The Economics of No-Grain Rations for Lactating Dairy Cows

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ABSTRACT: In recent years, increased research showing that meat and dairy products produced from no-grain pasture rations result in higher levels of conjugated linoleic acid (CLA) and more favorable Omega-3 to Omega-6 fatty acid ratios. Historically high grain prices since 2005 caused livestock farmers, especially grazing and organic farmers, to decrease the amount of grain in dairy rations. At the same time, small niche markets have developed for animal products produced without grain as consumers began recognizing the demonstrated health benefits of CLA and a favorable Omega-3 to Omega-6 ratio to the point that some were willing to pay a premium price for pasture produced animal products.

However, the question still remains about how economically viable it is for producers to produce animal products without grain. It is a question most accurately answered in hindsight and then is still difficult to answer.

For at least a century, farmers and researchers have been discussing the question of what is the optimum grain:forage ratio in dairy cow rations. The answer is a moving target which changes daily on every farm because it is subject to a large number of variables. Important variables that influence the answer to this question include: quality of forage, pasture height, pasture density, forage intake, total dry matter intake, stage of lactation, the cow's genetic potential, cow's health, cow comfort, input prices, output prices, and weather.

Despite these many variables, enough is known to provide useful guidelines to help producer's decision making. First, assuming all other variables are equal, some production will be sacrificed with no-grain rations. Second, maximum intake of quality forage is essential for maximizing production with or without grain. Third, maximum economic production requires good management with or without grain. Fourth, a review of the research about the production response to grain in dairy cattle rations suggests a thumb rule that over the course of a year and across an entire herd, one can expect to gain about a pound of milk for every pound of grain consumed.

This information and more was used to project the price premium that most dairy graziers would need to achieve the same profit levels without grain as they could achieve with grain. Under current assumptions, the premium is estimated to be about $5-7.00 per cwt. sold. This study further examines the relative impact of changes in some of the variables on the price premium needed.

Introduction

High grain prices from 2006 to 2013 and the desire to fill the grass fed market niche for dairy products increased the interest in the economics of no-grain rations for lactating dairy cows.

However, the question still remains about how economically viable it is for producers to produce animal products without grain. It is a question most accurately answered in hindsight and then is still difficult to answer.

Guidance for the range of production responses to grain feeding levels for this analysis came primarily from the following research.

Dr. Larry Satter with several coworkers at the U.S. Dairy Forage Research Center conducted several studies of combinations of grain and forages in rations (Tessmann, 1988), (Tessmann, 1991). They showed that grazing cows consuming high quality forages could produce as much as 13,000 lbs. of milk per lactation without grain. Collectively these studies also suggested that for an entire herd for an entire lactation, one could expect to gain about a pound of milk production for every pound of grain fed (Dhiman, 1993).

Research by Dr. Dave Combs and Dr. Ken Albrecht of the University of Wisconsin Dairy Science and Agronomy Departments, respectively, fed stored feed to one group of cows (Depies, 1994). Another group was rotationally grazed and supplemented with stored feed to be nutritionally similar to the stored feed ration. This study demonstrated that at least up to

about 22,000 lbs per lactation, production did not have to be sacrificed in a grazing system as long as the manager was willing to supplement pastures with other feed.

A more recent study led by Dr. Brad Heins at the University of Minnesota divided an organic herd into three groups (Heins, 2013). During the 2012 and 2013 grazing seasons (125 days long each year), one group consumed pasture plus minerals, another group was fed six lbs. of a grain mix and the third group was fed twelve lbs. of a grain mix to supplement pasture. The grain was fed as part of a TMR, which included some corn silage, haylage, and minerals. On the average day in the two 125 day periods in this study, the pasture-only group produced 32.03 lbs. of milk, the group receiving six lbs. of grain produced 38.98 lbs. of milk and the group receiving 12 lbs. of grain produced 41.66 lbs. of milk. Based on prices at the time of this study, the no-grain ration had the highest level of income over feed cost.

As mentioned before, many variables affect the relative profitability of grain versus no-grain rations for dairy cattle. This obviously makes the answer to the question of which is more profitable a constantly moving target. Despite that fact, the above and other research collectively indicates the following points with a fair amount of confidence about attempting to make the feeding of no-grain to lactating cows economically competitive.

1. Milk production has almost always been shown to decrease from some to no-grain in dairy cow rations. A wide range of this decrease has been shown in various studies.
2. Adequate intake of quality forage is essential with or without grazing throughout the lactation. This includes having productive pastures, developing grazing management skills, and having the ability to mechanically harvest forages in a state of high quality.
3. On the average, for an entire herd and an entire lactation, one pound of grain can be expected to yield an additional pound of milk produced. Consequently, not feeding grain has its best chance of being economically competitive when the per-pound price of grain exceeds the per-pound income from milk produced and/or when a milk price premium is paid.
4. No-grain rations are not likely to be a cure for a previous lack of profitability.
5. Success requires good management with or without grain.
6. Without a production response, feeding grain would not pay.

Economic Analysis Approach

Economic data from operating no-grain dairy farms is very scarce. The author has about five farm years of reliable whole farm financial data from dairy farms that do not feed grain. The author also has discussed the practice with a handful of dairy farms that feed no-grain. All of these no-grain farms rotationally graze during the growing season and most of them are organic herds.

Under most circumstances, a price premium is needed to obtain the same amount of income over grain cost per cow per day in the no-grain case versus feeding some grain. Given that situation, it is appropriate to illustrate this very complex issue in a way that makes the likely economic outcomes easier to understand.

Guided by the above research, several combinations of production levels between grain and no-grain rations, using several combinations of milk price and grain price were compared in a partial budgeting approach to compare the income over grain costs in each grain versus no-grain comparison. The partial budgeting approach measures the net effect of increases and decreases in income and cost that result from a change such as feeding grain or not feeding grain or changing an input or an output price. The advantage of the partial budgeting approach is that it simplifies the analysis by ignoring details that don't influence the outcome. A disadvantage to the partial budgeting approach is that it does not measure overall profitability.

Choosing examples to illustrate.

Milk production from actual no-grain herds that the author has some data from has ranged from about 5,000 to 9,000 pounds of milk per cow per lactation. Many farm years of data from Wisconsin dairy farms reveal an average of about 16,000 pounds of milk sold per lactation from non-organic grazing herds that supplement some grain and about 14,000 pounds from organic herds that supplemented some grain. Using the above range of production levels suggests that no-grain feeding herds in Wisconsin are sacrificing about 30-70% of their production by not feeding grain. The Minnesota research suggests production sacrifice levels of 18-20% with high level management, when measured during the grazing season.

The following chart (Table 1) multiplies the per cow average daily pounds of milk sold by 305 days in a lactation to make it easy for readers to compare selected daily lactation average pounds of milk per cow to pounds of milk per 305 day lactation per cow.

Table 1

Daily lactation average lbs. milk per cow	Lbs. milk per 305 day lactation/ per cow
65 lbs.	**19,825**
50 lbs.	**15,250**
45.5 lbs.	**13,878**
40 lbs.	**12,200**
35 lbs.	**10,675**
30 lbs.	**9,150**
28 lbs.	**8,540**
20 lbs.	**6,100**

The assumptions are the most important part of any analysis and the following discussion explains the range in values of variables that were chosen to be displayed in this report.

1. Each pairing of grain to no-grain assumes the same cow and management level.
2. A 305 day lactation is assumed in all cases.
3. Mechanically harvested, stored forage may be fed in all rations, especially in the non-growing season.
4. Corn silage is not acceptable as a forage for no-grain herds unless the silage is free of grain.
5. Pasture must be at least 30% of the dry matter intake (DMI) during the growing season.
6. The two grain feeding levels were zero and 10 pounds of DM per cow per day.
7. The forage DMI in all rations is assumed to be 30 pounds.
8. It is assumed that the cows with grain in their rations consume 30 pounds of DM forage and 10 pounds of grain DM per day.
9. Since corn is the most common grain used for livestock feed, it was assumed that corn would be fed in these comparisons.
10. Additional scenarios were performed in which the DM intake was made equal between the grain and the no-grain group. However, those comparisons produced results that were fairly similar to the other scenarios and tended to be less favorable to the no-grain economic performance.
11. By examining 50-100 combinations of these variables, it is possible to sort out the more likely economic margin differences between the grain and no-grain scenarios.

Assumptions specific for the comparisons involving non-organic graziers:

1. The milk income per pound sold ranged from 15-20 cents.
2. The grain prices of 5, 10, and 15 cents per pound were used. These prices translate to $2.80, $5.60, and $8.40 per bushel of corn.

Results

A positive number in the rightmost column in the following six tables shows the price premium in dollars that would be needed to make the income over grain cost per cow per day and per lactation for the no-grain ration equal to the ration with grain.

Table 2 assumes non-organic grazing herds and assumes the thumb rule that one pound of grain will produce a pound of milk. The grain versus no-grain daily milk production is 40 versus 30 pounds of milk, which translates to 12,200 and 9,150 pounds of milk per 305 day lactation, respectively. This is a production sacrifice of 25%. These production amounts are fairly close to those obtained in the Minnesota study. In the six combinations of prices in this table, only in the case where the grain and milk price are equal is the income over grain cost equal for the no-grain and grain rations. For the income over grain cost to be equal in the other five combinations in this table, a milk price premium ranging from $1.67 to $5.00 per CWT would be needed for the no-grain group. It is useful to recognize that the

one scenario in this table that shows the income over grain cost to be equal requires a high per-bushel conventional corn price of $8.40 that also equals the price of milk.

Table 2

Total Intake (Lbs. DMI/day)		Lbs. milk/cow/day		Production % Sacrificed with no-grain	Milk Income	Grain price	Milk Price Premium Needed $/CWT For No-Grain Group
Grain	No-grain	Grain	No-grain		¢/Lb.	¢/Lb.	
40	30	40	30	25%	20	15	$1.67
40	30	40	30	25%	20	10	$3.33
40	30	40	30	25%	20	5	$5.00
40	30	40	30	25%	15	15	$0.00
40	30	40	30	25%	15	10	$1.67
40	30	40	30	25%	15	5	$3.33

Table 3 somewhat mimics the average daily production achieved by non-organic grazing herds that the author has data from. It ignores the thumb rule that one pound of grain will produce a pound of milk. The grain versus no-grain daily milk production is 50 versus 30 pounds of milk, which translates to 15,250 and 9,150 pounds of milk per 305 day lactation, respectively. This is a production sacrifice of 40%. For the income over grain cost to be equal in the six combinations in this table, a milk price premium ranging from $5.00 to $11.64 per CWT would be needed for the no-grain group.

Table 3

Total Intake (Lbs. DMI/day)		Lbs. milk/cow/day		Production % Sacrificed with no-grain	Milk Income	Grain price	Milk Price Premium Needed $/CWT For No-Grain Group
Grain	No-grain	Grain	No-grain		¢/Lb.	¢/Lb.	
40	30	50	30	40%	20	15	$8.33
40	30	50	30	40%	20	10	$10.00
40	30	50	30	40%	20	5	$11.64
40	30	50	30	40%	15	15	$5.00
40	30	50	30	40%	15	10	$6.67
40	30	50	30	40%	15	5	$8.33

Assumptions specific for the comparisons involving organic graziers:

1. The milk income per pound sold ranged from 25-35 cents.
2. The grain prices of 18, 30, and 44.6 cents per pound were used. These prices translate to $10.08, $16.80, and $25.00 per bushel of corn. Although uncommon this decade, both extremes have occurred.

Table 4 assumes organic grazing herds and assumes the thumb rule that one pound of grain will produce a pound of milk. The grain versus no-grain daily milk production is 40 versus 30 pounds of milk, which translates to 12,200

and 9,150 pounds of milk per 305 day lactation, respectively. This is a production sacrifice of 25%. These production amounts are fairly close to those obtained in the Minnesota study. Milk and grain prices are higher in the organic tables than in the non-organic tables. In the three cases where the grain price is higher than the milk price, the income over grain cost is higher for the no-grain ration. For the income over grain cost to be equal in the other three combinations in this table, a milk price premium ranging from $1.67 to $5.67 per CWT would be needed for the no-grain group. It is useful to recognize that two of the scenarios in this table that shows the income over grain cost to be higher for the no-grain group required a per-bushel corn price of $25, which is quite high. The other scenario had a per-bushel corn price of $16.80, but a low organic milk price of $25 per CWT.

Table 4

Total Intake (Lbs. DMI/day)		Lbs. milk/cow/day		Production % Sacrificed with no-grain	Milk Income	Grain price	Milk Price Premium Needed $/CWT For No-Grain Group
Grain	No-grain	Grain	No-grain		¢/Lb.	¢/Lb.	
40	30	40	30	25%	35	44.6	$-3.30
40	30	40	30	25%	35	30	$1.67
40	30	40	30	25%	35	18	$5.67
40	30	40	30	25%	25	44.6	$-6.53
40	30	40	30	25%	25	30	$-1.67
40	30	40	30	25%	25	18	$2.33

Table 5 somewhat mimics the average daily production achieved by organic grazing herds that the author has data from. It ignores the thumb rule that one pound of grain will produce a pound of milk. The grain versus no-grain daily milk production is 50 versus 30 pounds of milk, which translates to 15,250 and 9,150 pounds of milk per 305 day lactation, respectively. This is a production sacrifice of 40%. Milk and grain prices are higher in the organic tables than in the non-organic tables. For the income over grain cost to be equal in the six combinations in this table, a milk price premium ranging from $1.80 to $17.33 per CWT would be needed for the no-grain group.

Table 5

Total Intake (Lbs. DMI/day)		Lbs. milk/cow/day		Production % Sacrificed with no-grain	Milk Income	Grain price	Milk Price Premium Needed $/CWT For No-Grain Group
Grain	No-grain	Grain	No-grain		¢/Lb.	¢/Lb.	
40	30	50	30	40%	35	44.6	$8.47
40	30	50	30	40%	35	30	$13.33
40	30	50	30	40%	35	18	$17.33
40	30	50	30	40%	25	44.6	$1.80
40	30	50	30	40%	25	30	$6.67
40	30	50	30	40%	25	18	$10.67

Results Summarized

The various combinations of production responses and prices of grain and milk show that under most circumstances, not only is milk production per cow per day in lactation sacrificed, but income over grain cost is sacrificed as well.

As the price per pound of grain equals or exceeds the price per pound of milk that the amount of income over grain cost that is sacrificed gets smaller or disappears. This is rare.

The more one sacrifices production from no-grain rations, the more income over grain cost is sacrificed with the no-grain option.

In a few cases, the charts show a no-grain scenario in which the income over grain cost is higher for the no-grain ration than for the grain ration. However, most of those scenarios require price relationships between milk and grain that are highly unusual and/or production sacrifices that are less than many producers achieve.

Since the scenarios suggest that producing milk on no-grain rations is not usually economically competitive without a milk price premium, how much should that premium be?

It should be obvious that there is not a one size fits all answer to this question. There is also not necessarily a mathematically sound way of providing such an answer, given the variability that exists among production responses and the price of milk and grain. However, from looking at 50-100 combinations of prices and production responses, it appears like producers would probably need a price premium of $5-$7 per CWT of milk sold to achieve as much income over grain cost per cow and per lactation using a no-grain ration. Obviously, some producers may not need as much of a premium, while others are likely to need much more of a premium. The dollar amount of premium required to keep no-grain milk production an economically attractive practice for producers is likely to increase as the milk price increases.

What is needed to make no-grain pay?

- Careful management and monitoring
- High intake of quality forage all year
- Don't sacrifice more than 10-15% of production—difficult to verify
- Don't sacrifice more than 10 lbs. milk/cow/day—difficult to verify
- Grain prices as high or higher than milk AND/OR
- Attractive premium $5-7/CWT sold

Other considerations with no-grain feeding

- More difficult to maintain body weight, especially in multiple lactations
- Could more difficult to maintain calving intervals with low energy diets
- No-grain diets may result in lactation lengths shorter than 305 days
- Best response from grain feeding likely to occur in early lactation. Every Lb. milk lost/cow/day at peak lactation reduces lactation production by about 200 Lbs.

If feeding some grain is usually profitable, how much should be fed?

- Most grazing and organic herds will be more profitable most of the time if some grain is included in the ration
- The optimum amount to feed continues to be a moving target every day
- The research suggests that an average of about 5 lbs. grain/cow/day as a minimal level.
- Successful managers will increase and decrease the amount of grain fed based on stage of lactation, the quality of other available feeds, and all of the other variables
- Use the new TTNDFD test in ration balancing

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