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Original paper

Preweaning growth performances of Aberdeen Angus calves

EUGEN CLAUDIU JURCO[1], GRIGORE ONACIU[1], SORIN SUCIU[2], ANCUTA NADIA JURCO[3,*], AUGUSTIN CATALIN MOT[4] and SIMONA GABRIELA JURCO[1]

[1]Faculty of Animal Husbandry and Biotechnology, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Calea Manastur, 400372 Cluj-Napoca, Romania
[2]Association of Aberdeen - Angus Romania
[3]Faculty of Mechanical Engineering, Technical University of Cluj-Napoca, 103-105 B-dul Muncii, 400641, Cluj-Napoca, Romania
[4]Faculty of Chemistry and Chemical Engineering, Babes-Bolyai University, Cluj-Napoca, 11, Arany Janos str., 400028, Romania

Abstract The purpose of this study was to determine the influence of birth weight, sex of calves, and the birth season effect on growth performance of Aberdeen Angus calves in the pre-weaning period, in four different farms from different counties. The evaluation of growth indicators of 138 Aberdeen Angus calves was performed in the period of 2 years and refer to weaning weight, weight at the age of 200 days, total increase and average daily gain from birth to weaning age. Autumn calving produced calves with the lowest birth weights (30.88±0.33 kg), the highest average daily gains (1062.01±21.55 g) and the highest weaning weight, while the spring calving produced calves with the birth weights of (32.30±0.50 kg), the lowest average daily gains (905.46±18.70 g) and the lowest weaning weight. Corrected weaning weights of calves at the age of 200 days shows that the highest weight is made in SC Karpaten Meat SRL farm, those born in autumn and those who had a birth weight below 30 kg.

Keywords Angus, Calves, Preweaning growth, Testing performance.

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*Corresponding author: ANCUTA NADIA JURCO, Faculty of Mechanical Engineering, Technical University of Cluj-Napoca, 103-105 B-dul Muncii , 400641, Cluj-Napoca, Romania
E-mail: ancuta.jurco@auto.utcluj.ro

Introduction

Aberdeen Angus breed was raised and selected of generations for the characteristics like resistance, precocity, growth rate and carcass quality. These qualities, along with longevity, fertility, ease of calving make Aberdeen Angus an efficient and easy to grow breed.

In Romania, the Angus breed appeared during the years 1958-1961 (Asociația Aberdeen Angus Romania) and was used for industrial crosses with local breeds to obtain hybrids with good skills for meat production. In subsequent years there were constant imports of females and males, so that at the end of 2013 there were over 100 Angus farmers with over 5000 heads. The association accredited for the official control of beef production and for keeping Aberdeen Angus Genealogical Register is the Aberdeen Angus Romania Association. The Aberdeen Angus Romania Association currently has over 700 members from all regions of the country that own over 40,000 cattle, meaning more than 90% of the total number of heads currently in the country (Asociația Aberdeen Angus Romania).

At national level, many beef producers have chosen the easiest way, using half- beef breeds, starting from their own cows or importing calves, but that does not mean they already have a beef farm and are competitive with those who supply the calves. The idea is not entirely new, but we also have to produce ourselves, important for the farmer is to know which breed is better adapted to his region.

Romanian beef producer in today's economy is continually being pressured to operate in a more efficient manner, in order to produce quality product, requested on meat market, but at the same time, has at his disposal a large variety of breeds, which is more or less adapted to the specific growing conditions (ONACIU, 2016).

The main goal in organizing fattening technology in the cow-calf line system is to produce a high-quality meat at a low cost by utilizing the biological potential of the animals and agricultural potential area (REIMER et al, 1983).

The birth weight and the growth performances of calves in the pre-weaning period are influenced by various factors, such internal factors referring to individual, sex of calves, cows parity (AHUNU and MAKARECHIAN, 1986; KRUPA et al, 2011; TOUŠOVÁ et al, 2015; BĂCILĂ et al, 2014), as well as environmental factors, referring to the season of birth (SZABÓ et al, 2006) and nutrition (DYMNICKI et al, 1996). Ahunu and Makarechian (1986) affirm that the ,,birth weight and preweaning performance are recognized as important components in determining economic returns from beef cattle", given the fact that growth of calves and their weaning weight tends to have low heritability (h^2 = 0.12-0.27) (SZABÓ et al, 2006).

Materials and Methods

1. The Experimental Area

The data were collected from four private farms from different counties of environmental conditions in Romania. SC Karpaten Meat S.R.L. is located in Marpod, Sibiu County, at the coordinates: 45°52′16″N, and 24°29′45″E and is characterized by an annual mean maximum temperature of 15.33°C, a mean minimum temperature of 5.16°C, and a mean annual precipitation of 716 mm (calculated, as an average of the last 30 years (Meteoblue. Marpod)). SC Agrochioar SRL is located in Valea Chioarului, Maramures County, at the coordinates: 47°24′44″N, and 23°28′04″E and is characterized by an annual mean maximum temperature of 15.16°C, a mean minimum temperature of 5.25°C, and a mean annual precipitation of 586 mm (calculated, as an average of the last 30 years (Meteoblue. Valea Chioarului)). SC Sedomar Grup SA is located in Gliganu de Jos, Argeș County, at the coordinates: 44°39′27″N, and 25°2′9″E and is characterized by an annual mean maximum temperature of 17.58°C, a mean minimum temperature of 6.25°C, and a mean annual precipitation of 433 mm (calculated, as an average of the last 30 years (Meteoblue. Gliganu de Jos)). The last farm in which the Official Control of Meat Production Performance was made is represented by SC Bukovina - Meat SRL from Vatra Moldovitei, Suceava County, at the coordinates: 47°39′8″N, and 25°34′23″E and is characterized by an annual mean maximum temperature of 12.41°C, a mean minimum temperature of 3.75°C, and a mean annual precipitation of 735 mm (calculated, as an average of the last 30 years (Meteoblue. Vatra Moldovitei)).

2. Data Collection and Statistical Analyses

The biological material was represented by a total of 138 calves (male, n = 56; female, n = 82) of Aberdeen Angus breed, born in three different seasons, autumn, winter and spring, in the period of two years.

Feeding and management practices were more or less uniform for all farms throughout the year. During the pre-weaning period the calves were raised with dams without additional feeding with concentrate, in four different farms form Romania (SC Karpaten Meat SRL, n=64; SC Agrochioar SRL, n=33; SC Sedomar Grup SA, n=18 and SC Bukovina - Meat SRL, n=23). Calf ID, date of birth, weight at birth, calf sex was recorded at birth, when individual identification was also made by ear tags placed in each ear. The calves were weighed again at weaning, close to an age of 200 days.

The evaluation of growth indicators refers to weaning weight (WW), weight at the age of 200 days (W200), total gain (TG) and average daily gain (ADG) from birth to weaning age was performed, based on data collected from Official Control of Meat Production.

Calculation was as follows:

$$TG = WW - BW \quad (1)$$

$$ADG = 1000(WW - BW)/WD \quad (2)$$

$$W200 = BW + (WW - BW) \times 200/WD \quad (3)$$

where:

TG = total gain (kg) ADG = average daily gain (g)
W200 = 200-day weight (kg) WW = weaning weight (kg)
BW = birth-weight (kg) WD = weaning age (days)

Corrected weaning weights data at the age of 200 days (W200), were used to evaluate the effect of birth season, sex of the calves and birth weight of calves on the weaning results.

The results were statistically analyzed using parametric tests (t test and ANOVA) and nonparametric test (Mann-Whitney-U-test) depending on sample size and distribution through Statistica 12 software. Statistical differences were considered to be significant if $p < 0.05$.

Results and Discussion

The overall average birth weight (BW) was 31.73 ± 0.31 kg, with a ADG of 977.61±14.95 kg and adjusted 200-d BW of 227.25±2.94 kg. There were significant differences (P < 0.01) due to the locations, sex of calves, birth season and birth weight group. The results are in accordance with findings of Szabó et al. (2006), who analysed the factors affecting weaning weight from the beef-cattle population of the Georgikon Faculty of Agricultural Sciences at Keszthely.

From the statistical analysis of 138 calves, can be observed a difference of 16 kg between BW, with a minimum of 24 kg and a maximum of 40 kg (Figure 1).

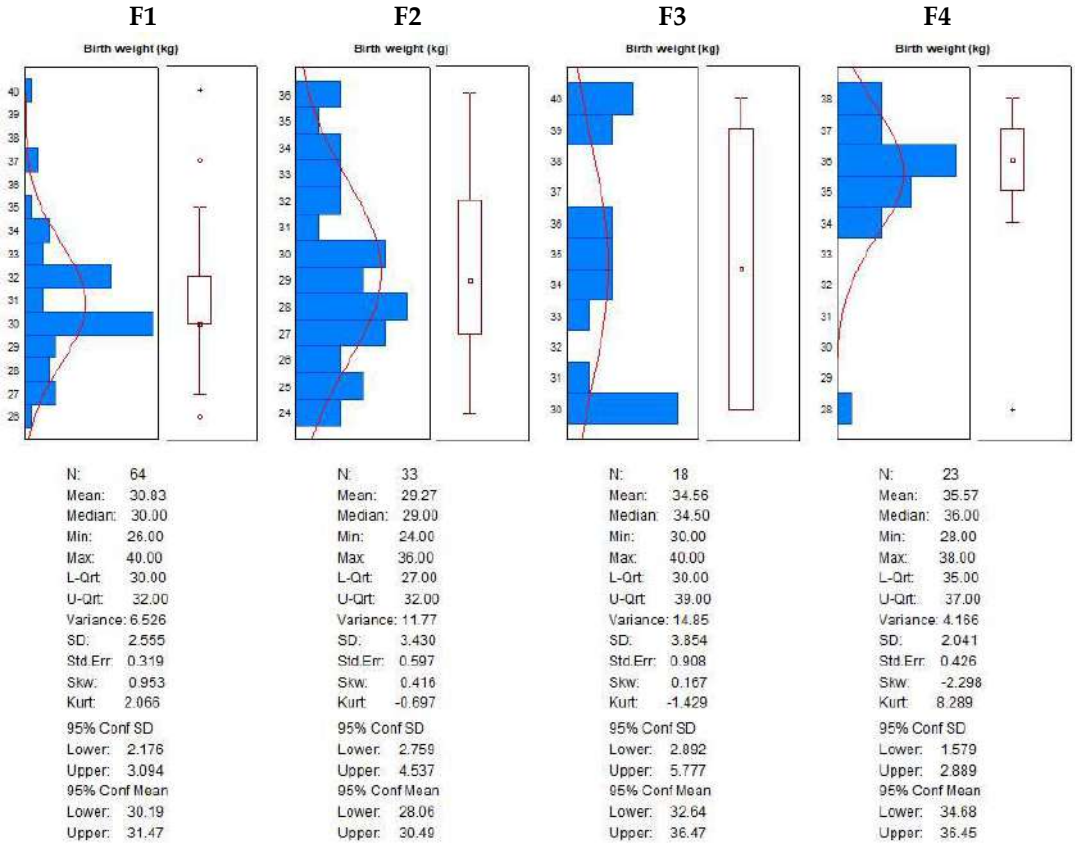


Figure 1. Histogram of birth weight in kilograms (**F1** – Karpaten Meat farm, **F2** – Agrochioar farm, **F3** – SC Sedomar Grup SA farm, **F4** – Bukovina-Meat farm).

Growth rate during the suckling period was expressed by ADG, which was 977 g, with differences depending on the farm: 1054 g for the calves on the SC Karpaten Meat SRL farm, 963 g at the SC Agrochioar SRL farm, 1003 g in SC Sedomar Grup SA farm and 767 g for the calves from SC Bukovina - Meat SRL farm (Figure 2). Mean value of the W200 of all calves was 225 kg, with a difference between minimum and maximum of 205 kg (Figure 3).

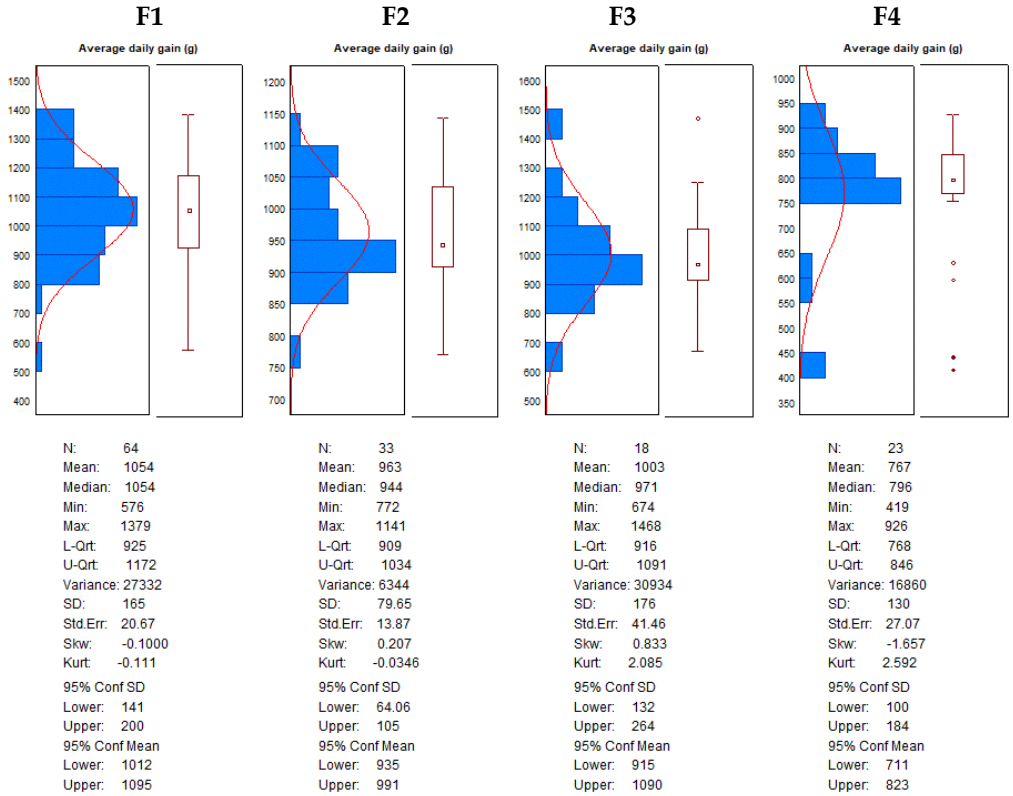


Figure 2. Histogram of growth rate during the suckling period (**F1** – Karpaten Meat farm, **F2** – Agrochioar farm, **F3** – SC Sedomar Grup SA farm, **F4** – Bukovina-Meat farm).

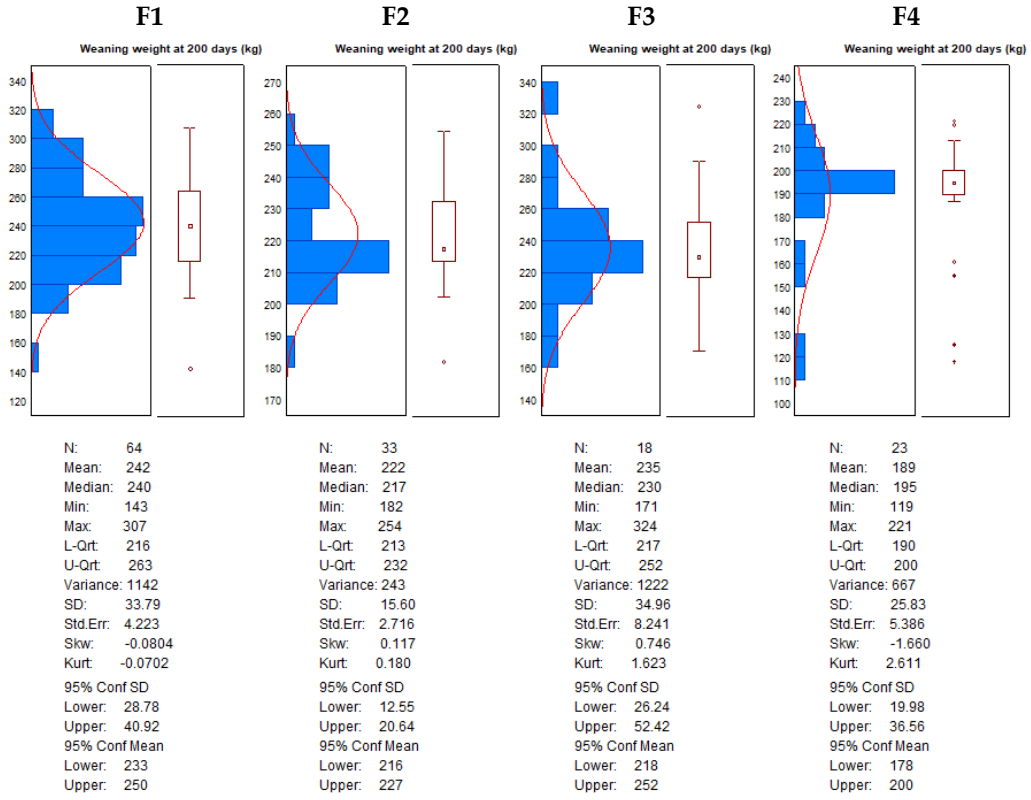


Figure 3. Histogram of corrected weaning weights of calves at the age of 200 days (**F1** – Karpaten Meat farm, **F2** – Agrochioar farm, **F3** – SC Sedomar Grup SA farm, **F4** – Bukovina-Meat farm).

Table 1. Testing statistical significance of farms upon birth weight, average daily gain and weaning weight at 200 days using t-test and ANOVA (for p values < 0.05, null hypothesis is rejected). (F1 – Karpaten Meat (n = 64), F2 – Agrochioar (n =33), F3 – SC Sedomar Grup SA (n = 18), F4 – Bukovina-Meat (n =23)).

Test	Birth weight	Average daily gain	Weaning weight at 200 days
ANOVA (all farms comparison)	0.000	0.000	0.000
t-test for F1 vs. F2	0.013	0.004	0.002
t-test for F1 vs. F3	0.000	0.256	0.476
t-test for F1 vs. F4	0.000	0.000	0.000
t-test for F2 vs. F3	0.000	0.273	0.068
t-test for F2 vs. F4	0.000	0.000	0.000
t-test for F3 vs. F4	0.287	0.000	0.000

p value: < 0.001 – Extremely significant; 0.001 to 0.01 – Highly significant; 0.01 to 0.05 – Significant; ≥ 0.05 – Not significant.

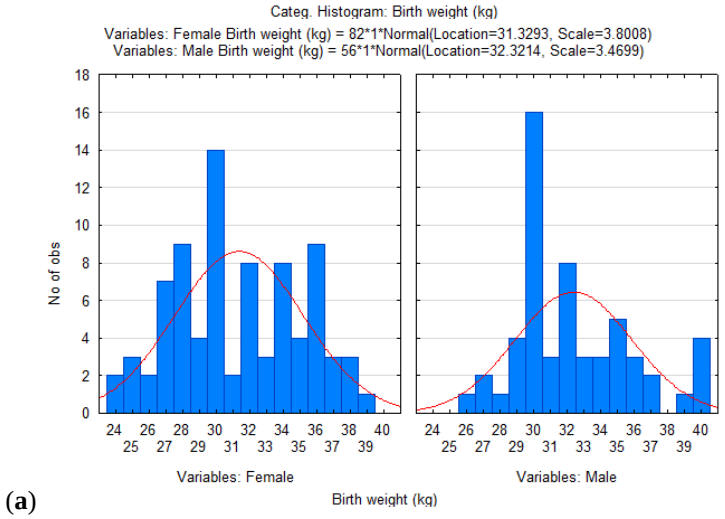
Table 2. Testing statistical significance of calf sex upon birth weight, average daily gain and weaning weight at 200 days using t-test and non-parametric Mann-Whitney U test (for p values < 0.05, null hypothesis is rejected).

Parameter		Female (n =82)	Male (n = 56)
Birth weight			
	Mean (kg)	31.3	32.3
	SD (kg)	3.8	3.5
	Min/max (kg)	24/39	26/40
p-values	t-test	0.121	
	Mann-Whitney U Test	0.164	
Average daily gain			
	Mean (g)	939	1035
	SD (g)	166	175
	Min/max (g)	442/1468	419/1379
p-values	t-test	**0.001**	
	Mann-Whitney U Test	**0.000**	
Weaning weight at 200 days			
	Mean (kg)	219	239
	SD (kg)	32	35
	Min/max (kg)	125/324	119/307
p-values	t-test	**0.001**	
	Mann-Whitney U Test	**0.000**	

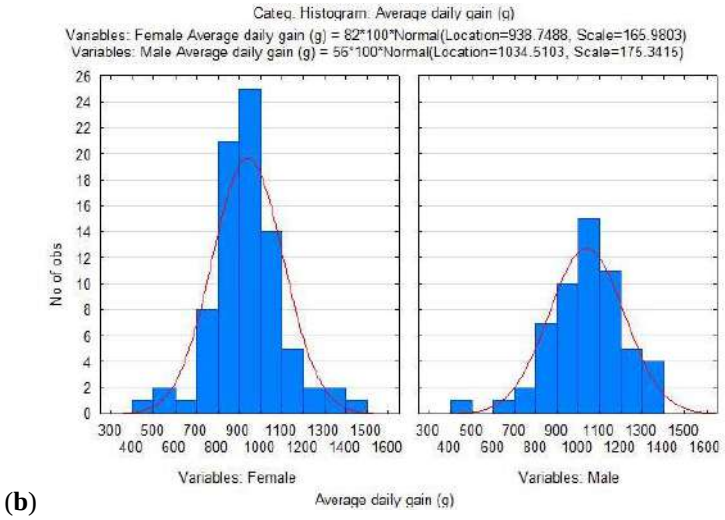
p value: < 0.001 – Extremely significant; 0.001 to 0.01 – Highly significant; 0.01 to 0.05 – Significant; ≥ 0.05 – Not significant.

Statistical significance of farms upon BW, ADG and W200 are shown in Table 1 and the histogram, by calf sex, is shown in Figure 4. The interaction between farms regarding BW was highly (P < 0.01) significant, with one exception between SC Sedomar Grup SA farm and Bukovina-Meat farm were the difference of mean value was about 1.0 kg. The interaction between farms regarding ADG and WW was also significant.

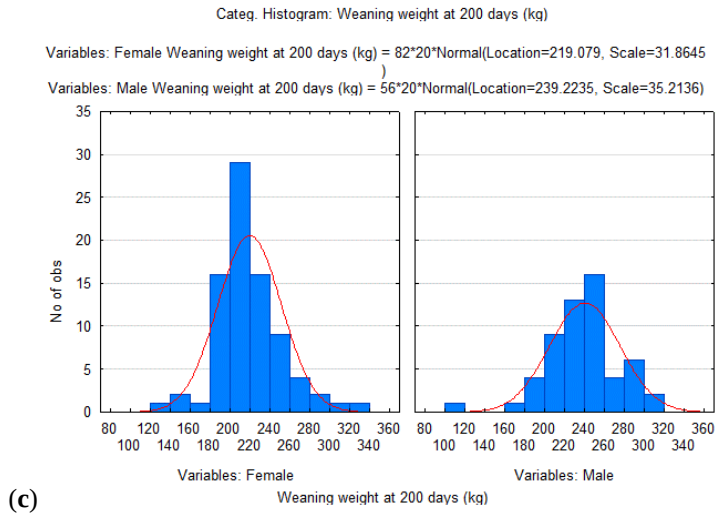
BW wasn't affected (P ≥ 0.05) by calf sex (Table 2), male calves were 1 kg heavier at birth than their female counterparts, but extremely significant differences between calf sex (P< 0.001) have occurred at preweaning ADG and W200.



(**a**)



(**b**)



(**c**)

Figure 4. Histogram of BW (**a**), ADG (**b**) and W200 (**c**) for females and males.

Statistical significance of calf season birth upon BW, ADG and W200 are presented in Table 3. Significant differences among season birth groups for BW and daily weight gain from birth to weaning were observed. Autumn calving produced calves with the lowest BW (30.9±0.33 kg), the highest ADG (1062±21.55 g) and the highest WW (243±4.41 kg), while the spring calving produced calves with the higher BW (32.3±0.50 kg), the lowest ADG (905±18.70 g) and the lowest WW (213±3.57 kg).

Birth weight group influences were also apparent in

terms of preweaning growth and W200 (Table 4). Calves that had the lowest calving weight (< 30 kg) were made in the suckler period the highest growth and highest weaning weight.

In agreement with the present study, Krupa et al. (2005), Renata Toušová et al (2015) reported similar lower BW, lower growth performance of females at the age of 200 days.

Table 3. Testing statistical significance of calf season birth upon birth weight, average daily gain and weaning weight at 200 days using t-test and non-parametric Mann-Whitney U test (for p values < 0.05, null hypothesis is rejected). (Winter was excluded due to low number of subjects, n = 7).

Birth weight					
Season	Mean (kg)	SD (kg)	Min/max (kg)	t-test	p-values Mann-Whitney U Test
Autumn (n =60)	30.9	2.5	26/40	**0.025**	**0.031**
Spring (n = 71)	32.3	4.2	24/40		
Average daily gain					
Season	Mean (g)	SD (g)	Min/max (g)	t-test	p-values Mann-Whitney U Test
Autumn (n =60)	1062	167	576/1379	**0.000**	**0.000**
Spring (n = 71)	905	158	419/1468		
Weaning weight at 200 days					
Season	Mean (kg)	SD (kg)	Min/max (kg)	t-test	p-values Mann-Whitney U Test
Autumn (n =60)	243	34	143/307	**0.000**	**0.000**
Spring (n = 71)	213	30	119/324		

p value: < 0.001 – Extremely significant; 0.001 to 0.01 – Highly significant; 0.01 to 0.05 – Significant; ≥ 0.05 – Not significant.

Table 4. Testing statistical significance of birth weight group upon average daily gain and weaning weight at 200 days using t-test and ANOVA (for p values < 0.05, null hypothesis is rejected).

Parameter			**Birth weight (kg)** **G1 < 30** (n = 65)	**G2 31 –35** (n = 47)	**G3 > 35** (n = 26)
Birth weight					
Mean (kg)			28.6	33.1	37.3
SD (kg)			1.7	1.3	1.5
Min/max (kg)			24/30	31/35	36/40
Average daily gain					
Mean (g)			1016	970	894
SD (g)			146	174	202
Min/max (g)			576/1468	419/1379	442/1329
p values	ANOVA			**0.010**	
	t-test	G1 vs. G2		0.143	
		G1 vs. G3		**0.002**	
		G2 vs. G3		0.108	
Weaning weight at 200 days					
Mean (kg)			232	227	216
SD (kg)			30	36	41
Min/max (kg)			143/324	119/307	125/303
p values	ANOVA			0.149	
	t-test	G1 vs. G2		0.455	
		G1 vs. G3		**0.045**	
		G2 vs. G3		0.242	

p value: < 0.001 – Extremely significant; 0.001 to 0.01 – Highly significant; 0.01 to 0.05 – Significant; ≥ 0.05 – Not significant.

Conclusions

The differences between farms could be attributed to better feeding and management practices at SC Karpaten Meat SRL farm compared to other farms.

Corrected weaning weights of calves at the age of 200 days shows that the highest weight is made by those born in autumn (243.28±4.41 kg) and those who had a birth weight below 30 kg (230.20±3.96 kg).

In conclusion, this study reveals that, among others, calf sex, season and birth weight of calves had a significant effect on preweaning growth characteristics.

Knowing the production capacity represent starting point in determining the quality of breeding animals and represents the basic element of beef cattle breed selection which include: evaluation marks, classification, testing performance of self and descent with subsequent entry of valuable animals in the Genealogical register.

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