Biotechnology in Animal Husbandry 25 (5-6), p 293-300, 2009 ISSN 1450-9156
Publisher: Institute for Animal Husbandry, Belgrade-Zemun UDC 637.5

THE BEEF PRODUCTION EFFICIENCY OF MILK CATTLE USED CROSSED WITH DIFFERENT INTENSIVE BEEF CATTLE BREEDS

V. Jukna, Č. Jukna, N. Pečiulaitienė

Lithuanian Veterinary Academy, Laboratory of Meat Characteristics and Quality Assessment, Tilžės 18, Kaunas LT-47181, Lithuania
Corresponding author: vjukna@lva.lt
Invited paper

Abstract: The cross efficiency of Lithuanian Black-and-White with intensive (Charolais, Limousin) and semi-intensive (Hereford, Angus) beef cattle bulls was analysed. It was established that the weight at the age of 500 days of Charolais crossbred offspring were by 9.0 %, Limousin by 3.9 % ($P<0,05$), Hereford by 1.6 % higher, whereas Angus by 2.2 % lower than Lithuanian Black-and-White. The crosses with intensive breeds used by 6.6–6.2 % feed energy for 1 kg overweight and semi-intensive by 4.7–4.8 % less and theirs carcass yield was by 5.1–3.3 % ($P<0.01–<0.05$) and semi-intensive – by 2.2–1.8 % higher compared to purebred dams. The carcass of crossbred cattle was superior in point of muscularity class. Differences in meat chemical composition between crossbreeds and purebreds were insignificant. The crossbreeds had significantly superior pH of meat ($P<0.05$). Crosses, except Angus, had major water binding capacity and shear force of meat. Other meat quality traits of purebreds Lithuanian Black-and-White and theirs crossbreeds with analysed beef cattle breeds differed fractionally. It has been concluded that it is beneficial to cross Lithuanian Black-and-White with beef breed bulls. Efficiency of crossing with semi-intensive breed bulls was inconsiderable.

Key words: cattle, bulls, crossbreeds, carcass yield, meat quality

Introduction

The beef is substantial source of amino acids, mineral materials and vitamins, therefore it performs importantly role in human nutrition *(Заяс, 1981)*. The developed dairy cattle breeding countries the larger half beefy obtained from dairy breeds cattle offspring and grown-up cull cattle *(Golze et al., 1997; Gutkin et al., 2000)*.

The rising standard of human life raises the claim and meat quality. The highest quality beef obtainable is from special beef cattle breeds. However, the

beef breed cows make from 5 to 15 percent in the developed dairy cattle breeding countries. In these countries, for the purpose of increase of cattle meat production and improvement of quality, inferior value cows are inseminated with beef bull sperm in order to get heavy, superior muscularity class carcass and better quality meat. The individual authors proposed that growing speed of crossbreeds were from 3 to12 percent major and about thus much less forage input per gain unit. In separate experiments were assessed, that carcass output of dairy and beef breeds crosses was from 2 to 7 percent, while of carcass soft parts output from 1 to 4 percent higher than mother's breed animals. Besides, meat of crosses is characterized by better biological and technological traits *(Golze et al., 1997, 2002; Бабаринов et al., 2001; Гнездилова et al., 2006; Зеленов, 2006; Fürst, 2000; Косилова et al., 2004; Каюмов et al., 2004; Косилов et al., 2005; Левахин et al., 2005; Brade, 2002; Nagalski et al., 2001; Jukna et al., 1998; Braghieri et al., 2005; Gregori, 1999)*.

In the cattle breeding success of crossing depends on breed combination and feeding and keeping conditions. Therefore about breeds selection for purposeful crossing need to adjudicate every case severally *(Косилов et al., 2004; Петрушко, 2004)*. In crossing with dairy cows it is possible to use intensive, semi-intensive and extensive beef cattle bulls *(Golze et al., 1997)*. The major efficiency available is expected in crossing with intensive breeds *(Fürst-Waltl. 2000; Каюмов et al., 2004)*.

In Lithuania beef is mainly obtained from dairy cattle breeds. The nursing cows of purebred beef breeds and crosses compose about 2.6 percent. Consequently, it is necessary to find ways to increase beef production efficiency and to improve its quality.

The aim of this study was to investigate beef production from dairy cattle efficiency the use of different intensive dairy cattle breeds.

Material and Methods

In the experiment five bull groups with of 16–18 bulls from 2 until 3 months of age were formed. Control group contained Lithuanian Black-and-White (LB) cattle and testing groups were formed from crosses of intensive beef breeds: Black-and-White x Charolais (LBxCH), Black-and-White x Limousin (LBxLI) and crosses with semi-intensive breeds: Black-and-White x Hereford (LBxHE), Black-and-White x Angus (LBxAN). The offspring of two bulls were selected to every group. The bulls were grown in the Silute's control bulls feeding station till 500 days of age. The accounting of feeding was carried out from 210 until 500 days of age. The offspring from all groups was kept in the same cowshed. They were kept in cluters loose till 6 months of age but from 6 months of age they were tied and fed same forage. Milk substitution, concentrated forage and hay were normalized

but animals ate silage to satiety. Consumed forage amount was determined by performing control weighing of all given forage and not consumed remains of forage every two weeks 2 days in a row. With reference to forage control weighing data were evaluated consumed forage amount during period between control weighing. Bulls were weighted on an average than group achieved from 120 until 500 days of age for growth control. The mediate weighing was performed every three months.

The group has reached 500 days of age on average when 8 bulls were selected which most fit the average of the group and accomplished their control slaughter. During the control slaughter were assessed weight before slaughtering, the weight of warm carcass, lean meat and fat classes (according SEUROP standard), hip-thigh portion mass and morphological composition, the area of *musculus longissimus dorsi* at the last rib. The sample for the meat quality determination was taken from the *musculus longissimus dorsi* at the 3 last ribs. The meat quality was determined in Lithuanian veterinary academy, Meat Characteristics and Quality Assessment Laboratory. The chemical composition of meat was established by using common accepted methods. The meat cooking loss was measured by Shiling method, water-holing capacity by Grau and Hamm method, with modified Valovinskaja and Kelman, pH – by a pH-meter Inolab 3, by a contact electrode (pH ISO 2917:1999 Meat and meat products. Measurement of pH), shear force – according to Warner-Bratzler method, meat colour by a Minolta Chroma Meter 410, measuring values L * – for lightness, a * − for redness and b * − for yellowness, tryptophan − by the Spies and Chambers method oxyproline − by Neuman and Logan method. The index of protein value was determined according to the relationship of amino acids: tryptophan and oxyproline.

Results and Discussion

The rations structure of experimental bulls according sustenance was such: concentrate 38–39 percent, hay 16–17 percent, silage 16–17 percent, green forage 29–31 percent. The green protein composed 12.2–12.6 percent, starch 9.9–10.4 percent, sugar 6.8–7.2 percent and green cellular 21.3–22 percent. In one kilogram ration there was dry matter- 8.2 MJ ME.

Weight at the end of experiment of (LBxCH) crosses is presented in table 1. Their weight was by 42.7 kilogram, or 9.0 percent higher ($p<0.05$) compared with purebreds (LB). Crosses of Limousin (LBxLI) compared with (LB) contemporaries weighed by 18.3 kilogram, or 3.9 percent more ($p<0,05$). The weight of Hereford (LBxHE) crosses was higher by 1.6 percent compared with purebreds (LB) but weight of Angus (LBxAN) was by 2.2 percent lower than in control group bulls. Crossbreeds of all breeds for 1 kilogram of gain used less forage energy than purebred mothers breed bulls. The crosses with intensive breed

(CH) and (LI) bulls forage input for unit of gain was 6.6–6.2 %, and semi-intensive breeds crossbreeds of (HE) and (AN) 4.7–4.8 % less than purebred mothers breed animals.

Table 1. Experimental bulls growing and the control slaughter data

Indicators	Genotype				
	LB	LBxCH	LBxLI	LBxHE	LBxAN
Body mass 500 days, kg	473.5	516.2*	498.8*	481.0	463.0
Gain, Average daily, g	905	1019	1007	962	921.0
Feed energy for 1 kg gain, MJ	81.3	75.9	76.3	77.5	77.4
Feed energy for1 kg carcass, MJ	145.0	124.1	128.9	130.1	132.0
Carcass mass, kg	246.0	291.0*	268.5*	255.3	251.0
Carcass yield, %	51.3	56.4**	54.6*	53.5	53.1
Hip – ham yield, %	32.0	34.1	33.9	33.1	33.2
Meat yield of soft parts from hip thigh part, %	80.0	81.5	81.7	81.5	80.9
Hip – ham parts succulence coefficient	4.0	4.4	4.4	4.3	4.2
Musculus longissimus dorsi area, cm^2	60.1	93.5*	88.9*	74.3	73.2
Carcass muscularity class	O/P	O/R	O/R	O/R	R/O
Carcass fat class	2.0	2.5	2.4	3	3

** P <0.01; * P <0.05

Paternal breeds had influence to carcass weight and yield. The (CH) and (LI) crossbreed carcass were by 45–22.5 kg ($p<0.05$) and (HE) and (AN) 9.3–5 kg ($p>0.05$) heavier compared with Black-and-White bulls. The intensive breeds crossbreeds carcass yield was 5.1–3.3 proc. ($p<0.01$–<0.05), and semi-intensive breeds – 2.2–1.8 % ($p>0.05$) major compared with control group bulls. The crossbreed's carcass was superior muscularity and fat classes.

The chemical composition of meat analysed genotype bulls differed marginally. Only in the (CH) crossbreeds meat of protein was 1.53 proc. ($p<0.05$) more than (LB) bulls. Differences of protein amount in meat between other groups statistically were insignificant. Major intermuscular fat amount was observed in the (HE) meat. Lightness meat (lightness L *) was of (AN) crossbreeds ($p<0.01$) and darkness meat was of purebreds (LB). Meat of other groups compared with purebreds was minutely lightness. Differences were minor of meat yellowness (b *) between groups. Meat yellowness (b *) was most of (AN) crossbreeds and least (LB) bulls. French crossbreeds had pH of meat nearly equal and high. pH of meat other groups bulls was close desirable. Water-holing capacity from (CH) and (LI) crossbreeds meat was major than (LB) bulls ($p<0.05$). Meat quality important index is hardness. Hard meat heavily digested and worse digestible. Meat from

(LBxLI) crossbreeds was softer while from (LBxAN) crossbreeds was most hard ($p<0.05$). Cooking loss from (LBxHE) crossbreeds meat was a bit lower, while most (LB) bulls. Meat protein value index was high all crossbreeds.

Table 2. Of meat the chemical composition and physical properties

Indicators	Genotype				
	LB	LBxCH	LBxLI	LBxHE	LBxAN
Ddry matter, %	23.00	24.25	23.85	24.01	23.55
protein, %	20.02	21.55	21.02	20.89	20.96
fat, %	1.89	1.62	1.73	2.10	1.45
ash, %	1.09	1.08	1.10	1.02	1.14
Calorific values, kg/kcal	1320	1382	1362	1390	1332
Colour: L*	34.92	37.42	36.17	36.51	40.96**
a*	16.18	18.12	18.03	17.24	18.68
b*	3.15	5.62*	6.02*	5.34*	6.90*
pH	5.48	6.39*	6.38*	5.83	5.67
Water holding capacity, mg%	59.05	65.12*	66.3*	62.8	58.55
Shear force, kg/cm^2	1.60	1.48	1.38x	1.47	1.82*
Cooking loss, %	32.04	30.80	31.00	29.85	30.60
Tryptophan, mg%	350.0	375.0	368.0	358.0	357.0
Oxyproline, mg%	68.01	68.10	65.13	67.04	70.11
Protein value	5.15	5.51	5.65	5.34	5.09

** P <0.01; * P <0.05

In our experimentation data obtained coincided with other authors data, also some of the authors interbred dairy breeds cows with different intensive beef breeds bulls. In their experimentation intensive beef breeds bull's crossbreeds characterized biggest growing speed than less intensive beef breeds crossbreeds and that crossing had the biggest influence on the growing speed, keep input, carcass yield but less on meat quality. However, part of meat quality indicators crossbreeds were better compared with purebred mothers breed animals *(Доротюк et al., 1998; Groth et al., 1999; Brade, 2002; Braghieri et al., 2005; Ostojic-Andric, et al., 2007; Юкна et al., 2007; Леванин et al., 2008)*.

Conclusion

1. Dairy cattle crossing efficiency depends on beef bulls breed. The intensive beef breeds (Charolais and Limousin) crossbreeds mass at the age of 500 days was by 9–3.9 % ($p<0.05$) higher, whereas crosses with semi-intensive

breeds (Hereford and Angus) had by 1.6 % higher body mass and by 2.2 % lower compared with purebreds (LB) ($p>0.05$).

2. Breed had influence on crossbreeds carcass yield. The carcass yield of intensive beef breeds crossbreeds was 5.1–3.3 % ($p<0.01–<0.05$) biggest, whereas of semi-intensive breeds 2.2–1.8 % biggest nor purebreds (LB) ($p>0.05$).

3. Meat from all crossbreeds, except (AN), was softer and characterized by better water holding capacity.
   Meat of all breeds crossbreeds was lighter. The pH of meat from crosses with intensive breeds was the highest compared to other groups bulls ($p<0.05$).

4. Lithuanian Black-and-White cows purposeful to hybridize with intensive beef breeds bulls. The semi-intensive breeds bulls for crossing may to use only to impregnate heifers.

Efikasnost proizvodnje goveđeg mesa ukrštanjem mlečnih grla sa različitim tovnim rasama

V. Jukna, Č. Jukna, N. Pečiulaitienė

Rezime

Analizirana je efikasnost ukrštanja litvanske crno-bele rase sa bikovima intenzivnih (šarole i limuzin) i polu-intenzivnih (hereford, angus) tovnih rasa Utvrđeno je da su u uzrastu od 500 dana, potomci šarole bikova imali za 9.0 % veću telesnu masu, potomci limuzin bikova za 3.9 % ($P<0,05$), i hereforda za 1.6 %, dok su potomci angus bikova imali za 2.2% manju telesnu masu u odnosu na litvansku crno-belu rasu. Melezi sa intenzivnim tovnim rasama su za 1 kg porasta koristili za 6.6–6.2 % manje hrane, a sa polu-intenzivnim za 4.7–4.8 % i njihov randman je bio za 5.1–3.3 % ($P<0.01–<0.05$) veći u odnosu na majčinsku rasu, odnosno kod meleza sa polu-intenzivnim rasama za 2.2 –1.8 % veći u odnosu na majčinsku rasu. Trupovi meleza su bili superiorniji sa stanovišta muskuloznosti. Razlike u hemijskom sastavu mesa između meleza i čiste rase nisu bile značajne. Melezi su imali signifikantno veću pH vrednost mesa ($P<0.05$). Melezi, osim sa angusom, su imali bolju sposobnost vezivanja vode i shear force of meat. Ostale osobine kvaliteta mesa litvanske crno-bele rase i meleza sa ispitivanim tovnim rasama su se delimično razlikovale. Zaključeno je da je opravdano ukrštanje sa

tovnim rasama. Efikasnost ukrštanja sa polu-intenzivnim rasama bikova nije bila znacajna.

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Received 31 May 2009; accepted for publication 15 August 2009