Title: Feedlot Performance and Carcass Characteristics of Tennessee Meat Goats and Boer Cross Wethers

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Introduction

The information presented herein resulted from a 1997 trial conducted at Prairie View A&M University by Dr. Lou Nuti to make an early and, admittedly, exploratory evaluation of the recently introduced Boer goat as a terminal sire on dairy, Spanish and Tennessee Meat Goats (TMG). Although the small numbers and variable ages and sizes of animals available for purchase at that time made the data ineligible for publication in refereed journals, we feel current goat producers might glean useful information from the findings, particularly in light of present industry interest in "finishing" Boer crossbreds. Too, a number of dairy goat owners are now using Boer sires to try to improve carcass merit of surplus kids sold for meat.

Research Procedure

The 50 wethers used in this trial were purchased from area goat producers and transported to Prairie View in late June, 1997. They were held for seven days of pre-trial observation and pre-conditioning (de-worming, confinement handling and exposure to new pelleted feed). The trial began June 30 with 5 breed groups: TMG, Boer x Spanish, Boer x Nubian/TMG, Boer x Nubian/Alpine and Boer x Nubian. Each breed group was penned separately and fed as groups. Therefore, it was impossible to obtain individual feed intakes and, accordingly, no individual feed conversion efficiencies. Only individual daily rates of gain could be determined. Initially, there were ten animals per breed group, but, early on, one TMG and two Boer x Spanish wethers died (no reason found). Group feed intakes in those pens were then adjusted to compensate for the smaller numbers.

The sole diet fed was a commercial, pelleted 'complete feed' with a tag guarantee of 16% crude protein, 1.5% fat (min.), 19% crude fiber, .8-.9% calcium, .32% Phosphorus, 1.0-1.25% salt, 10ppm-20ppmcopper plus vitamins A (15,000I.U./lb) and E (3000I.U./lb). It also had Decoquinate (Decox), 27.2 grams/ton, to suppress coccidiosis. The tag indicated a composition of grains, protein feeds, molasses, and 20% roughage products (unidentified). This figure, taken with the 19% fiber guarantee, suggests the total digestible nutrient (TDN) content of this feed mixture was about 72%, as-fed basis. (For comparison, corn is 80%, oats are 70% and good alfalfa hay is about 52% TDN.) In any case, the feed composition and expected feed intake were conducive to rapid growth rate when fed ad lib (all they wanted, all the time).

At the conclusion of the 120 day trial, all animals were weighed, then held off feed for 24 hours and thereafter weighed again just prior to slaughter. They were stunned, jugular-cut and hung for bleeding, skinning and removal of viscera. Head, shanks, liver, heart and kidneys- with- fat were removed prior to washing and weighing the hot carcass. After chilling for 24 hours at 34F, the carcasses were weighed and fabricated into selected retail cuts which were weighed to calculate yields.

Results and Discussion

We have tabulated the performance and carcass data under breed-group headings and in three separate tables for reader convenience.

Table 1. Performance parameters of TMG and Boer crossbred wethers.[1]

	Breed Groups Parameters	TMG	Boer x Sp.	Boer x Nub/TMG	Boer x Nub/Alp	Boer x Nubian
1.	Number of animals/group	9	8	10	10	10
2.	Ave. age at start, days	170	111	115	132	132
3.	Preweaning ave. daily gain	0.21	0.27	0.46	0.36	0.54
4.	Ave. weight @ start, lb	36	30	53	48	71
5.	Ave. weight @ end, lb	71	85	94	90	107
6.	Ave. daily gain, lb	.29	.46	.34	.35	.32
7.	Ave. daily feed intake, lb	2.25	2.44	2.78	2.74	3.07
8.	Daily feed intake, % of body wt.	4.20	4.24	3.78	4.00	3.45
9.	Ave. feed conv. effec. (#feed/#gain)	7.76	5.24	8.07	7.85	9.50
10.	Ave. feed cost/lb of gain[2]	$0.85	$0.58	$0.89	$0.86	$1.05

1.Figures rounded to minimize decimals were possible.
2.This particular feed, billed as a "show-goat" ration cost $14/cwt. Other feeds of similar tag composition were available at lesser prices; we have used a then typical price of $11/cwt to illustrate the influence of feed conversion efficiency on feed cost/lb of gain.

Readers should first remember that there were, essentially three different age and weight groups in the trial. These differences make precise comparisons of performance data impossible. However, the figures do reflect certain principles of animal growth with which producers should be acquainted. For example, pre-weaning growth rates are relatively low but become ever larger as the kid ages. After weaning, increasing average daily gain (adg) at first stabilizes around puberty (at .3 to .4 lb) and thereafter decreases with increasing age, particularly so as the animal approaches maturity. However, post-weaning kids, if fed ad lib., will continue to grow at a higher adg for a longer time, but eventually, their adg rate will slow, even in the face of higher rates of daily feed intake, because, as they grow and begin to fatten, their feed conversion efficiency declines sharply. Remember, it takes 2.25 times more feed (energy) to put on a pound of fat than it does to put on a pound of protein (muscle). The economic consequences of this physiological phenomenon are two: it increases the cost/lb of gain and, secondly, the selling price/lb of the live goat usually decreases as it becomes larger and unacceptably fatter than current markets demand.

Note also in Table 1 that, as expected, larger goats have higher daily feed intake (dfi) than smaller goats, but, when dfi is expressed as a percent of body weight, larger goats cannot eat as much, proportionately, as smaller ones. Right when the larger goat is fattening and needs ever more feed/day, it simply cannot eat enough to sustain a high adg. Essentially, the economic principle of diminishing returns is mirrored in the diminishing feed conversion efficiency (fce)---one gets ever less return (gain and income) per unit of feed

eaten and feed dollar spent; sooner or later, the net selling price/lb will not cover the cost per pound of gain (and overhead). When the cost of feed and overhead for the next pound of gain exceeds the selling price of that pound, it is time to load and go.

At the conclusion of this trial in November of 1997, choice slaughter goats in the 40 to 80 pound range were selling at the San Angelo, TX. auction for $.86/lb. Referring to line 10 of Table 1, it is apparent that the feed cost/lb of gain, not to mention overhead, exceeded the selling price/lb received except for the Boer x Spanish cross group.

Readers will recognize that, if these wethers had been purchased at less than the $.86/lb selling price (e.g. $.70/lb), then a profit on the purchased weight could have been made ($.86 - $.70 = $.16/lb x pounds of purchase weight). Growing and fattening (finishing) of weanling or stocker goats in a typical, intensive feedlot environment is not for faint hearts or shallow pockets. Assuming adequate disease control and low death loss, feed-lotting can be done. However, to win, the trifecta of feed cost, fce and sale price must be sufficiently advantageous. One is somehow reminded of the dicey probability of lining up those required three fruits on a slot machine.

Turning now to carcass information, we again tabulate by breed groups. Table 2 shows gross carcass characteristics while Table 3 presents retail cut yields and values. The goats were slaughtered serially over a period of a few days following the end of the feeding trial but were again weighed just prior to slaughter. All chilled carcasses were first divided into fore and hind halves by cutting transversely between the 12th and 13th rib. Each half was then fabricated into selected retail cuts and edible scrap, with non-edible scrap/bone being the difference between cold carcass weight and saleable cuts plus edible scrap. (See Fig. 1.)

In Table 2, the characteristics measured and the average values per group found are not very different with the possible exception of the purebred TMG wethers which had appreciably higher hot and cold carcass yields (%). We will report shortly in The Goat Rancher further carcass work with TMG, Boer and Spanish purebreds.

The size of the ribeye (12th rib) muscle is of economic value and breeder interest to cattle and sheep producers and processors. However, goat processors do not seem to exhibit much concern for ribeye size, most probably because well over 90% of carcasses are sold whole to retailers who, on demand, cut and sell halves, quarters and, only rarely, smaller individual cuts. Perhaps as, and if, restaurants and supermarkets become more interested in larger (40 lb. plus) carcasses (possibly from 'finished' goats), they too may come to prefer larger ribeyes. Readers should note in Table 2, item 12, that when ribeye measurements of various sizes in a collection of carcasses are compared on a per/pound of cold carcass basis, the observed differences all but disappear. Accordingly, you should understand that many, if not all, of the observable differences in sizes of ribeye from goats (of various breeds, sizes, condition, etc.) are due to size of carcass, not to breeding, feeding, etc.; see Fig. 2.

Regarding Table 3, we show the saleable yields of the chosen cuts from the rear and front halves and also the non edible waste, sometimes referred to as "cutting loss". The ratios of these items (items 15 and 18) have obvious economic consequence. Readers should especially note that, in this trial, the weights of liver, heart and kidneys were not taken nor were they assigned any dollar values in the retail sale calculation. This decision had the effect of lowering the retail yields by approximately 1.2 lb./carcass or about 3% yield

(which would be now worth about $3.00).

In earlier times, slaughter plants gained revenue from the sale of non-edible offal(viscera, bone, blood, hides, etc.), but, currently, they usually have to pay additional sums for its removal. Goat hides may draw $1-$2 each, or zero, or be an offal-removal cost, depending on the operation.

Please refer briefly to Table 2, line 7, to note that the Boer crossbred's cold carcass dressing percentages averaged 46.5% (range 45.3% to 48.1%) while the TMG yielded 53.5%, a 15% advantage (53.5% divided by 46.5 %). Urban abattoir personnel tell us that 45-47% cold carcass yields are typical for commercial goats and that 50-53% is the exception. In Table 3, lines 15 and 16 show the yield of saleable cuts, by weight and as a percentage of the cold carcasses. The retail yield for the Boer crossbreds ranged from 86.5 to 88.9% (ave. 87.8%) while the TMG average was 92.2%, a further advantage of 5.0% (92.2% divided by 87.8%) for the TMG (explained in part by its noticeably lower percentage(7.8) of non-edible scrap, line 18).

The value of retail cuts (line 19) was calculated by multiplying the weight of individual cuts by the retail price of that cut and then summing. We report the 1997 Austin, Tx retail goat meat prices as:

Hindquarter Cuts	Price per lb. ($)		Forequarter Cuts	Price per lb. ($)
Loin Chops	$5.49		Shoulder Roast	$2.39
Sirloin Roasts	$2.69		Neck Roast	$1.99
Leg Steaks	$2.99		Rib Chops	$2.69
Edible Scrap	$1.99		Ribs	$1.89
			Edible Scrap	$1.99

In this price list, the double cut/bone-in rib chops at $2.69/lb (see Fig. 3) seem to be underpriced relative to the double cut/bone-in loin chops at $5.49/lb. Think of beef rib eye steaks (chops) vs. T-bone steaks (chops). The other hind- and forequarter cuts seem to us comparably priced in terms of edible meat, but, remember, very little commercial goat meat is yet sold in urban markets as individual cuts. Thus, current retail pricing patterns are not readily available for comparing to 1997 values.

The retail value per pound of cuts for the breed groups are shown on line 20, Table 3. The Boer crossbreds averaged $2.54/lb and the TMG averaged $2.79/lb, a TMG advantage of 9.8% ($2.79 divided by $2.54). The final carcass measurement, value of retail cuts per pound of shrunk live weight (line 21), favors the TMG by 20% ($1.24/$1.03 crossbred average). This higher crucial value for the TMG is due to a combination of factors: higher cold carcass yield (53.5%, line 7, Table 2), lower cutting loss (7.8%, line 18, Table #3) and higher average value per pound of retail cuts ($2.79/lb, line 20, Table 3).

Table 2. Carcass characteristics of TMG and Boer cross wethers.

	Breed Groups Parameters	TMG	Boer x Sp.	Boer x Nub/TMG	Boer x Nub/Alp	Boer x Nubian
1.	Live wt., pre-slaughter, not shrunk, lb[1]	72.3	88.9	95.4	95.6	112.4
2.	Shrunk wt., pre-slaughter[2]	70.1	86.9	91.4	91.3	108.4
3.	Shrinkage, pre-slaughter, %[3]	2.9	2.2	4.2	4.5	3.6
4.	Hot carcass wt., lb	39.5	42.1	44.7	42.5	52.8
5.	Hot carcass wt./shrink wt., %	56.3	48.4	48.9	46.5	48.7
6.	Cold carcass wt., lb.	37.3	41.8	42.6	41.5	49.4
7.	Cold carcass wt./ shrunk wt., %	53.5	48.1	47.1	45.3	45.6
8.	Cooler shrink (hot%-cold%), %[4]	2.8	0.3	1.8	1.2	3.1
9.	Hindquarter wt./cold carc. wt., %[5]	42.1	44.0	44.1	43.9	46.6
10.	Forequarter wt./cold carc. wt., %[5]	57.9	56.0	55.9	56.1	53.4
11.	Loin eye area, 12th rib, sq. inches[6]	1.96	2.02	2.34	2.37	2.69
12.	Loin eye area/cold carc. wt., sq. inches[6]	0.053	0.048	0.052	0.053	0.051

1.Equivalent to an on-farm weight; animals minimally hassled prior to weighing.
2.Off feed 24 hrs and water 12 hrs prior to slaughter.
3.Farm fresh goats hauled to and through an auction generally shrink 3-4%; they may lose another 3-4% if hauled long distances to slaughter.
4.Other research typically shows 2.5 to 3.5% cooler shrink on Spanish and Boer crossbreds.
5.Typical commercial ratios are approx. 45% rear and 55% front on carcasses halved between the 12th and 13th rib; intact males are heavier in the front.
6.See discussion section for interpretation of these figures.

Table 3. Carcass yields of retail cuts from TMG and Boer crossbred wethers

	Breed Carcass Yield	TMG	Boer x Sp	Boer x Nu/TMG	Boer x Nu/Alpine	Boer x Nubian
1.	Hindquarters wt, lb	15.7	18.4	18.8	18.2	23.0
2.	Sirloin roasts	6.1	6.9	6.9	6.7	8.5
3.	Loin chops[1], lb	2.6	2.8	3.1	3.1	3.7
4.	Leg steaks,	2.3	2.2	2.5	2.4	3.2
5.	Edible scrap, lb	3.0	3.2	3.6	3.1	4.8
6.	Non-edible scrap/bone, lb[2]	1.7	3.3	2.7	2.9	2.8
7.	Forequarters wt., lb	21.6	23.4	23.4	23.3	26.4
8.	Shoulder roasts, lb	4.4	4.1	3.9	3.6	4.4
9.	Neck roast, lb	3.4	3.6	3.6	3.9	3.8
10.	Rib chops [1], lb	2.7	2.8	2.8	3.0	3.8
11.	Ribs, lb	7.5	7.6	7.2	7.4	8.0
12.	Edible scrap, lb	2.4	3.5	2.9	3.3	3.7
13.	Non-edible scrap/bone, lb[2]	1.2	1.8	3.0	2.1	2.7
14.	Cold carcass wt., lb	37.3	41.8	42.2	41.5	49.4
15.	Total retail cuts, lb	34.4	36.7	36.5	36.5	43.9
16.	Retail cuts/cold car. wt, yield, %	92.2	87.8	86.5	88.0	88.9
17.	Total non-edible scrap/bone, lb	2.9	5.1	5.7	5.0	5.5
18.	Non-edible scrap/cold car. wt, %,[3]	7.8	12.2	13.5	12.0	11.1
19.	Value of retail cuts per carcass, $	$87.04	$92.70	$93.61	$93.38	$110.09
20.	Ave. value per lb, retail cuts, $[4]	$2.79	$2.53	$2.56	$2.56	$2.51
21.	Value of retail cuts/shrunk b.w., $	$1.24	$1.07	$1.02	$1.02	$1.02
22.	Auction price/hd (shrunk wt x $.86/lb) $	$66.95	$73.10	$80.84	$77.40	$92.02
23.	Gross differ., retail value--auction cost, $	$20.98	$19.60	$12.77	$15.98	$18.07

1.Chops double-cut, transversely (carcass rib and loin areas were not split down the backbone)
2.Consists of separable fat, connective tissue and bone.
3.Fatter goats generally have higher cutting losses, as is demonstrated.
4.See discussion section for retail prices/cut.

Unfortunately, we had too few animals in each breed group and, secondly, there was too much

individual difference within each breed group; we cannot, therefore, say that the TMG advantage was statistically significant. But, this data and other findings soon to be reported do suggest a rationale for doing further work with larger numbers of genetically representative TMG. Anecdotal experiences with Boer x TMG crosses (50%TMG x 50%Boer and 75% Boer x 25% TMG) by the authors and others seem quite promising; perhaps a "classic cross," 5/8 Boer x 3/8 TMG, would be commercially useful. But, readers should note in Tables 1, 2 and 3 that the Boer x TMG/Nubian crossbreds were neither better nor worse than the other non-TMG x Boer crosses in either performance or carcass data. Much caution is urged regarding small-number breed comparisons. Too, superior carcasses, even if statistically real, may not necessarily come from animals of superior productive and/or reproductive performance; proceed with skepticism as your constant companion.

One last, but very instructive observation...line 22 in Table 3 shows the auction price per head a processor would have had to pay for the shrunk goat. Subtracting these figures from the retail values per carcass (line 19) gives the gross margins the processor/wholesaler and the retailer would have had to share to cover all their expenses and profits (line 23). These breed margins ranged from $20.98 to $12.77 and averaged $17.48/hd. The processor/wholesaler would have engendered procurement/shipping, hauling shrinkage, slaughter and carcass shrinkage costs and, of course, a profit. Thereafter, the retailer would have had expenses for transporting the carcass, possibly fabricating it into cuts and merchandising them, plus his mark up (i.e., profit).

The precise costs and exact profits from processing, distribution and retailing goat meat are proprietary and, accordingly, are not likely to be deeply researched by those desiring further life expectancies. Certain costs, however, may be estimated with some accuracy and, by comparing retail prices for hanging carcasses in, say, New York City, to known live goat prices in San Angelo, one can confidently speculate that processors and retailers each profit, perhaps $3-$7/carcass, on the average, across annual ever changing supply and demand pattern; after all, who can gainsay?

Conclusion:

1. None of the performance measurements were significantly different between the TMG and the various crossbred wethers.
2. The feed efficiencies and feed costs per lb of gain recorded herein demonstrate the economic uncertainties associated with finishing goats in intensive environments.
3. Although there were measurable differences in carcass characteristics between the TMG and Boer crossbreds, too few goat numbers and too much variation within breed groups made the results inconclusive, but certainly worthy of further investigations.
4. The gross margins between the aggregate retail sales values of the carcass components and the auction costs of the "finished" slaughter goats are sufficiently narrow to give pause to those contemplating options such as retained ownership, slaughter operations, value-added merchandising, etc. Extreme care should be exercised by those only partially informed of the perils and (presumed) profits from marketing goats beyond the farmgate.