ECONOMIC UTILIZATION OF FORAGES IN THE PRODUCTION OF MILK AND BEEF IN THE NORTHEAST UNITED STATES

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INTRODUCTION

Historically, the production, storage and feeding of forages has been a topic of considerable analysis by animal scientists and agricultural economists. In today's economic environment, forage system selection may be even more crucial to farm profitability. With farm production expenses rising rapidly, most of which are not directly controllable by the individual business, it is imperative that component strategies of a farming system that utilizes resources most efficiently be selected. Perhaps no single component strategy has such extensive implications for profitability as the selection of a forage production, storage and feeding system. Capital investments in forage machinery, feed storage units and feeding equipment in the hundreds of thousands of dollars and production expenses to grow or purchase feeds in the tens of thousands of dollars are not uncommon. Minimizing these costs and thereby using resources efficiently can increase the likelihood of profitability.

With present high beef price levels, many are advocating utilization of the marginal land resources of the Northeast for beef production. Estimates of farm profitability with selected milk and beef production enterprises can provide insight into future production systems which may exist on these resources.

The objectives of this paper are 1. to determine the most economical forage production, storage and feeding system for milk production, finishing dairy steers to slaughter weight and finishing traditional beef breed steers to slaughter weight on a productive land resource, 2. to determine the most economical forage production, storage and feeding system for milk production, finishing dairy steers and a traditional beef breed cow-calf operation on a marginal land resource and 3. to compare profitability of milk production, feeding dairy steers and a traditional beef breed cow-calf operation on a marginal land resource.

METHOD OF STUDY

Representative farm land resource situations are specified for a productive land resource and a marginal land resource. Acreage, productivity

and rotation constraints are specified for the two soil resource situations (Table 1). These resource situations are constructed to be representative of those found in many areas of the Northeast.

Table 1. PRODUCTIVE AND MARGINAL LAND RESOURCE SITUATIONS: YIELDS AND ROTATION CONSTRAINTS

	Representative Farm Size(s)	Yield/Acre	Rotation Constraints
PRODUCTIVE LAND RESOURCE	480 and 300 Acres		
Hay Crop Silage[a/]		6.2 T.	Minimum 80 acres
Corn Silage		16 T.	Maximum 400 & 220
Corn Grain		95 bu.	acres respectively
MARGINAL LAND RESOURCE	160 Acres		
Pasture		1.0 T.	50 acres suitable for pasture
Hay[b/]		1.75 T.	Minimum 70 acres
Corn Silage		12 T.	Maximum 40 acres

a/ Yields above the 80 acre minimum increase to 7.3 T/Acre. Hay crop silage is 40 percent dry matter.

b/ Yields on the 40 acres which could grow corn increase to 2.25 T/Acre.

The most economical forage system is determined for each livestock enterprise on the productive and the marginal land resource. This analysis concerns the choice of the best system in the intermediate to long run; therefore, variable and fixed costs are considered. The cost of capital investments are based on new equipment purchased at 1978 prices. After the most economical forage systems are determined, the profitability of livestock enterprises on the marginal land resource is considered using the most economical forage system. In the profitability calculation, an existing dairy farm is used to compare profitability of continued milk production and converting to beef production.

The forage systems contain differing proportions of hay crop and corn silage. On the productive land resource the three forage compositions for milk production are 1. hay crop silage as the only forage, 2. equal parts

of hay crop silage and corn silage on a dry matter basis and 3. mostly corn silage with 30 percent of the forage dry matter from hay crop silage. For the dairy steers and traditional beef breed steers the first two forage compositions for milk production and two compositions containing 75 and 100 percent of the forage from corn silage are compared.

On the marginal land resource the corn silage based systems are not considered. Forage systems for milk production and feeding dairy steers are 1. all hay or 2. equal parts hay and corn silage.

Traditional beef breed cow-calf systems analyzed are 1. an all hay system in which the first cutting is harvested as hay and remaining growth pastured and 2. a corn silage and pasture system in which all hay production is pastured. Sale of feeders in the fall or backgrounded and sold in the spring are also studied for each forage system.

The most economical forage system is determined by calculating the total production, storage and feeding costs for each forage composition. This calculation has three components. The first is formulation of rations for each forage composition, the second is determination of storage facilities and equipment required and their associated costs, and the third is the calculation of crop production costs and feed purchases or sales.

In formulating rations, milk production and rate of gain are the same for each roughage composition. Milk production is 16,000 pounds per cow per year on the productive land resource and 13,000 pounds per year on the marginal land resource (Table 2). A least cost balanced dairy ration model was used for milking cows, dry cows and heifers (6, 10, 12). Rations for dairy steers and traditional beef breed steers were formulated using a least cost ration program and performance simulation model (1, 2, 5). All rations formulated for the productive land resource are designed to attain a low rate of gain initially (NEg of 0.45 Mcal/lb. of dry matter) and a high rate of gain (NEg of 0.57 Mcal/lb. of dry matter) for finishing. On the marginal land resource, these low-high rates of gain and a low-low (NEg of .45 Mcal/lb. of dry matter for finishing) rate of gain are both considered (Table 2). Feed requirements for the cow-calf operation are formulated by a budgeting procedure (4).

The second component of the analysis is the calculation of investments and annual costs of forage harvesting, forage and grain storage, and feeding equipment. Herd size and feedlot capacities indicated in Table 2 are used for these calculations. On the productive land resource, dairy herd size and beef feedlot capacities are specified to require approximately the same crop production capability (forages and corn grain). On the marginal land resource the size of the livestock enterprise is tied to the forage producing capability of the land resource.

The third component of the analysis is to utilize the formulated rations, the land resource with its crop yields ard rotation restrictions (Table 1), and the storage and feeding losses of the specified systems to determine crop

Table 2. LIVESTOCK ENTERPRISES ON THE PRODUCTIVE AND MARGINAL LAND RESOURCES

	Herd Size or Feedlot Capacity	Production or Weight Gain
PRODUCTIVE LAND RESOURCE		
Dairy Livestock		
Dairy Cows	120	16,000# milk
Heifers	77	28 months-birth to freshening
Dairy Steers	400[a/]	140 - 1,250#
Traditional Beef Breed Steers	400[a/]	450 - 1,050#
MARGINAL LAND RESOURCE		
Dairy Livestock		
Dairy Cows	35	13,000# milk
Heifers	23	28 months-birth to freshening
Dairy Steers	180 and 130[b/]	140 - 1,250#
Beef Cow-Calf Operation	50, 46, 68 and 56[c/]	500# and 780# feeder steers[d/] 420# and 660# feeder heifers[d/]

a/ 328 head of dairy steers sold annually and 532 head of traditional beef breed steers sold annually. A low rate of gain ration (NEg of .45 Mcal/lb. dry matter) is fed to 850 pounds for dairy steers and 650 pounds for traditional beef breeds. A high rate of gain ration (NEg of .57 Mcal/lb. dry matter) is fed to finish weight.

b/ 148 and 97 head of dairy beef sold annually with a low-high rate of gain and low-low rate of gain respectively.

c/ Number of beef cows with all hay forage system - fall sale of feeders; all hay - spring sale of feeders; corn silage and pasture - fall sale and corn silage; and pasture - spring sale, respectively. Ninety percent calf crop weaned.

d/ Fall and spring sale weights respectively.

enterprise acreages, crop production costs, crop sales and off farm feed purchases (11). The three components yield partial budgets which can be used to select the most economical forage system. Profitability calculations on the marginal land resource require total farm budgets which utilize partial budgets for the most economical forage system.

RESULTS

The results for the productive and marginal land resources are presented separately. For each land resource the investments are discussed, the budgets are presented, and conclusions are summarized.

Productive Land Resource

Investments and annual cost of forage harvesting, forage and grain storage, feeding equipment and labor exhibited the same trend when moving to higher levels of corn silage feeding for all three livestock enterprises (Tables 3 and 4). An increase in investments and annual costs resulted as corn silage is included in the forage mix at the 50 percent level and then decreased with an increasing quantity of corn silage in the forage mix. This can be attributed to three factors. First, the addition of a crop head to the forage machinery required increased investments. Second, increased forage dry matter is handled in systems using larger amounts of corn silage. The increase in dry matter to be stored increased costs because of storing a smaller amount of hay crop silage at a higher per unit cost without attaining full benefit of the economies in storing corn silage in a bunker silo. At higher levels of corn silage feeding this effect is overcome. Third, ration requirements and, thereby, investments in grain storage decrease as corn silage content of the forage mix increases.

The most economical forage system for the production of milk contains 50 percent of the forage dry matter from hay crop silage and 50 percent from corn silage for both 480 and 300 acre productive land resource farms (Table 5). This results even though forage harvesting, feed storage, and feeding costs are largest for this system. In feeding dairy cows, the hay crop silage and corn silage complement each other with the protein from the hay keeping purchases of soybean meal down and the energy from the corn silage reducing the corn grain requirement. On the 480 acre farm, the land extensiveness of the hay crop silage only system leaves almost no land for use in producing crops for cash sale. Although both crop production expenses and feed purchases are lowest, the almost complete use of the land resource for feeding the dairy livestock prevents this system from being the lowest cost. The mostly corn silage system proves less economical because of the large soybean meal purchases. If corn grain as a cash crop were more profitable or a more profitable cash crop were grown, the mostly corn silage system could become the most economical.

Table 3. INVESTMENTS AND ANNUAL COSTS OF FORAGE HARVESTING, STORAGE AND FEEDING EQUIPMENT FOR ALTERNATIVE HAY CROP SILAGE AND CORN SILAGE FORAGE SYSTEMS FOR A 120 COW DAIRY, 1978

	Percent Hay Crop Silage in Forage Mix		
	100	50	30
FORAGE HARVESTING MARCHINERY[a/]	$ 36,400	$ 39,000	$ 39,000
FORAGE STORAGE[b/]	65,500	67,000	53,500
GRAIN STORAGE[c/]	12,400	10,900	9,500
FEEDING EQUIPMENT[d/]	11,300	12,500	12,500
TOTAL INVESTMENT	$125,600	$129,400	$114,500
TOTAL ANNUAL COST[e/]	$ 22,600	$ 24,170	$ 22,080

a/ Includes a mower-conditioner-windrower, rake, forage harvester with pick-up head and forage wagons for each system plus a crop head for the two systems containing corn silage.

b/ Hay crop silage is stored in upright concrete silos and corn silage in concrete tilt-up bunker. Investments include unloaders for tower silos.

c/ High moisture corn is stored in upright concrete silos. Investment includes the unloader.

d/ Includes silo blower and mixer wagon.

e/ Annual costs include depreciation, repairs, interest, insurance, taxes and labor valued at $3.75 per hour. Labor hours required are variable from farm to farm, but relative usage is believed accurate. If labor is operator supplied, it is not a cash cost. Lower labor requirements allow for completion of other tasks, management or leisure activities.

Table 4. INVESTMENTS AND ANNUAL COSTS OF FORAGE HARVESTING, STORAGE AND FEEDING EQUIPMENT FOR ALTERNATIVE HAY CROP SILAGE AND CORN SILAGE FORAGE SYSTEMS FOR A 400 HEAD CAPACITY DAIRY STEER AND TRADITIONAL BEEF BREED STEER FEEDLOT, 1978

	Percent Hay Crop Silage in Forage Mix			
	100	50	25	0
	Dairy Steers			
FORAGE HARVESTING MACHINERY[a/]	$ 36,400	$ 39,000	$ 39,000	$ 37,500
FORAGE STORAGE[b/]	32,600	37,200	35,000	21,500
GRAIN STORAGE[c/]	34,200	29,200	19,300	15,200
FEEDING EQUIPMENT[d/]	11,300	12,500	12,500	12,500
TOTAL INVESTMENT	$114,500	$117,900	$105,800	$ 86,700
TOTAL ANNUAL COST[e/]	$ 20,680	$ 22,240	$ 20,450	$ 17,100
	Traditional Beef Breed Steers			
FORAGE HARVESTING MACHINERY[a/]	$ 36,400	$ 39,000	$ 39,000	$ 37,500
FORAGE STORAGE[b/]	30,900	30,800	30,000	19,000
GRAIN STORAGE[c/]	36,600	36,600	34,200	29,200
FEEDING EQUIPMENT[d/]	11,300	12,500	12,500	12,500
TOTAL INVESTMENT	$115,200	$118,900	$115,700	$ 98,200
TOTAL ANNUAL COST[e/]	$ 20,870	$ 22,310	$ 21,920	$ 18,830

a/ Includes a mower-conditioner-windrower, rake, forage harvester with pick-up head and forage wagons for each system plus a crop head for the two systems containing corn silage.

b/ Hay crop silage is stored in upright concrete silos and corn silage in concrete tilt-up bunker. Investments include unloaders for tower silos.

c/ High moisture corn is stored in upright concrete silos. Investment includes the unloader.

d/ Includes silo blower and mixer wagon.

e/ Annual costs include depreciation, repairs, interest, insurance, taxes and labor valued at $3.75 per hour. Labor hours required are variable from farm to farm, but relative usage is believed accurate. If labor is operator supplied, it is not a cash cost. Lower labor requirements allow for completion of other tasks, management or leisure activities.

Table 5. CROP PRODUCTION, FEED PURCHASE AND HARVEST, STORAGE AND FEEDING COSTS AND CROP SALES FOR MILK PRODUCTION WITH THREE ALTERNATIVE FORAGE SYSTEMS ON A 480 AND 300 ACRE REPRESENTATIVE FARM

CATEGORY	Representative Farm Size					
	480 Acres			300 Acres		
	Percent Hay Crop Silage in Forage Mix					
	100	50	30	100	50	30
CROP PRODUCTION[a/]						
Hay Crop Silage	$22,250	$12,280	$ 6,640	$22,250	$12,280	$ 6,640
Corn Silage	--	9,650	17,050	--	9,650	17,050
Corn Grain	19,350	25,930	27,310	1,750	5,550	6,040
FEED PURCHASES[b/]						
Corn Grain	--	--	--	40,040	13,950	5,650
Soybean Meal	4,940	18,900	28,830	4,940	18,900	28,830
Minerals	1,390	1,550	1,620	1,390	1,550	1,620
CROP SALES[b/]						
Corn Grain	(380)	(25,210)	(33,100)	--	--	--
FORAGE HARVEST, STORAGE AND FEEDING ANNUAL COSTS[c/]	22,600	24,170	22,080	20,770	24,110	22,210
ANNUAL COSTS	$70,150	$67,270	$70,430	$91,140	$85,990	$88,040

a/ Crop production costs are from (11). All variable costs of production, including labor at $3.75 per hour are included. Drying and marketing costs are added for corn grain sold.

b/ Corn grain is purchased at $2.60 per bushel, soybean meal at $260 per ton and urea at $180 per ton. Corn grain is sold for $2.25 per bushel.

c/ From Table 3 with decreased costs where all corn grain requirements cannot be produced and consequently need not be stored.

When the land resource is reduced to 300 acres, the system with hay crop silage as the only forage becomes relatively less economical. Over 95 percent of the corn grain required must be purchased with this system. The corn silage based system allows for production of most of the corn grain requirement; however, total feed purchases and crop production expenses are more than for the equal proportions of hay crop silage and corn silage system.

The most economical forage system for the production of slaughter weight dairy steers for both the 480 and 300 acre land resource is the total corn silage forage system (Table 6). A system with 100 percent of the forage from hay crop silage on the 480 acre land resource has the lowest crop production and purchased feed costs. Unlike the systems containing larger amounts of corn silage, there are no crops available for cash sale. The crops for cash sale, in combination with lower harvest, storage and feeding costs, make the total corn silage system the lowest cost. While the result is the same on the 300 acre land resource, the causes are different. Corn grain purchases on the 100 percent hay crop silage system are larger than total feed purchases for the other systems. Combining the lower feed costs for systems with corn silage and the fact that crop sales increase as larger quantities of corn silage are produced results in significantly lower costs for the all corn silage system.

The most economical forage system for traditional beef breed steer production for both the 480 and 300 acre land resource is again the total corn silage system (Table 7). The same relationships among crop production expenses, feed purchases, and crop sales exist as with the dairy steer production. The differential, however, between all hay crop silage and all corn silage systems narrows. A 12 percent reduction in forage system costs occurs with traditional beef breeds, compared with almost 20 percent with dairy beef. This difference results primarily from the larger amount of roughage utilized by the dairy beef which accentuates the difference between roughage producing systems.

The difference in most economical forage composition between dairy and beef are significant and result from the nature of the production in the two livestock enterprises. The dairy cow is primarily a milk producing animal and consequently requires large amounts of protein; the beef animals however, are producing weight gain and consequently require relatively larger quantities of energy and less protein. These conclusions are consistent with the historical importance of milk production in the Northeast.

Marginal Land Resource

The marginal land resource is comprised of 160 acres with productivity, rotation constraints and location characteristics which put these operations at a comparative disadvantage. Most of the small, poor quality land resources in the Northeast are used for dairy production. This analysis focuses on the most efficient use of these resources to produce forage for milk production, dairy steer production and a traditional beef breed cow-calf operation. A

Table 6. CROP PRODUCTION, FEED PURCHASE AND HARVEST, STORAGE AND FEEDING COSTS AND CROP SALES WITH FOUR ALTERNATIVE FORAGE SYSTEMS ON A 480 AND 300 ACRE REPRESENTATIVE FARM FOR SLAUGHTER WEIGHT DAIRY STEER PRODUCTION

CATEGORY	Representative Farm Size							
	480 Acres				300 Acres			
	Percent Hay Crop Silage in Forage Mix							
	100	50	25	0	100	50	25	0
CROP PRODUCTION[a/]								
Hay Crop Silage	$14,350	$ 9,670	$ 6,160	$ 6,110	$14,350	$ 9,670	$ 6,160	$ 6,110
Corn Silage	--	7,850	13,910	20,520	--	7,850	13,910	20,520
Corn Grain	28,950	29,070	29,110	23,120	11,400	10,330	9,360	3,610
FEED PURCHASES[b/]								
Corn Grain	1,120	--	--	--	43,990	30,920	20,910	23,400
Soybean Meal	4,080	7,410	10,190	13,910	4,080	7,410	10,190	13,910
Urea, Rumensin, and Minerals	910	1,140	1,610	2,300	910	1,140	1,160	2,300
CROP SALES[c/]								
Dry Hay	--	--	(150)	(8,700)	--	--	(150)	(8,700)
Corn Grain	--	(10,730)	(19,710)	(17,480)	--	--	--	--
FORAGE HARVEST, STORAGE AND FEEDING ANNUAL COSTS[d/]	20,680	22,240	20,450	17,100	18,090	19,990	19,700	16,160
TOTAL ANNUAL COSTS	$70,090	$66,650	$61,570	$56,880	$92,820	$87,310	$81,690	$77,310

a/ Crop production costs are from (11). All variable costs of production, including labor at $3.75 per hour are included. Drying and marketing costs are added for corn grain sold.

b/ Corn grain is purchased at $2.60 per bushel, soybean meal at $260 per ton and urea at $180 per ton. Corn grain is sold for $2.25 per bushel.

c/ Hay sold as baled hay at $50 per ton. Incorporating harvesting loss differentials, one ton of dry hay can be sold for every 2.85 tons of hay crop silage produced. Corn grain is sold for $2.25 per bushel.

d/ From Table 4 with decreased costs where all corn grain requirements cannot be produced and consequently need not be stored.

Table 7. CROP PRODUCTION, FEED PURCHASE AND HARVEST, STORAGE AND FEEDING COSTS AND CROP SALES FOR SLAUGHTER WEIGHT TRADITIONAL BEEF STEER PRODUCTION WITH FOUR ALTERNATIVE FORAGE SYSTEMS ON A 480 AND 300 ACRE REPRESENTATIVE FARM

CATEGORY	Representative Farm Size							
	480 Acres				300 Acres			
	Percent Hay Crop Silage in Forage Mix							
	100	50	25	0	100	50	25	0
CROP PRODUCTION[a/]								
Hay Crop Silage	$11,650	$ 7,900	$ 6,150	$ 6,110	$11,650	$ 7,900	$ 6,150	$ 6,110
Corn Silage	--	6,170	10,880	16,820	—	6,170	10,880	16,820
Corn Grain	32,260	32,470	31,140	25,780	14,720	13,940	11,990	6,820
FEED PURCHASES[b/]								
Corn Grain	1,540	--	--	--	44,410	32,920	26,970	28,870
Soybean Meal	4,160	7,360	10,560	14,270	4,160	7,360	10,560	14,270
Urea, Rumensin, and Minerals	1,170	1,530	2,030	2,830	1,170	1,530	2,030	2,830
CROP SALES[c/]								
Dry Hay	--	--	(1,900)	(8,700)	--	--	(1,900)	(8,700)
Corn Grain	--	(8,930)	(14,270)	(12,560)	--	--	--	--
FORAGE HARVEST, STORAGE AND FEEDING ANNUAL COSTS[d/]	20,870	22,310	21,920	18,830	18,250	19,690	19,330	16,430
TOTAL ANNUAL COSTS	$70,480	$68,810	$66,510	$63,380	$94,360	$89,510	$86,010	$83,450

a/ Crop production costs are from (11). All variable costs of production, including labor at $3.75 per hour are included. Drying and marketing costs are added for corn grain sold.

b/ Corn grain is purchased at $2.60 per bushel, soybean meal at $260 per ton and urea at $180 per ton. Corn grain is sold for $2.25 per bushel.

c/ Hay sold as baled hay at $50 per ton. Incorporating harvesting loss differentials, one ton of dry hay can be sold for every 2.85 tons of hay crop silage produced. Corn grain is sold for $2.25 per bushel.

d/ From Table 4 with decreased costs where all corn grain requirements cannot be produced and consequently need not be stored.

comparison of the profitability of each of these livestock enterprises provides insight into potential future uses of this land resource.

Investments and annual costs of forage harvesting, storage and feeding equipment are almost double with the system that contains corn silage for both milk and dairy steer production (Table 8). More forage is stored with corn silage in the ration and higher investments are required to harvest and store two forages rather than only baled hay. For cow-calf production, forage system investments exhibit a similar pattern when corn silage is included, but are at a lower level as a result of most or all of the hay production being pastured.

Most Economical Forage Systems

The most economical forage system for milk production with a 35 cow dairy farm is the all hay forage system (Table 9). Equipment investments to include corn silage in the forage mix outweigh the advantages of lower corn grain purchases and fewer acres necessary to meet forage requirements. However, if a suitable storage structure and feeding system were in existence on the farm, then utilization of those resources would be profitable if economical harvesting was available. Thus, if a farm is currently following a forage system with hay as the only forage and an inclusion of corn silage would necessitate investments in harvest, storage and feed equipment, the likely result would be to lower profits.

For dairy steer production, the most economical forage system per head sold is to feed the low rate of gain ration to 850 pounds and a high rate of gain to market weight with an all hay forage system (Table 10). With the low-low rate of gain ration, 35 percent fewer animals can be fed per year which is not offset by the 28% lower forage cost. Only minor cost differences exist between hay and hay and corn silage systems within each rate of gain category.

For fall and spring sale of feeder calves from the traditional beef breed cow-calf operation the corn silage and pasture system is most economical per 1,000 pounds produced (Table 11). The major factor involved is an increase in beef cow units carried per acre, without offsetting increases in equipment costs. Since all hay land is pastured and the corn silage is the exclusive source of winter feed, only one set of harvesting equipment is required.

Table 8. INVESTMENTS AND ANNUAL COSTS OF FORAGE HARVESTING, STORAGE AND FEEDING EQUIPMENT FOR TWO HAY AND CORN SILAGE FORAGE SYSTEMS FOR MILK AND DAIRY STEER PRODUCTION ON A 160 ACRE MARGINAL LAND RESOURCE, 1978

	Dairy		Dairy Steers	
	Percent Hay in Forage Mix			
	100	50	100	50
FORAGE HARVESTING MARCHINERY[a/]	$15,100	$30,500	$15,100	$30,500
FORAGE STORAGE[b/]	9,100	20,000	7,700	21,200
FEEDING EQUIPMENT[c/]	--	2,300	6,700	8,400
TOTAL INVESTMENT	$24,200	$52,800	$28,500	$60,100
TOTAL ANNUAL COST[d/]	$ 4,970	$ 9,710	$ 6,090	$11,310

a/ Includes a mower-conditioner-windrower, rake, baler, and bale wagons for the all hay system and a forage harvester and forage wagons for the system containing corn silage.

b/ Hay is stored in a hay barn and corn silage in upright concrete silo. Investment includes silo unloader.

c/ Includes silo blower for all systems, feed cart for corn silage system in milk production and mixer wagon for beef steer production.

d/ Annual costs include depreciation, repairs, interest, insurance, taxes and labor valued at $3.75 per hour. Labor hours required are variable from farm to farm, but relative usage is believed accurate. If labor is operator supplied, it is not a cash cost. Lower labor requirements allow for completion of other tasks, management or leisure activities.

Table 9. CROP PRODUCTION, FEED PURCHASE, HARVEST, STORAGE AND FEEDING COSTS AND CROP SALES FOR MILK PRODUCTION WITH TWO FORAGE SYSTEMS ON A 160 ACRE MARGINAL LAND RESOURCE FARM

	Percent Hay in Forage Mix	
	100	50
CROP PRODUCTION[a/]		
Pasture	$ 960	$ 960
Hay	8,000	5,360
Corn Silage	--	3,130
FEED PURCHASES[b/]		
Corn Grain	11,540	6,020
Soybean Meal	650	3,950
Minerals	320	360
CROP SALES[c/]		
Hay	(850)	(2,050)
FORAGE HARVEST, STORAGE AND FEEDING ANNUAL COSTS[d/]	4,970	9,710
ANNUAL COSTS	$25,590	$27,440

a/ Crop production costs are from (11). All variable costs of production, including labor at $3.75 per hour are included. Drying and marketing costs are added for corn grain sold.

b/ Corn grain is purchased at $2.60 per bushel, soybean meal at $260 per ton and urea at $180 per ton.

c/ Hay sold at $50 per ton.

d/ From Table 8.

Table 10. CROP PRODUCTION, FEED PURCHASE, HARVEST, STORAGE AND FEEDING COSTS FOR DAIRY BEEF PRODUCTION WITH TWO FORAGE SYSTEMS AND RATES OF GAIN ON A 160 ACRE MARGINAL LAND RESOURCE

	Rate of Gain			
	Low-Low		Low-High	
	Percent Hay in Forage Mix			
	100	50	100	50
CROP PRODUCTION[a/]				
Pasture	$ 960	$ 960	$ 960	$ 960
Hay	8,000	4,960	8,000	4,960
Corn Silage	--	3,580	--	
FEED PURCHASES[b/]				
Corn Grain	19,540	12,210	32,420	25,340
Soybean Meal	1,200	2,180	1,850	3,330
Urea, Rumensin and Minerals	240	340	410	510
CROP SALES[c/]				
Hay	(1,600)	(1,000)	(1,600)	(1,050)
FORAGE HARVEST, STORAGE AND FEEDING ANNUAL COSTS[d/]	6,090	11,310	6,090	11,310
ANNUAL COSTS	$34,430	$34,540	$48,130	$48,940
PER HEAD SOLD	$ 355	$ 356	$ 325	$ 330

a/ Crop production costs are from (11). All variable costs of production, including labor at $3.75 per hour are included. Drying and marketing costs are added for corn grain sold.

b/ Corn grain is purchased at $2.60 per bushel, soybean meal at $260 per ton and urea at $180 per ton.

c/ Hay sold at $50 per ton.

d/ From Table 8.

Table 11. CROP PRODUCTION, FEED PURCHASE, HARVEST, STORAGE AND FEEDING COSTS FOR TRADITIONAL BEEF BREED COW-CALF OPERATION WITH TWO FORAGE SYSTEMS AND TIME OF CALF SALE ON A 160 ACRE MARGINAL LAND RESOURCE

	Forage System			
	All Hay		Silage & Pasture	
	Sale of Feeders			
	Fall	Spring	Fall	Spring
CROP PRODUCTION[a/]				
Pasture	$ 960	$ 960	$ 960	$ 960
Hay	6,180	6,180	2,160	2,160
Corn Silage	--	--	3,430	3,430
FEED PURCHASES[b/]				
Corn Grain	450	2,360	--	--
Soybean Meal	--	--	--	730
Urea and Minerals	440	490	820	820
FORAGE HARVEST, STORAGE AND FEEDING ANNUAL COSTS	4,450	4,450	5,640	5,640
ANNUAL COSTS	$12,480	$14,440	$13,010	$13,740
ANNUAL COSTS PER 1,000 LBS.	$ 498	$ 449	$ 382	$ 351

a/ Crop production costs are from (11). All variable costs of production, including labor at $3.75 per hour are included. Drying and marketing costs are added for corn grain sold.

b/ Corn grain is purchased at $2.60 per bushel, soybean meal at $260 per ton and urea at $180 per ton.

Profitability of Marginal Land Resource Farms

Two measures of profitability are calculated; cash income and the return to operator's labor and management. Cash income is cash receipts minus cash expenses. Return to operator's labor and management is cash income reduced for depreciation on buildings and equipment, the opportunity cost of the capital investment, and unpaid family labor. Return to operator's labor and management is, therefore, a residual claimant.

Cash expenses are representative of the 1978 period. Depreciation and interest on investment charges are based on existing market values for the base dairy farm. The additional investment in housing and feeding equipment to convert to dairy steer production is charged at new investment costs in 1978. Only fencing is a needed investment to convert the dairy facilities to cow-calf operation.

Prices used are conservative approximates of future prices. With milk prices related to cost of production, milk prices are almost certain to increase. A recent Congressional study projects milk prices at 75 percent of parity to average $15.85/cwt. in 1983 and average over $13.75 from 1979 to 1983. The $11.50/cwt. appears conservative in comparison, but the relationship between receipts and expenses is believed to be representative of an intermediate run situation. The same applies to beef and feeder prices used. They are below current levels, but are believed to be representative of a longer run situation.

Profitability of milk production exceeds all others, but is only slightly more profitable than feeding dairy steers to slaughter weight with a low-high rate of gain system (Table 12). Feeding dairy steers a low-low rate of gain ration does return more than $20,000 cash income but less than $100 return to operator's labor and management. Traditional beef breed cow-calf operations show $7,190 and $9,430 cash incomes for fall and spring sale of feeders respectively, but returns to labor and management are negative.

SUMMARY

Forage system selection can have a substantial impact on costs incurred in the production of milk and beef. On the productive land resource, growing either all forage and grain or only forage containing equal parts of hay crop silage and corn silage was the most economical forage system. For dairy steer and traditional beef breed steer production, the forage system containing 100 percent of the forage from corn silage was the low cost system.

On the marginal land resource, the all hay forage system was the most economical system for milk production. Investments in corn silage harvest equipment and a storage facility were not economical for the small acreage of corn silage. For dairy steer production, forage system costs were comparable but a slightly lower cost existed for the system with hay as the only forage. However, systems of corn silage and pasture were the most economical for the

Table 12. PROFITABILITY OF MILK PRODUCTION, FEEDING DAIRY STEERS TO SLAUGHTER WEIGHT AND A TRADITIONAL BEEF BREED COW-CALF OPERATION ON A 160 ACRE MARGINAL LAND RESOURCE

	Milk Production	Dairy Steers		Traditional Beef Breed Cow-Calf	
		Low-Low Rate of Gain	Low-High Rate of Gain	Feeders Sold in Fall	Feeders Backgrounded Sold in Spring
Cash Receipts	$57,510[a]	$65,150[b]	$99,400[b]	$17,270[c]	$19,770[c]
Cash Expenses[d]	27,780	44,545	65,625	10,080	10,340
Cash Income	$29,930	$20,605	$33,775	$ 7,190	$ 9,430
Depreciation and Interest on Investment[e]	$16,200	$19,110	$21,100	$16,510	$15,950
Unpaid Family Labor	1,400	1,400	1,400	1,400	1,400
Non-Cash Expenses	$17,600	$20,510	$22,500	$17,910	$17,350
Return to Operator's Labor and Management	$12,330	$ 95	$11,275	-$10,720	-$ 7,920
Hours of Labor Required	4,000	2,670	2,670	2,040	2,040

[a] Includes milk sales @$11.50/cwt., cull cow sales @$36/cwt. and calf sales @$85 per head.

[b] Dairy steers sold at $55/cwt.

[c] Includes cull beef cows at $34/cwt., fall sale of steer feeders at $60/cwt. and heifers at $59/cwt., spring sale of backgrounded steers at $56/cwt. and heifers at $53/cwt.

[d] Includes all cash crop production and feed purchase expenses, cash nonfeed livestock production costs, property taxes and insurance. Does not include interest payments on debt capital.

[e] Weighted average cost of capital used is 8 percent. Includes increased investment of $21,370 for housing with 180 head feedlot and $15,960 with 130 head feedlot for dairy steer production.

beef cow-calf operation. Corn silage permitted a larger number of cows to be carried without an offsetting increase in equipment costs and the result was a lower system cost per 1,000 pounds of beef produced.

Comparative future profitability of converting an existing 35 cow dairy on the marginal land resource to alternative beef production enterprises found milk production to be the most profitable. However, following excellent management and the most economical forage system, dairy steer production was only slightly lower. Traditional beef breed cow-calf operations were lowest in profitability and at a small size clearly is a part-time income supplementing enterprise.

Dairy steer production with excellent management and a low-high rate of gain ration containing corn silage competed favorably with the profitability of milk production. However, much greater market risk exists with dairy steer production. Assessment of the transferability and attainment of new management skills in moving from milk to beef production is crucial. It is believed that a manager of a 13,000 pound dairy herd can attain the high level of management assumed in dairy steer production. If this is not the case, substantial income reduction may occur.

Beef cow-calf production on the marginal land resource is not as profitable as the alternative livestock enterprises. Requiring about one-half the labor of the 35 cow dairy, cow-calf operations of this size are likely to be income supplements.

A substantial portion of the marginal land resources in the Northeast which exits from dairying will not likely return to production. Some may be utilized for part-time beef or sheep production or other alternatives. Long run profitability, however, will determine the longevity of those operations on the marginal land resource. If the land owner is employed off the farm and the farm becomes primarily a residence, the facilities, land and family labor then have little alternative use. Income over cash costs then usually determines the feasibility of a beef cow-calf enterprise. Further work is needed to identify the best management system under these conditions, considering available labor, off farm income, and markets for feeder cattle or beef.

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