from the Aberdeen Angus cattle breed are born relatively light- 35 kg but have a very good compensatory growth at the different age stages.

The live weight at birth of the calves whose mothers are reared in organic farming and bio-friendly conditions is influenced by the season ($P<0.001$) and the month of birth ($P<0.001$) with the effect of the latter being specific throughout the different years ($P<0.05$). Similar influence was also ascertained by Forster et al., (2010) and it was added that the season directly affects not only the weight at birth but also the weight upon weaning. The authors share the opinion that the best results have been achieved upon weaning of the calves in September, while October is suitable for calving.

As a whole, under the conditions of our study the calves having the highest live weight are the ones born in the summer (figure 1). When compared to the ones born in the other

seasons, the difference is from 12.3%- during the autumn to 18.5 % for those born in the winter; in addition, the year of birth also leaves its mark on the tendency and the magnitude of the said differences. In 2017 the calves born in the spring were lighter than those born in the winter, while in 2018 it was the opposite.

The calves born within one year- 2016 had the highest and lowest weight at birth, and those born in the summer were 31.7% heavier than those born in the next season.

Tab. 1. Live weight at birth, absolute and average daily growth of male Aberdeen Angus calves upon bio-friendly rearing

Age, months=		Live weight			Average daily growth		
	N	LS	Sx	SDev	LS	Sx	SDev
at birth	34	33.9	0.31	5.3			
Standardized at birth	34	34.3	0.92	5.3			
1	34	55.0	1.77	10.15	0.713	0.040	0.229
2	32	74.6	2.29	12.73	0.712	0.033	0.183
3	33	97.7	3.11	17.60	0.753	0.044	0.248
4	35	122.5	4.14	24.16	0.823	0.049	0.288
5	30	142.1	5.30	28.56	0.788	0.063	0.340
6	31	168.9	6.53	35.74	0.881	0.056	0.309
7	30	197.5	7.86	42.35	0.948	0.068	0.368
8	28	231.4	9.60	49.89	1.151	0.101	0.527
9	28	253.6	8.92	46.36	1.171	0.067	0.346
10	21	284.4	12.66	56.61	1.136	0.093	0.417
11	18	322.2	14.75	60.84	1.149	0.083	0.341
12	18	349.3	14.24	58.73	1.132	0.140	0.579
13	15	366.0	18.65	69.78	1.041	0.172	0.644
14	9	394.6	30.94	87.50	1.166	0.262	0.742
15	8	443.7	37.83	100.09	1.226	0.163	0.432
16	6	453.1	47.21	105.57	1.328	0.130	0.291
17	5	481.9	56.59	113.19	1.060	0.088	0.176
Total	381	200.9	6.23	121.53	0.943	0.021	0.413

Fig. 1. Influence of the year and season of calving on the live weight at birth of male calves of the Aberdeen Angus cattle breed

The birth weight positively correlates with the growth during the suckling period and the weight at weaning at 210 days old (Przysucha et al., 2002; 2016). The weight at this age and that at 120 days old is an important indicator upon reporting the growth capacity of the meat breeds calves during the suckling period.

The results from the study we performed show that at the age of 120 days, the male calves have an average live weight of 122.5 ± 4.14 kg, and at 210 days old- 197.5 ± 7.86 kg. Higher values of the same parameter in Aberdeen Angus male calves at the same age are reported by Toušová et al., (2015) - 177.70 ± 2.308 kg at 120 days old and respectively 277.94 ± 3.206 kg at 210 days old. The data submitted by the authors are collected under the conditions of seasonal calving in the period February- April during which the calves are given feed depending on the growth curve. This once again demonstrates the importance of the particular breeding technology for the efficiency of the use of one breed or another.

The animals reared in the farm examined by us are given free access to individual feeder containing starter mix as early as their first month because the fact that with the age increase, their growing needs cannot be satisfied by the mothers' milk only is taken into account. This provides the opportunity for maintenance of relatively good growth during the suckling period and the average daily growth gradually increases (table 1).

During their first month the calves increase their live weight by 60.3%. During the second month the average daily growth remains unchanged, and during the following two months it increases with 5.8 and 9.3% respectively against the background of decreasing relative growth (figure 2).

After a certain fall during the fifth month, the average daily growth during the next two months until weaning continues to rise, and in the month of weaning (7 months old) it reaches 0,948±0.068 kg.

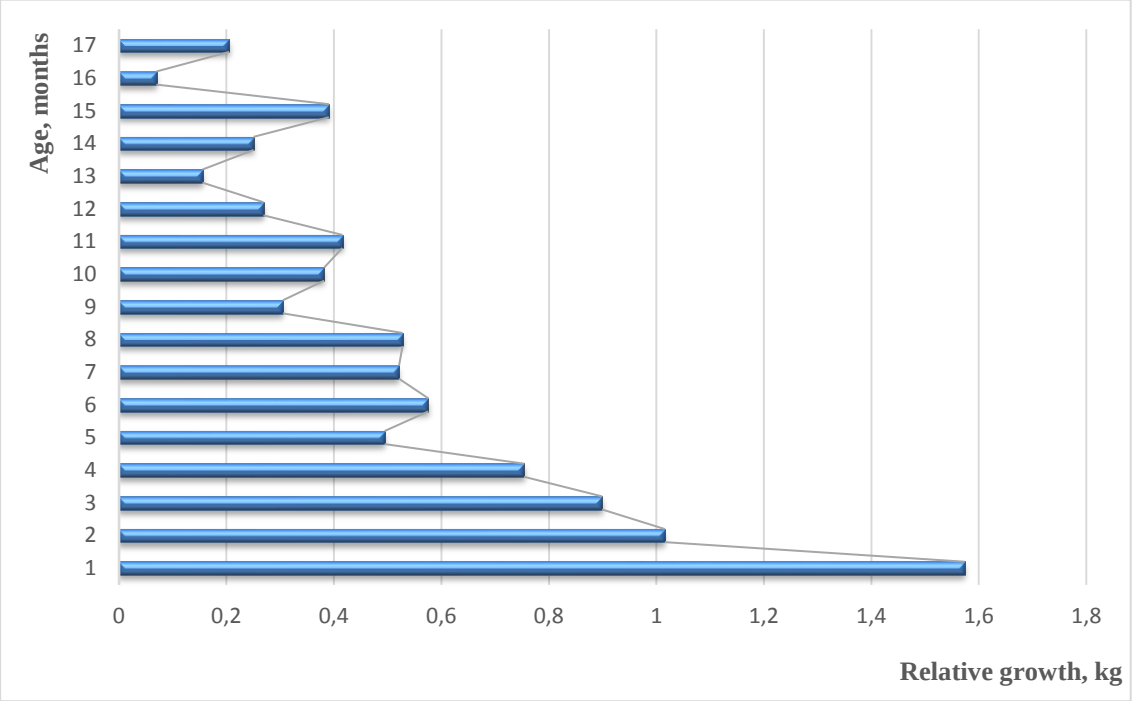

Fig. 2. Relative growth of male calves of the Aberdeen Angus cattle breed reared in an organic farm

During the suckling period from birth to weaning, the male calves live weight increases averagely by 72%, and the average daily growth by 25%. Davidova (2019), reports average live weight at 8 months old of 230 ± 2,51 kg in Russia, which is similar to the one reported by us. Higher results with reference to the male Aberdeen Angus calves are displayed by Donetskikh (2019) in Russia, where the average daily growth between the age from 0 to 6 months are 1111.2 g. Upon weaning, the calves from the farm examined by us are strong enough which is exhibited by the fact that after weaning, the growth has not fallen, quite the contrary- it has risen by 21.4%. Obviously, the weaning stimulates the calves to search and consume feeds more vigorously. Under the conditions of pasture rearing of cows with suckling calves in the summer, Gangnat et al., (2017) have found that the weaning performed earlier than the optimal period is connected to higher growth at all ages and a better meat quality.

After weaning, the male calves are separated from their mothers and are reared freely in groups until the end of the fattening period. The feeding is balanced with „TMR“ feeds according to the requirements and in compliance with the category, age and the livel weight reached. High quality roughage and concentrated feeds are used at all periods, and during the finishing period the share of the carbohydrate concentrated feeds is increased.

In the period 5-8 months old, the growth intensity varies at relatively similar levels, while during the following months- it shows specific fluctuations, predictably, the growth continues to decline (figure 2). The average daily growth increases slowly but steadily. After weaning until attaining 12 months of age, the calves' average daily growth changes within 19.4%.

The live weight during the same period increases by 76.9%. The live weight increases

by 27% more in the period from 12 to 15 months of age. In Ukraine, Svyrydenko and Kostenko, (2019), report an average live weight of the Aberdeen Angus calves at 210 days old- 202.07 ± 4.00kg, at 9 months- 244.9 ± 4.17 kg, at 12 months- 316.6 ± 5.44 kg, and at 15 months- 394.5 ± 6.84 kg. The initial data are similar to the ones ascertained by us but the further results are worse. Also in Ukraine, Dzhus et al., (2016) report similar results with reference to the live weight at 210 days old- 228.03 ± 6.750 kg, average daily growth- 964.1 ± 30.881 g, at 12 months old- 389.3 ± 8.35 kg, average daily growth 1114.47 ± 34.208 g.

The purpose of the farm is the male calves fattening to end at the age of 15, 16 months upon reaching live weight of 450 kg which is favourable for both the commercial and biological maturity at the end of the fattening period. Table 1 clearly displays that this aim is entirely achievable. Similar results regarding male calves of the Aberdeen Angus cattle breed are reported by Kulintsev et al., (2018) who, following a different feeding system and technological period duration, have ascertained that at the age of 14-18 months, the calves reach live weight of 441-445 with feed use of 7-7.7 FU/ kg growth.

The analysis of the separate age groups of the Aberdeen Angus calves shows that the highest growth rates are observed in the period from 12 to 15 months old, with an average daily growth from 910.5- 925.5g (Fomina et al., 2019) to 1200 g (Dyuldina 2017). Gorlov et al., (2018) have observed a steady and intensive growth in the period from 8 to 16 months of age, when the live weight has increased from 233.6 kg to 482.7 kg, and the average daily growth with reference to the particular period has been 1042.1 g. Kazhgaliyev et al., (2016) have ascertained that under the conditions in Kazakhstan and when compared to other breeds, the Aberdeen Angus male calves have the most intensive growth between 6 and 15 months old. They lag in their height development but retain their compactness and good fattening capacity by reaching 189.1 ± 2.5 kg at 6 months, 308.2 ± 3.1 kg at 12 months and 394.7 ± 3.6 kg at 15 months old. Aberdeen Angus calves reared in Portugal exhibit an average daily growth of 1.38 kg for a period of 174 days of intensive fattening, and weight of 487.83 kg at the end of the fattening period (Galliani et al., 2017).

Apart from the age, other parameters influencing the growth of the calves are the year, season and month of birth which are in complex interaction (table 2).

Tab. 2. Influence of major paratypic factors on the growth of bio-friendly reared male calves of the Aberdeen Angus cattle breed (F criteria and degree of reliability)

Factor	Absolute growth	Average daily growth
Season	1.305	4.487**
Month	1.956*	2.002*
Year	4.990**	10.439***
Year * Month	0.050	0.066
Year* Season	1.110	2.384*
Age* Year	1.915*	0.822
Month* Season	1.110	2.384*
Age * Season	1.866*	2.579***
Age * Month	3.461***	1.076

Age* Month* Season	3.468***	2.560***
Age* Year* Month	1.422	0.446
Age*Year* Season	2.246***	3.671***

***p <0.001; ** p<0.01; * p<0.05

The most significant is the influence exercised by the year, while the month and the season within the year do not affect the absolute growth, and the month- the average daily growth. The latter is influenced by the season both as a whole and within the respective year.In general, the age influences the growth of the calves, however, when combined with the month and the year of birth, the respective influence 'dillutes' which comes to prove that the separate factors have divergent effect. Khan et al., (2019), Moaeen-ud-Din and Bilal (2017) and others have ascertained influence (P=0,05) of the season and the year of birth on all parameters related to the growth capacity, and of the month of birth and interaction year-genotype - Scholtz et al., (2017) on the live weight of the calves at 205 days old.

Figure 3 displays the growth of calves born during different seasons throughout the year. During the first 2-3 months after birth, no significant differentiation in terms of live weight is observed. The calves born in the autumn have a negligibly higher weight. A more considerable difference is reported from the third month on. After that age, the calves born in the autumn have higher live weight during the suckling period, higher, realised weight upon weaning and a better growth which, until turning 9 months of age, outweighs that of the calves born during the other seasons.

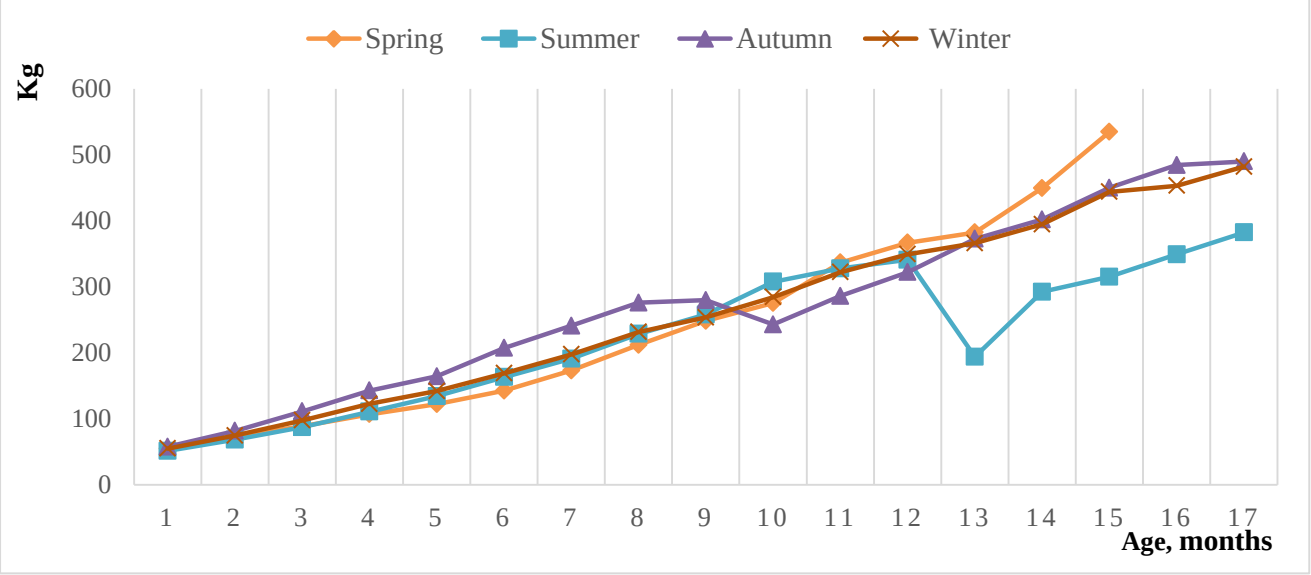

Fig. 3. Influence of the season of birth on the growth of male calves of the Aberdeen Angus cattle breed.

The first months of the suckling period which are in the autumn period, coincide with the most unfavourable period in terms of feeding of mothers, however, the needs of the calves then are the lowest. The period of increase of the calves' needs coincides with the transition to winter feeding which is considerably more favourable than the autumn one. The weaning, on the other hand, is during the spring when the pastures are at their best condition.

Having in mind that the male calves spend only their suckling period at the pastures, it is essential that they are strong enough to undergo the weaning period more smoothly. According to Sukhanova et l., (2018), there is a high positive correlation (r=0.92) between the live weight at weaning and the live weight at the end of the fattening period, and an increase of the weight at weaning with only 1 % would lead to an increase of the pre- slaugther weight by 1.17 %.

In the study carried out by us, the calves born in the autumn months (September-November) are weaned in the spring when the temperatures are still moderate. During the summer and the autumn of the following year the growth decreases but until the end of the fattening period the calves, born in the autumn maintain a satisfactory growth.

The most sustainable growth during the different ages is shown by the calves born in the winter. The decrease in the milk yield of the mothers is in the spring and coincides with the development of the grassland which ensures the most optimal feed for the calves. At the beginning of the summer when the heat starts and the pastures get dry, the calves are already being put to stationary feeding. The worst development was displayed by the calves born in the summer. Tofastrud et al., (2020) have ascertained that upon pasture farming throughout the suckling period of calves born in the spring, they have a higher live weight than that of those born in the autumn- respectively 92 ± 1.7 kg and 65 ± 4.4 kg.

CONCLUSION

The male calves of the Aberdeen Angus cattle breed reared in a certified organic production farm in Bulgaria are born with a live weight of 33.9 ± 0.31 kg, and upon weaning at 210 days old they weigh 197.5 ± 7.86 kg.

The growth of the animals both as a whole and within the scope of the separate age groups is affected by the year, season and month of birth.

Until becoming one year old, the calves which developed the best are those born in the autumn, and after that age, the calves born in the spring, however, the most sustainable growth is displayed by the calves born in the winter.

The male calves of the Aberdeen Angus cattle breed reared in an organic farm reach an optimal slaughter age of 16 month with an average live weight of 453.1 ± 47.21 kg.

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