An Analysis of the Potential for Producer Profitability Given Changing Consumer Preferences for Pasture Dairying

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Executive Summary

More and more consumers are taking an interest in where and how their food is produced. Not only do they want to know that their food is safe to eat, but also that the animals that produced their food were treated humanely. A survey by Lusk and Norwood (2008) showed that only about half of consumers rely on science, rather than morals and ethics, to base their judgments on animal welfare. Whether founded in science or not, a segment of consumers and handful of interest groups have played a role in shaping the agricultural industry. One of the primary ways that consumers can influence the market is through their changing demands, and this particular change in demand has resulted in a trend towards food products labeled with credence attributes. Olynk, Tonsor, and Wolf (2010b) demonstrated consumers' willingness to pay for credence attributes with verified pasture access milk. Their work showed that consumers valued self-verified pasture access milk at $0.20 per gallon over the retail price of conventional milk, and consumer group-verified and USDA-verified milk produced from cows with pasture access at $1.17 and $2.14 per gallon, respectively, above conventional milk.

Producers must now decide how to respond to consumer demands. They too, have options, such as which management system they should employ to maximize the profitability of their farm. The intent of this study is to compare two management systems, conventional and grazing, or pasture access, to determine expected profitability under various industry scenarios, given an evolving consumer marketplace. The farm share of premiums paid for the various verifications of pasture access, as well as the farm revenues received for each hundredweight of milk sold were calculated. Then a simplified budget was created using Cornell University's Dairy Farm Business Summaries for grazing and non-grazing farms. Several key input costs in

this budget were adjusted, *ceteris paribus*, by a factor of 10 percent to represent the variability that producers may experience.

Based on a set of key assumptions for price and farm share, this study found that grazing farms have a greater expected profit than their conventional counterparts. With no adjustments to input costs made, conventional and self-verified pasture access grazers suffered a net loss of $1.22 per hundredweight and $1.11 per hundredweight, respectively, under the, admittedly very difficult, 2009 dairy market. Consumer group-verified grazers had a potential margin of $4.12 per hundredweight sold in 2009 market conditions, but the USDA-verified grazers seemed to be in the best position with a potential profit margin of $9.24 per hundredweight. However, it is important to note that these figures for grazers do not include the cost for verifying their product or farm as having pasture access. The addition of verification expenses would most likely have a significant impact on the profitability of the grazing operations and is expected to vary hugely across farms.

Through the use of such budgets, producers can estimate which management system is best for their particular farm situation. There is no one-size-fits-all system that works for every producer, and making the change from one management system to another can be very costly. Producers need a methodology to anticipate the short and long term implications of the management system they choose.

An Analysis of the Potential for Producer Profitability Given Changing Consumer Preferences for Pasture Dairying[1]

Abstract: *Fourteen states currently have legislation in place to govern the welfare of livestock and poultry animals. Although this is a growing trend, few scientific studies have found significant performance differences from animals housed in farms that use "conventional" practices versus those that meet a standard of "natural" or "welfare-friendly". Studies have shown that some consumers are willing to pay a premium for specific verified credence attributes of particular livestock care systems. However, it is generally believed that meeting higher welfare standards is more costly to producers than using conventional management practices. This analysis seeks to incorporate the production costs for both grazing and non-grazing dairy farms and determine if the potential premium paid by consumers for the verified grazing (or verified pasture-access) attribute makes grazing an economical production system for the average dairy producer. Without taking into consideration the cost of verification, the results of this study show grazing farms as having a greater return over operating costs than conventional operations, even given changes in input costs. USDA-verified pasture access has the highest return over operating costs, followed by consumer group-verified pasture access, self-verified pasture access, and finally conventionally produced milk.*

Introduction

A recent curiosity into the animal husbandry practices of U.S. livestock and poultry producers has taken grip on consumers and organized interest groups across the nation. According to a survey of consumers conducted by Lusk and Norwood (2008), only 54.3 percent of respondents felt that decisions on animal welfare should have a basis of some scientific measurability rather than a basis of morals and ethics. The general public's concern is beginning to turn attention to the practices of the animal production industry and even translate into a push for state legislation requiring certain minimums of animal care to be maintained, specifically in terms of providing penned or caged animals with a particular level of mobility (giving them the

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freedom of movement to turn around and fully extend their limbs) (Rumley, 2011). The mounting concern over animal welfare has also resulted in greater product variation being available to the consumer, which has been demonstrated by products toting labels with credence attributes such as "organic", "natural", or "pasture-access". While little scientific evidence exists confirming any substantial benefit from such attributes for the animals or end products, at least some segment of consumers have spoken and shown that they are willing to pay a premium for these food products produced by farms that meet a set of higher standards for animal care (Olynk et al., 2010b).

Specific to the willingness to pay for fluid milk, Olynk, Tonsor, and Wolf (2010b) found that consumers perceive a premium, above conventional[2] milk prices, of $0.20 per gallon for self-verified pasture access milk[3], $1.17 per gallon for consumer group-verified pasture milk and $2.14 per gallon for USDA-verified pasture access milk. Conner et al. (2008) found that of 988 surveyed responses from Michigan consumers, 39 percent always or most of the time purchased pasture-raised products, while 35 percent purchased such products some of the time. Clearly a portion of consumers have placed some value on the grazing[4] attribute of milk production, but studies differ in confirming the actual value of grazing access for the animal itself. Based on a study done by Hernandez-Mendo et al. (2007), certain compromises in well-being exist for dairy cattle raised with access to pasture. Through their work in British Columbia, the researchers

[2] For the purpose of this study, "conventional" dairy operations or "conventionally" produced milk will be defined as dairy operations or milk that is not produced under any particular production system and does not warrant a credence attribute label.

[3] "Pasture access milk" refers to milk produced on a grazing dairy operation (see below). Specific verifications exist for pasture access and will be referred to by the verifying body, whether self-verified, consumer group-verified, or USDA-verified.

[4] "Grazing" will be used in reference to non-organic farms that grazed dairy cows for at least a three month time period and had greater than 30 percent of their forage consumed during the growing season as a result of grazing (Intensive Grazing Farms, DFBS 2009, pp. 1).

found that the gait and lameness in the cows studied improved after being put on pasture; however their milk production decreased as a result (Hernandez et al., 2007).

Dairy producers are faced with the same animal welfare pressures as many other livestock sectors, yet at this time the swine and poultry industries have, arguably, seen more direct impact from state legislation changes. While some might dismiss the dairy industry as a primary concern in the heat of the animal welfare issue, fluid milk stands as a staple food, with a very inelastic demand from American consumers (Wolf, 2010). The importance of fluid milk in the diet is precisely why the dairy industry is facing a significant amount of pressure and attention from the American public in producing a safe product that meets their demand of animal care.

This analysis builds on the findings of previous studies done by Olynk, Tonsor, and Wolf from their assessment of a positive consumer willingness to pay existing for verification of livestock credence attributes (Olynk, Tonsor, and Wolf, 2010a) to the producer response in reaction to these consumer behaviors (Olynk, Tonsor, and Wolf, 2010b). Producers' cost of production for both "conventional" dairies and "grazing" dairies will be compared to analyze key differences, which may impact whether conventional dairies can incorporate grazing or pasture-based production attributes into their systems economically. The objective of this project is to compare the economic benefits and costs to dairy producers of utilizing either conventional husbandry practices or maintaining a pasture-based grazing dairy operation. Essentially, this analysis seeks to address the question of whether the "average" dairy could profitably incorporate pasture-access production practices into their system, assuming that consumers are willing to pay a positive, albeit uncertain, premium for this attribute.

Literature Review

The issue of livestock animal welfare is relatively new at resulting in consumer preferences and demands in the United States. Other countries, particularly European nations, have traditionally had a more pronounced trend of paying higher premiums for credence attributes than U.S. consumers (Mitchell, USDA, 2004). The average willingness-to-pay in the European Union (EU) has reached a level of roughly 22 percent higher for organic milk products than for the conventional comparison, with organic milk consumption expected to grow from 1.25 percent of total milk consumption to 10 percent of total consumption by 2015 (Rosa et al., 2009). Breustedt, Latacz-Lohmann, and Tiedemann (2010) studied the producer budgets of both conventional and organic dairies in Bavaria, Germany, with their very different farm structure and several options of government policy taken into account. The study found that 70.5 percent of conventional farmers and 72.5 percent of organic farmers had chosen the management system that was most profitable, or optimal, for their individual farm. For the farms that did not choose the optimal management system for their particular operation, conventional dairies had the potential to increase their profitability by 18 percent and organic dairies by 7 percent, on average, if they changed to the alternative management system (Breustedt et al., 2010). In similar fashion to the goal of this study, Breustedt et al. (2010) demonstrated just how significantly producer profitability can fluctuate from utilizing various management systems and how each unique farm differs in finding the management system that is optimal for their situation.

The growing concern for utilizing more animal-friendly practices in the U.S. is now being reflected by a movement of both companies and farms alike taking a more proactive approach in response to consumer group pressure and states putting legislative standards in

place. According to Schweikhardt and Browne (2001), the politics of the food industry have been shaped over the years by three converging forces: 1) a fragmentation of interest groups, resulting in a congestion of established legislation channels, 2) the rising affluence of consumers leading to an increased demand in products with specific attributes, and 3) the concentration of consumer food markets with a few firms controlling most of the market. The result of these forces has been that political agendas can now be accomplished via the marketplace (Schweikhardt and Browne, 2001). Rather than rely on the government to step in to regulate, many companies have acted by promising that they, or the producers who supply their agricultural inputs, will meet specific standards of care (Schweikhardt and Browne, 2001). However in some cases, states are resorting to legislative action to address the concerns of consumers and interest groups. One example of this would be in Ohio, where a Livestock Standards Care Board has been formed, along with the banning of veal crates, gestation crates, and new requirements set for battery cages for laying hens (Rumley, 2011). But Ohio is not the first state to pass legislation that establishes welfare minimums for the production sector. Oregon, California, Utah, Arizona, Colorado, Oklahoma, Michigan, Indiana, West Virginia, Georgia, Florida, South Carolina, and Maine all have some form of legislation or board in place created to set standards of animal care (Rumley, 2011).

While this may or may not be a factor in the basis of the state-by-state legislation, science shows that stress in dairy cattle, which can come from a variety of sources, including heat, water or feed deprivation, and husbandry practices, can inhibit, or greatly reduce milk production (Silanikove et al., 2000). One particular study in British Columbia analyzed a measurement of lameness and production of milk in cows kept in pasture versus those that were housed indoors (Hernandez-Mendo et al., 2007). Through their observation, Hernandez et al. (2007) noted that

cows were given access to pasture spent less time laying down than those kept indoors, and improved in any lameness they were demonstrating by a factor of 0.22 units per week (based on the numerical rating system established by Flower and Weary (2006)). They also found signs of improvement in the cows in tracking up (or the extent that the back hoof is set in the same place as the front hoof) and evenly distributing their weight on all four hooves after they had been given access to pasture. However, the cows placed in pasture also tended to go through more significant weight loss and produce less milk than their conventional, indoor counterparts (Hernandez-Mendo et al., 2007). Another study by Haskell et al. (2006), performed in Great Britain, found similar results; cattle that were grazed had a tendency to demonstrate less lameness, and the lameness factor increased with the amount of time that the dairy cows were housed indoors with no opportunities for grazing (Haskell et al., 2006). These studies highlight that while conventional housing has the potential to lead to higher milk production, it also leads to more occurrences of lameness in dairy cattle (Hernandez-Mendo et al., 2007; Haskell et al., 2006). Grazing, or pasture-access, operations have the opposite effects, with milk production decreasing, along with prevalence of lameness.

The benefit of various production systems may be somewhat inconclusive, but the question considering the value of credence attributes for food products is one that should not be taken lightly, as this niche market is becoming a global multi-billion dollar business (Glaser and Thompson, 2000). Whether or not performance is impacted by different environments and treatments, several studies have found positive consumer preferences for fluid milk produced with various credence attributes (Packaged Facts, 2008; Kanter et. al, 2009; Bernard et al., 2009; McBride and Greene, 2007). According to *Natural and Organic Food and Beverage Trends in the U.S.,* a study conducted by Packaged Facts (2008), the organic sector that started the attribute

craze reached sales of $20.0 billion in 2008 from solely the U.S. food and beverage market. From 1998 to 2007, organic foods saw a consistent growth in sales between 17 and 21 percent (Packaged Facts, 2008). Kanter et al. (2009) found from a surveying 148 adult consumers that after the introduction of milk produced without synthetic growth hormone (rbST) to the marketplace, their willingness to pay dropped by 33 percent for conventional milk (or milk that may or may not have been produced with rbST but was not labeled as "rbST-free"). After the "organic" label became available as another option on the marketplace, these consumers' willingness to pay for the conventional product dropped again, but this time by 45 percent (Kanter et al., 2009). These figures are surprisingly high, but they demonstrate just how much some consumers value differentiated products. Milk made up 15 percent of the entire organic market and contributed to 2.1 billion dollars in sales in the year 2005 (Bernard et al., 2009). Although this brought in substantial revenue, organic milk only accounted for 2.4 percent of total milk consumption that year and actually had a markup of over 100 percent (Bernard et al. 2009). After the third quarter in 2010, the American Farm Bureau reported the average price of a half-gallon of conventional whole milk to be $2.04, while a half-gallon of milk produced without rbST was priced at $3.36 and the organic milk sold for $3.62 on average (Meyer, 2010). To show what these premiums mean for organic producers, McBride and Greene (2007) studied the cost of producing milk on an organic operation and found that operating costs for producing organic milk were on average $5.48 per hundredweight higher than the operating costs of producing a hundredweight of conventional milk. The premium received on average for organic producers in 2005 was $6.69 per hundredweight, thus covering their higher operating costs (McBride and Greene, 2007). However, with the addition of operating and capital ownership costs and unpaid labor, the break-even figure for organic producers actually increases to $10.93

per hundredweight (McBride and Greene, 2007). While these premiums and expenses are not specific to the grazing attribute, they do correspond to other products that are differentiated from the conventional norm, and help to tell the story behind the growing trend towards credence attributes.

Consumers have shown they care about animal welfare from their purchase practices. A segment of consumers is willing to pay a premium for credence attributes, whether or not science can prove any certain benefit for the animal from meeting these attribute requirements. The interest expressed by the consumer has translated into some states addressing their animal welfare codes. Some farmers may want to transition their dairy farm now to meet standards they may be forced to meet in the future, and in this case they may want to anticipate the cost of various production systems and compare the profitability of their farm under these new management systems.

Methods

Producer budgets were developed and a sensitivity analysis was conducted to determine the impacts of changes in the input costs and output values in the marketplace. Few states keep financial records (including input costs and output prices) for both grazing and conventional dairies, thus the data that was available had to be assessed for how accurately it could be applied in other regions or states. Key input costs were gathered to demonstrate operating costs for both farm types. Premiums for the grazing credence attribute were then calculated based on conversions to premiums expected per hundredweight. Input costs were adjusted to determine how their changes impacted the potential profitability of grazing farms.

Financial Data: Comparisons of dairy industry structures and farm financials in Indiana and New York

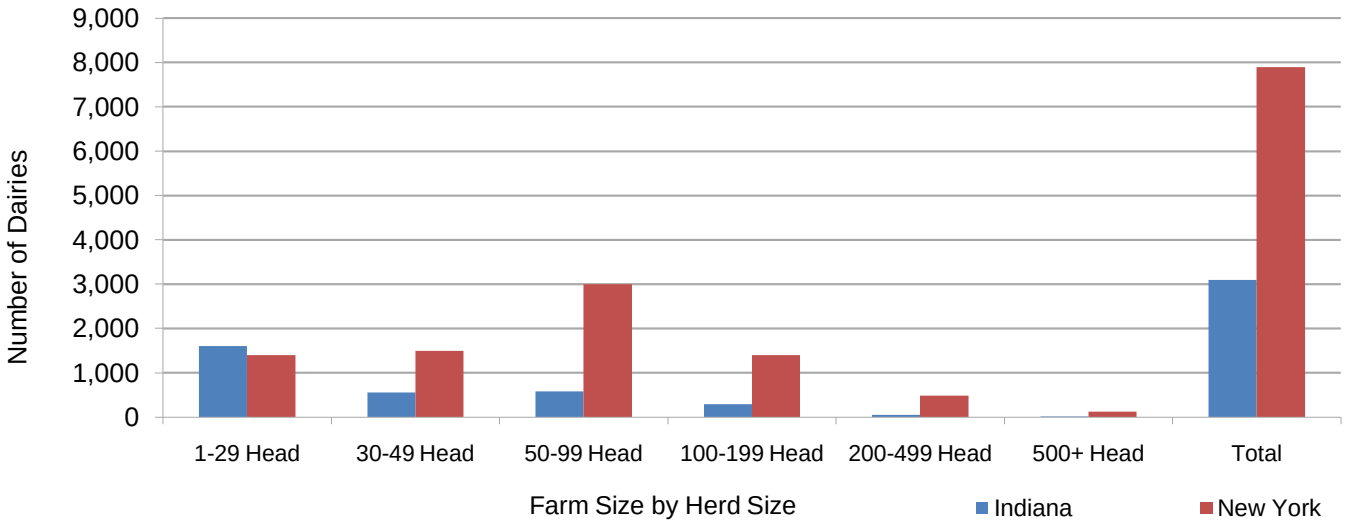
To compare the costs incurred by producers from both conventional dairy farms and grazing dairies, detailed budgets were compared to identify where expenditures differed greatly depending on the farm type (grazing or pasture-based dairying versus conventional dairying, for example). Publicly available data tracking the average costs and revenues for various dairy farm production systems is not published for the state of Indiana. Cornell University publishes a number of Dairy Farm Business Summaries (DFBS) annually, summarizing accrual profitability measures in addition to financial figures on the production and business resources used by dairies in the state of New York (Lazarus et al., 1990). Multiple previous analyses have used the DFBS data to look at things like the competitiveness of small New York dairies in comparison to large farms (Tauer, 2001), the effects of rbST use in milk production and profitability (Tauer and Knoblauch, 1997), the impact of emerging technology on production (Tauer, 1998), and lactation differences from pasture-housed cows and conventionally-kept cows (White et al., 2002).

The most heavily used data for this particular study was found in the 'Progress of the Farm Business' table, which gave a well-rounded look into where the average of the farms surveyed fell and outlined factors impacting the industry, including: size of business, rates of production, labor efficiency and costs, cost control, capital efficiency, income generation, profitability, and financial summary (DFBS 2009: 300 or Larger, pp. 3; 80 or Fewer, pp. 3; Intensive Grazing Farms, pp. 3). The DFBS are broken into sizes of 80 and fewer cows, 300 cows and larger, "intensive grazing farms", as well as by geographical region (for 2009, these

regions were 'Western', 'Northern', and 'Hudson and Central'[5]). The various summary breakdowns enable comparing and contrasting of farms from different demographics.

Before comparing financial data, comparisons had to be made on the number and sizes of dairies in both Indiana and New York to assess whether a reasonable comparison could be made between the two states. Through the United States Department of Agriculture (USDA) Stats Query, the number of dairies in both Indiana and New York were segmented and graphed by farm size (USDA, Dec. 2010). In 2000, Indiana had 3,100 dairy farms across the state, while New York had 7,900 farms. In each size segment, New York consistently had a greater number of farms (Figure 1).

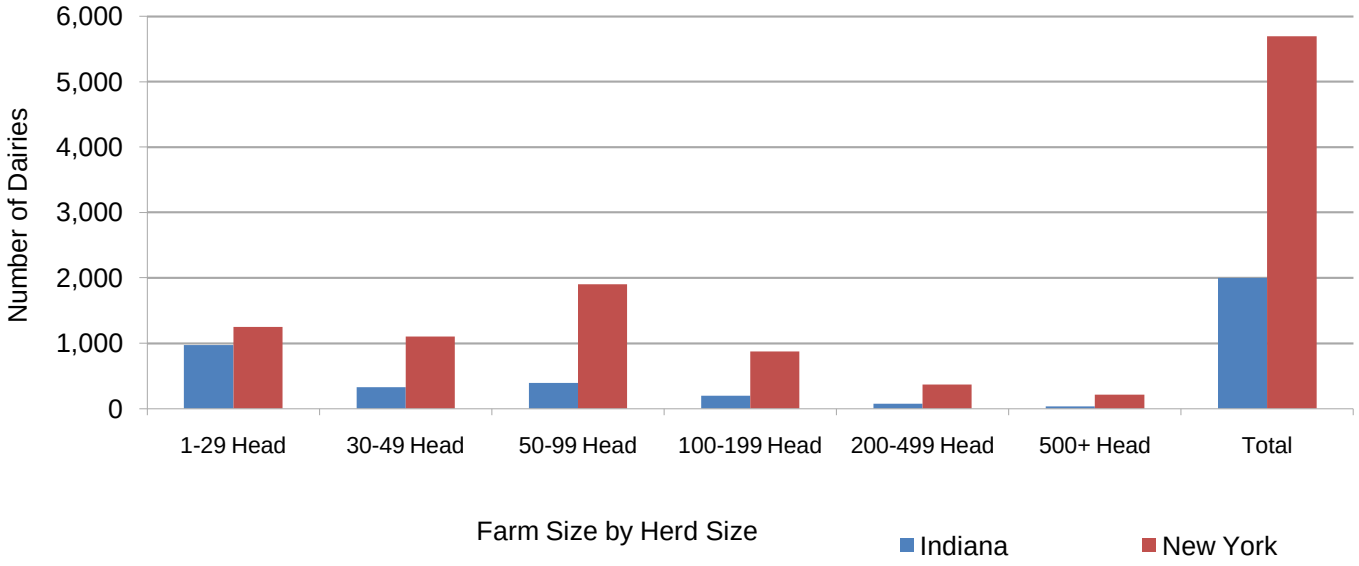
Figure 1. Comparing IN and NY Farm Size Distributions in 2000 (Total Number of Farms)



[5] The geographical regions that Cornell University has chosen to divide into smaller segments of summaries has varied over the years. For example in the year 2000, the regional break-downs available were: 'Western and Central Plain', 'Northern', 'Southeastern', 'Northern Hudson', 'Central Valleys', and 'Eastern Renters'. While both the 'Intensive Grazer' and '300 or Larger Cow Herds' existed in their current form, the smaller herd segment studied was actually limited at 70 cows or less up until the 2002 DFBS, when the size of herds in this category was increased to 80 or fewer cows as it still currently is defined.

Since then, the total number of farms for both states has gradually continued to fall. Small farms, or those defined as 1-29, 30-49, or 50-99 head of cattle, decreased each year between 2000 to 2007 for both Indiana and New York. Dairies with between 100-199 head or 200-499 head saw an overall general decrease over the 2000 to 2007 time frame. Farms with 500 or more head of dairy cattle saw a mostly consistent increase in their numbers over the 2000 to 2007 time period. As farms are becoming larger and more specialized across the U.S., those trends in changing herd sizes in Indiana and New York are not surprising (Olynk and Wolf, 2010). Looking at 2007, the most recent year available from the USDA query, New York had a total of 5,700 dairies, while Indiana had a total of only 2,000 farms. New York again had more farms at each farm size segment, which can be demonstrated in Figure 2.

Figure 2. Comparing IN and NY Farm Size Distributions in 2007 (Total Number of Farms)



While these differences in total herd numbers make it hard to directly compare the states, a comparison of industry structures in Indiana and New York can be made when the size segments are compared as percentages of the total number of farms. As shown in Figure 3, the same comparison of dairy farms in the year 2000 paints a very different picture when depicted

through percentages rather than compared as total farms. Over the years, the percentages of dairy farms in various size categories have become more similar for Indiana and New York. Figure 4 depicts the percentage of total dairy farms in various size ranges in 2007.

Figure 3. Comparing IN and NY Farm Size Distribution in 2000 (Percentages of the Total Number of Dairy Farms)

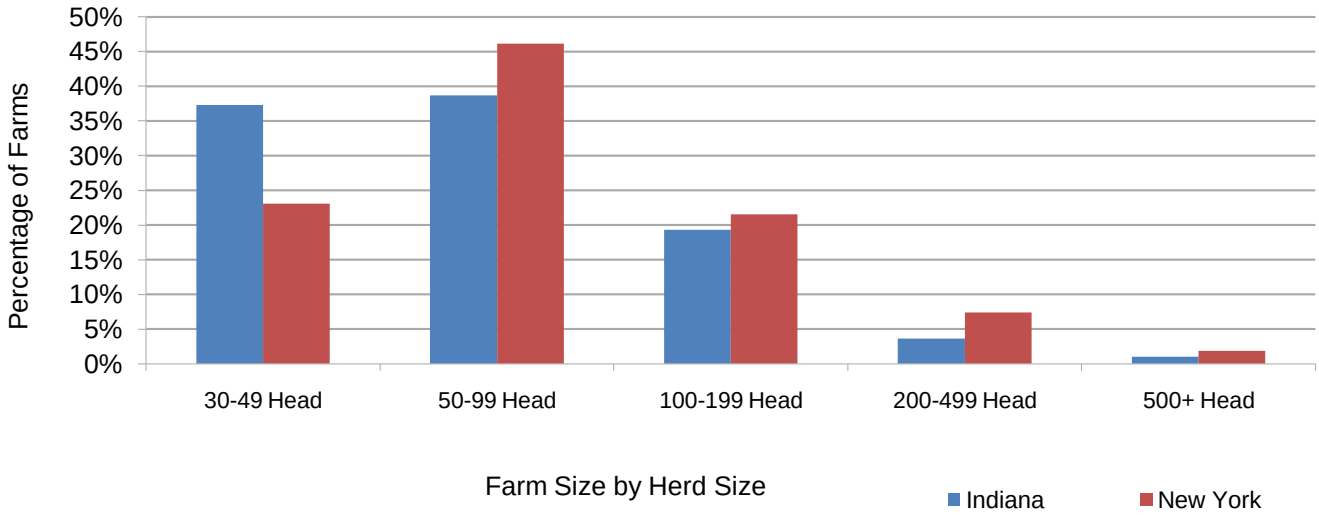
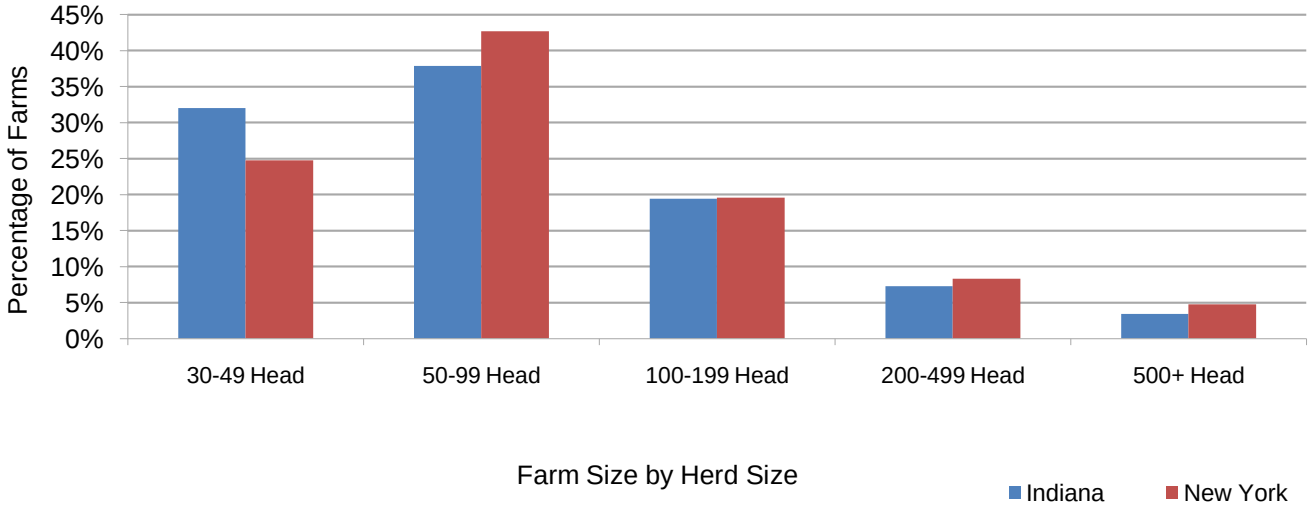


Figure 4. Comparing IN and NY Farm Size Distributions in 2007 (Percentages of the Total Number of Dairy Farms)



Producer Costs of Production

To flesh out the producer budgets of grazing versus conventional dairies, the DFBS for the Intensive Grazing Farms (2009) was compared against the 80 or fewer and 300 and larger cow herd DFBS (2009). Below, in Table 1, are ten of the 23 factors that were recorded for the sample year 2009.

Table 1. 2009 Progress of the Farm Business Factors, Comparing Large, Small, and Grazing Farms

2009 Factors	**80 or Fewer***	**300 or Larger****	**Intensive Grazing Farms*****
Ave. # of cows	55	879	165
Milk sold, lbs.	1,020,438	21,892,641	2,595,519
Hired labor costs per cwt.	$0.97	$2.81	$1.74
Grain & concentrate per cwt. milk	$5.12	$5.17	$4.73
Dairy feed & crop expense per cwt. milk	$6.54	$6.34	$6.70
Total farm operating costs per cwt. sold	$15.51	$15.80	$15.89
Farm capital per cow	$11,657	$8,829	$8,153
Machinery & equipment per cow	$2,315	$1,486	$1,485
Gross milk sales per cow	$2,514	$3,453	$2,221
Gross milk sales per cwt.	$13.57	$13.87	$14.12

Source: *Small Herd Farms, 80 Cows or Fewer DFBS, Cornell University, 2009, pp. 3
**Large Herd Farms, 300 Cows or Larger DFBS, Cornell University, 2009, pp. 3
***Intensive Grazing Farms DFBS, Cornell University, 2009, pp. 3

These numbers highlight the different financial situations facing various sizes and production systems and provide a starting point for the comparisons made in this study.

After taking these factors and trends into account, simplified producer budgets were designed to enable comparisons across farm types. Several of the key expense components were compared (on a per hundredweight basis) for grazing and non-grazing farms. These expenses included hired labor, feed, veterinary services and medicine, and then a broad category of all others. These were summed together to find the operating cost of producing each hundredweight

of milk (following the 2009 DFBS figures and calculations for total operating costs for Intensive Grazing Farms, pp. 11). The operating cost of producing milk per hundredweight, as shown in the budget, is calculated at:

$$y = E - R$$

where *y* is the operating cost to produce one hundredweight of milk, *E* is the total accrual operating expenses including purchases of expansion animals, and *R* is any non-milk accrual receipts (Intensive Grazing Farms DFBS, 2009, pp. 33). One of the additional factors to operating costs that comes to play in determining the total costs per hundredweight represented in the budget is the owner and operator resources invested per hundredweight of milk produced and sold. According to the Intensive Grazing DFBS, the owner and operator resources per hundredweight value is defined as "the total value of equity, management, and labor contributed to the farm from all owners/operators" (DFBS 2009, pp. 48). The equation used to represent this cost was:

$$r = \frac{i + l}{total\ cwt}$$

where *r* is the owner and operating resources used per hundredweight produced, *i* is all interest on equity capital, *l* is the value of both labor and management for all owners and operators, and *total cwt* is the total hundredweight produced in that given year (Intensive Grazing Farms DFBS, 2009, pp. 48). The final configuration of the total costs of producing milk per hundredweight was calculated by:

$$T = y + u + r + c$$

where *T* represented the total costs of production per hundredweight, *y* is the operating costs (with depreciation of machinery factored in), *u* is the value of all unpaid family labor, *r* is the owner and operator resources for labor and management, and *c* is the interest charge for equity

capital (Intensive Grazing Farms DFBS, 2009, pp. 33). The average depreciation figures and unpaid family labor costs were not calculated on a per hundredweight basis for the intensive grazing farms surveyed, thus they were not individually represented in the simplified budget for this study (Intensive Grazing Farms DFBS, pp. 11).

Calculating Premiums

In order to determine profitability and how much the grazing attribute is worth for producers to implement, estimates for how much of the premium consumers are willing to pay actually gets back to the producer were developed. Consumers' willingness to pay, or the premium given to the verified grazing attribute in milk production, was $0.20 per gallon above conventional milk for self-verification, $1.17 per gallon greater for consumer group-verification and $2.14 per gallon greater for USDA-verification, as shown in Table 2.

Table 2. Per Gallon Premiums and Break-even Figures for Various Pasture-verified Milk

Verified Attribute	**Consumer Value from Indirect Questioning**	**Break-even Cost for Providing Verified Pasture Access in 2008***	**Break-even Cost for Providing Verified Pasture Access in 2009**
Self-verified pasture access	$0.20	$0.11	$0.09
Consumer group-verified pasture access	$1.17	$0.62	$0.54
USDA-verified pasture access	$2.14	$1.14	$0.98

Source for Consumer Value from Indirect Questioning and 2008 Break-even figures: Olynk, Tonsor, and Wolf (2010b).
*Break-even values for 2008 are calculated with a farm share of 53 percent; break-even values for 2009 are calculated with the 46 percent farm share.

Not all of this premium paid for verified grazing, however, makes it back to the producer. In 2009, the farm share represented 46 percent of the retail price of whole milk according to the

Economic Research Service (ERS) (USDA). Using this farm share of the retail price for 2009, the share of the premium for producers was calculated to be $0.09 per gallon for self-verified milk, $0.54 per gallon for consumer group-verified pasture access milk and $0.98 per gallon for USDA-verified pasture access milk. Table 2 also compares these farm shares to those found by Olynk, Tonsor, and Wolf (2010b) with the farm share estimated at 53 percent in 2008 (USDA, ERS). The farm share is representative of the break-even cost for producers to provide verified pasture access milk; this being the case because the producer will not be willing to exceed the premium received on the farm to produce the attribute (Olynk, Tonsor, and Wolf, 2010b).

The estimated premium per gallon must be converted to a per hundredweight figure to facilitate calculating profitability at the farm level. The conversion from gallons to hundredweight is 11.63 gallons to the 100 pounds (hundredweight). If the per gallon premium is then multiplied by the 11.63 factor, the result is the premium per hundredweight that grazers can expect to take home. Using these conversion factors, the premium per hundredweight that grazing dairies can expect to yield for their milk is $1.05 for self-verification of grazing, $6.28 for consumer-group verification of grazing and $11.40 for USDA verification of grazing.

The information from the USDA's ERS can also provide an estimate of the revenues expected for the conventional dairy farms. To determine the revenue per hundredweight for conventional farms, the farm value figure, $1.43 per gallon, (calculated from the 46 percent farm share of the average retail price in 2009 at $3.11) can be converted from a per gallon value to a per hundredweight value with the 11.63 conversion rate. The outcome is revenue received by conventional dairies at roughly $16.63 for each hundredweight of whole milk sold during the year. This was calculated from the equation:

$$cd = RP * FS * 11.63$$

where *cd* is the revenue per hundredweight for conventional dairies and the base of the amount received by the grazing dairies, *RP* is the per gallon retail price for whole milk, *FS* is the farm share or the percentage of the retail price that the producer receives, and *11.63* is the conversion factor from per gallon to per hundredweight[6]. The premiums paid to grazers for their milk product for self-verification, consumer-group verification and USDA verification were $1.05, $6.28 and $11.40 per hundredweight, respectively. If those premiums are added to the $16.63 farm revenue expected for conventional farms, the total revenue per hundredweight sold would be $17.68 for milk from cows with self-verified pasture access, $22.91 for milk from cows with consumer-group verified pasture access and $28.03 for milk from cows with USDA-verified pastures access in the 2009 market. These revenues per hundredweight can be compared to the total costs of producing each hundredweight of milk, allowing estimates of profitability under different milk price premium and cost of production scenarios. Table 3 summarizes the premiums per hundredweight available for providing verified pasture access (again representative of the break-even cost in producing the attribute, and given at the 2009 farm share of 46 percent) and revenue figures, which will assumed throughout the remainder of the study.

[6] The methodology used to calculate the farm share of the premium that consumers are willing to pay for verification of pasture access was also used to calculate the farm share of retail milk prices per hundredweight, for shake of consistency throughout the study. It should be recognized that according to the USDA, the actual monthly prices received per hundredweight of fluid grade milk sold were: January, $13.40; February, $11.60; March, $11.70; April, $11.90; May, $11.60; June, $11.30; July, $11.30; August, $12.10, September, $13.00; October, $14.30; November, $15.40; and December, $16.50.

Table 3. Per Hundredweight Break-even Costs for Verified Milk and Revenue Received on Farm

Verified Attribute	Break-even Cost for Providing Verified Pasture Access in 2009 per cwt.	Revenue Received per cwt.
Conventional (no attribute)	--	$16.63
Self-verified pasture access	$1.05	$17.68
Consumer group-verified pasture access	$6.28	$22.91
USDA-verified pasture access	$11.40	$28.03

Implications of a Variable Market: Sensitivity Analysis

All livestock production is sensitive, to some degree, to changes in the aggregate marketplace. Producers witnessed just how variable their profits could be during the 2008 and 2009 extreme volatile period of the dairy and feed markets. Each expense was altered, *ceteris paribus,* to determine how sensitive the overall profitability of the operation was pending a change in one input cost. The increase in one input cost was applied for both grazing and non-grazing farms to compare which practice would fare better with such a change in their operating expenses. This should serve as an example for producers to use when determining whether the premium paid to grazing operations is enough to compensate for potentially higher production costs and to help determine whether grazing operations are more (or less) able to withstand changes in the marketplace.

To measure sensitivity, three key input costs in the simplified budget (labor, feed, and veterinary and medical expenses) were adjusted, *ceteris paribus,* by a factor of 10 percent. The new operating costs were used to determine profitability under the new scenario for both

conventional and grazing dairies. Grazing dairies received the calculated expected price premiums for verified grazing milk production.

Results and Discussion

A simplified producer budget was created to summarize key differences in operating costs for the differing production systems, namely conventional and pasture-based dairying. The figures in the budget produced below show some key itemized expenses, total operating costs per hundredweight, and the total cost of producing a hundredweight of milk across grazing and conventional (non-grazing) farms in the year 2009 (Intensive Grazing Farms DFBS, 2009, pp. 11).

Table 4. Simplified Budget Analysis for Grazing vs. Non-Grazing Farms, 2009

Milk Production Costs, per cwt. 2009	**Non-Grazing Farms (82 farms)**	**Intensive Grazing Farms (27 farms)**
Milk Sold Per Cow, lbs.	21,946	15,884
Hired Labor	$2.06	$1.66
Feed (Including grain & concentrate and purchased roughage)	$5.60	$5.52
Veterinary & Medicine	$0.58	$0.41
Other expenses	$4.83	$4.80
Operating Cost of Producing Milk per cwt.*	$13.07	$12.39
Owner and Operator Resources per cwt.**	$3.26	$4.33
Total Cost of Producing Milk per cwt.***	$17.85	$18.79

Source: Intensive Grazing Farms DFBS, Cornell University, 2009, pp 11.

*Operating cost of producing milk per cwt. is calculated by subtracting out non-milk accrual receipts from total accrual operating expenses (this would also include the purchase of expansion animals (Intensive Grazing Farms, DFBS 2009, pg. 33).

**Owner and operator resources per cwt. represent "the total value of equity, management, and labor contributed to the farm from all owners/operators." It is calculated by finding the sum of interest on equity capital and the value of both labor and management for all owners/operators, and then dividing this number by the total hundredweight produced in the given year (Intensive Grazing Farms, DFBS 2009, pg. 48).

***Total costs of producing milk per cwt. is the summation of operating costs (with depreciation of machinery taken into account), the value of any unpaid family labor, the value of the operators' labor and management, and the interest charge for the equity capital (Intensive Grazing Farms, DFBS 2009, pg. 33).

Comparisons can be made both between the operating costs and total costs in producing milk per hundredweight to the revenues for conventional and pasture-access milk.

A conventional dairy would earn revenue of $16.63 per hundredweight of milk sold. First, we can analyze this against the total operating costs for conventional farms, or $13.07 per hundredweight of milk, on average (Intensive Grazing Farms DFBS, 2009, pp. 11). The return over operating cost in this case would be $3.56 for each hundredweight of milk sold under the assumptions described in the methods used to estimate expected milk price to the farm gate. Comparing this same revenue figure to the total cost of producing one hundredweight per milk, which is $17.85 for non-grazers (Intensive Grazing Farms DFBS, 2009, pp. 11), a net loss of $1.22 per hundredweight is actually incurred under our assumptions.

Given this budget structure and the premiums evaluated, grazing farms have a significant return and profit for producing their grazing credence attribute, as compared to the conventional dairies. The operating costs incurred by grazers were actually lower compared to conventional farms, coming in at a value of $12.39 per hundredweight, as opposed to $13.07 per hundredweight. With the premium for self-verification of pasture access taken into account, grazers yield an expected revenue of $17.68 per hundredweight of milk and would see a return over operating costs of $5.29 per hundredweight. Grazers who utilize consumer group-verification for pasture access had revenue of $22.91 per hundredweight and would see a return over operating costs of $10.52 per hundredweight. The return over operating costs for USDA-verification of pasture access would then be $15.64 per hundredweight of milk, after their revenue of $28.03 per hundredweight.

The total costs of producing milk per hundredweight, which is higher for the grazers and totals $18.79 as compared to $17.85 per hundredweight for conventional dairies, should also be

compared to the revenue figures to determine potential profit margins. For self-verification of pasture access, grazers would have a net loss of $1.11 per hundredweight, while consumer-group verified grazers would have a potential profit of $4.12 per hundredweight and USDA-verified grazers a potential profit of $9.24 per hundredweight. While these profit margins for grazers seem very large, producers should be cognizant of other expenses and factors that are unique to each farm. In particular, verification costs for pasture-access have not been taken into account here. Grazing operations who choose to meet the standards for USDA-verification are earning the highest returns, but they most likely have significant expenses for verifying their product. Because verification costs differ so greatly on a farm by farm basis, no relative values can be placed on the budget to represent this expense (Olynk, Wolf, and Tonsor, 2009a). The only certainty in comparing these costs is that self-verifying farms would have the least expense for verifying their pasture access nature in relation to both consumer group and USDA-verification for pasture access.

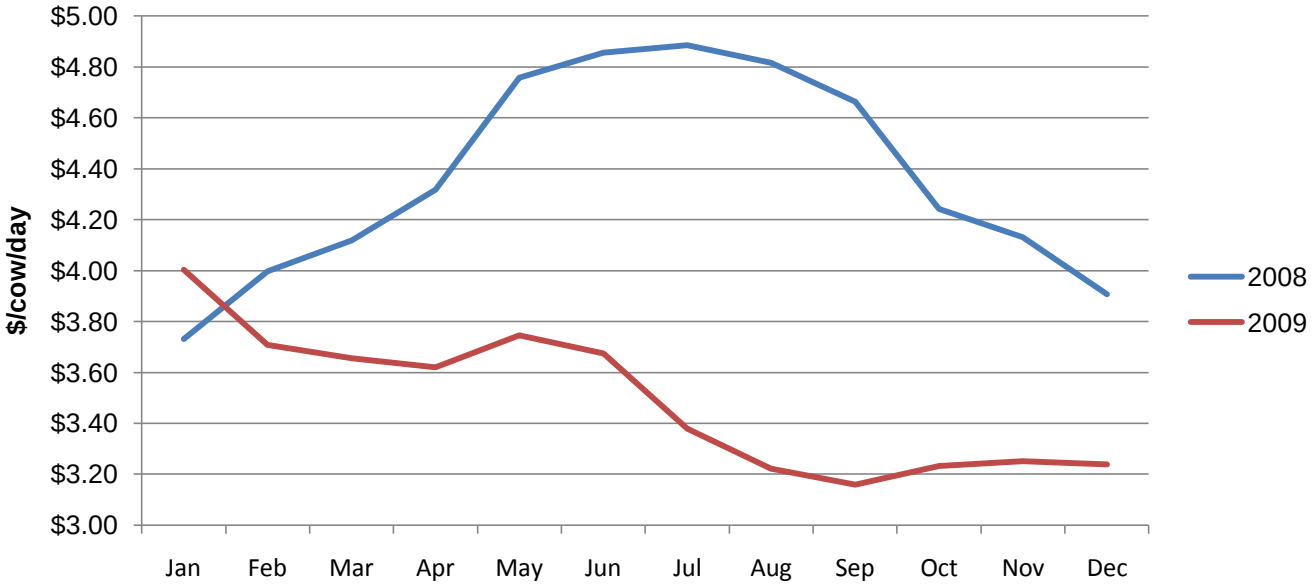
As is demonstrated from the potential returns and profits, the operating costs in producing one hundredweight of milk varies a considerable amount from the total cost to producing that same hundredweight. Conventional farms had higher operating costs, yet lower total costs of production. Highlighted in Table 4, one factor that contributes to the higher total costs for grazers is the owner and operator resources per hundredweight, which is "the total value of equity, management, and labor contributed to the farm from all owners/operators" (Intensive Grazing Farms DFBS 2009, pg. 48). This value and other contributors to the grazers' total costs of production cannot be identified by a single number, but they do exist and play a heavy role in leaving grazers with higher total costs per hundredweight than conventional farms.

This initial review shows the average grazing operation in New York earning a higher profit margin than the average conventional farm. Grazers who meet the requirements for USDA-verification for their pasture-access also received a higher premium, thus greater potential profit margin than grazers who opt for self or consumer-group verification of pasture access. It should be noted that the costs associated with verifying (either by the farm itself, a consumer group, or the USDA) are not reflected in these budgets. There are expected to be costs, perhaps significant costs, associated with verifying pasture access on dairy farms with one of these verifying entities. Such costs are unlikely to be trivial and may play a large role in determining whether the verified grazing attributes is indeed profitable for individual dairy farms to provide.

Sensitivity Analysis of Changing Input Costs

To represent a more accurate scenario with variability in input costs, the key itemized expenses will be adjusted in the sensitivity analysis portion of this study to determine the impacts on conventional and grazing dairy operations' expected profitability. Even after comparing producer budgets to find the most profitable choice to fit their needs, producers should consider that this is not a static marketplace and anticipate both the short-run and long-run implications that such variability may have on their overall profitability. For example, recent feed costs have changed dramatically and have certainly had implications in the short term for many farms. Figure 5, below, shows just how dynamic changes in feed expenses can be from year to year and even month to month.

Figure 5. Dairy Feed Cost (65 lbs/day)



Source: Understanding Dairy Markets, hosted by Brian Gould at the University of Wisconsin, Madison

To assess how these varying input costs impact profits, each key input expense was adjusted by 10 percent, *ceteris paribus*. The results provide an example of how different systems respond to changes in input prices and which system is better suited to coping with these changes.

Labor: Increases in hired labor costs reduce the margin available to producers from both conventional and grazing farms. The return from the operating costs with the 10 percent increase in hired labor costs is $3.35 per hundredweight for conventional farms. When compared to the adjusted total costs of producing a hundredweight of milk, the revenues from conventional farms aren't ample enough to cover the increase in costs, giving a net loss of $1.43 per hundredweight. Self-verifying grazers have a return over operating costs of $5.12 per hundredweight, but like conventional farms, they suffer a net loss compared against total costs of production at a rate of $1.28 per hundredweight. Grazing farms that have consumer-verified pasture access have a

return over operating costs of $10.35 per hundredweight. When compared to the total costs of producing milk per hundredweight, the profit margin for consumer-verified pasture access is $3.95 per hundredweight. Returns and potential profit for USDA-verification of pasture access are greater at $15.47 per hundredweight and $9.07 per hundredweight at the operating expense level and total cost of production level, respectively. However, it should be noted that a portion of labor expense cannot be accounted for here, which comes in the form of unpaid family labor and owner and operator expenses. These figures are factored into the difference from operating costs to total costs of production, which is where grazers exceeded conventional farms in expenses (refer to Table 5). As stated previously, the costs associated with verification (whether self, consumer, or USDA) are not included in these budgets. The costs are likely to vary widely across individual farm operations and should be assessed on a farm-specific basis. Nonetheless, the fact that these costs are not yet accounted for in these budgets should be recognized.

Table 5. Simplified Budget Analysis with Adjustments to Labor Expenses, 2009

Milk Production Costs, per cwt. 2009	**Adjusted Non-grazing- Labor**	**Adjusted Intensive Grazing Farms- Labor**
Hired Labor	$2.27	$1.83
Feed (Including grain & concentrate and purchased roughage)	$5.60	$5.52
Veterinary & Medicine	$0.58	$0.41
Other expenses	$4.83	$4.80
Adjusted Operating Cost of Producing Milk per cwt.	$13.28	$12.56
Unadjusted Total Cost of Producing Milk per cwt.	$17.85	$18.79
Plus Adjustment	$0.21	$0.17
Adjusted Total Cost of Producing Milk per cwt.	$18.06	$18.96
Revenues: Conventional vs. Self-verification	$16.63	$17.68
Revenues: Conventional vs. Consumer Group-verification	$16.63	$22.91
Revenues: Conventional vs. USDA-verification	$16.63	$28.03

Feed: A 10 percent increase in feed costs, including grain, concentrate and roughage, has the most significant effects on the total costs of producing one hundredweight of milk. The revenue for conventional farms is still greater than the adjusted operating costs, with a return of $3.00 per hundredweight. However, the newly adjusted total cost of producing milk is higher than the revenue by a margin of $1.78 per hundredweight. Grazers who self-verify their product see a return over operating costs of $4.74 per hundredweight, but a loss of $1.66 per hundredweight compared to total costs per hundredweight. Consumer-verified grazers have a return over operating costs of $9.97 per hundredweight even with the adjustment made to feed costs. The grazers are still profitable, but the margins are much slimmer, when comparing to the adjusted total cost of producing milk at $3.57 per hundredweight before verification costs. USDA-verified milk yields a return of $15.09 per hundredweight when compared to operating costs and potential profit of $8.69 per hundredweight compared to total costs of production, without any verification costs taken into account.

Table 6. Simplified Budget Analysis with Adjustments to Feed Expenses, 2009

Milk Production Costs, per cwt. 2009	**Adjusted Non-grazing- Feed**	**Adjusted Intensive Grazing Farms- Feed**
Hired Labor	$2.06	$1.66
Feed (Including grain & concentrate and purchased roughage)	$6.16	$6.07
Veterinary & Medicine	$0.58	$0.41
Other expenses	$4.83	$4.80
Adjusted Operating Cost of Producing Milk per cwt.	$13.63	$12.94
Unadjusted Total Cost of Producing Milk per cwt.	$17.85	$18.79
Plus Adjustment	$0.56	$0.55
Adjusted Total Cost of Producing Milk per cwt.	$18.41	$19.34
Revenues: Conventional vs. Self-verification	$16.63	$17.68
Revenues: Conventional vs. Consumer Group-verification	$16.63	$22.91
Revenues: Conventional vs. USDA-verification	$16.63	$28.03

Veterinary and Medical: Of the key input costs outlined in this study, the 10 percent change in veterinary and medical expenses had the least impact on the profit margin for both conventional and grazing farms. Conventional farms still have a return of $3.50 per hundredweight when only compared to operating costs, and a net loss of $1.28 per hundredweight when compared to the total costs to produce a hundredweight of milk. Self-verification for grazers results in a return over operating costs of $5.25 per hundredweight, but again yields a net loss when held to total costs of production, this time at $1.15 per hundredweight. Grazing operations that opt for consumer group-verification have return of $10.48 per hundredweight and potential profit of $4.08 per hundredweight when held to operating costs and total costs, respectively, prior to payment for their verification. The USDA-verification for grazing dairies yields a return over operating cost of $15.60 per hundredweight and potential profit of $9.20 per hundredweight compared to total costs of production, without verification expenses factored in.

Table 7. Simplified Budget Analysis with Adjustments to Veterinary and Medical Expenses, 2009

Milk Production Costs, per cwt. 2009	**Adjusted Non-grazing- Vet & Med**	**Adjusted Intensive Grazing Farms- Vet & Med**
Hired Labor	$2.06	$1.66
Feed (Including grain & concentrate and purchased roughage)	$5.60	$5.52
Veterinary & Medicine	$0.64	$0.45
Other expenses	$4.83	$4.80
Adjusted Operating Cost of Producing Milk per cwt.	$13.13	$12.43
Unadjusted Total Cost of Producing Milk per cwt.	$17.85	$18.79
Plus Adjustment	$0.06	$0.04
Adjusted Total Cost of Producing Milk per cwt.	$17.91	$18.83
Revenues: Conventional vs. Self-verification	$16.63	$17.68
Revenues: Conventional vs. Consumer Group-verification	$16.63	$22.91
Revenues: Conventional vs. USDA-verification	$16.63	$28.03

In all scenarios with increases in the individual input costs, the grazers fared better, particularly those that were USDA-verified, as USDA verification of pasture access yielded the largest milk price premium. Outside of these controlled scenarios, it would be rare for one input cost to change without the others also being impacted by some degree. These adjustments were very simplistic, but they provide a model for producers to compare their financial records with to measure how potential input cost changes will impact their bottom-line.

Conclusion

This study set out to compare grazing dairies versus conventional dairies, allowing producers to decide for themselves what production system best fits their needs. Based on the simplified budget analysis, grazing farms received a higher profit margin than conventional farms when estimated premiums for milk from cows with pasture access were included, under the assumptions of a 46 percent farm share of the average 2009 retail price and consumer willingness to pay for the verified grazing attribute. Grazing farms who received consumer group-verification of pasture access on average received $22.91 per hundredweight of milk sold in revenue. USDA-verification for grazers produced average revenues of $28.03 per hundredweight, whereas conventional farms without verified pasture access averaged $16.63 per hundredweight of milk sold. One important factor to note is that conventional farms typically produce much more milk than grazing operations (21,946 pounds sold per cow versus 15,884 pounds per cow) (Intensive Grazing Farms DFBS, 2009, pp. 11). Under the assumptions made for the 2009 farm share and the total cost of producing a hundredweight of milk ($17.85 per hundredweight for conventional farms and $18.79 for grazing farms), conventional farms and self-verifying farms suffered a net loss of $1.22 per hundredweight and $1.11 per hundredweight, respectively. Farms that opted for consumer group-verification of pasture access

had a potential profit of $4.12 per hundredweight, and USDA-verified pasture access on farms resulted in a potential profit of $9.24 per hundredweight. However, these margins fluctuate with changes in the marketplace and input costs.

Future research could provide another interesting layer to this comparison if price sensitivity for credence attributes could be quantified. Fluid milk is a staple food product with an inelastic demand, yet little research has been done on consumer demand elasticities for milk produced and labeled with specific attributes. Conventionally produced milk and differentiated milk could be substituted for one another, but consumers' willingness to replace their conventional milk with verified pasture access milk, for instance, would be dependent on factors such as income and price.

Despite being able to provide the budget analysis for the average dairy farm, deciding which management system to use is a very individual choice with many variables impacting each farm's final decision. Ultimately, each producer has to gauge their particular economic situation to find the long-run solution that makes their dairy operation profitable. Potential premiums for grazing (or other credence attributes) have the potential to impact the profitability of dairy farms, yet the expense of verifying their farm and milk product may also influence profitability. Producers should be aware of how different systems may yield differing output prices in the marketplace, and how such premiums may impact whole-farm profitability, especially in turbulent times.

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