Beef Quality of Bonsmara Cattle

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BOTTOM LINE

Within the range of the scope of this project, Bonsmara calves produced consistently tender beef.

Summary

- Bonsmara calves grown in different patterns had similar tenderness values indicating consistent quality.
- Bonsmara calves from different sources had different tenderness values indicating improvement possibilities through selection..
- Bonsmara calves produced beef comparable in tenderness to values in the literature for the most tender breeds.
- Bonsmara calves grown in these systems had lower measures of fat and cholesterol than USDA graded beef loin, chicken meat, and chicken breast with skin.

Introduction

Production of consistent, high quality beef is the goal of the beef industry. This goal must be attained at a reasonable cost. Only cattle adapted to the prevalent production environments can be produced with reasonable costs. The goal of this project was to determine the consistency of beef in alternative production systems for Bonsmara cattle. Bonsmara is a composite breed that was developed in the subtropics of South Africa for adaptation to hot environments..

Experimental Approach

One hundred sixty weanling purebred Bonsmara bulls were purchased from fourteen South African Bonsmara breeders, castrated, stratified according to source, sire and initial weight, and allotted to seven feeding regimes at the Animal Nutrition and Animal Products Institute in Irene, South Africa. An attempt was made to purchase calves from as many unrelated bulls from as many sources as possible in order to represent both the breed and the cattle that have been exported to the United States. The goals of the selection procedure were to obtain purebred Bonsmara (15/16 Bonsmara) male calves that: (1) represented the kind of calves that go to market in South Africa (not the elite calves, but calves with birth certificates), (2) represent the germplasm that has been exported to the U.S., and (3) represent the lines that have been characterized by other research in South Africa. The seven feeding regimes were: (1) Weaning followed by short concentrate feeding (Finishing Period) until 300 kg, (2) Weaning followed by concentrate feeding until 400 kg, (3) Weaning followed by concentrate feeding until 500 kg, (4) Weaning followed by high forage feeding for 100 days (Backgrounding Period) followed by concentrate feeding until 400 kg, (5) Weaning followed by high forage feeding for 100 days followed by high concentrate feeding until 500 kg, (6) Weaning followed by high forage feeding for 200 days followed by high concentrate feeding until 400 kg, and (7) Weaning followed by high forage feeding for 200 days followed by high concentrate feeding until 500 kg. During the Backgrounding Period, lovegrass (*Eragrostis curvula*) hay was mixed with a supplement to effect about .7 kg/day gain (Table 1).
During the Finishing Period, a production ration was fed that was designed to be about 90% concentrate containing at least

Table 1: Ration and nutrient value for Backgrounding Period.

Feedstuff	Percent (as is basis)
Brewers grain (dried)	8
Hominy chop (> 5% fat)	34
Wheat bran	8.3
Molasses mean	5
Eragrostis curvula hay	43
Limestone	1
Salt	0.5
Premix*	0.2
Nutrient values (%)	**% (DM)**
Dry Matter	90.70
ME (MJ/kg)	9.38
Crude Protein	9.90
Crude Fibre	18.91
Calcium	0.57
Phosphorus	0.38

* Contained per 2 kg unit which is added/ton feed: 5000000 IU Vit A, 450000 IU Vit D3, 8000 IU Vit E, 2800 mg Vit B1, 100000 mg Niacin, 40 g Fe, 170 g Mg, 17 g Cu, 60 g Zn, 40 g Mn, 2.2 g I, 560 mg Co, 200 mg Se, 165 g Romensin (20%), 100 g Tylan 100.
Hay is milled 10 to 15 mm lengths

Table 2. Ration and nutrient value for the Finishing Period.

Feedstuff	Percentage (as is basis)
Brewers grain (dried)	9
Cotton seeds (whole)	3
Hominy chop (> 5% fat)	55.2
Wheat bran	15
Molasses mean	10
Eragrostis curvula hay	5
Limestone	1.6
Urea	0.5
Salt	0.5
Premix*	0.2
Nutrient values (%)	**(DM basis)**
Dry Matter	89.90
ME (MJ/kg)	12.03
Crude Protein	13.50
Crude Fibre	11.74
NDF	40.70
Calcium	0.90
Phosphorus	0.61

* Contained per 2 kg unit which is added/ton feed: 5000000 IU Vit A, 450000 IU Vit D3, 8000 IU Vit E, 2800 mg Vit B1, 100000 mg Niacin, 40 g Fe, 170 g Mg, 17 g Cu, 60 g Zn, 40 g Mn, 2.2 g I, 560 mg Co, 200 mg Se, 165 g Romensin (20%), 100 g Tylan 100.
Hay is milled 10 to 15 mm lengths

4.0 Mcal DE/kg (Table 2). Calves were individually weighed and scored for condition and frame size (1-9 scores) at the beginning of the trial. During the Finishing Period, calves were weighed biweekly in order to predict time of slaughter. Cattle were slaughtered at the Irene Lab Abattoir with as little stress as possible. Carcasses were weighed immediately after removal of head, hide and offal, and again after a 48 hour chill. Carcasses were trimmed to 4 mm of subcutaneous fat. Weight of fat trim, offal, hide and head were recorded. Carcasses were processed to closely trimmed (4 mm) round, rib, loin and chuck, and the weights of each recorded. Carcasses were graded for USDA quality and yield grades. Percent kidney, heart and pelvic fat was estimated. Rib eyes and subcutaneous fat thickness (between the 12^{th} and 13^{th} ribs) were traced on wax paper for later measurement. Degree of marbling, and degree of maturity of lean and skeleton were estimated by USDA standards. Rib eyes were taken from the carcass for Warner Bratzler Shear and sensory evaluation. Samples from each side of the carcass were excised, aged for 10-14 days
and then vacuum packed and frozen until evaluation.

Results

Rib eye steaks taken from cattle that had been fed to gain at different rates were similar in Warner Bratzler Shear values (WBS, no differences detected for target weight or days backgrounded, P>.05), indicating that these cattle were consistent in tenderness regardless of age or weight at slaughter (Table 3). WBS values can differ between labs and even experiments conducted in the same lab, and thus comparisons between labs or between experiments may be compromised by these confounding factors. Table 4 is, therefore included only as a reference for the breeds analyzed at the U.S. Meat Animal Research Center (USMARC).This table illustrates the problems of comparing values from different experiments in that values for British cattle vary from 3.44 to 5.66 kg from one experiment to another at the same lab. However, the average WBS across all treatments of 3.54 kg (Table 3) compared favorably to values reported from the USMARC (Table 4), and is well within the range considered to be tender. A significant difference was detected in WBS between sources of the cattle providing evidence that, even though the beef from Bonsmaras are generally tender, progress can be made through selection (Table 5). Fat in the Longissimus dorsi increased as slaughter weight increased (Table 6). Fat content, polyunsaturated fat and cholesterol in the Longissimus dorsi (as an average of all treatments) was less than USDA graded beef loin, chicken meat and chicken breast with skin (Table 7). Levels of saturated fat was greater than chicken meat but less than beef loin or chicken breast with skin. Levels of mono-unsaturated fat were similar to chicken meat but less than beef loin or chicken breast with skin. Average ether extract levels in this trial was also less than values in the literature for cattle having practically devoid levels of marbling (Table 8).

Table 3. WBS Values, kg

Days Backgrounded	Target Weight, kg		
	300	400	500
0	3.23	3.41	3.66
100	-----	3.38	3.43
200	-----	3.62	3.33

Mean=3.54, Residual Standard Deviation=.726, Model, Y=Target wt, kg + Days backgrounded + Target wt.*Days backgrounded

Table 4. WBS of breeds tested at USMARC.

Sire	Shear
Tarentaise[1]	3.79
Pinzgauer[1]	3.48
Brahman[1]	3.92
Saihiwal[1]	4.27
British[1]	3.44
British[2]	5.66
Charolais[2]	5.93
Gelbvieh[2]	5.64
Pinzgauer[2]	5.09
Shorthorn[2]	5.90
Galloway[2]	5.84
Longhorn[2]	6.09
Nellore[2]	7.16
Piedmontaise[2]	5.36
Salers[2]	6.32
Hereford[3]	4.82
Angus[3]	4.05
Brahman[3]	6.00
Boran[3]	5.14
Tuli[3]	4.59
Piedmontese[3]	4.59
Belgian Blue[3]	4.86
British[4]	4.40
Pinzgauer[4]	4.95
Sahiwal[4]	6.90
Brahman[4]	5.88
Red Poll[4]	4.72
Hereford[5]	5.06
Angus[5]	4.50
Limousin[5]	5.62
Braunvieh[5]	5.09
Pinzgauer[5]	4.47
Gelbvieh[5]	5.78
Simmental[5]	5.48
Charolais[5]	5.16

[1] Koch, Dikeman, Crouse,(1982) JAS 54:35
[2] Wheeler et al., (1996) JAS 74:1023
[2] Cundiff et al. (1997)
[4] Crouse et al. (1989) JAS 67:2661
[5] Gregory, K.E., et al. (1994) JAS 72:1174

Table 5. Effect of source on Warner Bratzler shear values of Longissimus dorsi, kg

Source	Shear
1	5.01
2	3.08
3	3.63
4	3.15
5	3.98
6	3.71
7	3.84
8	3.43
9	3.80
10	3.40
11	3.76
12	3.13

Mean=3.52, Residual Standard Deviation=.68, Model: Y=Source (P<.0001).

Table 6. Fat in Longissimus dorsi, g/100g

Days Backgrounded	Target Weight, kg		
	300	400	500
0	1.15	1.57	2.44
100	------	1.63	2.87
200	------	1.53	------

Mean=1.72, Residual Standard Deviation=.694, Model, Y=Target wt, kg (P<.0001) + Days backgrounded + Target wt.*Days backgrounded

Table 7. Fat and cholesterol content of other meats.

Item	Bonsmara Loin	Beef Loin[ad]	Chicken Meat[bd]	Chicken Breast w/skin[cd]
Total fat, g/100g	1.72	7.90	3.08	9.25
Saturated fatty acids, g/100g	1.01	2.95	0.79	2.66
Monounsaturated fatty acids g/100g	0.93	3.05	0.90	3.82
Polyunsaturated fatty acids g/100g	0.27	0.36	0.75	1.96
Cholesterol, mg/100g	52	62	70	64

[a]Beef, tenderloin, seperable lean only, trimmed to 1/4" fat, all grades, raw, NDB#13249
[b]Chicken, broilers or fryers, meat only, raw, NDB#05011
[c]Chicken, broilers or fryers, breast, meat and skin, raw, NDB#05057
[d]www.nal.usda.gov/fnic/cgi-bin/list_nut.pl

Table 8. Fat content compared to graded beef[a].

Item	Bonsmara Lion	Level of Marbling			
		Small	Slight	Traces	P.D.
Total Fat, g/100g	1.72	4.99	3.43	2.48	1.77
Saturated fatty acids, g/100g	1.01	2.25	1.55	1.12	0.80
Monounsaturated fatty acids g/100g	0.93	2.53	1.74	1.26	0.90
Polyunsaturated fatty acids g/100g	0.27	0.21	0.15	0.11	0.08

[a]Savell, (1986) J. Food Sci. 51:838.

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