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SHORT COMMUNICATION

A study of growth and carcass traits in dehorned and polled composite bulls

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Goonewardene, L. A., Price, M. A., Liu, M. F., Berg, R. T. and Erichsen, C. M. 1999. **A study of growth and carcass traits in dehorned and polled composite bulls.** Can. J. Anim. Sci. **79**: 383–385. Phenotypically dehorned (genetically horned) and polled bulls were similar for birth, weaning weight, pre- and post-weaning ADG, carcass weight, grade fat, marbling, rib-eye area, cutability and carcass grade. Polled bulls had higher ($P < 0.02$) fat over the rib-eye compared with dehorned. The similarity in growth and a majority of carcass traits between polled and horned, would suggest that breeding for polledness may be recommended to eliminate horns.

Key words: Dehorned, polled, growth, carcass traits, bulls

Goonewardene, L. A., Price, M. A., Liu, M. F., Berg, R. T. et Erichsen, C. M. 1999. **Étude des caractères de croissance et de carcasse chez les taurillons de races synthétiques décornées ou génétiquement sans cornes**. Can. J. Anim. Sci. **79**: 383–385. Des taurillons décornés et des taurillons génétiquement sans cornes se sont révélés semblables quant au poids à la naissance et au sevrage, au GMQ en pré et en post-sevrage, au poids de carcasse, à l'épaisseur du gras dorsal, à l'indice de persillé, à la surface de la noix de côte, au rendement boucher et au classement de la carcasse. Les taurillons génétiquement sans corne portaient toutefois plus de gras ($P < 0,02$) sur la noix de côte. La similitude observée des caractères de croissance et de la plupart des caractères de carcasse laisse à penser qu'il y aurait avantage à sélectionner les bovins pour le caractère sans cornes.

Mots clés: Décorné, génétiquement sans cornes, croissance, caractères de carcasse, taurillon

Cattle with horns often pose management problems. In a recent Alberta survey it was recognized that at slaughter 14.8% of all cattle had full horns, while 25.2% had scurs, tips or horn buds, and the economic costs to the Canadian beef industry due to horns was estimated at $97 752 and due to bruising $10 537,629 (Van Donkersgoed 1997). As such, the beef feedlot-slaughter cattle industry appears to be most affected by the presence of horns. The removal of horns from young feeder cattle has been shown to be stressful and reduce growth rates (Goonewardene and Hand 1991; Cooper et al. 1995). However, a perception exists in the beef industry that polled cattle are somewhat inferior to horned.

The polled gene in *Bos taurus* cattle is dominant to the horned condition and has been mapped close to the centromere of the first chromosome (Long and Gregory 1978; Georges et al. 1993). Although some beef breeds such as the Angus and Red Poll are naturally polled, horns have been reintroduced into crossbred slaughter cattle by outcrossing with horned breeds. Due to the management problems associated with horned cattle, the inconveniences and costs of dehorning, selective breeding with polled cattle may be a welfare-friendly method of eliminating the need to dehorn cattle. The phenotypic similarities, however, in traits associated with reproduction, fitness, growth and carcass need to be established between horned and polled cattle before breeding for polledness can be recommended. In earlier studies we showed that horned and polled cattle were similar for growth and reproductive traits (Stookey and Goonewardene 1996; Goonewardene et al. 1999), but little information is available on carcass traits. The objective of this study was to compare the growth and carcass traits of genetically horned and polled beef bulls from three composite (synthetic) breed groups.

The data for the study were obtained over 2 yr, 1990 and 1991, from the University of Alberta beef cattle ranch at Kinsella, Alberta. Records from 498 bulls were analyzed for growth and ADG, of which 328 records were analyzed for carcass traits. The animals studied were cared for in a manner similar to those of the Canadian Council on Animal Care Guidelines (1993). The three breed groups studied were: Beef Synthetic 1 (BS1), Beef Synthetic 2 (BS2) and Dairy Synthetic (DS). The breed composition of the synthetic breed groups and the management practices employed were described in earlier reports (Pang et al. 1998; Goonewardene et al. 1999). Briefly, the BS1 is composed of 33% each of

Abbreviations: **ADG**, average daily gain; **BS**, Beef Synthetic; **DS**, Dairy Synthetic; **DH,** dehorned; **PP,** polled; **REA**, rib-eye area

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Table 1. Growth and carcass traits of dehorned and polled synthetic bulls

Trait	Levels	n^z	Birth wt. (kg)	Wean wt. (kg)	Pre-ADG (kg d^{-1})	Post ADG^y (kg d^{-1})	n^x	Carc wt. (kg)	Avg. fat (mm)	Grade fat (mm)	Marbling	REA^w (cm^2)	Cutability
Horn status	Dehorned	259	38.8	205.7	1.12	1.26	173	305.2	8.4*a*	7.8	8.0	82.1	60.1
	Polled	239	39.0	206.8	1.12	1.28	155	309.7	9.5 b	8.4	8.1	82.6	59.5
	SEM^v		0.35	1.92	0.01	0.02		2.75	0.30	0.27	0.04	0.81	0.28
	P		0.63	0.68	0.98	0.49		0.25	0.02	0.11	0.40	0.63	0.12
Breed	BS1	175	38.3*a*	204.6*a*	1.11*a*	1.25	107	312.4*a*	7.5*a*	6.7*a*	8.1*a*	85.0*a*	61.3*a*
	BS2	175	38.2*a*	190.5*b*	1.02*b*	1.28	131	290.3*b*	10.6*c*	9.8*c*	7.8*b*	81.1*b*	58.9*b*
	DS	148	41.2*b*	223.6*c*	1.22*c*	1.27	89	319.5*a*	8.8*b*	7.9*b*	8.1*a*	80.8*b*	59.3*b*
	SEM		0.45	2.31	0.01	0.02		3.32	0.37	0.34	0.04	0.97	0.34
	P		<0.01	<0.01	<0.01	0.65		<0.01	<0.01	<0.01	0.02	<0.01	<0.01
Age of dam	Heifer	116	34.3*a*	181.4*a*	1.02*a*	1.29	78	296.6*a*	8.3	7.4	8.0	80.4	60.1
	2–5 yr	223	40.5*b*	214.2*b*	1.15*b*	1.27	144	313.1*b*	9.3	8.4	8.0	83.3	59.8
	>5 yr	149	41.8*b*	223.1*c*	1.20*c*	1.25	105	312.5*b*	9.2	8.6	8.1	83.3	59.7
	SEM		0.46	2.33	0.01	0.02		3.36	0.34	0.38	0.05	1.1	0.33
	P		<0.01	<0.01	<0.01	0.69		<0.01	0.15	0.07	0.65	0.08	0.57

[z]Number of observations for growth and ADG traits.
[y]Weaning to yearling.
[x]Number of observations for carcass traits.
[w]Rib-eye area.
[v]Standard error of the mean.
a–c Means with different letters in the column for each trait are significant ($P < 0.05$).

Angus and Charolais, 20% Galloway, with the remainder being comprised of other beef breeds, while the BS2 is made up of approximately 60% Hereford and 40% other beef breeds. The DS is composed of approximately 60% dairy breeds (Holstein, Brown Swiss or Simmental) and 40% beef breeds. All breed groups were maintained and managed similarly, and were subject to the same selection program. Selection of sires within each group was based primarily on pre- and post-weaning gain. Selection of male and female breeding stock was independent of their horn status. Cows calved in the open range and heifers calved out in a separate pasture that was easily accessible. Calf birth weights were recorded and within the first week horn buds were removed from horned calves by applying a caustic paste (Dominion Veterinary Laboratory Ltd., D-HORN paste). Bull calves were weaned when they were 149 ± 16 d of age, and following a 28-d adjustment period, placed on a standard feed test and fed a diet of 80% grain and 20% roughage. Slaughter readiness was based on body weight and the level of finish, and the age at slaughter was 402 ± 40 d. Bulls judged ready for slaughter were shipped to a federal slaughter plant in batches of approximately 20 at 7–10 d intervals. Management details for the Kinsella cattle were reported in earlier studies (Pang et al. 1998; Goonewardene et al. 1999).

Calf birth, weaning and yearling weights were recorded and pre-weaning ADG calculated from birth to weaning and post-weaning ADG were calculated from weaning to yearling. Carcass data, such as carcass weight, average fat, grade fat, marbling, rib-eye area, cutability and carcass grade were obtained from the Agriculture Canada blue tag program (Agriculture Canada 1978).

Birth, weaning weight and pre- and post-weaning gain were analyzed using the General Linear Model (GLM) of the SAS Institute Inc., (1985), with horn status (DH or PP), year (1990,1991), breed (BS1, BS2, DS), age of dam (heifer, 2–5 yr, >5 yr) and interactions between horn status and the other fixed effects, with age as a covariate. Carcass traits such as, carcass weight, average fat, grade fat, marbling, cutability and rib-eye were analyzed by GLM using the same statistical model with slaughter age as the covariate. Carcass grades were analyzed by chi-square procedures to determine differences between DH and PP bull carcasses (SAS Institute, Inc.1985).

Body weight, ADG and carcass traits by horn status, breed group and the age of dam are shown in Table 1. No differences ($P > 0.05$) between DH and PP were observed for all growth and carcass traits with the exception of average fat which was higher ($P < 0.02$) in PP. The only significant ($P < 0.01$) interaction was between horn status and breed group for calf weaning weight, where the differences between DH and PP for BS1 and DS were 2.2 and 2.9%, respectively, higher for DH but was 7.1% lower for DH i BS2. Differences ($P < 0.02$) between breed types were observed for body weight, pre-weaning ADG and all carcass traits. The DS had higher ($P < 0.01$) weaning weights and pre-weaning gains compared with BS1 and BS2 due to the influence of the dairy genetics in the composite. The breed group differences recognized in this study are similar to previous reports by Pang et al. (1998) and Goonewardene et al. (1999). Marbling was lower ($P < 0.01$) in BS2 compared with BS1 and DS, while BS1 had a higher ($P < 0.01$) REA and cutability compared with BS2 and DS. Maternal effects were significant ($P < 0.01$) for birth and weaning weights, and pre-weaning ADG traits with the calves from heifers showing smaller weights and gains compared with calves from the more mature cows, but maternal influence had little effect on post-weaning ADG and carcass traits such as fat, marbling, REA and cutability.

No differences ($P > 0.05$) were observed between DH and PP for any of the carcass grades (Table 2). Although there was a trend ($P = 0.06$) towards a greater frequency of dark-cutting carcasses among polled bulls, the sample is too small to make a clear judgement. Interestingly, six of the PP and three of the DH bulls that were dark cutting were in the same

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Table 2. Carcass grades of dehorned and polled synthetic bulls

		Carcass grade									
Status	*n*	A1	(%)[z]	A2	(%)	A3 & A4	(%)	B1-B3	(%)	B4[y]	(%)
Dehorn	173	117	(67.6)	30	(17.3)	6	(3.5)	15	(8.8)	5	(2.9)
Polled	155	94	(60.6)	31	(20.0)	7	(4.5)	11	(7.2)	12	(7.7)
P		0.19		0.55		0.62		0.58		0.06	

[z]Expressed as a percent of the total number in each row.
[y]Dark cutting carcasses.

shipment. It is well established that dark cutting is primarily due to pre-slaughter stress (Scanga et al. 1998).

The small differences in growth and carcass traits observed between DH and PP may be due to differences in breeding contributions from the foundation breeds in each synthetic breed group. Although the three synthetic groups are closed, and bulls and cows for breeding are selected from within each group, yet the variation in their genetic make up may reflect detectable phenotypic differences. The average fat over the rib-eye measured from the four quadrants was higher ($P < 0.02$) in PP compared with DH bulls. A higher back fat thickness in polled Charolais bulls compared with horned has been reported by Stookey and Goonewardene (1996).

As the polled gene is dominant in its expression to horned, in a homozygous polled × horned cross, all progeny will be polled, whereas in a heterozygous polled × horned cross 50% of the progeny will be polled. Since the heritable variation is expressed only in the heterozygote and it is halved in every generation, at the fourth generation 94% of all progeny should be polled, provided gene penetrance is complete.

The present paper establishes that growth and carcass traits are similar for DH and PP bulls. Research data from Frisch et al. (1980), Lange et al. (1990), Stookey and Goonewardene (1996) and Goonewardene et al. (1999), and this study suggest that the phenotypic differences influencing production traits between genetically horned and polled cattle are small and insignificant. As such, breeding for polledness can be recommended as a non-invasive means of progressively eliminating the need to dehorn feeder-slaughter cattle.

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