A Case Study of Fall versus Spring Calving for the Rocky Mountain West

By Brian A. Strauch, Dannele E. Peck, and Larry J. Held

Abstract

Feeder cattle prices are generally lower in the fall, when the volume of calves for sale is highest. Most ranches in the Rocky Mountains calve in March or April, which results in the sale of weaned calves in October, when feeder cattle prices tend to be lowest. This study was initiated with the idea that a rancher might improve profitability by switching to fall calving, which would enable them to sell calves in April at a higher price. In this study, fall calving generated both higher and less variable profit, but mainly because of cost savings.

Background

Most cow-calf ranches in the Rocky Mountain West (including eastern Utah, western Colorado, and Wyoming) are spring calving operations, with calves typically born in March or April. Seventy-four percent of ranchers surveyed in Wyoming (Nagler, et al.), for example, classified their operations as spring calving. Most ranchers in this region also sell their calves at about the same time of year (usually in October), which reduces feeder cattle prices relative to times when fewer calves are on the market.

The seasonal pattern of feeder cattle prices for various weight classes (Figure 1) confirms that calves can be sold for higher prices (on average) in the spring than in the fall, particularly for calves in the 400- to 700-pound weight classes. This creates a question as to whether ranchers could increase their profits by calving in the fall (August/September), which would enable them to sell calves for higher prices the following spring (March/April). Many producers care not only about the magnitude of profit, however, but its variability as well. Differences in the variability of prices associated with spring versus fall calving systems (Table 1) might therefore be important.



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Previous Work

Previous studies have examined the relative profitability of late season calving. Stonehouse, et al., for example, report that summer calving (June/July) is less profitable than winter calving (February/March) in Ontario, Canada when offspring are sold as weaned calves. ZoBell, et al. note price premiums of three to five percent in Utah for fall-born calves sold in the spring. They also provide a nice summary of the pros and cons of fall calving, and an overview of seasonal management issues. Millar reports higher net returns for a fall calving herd as compared to a spring calving herd in Colorado. The literature therefore reports mixed conclusions about the relative profitability of fall versus spring calving. Inconsistent findings about the relative profitability of fall calving might explain, in part, why more ranchers in the Rocky Mountain West have not yet adopted the practice.[1]

Differences in business risk, due to variable prices for example, might also influence a producer's choice between alternative management practices. It is not clear whether business risk helps to explain ranchers' apparent preference for spring calving over fall calving, however, because the literature has not compared the variability of profit under these two systems. Business risk would not influence risk-neutral ranchers' choice between calving systems, because they are only concerned with profit's magnitude, not its variability. Risk-averse ranchers, in contrast, would be concerned with both magnitude and variability of profit. If, for example, profits were higher (on average) under fall calving, but also more variable, a risk-averse rancher might choose spring calving.[2] Without knowledge of individual ranchers' risk preferences, we cannot predict who will adopt fall calving. We can, instead, provide information about the relative business risk of fall versus spring calving, which risk-averse ranchers can then use to weigh potential tradeoffs between the magnitude and variability of profit under each system.

Objectives

This article compares fall and spring calving in the Rocky Mountain West with respect to: 1) profitability; and 2) business risk due to variable sale prices.

Methods

Two mountain valley ranch models were constructed to represent one fall calving operation and one spring calving operation. Each model assumed different prices for calves (and cull cows), due to different sale dates. The fall calving model assumed calves and cull cows were sold in April; the spring calving model assumed calves were sold in October and cull cows were sold in November. Sale prices were based on twenty-one-year (1987-2007) price series for individual months (USDA Agricultural Marketing Service).

Differences in Performance Attributes

Performance attributes for the fall calving versus spring calving models were identified from existing literature (Feuz and Kearl), as well as surveys and personal interviews with five fall calving operators in Wyoming. All of these operators had practiced spring calving in the past, before switching to fall calving.

Producers identified several advantages to fall calving, including higher prices for fall-born calves, higher rates of calf survival at birth, and lower labor and veterinary costs from calving in milder weather.[3] These advantages are consistent with those reported by Stonehouse, et al. (p.114), who indicate that summer calving labor requirements in Ontario are about seventy-five percent of winter calving requirements (3.08 hours/cow versus 4.04 hours/cow). Wyoming ranchers surveyed for this study estimated fall calving labor requirements to be about sixty-seven percent of spring calving requirements.

Some differences between spring and fall calving operations are less obvious, but equally important. For example, between birth and weaning, fall-born calves are more likely to face severe winter weather, which can lead to lower weaning and sale weights. Additionally, fall calving herds may require more winter forage (both hay and range cake) than spring calving herds because fall calving cows are lactating. Parameters in the fall calving model were adjusted to reflect these differences.

Profitability Analysis

Two profit-maximizing linear programming (LP) models were developed to represent a spring calving operation and a fall calving operation. Both LP models maximize ranch Net Income (i.e., Ranch Revenue minus Specified Costs), subject to identical feed resource constraints (i.e., hay production and Animal Unit Months of summer grazing). Performance factors that differ between fall calving and spring calving operations, as described in the previous section were incorporated in the respective models. Each LP model also incorporated different cattle prices. A partial tableau of the ranch LP models[4] (Table 2) shows the common resource base assumed in both the spring and fall calving ranches, which includes 635 acres of hay meadows, 1,459 AUMs of deeded range for summer or fall grazing, and 2,911 AUMs of BLM/Forest Service range for summer grazing.

The LP models were solved to identify the numbers of cows/calves that maximized Net Income for each ranch setting. Given the optimum number of cows (and related numbers of calves, bulls, and replacement heifers), corresponding cow-calf enterprise budgets were developed to estimate Ranch Revenue, Specified Costs, and resulting Net Income for each calving system, assuming 21-year average hay and cattle prices, and 10-year average hay prices.

Business Risk

Producers may be concerned not only about Net Income, but its variability as well. A Monte Carlo simulation analysis was therefore conducted to determine if business risk, associated with random variation in prices, differs between the two calving systems. The software program @RISK (Palisade Corporation), which is an add-on to Microsoft Excel©, was used to recalculate Net Income 100,000 times (i.e., 100,000 iterations) for each calving system. Each iteration used a different set of steer calf, heifer calf, cull cow, and hay prices, drawn randomly from pre-determined probability distributions (Table 3).

Probability distributions were derived from historical price data (the same data referenced in Table 1) and @Risk's "distribution fitting" tool. Probability distributions for cattle prices were defined for each calving system based on @Risk's measures of best fit. The distribution of hay price was assumed the same across systems. Standard parameter values for the respective distributions are reported in Table 3, as well as truncated lower and upper bounds (a function of the dataset's lowest or highest price and standard deviation), and correlation coefficients (larger positive coefficients indicate stronger positive correlation between two prices, which signals to @Risk that if it draws a high spring heifer or cull cow price, for example, it should draw a high spring steer price as well).

Net Income was re-calculated 100,000 times, based on random draws of prices. This enabled us to express Net Income for each calving system in the form of a probability distribution, rather than a single point estimate. The relative performance of fall versus spring calving can therefore be measured not only in terms of average Net Income, but also standard deviation of Net Income, coefficient of variation of Net Income, and probability of "negative" Net Income (i.e., a net loss).

Results and Discussion

Ranch Revenue, Specified Costs, and Net Income for a 521-cow spring calving herd versus a 464-cow fall calving herd are reported in Table 4. Results for each category are discussed below.

Ranch Revenue

Despite receiving higher prices, on average, for calves sold in April rather than October, Table 4 shows that Ranch Revenue under fall calving ($288,188) is actually $10,379 less than under spring calving ($298,567). This is attributable to the fall calving operation's lighter calf sale-weights (525 lbs. versus 550 lbs. for fall-born versus spring-born steer calves, and 475 lbs. versus 500 lbs. for heifer calves), smaller herd size (464 cows in the fall model versus 521 in the spring model), due to different seasonal forage requirements), and higher replacement heifer needs (0.14 replacement heifers per cow in the fall model versus 0.10 in the spring model, due to the stresses of breeding through the winter), all of which offset higher weaning rates (92% in the fall model versus 90% in the spring model, due to more favorable weather during calving and less calf sickness).

The fall calving model's smaller herd size, originates from differences in their seasonal nutritional requirements relative to the spring calving herd. These differences imply an optimal grazing period of 9 months (6 months during the summer and 3 months during the fall), which is a full month longer than the spring calving herd (5.5 months in the summer and 2.5 months in the fall).[5] The fall calving herd therefore has larger AUM requirements per cow, which causes the deeded and BLM/FS range constraints to become binding at a smaller herd size than in the spring model. Hay production is not a binding constraint in either model, so it plays no role in the relative size of the fall versus spring herd.

Specified Costs

Specified Costs (Table 4) include all costs except management and interest on owned land. The fall calving system generates a cost advantage of $21,850 ($264,872 vs. $286,722). This advantage is due to cost savings in the following five categories: (1) veterinary cost savings = $2,061; (2) labor cost savings = $3,366; (3) decreased annual cost for bulls = $7,072 (because one bull can service 40 cows in the fall calving system compared to only 25 cows in the spring calving system); (4) hay cost savings = $6,506 (because fewer cows and bulls are carried in the fall calving herd), and (5) lower interest cost on breeding stock = $2,845 (again because of the smaller fall calving herd).

Net Income

Net Income (Table 4) is defined as Ranch Revenue minus Specified Costs. It therefore represents the residual return to unpaid costs (i.e., management and interest on deeded land). Although fall calving generates less Ranch Revenue than spring calving (assuming average prices), fall calving actually generates more Net Income (assuming average prices) than spring calving ($23,316 versus $11,845). The $11,471 Net Income advantage for fall calving results from its $21,850 Specified Cost advantage minus its $10,379 Ranch Revenue disadvantage. The role of cost savings is important to note. Without sufficient cost savings, the Net Income advantage of fall calving could easily be reversed to a Net Income advantage for spring calving.

Business Risk

Results of the business risk analysis show that, when variation in cattle and hay prices are considered, mean Net Income is higher ($17,969 versus $9,456) and Net Income is less variable under fall calving than spring calving (Table 4). Specifically, Net Income has a smaller standard deviation ($46,673 versus $55,530) and a smaller coefficient of variation (2.0 versus 4.7) for fall calving than spring calving. The fall calving system also generates less downside risk, i.e., it has a smaller probability of generating a loss ("negative" Net Income), than the spring calving system (38% versus 45%).

Conclusions

The results of this study suggest that fall calving on a Rocky Mountain ranch can generate more profit (on average) and less business risk than spring calving. This raises the question of why spring calving is so much more common than fall calving in the Rocky Mountain West. There are likely many good reasons. It is beyond the scope of this study to identify and critique them, but we can offer a few thoughts on the apparent discrepancy. First, although mean Net Income under fall calving is almost double that under spring calving, this dramatic *relative* increase translates to a relatively modest *absolute* increase of just $8,513 per year (on average). This modest absolute increase in Net Income, even when paired with lower variability, may not be sufficient in many producers' minds to offset the costs and financial risks of transitioning to a new calving system.

Suppose, for example, that a producer transitioned from spring to fall calving by delaying the breeding period of their entire cow herd. The lack of spring-born calves (and associated fall sales) during the first year of conversion could cause profound cash-flow deficits. Extra loans may be needed to compensate for this income shortfall. These loans would increase the ranch's financial risk by increasing debt payments. Some producers may not be willing to take on additional financial risk to achieve a moderate absolute increase in mean Net Income, even if accompanied by a decrease in business risk.

The financial risk of transitioning to fall calving could potentially be reduced by converting one-third of the herd over a three-year period, or perhaps one-half of the herd over a two-year period, to maintain adequate cash-flow. Management of a herd comprised of both spring and fall calving cows would, however, require additional resources (e.g., labor, management, and forage). The cost of these additional resources may discourage producers from transitioning from spring to fall calving in the Rocky Mountain West. Future research could build upon the results of this study by quantifying the costs and risks associated with alternative transition strategies.

An important limitation of this study is that the models used in the analyses were based on aggregate production and resource data (i.e., data from multiple ranches). The study's results therefore do not represent the climate, seasonal feed resources, management skill, or production characteristics of any individual ranch. The characteristics of a specific ranch may cause fall calving to be more or less profitable than what is reported here. There is reason to believe that the fall calving ranchers surveyed for this study possess higher than average management skills, and perhaps a greater willingness to experiment with new unconventional practices.

Prior to this study, we hypothesized that higher prices for fall-born/spring-sold calves would cause Net Income from fall calving to exceed that from spring calving. Higher prices did indeed contribute to higher Net Income; however, they alone were not sufficient to increase Net Income. If the estimated cost savings from fall calving ($21,850) were smaller, the Net Income advantage of fall calving would be lower than estimated in this study, and the result of switching from spring to fall calving on the basis of higher output prices alone could be disappointing.

This result may be relevant to the adoption of other new management practices as well. The accessibility and transparency of data on output prices, as compared to production outcomes and costs, might tempt some managers to adopt a new practice based mainly on its potential to gain access to higher prices. Unique resource requirements, adverse production outcomes, or unexpected costs, however, could easily cause Net Income from the new practice to be only slightly better or perhaps even worse than expected.

Footnotes

[1] It is beyond this study's scope to determine the reasons more ranchers in this region have not switched to fall calving as a means to improve profitability. We can therefore only speculate on a few possible reasons. As ZoBell, et al. acknowledge, "Tradition dies hard, but there are other reasons that particular practices continue." Switching from spring to fall calving might, for example, require cash flow disruptions and new management skills that ranchers perceive as too costly or risky compared to the potential gains.

[2] Risk-averse ranchers, by definition, are willing to give up some profit in exchange for more certainty about its magnitude.

[3] Labor savings associated with fall calving could be useful for other critical needs on a mountain valley ranch, such as irrigation of hay meadows, and maintenance and repair activities. The LP models used in this study assume an unlimited quantity of labor can be hired, i.e. labor is unconstrained (as is capital). The value of labor savings associated with fall calving is therefore captured directly through decreased labor costs per cow, rather than indirectly through the value of increased production of hay or other ranch activities and outputs.

[4] The ranch LP models were initially formulated in matrix form (as in table 3), but were then written and solved as a set of equations in GAMS (General Algebraic Modeling System) (GAMS Development Corporation).

[5] Spring calving cows are fed an average of 30 lbs. of hay per head per day (less before calving, and more after calving) of native hay from November to April. Fall calving cows, in contrast, are fed 15 lbs. of hay supplemented with 2 lbs. per day of a 20% range cake during November and December due to increased nutritional requirements during lactation. As the cows' nutritional requirements decrease, supplemental protein is cut from the diet and hay is increased to 30 lbs. per day through January, February, and March (see Strauch for details about nutritional requirements). Because the fall calving herd is nearing weaning at this point in early spring, they can be turned out at the end of March to begin grazing. The spring calving herd, in contrast, is just beginning to calve and lactate at this point, and therefore cannot meet their nutritional requirements without being fed hay through the month of April. The fall calving herd, unlike the spring calving herd, is biologically able to graze one month sooner in the spring (and hence one month longer over the course of the year). Economic analyses confirmed that it is also more profitable to turn the fall calving herd out sooner, rather than continue to feed them hay. The same could not be said for the spring calving herd.

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Figure 1. Twenty-one-year average steer prices by month and weight class (1987-2007) for Torrington, Wyoming (USDSA Agricultural Marketing Service)

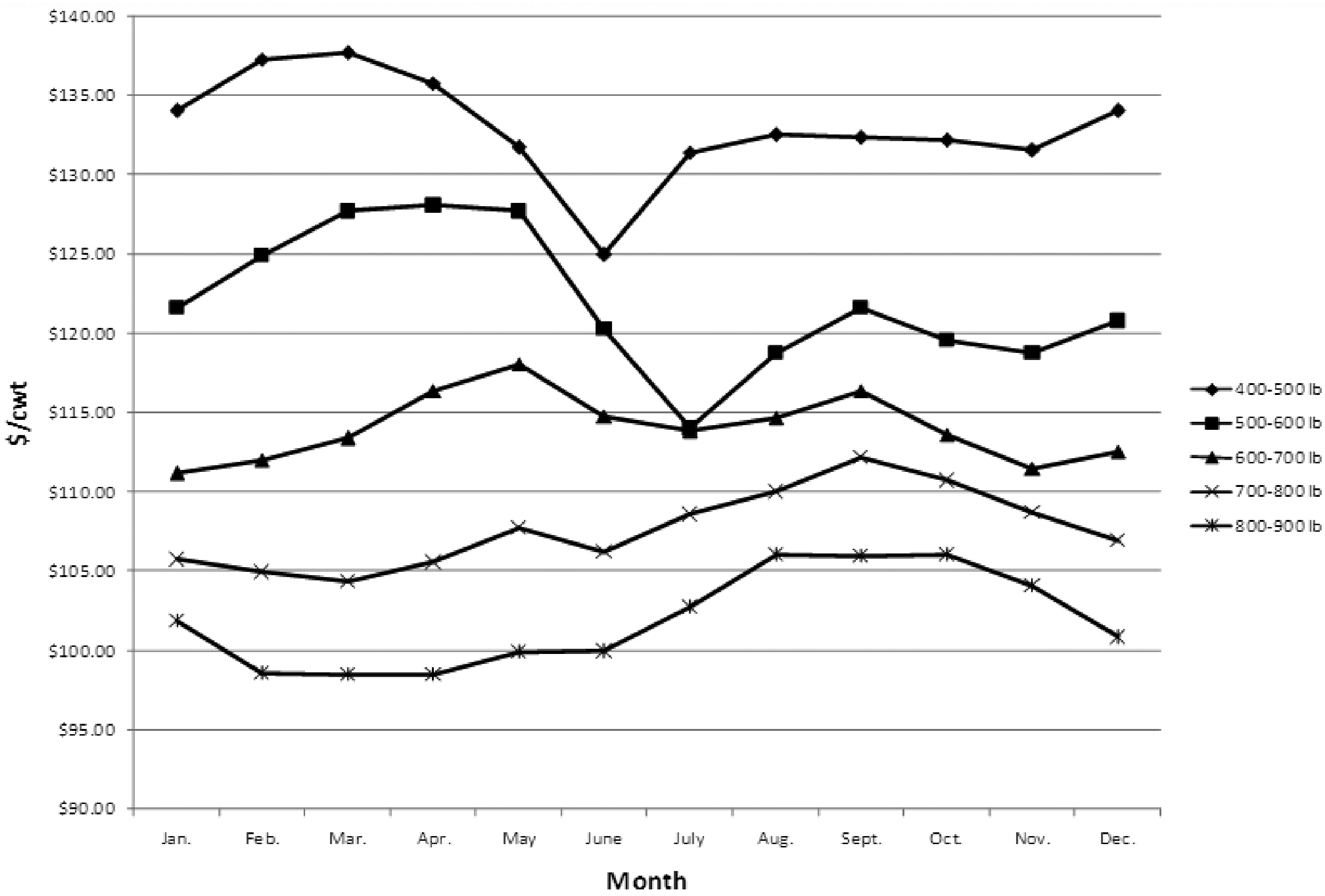

Table 1. Average hay prices (1997-2006) and cattle prices (1987-2007), and associated measures of dispersion, for spring-calving and fall-calving operations.[a]

	Statistical properties				
	Average	Standard deviation	Coefficient of variation[b/]	Minimum	Maximum
Spring-calving					
Steer price[d/] (Oct) ($/cwt)	119.61	19.34	0.162	82.00	144.65
Heifer price[d/] (Oct) ($/cwt)	110.88	18.66	0.168	72.34	133.53
Cull cow price (Nov) ($/cwt)	52.96	12.78	0.241	38.63	74.51
Hay price[c/] ($/ton)	24.58	17.76	0.694	5.78	55.01
Fall-calving					
Steer price[d/] (Apr) ($/cwt)	128.08	17.79	0.139	81.61	156.55
Heifer price[d/] (Apr) ($/cwt)	115.40	17.07	0.148	67.39	141.27
Cull cow price (Apr) ($/cwt)	58.97	12.75	0.216	40.27	79.65
Hay price[c/] ($/ton)	25.58	17.76	0.694	5.78	55.01

[a/] Average prices and associated measures of dispersion are adjusted to 2007 dollars. Cattle prices are for Torrington, Wyoming (source: USDA Agricultural Marketing Service).

[b/] Coefficient of variation = standard deviation ÷ average; a standardized measure of dispersion that allows comparison of variables with different averages. Larger coefficients of variation indicate more variability.

[c/] Hay price is for the state of Wyoming.

[d/] For the 500-600 lb. weight class.

Table 2. Partial tableu of the ranch LP models for spring calving (fall calving)[a]

	Grow hay (ton)	Sell hay (ton)	Graze deeded range (AUM)	Graze BLM/FS range (AUM)	Maintain Cow (head)	Sell steer (head)	Sell heifer (head)	Right hand side
Max	-$67	$92	-$1.93	-$3.88	-105 [-97]	$658 [$672]	$544 [$581]	= Net Income
Hay meadow	2.3							≤ **635** acres
Dd. rg.			1					≤ **1,459** AUMs
Fed. rg.				1				≤ **2,911** AUMs
Hay transfer	-2.3	1			1.80 [1.81]			≤ **0** tons
Summer graze tfr			-1	-1	6.3 [6.9]			≤ **0** AUMs
Fall graze tfr	-1.5		-1		2.9 [3.5]			≤ **0** AUMs
Steer transfer					-.45 [-.46]	1 [1]		≤ **0** head

[a/] Coefficients for the fall calving ranch, if different than for the spring calving ranch, are reported in brackets. For example, revenue from selling a fall-born steer is reported as [$672] vs. $658 for a spring-born steer.

Table 3. Distributions and parameters assigned to prices in the fall versus spring calving models

	Steer calf price (spring)	Steer calf price (fall)	Heifer calf price (spring)	Heifer calf price (fall)	Cull cow price (spring)	Cull cow price (fall)	Hay price (spring & fall)
Distribution assumed	Logistic	Logistic	Normal	Normal	Lognorm2[a/]	Lognorm2	Extreme value
Location parameter	α=120.82	α=129.00	μ=110.88	μ=122.21	μ=exp(52.96)	μ=exp(58.97)	α=17.35
Scale parameter	β=11.18	β=9.67	σ=18.66	σ=19.02	σ=exp(12.78)	σ=exp(12.75)	β=12.35
Lower bound	43.32	46.04	35.02	31.66	13.08	14.76	0
Upper bound	183.33	192.12	170.85	187.52	100.06	105.16	90.53
Correlation coefficient	w/$P_{spr\ heif}$ 0.996	w/$P_{fall\ heif}$ 0.984	w/$P_{spr\ steer}$ 0.996	w/$P_{fall\ steer}$ 0.984	w/$P_{spr\ steer}$ 0.814	w/$P_{fall\ steer}$ 0.726	N/A[b/]
Correlation coefficient	w/ $P_{spr\ cull}$ 0.814	w/$P_{fall\ cull}$ 0.726	w/$P_{spr\ cull}$ 0.816	w/$P_{fall\ cull}$ 0.741	w/$P_{spr\ heif}$ 0.816	w/$P_{fall\ heif}$ 0.741	N/A

[a/] Derived in @Risk by first fitting a normal distribution to the data, and then defining the lognormal distribution's parameters by taking the exponential of the normal distribution's mean and standard deviation. The normal distribution's parameters, when fit to the spring cull cow price dataset, are: μ=52.96, σ=12.78. The lognormal distribution's parameters are therefore μ=exp(52.96), σ=exp(12.78).

[b/] No correlation between hay prices and cattle prices is assumed because of the complex and lagged relationship between the effects of drought (and other relevant events) on hay versus cattle prices.

Table 4. Annual net income and business risk for a spring versus fall calving ranch

	Spring calving, 521 cows				Fall calving, 464 cows			
Activity	Month of sale	Sale price ($/cwt)[a/]	Sale weight (lbs/calf)	Calves sold (head)	Month of sale	Sale price ($/cwt)[a/]	Sale weight (lbs/calf)	Calves sold (head)
Sell Steer Calves	OCT	$119.61	550	234	APRIL	$128.08	525	213
Sell Heifer Calves	OCT	$110.88	500	182	APRIL	$122.21	475	148
Ranch Revenue[b/]				**$298,567**	**Ranch Revenue**[b/]			**$288,188**
Specified Costs[c/]				**$286,722**	**Specified Costs**[c/]			**$264,872**
Net Income using Avg Price[d/]				**$ 11,845**	**Net Income using Avg Price**[d/]			**$ 23,316**
RESULTS FROM BUSINESS RISK ANALYSIS					*RESULTS FROM BUSINESS RISK ANALYSIS*			
Mean Net Income[e/]				**$ 9,456**	**Mean Net Income**[e/]			**$ 17,969**
Standard Deviation				**$ 55,530**	**Standard Deviation**			**$ 46,673**
Coefficient of Variation[f/]				**4.7**	**Coefficient of Variation**[f/]			**2.0**
Minimum Net Income				**- $182,401**	**Minimum Net Income**			**- $172,858**
Maximum Net Income				**$193,189**	**Maximum Net Income**			**$199,869**
Pr(Net Income < $0)				**45%**	**Pr(Net Income < $0)**			**38%**

[a/] **Sale Price** is the 21-year average feeder cattle price for the relevant month of sale.

[b/] **Ranch Revenue** includes annual calf sales, the sale of excess hay ($10,680 in the spring calving system, $13,052 in the fall calving system), and the sale of cull cows ($33,047 in the spring calving system, $45,997 in the fall calving system).

[c/] **Specified Costs** include all annual costs except operator management costs and interest on owned land.

[d/] **Net Income using Average Price** represents the amount of Ranch Revenue left over after covering Specified Costs assuming average hay and cattle prices. It represents residual return to the operator's management and interest on owned land assuming average prices.

[e/] **Mean Net Income** is an average of all net incomes generated over 100,000 iterations, in which each iteration uses a different set prices of prices drawn randomly from the probability distributions. This contrasts to the "Net Income using Average Prices" reported in the previous row which is calculated once using average prices (the 21-year average prices). Both approaches indicate a moderate profitability advantage for fall calving over spring.

[f/] **Coefficient of Variation** is a ratio of the standard deviation to the mean. It normalizes the size of standard deviation by the size of the mean, making it easier to compare the variability of Net Income under fall calving versus spring calving. A higher coefficient implies more variability.