Cow Size and Milk Level: Results of a Simulation Program

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Summary

A simulation program was used to evaluate nine genotypes of cattle based on cow size and milk production. Return per cow unit using current economics is given. The larger, heavy milking cows were more than twice as profitable on a ranch basis than the small, low milking cows.

Introduction

A breeding program can alter cow size and milk production over a wide range. The impact of these changes is of major concern. Using a simulation program, which combines results from many research studies, the profitability of nine genetic types of cattle were compared.

Procedures

Small, medium, and large-type cows, each producing low, medium, and high milk levels were compared. All simulated herds used a two-breed rotational crossbreeding program. Bulls used were of comparable size to the cows to provide constant size replacement heifers. Breeding season was June and July. Calves were weaned October 1, fed grain and alfalfa hay, and sold November 1. Replacement heifers were fed grain and alfalfa hay through April. Cows grazed native short-grass range year around (grass data came from a Northeast Colorado Range research study) and were supplemented from December 1 through April with alfalfa hay. Enough supplemental winter feed was allowed so that cows and yearling heifers were condition score 5 early in the breeding season, but were not excessively fat at the end of the grazing season. All open cows, plus a number that were unsound, were culled in October. No cows were kept past 11 years of age. Gestation period was 282, 285, and 288 days for the small, medium, and large size cows, respectively.

On-farm costs were compiled by Dr. Kerry Gee (USDA-ERS) for 1982 in midsized herds (average 305 cows) in eastern Colorado. Prices of feed and cattle are approximately those received in the fall of 1985. All alfalfa hay and grass was produced on the ranch. The actual values of the expenses may vary with different size operations; however, the relative comparisons should remain the same. Operating capital was borrowed at 12% interest and surplus cash returned 10% from short-term investments.

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Results

All heifers had similar pregnancy rates (Table 16.1). Pregnancy rate decreased slightly as cow size increased because of longer gestation and higher dystocia rate (Table 16.2). This necessitated a slightly higher heifer replacement rate. Milk production was similar among different cow sizes (Table 16.3). Cows with low milk production tended to get fat during the summer, allowing less winter supplemental feeding. Heavy milking cows maintained rather constant condition throughout the year but required more supplemental feeding (Table 16.4). Yearly TDN consumption increased with both size and milk production.

Calf weights increased with increasing milk production and increasing cow size (Table 16.5). Calf prices were higher for the larger frame calves and decreased for fatter calves. Pounds of cull cows sold increased with increased cow size because of both greater numbers and heavier weights.

Fixed costs are associated with the ranch operation and not with number or kind of animals. Variable costs are associated with an animal unit (Table 16.6). There were no additional costs associated with increased milk production. Total cost increased with increased cow size, but production increased faster, making the high milking, large cow the most profitable. This is partly because the variable cost were approximately the same for all cows and there were 14% fewer large cows. The total pounds of product produced per year were considerably higher for the large cow with high milk production (112 lb per cow unit).

Table 16.1. Pregnancy Rate of Genotypes by Age

Genotype Size Milk	% Heifers[1]		% 2-yr olds[1]		% Cows[1]	
	Bred July 1	Bred Aug. 1	Bred July 1	Bred Aug 1	Bred July 1	Bred Aug 1
SM-LO	69.2	92.6	51.2	84.8	42.0	85.7
SM-ME	69.6	92.5	50.1	84.1	44.0	85.8
SM-HI	69.0	91.7	50.0	83.2	48.5	87.1
ME-LO	68.8	92.5	49.3	82.4	36.4	83.9
ME-ME	73.4	93.9	51.5	83.4	39.4	84.5
ME-HI	70.6	92.5	48.0	81.8	41.1	85.1
LG-LO	69.1	92.5	49.4	79.8	37.4	82.4
LG-ME	73.9	94.1	50.8	80.5	39.9	83.1
LG-HI	71.2	92.9	44.4	78.3	36.4	82.0

[1] 60 day breeding season ended Aug. 1.

Table 16.2. Calving and Replacement Rate by Genotypes

Genotype Size Milk	% Heifers Dystocia	% Heifers Calving Loss	% Overall Dystocia	% Overall Calving Loss	% Calf Crop Weaned of Pregnant Cows	Heifer Replacement Per Cow
SM-LO	18.7	5.5	5.7	4.0	92.8	.243
SM-ME	18.9	5.5	5.8	4.0	92.8	.244
SM-HI	19.3	5.6	5.8	4.0	92.8	.240
ME-LO	23.7	6.0	7.8	4.1	92.6	.262
ME-ME	23.5	6.0	7.6	4.1	92.6	.251
ME-HI	24.3	6.1	7.8	4.2	92.6	.257
LG-LO	30.7	6.7	13.0	4.7	91.5	.283
LG-ME	30.3	6.8	12.8	4.7	92.1	.271
LG-HI	31.1	6.8	13.4	4.7	92.0	.290

Table 16.3. Cow Weights, Condition Score, and Milk Production.

Genotype Size Milk	Avg. Milk Production	Minimum Wt	Minimum Date	Minimum Cond Score	Maximum Wt	Maximum Date	Maximum Cond Score
SM-LO	12.4	964	May 1	4.1	1088	Dec 1	5.9
SM-ME	18.5	979	May 1	4.5	1049	Jan 1	5.4
SM-HI	23.2	1006	Jun 1	4.8	1028	Feb 1	5.1
ME-LO	12.4	1102	May 1	4.3	1246	Nov 1	5.8
ME-ME	18.3	1120	May 1	4.5	1208	Oct 1	5.4
ME-HI	23.6	1140	May 1	4.7	1201	Sep 1	5.2
LG-LO	12.4	1271	May 1	4.5	1415	Nov 1	5.8
LG-ME	18.4	1297	May 1	4.7	1393	Sep 1	5.6
LG-HI	23.8	1298	May 1	4.8	1357	Sep 1	5.3

Table 16.4. Per Head Feed Consumption By Genotypes

Genotype Size Milk	Winter Grass DM	Winter Grass Cost	Winter Hay DM	Winter Hay Cost	Winter Grain DM	Winter Grain Cost	Summer Grass DM	Summer Grass Cost	Yearly TDN Consumed	Yearly TDN Cost
	lb	$	lb	$	lb	$	lb	$	lb	$
SM-LO	2066	12.40	1889	62.34	211	16.46	7191	79.10	5036	170.30
SM-ME	2114	12.68	1891	62.40	179	13.96	7031	77.34	6100	166.38
SM-HI	1894	11.36	2445	80.69	150	11.70	6924	76.16	6230	179.91
ME-LO	2106	12.64	1982	65.41	245	19.11	8089	88.98	6795	186.14
ME-ME	2170	13.02	2206	72.80	220	17.16	7862	86.48	6802	189.46
ME-HI	2226	13.36	2511	82.86	182	14.20	7772	85.49	6923	195.91
LG-LO	2143	12.86	2550	84.15	278	21.68	8804	96.84	7552	215.53
LG-ME	2219	13.31	2761	91.11	256	19.97	8559	94.15	7545	218.54
LG-HI	2320	13.92	3005	99.16	214	16.69	8491	93.40	7664	223.17
Price/ ton DM		$12.00		$66.00		$156.00		$22.00		

Table 16.5. Sale Cattle Weights, Number, and Value Per Cow by Genotypes

Genotype Size Milk	Steer Calves Wt	Steer Calves Number	Steer Calves Value	Heifer Calves Wt	Heifer Calves Number	Heifer Calves Value	Yearling Heifers Wt	Yearling Heifers Number	Yearling Heifers Value	Cull Cows Wt	Cull Cows Number	Cull Cows Value
	lb		$	lb		$	lb		$	lb	$	
SM-LO	455	.464	.64	411	.221	.53	872	.039	.42	1069	.183	.36
SM-ME	509	.464	.62	460	.220	.52	870	.039	.42	1026	.183	.35
SM-HI	563	.464	.60	508	.224	.51	867	.041	.42	989	.178	.34
ME-LO	507	.463	.66	458	.201	.55	1001	.044	.40	1238	.197	.36
ME-ME	561	.463	.65	507	.212	.54	1019	.038	.40	1199	.191	.35
ME-HI	615	.463	.64	555	.206	.53	1004	.042	.40	1156	.193	.34
LG-LO	563	.458	.67	508	.175	.56	1136	.048	.38	1410	.211	.36
LG-ME	618	.460	.66	558	.189	.55	1157	.041	.38	1370	.206	.35
LG-HI	667	.460	.65	602	.170	.54	1140	.047	.38	1313	.218	.34

Table 16.6. Income and Expenses Per Cow by Genotype.

Genotype Size Milk	Fixed Cost	Grain[1] Cost	Variable Cost	Operating Interest	Total Cost	Gross Income	Return for Labor Management and Investment	Relative[2] Carrying Capacity	Return[2] Per Cow Unit
SM-LO	$146.53	$16.46	$50.39	$12.17	$225.55	$267.88	$42.33	1.00	$42.33
SM-ME	146.53	13.96	47.85	12.25	220.59	279.01	58.42	1.00	58.42
SM-HI	140.48	11.70	48.23	12.22	212.53	289.54	76.91	1.04	79.99
ME-LO	158.38	19.11	48.90	13.27	239.66	310.82	71.16	0.92	65.47
ME-ME	157.28	17.16	49.11	13.29	236.84	322.46	86.62	0.93	76.63
ME-HI	158.38	14.20	49.65	13.40	235.63	335.53	99.90	0.92	91.91
LG-LO	168.12	21.68	50.56	14.39	254.75	350.10	95.35	0.87	82.95
LG-ME	167.18	19.97	50.79	14.42	252.36	362.60	110.24	0.88	97.01
LG-HI	169.52	16.69	51.49	14.54	252.24	372.53	120.29	0.86	103.45

[1]Home grown hay is used and production expenses are included in other costs.

[2]A cow unit is assumed to be a 1000 lb cow of low milk production with the necessary replacements and calf.