Controlled versus Continuous Calving Seasons in the South: What's at Stake?

By Damona Doye, Michael Popp, and Chuck West

Abstract

This paper analyzed the financial ramifications of differences in seasonal input requirements of cow-calf operations by comparing a defined 90-day calving season to year-round calving. Assuming the same calving rate and labor requirements for both production systems, as well as no premiums for larger, more uniform lots of calves with the controlled calving season, uncontrolled calving resulted in slightly higher returns primarily due to better seasonal forage utilization. However, minimal changes to calving rate, expected calf price premiums, and changes in labor requirements favored controlled calving with returns deemed insufficient for small operators to switch from their current practice.

Introduction

Animal scientists have long encouraged producers to adopt controlled breeding seasons in their cow/calf herds. For example, as part of the Arkansas Beef Improvement Program (ABIP), special projects were developed to address common beef management problem areas, including establishing breeding and calving seasons (Troxel et al., 2004). Hopkins, Neel, and Blair advocate a controlled calving season for top reproductive performance. In the *Oklahoma Beef Cattle Manual*, Selk and Barnes state that the use of two defined calving seasons may allow producers to reduce bull costs, allow fall-born heifers to be bred in spring (and spring born heifers to be bred in fall) to calve at more than two years of age, and spread marketing risk.

However, evidence persists that the recommendation to develop either one or two controlled breeding seasons has been ignored by many producers. 1997 National Animal Health Monitoring Systems (NAHMS) data indicated that nearly 54 percent of operations have no set calving season. Recent data collected with the distribution of Oklahoma beef cattle manuals indicated that 47 percent of producers with fewer than 100 cows and less than 40 percent of household income from the beef enterprise leave the bull out year-round (Vestal, Ward, Doye & P, 2006). Hypothetical reasons for this phenomenon vary. One reason given by producers relates to cash flow.

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In any given month, a calf could be ready for sale, thus enabling timely payment of either expected or unexpected expenses. An income-averaging rationale is also sometimes offered, suggesting that because calf sales are scattered throughout the year, producers are guaranteed not to sell the entire calf crop at the year's lowest price. Further, an uncontrolled breeding system is "easy;" for example, bulls do not have to be maintained separately. Another reason proffered is that forages may be better utilized.

Specialists who recommend controlled breeding seasons note that benefits include the ability to better manage cow nutrition, cow and calf health, cow culling, weaning programs, and marketing of calves and cull cows. With a continuous calving system, a herd always consists of cows in different stages of lactation and/or gestation with attendant-varying nutritional requirements. Thus, with uncontrolled calving, if the herd is fed to meet the needs of the lactating cow(s), the average cow may be overfed resulting in feed costs that are higher than is necessary; alternatively, if nutrition is not balanced, the lactating cow is malnourished leading eventually to lesser beef production. Similarly, the potential of seasonal income averaging and cashflow benefits of a continuous calving system may be more than offset by failure to capture price premiums for consistent, larger batches of calves that may be sold if the calving season is controlled and calves are sold once per year (Avent, Ward, & Lalman, 2004; Troxel et al., 2006).

Therefore, questions regarding real or perceived economic benefits are important since the decision to modify calving season typically involves major adjustments in management over several years. For the five farms enrolled in the ABIP project for example, it took an average of 4.3 +/- 0.58 years to reach desired breeding and calving season goals (Troxel et al., 2004). Over the course of the project, the percentage of cows calving in the desired calving season increased from 36.5 percent in the baseline year to 100 percent within 5 years. The authors indicated that specified costs per animal unit decreased and that income over specified costs improved, demonstrating that defining the breeding season increased beef production efficiency in this case.

The objective of this study was to analyze the impact of potential factors affecting the adoption of a controlled breeding system. The financial impact of differences in calving season management on cattle and forage enterprises was assessed and sensitivity of results to assumptions on calving rate (with attendant cow nutrition requirements and forage utilization), operator labor requirements, and calf sale prices were tested. This was done to test a null hypothesis of insignificant differences in financial performance of cow-calf operations using a defined 90-day spring calving season similar to Anderson et al. versus a production system where reproductive performance is more or less a function of seasonal pasture production and natural breeding seasons. Additional analyses were also performed to examine differences in economic returns related to pasture type to provide producers and extension agents further information about calving season management.

Background

Livestock budget studies are periodically conducted in many geographic regions, typically with either a stocker or cow/calf focus and often with specific forage-base and management assumptions (Walker, Lusby & McMurphy, 1987; Zaragoza-Ramire, Bransby, & Duffy, 2006; Phillips et al., 2003; National Ag Risk Education Library, 2006; King-Brister, 2003). Production budgets for beef cattle and pastures may spell out cow herd dynamics, nutrient requirements, medical expenses, labor requirements, machinery and equipment operating costs, overhead costs, and other costs along with production and sales data. These budgets allow producers to evaluate the potential returns to land, management, and capital resources of pasture-based cow/calf production systems. Decision support tools for ranchers also often focus on potential production or economic outcomes in fairly narrowly defined scenarios, for instance, cost and returns associated with a specific size of operation.

Research to identify the most profitable enterprises for a given resource base in a systems framework that incorporates forage production details and livestock nutritional requirements is scarce, however. May, Van Tassell, Smith and Waggoner used integer programming to examine optimal monthly feeding strategies and costs for March and May calving alternatives (1998), and to identify minimum cow feed costs with basin wild rye as a winter grazing option (1999). Smith et al.'s mixed integer programming model used both quality and quantity measures of forage in matching seasonal forage production and livestock nutritional requirements to solve for optimal combinations of cow/calf and stocker enterprises on different resource bases.

Data and Methods

Animal unit months (AUMs) have traditionally been used to define the carrying capacity of pasture. But, the quantity produced and quality of different forages vary significantly over a year, and different calving season patterns place different seasonal demands on forages, labor, and capital, for example. Thus, a model able to incorporate seasonality of inputs and outputs and solve for optimal solutions under different conditions was needed. The modeling framework of Smith (1999) was adapted to a base case scenario of a small 50-cow operation in Arkansas to determine the conditions under which a producer might elect to control their cow breeding and hence calving season.

The model solves for the optimal combination of forage and beef production to maximize returns to an operator's land resource base, labor, management and risk and can be mathematically described as:

$$Max\, Z = \sum_j C_j X_j$$

where:

C_j = income or costs of activity j

X_j = level of activity j

subject to the constraints:

$$\sum_j a_{ij} X_j \leq b_i$$

$$X_j \geq 0$$

where:

a_{ij} = quantity of resource i required per unit of activity j

b_i = quantity of resource i

The linear programming tableau was built in Microsoft Excel. The tableau referred to other worksheets in the spreadsheets that contained data, formulas for calculations, and user-entered information regarding resources and production preferences. Potential production activities included cow-calf, stocker, crop, and forage enterprises. For this research, the activities were restricted to cow-calf and forage enterprises. As the tableau for this model exceeded the limits for the standard Excel Solver, Solver Premium Plus from Frontline Systems was used. Linear programming was used to solve the continuous model through several iterations of simultaneous equations.

The total number of owned acres by land type, the minimum and maximum number of acres of crop and forage enterprises, and the expected annual production per acre (including forage quality) for each type of forage used were specified. Cow-calf nutrient requirements were a function of average body weight (BW) of cows in the herd, average body condition score for cows, average cow milk production, average expected calf birth weight, expected percent calf crop, expected percent of replacement heifers, and expected calf weaning weights (National Research Council [NRC]). Cow-calf nutritional requirements were calculated for various stages of the reproductive cycle (first 180 days, following 90 days, and last 90 days). Maximum dry matter intake (DMI) of cows was set to 2.5 percent and minimum consumption to 1.5 percent of BW (NRC, 1984). For every pound of dry matter (DM) used by the animals, associated pounds of crude protein (CP) and total digestible nutrient (TDN) were also used.

Monthly forage quality was characterized by TDN, CP, and DM quantity, with the quantity produced and quality of different forages varying significantly during a year. Stockpiling of forage resulted in decreased available quality and quantity over time and was dependent on forage type. Both forage quality and quantity adjustments for stockpiled forage were based on expert opinion (West, 2006) and forage transfer from month to month ranged from 68-75 percent depending on climatic conditions. Forages could also be harvested for hay in summer months if not used by the animals. The model was not sensitive to grazing intensity, nor was an animal's DMI a function of TDN concentration in the diet. However, because the model selected forages to meet livestock DM requirements and the TDN values varied by forage type and by month, the TDN concentration of the diet was unknown before the model was run. Therefore, if CP or TDN requirements were a limiting factor for the animal's nutrition in any month, hay and/or other supplemental nutrition could be produced on farm or purchased.

Monthly labor requirements, operating capital, and total costs (excluding labor, feed, and capital costs) for all forage, crop, and livestock enterprises were specified along with general farm information, such as starting operating capital, maximum capital that can be borrowed, annual percentage rate on the borrowed capital, monthly labor hours available from the owner/operator, and the wage rate for hired labor. If labor was a limiting factor in any month, additional labor could be hired up to a user-specified limit.

In this application of the model, farm income was generated from the sale of hay or calves. The calf crop was assumed to be half bull calves and half heifers. An output worksheet summarized the number of spring calving and continuous calving cows, the number of head of steer and heifers calves sold, and supplemental hay and feed purchases by month. A labor summary table showed the number of owner/operator hours used, number of hired labor hours purchased, cost of hired labor per hour, and total cost of hired labor. Total capital required, own capital provided, operating capital borrowed, and interest on capital were also tabulated. Finally, monthly sales and expenses along with net returns to land, overhead, own labor, and capital can be analyzed.

For sensitivity analyses, specific parameters that were expected to differ under controlled and uncontrolled breeding season production systems were modified, including 1) calving rate, defined as ratio of the number of calves sold to the number of cows exposed to a herd sire on an annual basis; 2) operator labor requirements for performing not only physical but also management operations associated with the cow-calf enterprise; and 3) calf prices net of marketing charges to account for potential price premiums for larger and more consistent batches of calves. Finally, the impact of changing to more intensive pasture management was also considered to test for owner labor and land cow-carrying capacity limitations. That is, a producer changes pasture management and then the model tests whether continuous or controlled calving leads to optimal returns. Beyond the scope of this study were interactions between pasture management by calving season management. For instance, it may be argued that a producer using an uncontrolled calving season would likely also manage his or her pastures less intensely, but this aspect was not modeled here.

Base Case Scenario

Arkansas forage information and beef production practices were updated using existing production budgets (King-Brister, 2003). Two types of pasture were available to the operator. A less intensive pasture management choice was well managed, existing Bermuda and fescue pastures yielding forage production of 9,250 lb. of DM per acre; an alternative was a more labor and capital intensive system requiring sod seeding rye for winter annual forage. With winter rye production, total annual forage production increased to 15,800 lb. of DM per acre with heightened potential for early season grazing in February and March. This is accomplished by sod seeding rye in September of the previous year. Due to rolling terrain as well as soil limitations, only limited acreage was available for sod seeding for the base case. Finally, given forage establishment difficulties, pasture fertilization was assumed to maintain these pastures and thereby obviated the need to reestablish pastures and associated establishment charges.

Figure 1 shows the differences in weighted average DM production (top panel), forage CP (middle panel), and TDN content (bottom panel) for the two pasture types. Note that a base of 50/50 Bermuda and Fescue grasses were assumed with average production and quality parameters quantity weighted by month with the exception of January where stockpiling was assumed. In the model, grazing efficiency for forage was assumed to be 35 percent for both pasture types and calving scenarios. Unused forage could be baled at a cost of $40/ton and sold at $60/ton at a harvest efficiency of 70 percent. Again, this assumed that both controlled and continuous calving producers managed their pastures intensively and in a similar fashion.

Product prices and operating costs were entered for each enterprise, as were labor requirements by month (Tables 1-3). The model calculated operating capital requirements, operating interest, and returns to management, labor, and capital as no ownership charges were assessed. Thus model solutions represent a steady-state solution to owned resources. Maxima on borrowed capital were set at $200,000 with an interest rate of 6 percent APR. Available owner/operator hours were specified by month with a constraint of 100 hours per month; similarly, a maximum number of 100 hired labor hours per month was specified at $8.00 per hour.

The distribution of calving for the continuous calving system was based on observations with producers beginning the ABIP program (Richeson, 2006). Compared to the spring calving cows with a defined 90-day calving season from January to March, the continuous calving system more evenly spreads out nutritional requirements (Figure 2). For either controlled or continuous calving cow/calf production, average cow weight (1,100 lb), body condition score (5), milk production (11 lbs/day), calf birth weight (90 lb), percent calf crop (90), and weaning weights for steers (550 lbs.) and heifers (525 lbs.) were equal in the base case scenario. Livestock nutritional requirements were met with pasture and, if needed, hay produced on farm or purchased. Hay quality ranged from lower quality, average Arkansas mixed hay at a cost of $60/ton delivered (11% CP, 52% TDN, and 13% DM) or higher quality, Arkansas Timothy hay harvested in its late vegetative stage at $80/ton delivered (14% CP, 62% TDN, and 11% DM) (Gadberry, 2006). Supplements, 20 or 38 percent CP range cubes, could also be purchased at a price of $0.137 and $0.172 per pound respectively.

Seasonal calf sale prices were based on 1998-2007, long term, nominal, average Arkansas monthly prices (USDA – AMS, 2008) to avoid basing the analysis on cyclically high or low market prices. For both systems, quantity-weighted average monthly prices were used in the model for steer and heifer calf sales. That is, calves were sold seven months after weaning at the average market price associated with that month of the year. This resulted in an average, quantity weighted, seasonally adjusted price of $97.29 and $98.55 per cwt for steers and $89.73 and $90.66 for heifers, respectively, for the controlled compared to the continuous systems. The cash flow month for sales was associated with the modal calving month to simplify cash flow modeling (February calving and September cash flow for both systems). Finally, the above prices did not include marketing charges of $6 per head for hauling and $15 per head for sales commission and insurance. This allowed for appropriate sensitivity analyses on calf price premiums and calving rate as impacts of per head charges would not be mixed with price changes. Pecuniary economies of size in marketing calves were considered indirectly as larger, more uniform lots may also reap lower transport costs (i.e., part of the price premium could be transport cost efficiencies).

Cow replacements were assumed to be cost-neutral in the sense that foregone heifer calf sales and replacement heifer feeding costs were offset by cull cow sales either as cow/calf pairs or as open cull cows. This is somewhat restrictive (Feuz, 2006) but model size limitations dictated this restriction.

Results

Since most beef cattle operations in Arkansas have fewer then 50 head (USDA – NASS), an initial run of the model was used to determine the acreage needed to meet the nutritional needs of a 50 cow herd. Results indicated that approximately 40 acres of the Bermuda/fescue pasture as well as 20 acres of the sod-seeded pasture were needed to primarily pasture feed approximately 50 cows and supplementing with purchased hay during the winter months. This solution conforms well to pasture acreage requirements observed in Arkansas. Initially, the two cow-calf enterprises were assumed to be similar in terms of total non-nutrition costs and labor requirements with cost and revenue changes primarily a function of differences in seasonal calving distribution and associated monthly cow/calf nutrition requirements.

The differences between the two systems in returns as well as annual levels of key inputs were small given the initial assumptions.[1] Controlling the breeding season resulted in slightly lower returns for the herd as slightly more purchased hay was required. Examination of key production variables by month however, pointed out two things. One, as the nutritional needs for a spring-calving herd are greater than or equal to the need in a continuous calving herd for January through June, winter and early spring forage availability is critical and therefore conditions that would allow for more sod seeding would be preferred with controlled calving. Two, controlling the breeding season placed a much higher demand on operator labor in February and March. If less than 100 hours of operator labor were available or off-farm jobs prevented extra hours in these months, as may be the case for some small operations, producers may choose to spread the calving season out over the year to more easily meet their labor constraints.

Sensitivity analysis showed the financial ramifications of changes in model assumptions for calving rate, calf sale prices, labor requirements, and pasture availability. An argument can be made that the calving rate for continuous calving operations is typically lower than that of operations with controlled breeding seasons as the herd's nutritional needs at different gestational stages may be better targeted, e.g., open cows are more obvious and culled. ABIP records showed a disadvantage of approximately one percent lower calving rate for continuous compared to controlled calving operations (J. Richeson, personal communication, March 2006). Not surprisingly, given the small differences shown in initial runs, a reduction in calving rate from the 90 percent base case scenario to 88.5 percent causes a switch from continuous to controlled calving (Table 4). Results are also highly sensitive to calf prices. A $1.10 per cwt price premium for calves from a controlled breeding season resulting from larger, more uniform calf groups or pecuniary economies of size in transport caused controlled to be selected over the continuous breeding enterprise (Table 4).

For the base case scenario, total annual labor requirements per cow were assumed to be equal for the continuous calving system and year round calving as no studies document which system requires more operator time. We argue that controlling calving will save labor hours by not having to constantly monitor calving (continuous calving operations may require a somewhat constant need for cattle monitoring as cows could be calving in any month), but may also lead to more labor hours for more cattle handling for pregnancy checks, cattle sorting and record keeping.

A "most likely" scenario for differences between the two production systems was therefore developed which included an 85 percent calf crop for continuous calving operations (compared to 90% for controlled calving seasons), a 25 percent higher labor requirement for controlled calving enterprises, and a $3 per cwt price premium and/or equivalent in transport savings for calves from the controlled breeding season. In this case, the controlled breeding season enterprise prevails despite higher labor requirements because of the difference in sales generated by more calves at higher prices. Table 4 shows the resulting changes in key variables. Alternative pasture scenarios were also analyzed to determine the land base's impact on the type and scale of operation. Sixty acres with no sod-seeded pasture reduced cow-carrying capacity and significantly reduced net returns but eliminated the need for hired labor. A shift to a greater proportion of sod-seeded pasture allowed for herd expansion and increased returns but required additional hired labor.

Conclusions and Recommendations

Different model runs compared net returns to land, owner labor and capital plus annual labor requirements, amount of hay fed, cow carrying capacity, calf sales, annual operating interest, and associated capital requirements to identify under what conditions producers would choose among continuous or controlled calving seasons. With continuous and controlled calving assumed to have similar labor requirements and calving rate, the initial solution, using Arkansas farm size and forage conditions, narrowly favored continuous calving. A controlled breeding season with spring calving resulted in high demands for forage at a time when production is negligible or low. Results also show, perhaps more importantly, that available owner labor in small, part-time operations may be stressed with controlled calving. For these reasons, continuous calving did not and does not seem unreasonable in some circumstances. Thus, educators and farm managers need to be cognizant of the constraint that operator labor may place on recommendations made.

Sensitivity analyses revealed that even small changes in assumptions favoring controlled breeding seasons make control over breeding season the more profitable choice. Either a 1.5 percent advantage in calving rate or a $1.10 per cwt premium for larger, more uniform calf lots sold shifted the choice to the controlled breeding enterprise. Further, a combination of price premiums and higher calving percentages outweighed higher labor requirements for the controlled calving season, even if additional labor needed to be hired. Thus, our results suggest that small producers may benefit from a variety of educational programs with economic content, particularly studies showing price premiums associated with marketing calves in uniform groups, and analyses that demonstrate the importance of calving rate in determining financial returns.

Additional research is needed to quantify differences in key statistics, such as calving percentage and labor use for typical operators employing continuous breeding systems relative to those using controlled breeding systems. Finally, further study related to pasture management in combination with calving season management is expected to highlight additional labor and/or production cost differences across systems.

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Endnote

[1] Information on monthly, key production statistics like labor use, capital requirements, minimum DM intake, grazing consumption, and hay purchases are available from the authors upon request.

Table 1. Estimated costs excluding operating interest per acre, maintaining established fescue, and bermuda grass for grazing in Arkansas, 2008

	Month	***Unit***	***Price***	***Quantity***	***Value or cost***
Direct Costs					
Fertilizer[1]					
19-19-19	Sept.	lbs	0.332	200.00	66.40
Ammonium Nitrate 34%	Sept.	lbs	0.240	100.00	24.00
Ammonium Nitrate 34%	Mar.	lbs	0.240	120.00	28.80
Ammonium Nitrate 34%	May	lbs	0.240	120.00	28.80
Lime	Mar.	ton	36.00	0.33	12.00
Labor – Fertilizer Buggy[2]	Sept.- May	hours	0.00	0.60	0.00
Herbicides					
2,4-D Amine	Jun.	pint	1.79	2.000	3.58
Labor – 20' Sprayer	Jun.	hours	0.00	0.120	0.00
Mowing					
Labor – 12' Rotary Mower	May	hours	0.00	0.140	0.00
Fuel					
Diesel fuel	Mar., May,	gal	3.25	1.641	5.32
Repair & Maintenance	Sept.				
Machinery		acre	1.20	1.00	1.20
Tractor (2WD 50 hp)	Sept.	acre	0.45	1.00	0.45
	Sept.				
Total Direct Cost		acre			**170.55**

1 It is unlikely that a producer would spend this amount of money on fertilizer. Alternatives such as overseeding nitrogen fixing legumes like clover, birdsfoot trefoil or lespedeza or application of poultry litter are more likely. The above are nonetheless recommended fertilization practices and therefore the reader is cautioned that the above cost estimates are likely conservatively high.

2 With the fertilizer purchase, a buggy is supplied at no extra charge for use with the 50 hp tractor. Each application requires 0.15 hrs/acre of labor and the September application is one trip for both fertilizers.

Table 2. Estimated costs excluding operating interest per acre, maintaining established fescue and bermuda grass with sod-seeded rye for grazing in Arkansas, 2008

	Month	Unit	Price	Quantity	Value or cost
Direct Costs					
Fertilizer[1]					
19-19-19	Sept.	lbs	0.332	300.00	99.60
Ammonium Nitrate 34%	Feb.	lbs	0.240	200.00	48.00
Lime	Mar.	ton	36.00	0.33	12.00
Labor – Fertilizer Buggy[2]	Feb.,Sept.	hours	0.00	0.45	0.00
Herbicides					
2,4-D Amine	Jul.	pint	1.79	2.000	3.58
Labor – 20' Sprayer	Jul.	hours	0.00	0.120	0.00
Mowing					
Labor – 12' Rotary Mower	May	hours	0.00	0.140	0.00
Sod Seeding					
Rye seed	Sept.	lbs	0. 35	90.00	31.50
Labor – 15' No-till Drill	Sept.	hrs	0.00	0.310	0.00
Fuel					
Diesel fuel	Feb., Sept.	gal	3.25	1.779	5.78
Repair & Maintenance					
Machinery	Sept.	acre	3.32	1.00	3.32
Tractor (2WD 50 hp)	Sept.	acre	0.62	1.00	0.62
Total Direct Cost		acre			**204.40**

1 It is unlikely that a producer would spend this amount of money on fertilizer. Alternatives such as overseeding nitrogen fixing legumes like clover, birdsfoot trefoil or lespedeza or application of poultry litter are more likely. The above are nonetheless recommended fertilization practices and therefore the reader is cautioned that the above cost estimates are likely conservatively high.

2 With the fertilizer purchase, a buggy is supplied at no extra charge for use with the 50 hp tractor.

Table 3. Estimate of direct cost of production other than livestock nutrition, pasture costs, and operating interest for a 50-cow cattle enterprise, 2008

Description	**Unit**	**Quantity**	**Price or cost/Unit**	**Value or cost**	**Months charged[1]**
Direct Costs					
Feeding & Operating					
Salt & Minerals	$/bag	60	19.00	$1,140.00	every month
Vaccine, Deworming & Fly control	$/pair	50	4.14	$206.80	Mar., Oct.
Sick Treatment & Vet[2]	$	1	563.75	$563.75	Feb., Oct.
Breeding	$/hd	50	22.69	$1,134.50	every month
Miscellaneous					
Fuel Feeding	$/month	3	120.00	$360.00	Dec. – Feb.
Pasture checking	$/month	9	50.00	$450.00	Mar. – Nov.
Repair & Maintenance		1	1,139.91	$1,139.91	every month
Total Direct Costs				$4,994.96	

1 For the model to calculate operating interest, expenses must be allocated to months. Where more than one month is indicated, charges were split equally across each month. Since breeding costs were primarily bull feeding costs and ownership charges, they were assessed each month rather than for just the breeding period.

2 Medication and veterinary charges were calculated for the entire herd and include 2 veterinarian visits, 57 pregnancy checks at $2.75 each and 2 bull exams at $40 each. For the continuous calving operation, cows were not pregnancy checked but other veterinary costs were expected to offset this difference. Sick treatment and vet charges were spread evenly across each month for the continuous calving system but assigned to October and February for the controlled system.

Table 4. Profit maximizing solutions for alternative-size operations across continuous and controlled calving seasons

% Calving rate (Continuous / Controlled)	**90/90**	**88.5/90**	**90/90**	**85/90**	**85/90**	**85/90**
Pasture acres (Bermuda Fescue / Sod seeded)	**40/20**	**40/20**	**40/20**	**40/20**	**60/0**	**30/30**
Cow Labor requirements (Controlled as % of Continuous)	**100**	**100**	**100**	**125**	**125**	**125**
Calf price premium ($/cwt more for continuous)	**$0**	**$0**	**$1.10**	**$3**	**$3**	**$3**
Net Returns Before Taxes to Land, Overhead, Own Labor, and Own Capital	$2,162	$1,916	$2,178	$2,571	$850	$3,365
Annual Labor Requirements						
Owner (hrs)	345	346	346	408	361	426
Hired (hrs)				7	0	16
Hay Feeding Requirements(lbs of DM)						
Mixed Hay (11% CP, 52% TDN, 13% DM)	89,628	90,241	90,241	90,241	89,025	91,945
Months fed				Oct-Mar		
# of Cows Controlled Calving		49	49	49	42	53
# of Cows Continuous Calving	49					
Sales	$21,504	$21,292	$21,553	$22,004	$18,763	$23,624
Expenses	$19,342	$19,375	$19,375	$19,433	$17,913	$20,259
Annual Interest Expense	$450	$451	$451	$452	$430	$464
Max. Monthly Capital Borrowed	$12,982	$13,071	$13,071	$13,071	$12,613	$13,300

Figure 1. Forage Dry Matter (DM) production, Crude Protein (CP), and Total Digestible Nutrient (TDN) characteristics for the two types of pastures modeled

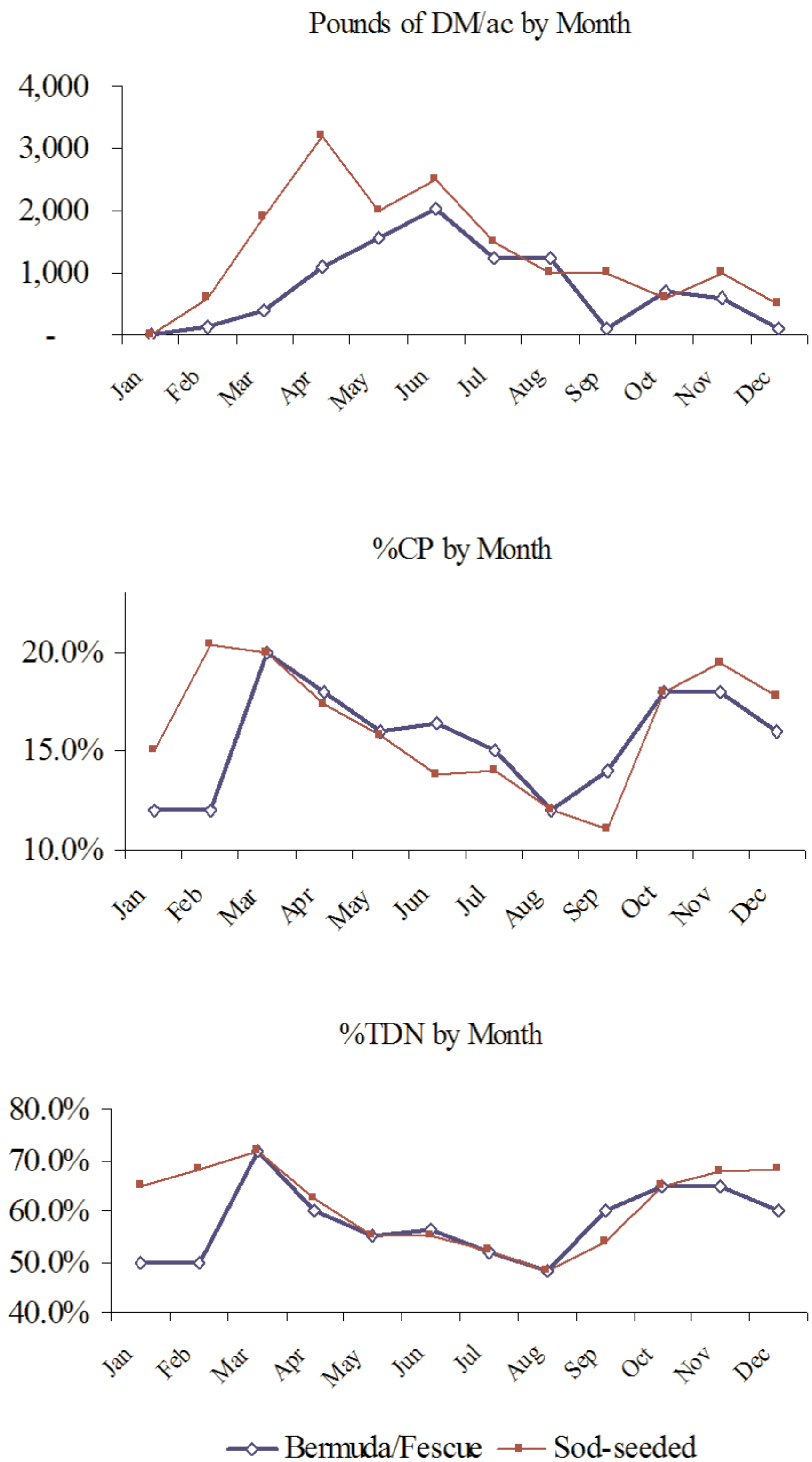

Figure 2. Crude Protein (CP) and Total Digestible Nutrient (TDN) requirements per cow based on seasonal calving distribution as affected by calving season management