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Economic Comparison of Intensive Cow-Calf Forage Systems for South Mississippi

Alicia bermudagrass and Pensacola bahiagrass are the two most common grasses for pasture and hay production in South Mississippi. The production, utilization and profitability of either grass is affected by numerous management practices. The purpose of this study was to compare their production and profitability in year-round cow-calf systems. Management, stocking rates, and fertilizer rates were held constant.

Experimental Procedures

Approximately 100 cows were calved each year in February and March of 1982, 1983, 1984, and 1985 (total of 389 calves). Data generated by these animals were used to compare the production and economics of two grazing systems (Alicia bermudagrass versus Pensacola bahiagrass) and creep feeding (creep feed versus forward grazing) in a 2 x 2 factorial in a randomized complete block design (years as blocks). Each grazing system consisted of 25 cows and calves on 25 acres. At birth, calves were weighed, identified, bull calves castrated, and calves were weaned in October.

Cows were balanced by breed (1/2 Angus, Brangus, Beefmaster, and Barzona x 1/2 Hereford and purebred Hereford) across both forage systems, but otherwise randomly assigned. Sire breeds (Brahman, Beefmaster, Barzona, Brangus, and Simbrah) of the calves were represented across both systems.

Each pasture was cross-fenced to permit three-way rotational grazing. Creep gates were installed in systems with forward grazing to allow calves free access to any of the three paddocks at any time. Systems with creep feeding had self-feeding calf creeps to allow *ad libitum* intake of a commercial pelleted creep ration. Excess summer forage was harvested as hay and hay yield (pounds/acre) was estimated by the number of large round bales. Two-thirds of each pasture system was overseeded with Marshall ryegrass in October using a no-till drill planter. Both winter and summer pastures were fertilized according to soil test recommendations. Only pesticides currently registered for use on pastures, hay fields, and beef cattle were used during the course of this study with strict adherence to all label instructions. A commercial salt-mineral mix was available *ad libitum*, and during winter grazing periods, a high magnesium mix was used.

During the first 60 days prepartum, cows were fed 25 pounds of hay per head per day and protein supplement. Initially, postpartum cows were allowed to limit graze ryegrass pastures when forage was available. When sufficient forage became available, cows and calves continuously grazed on ryegrass pastures.

Statistical analysis of data was done using GLM procedures from SAS. The linear model included year (as blocks), system, creep, system x creep interaction, and sex. The effects of year, system, creep, and system x creep interaction were tested with a pooled term error A (year x system x creep, 9 d.f.). Error B (year x system x creep x sex, 15 d.f.) was used to test effects of sex of calf. Year x system and year x creep interactions were tested in a preliminary analysis with all main effects included in the model so that, if they were not significant ($P<0.05$), they could be pooled in error A. Least squares means were computed for system, creep, sex, year x system, and year x creep.

Budgets were prepared for each forage system following the format used in the Farm Management Handbook published by the Agricultural Economics Department of the Mississippi Cooperative Extension Service. When actual income and expense figures were not available, assumptions were made to approximate the economic situation in South Mississippi. A major deviation from this format was in calculations for replacement cows because assumptions did not seem realistic.

Results and Discussion

The Alicia bermudagrass system produced more hay than the bahiagrass system (Table 1) under the management of this study. The amount of hay fed in the two systems was similar because the

Table 1. Hay yield and hay fed in cow-calf forage systems with Alicia bermudagrass and Pensacola bahiagrass. White Sand Unit of the MAFES South Mississippi Branch, 1982 - 1985.

Item	Unit	Year				Mean
		1982	1983	1984	1985	
Alicia						
Hay yield	tons/acre	2.41	1.16	1.68	1.11	1.59
Hay fed	tons/acre	1.14	1.67	0.93	0.62	1.09
Excess (deficit)	tons/acre	1.27	(0.51)	0.75	0.49	0.50
Bahia						
Hay yield	tons/acre	0.60	0.36	0.14	0.31	0.35
Hay fed	tons/acre	1.28	1.67	1.01	0.67	1.16
Excess (deficit)	tons/acre	(0.68)	(1.31)	(0.87)	(0.36)	(.81)

winter pastures and management were identical. Hay production exceeded hay feeding requirements in the Alicia bermudagrass system by approximately 0.5 ton per acre per year. However, years 1982, 1984, and 1985 had excess bermudagrass hay, and 1983 had deficit production. The bahiagrass system consistently produced less hay than was needed and, as a result, hay had to be purchased from outside the system. The mean hay deficit in the bahiagrass system was 0.8 ton per acre.

Calves in the bahiagrass system had a 21-pound heavier ($P<0.05$) adjusted 205-day weaning weight than calves in the Alicia bermudagrass system. A 17-pound advantage in actual weaning weight was not significant ($P=.07$, Table 2). Main effects of year, creep, and sex were significant for both adjusted and actual weaning weights. No two-way interactions were significant ($P<0.05$). Based on prevailing prices, this weaning weight advantage was negated by the bahiagrass system's hay deficit.

The Alicia bermudagrass system showed a net gain per cow (and per acre) of $40.46 compared to $9.82 for the Pensacola bahiagrass system — a difference of $30.64 in favor of bermudagrass (Tables 4 and 5). This difference is dependent on the year, prices, and/or other underlying assumptions. Calf weights in Table 2 were adjusted to give steer calves a 40-pound advantage over heifer calves. The advantage in steer calf weights should be greater than shown as it is common practice to save the heaviest heifer calves for replacements and sell the lightest.

Creep feeding increased weaning weights by 59 pounds over forward grazing. The economic advantage of creep feeding depends primarily upon feed conversion for added gain and the current calf prices (Table 3).

To adjust for price fluctuations, cattle prices used in the budgets were averaged over a 5-year period (1983-1988). Direct expenses listed in Tables 4 through 12 were for 1988 and 1989 in Poplarville, MS. Hay prices do not reflect differences in quality; thus, excess hay has the same value as purchased hay. The differences between Alicia bermudagrass and bahiagrass systems do not reflect fixed costs for establishment.

Fixed expenses for replacement cows were based upon a beef-forage management program used at the South Mississippi Branch Experiment Station since 1986. Heifers were calved as 2-year-olds and they were diagnosed pregnant with their second calf before being classified as mature cows. Most cow-calf budgets do not include a fixed expense for replacement females. Budgets in the Farm Management Handbook assume that (1) costs and income for first-calf cows are the same as for mature cows; (2) 15% of heifers are saved for replacement; (3) expenses for heifers are the same as mature cows; (4) no heifers are culled; and (5) conception rate of heifers is 100%.

In this study, when land areas for the cow herd and replacement females were combined, a total of 151.3 acres of pasture was required to support 100 head of mature cows. This assumes that 96% of cows that calved weaned a calf; that death rate was 1%; and that 15% of the cows were replaced each year. The 51.3 acres of land used for replacement females includes 18 acres of sod-seeded ryegrass for winter pasture that could be

Table 2. Least squares means of adjusted 205-day weaning weights and actual weaning weights in cow-calf forage systems comparing Alicia bermudagrass versus Pensacola bahiagrass. White Sand Unit of the MAFES South Mississippi Branch, 1982 - 1985.

		Year				
Item	Unit	1982	1983	1984	1985	Mean[a]
Alicia						
Adjusted 205-day WW	lb/hd	399	454	467	486	451x
Actual weaning weight	lb/hd	432	479	512	455	469
Bahia						
Adjusted 205-day WW	lb/hd	414	488	485	503	472y
Actual weaning weight	lb/hd	449	508	523	460	486

[a]Means in the same column with different letters are different ($P<0.05$).

Table 3. Least squares means of adjusted 205-day weaning weights and actual weaning weights in cow-calf forage systems comparing creep feeding versus forward grazing. White Sand Unit of the MAFES South Mississippi Branch, 1982 - 1985.

		Year				
Item	Unit	1982	1983	1984	1985	Mean[a]
Creep feeding						
Adjusted 205-day WW	lb/hd	431	501	506	519	489x
Actual weaning weight	lb/hd	467	529	549	482	507x
Forward grazing						
Adjusted 205-day WW	lb/hd	383	441	447	470	435y
Actual weaning weight	lb/hd	414	458	486	433	448y
Difference due to creep feeding						
Adjusted 205-day WW	lb/hd	48	60	59	49	54
Actual weaning weight	lb/hd	53	71	63	49	59
Creep feed consumed[b]	lb/hd	331	531	635	288	446
Feed conversion	ratio	6.25	7.48	10.08	5.88	7.56
Cost of feed[c]	$/hd	29.13	49.92	60.16	25.06	41.06
Cost of additional gain	$ /lb	.61	.70	.95	.51	.70

[a] Least squares means for type of creep in the same column with different letters are different ($P<0.05$).
[b] Creep feeding began 4/26/82, 5/1/83, 4/30/84, and 6/13/85.
[c] Commercial pelleted creep feed at $176 on in 1982, $188 on in 1983, $181 on in 1984, and $174 on in 1975.

used for hay production in the summer. Replacement female costs could be reduced from those shown in Table 6 by the value of hay sold.

The cost of producing replacement heifers was based on the assumptions that one-half of heifer calves weaned were retained as replacements and culled prior to breeding. At 15 months of age, 23% of the heifers were culled based on weight, frame size and/or pelvic area. Conception rate for heifers was 90%. Eighty percent of the first-calf cows rebred and were used as replacements in the mature cow herd. These assumptions were entered as input variables on an electronic spreadsheet that calculated whether or not sufficient heifers were retained to meet replacement needs. Using this tool, more or less animals can be kept to meet replacement needs. As more replacement heifers were saved and fewer culled prior to breeding, the cost per head for replacements decreased. Costs also decreased as conception rate for heifers and first-calf cows increased.

Summary

There was little economic difference between Alicia bermudagrass and Pensacola bahiagrass grazing systems for cow-calf production when stocked year round at one cow-calf unit per acre. Also, this study attempted to accurately calculate fixed costs for replacement females, a function not accomplished in most cattle budgets. These systems were designed for intensive land use and management. If fertilizer rates and/or stocking rates are changed, the results obtained from these forage systems may not be the same.

Table 4. Alicia bermudagrass forage system for cow-calf production in South Mississippi, estimated costs and returns of a 100-cow herd at a stocking rate of 1 head per acre[a].

Item	No. Head	Unit	Price ($)	Quantity	Amount ($)
INCOME					
Steer Calves	48	cwt	76.00	4.89	17,838.72
Heifer Calves	24	cwt	69.00	4.49	7,535.44
Cull Cows	14	cwt	40.00	10.00	5,600.00
Cull Bulls	1	cwt	47.00	15.00	705.00
Hay Sold[b]		ton	50.00	50.00	2,500.00
Total Income					34,079.16
DIRECT EXPENSES					
Summer Pasture[c]		acre	37.49	100.00	3,749.14
Sod-seeded Ryegrass Pasture[c]		acre	77.65	66.67	5,176.49
Hay Harvest-Pasture Clippings[bd]		ton	12.89	159.00	2,048.86
Hay Purchased[b]		ton	50.00	0.00	0.00
Protein Blocks, 500 lb		each	59.67	16.00	954.72
Salt and Minerals		cwt	13.00	24.00	312.00
Repairs on Buildings & Equipment[e]		year	306.14	1.00	306.14
Veterinary/Medicine		head	24.50	100.00	2,450.00
Interest on Operating Capital[f]		%	0.10	14,997.35	1,124.80
Marketing Cost		%	0.04	31,579.16	1,263.17
Labor		hour	5.00	485.00	2,425.00
Total Direct Expenses					19,810.32
RETURNS ABOVE DIRECT EXPENSES					14,268.84
RETURNS ABOVE DIRECT EXPENSES EXCLUDING LABOR					16,693.84
FIXED EXPENSES					
Depreciation and Interest					
Replacement Cows		head	342.57	15.00	5,138.55
Bull		head	1,240.00	1.00	1,240.00
Summer Pasture[c]		acre	2.34	100.00	234.00
Winter Pasture[c]		acre	5.62	66.67	374.67
Hay Harvest[d]		acre	9.73	159.00	1,547.07
Buildings & Equipment[e]		year	1,688.61	1.00	1,688.61
Total Fixed Expenses					10,222.90
TOTAL SPECIFIED EXPENSES					30,033.22
RETURNS ABOVE SPECIFIED EXPENSES					4,045.94
Per Cow (per acre)					40.46

[a] Assumptions for calculations: 96% calves weaned/cows calving, 1% death rate, 15% replacement rate, 50% heifers saved for replacement.
[b] Hay sold or purchased from Table 1.
[c] Summer and ryegrass pastures from Tables 7 and 8, respectively.
[d] Pasture clipping expenses from Table 10.
[e] Building and equipment expenses from Table 12.
[f] Interest on operating capital for 9 months.

Table 5. Pensacola bahiagrass forage system for cow-calf production in South Mississippi, estimated costs and returns for a 100-cow herd at a stocking rate of 1 head per acre[a].

Item	No. Head	Unit	Price ($)	Quantity	Amount ($)
INCOME					
Steer Calves	48	cwt	76.00	5.06	18,458.88
Heifer Calves	24	cwt	69.00	4.66	7,716.96
Cull Cows	14	cwt	40.00	10.00	5,600.00
Cull Bulls	1	cwt	47.00	15.00	705.00
Hay Sold		ton	50.00	0.00	0.00
Total Income					32,480.84
DIRECT EXPENSES					
Summer Pasture		acre	37.49	100.00	3,749.14
Sod-seeded Ryegrass Pasture		acre	77.65	66.67	5,176.49
Hay Harvest — Pasture Clippings		ton	12.89	35.00	451.01
Hay Purchased		ton	50.00	81.00	4,050.00
Protein Blocks, 500 lb		each	59.67	16.00	954.72
Salt and Minerals		cwt	13.00	24.00	312.00
Repairs on Buildings & Equipment		year	306.14	1.00	306.14
Veterinary/Medicine		head	24.50	100.00	2,450.00
Interest on Operating Capital		%	0.10	17,449.50	1,308.71
Marketing Cost		%	0.04	32,480.84	1,299.23
Labor		hour	5.00	485.00	2,425.00
Total Direct Expenses					22,482.44
RETURNS ABOVE DIRECT EXPENSES					9,998.40
RETURNS ABOVE DIRECT EXPENSES EXCLUDING LABOR					12,423.40
FIXED EXPENSES					
Depreciation and Interest					
Replacement Cows		head	342.57	15.00	5,138.55
Bull		head	1,240.00	1.00	1,240.00
Summer Pasture		acre	2.34	100.00	234.00
Winter Pasture		acre	5.62	66.67	374.67
Hay Harvest		acre	9.73	35.00	340.55
Buildings & Improvements		year	1,688.61	1.00	1,688.61
Total Fixed Expenses					9,016.38
TOTAL SPECIFIED EXPENSES					31,498.82
RETURNS ABOVE SPECIFIED EXPENSES					982.02
Per Cow (per acre)					9.82

[a]Assumptions and inputs are the same as for Table 4.

Table 6. Estimated annual costs and returns for replacement female production in South Mississippi, 15 head of replacements[a].

Item	No. Head	Unit	Price ($)	Quantity	Amount ($)
INCOME					
Cull Yearling Heifers	5	cwt	60.00	6.00	1,800.00
Cull 2-Yr Old Cows	3	cwt	40.00	9.00	1,080.00
Steer Calves	9	cwt	76.00	4.20	2,872.80
Heifer Calves	9	cwt	69.00	3.80	2,359.80
Total Income					8,112.60
DIRECT EXPENSES					
Ryegrass/Wheat Pasture[b]		acre	107.96	33.33	3,598.80
Sod-seeded Ryegrass Pasture[c]		acre	77.65	18.00	1,397.65
Millet Pasture[d]		acre	79.12	16.67	1,318.71
Hay Harvest — Alicia[e]		ton	52.13	29.50	1,537.98
Protein Block, 500 lb		each	59.67	2.88	171.85
Preconditioning Feed		ton	205.00	2.30	471.50
Mixed Feed, 12%		ton	180.60	3.45	623.07
Salt and Minerals		cwt	10.2	47.08	72.50
Veterinary/Medicine		head	21.00	41.00	861.00
Interest on Operating Capital[f]		%	0.10	10,053.07	753.98
Marketing Cost		%	0.04	2,880.00	324.50
Labor		hour	5.00	198.85	994.25
Total Direct Expenses					12,125.80
RETURNS ABOVE DIRECT EXPENSES					−4,013.20
RETURNS ABOVE DIRECT EXPENSES EXCLUDING LABOR					−3,018.95
FIXED EXPENSES (Depreciation and Interest)					
Bull		head	1,240.00	0.25	310.00
Ryegrass/Wheat Pasture[b]		acre	8.49	33.33	283.00
Overseeded Ryegrass Pasture[c]		acre	5.62	18.00	101.16
Millet Pasture[d]		acre	10.83	16.67	180.50
Hay Harvest — Alicia[e]		ton	8.50	29.50	250.69
Total Fixed Expenses					1,125.35
TOTAL SPECIFIED EXPENSES					13,251.15
SPECIFIED EXPENSES MINUS INCOME					5,138.55
Per cow (2.7-yr-old pregnant cow after weaning first calf)					342.57

[a] Assumptions: pregnancy rate for heifers 90%, pregnancy rate for first-calf cows 80%, 23 heifers weaned, 18 first-calf cows calving.

[b] From Table 9, stocked at 1.5 hd/acre for yearling heifers.

[c] From Table 8, stocked at 1 hd/acre for 2-yr-old cows.

[d] From Table 11, stocked at 3 hd/acre for yearling heifers and 2 hd/acre for 2-yr-old cows.

[e] High quality hay produced on land area designated for replacement female production. There is potential to sell hay from this land.

[f] Interest on operating capital for 9 months.

Table 7. Costs per acre for summer pasture maintenance, Alicia bermudagrass and Pensacola bahiagrass, South Mississippi, 1989.

Item	Unit	Price ($)	Quantity	Amount ($)
DIRECT EXPENSES				
Fertilizer (Spread)				
Lime	ton	30.00	0.33	9.90
Ammonium Nitrate (34% N)	cwt	9.25	2.00	18.50
Phosphate (46% P_2O5)	cwt	11.40	0.40	4.56
Potash (60% K_2O)	cwt	8.95	0.20	1.79
Operator Labor				
Tractors	hour	5.00	0.20	1.00
Diesel Fuel				
Tractors	gal	0.77	0.82	0.63
Repair & Maintenance				
Tractors	acre	0.47	1.00	0.47
Implements	acre	0.64	1.00	0.64
Total Direct Expenses	$/acre			37.49
FIXED EXPENSES (Depreciation and Interest)				
Tractors	acre	1.15	1.00	1.15
Implements	acre	1.19	1.00	1.19
Total Fixed Expenses	$/acre			2.34
TOTAL SPECIFIED EXPENSES	$/acre			39.83

Table 8. Costs per acre for ryegrass pasture, sod-seeded, South Mississippi, 1989.

Item	Unit	Price ($)	Quantity	Amount ($)
DIRECT EXPENSES				
Fertilizer (Spread)				
Ammonium Nitrate (34% N)	cwt	9.25	4.00	37.00
Phosphate (46% P_2O_5)	cwt	11.40	1.20	13.68
Potash (60% K_2O)	cwt	8.95	1.20	10.74
Seed				
Marshall Ryegrass Seed	lb	0.27	35.00	9.45
Operator Labor				
Tractors	hour	5.00	0.60	3.00
Diesel Fuel				
Tractors	gal	0.77	1.62	1.25
Repair & Maintenance				
Tractors	acre	0.93	1.00	0.93
Implements	acre	1.60	1.00	1.60
Total Direct Expenses	$/acre			77.65
FIXED EXPENSES (Depreciation and Interest)				
Tractors	acre	2.08	1.00	2.08
Implements	acre	3.54	1.00	3.54
Total Fixed Expenses	$/acre			5.62
TOTAL SPECIFIED EXPENSES	$/acre			83.27

Table 9. Costs per acre for Marshall ryegrass/wheat pasture, prepared seedbed, South Mississippi, 1989.

Item	Unit	Price ($)	Quantity	Amount ($)
DIRECT EXPENSES				
Fertilizer (Spread)				
Lime BL	ton	30.00	0.33	9.90
Ammonium Nitrate (34% N)	cwt	9.25	5.00	46.25
Phosphate (46% P_2O_5)	cwt	11.40	1.20	13.68
Potash (60% K_2O)	cwt	8.95	1.20	10.74
Seed				
Marshall Ryegrass Seed	lb	0.27	20.00	5.40
Wheat Seed	lb	0.12	90.00	10.80
Operator Labor				
Tractors	hour	5.00	0.97	4.85
Diesel Fuel				
Tractors	gal	0.77	3.33	2.56
Repair & Maintenance				
Tractors	acre	1.89	1.00	1.89
Implements	acre	1.89	1.00	1.89
Total Direct Expenses	$/acre			107.96
FIXED EXPENSES (Depreciation and Interest)				
Tractors	acre	4.49	1.00	4.49
Implements	acre	4.00	1.00	4.00
Total Fixed Expenses	$/acre			8.49
TOTAL SPECIFIED EXPENSES	$/acre			116.45

Table 10. Costs per acre for hay harvest of pasture clippings, 1 ton/acre per cutting, South Mississippi, 1989.

Item	Unit	Price ($)	Quantity	Amount ($)
DIRECT EXPENSES				
Other				
Twine	bun	17.89	0.04	0.75
Operator Labor				
Tractors	hour	5.00	0.90	4.50
Diesel Fuel				
Tractors	gal	0.77	2.65	2.04
Repair & Maintenance				
Tractors	acre	1.45	1.00	1.45
Implements	acre	4.15	1.00	4.15
Total Direct Expenses	$/acre			12.89
FIXED EXPENSES (Depreciation and Interest)				
Tractors	acre	3.29	1.00	3.29
Implements	acre	6.44	1.00	6.44
Total Fixed Expenses	$/acre			9.73
TOTAL SPECIFIED EXPENSES	$/acre			22.62

Table 11. Costs per acre for Tifleaf millet pasture, South Mississippi, 1989.

Item	Unit	Price ($)	Quantity	Amount ($)
DIRECT EXPENSES				
Fertilizer (Spread)				
Ammonium Nitrate (34% N)	cwt	9.25	3.50	32.38
Phosphate (46% P_2O_5)	cwt	11.40	1.20	13.68
Potash (60% K_2O)	cwt	8.95	1.20	10.74
Seed				
Tifleaf Millet Seed	lb	0.28	30.00	8.40
Operator Labor				
Tractors	hour	5.00	1.17	5.85
Diesel Fuel				
Tractors	gal	0.77	4.15	3.20
Repair & Maintenance				
Tractors	acre	2.36	1.00	2.36
Implements	acre	2.52	1.00	2.52
Total Direct Expenses	$/acre			79.12
FIXED EXPENSES (Depreciation and Interest)				
Tractors	acre	5.64	1.00	5.64
Implements	acre	5.19	1.00	5.19
Total Fixed Expenses	$/acre			10.83
TOTAL SPECIFIED EXPENSES	$/acre			89.95

Table 12. Annual costs for buildings, equipment, and improvements for cows, bulls and replacement females, 133 acres and six fields.

Item	Cost ($)	Unit	Life (Yr)	Amt. Req'd	Invest. Req'd ($)	Repair (%)	Repair Costs ($)	Annual Deprec. ($)
Fencing, Electric	1,000.00	mi	20	3.4	3,369	50	84.23	168.45
Charger, Misc.	688.00	ea	10	1.0	688	50	34.40	68.80
Gates	48.39	ea	10	7.0	339	50	16.94	33.87
Corral	3,000.00	ea	10	1.0	3,000	50	150.00	300.00
Hay Rings	97.00	ea	10	6.0	582	10	5.82	58.20
Feed Trough	167.95	ea	5	2.0	336	10	6.72	67.18
Water Trough	133.95	ea	10	6.0	804	10	8.04	80.37
Total					9,117.00		306.14	776.88
Interest on Investment					10%			911.74
Fixed Costs								1,688.61
Direct Costs								306.14
Per Head Fixed Costs								16.89
Per Head Direct Costs								3.06
							Total	19.95

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