FEEDING AND MANAGEMENT STRATEGIES FOR PRODUCING BEEF FROM HOLSTEIN STEERS ON NORTHEAST DAIRY FARMS

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Introduction

There are nearly one million Holstein bull calves born in the Northeast each year. This is a sizeable resource that should be evaluated for fed beef production to determine if it is a potentially viable alternative enterprise for Northeast farms. Previous research at Cornell has presented several beef production systems that would be practical in the Northeast (Knoblauch, et al. 1979; Woodell 1981). An additional system would be the rearing of the steer calves with the replacement heifers on dairy farms. Many dairymen have expressed a desire to expand their operation without increasing the milking herd, due to labor, management, facilities limitation or personal desires. Raising the Holstein steer calves produced on dairy farms is an alternative for expanding the farm operation and a means of marketing surplus forages. The purpose of this paper is to outline feeding and management strategies for raising the steers with the female replacements and marketing them either as feeder cattle or fed beef. The objectives are to use homegrown forages for as much of the feeding period as possible, while maintaining efficient growth and producing a quality feeder or slaughter weight steer.

Management Strategy

Successful rearing of these calves for fed beef depends primarily on the ability to get them through the critical starting phase with minimal death loss and chronic health problems, making the transition from milk to lower cost dry diets as quickly as possible, and proper energy and protein supplementation of feedstuffs commonly grown in the Northeast.

One post weaning feeding strategy revolves around feeding the heifers at the recommended plane of nutrition that results in adequate size at breeding (14-15 months of age) and at first calving (24 months), without allowing fat deposition that would result in reproductive problems or a reduction in lifetime milk production (Reid 1963). Table 1 shows rate of gain, dry matter intake and protein content that will result in desired growth at breeding and first calving. Dry matter intakes are based upon

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[1/] A Symposium Paper presented at the Northeastern Agricultural Economics Council annual meetings at the University of Maryland, Baltimore, on June 15-17, 1981.

Table 1. Expected ad libitum Dry Matter Intake, Average Daily Gain and Crude Protein Requirements; Large Frame Heifers, 2-24 Months of Age

Age (Months)	Weight Range (lbs.)	Dry Matter Intake lbs./day[a/]	Required Average Daily Gain	% Crude Protein in DM[b/]
2-4	160-250	6.6	1.4	14
4-6	250-340	8.7	1.6	14
6-8	340-450	10.8	1.9	14
8-10	450-560	13.0	1.8	13
10-12	560-670	15.0	1.7	12
12-14	670-740	16.4	1.2	10
14-16	740-810	18.0	1.2	10
16-18	810-880	19.2	1.2	10
18-20	880-960	20.0	1.2	10
20-22	960-1030	20.5	1.2	10
22-24	1030-1100	21.0	1.2	10

[a/] Based upon studies of Fox (1981). These values correspond closely to those suggested by the NRC publication, Nutrient Requirements of Dairy Cattle (1978).

[b/] Requirements as a percentage of ration dry matter.

recent studies with Holstein steers (Fox 1981) and values suggested by the National Research Council (NRC, 1978). As shown in Table 1, the most rapid rate of growth for dairy heifers is recommended for the period prior to 8-10 months of age so that they reach puberty by 14-15 months of age. After that age, the rate of gain is reduced to prevent excessive fat deposition.

The potentially appealing feeding strategy for the production of dairy beef is to raise the steers with the heifers until 9 to 10 months, feeding a ration formulated for the dairy heifers. When the heifers are changed to a lower energy diet, the steers should be separated and continued on the same or a higher energy level as the efficiency of growth for fed beef production is highest if the energy level is never lower than that fed at earlier stages of growth (Dexheimer, et al. 1971). Since actual dry matter intake reaches a constant level at approximately 900 pounds (Fox, 1981), as weight increases beyond this weight a higher proportion of the intake will be used for maintenance and the proportion of the gain that is fat increases. When a high energy diet is fed after a period of feeding on a high forage diet, the calves will make some compensatory growth, depending on the length of time on the low plane of energy and the degree of restriction in growth previously. Due to these effects, the energy density of the diet must increase to maintain the same rate of gain. Therefore, low energy forages are best utilized when fed during the first part of the feeding period.

The time when heifer ration energy levels are decreased and the steers and heifers are separated, is a logical point to consider the alternative of selling the steers as feeder calves, if good feeder calf markets are available (Milligan, et al. 1981).

Ration Formulation

Rations presented in this paper are formulated to feed the steers to slaughter weight utilizing the highest levels of forage that should be fed, considering the principles discussed previously and avoiding discounts for the carcasses that occur when steers are fed a low energy diet continuously (Table 2). Given targeted average daily gain, dry matter intake and crude protein requirement, a microcomputer program was used to evaluate a prespecified ration (Fox, et al. 1980). As the program performed as a ration analyzer, the composition of the ration was adjusted until the balanced ration with the least cost was obtained.

No growth stimulants or feed additives are included when the steers are with the heifers; however, after they are separated it is assumed that the steers are implanted with a growth stimulant every 100 days and Rumensin is fed at recommended levels (Minish and Fox 1981).

Feeding programs were developed for two feed availability circumstances.[1/] The first contains a hay that is primarily grass, corn silage and purchased

[1/] These feeding programs are consistent with the representative farms in Milligan, et al. 1981.

Table 2. Dry Matter Intake, Average Daily Gain and Crude Protein Requirements; Steers, 540-1250 Lbs.

Weight Range	Average Weight	Dry Matter Intake[a/] lbs./day	Minimum Average Daily Gain[b/] (lbs./day)	Required % Crude Protein in DM[c/]
540-850	690	15.1	2.0	12
850-1250	1050	19.3	2.0	10.5

[a/] Steer treated with Rumensin and growth stimulant.

[b/] Minimum daily gain acceptable as an average for that growth period, considering time on feed, cost of gain and achieving acceptable carcass quality.

[c/] Requirement as a percentage of ration dry matter.

corn grain and soybean meal. The second contains hay crop silage that is mostly legume, corn silage, high moisture shelled corn and purchased soybean meal. Both feeding programs were formulated for three alternative forage compositions: hay only, 50 percent hay crop and 50 percent corn silage on a dry matter basis, and corn silage only. Table 3 contains the average nutrient composition of the feed ingredients used to formulate the rations.

Feeding Program: Birth to Two Months

It is assumed that the calves have a birth weight of 100 pounds and are fed milk replacer and a complete dry calf starter, gaining an average of 60 pounds for the first 60 days (Fox and Warner 1980). On the average, the calves can be expected to consume 40 pounds of commercial milk replacer and 42 pounds of calf starter in this period. The composition of a calf starter developed and used at Cornell is shown in Table 4.

As with the heifers, rearing the steer calves for the first six to eight weeks requires a greater concentration of management than any other phase of the growth period. It is unlikely that dairymen that do not like starting calves or are having problems rearing the heifers will want to attempt raising the steers. Key management factors include adequate colostrum intake within the first few hours after birth, proper sanitation and ventilation, proper feeding of the milk replacer and calf starter, and early detection and treatment of sickness. Detailed procedures for a sound calf rearing program are outlined by Fox and Warner (1980). It is assumed that practices similar to those outlined by Fox and Warner are followed, resulting in calves at eight weeks of age that are healthy and therefore capable of maximum performance. Calves are castrated, dehorned, vaccinated and wormed between six and eight weeks of ages.

Feeding Program: Two Months to Slaughter

Rations were designed for five logical groupings of weaned calves by size and nutrient requirements. These are: heifers 2-6 months, heifers 6-12 months, heifers 12-24 months, steers 9-14 months, and steers 14-21 months.

The steers are assumed to be with the heifer group to nine months of age, then would be sold as feeders or placed in the two steers groups to slaughter. The rations for the various forage compositions are shown in Appendix Tables 1-4.

This many separate groups would not be practical on farms with small number of calves. Under these conditions, an appropriate average of rations should be fed, depending on the average size of the calves being fed together. If in doubt, always feed the ration best suited to the lightestanimals in the group to prevent their gains from being suppressed.

Table 3. Nutritional Value of Available Feeds

Feed	Dry Matter %	NE m Mcal/lb	NE g Mcal/lb	Crude Protein %
Mixed mostly grass hay	88	.55	.24	12.5
Mixed mostly legume hay crop silage	47	.58	.27	17
Corn silage	33	.71	.46	8.5
Dry shelled corn	89	1.02	.67	10
High moisture shelled corn	70	.89	.58	10
Soybean meal (48% CP)	90	.91	.60	53.9
Limestone	99	--	--	--
Dicalcium phosphate	99	--	--	--
Trace mineral salt	99	--	--	--
Urea	89	--	--	281

Table 4. Recommended Complete Calf Starter[a/]

Calf Starter	Percent of Ration
Corn and Cob Meal	20
Crushed Oats	25
Beet Pulp	16
Brewer's Grains	10
Soybean Meal (44% CP)	18
Molasses	7
Minerals	4

[a/] Fox and Warner, 1980.

Also more bunk space should be allowed per head when the variation in size within a pen is large. Since the rations are balanced to be fed ad libitum, feed should be available to the cattle at all times.

Total Feed Requirements

Total feed requirements for rearing the heifers and steers to the different stages of growth are shown in Tables 5-8. The performance simulation program developed for a microcomputer by Fox et al. (1981) was used to summate total feed use. Note that nearly all of the diet for the heifers after the first year of age is forages; supplemental energy and protein are needed for the first year, however.

Steer rations require more supplementation of grain than the heifers after a year of age because of the higher rate of gain being supported (Tables 7 and 8). Those rations containing hay crop require less supplemental protein, especially when they contain legumes. However, more corn grain must be fed because of the lower energy content of hay crop compared to corn silage. If the steers are not given growth stimulants and Rumensin, rate of gain and feed efficiency will decrease by approximately 15 percent from 540 pounds to slaughter weight (Minish and Fox 1981). The days required to reach 540 pounds could be reduced by about 30 days from that shown in this paper and feed requirements during this phase would be reduced about 6-8 percent if they were implanted with a growth stimulant during this phase. This could be done to the steers but not to the heifers during the time they are fed together.

Table 5. Feed Consumed by Heifers on Farms Having Mixed Mostly Grass as the Hay Source

Age, Months	Expected Weight (lbs.)	Feed (lbs. Consumed as Fed)					
		Hay[a/]	Corn Silage	Dry Corn[b/]	SBM[c/]	Dicalcium Phosphate	TM Salt
Hay Based Ration							
2-6	160-340	688	0	337	78	20	5
6-12	340-670	1,458	0	1,200	169	26	13
12-24	670-1100	6,922	0	1,616	0	0	38
Total		9,068	0	3,153	247	46	56
50% Corn Silage/50% Hay Crop Based Ration							
2-6	160-340	432	1,148	135	100	25	5
6-12	340-670	922	2,379	726	253	26	13
12-24	670-1100	4,979	10,195	0	0	40	40
Total		6,333	13,722	861	353	91	58
Corn Silage Based Ration							
2-6	160-340	285	1,785	0	123	25	5
6-12	340-670	0	6,563	0	363	38	13
12-24	670-1100	4,979	10,195	0	0	40	40
Total		5,264	18,543	0	486	103	58

[a/] Mixed mostly grass.

[b/] Dry shelled corn.

[c/] Soybean meal.

Table 6. Feed Consumed by Heifers on Farms With Mixed Mostly Legume Hay Crop Silage and High Moisture Shell Corn Based Ration

Age Months	Expected Weight (lbs.)	Feed (lbs. Consumed as Fed)					
		Hay[a/]	Corn Silage	HMSC[b/]	SBM[c/]	Dicalcium Phosphate	TM Salt
Hay Based Ration							
2-6	160-340	1,168	0	570	22	25	5
6-12	340-670	2,206	0	1,933	113	26	13
12-24	670-1100	13,609	0	1,817	0	0	39
Total		16,983	0	4,320	135	51	57
50% Corn Silage/50% Hay Crop Based Ration							
2-6	160-340	816	1,163	221	55	20	5
6-12	340-670	1,479	2,105	1,299	197	38	13
12-24	670-1100	11,237	7,075	0	0	0	39
Total		13,532	10,343	1,520	252	58	57
Corn Silage Based Ration							
2-6	160-340	550	1,898	0	88	25	5
6-12	340-670	0	6,526	0	334	38	13
12-24	670-1100	11,237	7,075	0	0	0	39
Total		11,787	15,499	0	422	63	57

[a/] Hay crop silage.

[b/] High moisture shelled corn.

[c/] Soybean meal.

Table 7. Feed Consumed by Steers on Farms Having Mixed Mostly Grass as the Hay Source

Age, Months	Expected Weight (lbs.)	Feed (lbs. Consumed as Fed)							
		Hay[a/]	Corn Silage	Dry Corn[b/]	SBM[c/]	Urea	Dicalcium Phosphate	Lime-stone	TM Salt
Hay Based Ration									
2-9	160-540	1,320	--	885	152	--	30	--	11
9-14	540-850	1,287	--	1,053	97	--	11	--	11
14-21	850-1250	2,244	--	2,026	--	--	--	--	19
Total		4,851	--	3,964	249	--	41	--	41
50% Corn Silage/50% Hay Crop Based Ration									
2-9	160-540	832	2,218	475	212	--	35	--	11
9-14	540-850	842	2,246	637	121	--	11	--	11
14-21	850-1250	1,367	3,646	1,352	--	20	--	--	18
Total		3,041	8,110	2,464	333	20	46	--	40
Corn Silage Based Ration									
2-9	160-540	250	4,817	--	286	--	41	--	11
9-14	540-850	--	5,816	--	217	--	22	22	11
14-21	850-1250	--	10,609	400	--	44	20	20	20
Total		250	21,242	400	503	44	83	42	42

[a/] Mixed mostly grass.

[b/] Dry shelled corn.

[c/] Soybean meal.

Table 8. Feed Consumed by Steers on Farms Having Mixed Mostly Legume Hay Crop Silage as the Hay Source

Age, Months	Expected Weight (lbs.)	Feed (lbs. Consumed as Fed)							
		HCS[a/]	Corn Silage	HMSC[b/]	SBM[c/]	Urea	Dicalcium Phosphate	Lime-stone	TM Salt
Hay Based Ration									
2-9	160-540	2,109	--	1,451	75	--	35	--	11
9-14	540-850	2,048	--	1,719	--	--	11	--	11
14-21	850-1250	3,227	--	3,196	--	--	19	--	19
Total		7,384	--	6,366	75	--	65	--	41
50% Corn Silage/50% Hay Crop Based Ration									
2-9	160-540	1,443	2,055	832	145	--	36	--	11
9-14	540-850	1,383	1,970	1,145	48	--	11	--	11
14-21	850-1250	2,309	3,288	2,381	--	--	20	--	20
Total		5,135	7,313	4,358	193	--	67	--	42
Corn Silage Based Ration									
2-9	160-540	482	4,876	--	242	--	41	--	11
9-14	540-850	--	5,862	--	205	--	22	22	11
14-21	850-1250	--	9,585	822	--	43	39	--	19
Total		482	20,323	822	447	43	102	22	41

[a/] Hay crop silage.

[b/] High moisture shelled corn.

[c/] Soybean meal.

APPENDIX

Appendix
Table 1. Heifer Rations for Farms Having Mixed Mostly Grass as the Hay Source

Age, Months	Expected Weight (lbs.)	Ration Composition, % of Dry Matter						NE_m d/ (Mcal/lb.DM)	NE_g e/ (Mcal/lb.DM)
		Hay a/	Corn Silage	Dry Corn b/	SBM c/	Dicalcium Phosphate	TM Salt		
Hay Based Ration									
2-6	160-340	60.5	--	30	7	2.0	.5	.70	.39
6-12	340-670	50.5	--	42	6	1.0	.5	.76	.44
12-24	670-1100	80.5	--	19	--	0	.5	.64	.32
50% Corn Silage/50% Hay Crop Based Ration									
2-6	160-340	38.0	38	12	9	2.5	.5	.68	.40
6-12	340-670	32.0	32	.5	9	1.0	.5	.74	.45
12-24	670-1100	56.0	43	--	--	.5	.5	.61	.33
Corn Silage Based Ration									
2-6	160-340	25.0	61	--	11	2.5	.5	.67	.40
6-12	340-670	--	85	--	13	1.5	.5	.72	.47
12-24	670-1100	56.0	43	--	--	.5	.5	.61	.33

a/ Mixed mostly grass.

b/ Dry shelled corn.

c/ Soybean meal.

d/ Net energy value for maintenance, Mcal/lb.

e/ Net energy value for gain, Mcal/lb.

Appendix Table 2. Heifer Rations for Farms Having Mixed Mostly Legume Hay Crop Silage as the Hay Source

Age Months	Expected Weight (lbs.)	Ration Composition, % of Dry Matter						NE_m[d] (Mcal/lb.DM)	NE_g[e] (Mcal/lb.DM)
		HCS[a]	Corn Silage	HMSC[b]	SBM[c]	Dicalcium Phosphate	TM Salt		
Hay Based Ration									
2-6	160-340	55	--	40.0	2	2.5	.5	.69	.39
6-12	340-670	41	--	53.5	4	1.0	.5	.75	.45
12-24	670-1100	83	--	16.5	--	0	.5	.63	.32
50% Corn Silage/50% Hay Crop Based Ration									
2-6	160-340	38.5	38.5	15.5	5	2.0	.5	.68	.40
6-12	340-670	27.5	27.5	36.0	7	1.5	.5	.74	.45
12-24	670-1100	69.0	30.5	--	--	--	.5	.62	.33
Corn Silage Based Ration									
2-6	160-340	26	63.0	--	8	2.5	.5	.67	.41
6-12	340-670	--	86.0	--	12	1.5	.5	.72	.47
12-24	670-1100	69	30.5	--	--	--	.5	.62	.33

[a] Hay crop silage.

[b] High moisture shelled corn.

[c] Soybean meal.

[d] Net energy value for maintenance, Mcal/lb.

[e] Net energy value for gain, Mcal/lb.

Appendix
Table 3. Steer Finishing Rations for Farms Having Mixed Mostly Grass as the Hay Source

Age, Months	Expected Weight (lbs.)	Ration Composition, % of Dry Matter								NE_m [d] (Mcal/lb.DM)	NE_g [e] (Mcal/lb.DM)
		Hay [a]	Corn Silage	Dry Corn [b]	SBM [c]	Urea	Dicalcium Phosphate	Lime-stone	TM Salt		
Hay Based Ration											
9-14	540-850	51	--	43.0	4	--	.5	--	.5	.75	.43
14-21	850-1250	52	--	47.5	--	--	--	--	.5	.77	.44
50% Corn Silage/50% Hay Crop Based Ration											
9-14	540-850	34	34	26.0	5	--	.5	--	.5	.74	.44
14-21	850-1250	33	33	33.0	--	.5	--	--	.5	.75	.45
Corn Silage Based Ration											
9-14	540-850	--	88.5	--	9	--	1	1	.5	.71	.46
14-21	850-1250	--	88.5	9	--	1	.5	.5	.5	.72	.45

[a] Mixed mostly grass.

[b] Dry shelled corn.

[c] Soybean meal.

[d] Net energy value for maintenance, Mcal/lb.

[e] Net energy value for gain, Mcal/lb.

Appendix
Table 4. Steer Finishing Rations for Farms Having Mixed Mostly Legume Hay Crop Silage as the Hay Source

Age, Months	Expected Weight (lbs.)	Ration Composition, % of Dry Matter								NE_m[d/] (Mcal/lb.DM)	NE_g[e/] (Mcal/lb.DM)
		HCS[a/]	Corn Silage	HMSC[b/]	SBM[c/]	Urea	Dicalcium Phosphate	Lime-stone	TM Salt		
Hay Crop Based Ration											
9-14	540-850	44	--	55	--	--	.5	--	.5	.74	.44
14-21	850-1250	40	--	59	--	--	.5	--	.5	.76	.45
50% Corn Silage/50% Hay Crop Based Ration											
9-14	540-850	30	30	37	2	--	.5	--	.5	.73	.45
14-21	850-1250	28	28	43	--	--	.5	--	.5	.74	.45
Corn Silage Based Ration											
9-14	540-850	--	89	--	8.5	--	1	1	.5	.71	.46
14-21	850-1250	--	82.5	15	--	1	1	--	.5	.72	.47

[a/] Hay crop silage.

[b/] High moisture shelled corn.

[c/] Soybean meal.

[d/] Net energy value for maintenance, Mcal/lb.

[e/] Net energy value for gain, Mcal/lb.

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