

## RESEARCH ARTICLE



# Growth performance of calves born from Holstein Friesian cows sired by Holstein, Charolais, Belgium Blue, Simmental and A. Angus bulls

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## Abstract

Study was carried out at commercial beef farm "Kazazi", Kavaja. The objective was to evaluate growth performance of F<sub>1</sub> crossbreds. A total of 40 calves (n= 8 heads of each group) was included in experiment. The analysis comprised purebred HF bull calves (control group) and crossbred bull calves (experiment groups) born from crossings: (CH × HF); (BB × HF); (S × HF) and (AA × HF). Body weights at birth, weaning (84 days) and post-weaning (182; 274; 365 and 450 days) were evaluated. Average daily gains, feed intake and efficiency as well as feed ration costs from birth to weaning, and post weaning (85-182; 183- 274; 275- 365 and 366-450 days) were evaluated. The CH × HF, BB × HF and S × HF F<sub>1</sub> crossbreds reached higher body weights (kg) at birth: 42.7±2.87; 40.81±2.51 and 41.6±2.70 (p<0.01; 0.05; 0.05); weaning: 115.10±9.24; 111.75±8.53 and 110.18±7.91 (p<0.05; 0.05; 0.001) and final one: 488.80 ±24.61; 478.58±46.34 and 459±32.77 (p<0.05; 0.01; 0.05) compared to purebred HF bull calves body weight (kg): at birth 40.22±2.60; weaning 102.48±8.56 and final one 404.28±31.52 respectively. The CH × HF, BB × HF and S × HF F<sub>1</sub> crossbreds had higher average daily gains (g): from birth to weaning 862±76; 844±72 and 816±62 (p<0.05; 0.01, 0.05) and weaning to finishing: 993±87; 978±82; and 953±76 (p<0.05; 0.05; p<0.01) compared to purebred HF bull calves daily gains(g): from birth to weaning 741±73 and weaning to finishing 825±64 respectively. AA × HF crossbred bull calves had the lowest body weights(kg) at birth 35.81±2.24 (P<0.05) and higher daily gains(g): from birth to weaning 781±73(p<0.01) as well as post weaning 969±58; 948± 59; 846± 61;782± 73(p<0.05; 0.05; 0.001) compared to purebred HF bull calves live weight(kg): at birth 40.22±2.60 and daily gains(g): from birth to weaning 741±73 as well as post weaning 897±58; 851±71; 810 ± 55; 729±68 respectively. Feed efficiency (gain/feed) for all the period from birth to finishing (0-450 days) for CH × HF, BB × HF, S × HF and AA × HF F<sub>1</sub> crossbreds resulted 24.48; 22.41; 19.02 and 11.4% higher than purebred HF bull calves respectively. Average costs of daily feed diets for the periods 0-84 and 366-450 days resulted 20.34 (283.8lek) and 14.51 % (270.07 lek) respectively higher than average feed diet cost (235.84 lek) for all the period 0-450 days. As a conclusion: CH × HF, BB × HF, S × HF and AA × HF F<sub>1</sub> crossbreds, as a result of heterosis, had growth rate as well as feed efficiency higher than purebred HF bull calves

**Key words:** calf; body weight; gain, feed efficiency

## Introduction

Beef production in Albania is mostly based on the breeds being used in dairy or beef- dairy production. There is no the farming of beef pure bred cattle breeds. At present, about 40 % of the whole cow population is sired by beef bulls. Crossbreeding involves chiefly dairy cows (Holstein Friesian & Jersey) and beef bulls (Charolais, Limousin, Belgian Blue, Simmental, Angus). Decisions regarding crossbreeding involve choice of breeds and design of combination or crossing scheme. Crossbreeding in commercial beef cattle production improves efficiency through heterosis and breed

complementation. The appropriate choice of breeds in crossbreeding depends upon the additive genetic merit of the breeds involved and heterosis resulting from the crossing of these breeds [1, 4]. Heterosis or hybrid vigor is an advantage in performance of crossbreds compared to the average performance of the parental breeds [5]. Crossbreeding of beef and dairy cattle has been widely used to achieve improvements in beef production [4] and [6]. Charolais F<sub>1</sub>crossbred progenies had daily weight gains higher than pure bred HF progenies [5, 7]. Charolais, Belgian Blue and Simmental crossbred progenies had higher growth rates compared to HF ones [4]. Charolais and

Simmental crossbred progenies gained more rapidly than Aberdeen Angus while Hereford was intermediate. [1]. [8] reported that the young bulls by Charolais sires, compared with those by Simmental sires, showed a tendency towards higher birth weights and higher gains. They also utilized fewer feed per kg of body weight gain. [2, 3] reported that crossbred progenies of Holstein dams sired by Charolais and Simmental breeds had small advantages in growth performance when compared to purebred Holstein contemporaries.

### Materials and Methods

A total of 40 calves (n= 8 heads of each group) was included in experiment. The Calves were randomly chosen. All groups were derived from the same herd and were raised together under the same conditions. The analysis comprised pure bred HF bull calves (control group) and crossbred bull calves (experiment groups) born from crossings: (CH x HF ); (BB x HF ); (S x HF ) and (AA x HF ). Body weights at birth, weaning (84days) and post weaning (182; 274; 365 and 450 days) were measured. Average daily gains, feed intake and efficiency as well as feed ration costs from birth to weaning, and post weaning (85-182; 183- 274; 275-365 and 366-450 days) were estimated. For the period from the birth to weaning, feed diets composed of whole milk (457 kgs or 5.6 kgs /head/day), starter (69 kg or 0.823 kg/head/day) and alfalfa hay (13.5 kgs or 0.160 kgs /head/day). For growth and fatening period (3 to 15 months), daily feed diets were composed of : maïse silage 4 to 15 kgs/head, alfalfa hay 1.7 to 2.7 kgs/ head and the concentrate mixture 2.2 to 3.3 kgs /head/day. Feed diets formulation were based on the recommendation of Nutrient Requirements of Beef cattle, Seventh Revised Edition: Update 2000. Nutrient feed content (% of dry matter ) is shown as follows : Whole milk (1 kg dry matter): 22.5 MJ ME, crude protein 25.4 %, fat 30.8

%, Ca 1%, P 0.75%, ash 6.9 %. Starter: 12.3 MJ ME; crude protein 18.8%; (ground maïse 42.5 %, ground wheat 11.5 %, ground barely 21.3 %, soybean meal 17.6 %, sunflower meal 4.1%, mineral and vitamin mixture 3 %). Maïse: ME (MJ) 12.84, crude protein 10.40 %, crude fiber 2.62 %, extract ether 4.17 %, ash 1.45 %. Wheat : ME (MJ) 12.67, crude protein 12.79 %, crude fiber 2.67 %, extract ether 2.08 %, ash 1.96 %. Barley: ME (MJ) 12.37, crude protein 16.22%, crude fiber 4.89 %, extract ether 1.53 %; ash 2.5 %. Soybean meal: ME (MJ) 12.78; crude protein 44 %. crude fiber 5.75%, extract ether 1.8 %, ash 6.4 %. Sunflower meal: ME (MJ) 12.65, crude protein 40.9 %, crude fiber 25.3%, extract ether 2.02 %, ash 8.60%. Wheat bran: Alfalfa hay : ME (MJ) 8.25; crude protein 17.62 %, crude fiber 36.5 %, ash 1.52 %,

Maïse silage: EM (MJ) 8.6; crude protein 6.73%, crude fiber 24.92 %. The resulting data were statistically processed by ANNOVA.

### Results and discussion

As shown in Table 1, for the period of 0 to 15 months, average daily gains of CH, BB, S and AA F<sub>1</sub> crossbreds are 19.77; 17.80 ; 14.71 and 7.41% higher than pure bred HF bull calves respectively. While according to the periods turn out: from birth to weaning: 16.33; 14.03; 10.2 and 5.4 %; from weaning to 182 days: 20.4; 18.86; 16.3 and 7.4 %; from 183 to 274 days: 25.1; 22.4; 20.9 and 11.4 % ; from 275 to 365: 14.9; 13.3; 10.8 and 4.4 %; from 365 to 450 days: 21.5; 19.3; 15.4 and 7.3 % higher respectively compared to pure bred HF bull calves. Similar results were reported by [1,2,4,5]. Results obtained from these crossings show that higher average daily gains reached to CH and BB F<sub>1</sub>crossbred bull calves and lower from pure bred HF bull calves. Similar Results were reported by [6,7]. S F<sub>1</sub> crossbred bull calves

reached average daily gains (4.42 dhe 2.7 %) lower than CH and BB  $F_1$  crossbreds respectively, but higher ( 6.8 %) compared to AA  $F_1$  ones. Approximate results were obtained by [1,8]. CH  $F_1$  crossbred bull calves reached average daily live weight gain (1.7%) higher than BB ones [4,5]. Pure bred HF bull calves had live weights at birth ( 6.2 dhe 3.4 % ) lower than CH and S  $F_1$  crossbreds respectively, but higher (12.3 %) compared to AA  $F_1$  crossbreds. Similar data were reported by [3,7, 8]. As shown in Table 1, higher average daily weight gains for all types of crossings are in the periods from 85 to 182 days and 183 to 272 days compared to other periods. Scheme of pre weaning calves' feeding is given in Table 3. During this period, calves have averagely consumed 1.582 kg DM/head/day (16.4 MJME and 21.6 CP/kg DM) and a feed diet structure composed of 44.1 % liquid feed and 55.9 % solid feed (starter 46.8 % and alfalfa hay 9.1 % ). Meanwhile, for growth and fattening periods (Tab. 4, 5, 7) the concentrate mixture ranged from 34 to 43 %; fresh forage(maise silage) from 25 to 38 % and alfalfa hay from 28 to 32%, supplying with 9.74 to 11.2 MJME/kg DM and 12.89 to 15.74 % CP/kg DM. Feed diets for the first post weaning both periods (85 to 182 and 183 to 274 days) are characterized by higher energy and protein densities per kg DM compared to other periods. Ingredient content (%) of concentrate mixture is given in Tab. 6. As shown by the table, ground maise and protein sources take the highest percentages of concentrate mixture. Referring to the data shown in Tab. 8, for all the period from the birth to 450 days, the efficiency of feed conversion into weight gain for  $F_1$  crossbred bull calves derived from crossings SH xH ; BB xH ; S x H dhe AA x H results 24.48, 22.41, 19.02 dhe 11.4 % higher than pure bred HF bull calves respectively. CH and BB,  $F_1$  crossbred bull calves have the highest efficiency of

feed conversion into live weight gain. S  $F_1$  crossbred bull calves have higher efficiency(4.32%) of feed conversion into weight gain than AA crossbred bull calves but lower (5.58 dhe 4.0 %) than CH and BB  $F_1$  crossbred bull calves respectively. Referring to pre and post weaning periods, the data denote that the periods 0-84 and 85-182 days have the higher efficiency of feed conversion into weight gain compared to the other periods.

Average daily costs (lek/head/day) of feed ration according to periods and for all the period (0-450 days) are given in Tab. 9. Referring to the data, daily feed diet costs for the periods 0-84 and 366-450 days are 20.3 % ( 283.81 lek) and 14.51 % (270.07 lek) higher respectively, compared to average daily costs for all the period 0-450 days (235.84 lek)

## Conclusions

- CH xHF ; BB xHF ; and S xHF  $F_1$  crossbred bull calves have the highest live weights at birth and growth rate. As a result of heterosis,  $F_1$  crossbred bull calves of these breeds reach to very good weight gains and heavy body weights.
- CH xHF ; BB xHF ;  $F_1$  crossbred bull calves have the highest efficiency of feed conversion into weight gain.
- AA x H  $F_1$  crossbred bull calves have lower body weight at birth but higher weight gains compared to pure bred HF bull calves.
- Average daily feed ration costs for the period from birth to weaning of calves is higher compared to other growth and fattening periods.

**Table 1.** Growth Performance of pure bred HF and F<sub>1</sub> crossbred bull calves according to the type of crossing (m, , s.e.)

Item	Type of crossing*				
	HF xHF (A)	CH xHF (B)	BB xHF (C)	S xHF (D)	AA x HF (E)
No.of animals	8	8	8	8	8
L.W. (kg)					
Birth	40.22±2.6 (0.92)	42.7±2.87 (1.01)	40.81±2.5 (0.89)	41.6±2.70 (0.95)	35.81±2.2 (0.79)
Wean.( 84d)	102.48±8.6 (3.02)	115.10±9.2 (3.26)	111.75±8.5 (3.01)	110.18±7.9 (2.79)	101.4±8.3 (2.94)
182 d.	190.36±14 (5.05)	220.7±15.8 (5.59)	214.89±14.0 (4.95)	212.28±16 (5.50)	196.4±13 (4.85)
274 d.	268.64±21 (7.34)	318.7±16.2 (5.72)	310.96±20.2 (7.16)	305.87±22 (7.81)	286.0±22 (7.88)
365 d.	342.34±26 (9.10)	413.5±18.7 (6.59)	394.52±25.5 (9.01)	387.63±27 (9.68)	363.0±28 (9.74)
450 d.	404.28±31 (11.14)	488.8±24.6 (8.70)	478.58±46.3 (16.38)	459.0±32.8 (11.58)	429.4±33 (11.84)
Av. d. gain(g)					
0 to 84 d.	741±73 (25.94)	862±76 (27.04)	844±72 (25.49)	816±62 (22.13)	781±73 (25.78)
85 to 182 d.	897±58 (20.78)	1079±67 (23.63)	1065±64 (22.63)	1042±78 (27.68)	969±58 (20.46)
183 to 274 d.	851±71 (24.97)	1063±70 (24.90)	1044±69 (24.51)	1017±76 (26.89)	948±59 (21.01)
275 to 365 d.	810±55 (19.36)	931±63 (22.21)	918±58 (20.60)	898±60 (21.24)	846±61 (21.59)
365 to 450 d.	729±68 (24.08)	886±73 (26.00)	870±57 (20.39)	841±64 (22.56)	782±73 (25.72)
Birth to 450d.	809±72 (25.45)	969± 67 (23.68)	953±62 (21.92)	928±76 (26.87)	869±64 (22.63)

\*HF-Holstein Friesian; Ch-Charolais; BB- Belgium Blue; S-Simmental; AA –Aberdeen Angus

**Table 2.** The standard error of the difference(s.e.d) and significance (sig.) according to type of crossing

Item	Type of crossing*							
	s.e.d <sub>A-B</sub>	sig.	s.e.d <sub>A-C</sub>	sig.	s.e.d <sub>A-D</sub>	sig.	s.e.d <sub>A-E</sub>	sig.
L.W. (kg)								
Birth	1.37	**	1.27	*	1.32	*	1.20	*
Wean.( 84d)	4.45	*	4.27	*	4.13	***	4.22	*
182 d.	7.46	*	7.00	*	7.52	*	6.75	*
274 d.	9.38	*	10.30	*	10.75	NS	10.75	NS
365 d.	11.32	*	12.87	NS	13.25	*	13.50	*
450 d.	13.99	*	32.10	*	15.95	*	16.00	*
Av. d. gain(g)								
0 to 84 d.	37.25	*	36.25	**	33.86	*	36.50	**
85 to 182 d.	31.33	*	30.53	*	34.36	*	29.00	*
183 to 274 d.	35.25	*	35.00	**	36.77	*	32.63	*
275 to 365 d.	29.56	**	28.26	*	20.57	NS	29.03	*
365 to 450 d.	35.27	*	31.37	NS	33.01	*	35.27	**
Birth to 450d.	34.77	*	33.59	*	36.99	*	34.06	*

\*(p<0.05);\*\*(p<0.01); (p<0.001), NS- Non significance

**Table 3.** \*Feed intake (kg DM/head/day) consumed from calves, pre weaning period

Age (days)	Total	Whole milk*	Starter	Alfalfa hay
1-7 d	0.625	0.625 (5 l)	ad lib.	-
8-21 d	1.162	0.750 (6 l)	0.412	-
22-42 d	1.615	0.875 (7 l)	0.630	0.110
43-63 d	1.805	0.750 (6 l)	0.865	0.190
64-77 d	1.925	0.500 (4 l)	1.160	0.265
78-84 d	1.933	0.375 ( 3 l)	1.270	0.288
0-84 days, average	<b>1.582</b>	<b>0.698 (5.6)</b>	<b>0.741</b>	<b>0.143</b>
ME (MJ/kg DM)	16.4	22.5	12.30	8.25
CP (% of DM)	21.6	25.4	18.80	17.62

\*l-litre; DM-Dry Matter; CP-Crude Protein; ME –Metabolizeable Energy, MJ-Mega Joule

**Table 4.** Feed Intake (kg DM/head/day) consumed from bull calves, growth and fattening periods

Feeds	Periods (days)			
	85-182	183-274	275-365	366-450
Alfalfa hay	1.5	1.9	2.2	2.4
Maise silage	1.2	1.8	2.5	3.3
Concentrate mixture	2.0	2.4	2.7	3.0
<b>Total</b>	<b>4.7</b>	<b>6.1</b>	<b>7.4</b>	<b>8.7</b>
ME ( MJ/kg DM)	10.08	11.20	9.72	9.74
CP (% of DM)	15.74	14.16	13.40	12.89

**Table 5.** Feed Intake (kg fresh / head /day) consumed from bull calves, growth and fattening periods

<i>Feeds</i>	<i>Periods (days)</i>			
	85-182	183-274	275-365	366-450
Alfalfa hay	1.68	2.13	2.46	2.69
Maise silage	4.00	6.00	8.30	11.00
Concentrate mixture	2.22	2.64	3.00	3.30
<b>Total</b>	<b>7.90</b>	<b>10.77</b>	<b>13.76</b>	<b>17.0</b>

**Table 6.** Ingredients (%) of concentrate mixture according to periods

<i>Ingredients</i>	<i>Periods (days)</i>			
	85-182	183-274	275-365	366-450
Maise	50	49	50	55
Wheat	16	18	16	15
Wheat bran	-	9	12	10.5
Soybean meal	11	3	-	-
Sunflower meal	20	17	18	16
Premix(pimasan)	3	4	4	3.5

**Table 7.** Feed diet structure (% of DM) according to periods

<i>Item</i>	<i>Periods (days)</i>			
	85-182	183-274	275-365	366-450
Concentrate mixture	43	39	36	34
Maise silage	25	30	34	38
Alfalfa hay	32	31	30	28

**Table 8 .** Feed diet efficiency (kg DM/kg weight gain)

<i>Periods (days)</i>	<i>Type of crossing</i>				
	H xH	SH xH	BB xH	S xH	AA x H
0-84 d	2.29	1.97	2.0	2.08	2.17
85-182 d	5.24	4.36	4.41	4.51	4.85
183-274 d	7.17	5.73	5.84	5.99	6.43
275-365 d	8.90	7.73	7.84	8.02	8.51
366-450 d	11.8	9.70	9.88	10.22	11.0
<b>0-450 d</b>	<b>7.32</b>	<b>5.88</b>	<b>5.98</b>	<b>6.15</b>	<b>6.57</b>

**Table 9.** \*Costs (lek/day) of daily feed ration, according to periods

Item	Periods (days)					average
	0-84	85-182	183-274	275-365	366-450	0-450 days
Whole milk	210.00	-	-	-	-	-
Starter/ concentr.	44.85	130.51	147.00	163.32	172.34	-
Alfalfa hay	28.96	30.12	38.19	44.11	48.23	-
Maise silage	-	18.00	27.00	37.35	49.50	-
<b>Total</b>	<b>283.81</b>	<b>178.63</b>	<b>212.19</b>	<b>244.78</b>	<b>270.07</b>	<b>235.84</b>

\*Prices : whole milk 37.5lek/kg; maise 35lek/kg; wheat 40 lek/kg, barley 40 lek/kg; soybean meal 80 lek/kg; sunflower meal 85 lek/kg, wheat bran 27 lek/kg; mineral and vitamin mixture 300 lek/kg; alfalfa hay 17.93 lek/kg; maise silage 4.5 lek/kg;

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