Evaluation of the Growth Rates and Biometric Traits in Meat Crossbred Calves

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Abstract
The aim of this study was to evaluate the body weight and some biometric measurements on meat crossbred calves comparative with Romanian Black Spotted dairy calves at weaning (4 months). The current research was carried out on a number of 45 calves in the Dairy cows' Experimental Farm of the Research and Development Institute for Bovine Balotesti, on four experimental groups, E_1: F_1 Blanc Blue Belgique x Romanian Black Spotted, E_2: F_1 Aberdeen Angus x Romanian Black Spotted, E_3: F_1 Limousine x Romanian Black, E_4: F_1 Charolaise x Romanian Black Spotted, with n=9 heads/group and the control group (M) Romanian Black Spotted, with n=9 heads/group. The obtained mean values for the body weight were statistically significant ($p<0.001$) for all experimental groups (E_1:153.54±1.36 kg, E_2:153.00±0.86 kg, E_3:150.77±0.87 kg, E_4:139.78±1.42 kg) comparative with the control group (M:128.36±0.74 kg). Moreover, the average daily gain recorded was statistically significant ($p<0.001$) for all experimental groups (E_1:933.34±10.00 g, E_2:945.56±8.82 g, E_3:928.89±3.33 g, E_4:790.00±20.62 g) comparative with the control group (M:746.67±8.66 g). The experimental groups E_1 and E_2 recorded the best performances for biometric traits: height at withers (HW), height at rump (HR), height of chest (HC) and length of rump (LR) comparative with the control group M ($p<0.001$). The obtained results demonstrates the usefulness of the crossbreeding system in dairy herds as an alternative to improve the sustainability of the dairy cows' farms.

Keywords: biometric traits, body weights, calves, crossbred, weaning.

1. Introduction

Crossbreeding is one of the several breeding strategies which might increase the profitability of dairy cow farms. The overall interest of crossbreeding among dairy farmers has increased during the last years [1], with the benefits of crossbreeding being well known and documented at commercial level [2,3]. The main benefits of crossbreeding are heterosis [4] and breed complementarity. Heterosis, or hybrid vigor is the improvement in the performance of the crossbred individuals, over the average of their straight bred parents [5,6,7]. The obtained crossbred calves will perform better (higher resistance to diseases, higher survival rates) than both parental breeds [8]. Heterosis is especially useful in improving performances when low heritable traits are involved.

2. Materials and methods

The experimental procedures used in this trial were in accordance with the Romanian Law no. 43/2014 for handling and protection of animals used for scientific purposes. The body weight and the biometric measurements of 45 calves have been evaluated at weaning (4 months). The current trial was carried out in the Experimental Farm of the Research and Development Institute for Bovine Balotesti (44°36′46″N 26°4′43″E), on four experimental groups, E_1: F_1 Blanc Blue Belgique x Romanian Black Spotted, E_2: F_1 Aberdeen Angus

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x Romanian Black Spotted, E_3: F_1 Limousine x Romanian Black, E_4: F_1 Charolaise x Romanian Black Spotted, with n=9 heads/group and the control group (M) Romanian Black Spotted, with n=9 heads/group. The body weight was determined by using certified digital scale PCANTV 1500 kg/1.2 x 2M. The height at withers (HW), height at rump (HR), height at chest (HC) were determined by using zoo meter. The length of the rump (LR) was measured by the compass. Means ± standard deviations and coefficients of variation (CV) of body weight and biometric traits were calculated. To test the levels of significance between groups, the Tukey method was used, at a confidence interval of 95%, using Minitab® Statistical Software, version 18.

To establish the statistical relationship between the body weight and the biometric traits, the correlation coefficient (r) was calculated.

Results and discussion

The obtained mean values for the body weight (Table 1) were statistically significant ($p<0.001$) for all experimental groups (E_1:153.54±1.36 kg, E_2:153.00±0.86 kg, E_3:150.77±0.87 kg, E_4:139.78±1.42 kg) comparative with the control group (M: 128.36±0.74 kg). Moreover, the average daily gain recorded was statistically significant ($p<0.001$) for all experimental groups (E_1:933.34±10.00 g, E_2:945.56±8.82 g, E_3:928.89±3.33 g, E_4:790.00±20.62 g) comparative with the control group (M: 746.67±8.66 g). The coefficient of variation calculated for body weight (BW) was lower than 1 %, expressing a very homogeneous population. The calculated coefficient of variation was also homogeneous (2.61-0.36%) for the average daily gain (ADG).

Table 1. The results for the body weight in calves at weaning.

Group/Breed[1]	BW (body weight), kg		ADG (average daily gain), g	
	X̄±sd	CV%	X̄±sd	CV%
E_1: F_1 BBB x BNR	153.54±1.36^{a}	0.89	933.34±10.00^{ab}	1.07
E_2: F_1 AA x BNR	153.00±0.86^{a}	0.56	945.56±8.82^{a}	0.93
E_3: F_1 LI x BNR	150.77±0.87^{b}	0.58	928.89±3.33^{b}	0.36
E_4: F_1 CH x BNR	139.78±1.42^{c}	1.02	790.00±20.62^{c}	2.61
M BNR	128.36±0.74^{d}	0.58	746.67±8.66^{d}	1.16

[1]BBB=Blanc Blue Belgique, AA=Aberdeen Angus, LI=Limousine CH=Charolaise, BNR=Romanian Black Spotted; means that do not share a letter are significantly different.

The obtained results for biometric traits in calves at weaning are presented in Table 2. The average values obtained for the height at withers (HW) were statistically significant ($p<0.001$) for the control group M: 86.88±1.16 cm compared the experimental groups E_1: 82.80±0.83 cm and E_2: 81.40±1.49 cm, the HW for the control group M was between 4.08-5.48 cm higher than the experimental groups E_1 and E_2.

The other experimental group E_3 and E_4, had no differences from the control group M, as is shown in the table. The mean values registered for the height at rump (HR) were significantly ($p<0.001$) for all experimental groups E_1, E_2, E_3 and E_4 comparative with the control group M (figure 1). The coefficient of variation calculated for HW and HR showed very homogeneous groups (0.83-1.83 %). The height at chest (HC) was significantly different ($p<0.001$) for the control group M comparative with the experimental groups E_2 and E_4 with a coefficient of variation raging between 1.81-3.42%. The recorded values of the length of rump (LR) were statistical significantly ($p<0.001$) for all experimental studied groups E_1, E_2, E_3 and E_4 comparative with the control group M, differentiated in absolute value of 1.51-3.33 cm (Figure 2).

The biggest value for the length of rump was recorded by the experimental group E_3 (30.27 cm) and de smallest length of rump was recorded by the experimental group E_1 (28.45 cm) comparative with the control group M (26.94 cm). The calculated coefficient of variation was also homogeneous for the length of rump (LR). Similar results were obtained by other authors [9-12].

The statistical relationship between quantitative variables used in this trial are presented in Table 3.

Table 2. The results for the biometric traits in calves at weaning.

Group/Breed[1]	Biometric traits	
	X̄±sd	CV%
HW (height at withers), cm		
E_1: F_1 BBB x BNR	82.80±0.83b	1.00
E_2: F_1 AA x BNR	81.40±1.49b	1.83
E_3: F_1 LI x BNR	87.45 ±0.73a	0.83
E_4: F_1 CH x BNR	87.22±0.90a	1.03
M BNR	86.88±1.16a	1.34
HR (height at rump), cm		
E_1: F_1 BBB x BNR	93.44±1.13ab	1.21
E_2: F_1 AA x BNR	92.46±1.08 b	1.17
E_3: F_1 LI x BNR	93.70 ±0.92ab	0.98
E_4: F_1 CH x BNR	94.00±0.87 a	0.93
M BNR	89.98±1.02c	1.13
HC (height at chest), cm		
E_1: F_1 BBB x BNR	40.33±0.87a	2.16
E_2: F_1 AA x BNR	38.10±0.69bc	1.81
E_3: F_1 LI x BNR	39.14 ±0.76ab	1.94
E_4: F_1 CH x BNR	37.54±0.74c	1.97
M BNR	40.08±1.37a	3.42
LR (length of rump), cm		
E_1: F_1 BBB x BNR	28.45±0.78b	2.74
E_2: F_1 AA x BNR	29.57±1.10ab	3.72
E_3: F_1 LI x BNR	30.27 ±0.90a	2.97
E_4: F_1 CH x BNR	29.96±0.64a	2.14
M BNR	26.94±1.07c	3.97

[1]BBB=Blanc Blue Belgique, AA=Aberdeen Angus, LI=Limousine, CH=Charolaise, BNR=Romanian Black Spotted; means that do not share a letter are significantly different.

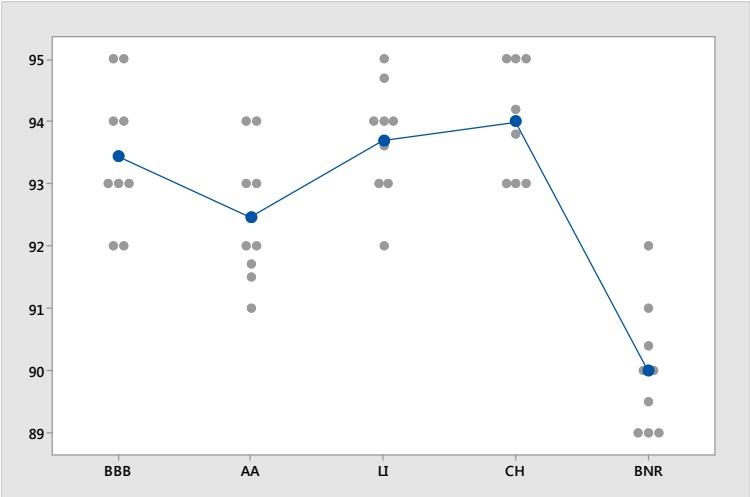

Figure 1. Graphical representation of the height at rump in calves at weaning.

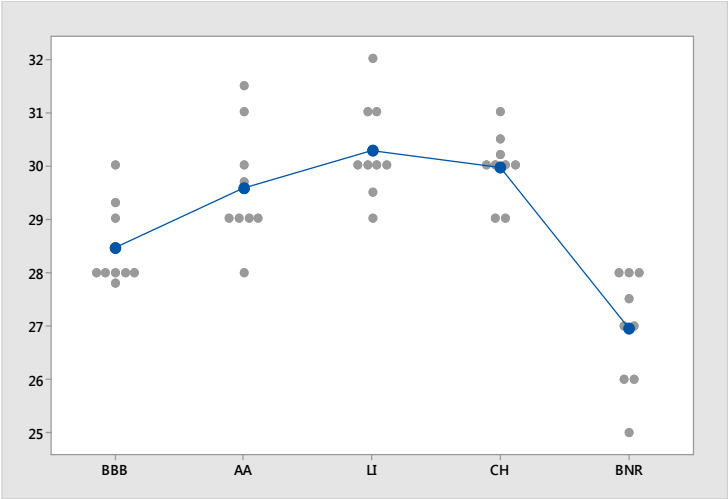

Figure 2. Graphical representation of the length of rump in calves at weaning.

Table 3. The correlation of the body weight and the biometric traits in calves at weaning.

Traits	BW	HW	HR	HC
E_1: F_1 BBB x BNR				
HW	0.44	-		
HR	0.18	0.30	-	
HC	-0.31	0.06	0.41	-
LR	0.11	0.02	-0.47	-0.18
E_2: F_1 AA x BNR				
HW	0.26	-		
HR	0.06	-0.64	-	
HC	0.47	0.04	-0.22	-
LR	-0.02	0.79	-0.50	0.07
E_3: F_1 LI x BNR				
HW	0.10	-		
HR	-0.34	-0.18	-	
HC	-0.80	0.01	-0.22	-
LR	-0.38	-0.12	-0.50	0.07
E_4: F_1 CH x BNR				
HW	-0.18	-		
HR	0.63	-0.19	-	
HC	-0.16	-0.70	0,22	-
LR	-0.03	-0.06	-0.11	-0.32
M BNR				
HW	-0.33	-		
HR	-0.40	0.31	-	
HC	-0.43	-0.10	-0.17	-
LR	-0.14	0.44	0.55	-0.43

BW=body weight; HW=height at withers; HR=height at rump; HC=height at chest; LR=length of rump.

The strongest positive correlations were determined between HW and LR (r= 0.79; $p<0.01$) in group E_2 and between BW and HR (r= 0.63; $p<0.05$) in E_4. The strongest negative correlations were determined between BW and HC (r= -0.80; $p<0.01$) in group E_3 and between HW and HR (r= -0.64; $p>0.05$) in E_2. Often, crossbred individuals were superior to purebred individuals because of increased heterozygosity. However, more information about heterosis are needed for dairy breeders to predict the future

outcome of possible crossbreeding systems and breed complementarity [13].

4. Conclusions

The current trial has confirmed statistical differences between the crossbred experimental studied groups, for the body weight, the average daily again and the biometric traits, comparative with the control group. The obtained results demonstrates the usefulness of the crossbreeding system in dairy herds as an alternative to improve the sustainability of the dairy cows' farms.

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