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Influence of the father on reproductive traits in cows of the Aberdeen Angus cattle breed, reared in an organic farm

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Abstract

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The reproductive capacity of 142 cows of the Aberdeen Angus cattle breed reared in the certified organic farm THRACE ANGUS FARM Ltd, Bulgaria was analyzed. The cows subject to the study (born in Bulgaria – 81; born in Germany – 61) were daughters of bulls born in Germany. The Aberdeen Angus cows reared in Bulgaria had a service period of 50.30 ± 8.05 days and a calving period – 335.09 ± 8.07 days on average. The age of first calving was, on average, 24.5 ± 1.60 months. The fathers and the consecutive calving had a reliable influence ($p < 0.05$) on the service period and the calving period of the daughters. The country of birth had no influence on the reproductive traits analyzed by us. Similarly, the fathers and the country of birth did not influence the age of first calving. The shortest service and calving interval was observed in the cows on their third calving.

Keywords: Aberdeen Angus, bulls, reproduction, origin

Introduction

The effective reproduction organization in beef cattle entails a timely service of healthy animals with a regular estrus cycle so as annual calving and lower medical treatment expenses to be ensured (Burns et al., 2010). There is a set of factors which influences the reproductive capacity of the cattle and the reduction of the economic losses incurred by an impaired reproduction (Reese et al., 2020; Ekowati et al., 2018). Factors such as the balanced feeding, physiological status of the animals (Arthington, 2016; Swecker Jr, 2014;), the climatic conditions (Gaughan and Cawdell- Smith, 2015) and last but not least, the managerial solutions of the owners (Larson and White, 2016) are directly connected to the achievement of good results. The challenges set for the modern strategies for introduction of new reproductive technologies in the beef herds are aimed at marketing quality and economically viable production (Patterson et al., 2019). The success rate of the regular provision of calves from the beef cows requires the application of a suitable selection plan appropriately combining the reproductive capacity of the animals and their adaptability and well-being (Walmsley et al., 2018). In terms of genetics, the traits related to the reproduction are with a low hereditability (Buzanskas et al., 2010) and most of them are in a negative correlation with the productive traits (Ribeiro et al., 2020; Pires et al., 2017). The lack of estrus in the suckler cows is a serious problem impeding the achievement of an optimal production cycle (Fontes et al., 2020; de Sá Filho et al., 2017). In the resent decades, the earlier sexual maturity onset of the Aberdeen Angus breed has been considered an advantage for earlier introduction of beef heifers in the production (Archer et al., 1998; Bonamy et al., 2020). The aim of the present study is to ascertain the influence of the fathers on some reproductive traits of cows of the Aberdeen Angus cattle breed, reared in Bulgaria.

Material and Methods

The reproductive capacities of 142 cows of the Aberdeen Angus cattle breed, reared in the certified organic farm- ''THRACA ANGUS FARM'' LTD were analyzed. The animals were under the selection control of the National Association for Beef Cattle Breeding in Bulgaria – Sofia. The animals spent around 8 months of the year on pastures adjacent to the farm. During the winter the animals were bred in a semi-open building with a yard. The calving was all-year-round. The calves suckling period was 210 days. The study includes data about the reproduction of cows from 2 to 6 years of age for the period from 2015 to 2020. Upon calculation of the age of first calving, the animals taken into account had a lower limit of 22 months, and upon calculation of the calving period, no cows with a period longer than 700 days were included. The methods used for calculation and evaluation of the reproductive qualities are in concordance with the recommendations of ICAR (2020) with reference to the beef farming. The data were processed via analysis of variance. Two models with the following statistical expression were used:

$$Yijkl = \mu + Fi + Oij + Lijk + eijk;$$

where: Yijkl – observation vector; μ – total average constant; Fi – fixed effect of the father (i = 22), Oj – fixed effect of the cows country of birth (j = 2; Bulgaria and Germany), Lk – fixed effect of the consecutive calving, eijkl – residuals. The statistical processing was performed via version 21 of the SPPS program. All cow fathers studied by us were born in Germany and had an American, Irish or German origin. 56 of the bulls daughters were born in Bulgaria and the other 161 daughters – in Germany.

Results and Discussion

Our study on the ascertainment of the fathers influence on the reproductive capacities of the Aberdeen Angus cows points to reliable differences (Table 1). As a whole, the daughters were serviced within a normal service period – 50.30 ± 8.05 days on average. The calving period was 335.09 ± 8.07 days, on average, which also corresponded with a regular annual reproduction. Usmanova et al., (2021) report a service period for the Aberdeen cows in Russia within 70-90 days. As a whole, the daughters were serviced within a normal service period- 50.30 ± 8.05 days on average. The calving period was 335.09 ± 8.07 days, on average, which also corresponded with a regular annual reproduction. Usmanova et al., (2021) report a service period for the Aberdeen cows in Russia within 70-90 days. The service period for 70% of the bulls daughters was between 40 and 80 days and for 14% of them it was approximately 80 days after calving. Similar results are reported with reference to the calving period where for 86% of the daughters it was between 320 and 365 days and for 13% of them the calving period was over 365 days.

Kazhagaliev et al., (2020) also ascertain differences in the productive and reproductive qualities of daughters of bulls with different origin. Due to the fact that, after calving, the cows are left for natural service with bulls from the herd and a minimal period from calving to service has not been controlled, most of them are serviced as soon as the onset of first estrus. Probably this is the reason why the daughters of one of the bulls examined had a relatively short service period 35.29 ± 6.104 days. The daughters of three of the bulls had a service period longer than the optimal 80-day one. Wider variation of the trait was observed in the service periods after the 80th day. The calving period of these daughters was between 370 and 384 days. The distribution of the cows which had a service period between the 40th and the 80th day was of seventeen fathers of all studied. Their daughters also had a calving period ranging from 335 to 364 days. The daughters of six fathers in Bulgaria had a calving period within the interval 320-339 days. A bigger part of the distribution of a total of 106 daughters of 13 fathers had a calving period between 340 and 364 days.

15 daughters of three bulls had a longer than the optimal calving period – from 370 to 384 days. The daughters of six fathers in Bulgaria had a calving period within the interval 320-339 days. A bigger part of the distribution of a total of 106 daughters of 13 fathers had a calving period between 340 and 364 days. 15 daughters of three bulls had a longer than the optimal calving period – from 370 to 384 days. Hilton (2020), considers that the influence of the father varies depending on the breed which is also related to the change of the physical condition at the beginning of the lactation period which in turn directly affects the reproduction.

The age of first calving of the Aberdeen cows studied by us was 26.12 ± 0.47 months, on average, which is acceptable considering the rapid sexual maturation of the breed. A value which is lower but close to our age of first calving ascertaiened for the Aberdeen was reported by Brzáková et al., (2020) in the Czech Republic and Mihaela et al., (2019) in Romania. During our study, our goal was to perform first service of the heifers at the minimum age of 14 months and after achieving live weight of at least 350 kg. The daughters of two of the bulls studied had a first calving up to 24 months old under the implementation of such reproduction organization (table 2). A bigger part of the bulls, around 50%, had daughters whose age at first calving was within the interval 26-27 months. The daughters of 25% of the bulls had a higher age of first calving – within the scope of 28-30 months.

Table 1. Influence of the father on the reproductive capacity of cows of the Aberdeen Angus cattle breed

Father	N	Service period			Calving period		
		LS	Sx	SDev	LS	Sx	SDev
1	4	86.25	36.78	63.70	371.25	15.93	58.46
2	4	65.25	15.03	26.03	350.25	6.51	29.05
3	4	61.00	15.89	27.52	346.00	6.88	23.14
4	5	57.00	7.91	15.81	342.00	4.48	26.88
5	5	99.00	28.78	57.57	384.00	18.41	128.90
6	5	70.60	23.29	46.58	355.60	11.42	79.94
7	5	52.00	9.13	18.26	337.00	11.57	80.97
8	6	62.17	13.75	30.75	347.17	4.25	29.76
9	6	88.67	18.93	42.34	373.67	5.53	38.68
10	7	35.29	6.10	14.95	320.29	7.40	66.59
11	8	78.88	15.56	41.17	363.88	6.12	44.08
12	8	66.50	13.42	35.50	350.88	5.18	51.82
13	8	53.63	7.90	20.91	338.63	4.35	18.16
14	8	61.00	17.35	45.89	346.00	9.13	41.77
15	10	40.00	4.38	13.14	325.00	4.72	56.63
16	11	56.73	12.74	40.28	341.73	3.66	47.48
17	11	61.09	14.99	47.39	346.09	4.31	56.11
18	15	49.53	7.77	29.09	334.53	1.82	29.19
19	15	64.40	9.55	35.73	349.40	3.43	58.28
20	18	50.33	4.35	17.95	335.33	3.99	79.79
21	21	57.33	6.35	28.39	342.33	1.69	42.19
22	33	56.21	4.89	27.68	341.21	0.80	27.90
Total	217	58.38	2.58	34.55	343.38	0.22	59.27

Table 2. Influence of the father on age of first calving of cows of the Aberdeen Angus cattle breed

Father	N	Age of first calving		
		LS	Sx	SDev
15	4	28.50	5.02	8.70
18	4	23.25	1.09	1.89
19	5	24.20	0.82	1.64
21	5	26.80	2.88	5.76
9	5	26.40	3.05	6.11
20	6	26.00	2.97	6.63
14	10	30.60	1.67	5.02
22	42	27.33	0.75	4.80
Total	81	26.12	0.47	5.04

Falleiro et al. (2019) claim that apart from the hereditary relationship, the age of first calving is also affected by the length of the reproductive period. The bulls whose daughters had an age of first calving of up to 24 months had the same relative share. A wider variation in the trait examined was reported with reference to the daughters of bulls with age of first calving of above 26 months. The lowest variation was marked by the daughters with age of first calving of up to 24 months. The daughters of bull № 14 had the oldest age of first calving 30.60 ± 1.67 months which did not negatively affect the service and the calving period. The trait variation did correspond to a similar scope of variation intensity indicated by the other two reproductive traits. Within the country, the daughters born and reared in Bulgaria had a calving period of averagely 347.59 ± 4.07 days and a service period of averagely 57.09 ± 4.22 days (table 3). The calving period of over 80% of the daughters born in our country was with a duration between 330 and 365 days.

Similarly, the service period of those daughters was with a duration of up to 80 days. In the model, where the daughters country of birth was not included, the cows with the shortest and the longest calving and service periods did not keep the same ranking. However, the tendency for the display under the same indicators was almost the same. With reference to the cows born in Bulgaria, the variation was almost analogous regarding both of the reproductive traits.

Within the country of origin, the daughters of the bulls born and reared in Germany had a calving period of 359.73 ± 4.54, on average, and a service period of 48.66 ± 2.58 days, on average (table 4). More than half – 56% of them – had a calving period duration between 330 and 365 days. When it comes to the service period, 26% of the German daughters

Table 3. Influence of the father on the calving and service periods of cows of the Aberdeen Angus cattle breed born in Bulgaria

Father	Calving period				Service period			
	N	LS	Sx	SDev	N	LS	Sx	SDev
2	4	350.25	15.03	26.03	4	65.25	15.03	26.03
22	35	342.51	4.78	27.90	37	52.16	4.94	29.67
4	6	351.33	12.02	26.88	6	47.50	12.18	27.23
14	8	346.00	17.35	45.89	8	61.00	17.35	45.89
9	7	374.29	15.79	38.68	6	88.67	18.93	42.34
Total	63	347.59	4.07	32.07	64	57.09	4.22	33.49

Table 4. Influence of the father on the calving and service periods of cows of the Aberdeen Angus cattle breed born in Germany

Father	Calving period				Service period			
	N	LS	Sx	SDev	N	LS	Sx	SDev
1	4	369.15	36.78	63.70	4	89.14	36.78	63.70
8	7	343.43	12.15	29.76	8	51.13	13.02	34.44
7	20	359.55	18.31	79.79	23	41.48	5.34	25.06
10	9	352.00	23.54	66.59	9	27.44	7.16	20.24
18	16	332.56	7.54	29.19	16	46.44	7.93	30.71
16	11	341.73	12.74	40.28	11	56.73	12.74	40.28
15	12	347.58	17.07	56.63	13	41.23	9.84	34.10
13	4	339.25	24.54	42.50	4	25.75	13.09	22.68
12	10	369.60	17.27	51.82	11	48.36	13.59	42.98
13	8	338.63	7.90	20.91	8	53.63	7.90	20.91
17	11	346.09	14.99	47.39	11	61.09	14.99	47.39
5	7	418.57	52.62	128.90	9	59.33	22.39	63.34
3	4	351.09	15.89	27.52	4	63.18	15.89	27.52
19	17	366.18	14.57	58.28	20	48.30	9.62	41.95
29	25	351.84	8.61	42.19	26	46.31	6.86	34.29
6	7	375.57	32.64	79.94	8	48.38	18.09	47.86
7	7	383.29	33.06	80.97	7	37.14	12.01	29.43
11	8	393.63	37.99	100.51	8	46.00	14.69	38.87
Total	187	359.73	4.54	65.20	222	48.66	2.58	38.43

Table 5. Influence of some factors on the reproductive capacity of cows of the Aberdeen Angus cattle breed

Factor	Service period	Calving period	Age of first calving
Father	1.563*	1.558*	0.828
Consecutive calving	2.878*	2.890*	–
Origin of born	0.128	0.153	1.394

* $p < 0,05$

were serviced up to the 40th day after calving. The tendency observed which shows that around 70% of the cows born in Germany registered an optimal service period within 40th-80th day after calving is favourable and also corresponds with the good total pregnancy rate of the herd achieved.

As a whole, it could be summarized that around 50% of the daughters of the bulls with German origin were serviced before the 40th day after calving and had a calving period shorter than 365 day. Approximately 13% of the daughters born in Germany exceeded the optimal calving period.

The father and the consecutive calving had a reliable influence ($p < 0,05$) on the service period and the calving period of the daughters. The country of birth did not have influence on the reproductive traits examined by us.

None of the factors examined has also had a reliable influence on the age of first calving. The heifers had the longest service and calving periods (Fig. 1). At their first calving, 70% of the daughters of the bulls studied had a service period within 80 days after calving.

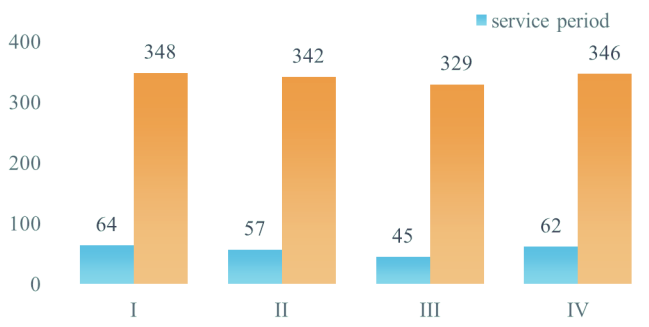

Fig. 1. Influence of the consecutive lactation on the reproductive capacity of cows of the Aberdeen Angus cattle breed

The results regarding the calving period were similar; 65% of the daughters had a first calving period within 365 days. The shortest service and calving periods was observed in cows during their third consecutive calving.

At that age, the cows become adults and in this case it could be explained that they had managed to recover from the calving faster so that they were serviced again. 90% of the cows had an optimal service period in third consecutive calving.

Conclusions

The cows of the Aberdeen Angus cattle breed reared in Bulgaria had a service period of 50.30 ± 8.05 days, on average, age of first calving – 24.5 ± 1.60 months, on average, and a calving period of 335.09 ± 8.07 days, on average. The shortest service and calving periods were reported for the cows on their third consecutive calving. The father and the consecutive calving had a reliable influence ($p < 0.05$) on the service period and the calving period of the daughters. The cows country of birth did not influence the reproductive traits studied by us. The fathers and the country of birth did not influence the age of first calving.

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