ECONOMIC ANALYSIS OF FORAGE SYSTEMS AND BEEF PRODUCTION IN EAST TEXAS*

by

Kenneth R. Poenisch, Ronald D. Kay, and F. M. Rouquette **

Department of Agricultural Economics

Texas Agricultural Experiment Station

Texas A&M University

College Station, Texas

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**Respectively, former Research Assistant and Associate Professor, Dept. of Ag. Economics, Tex. Ag. Exp. Sta., College Station and Associate Professor, Tex. A&M Univ. Ag. Res. and Ext. Center, Overton.

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INTRODUCTION

Forages furnish a major portion of the diet required in the production of beef cattle. The East Texas Timberlands area is characterized by an abundant supply of land suitable for forage production and beef cattle production is a major industry. Much of the 16 million acres in this area is forested. Nevertheless, much of the timberland produces some forage for livestock grazing. In addition, open areas, many of which were formerly cropped or cleared for improved pasture, are grazed by cattle. A cow-calf herd is the primary beef enterprise in the area but other alternatives exist along with numerous forage alternatives and combinations.

The purpose of this study was to determine the optimum or least-cost forage system for a beef cow herd of a given size for each of two calving seasons, to determine which calving season is the most profitable, and to determine the most profitable stage of production at which to sell calves from a cow herd. All land was assumed to be open or cleared land suitable for establishing improved pastures.

Background

Numerous forage species are adapted to the East Texas area. Coastal bermudagrass, bahiagrass, lovegrass, and common bermudagrass are the most commonly grown improved warm-season perennial grasses. They have different establishment and maintenance costs as well as differing monthly and annual production potential. Cattlemen also use winter pastures as a feed supply for cattle. Small grains, ryegrass, and clover are used by cattlemen to reduce winter hay feeding. Beef producers are faced with a large number of forage alternatives from which to choose the combination which best meets both the total and seasonal nutrient requirements of their livestock.

The calving season will largely determine cow and calf seasonal nutrient requirements during the year. A cow's nutrient requirements will vary with the different stages of production. Pregnant cows require adequate nutrients for fetal development. After the calf is born, the cow must have additional nutrients for lactation and the calf needs more nutrients as it grows. Thus, cattlemen are concerned not only with which calving season is the most profitable but also with selecting the forages which meet the seasonal cattle requirements in the least cost manner.

The rising trend in per capita beef consumption in the U.S. has been met largely by increased grain fattening. However, higher grain prices the past two years have caused economic losses for feedlots resulting in the slaughter of more non-fed cattle and calves. Two potential changes may open new alternatives for beef production in East Texas. One change would be keeping calves on grass longer before placing them in feedlots. By increasing the time calves are kept on grass, the grain feeding period is shortened. Another alternative is the possibility of fattening cattle on grass for slaughter. Because of consumer preference for grain fed beef in the past, the demand for grass fattened animals has been low. With higher fed beef prices and wider price differential between grades, consumer acceptance of grass fat beef may increase. However, for a fixed land area, either of these two alternatives must compete with the cow herd for land and forage resources. Thus, we need to identify the most profitable enterprise or enterprise combination and the price levels at which they become competitive.

METHOD OF ANALYSIS

The method used to analyze the alternative forage and beef enterprise involved: 1) identifying the different forages adapted to the area and estimating production on a month-by-month basis for each one, 2) developing livestock production and nutrient requirement data and 3) estimating prices and costs to calculate budgets for each forage and livestock alternative. With this information, a linear programming model was constructed which included the monthly production estimates for each forage and the monthly nutrient requirements for the livestock system(s) being analyzed. The model was then used to: 1) determine the least-cost forage system for a specific livestock system of fixed size and 2) determine the profit maximizing livestock and forage system given a fixed and limited land area.

FORAGE RESOURCES

Forage production data was obtained from research conducted by the Texas Agricultural Experiment Station at the Texas A&M University Agricultural Research and Extension Center at Overton. The forages consisted of: (1) perennial warm-season grasses and (2) perennial grasses overseeded or sodseeded with a winter annual(s). Average monthly production figures for the forage species most commonly grown in this area were calculated from data collected over a three year period and for three different stocking rates. The forages were produced using similar production practices which included equal fertilizer levels on similar types of forages. Perennial forages were fertilized at a rate of 200 pounds of nitrogen, 100 pounds of P_2O_5 and 100 pounds of K_2O per acre. Perennial forages overseeded with winter annuals received a yearly total application of 300-100-100 per acre of N, P_2O_5 and K_2O.

The forage nutrient production and cattle requirements are in terms of dry matter and digestible energy. All or nearly all of the protein requirements are met when the cattle eat enough to supply the energy requirements. Protein is seldom a limiting factor unless cattle are fed on mature and weathered pastures, low-grade hay or insufficient forage [3].

The model required all forage consumed to be produced on the ranch. Excess forage in any month could be saved for other periods either by deferred grazing or by harvesting for hay. Nutrient losses from deferred grazing were difficult to estimate due to limited research in this area. However, for this study, it was assumed that 20 percent of the digestible energy and 15 percent of the dry matter is lost by deferring grazing one month [7]. This reflects the loss due to the cows preference for young forage and the increase in dry matter per unit of digestible energy.

Baled hay losses are estimated at 27 percent of the total production broken down into: 10 percent loss in harvesting, 10 percent loss in storage, and 7 percent loss in feeding [4, 7]. Using excess monthly forage production by either of these two methods requires keeping cattle off this acreage at certain times of the year.

Livestock Production Data

Livestock enterprises considered were: (1) a fall-calving cow herd, (2) a spring-calving cow herd, (3) a forage-based stocker operation and (4) a grass fat slaughter cattle enterprise. The following assumptions about the cow herd were made to facilitate handling data for the model: (1) fall calves were born October 1 and weaned June 1 with spring calves born February 1 and weaned October 1; (2) under both options calves were weaned weighing 500 pounds and cows were assumed to weigh 1100 pounds for nutrient requirement calculations; (3) a 90 percent calf crop was assumed with half bulls and half heifers and; (4) cows were in the herd eight years requiring 12.5 percent of the cows to be replaced each year. The assumptions made relative to the stocker and grass fat slaughter cattle enterprises were: (1) calves available for these enterprises had to be raised on the ranch; (2) fall calves could be sold June 1 as weaned calves or retained in the herd as stockers and sold November 1 weighing 665 pounds or carried through November and December on hay and supplement and sold January 1 weighing 740 pounds; (3) spring calves could be sold October 1 when weaned or retained as stockers and sold May 1 weighing 740 pounds;

(4) stocker gain was assumed to be 1.5 pounds per day when on the high quality winter forage and 1.0 pounds while on the lower quality summer forage or hay; (5) stockers could be sold at the end of this production stage or retained as grass fat cattle then sold for slaughter; (6) fall-calved stockers were transferred to the grass fat operation on January 1 and sold July 1 weighing 1010 pounds grading USDA Good; (7) spring-calved stockers were transferred May 1 and sold November 1 weighing 1010 pounds grading USDA Good. A monthly price index was developed over a 13-year period from 1961-73 and base prices were calculated from 1968-72 average prices for similar grade and weight cattle [12]. The monthly prices calculated by this procedure allowed for historical seasonal price changes but with price levels reflecting beef prices in more recent years.

Budgeting Techniques

Livestock and forage budgets list the costs and expected income for the various enterprises. These budgets reflect beef and forage production estimates and the cost of typical inputs. Forage budgets include costs of fertilizer, equipment use, chemicals, and prorated establishment costs. Cattle budgets include costs for salt and minerals, veterinary and medicine expense, marketing, transportation, labor, replacement cost, interest on operating and livestock capital and miscellaneous expenses. Little work has been done in the area of grass fattening slaughter cattle so these budgets were developed from stocker budgets by making allowances for increased mineral intake and a lower veterinary cost. Budgets were developed from Texas Agricultural Extension Service Budgets [10, 11] and are presented in the Appendix, Tables 1-4.

RESULTS

Forage System for a Fall-Calving Cow Herd

Using the basic forage production and cost data and the livestock nutrient requirements for a fall-calving cow herd of 100 cows and 4 bulls, a linear programming model was used to calculate the least-cost forage system for this herd. The results are shown in Table 1. With an annual land charge of $30.00 per acre, the least-cost system was 7.4 acres or 15.7 percent coastal bermudagrass overseeded with ryegrass, 21.5 acres or 45.7 percent in coastal overseeded with crimson clover and 18.2 acres or 38.6 percent in pure coastal. The total acreage required was 47.1 acres. However, the model assumes perfect and complete utilization of all available forage. Since this is not possible under actual conditions, the optimal forage combination and relative amounts of each forage are more important results than the total acreage needed and implied stocking rate.

Annual land cost was budgeted at $30 per acre assuming land was owned with an opportunity cost charged. Typical land rent in East Texas would be less than $30 per acre. When the land charge was changed from $30 to $10 per acre the forage species remained the same, but the relative amounts changed and slightly more land was used. Coastal bermudagrass

Table 1. Forage system for 100 head of cows with fall calving system and two per acre annual land charges.

	$10 Land Charge		$30 Land Charge	
	Acres	Percent	Acres	Percent
Coastal Bermudagrass	15.5	31.9	18.2	38.6
Coastal - Ryegrass	17.1	35.2	7.4	15.7
Coastal - Crimson Clover	16.0	32.9	21.5	45.7
Total	48.6	100.00	47.1	100.00

decreased to 15.5 acres, coastal-ryegrass increased to 17.1 acres, and coastal-crimson clover decreased to 16.0 acres. Other changes in the results were only minor and the remaining discussion is based on results with the $30 annual land charge.

The forage species included in the plan provided cattle requirements at the least cost with other species increasing costs if they were planted. Using perennial forages other than coastal bermudagrass would increase costs from $15.06 to $55.78 for each acre planted. If other winter annuals were overseeded on coastal the increase in cost ranged from $18.93 to $43.10 per acre. The relative amount of winter annuals in the solution changed with slight variations in costs. If the cost of ryegrass increased only 15¢ per acre relative to crimson clover, its production would fall to zero. If the cost of crimson clover decreased by 17¢ per acre relative to ryegrass, it would increase by 6.59 acres. It is evident from these figures that coastal bermudagrass is the least-cost perennial forage. Ryegrass and crimson clover are the least-cost winter annuals but the amount of each is very sensitive to their relative costs.

To meet total fall and winter feed requirements, it was also necessary to transfer forage and make hay. Forage was held for deferred grazing each month from July through October on over one-third of the acreage. Although 20 percent of the available digestible energy is lost each month grazing is deferred, it was still less costly than making hay. This transfer provided enough forage to maintain the 104 head on 18.2 acres in October and November when winter annuals were being overseeded.

Some hay was fed each month from December through April. In December, all cattle requirements are met with hay because no growing forage was available. Hay was made each month from May through September with the largest amount made in June. About 40 percent of the total coastal bermudagrass production was made into hay.

Forage System for a Spring-Calving Cow Herd

The least-cost forage system for a spring-calving cow herd of 100 head is shown in Table 2. It consisted of 12.8 acres or 28.8 percent of the land in coastal bermudagrass overseeded with ryegrass, 18.9 acres or 42.6 percent coastal overseeded with crimson clover, and 12.7 acres or 28.6 percent in pure coastal. Total acres needed was 44.4 or 2.7 less than with a fall calving herd. With a $10 annual land charge, the forage system changed to 14.9 acres of coastal-ryegrass, 16.8 acres of coastal-crimson clover, and 13.0 acres of pure coastal. The lower land charge allowed a small amount of additional land to be substituted for some of the more costly forage.

Table 2. Forage system for 100 head of cows with spring calving system and different per acre annual land charges.

	$10 Land Charge		$30 Land Charge	
	Acres	Percent	Acres	Percent
Coastal Bermudagrass	13.0	29.1	12.7	28.6
Coastal - Ryegrass	14.9	33.3	12.8	28.8
Coastal - Crimson Clover	16.8	37.6	18.9	42.6
Total	44.7	100.00	44.4	100.00

The use of perennial forages other than coastal bermudagrass would increase costs by $17.18 to $55.79 per acre with the $30 annual land charge. Planting winter annuals other than ryegrass and crimson clover on coastal bermudagrass would increase costs by $18.93 to $43.48 per acre. Slight variations in the cost of winter annuals would cause the forage system to change. An increase in ryegrass costs of 15¢ per acre causes crimson clover to replace all ryegrass. A decrease in costs of $1.43 per acre would increase ryegrass production by 2.14 acres to replace an equal amount of crimson clover.

Coastal bermudagrass hay was made from May through September. Greatest hay production was in June and just over one-fourth of the total coastal production is harvested as hay. Some forage was transferred each month from July through October. This deferred grazing on just over one-fourth of the acreage provided forage in October and November when other pastures were being overseeded.

Comparison of the Fall and Spring Calving Season

The fall and spring calving seasons were compared to determine which was the most profitable. Returns from a 90 percent calf crop and 500-pound weaning weights were assumed for both systems. Given a fixed acreage (assumed to be 100 acres here), the spring calving system was the most profitable with 224.8 cows carried on the 100 acres. Return to land was $2,237.18 or there was a loss of $762.82 when the $30 per acre land charge was included as an expense.

A per cow comparison of the forage systems and costs for the two calving systems with the $30 annual land charge is shown in Table 3. Table 4 contains the same information but on a per acre basis. Forage production and harvesting costs including land totaled $93.56 per cow under the spring-calving system and $111.34 per cow for fall calving. This cost difference was a result of three factors. First, the forage system for the spring-calving cow herd contained fewer acres of winter annuals which reduced seed, equipment and fertilizer costs. Second, hay making costs were much lower under the spring system and third, more cows could be maintained on the 100 acres with spring calving rather than fall.

Spring calving allowed the months of highest nutrient requirements to more nearly coincide with the months of greatest forage production, late spring and early summer. Also, the period of smallest nutrient requirements was fall and early winter when there is little growing forage. This combination resulted in a spring-calving cow herd requiring

Table 3. <u>Per Cow</u> costs and returns for fall and spring calving systems.

	Fall Calving	Spring Calving
Gross Receipts	$162.72	$157.39
Production Costs		
Livestock		
Cows	63.44	63.44
Bulls	3.77	3.77
Forage		
Coastal-Ryegrass	2.83	4.92
Coastal-Crimson Clover	10.90	9.61
Coastal Bermudagrass	4.37	3.06
Fertilizer	42.46	41.29
Hay Making	36.68	21.34
Land	14.10	13.34
Total Costs	178.55	160.77
Returns/Cow	$ -15.83	$ -3.38

only 58 percent as much hay as a fall-calving herd. The need for holding forage for deferred grazing in October and November was also reduced to about one-third that needed for fall calving. Because of the lower hay and deferred grazing needs, 224.8 cows could be maintained on the fixed 100 acres compared with only 212.7 cows with fall calving. This higher stocking rate and lower cost per cow made spring calving more profitable in spite of typical seasonal price differences causing spring calves to sell for less than fall calves.

Table 4. Per acre costs and returns to land for fall and spring calving systems.

	Fall Calving	Spring Calving
Gross Receipts	$346.20	$353.84
Production Costs		
Livestock		
Cows	134.97	142.62
Bulls	8.01	8.47
Forage		
Coastal-Ryegrass	6.01	11.05
Coastal-Crimson Clover	23.18	21.62
Coastal Bermudagrass	9.31	6.89
Fertilizer	90.34	92.84
Hay Making	78.04	47.98
Total Costs	349.87	331.47
Returns/Acre	$ -3.66	$ 22.37

The greater profitability of spring calving is dependent on the assumed equal weaning weights and calving percent under both systems. Fall calves might be expected to weigh more because they would typically be sold after grazing the higher quality winter forages. At the combined steer and heifer average selling price of $34.98 for spring calves and $36.16 for fall calves, the fall calves would have to average approximately 40 pounds heavier before they would become the more profitable. If fall calves were the same weight but of higher quality, they would have to sell for approximately $2.75 per hundred more than the price used in this study in order to compete with spring calves. A difference in calving percent would also affect the relative profitability of the two systems. If the spring-calving cows averaged between 7.5 and 8.0 percent fewer calves, fall calving would then become the more profitable alternative assuming equal weaning weights and the selling prices stated above. In the final analysis, choosing the most profitable calving season will depend upon actual differences in weaning weights, calving percentage and selling prices.

Extended Calf Ownership

Once the more profitable calving season had been found, the model was used to determine if it was profitable to retain calf ownership past weaning. Two alternatives were added to the model. The first was a stocker program with the weaned calves kept until they weighed 740 pounds with the fall-calved stockers selling for an average of $30.50 per hundred and spring-calved stockers for $32.46. The second alternative allowed the stockers to be continued on a forage program and sold as grass-fat slaughter cattle weighing an average of 1010 pounds. Calves born in the fall were assumed to be sold 21 months later for an average price of $29.19 and those born in the spring for $27.99 also after being owned 21 months. The price differences reflect typical seasonal price variations due to different selling dates.

Neither alternative was found to compete with a spring-calving cow herd for the forage resources on a fixed land area. The additional per head income was not enough to offset the extra costs and fewer calves produced from the smaller cow herd. With a fixed number of acres, the cow herd must be reduced to provide forage for the stockers and grass-fat slaughter cattle. For each spring calf kept through the stocker phase, net income was reduced by at least $7.81. Continuing with this stocker through the grass-fat production phase reduced net income by another $8.19.

Determining Competitive Price Relationships

While stockers and grass-fat cattle could not compete with a straight cow-calf herd at the assumed prices, at some higher price they would become profitable. Given the dynamic nature of the beef industry, price relationships may at some time be such that stockers and grass-fat slaughter cattle would be profitable beef enterprises in East Texas. The parametric feature of linear programming was applied to the model to determine these prices.

The first step was to establish the break-even price for stockers. At this price, the net income would be the same whether calves were sold when weaned or carried through the stocker stage. For the spring-calving system with 500-pound calves selling for $34.98 per hundred, the 740-pound stocker cattle must sell for $34.19 per hundred or more to be profitable. This is a price increase of $1.73 per hundred above the original price. This increases income just enough to offset decreased income from a smaller cow herd and the increased production costs for stockers. Originally, 224.8 cows were kept on the 100 acres and 202.3 calves sold at weaning. At the new stocker price, 159.3 cows are kept and 143.4 stockers are sold.

The smaller cow herd and producing stockers necessitate a change in the forage program. Ryegrass overseeded on coastal bermudagrass increased to 48.3 percent of the acreage from 28.8, crimson clover on coastal decreased to 18.7 percent from 42.6 percent, and pure coastal bermudagrass acreage increased to 33.1 percent from 28.7. The increase in ryegrass production resulted from dry matter being the limiting factor during the months when stockers are maintained. Ryegrass furnishes a cheaper source of dry matter than crimson clover. Some crimson clover was still grown because of its higher quality and lower cost per unit of digestible energy.

The break-even price for grass-fat slaughter cattle was found to be $29.67 per hundred. This was an increase of $1.68 per hundred above the base price and $4.52 per hundred below the break-even price for stockers. Producing grass-fat cattle made it necessary to decrease the cow herd to 128.5 cows and 5.1 bulls. With a 90 percent calf crop, 115.6 grass-fat cattle would be sold each year.

Grazing the spring calves until they reach slaughter weight and the further reduced size of the cow herd, caused another change in the optimal forage program. Winter ryegrass pastures decreased to 25.9 percent of the acreage, crimson clover pastures increased to 38.3 percent and pure coastal bermudagrass increased to 35.8 percent from the optimal forage program for the stocker operation. Hay costs decreased due to lower stocking rates during months of low forage production. The costs and returns for the three systems at break-even prices are shown in Table 5.

If selling prices for stocker and grass-fat slaughter cattle are a little above the break-even prices, further changes occur in the optimal

Table 5. Costs and returns at break-even prices for alternative calf ownership on 100 acres. (Spring Calving)

	Weaned Calves	Stockers	Grass Fat
Price per cwt.	$ 34.98	$ 34.19	$ 29.67
Gross Receipts	35,388.51	36,285.94	34,655.55
Production Costs			
Livestock			
Cows	14,262.39	10,107.90	8,153.12
Bulls	846.50	599.80	483.98
Stockers		3,775.72	3,045.46
Grass Fat			3,085.94
Forage			
Coastal-Ryegrass	1,105.44	1,853.67	994.05
Coastal-Crimson Clover	2,161.70	947.05	1,945.89
Coastal-Bermudagrass	689.03	795.81	860.99
Fertilizer	9,283.73	9,172.81	9,104.99
Hay	4,798.25	6,788.45	4,737.41
Total Costs	33,147.04	34,041.21	32,411.83
Net Returns	2,241.47	2,244.73	2,243.72

beef and forage systems. Increasing the stocker selling price by another 85¢ per hundred to $35.04 caused the forage program to change to 65.1 percent crimson clover overseeded on coastal and 34.9 percent pure coastal. This change allowed the cow herd to increase by 8.5 to 167.8 cows with 151.0 stockers sold.

In a similar manner, increasing the selling price of grass-fat slaughter cattle by another 77¢ per hundred to $30.44 caused some changes. Crimson clover overseeded on coastal for winter pasture should be 63.2 percent of the acreage with pure coastal on the remaining 36.8 percent. This change allowed an increase in the cow herd of 3.6 cows over the result obtained at the break-even selling price for grass-fat cattle.

Both of the above changes were related to dry matter requirements and production during the winter. Dry matter was more limiting than digestible energy during this period. At the break-even prices, some ryegrass was overseeded on coastal to provide extra dry matter from January through May. Crimson clover produces less dry matter per acre during the same period but it was of better quality with more digestible energy per pound of dry matter. With prices slightly above the break-even level, it became more profitable to plant all crimson clover on the overseeded acres and harvest more hay during the summer. The extra hay was used to supplement the crimson clover in order to meet the total dry matter requirements of the livestock.

SUMMARY AND CONCLUSIONS

Coastal bermudagrass was found to be the optimal perennial forage for livestock production in East Texas. This was true for all livestock systems studied. Sodseeding the coastal with winter annuals proved to be an economical source of forage for use in winter and early spring. Ryegrass and crimson clover were used as winter annuals on 60-70 percent of the land for all livestock programs. The relative amounts of ryegrass and crimson clover depend on the livestock program being followed, livestock prices and the relative cost of the two forages.

The optimal forage system for a fall-calving cow herd consisted of 38.7 percent pure coastal, 15.7 percent coastal overseeded with ryegrass and 45.6 percent coastal overseeded with crimson clover. About 40 percent of the total coastal production was made into hay and grazing was deferred on 18.2 acres until October and November when the winter annuals were being seeded. This forage program provided the least-cost method of providing the nutrients required by a 100-head cow herd. The total land requirement was 47.1 acres.

A spring-calving cow herd of 100 head had a slightly different least-cost forage system. A total of 44.4 acres was required with 28.6 percent in pure coastal, 28.8 percent overseeded with ryegrass and 42.6 percent overseeded with crimson clover. Hay and deferred grazing were again used to provide forage in fall and early winter.

When the model was changed to maximizing net income from a given and fixed land area and was allowed to choose between fall and spring calving, the spring-calving cow herd proved to be the more profitable. Spring calves sold for a lower price because of seasonal price differences, but the higher monthly forage requirements more nearly matched the months of highest forage production. This resulted in less hay being needed which lowered costs, less forage was left standing for deferred grazing in the fall, and the stocking rate was slightly higher. These factors more than offset the lower calf selling price and cause spring calving to be more profitable. However, the potential for higher weaning weights and calving percentage under a fall-calving system may be sufficient to make fall-calving more profitable in some cases.

Retaining ownership of spring calves and grazing them on forage through the stocker and grass-fat slaughter production phases, was not profitable at the prices used in this study. These average prices were $34.98 per hundred for calves, $32.46 for stockers and $27.99 for grass-fat slaughter cattle. At these prices and with a fixed land area, selling calves at weaning was the most profitable production system. Keeping calves past weaning meant reducing the size of the cow herd. Even though stockers and slaughter cattle sold for more per head than calves, this was not enough to compensate for the smaller number of head that could be calved and fed out on the fixed acreage available.

With spring calf prices at $34.98 per hundred, stocker price would have to increase $1.73 to $34.19 and grass-fat slaughter cattle price $1.68 to $29.67 per hundred before they would compete with selling calves at weaning. At the above prices, net income from a given amount of land is the same for all three alternatives. Keeping calves past weaning caused some changes in the optimal forage program but it always included coastal bermudagrass on all the acreage with some combination of ryegrass and/or crimson clover overseeded on at least 60 percent of the acres.

The implied stocking rates in this study are higher than could be expected under actual grazing conditions and should not be construed as being recommended. Mathematical properties of the linear programming model used to obtain the results reported here include several implicit assumptions. Most important is the assumption of complete and perfect utilization of all available forage above the minimum amount necessary to maintain forage stand and vigor. In practice this would mean perfect timing when moving cattle between pastures and forages, completely variable pasture sizes allowing for maintaining the exact optimum stocking rates throughout the year and no hay loss due to weather. Other practical problems such as variability of forage production due to weather and possible difficulties establishing winter forages could not be included in the study.

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Table 1. Costs per acre for perennial forages.

	Coastal Bermudagrass	Lovegrass	Bahia	Common Bermudagrass
Fertilizer	75.00	75.00	75.00	75.00
Fertilizer Appl. Rent	5.00	5.00	5.00	5.00
Herbicide	1.15	1.15	1.15	1.15
Lime	3.62	3.62	3.62	3.62
Machinery	3.59	3.59	3.59	3.59
Labor	1.92	1.92	1.92	1.92
Interest	3.10	3.10	3.10	3.10
Prorated Estab. Costs	5.67	5.77	5.88	---
Total Costs	99.05	99.15	99.26	93.38

Table 2. Additional costs per acre for winter annuals sod-seeded on a perennial forage.

	Crimson Clover	Arrowleaf Clover	Ryegrass	Crimson-Ryegrass	Crimson-Arrowleaf
Fertilizer	25.00	25.00	25.00	25.00	25.00
Fert. Appl. Rent	2.50	2.50	2.50	2.50	2.50
Seed	18.56	12.78	6.19	24.75	18.97
Insecticide	1.78	1.78	1.78	1.78	1.78
Machinery	1.48	1.48	1.48	1.48	1.48
Labor	1.19	1.19	1.19	1.19	1.19
Interest	1.22	1.22	1.22	1.22	1.22
Total Costs	51.73	45.95	39.36	57.92	52.14

Table 3. Estimated costs and returns per cow for livestock activities.

	Fall-Calving System	Spring-Calving System	Fall-Calved Stockers June 1 to Nov. 1
Gross Receipts	$	$	$
Steer Calves	87.32	84.62	113.85
Heifer Calves	75.40	72.77	100.71
Total	162.72	157.39	214.56
Variable Costs			
Salt and Minerals	3.12	3.12	1.11
Veterinary and Medicine	3.17	3.17	1.61
Hauling and Marketing	5.11	5.11	6.00
Equipment Expense	2.00	2.00	1.07
Labor	16.00	16.00	7.14
Net Replacement Costs	8.75	8.75	
Int. Operating Capital	1.09	1.09	.18
Int. on Livestock Capital	21.20	21.20	6.52
Miscellaneous	3.00	3.00	
Total	$ 63.44	$ 63.44	$ 23.63

Table 4. Estimated costs and returns per cow for livestock activities.

Item	Fall-Calved Stockers Nov. 1 to Jan. 1	Spring-Calved Stockers Oct. 1 to May 1	Fall-Calved Grass Fat Cattle Jan. 1 to July 1	Spring-Calved Grass Fat Cattle May 1 to Nov. 1
Gross Receipts	$	$	$	$
Steer Calves	118.29	125.65	150.04	144.18
Heifer Calves	107.37	114.59	144.78	138.52
Total	225.66	240.24	294.82	282.70
Variable Costs				
Veterinary and Medicine	.64	2.25	1.50	1.50
Hauling and Marketing	6.00	6.00	6.00	6.00
Salt and Mineral	.45	1.56	1.86	1.86
Equipment Expense	.43	1.50	1.50	1.50
Labor	2.86	10.00	10.00	10.00
Int. on Operating Capital	.03	.36	.30	.30
Int. on Livestock Capital	2.86	9.69	10.41	10.46
Total	$ 13.27	$ 31.36	$ 31.57	$ 31.62