

Economics of Conventional and Hybrid Grazing Dairies Relative to Organic and Organic No-Grain Dairies

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The economics of various dairy production systems is a topic of frequent conversation in Extension's work with Iowa dairy producers and industry professionals. This article attempts to shed further light on the economics of four dairy systems:

- 1) Conventional/Confinement dairy (CONV)
- 2) Hybrid Grazing dairy (HGraz)
- 3) Organic dairy (ORG)
- 4) Organic No-Grain dairy (ORG-NG)

This study uses the "Millionaire Model Dairy Farm Performance in Iowa" publications and data from both 2015 and 2016 to compare relative profitability of these systems.

Conventional Milk Price Drives Most Profitable System

The conventional and organic milk prices are one of the most important factors when comparing profitability of the various dairy systems. The organic milk price changes but is more stable than conventional milk prices. In both years of this study, conventional milk prices were relatively lower than than a more typical 3-5 year milk price time frame. A further analysis would be appropriate to show comparative system profits with milk price correlation over a longer period.

For instance, if conventional milk prices would have been \$1/cwt higher in 2016, return increased by an estimated \$12.32 per labor hour with 1.78% increased return to assets to the CONV farms. ***Thus, only a \$1-\$2/cwt increase in the conventional milk price would have made the CONV and HGraz farms very competitive with both the ORG and ORG-NG farms.*** The same is true when considering the 2015 data, too. Above \$19/cwt average conventional milk price, a significant advantage would seem to go to both the CONV and HGraz farms.

Non-Conventional Dairy Systems are Profitable

ORG and ORG-NG dairies have earned respect as a viable and profitable dairy system as have our CONV and HGraz dairies. In 2015, the HGraz system had similar profitability to the ORG and ORG-NG systems but one farm was in expansion mode in 2016 which reduced profitability. In 2015 and 2016, the ORG and ORG-NG dairies were separated into two groups because all three of the ORG-NG dairies earned their way into the high profit group of organic dairies.

The data for each of these systems is summarized in Table 1 (last page of publication) which clearly shows a profit advantage to both the ORG and the ORG-NG systems over the CONV and the HGraz systems. The ORG system received a milk price of \$35.03 with a cost of production per hundredweight equivalent (cwt. eq.) of \$30.38 for a net profit after all costs, including opportunity costs of both equity and

unpaid labor, of \$4.65. The ORG-NG system received a milk price of \$41.17 with a cost of production per cwt. eq. of \$32.46 for a net profit after all costs of \$8.71. Table 2 below summarizes the profit of the ORG and ORG-NG systems.

Table 2. Average Returns 2015-16 Iowa Comparison	ORG Farms 2015-16		ORG-NG Farms 2015-16	
	Per Cow	Total	Per Cow	Total
Net Cash Income	\$2,320	\$197,286	\$2,169	\$168,853
Inventory Change	-\$438	-27,120	-\$32	-\$2,503
Net Farm Income	\$1,881	\$170,166	\$2,137	\$166,351
Equity @ 4% on all assets	\$708	\$58,387	\$720	\$56,057
Return to Unpaid Labor	\$1,173	\$111,779	\$1,417	\$110,294
Labor Earnings Per Hour	\$24.74		\$31.05	
Rate of Return on Assets..	7.87%		9.28%	
Operating Profit Margin....	29.32%		38.08%	
Asset Turnover Ratio.....	34.82%		24.81%	

The CONV system received a milk price of \$16.73 with a cost of production per cwt. eq. of \$16.19 for a net profit after all costs, including opportunity costs of both equity and unpaid labor, of \$0.54/cwt. The HGraz system received a milk price of \$17.05 with a cost of production per cwt. eq. of \$16.00 for a net profit after all costs of \$1.05/cwt. Table 3 below shows the 2015-16 profit of the CONV and HGraz systems.

Table 3. Average Returns 2015-16 Iowa Comparison	CONV Farms 2015-16		HGraz Farms 2015-16	
	Per Cow	Total	Per Cow	Total
Net Cash Income	\$1,008	\$291,850	\$918	\$152,597
Inventory Change	-\$53	-32,650	\$171	\$16,310
Net Farm Income	\$955	\$259,200	\$1,088	\$168,907
Equity @ 4% on all assets	\$447	\$126,148	\$462	\$79,875
Return to Unpaid Labor	\$508	\$133,052	\$627	\$89,032
Labor Earnings Per Hour	\$21.55		\$22.58	
Rate of Return on Assets..	5.82%		5.79%	
Operating Profit Margin....	11.59%		18.28%	
Asset Turnover Ratio.....	50.41%		34.59%	

In a general sense, the profitability of the CONV and HGraz systems are less than the profitability of the ORG and ORG-NG systems. But, again, this study stems from a 24 month comparison when conventional milk prices were considered low. Therefore, further analysis follows to analyze possible results "if" conventional milk prices were \$1-\$2/cwt. higher.

Realize that past history at times has rewarded conventional producers with prices \$6-\$8/cwt. higher than 2015 and 2016 prices. Thus, the realm of conventional milk prices and profitability over a 3-4 year timeframe, can vary dramatically. Organic milk pay prices, though more stable, can also change as marketers learn to deal with supply and consumer demand. The next section aims to highlight profit changes to conventional milk price increases.

Using Dairy TRANS to Compare Profits with an Increase in Milk Price

Profit differences between CONV or HGRAZ and ORG or ORG-NG seems to hinge on which side of \$18-\$20/cwt range the conventional milk price is, assuming somewhat current cost structures. Within that range, the systems seem to be very competitive. There is probably as much variability among farms within the various systems as among the systems. To give credence to this concept, the combined 2015-2016 data on average was entered into the Dairy TRANS financial analysis program to gauge changes in milk price sensitivity for both the CONV and HGRAZ systems. The results are in Table 4 below:

The left half of Table 4 shows results for the CONV farm example for 2015-16 data. The CONV milk price was \$16.73/cwt. The first column of numbers shows profit on a per cow basis and the second column of numbers shows total dollar value per farm. The next two columns show the results if \$1/cwt was added to the CONV milk price, per cow and per farm, followed by a \$2/cwt. increase for the CONV farms in the following two columns. The right half shows results for the HGRAZ farms in similar fashion. The HGRAZ milk price was \$17.05/cwt. The Labor Earnings are for main operator/manager(s) only, not paid employees.

Table 4. Average Returns 2015-16 Iowa Comparison	Average CONV Farms		Plus \$1/cwt Milk Price		Plus \$2/cwt Milk Price		Average HGRAZ Farms		Plus \$1/cwt Milk Price		Plus \$2/cwt Milk Price	
	Per Cow	Total	Per Cow	Total	Per Cow	Total	Per Cow	Total	Per Cow	Total	Per Cow	Total
Net Cash Income	\$1,008	\$291,850	\$1,297	\$363,251	\$1,552	\$434,651	\$918	\$152,597	\$1,018	\$185,307	\$1,198	\$218,017
Inventory Change	-\$53	-32,649.92	-116.61	-32,650.00	-116.61	-32,650.00	\$171	\$16,310	\$90	\$16,310	\$90	\$16,310
Net Farm Income	\$955	\$259,200	\$1,181	\$330,601	\$1,436	\$402,001	\$1,088	\$168,907	\$1,108	\$201,617	\$1,288	\$234,327
Equity @ 4% on all assets	\$447	\$126,148	\$451	\$126,213	\$451	\$126,213	\$462	\$79,875	\$438	\$79,768	\$438	\$79,768
Return to Unpaid Labor	\$508	\$133,052	\$730	\$204,388	\$985	\$275,788	\$627	\$89,032	\$670	\$121,849	\$849	\$154,559
Labor Earnings Per Hour	\$21.55		\$33.10		\$44.67		\$22.58		\$30.90		\$39.20	
Return on Assets	5.82%		8.08%		10.34%		5.79%		7.43%		9.07%	

A \$1/cwt. increase in milk price would give labor returns per hour for both the CONV and HGRAZ systems at a level competitive with the ORG and ORG-NG farms and increase the returns to assets by 2.26% and 1.64% for the CONV and HGRAZ farms, respectively. At this milk price level, both the CONV and HGRAZ system are very competitive with the ORG and ORG-NG farms. For the CONV farms, profits in general, double with a \$2/cwt. milk price increase, when both return to labor and return to assets are considered. Profits for the HGRAZ farms follow a similar pattern, though slightly lower. It is the opinion of this author that, without the "expansion change" of the one HGRAZ farm in 2016 alluded to earlier, the results comparing the CONV and HGRAZ systems would have been very similar with both the \$1/cwt. and \$2/cwt. increase in milk price.

At a \$2/cwt. increase in milk price, this would give \$18.73/cwt. and \$19.05/cwt. milk price for the CONV and HGRAZ farms, respectively. Realize the CONV farms in this data set probably have annual milk production levels somewhat above an estimated average, while the HGRAZ, ORG and ORG-NG milk production levels seem more typical of their respective systems. Average milk production levels per cow in Iowa tend to be in the 22,500 lbs. per cow annually range with all systems included. Grazing farms tend to have milk production levels in the 17,000 lbs. per cow annually (similar to WI data). CONV farms with lower milk production levels per cow, and somewhat similar production costs as the CONV farms in this data set, may need more than an additional milk price of \$1-\$2/cwt to be competitive with the HGRAZ, ORG and ORG-NG systems. Likewise, the other HGRAZ, ORG and ORG-NG farms could experience the same lower levels of profitability relative to their respective system with milk production levels lower than those of the model farms represented in this data.

Economies of scale may also affect system differences as both cost and income variables might change significantly with larger herd sizes. For example, these cost variables could include labor, utilities, supplies, depreciation, interest plus other machinery, equipment and milking system costs as those costs are spread over more cows. The income variables could include increased volume premiums. An economy of scale analysis is also beyond the scope of this study, but note the ORG and ORG-NG farms milk less than half (44%) of the cows on the HGRAZ farms and less than a third (29%) of the cows of the CONV farms. So, even though all the model farms studied are significantly larger than the average farm for their system, there are still economy of scale differences that come into play as these systems are compared or the milk price changes.

The increase in the conventional milk price, for example, will impact the CONV farms at an increasingly faster rate than the HGRAZ, ORG and ORG-NG farms since its impact will be spread over more cows and more milk production per cow. And, due to their higher levels of labor efficiency of the HGRAZ and CONV farms, each \$1 increase in the conventional milk price will impact their return to unpaid labor at an increasing rate as well, compared to a \$1 increase in the ORG or ORG-NG milk price. Milk price increases may also cause feed, supply and other inputs to increase milk production in response. Bottom line is that "economy of scale" impacts become more evident in this system comparison as conventional milk prices increase, favoring the CONV and HGRAZ farms the most. But, ORG and ORG-NG farms also have significant "economy of scale" that this author suspects will become more of a reality as the ORG farms continue to mature and grow. Please be cautioned that this is a small data set and that the farms in each of the systems are hand-selected as good models for their respective systems. Due to the small data set, one farm can significantly change the results. These results may or may not be exactly representative of each of the systems in the state of Iowa. However, in the experience of this author doing financial analysis and experience with each of the systems, the conclusions seem fairly representative of the Iowa dairy industry. **Thus, for good CONV and HGRAZ producers, the \$18-\$19/cwt. range seems a comparative break-even in system comparison if ORG milk prices remain in the \$34-\$35/cwt range.**

However, production costs vary greatly within each of the systems but most typically within a \$3/cwt. range for CONV and HGRAZ farms and in the \$6/cwt range for ORG and ORG-NG farms from the experience of this author. And, producers management ability varies greatly within the various systems. Which system may be most profitable for any particular producer will depend on management skills within each system. But, with all the systems compared, the HGRAZ system can be as or more profitable as the CONV system at these herd relative sizes and production levels. For good dairy managers considering transitioning to ORG, the more profitable system probably depends which side of the \$18-\$19/cwt range the milk price is on with current costs. For medium or lower level dairy managers on the CONV side, milk prices on higher side of \$19-\$20/cwt. may be necessary to be competitive with ORG and ORG-NG herds.

A Two Year Comparison of Differences among Conventional, Grazing, Organic and Organic No-Grain Dairies

Table 1 on the next page, in the experience of this author, shows data very representative of the CONV, HGRAZ, ORG and ORG-NG systems. As producers—beginning, transitioning or established—decide on their future in the dairy industry this data analysis should give a baseline confidence to potential profit success in each of the models systems. There are variations within each of these systems: the use of other dairy breeds; cross-breeding; higher or lower levels of grazing; higher or lower levels of milk production; higher or lower levels of land per cow--just to name a few.

To begin review of the data in Table 1, notice that the ORG milk price is approximately double the CONV milk price. Cash income per cow was more similar due to higher CONV milk production per cow, only \$324 per cow lower for the CONV farms. Though the milk price for the HGRAZ farms was only 41% of the ORG-NG milk price, total cash income per cow was very similar, but \$86 per cow lower for the HGRAZ farms. It is interesting to note that when comparing ORG versus CONV and ORG-NG versus HGRAZ, the CONV and HGRAZ farms make up the majority of the milk price difference in cash income per cow with approximately double the milk production per cow. But, there are some crop sale and other income differences as well. It should be noted that the CONV farms were considered great crop producers as well which shows in their acres owned per cow in relation to their crop sales per cow. The CONV farms also had good cow husbandry skills as well as noted by their vet and medicine cost of \$147 per cow. Though higher than all the other groups in this study, this cost is a very respectable benchmark for COVN herds. In comparison, the vet and med cost of the ORG farms was \$65/cow; the ORG-NG farms was \$14/cow; and the HGRAZ farms was \$77/cow. All of these groups set a good industry benchmark for vet and medicine costs.

Feed usually represents 50%-60% of the cost of producing milk. The productive crop acres per cow for the CONV farms versus the ORG farms was about half (2.14 vs 4.09) but the CONV farms purchased about 40% of the feed per cow compared to the ORG farms (\$1,298 versus \$526). The CONV farms had very similar feed purchases per cow as the HGRAZ farms (\$1,298 versus \$1,330) but ran approximately 25% less acres (2.14 versus 1.52). The HGRAZ farms ran half the acres per cow of the ORG-NG farms but the ORG-NG farms purchased only 27% of the feed compared to the HGRAZ farms (\$356 versus \$1,330). Past typical benchmarks point to 3-3.5 acres needed to produce feed for both the cows and replacement heifers, approximately 2 acres of forage per cow and one acre of grain. Thus, the CONV farms seem highly productive in crop management (raised feed costs) relative to both yields (acres per cow) and forage quality (feed purchases per cow). The ORG-NG farms milk about the same number of cows as the ORG farms but produce only 60% of the milk per cow with 25% less land and 32% less feed purchased per cow. In this comparative relationship, it seems a \$5/cwt. trade-off in milk price is enough to make the ORG-NG system viable and profitable. However, this is not saying the ORG-NG system is more profitable, it depends on the individual farm. But, this ORG-NG system is deserving more attention "if" there is a long term market for increased levels of milk sales.

Labor efficiency is often highly related to profit. The HGRAZ farms had the highest labor efficiency with 1.24 million pounds of milk sold per FTE (3,000 hours) and had 70 cows per FTE. The CONV farms at 1.2 million pounds milk sold per FTE and had 47 cows per FTE. The ORG farms at 444,000 pounds milk sold per FTE and had 34 cows per FTE. The ORG-NG at 413,900 pounds milk sold per FTE and had 49 cows per FTE. The ORG farms had the highest labor cost at \$1,249/cow, with the CONV farms at \$851/cow; the ORG-NG at \$807/cow and the HGRAZ farms at \$621/cow. The HGRAZ farm's strength is labor efficiency with the cows harvesting much of their feed, hauling their own manure onto pastures and saving equipment and facility costs relative to the CONV system, often enough to make up 20%-33% less milk per cow. ORG and ORG-NG farms often suffer from labor inefficiency often related to milking, housing or feeding facilities, especially in winter/non-grazing months.

CONV farms tend to have lower Operating Profit Margins but their strength tends to be their Asset Turnover Ratio with larger herds and higher milk production per cow. Their profits shine in higher milk price years. HGRAZ, ORG and ORG-NG farms tend to have better Operating Profit Margins. The HGRAZ system tends to weather conventional milk price declines better than CONV farms. The ORG and ORG-NG systems benefit greatly from the more stable milk pricing of the organic milk markets. Bottom line is that depending on manager skills and desires, all the systems studied have merit for the future of the Iowa dairy industry. The most profitable system depends on the **milk prices**; maintaining high levels of **labor efficiency**; producing decent volumes of **milk production** per cow and per farm relative to their system; ability to secure **quality feed** resources; and managing acceptable levels of **capital efficiency** (depreciation and interest/equity charges).

Funding for this project was provided by the North Central Extension Risk Management Education Center, the USDA National Institute of Food and Agriculture Award Number 25-6324-0119-302. Thanks to the ISU Extension and Outreach Dairy Team for their review and assistance with this project. For more information visit the ISU Dairy Team at: www.extension.iastate.edu/dairyteam

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Table 1. Two-Year Comparison	CONV			HYGRAZ			ORG			ORG-NG			
Iowa Model Dairy Farms 2015 and 2016 Combined	Ave of Conventional Farms /Cow n=5			Ave of Hybrid Grazing Farms /Cow n=5,4			Ave of Organic Farms Fed Grain /Cow n=7,8			Ave of Organic No Grain Farms /Cow n=3			
Productive Acres Operated	646			255			328			245			
Average Number of Cows	280			182			81			78			
Total Assets on Farm	\$3,201,237 \$11,416			\$2,020,650 \$11,735			\$1,462,684 \$17,752			\$1,417,031 \$18,206			
Milk Price	\$16.73			\$17.05			\$35.03			\$41.17			
Milk Hundred weight Equiv.	93,862	341		40,468	230		13,015	136		7,644	98		
Milk Hundredweights	71,400	257		32,710	178		11,068	115		6,567	84		
Milk Sales	\$1,197,390 \$4,348			\$559,307 \$3,191			\$386,135 \$4,158			\$264,744 \$3,401			
Cull Cow Sales	\$84,386	\$331		\$43,818	\$279		\$16,474	\$203		\$12,381	\$159		
Calf Sales	\$28,965	\$121		\$27,605	\$208		\$11,069	\$175		\$8,845	\$114		
Crop Sales	\$95,243	\$248		\$1,076	\$12		\$23,312	\$258		\$0	\$0		
Other Income	\$111,781	\$455		\$16,643	\$118		\$39,597	\$386		\$17,017	\$219		
Total Cash Income	\$1,517,764 \$5,503 /Cwt.Eq.			\$648,449 \$3,807 /Cwt.Eq.			\$476,587 \$5,179 /Cwt.Eq.			\$302,987 \$3,893 /Cwt.Eq.			
Veterinary, Medicine	\$39,984	\$147	\$0.43	\$13,076	\$77	\$0.33	\$8,111	\$65	\$0.48	\$1,084	\$14	\$0.17	
Dairy Supplies	\$53,355	\$199	\$0.58	\$24,202	\$137	\$0.60	\$15,773	\$186	\$1.37	\$13,305	\$171	\$2.03	
Breeding Fees	\$13,491	\$52	\$0.15	\$7,820	\$43	\$0.19	\$1,200	\$14	\$0.10	\$1,237	\$16	\$0.19	
Feed Purchased	\$364,137	\$1,298	\$3.80	\$230,325	\$1,330	\$5.77	\$48,773	\$526	\$3.88	\$27,673	\$356	\$4.21	
Repairs	\$74,413	\$291	\$0.85	\$21,377	\$136	\$0.59	\$27,749	\$324	\$2.39	\$19,212	\$247	\$2.93	
Seed, Chem, Fert	\$133,687	\$525	\$1.54	\$22,756	\$148	\$0.64	\$35,885	\$372	\$2.74	\$17,318	\$223	\$2.64	
Fuel, Gas, and Oil	\$33,022	\$135	\$0.39	\$13,846	\$92	\$0.40	\$13,772	\$163	\$1.20	\$10,745	\$138	\$1.64	
Utilities	\$32,214	\$119	\$0.35	\$11,084	\$57	\$0.25	\$9,326	\$95	\$0.70	\$6,376	\$82	\$0.97	
Interest Paid -- not included		\$0			\$0			\$0			\$0		
Labor Hired	\$184,653	\$650	\$1.91	\$59,372	\$345	\$1.50	\$24,537	\$250	\$1.84	\$10,527	\$135	\$1.60	
Rent, Lease and Hire	\$218,600	\$782	\$2.29	\$51,145	\$295	\$1.28	\$62,732	\$477	\$3.52	\$2,140	\$27	\$0.33	
Property Taxes	\$6,752	\$27	\$0.08	\$4,822	\$27	\$0.12	\$5,662	\$65	\$0.48	\$6,244	\$80	\$0.95	
Farm Insurance	\$24,801	\$102	\$0.30	\$10,954	\$54	\$0.23	\$7,078	\$80	\$0.59	\$5,848	\$75	\$0.89	
Other Cash Expense	\$46,805	\$168	\$0.49	\$25,073	\$150	\$0.65	\$18,703	\$243	\$1.79	\$12,426	\$160	\$1.89	
Total Cash Expense	\$1,225,914 \$4,495 \$13.18			\$495,852 \$2,890 \$12.55			\$279,300 \$2,859 \$21.09			\$134,134 \$1,723 \$20.42			
Net Cash Income	\$291,850 \$1,008 \$2.96			\$152,597 \$918 \$3.98			\$197,286 \$2,320 \$17.11			\$168,853 \$2,169 \$25.71			
Inventory Change	-\$32,650	-\$53	-\$0.16	\$16,310	\$171	\$0.74	-\$27,120	-\$438	-\$3.23	-\$2,503	-\$32	-\$0.38	
Net Farm Income	\$259,200 \$955 \$2.80			\$168,907 \$1,088 \$4.72			\$170,166 \$1,881 \$13.88			\$166,351 \$2,137 \$25.33			
Equity @ 4% across all asset	\$126,148	\$447	\$1.31	\$79,875	\$462	\$2.00	\$58,387	\$708	\$5.23	\$56,057	\$720	\$8.54	
Return to Labor	\$133,052 \$508 \$1.49			\$89,032 \$627 \$2.72			\$111,779 \$1,173 \$8.65			\$110,294 \$1,417 \$16.79			
Labor Earnings Per Hour	\$21.55			\$22.58			\$24.74			\$31.05			
Gross Income per Cwt. Eq.	\$16.73			\$17.05			\$35.03			\$41.17			
Gross Expense per Cwt. Eq.	\$16.19			\$16.00			\$30.38			\$32.46			
Net Income per cwt.	\$0.54			\$1.05			<b">\$4.66</b">			\$8.71			
Return to All Labor per FTE Labor.....	\$46,564			\$58,245			\$59,789			\$78,622			
Number of Cows per FTE Labor.....	47			70			34			49			
Cwts. of Milk Sold per FTE Labor..	12,015			12,394			4,440			4,139			
Pounds of Milk Sold per Cow.....	25,770			17,597			13,604			8,266			
Productive Crop Acres per Cow.....	2.14			1.52			4.09			3.0			
Capital Cost per Cow.....	\$692			\$573			\$1,079			\$792			
All Labor Costs per Cow.....	\$851			\$621			\$1,249			\$807			
Fixed Cost per Cow (DIRTI)	\$1,064			\$779			\$1,549			\$1,189			
Capital Invested per Cow.....	\$9,290			\$10,525			\$20,784			\$16,520			
Net Farm Income per Crop Acre.....	\$451			\$726			\$669			\$802			
Lbs. Milk Produced per Crop Acre.....	13863			15323			3546			3,071			
Fert/Chem/Seed Cost/Crop Acre.....	\$203			\$97			\$102			\$74			
All Labor as Percent of Total Costs.....	16.04%			18.34%			24.85%			25%			
Fixed Cost as Percent of Total Cost.....	20.03%			23.24%			34.33%			37%			
**Net Farm Income From Operation	\$259,200			\$168,907			\$170,166			\$166,351			
**Rate of Return on Assets.....	5.82%			5.79%			7.87%			9.28%			
**Operating Profit Margin.....	11.59%			18.28%			29.32%			38.08%			
**Asset Turnover Ratio.....	50.41%			34.59%			34.82%			24.81%			
Dairy TRANS Performance Rating	66.90%			73.83%			68.32%			76.67%			

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Note: The "average" is calculated as the sum of the individual farms for each item, not a previous item's sum divided by another item's sum, which yields slightly different results. Thanks to the many dairy producers who so graciously shared their financial data for others to learn.