

DuPont System for Financial Analysis

A Process for Discovering Where to Spend My Management Time Tomorrow Morning after Breakfast

By

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I get very excited when I am faced with a day of discovering the financial story of some farm business through picking apart a balance sheet, income statement, and financial ratios. However, I think it may be safe to say that I might be standing somewhat alone in my excitement for such a day! Many farmers when faced with the same may suddenly remember a tractor that needs maintenance, livestock to vaccinate, or even a barn to clean.

Hadley summed up well the reluctance in a 2012 E-Extension article:

If we are lucky enough to have the minimum number of financial documents needed to conduct a meaningful financial analysis (both beginning and ending balance sheets, either an actual accrual or accrual adjusted income statement, and a statement of cash flows), we are then inundated with pages and pages of intimidating numbers to sort through.

This gives many managers and advisers a justification not to give their financial records anything more than a passing glance. This is unfortunate. A good financial performance analysis should do more than inform about how a farm performed in the past. More important, it should provide the manager and adviser with insight regarding how to prioritize activities that will enable the farm to improve its financial performance.

(http://www.extension.org/pages/The_DuPont_Analysis:_Making_Benchmarking_Easier_and_More_Meaningful).

In the cloud of numbers, it can be difficult to see the value of financial analysis. A diagnostic system is needed that can process the many bits of financial data into a coherent means to track and diagnose where bottlenecks may lie and ultimately where management time should be spent tomorrow morning after breakfast.

Two such systems that provide diagnostic capability for farm businesses are:

1. “Farm Finance Scorecard” (University of Minnesota, Center for Farm Financial Management and University of Vermont Extension, <http://www.cffm.umn.edu/Publications/pubs/FarmMgtTopics/vermont.pdf>)
2. “DuPont System for Financial Analysis” (E.I. du Pont de Nemours and Co, 1919).

¹ Many thanks for the review and suggestions by Dr. Gary Frank, Emeritus Professor, Center for Dairy Profitability, UW-Extension.

The Farm Finance Scorecard uses 21 financial ratios recommended by the Farm Financial Standards Council for evaluating five areas of the farm business – liquidity, solvency, profitability, repayment capacity, and financial efficiency. The scorecard also includes benchmark measures allowing the user to categorize areas of strength, vulnerability, or a cautionary area in-between. See the link for a view of the scorecard and its accompanying benchmarks.

The DuPont System for Financial Analysis is a financial diagnostic system that uses many of the same ratios as the Farm Finance Scorecard.

However, it is different in how the ratios are diagnostically used. It is premised on evaluating three primary levers of profitability:

1. [Turnings] Asset utilization or working assets to create gross revenues,
2. [Earnings] Efficiency or how well management does in converting gross revenues into net revenues after expenses are paid, and
3. [Leverage] The use of debt financing to multiply the profit earning capability of one's own equity.



The DuPont system allows the user to identify which lever(s) of profitability poor performance is coming from. Digging further into the problem lever can identify more specifically where profit performance is being held back and thus where management's time may best be spent.

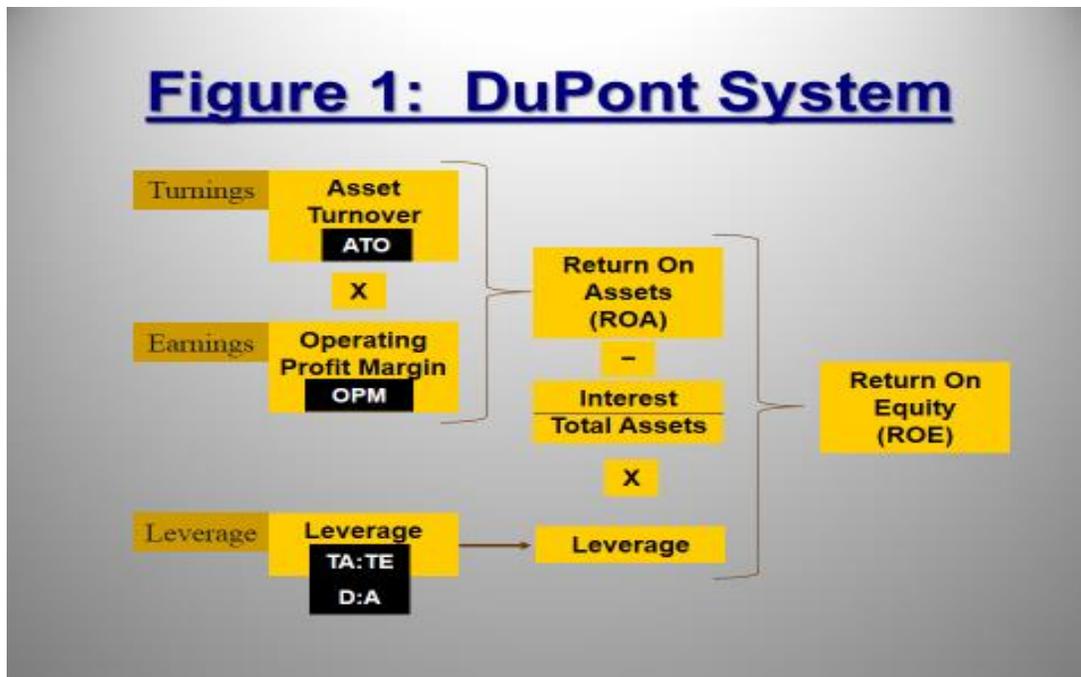
Figure 1 shows a graphic of the DuPont system. Diagnostics begins on the far right side with the Return on Equity (ROE). If the ROE is not at a satisfactory level then the financial manager can drill backward to see where ROE performance either is, or is not, coming from. The math of DuPont is shown in Appendix 1.

Return on Equity comes from the multiplication of Return on Assets (ROA) adjusted for interest² and Leverage. If leverage is not a problem, but ROA is low then the manager knows to continue drilling back into what is making ROA lower than desired.

Return on Assets is determined by two of the three levers of profitability – Asset Utilization (turnings) and Efficiency (earnings). The first, Asset Utilization, is a measure of how well capital

² The Return on Assets (ROA) must be adjusted first by backing out interest costs. Thus, the number that is multiplied by leverage to get ROE is (ROA-interest/total assets). Another name for the adjusted ROA, often used in nonfarm businesses, is Return on Investment (ROI).

Figure 1: DuPont System



assets are being used (turned) to create production and ultimately sales. To use an extreme example, if 300 acres of tillable land were left idle then asset utilization would be poor and the performance of turning capital assets into production and sales would not be good. The “turnings” lever of profitability is measured by the Asset Turnover Ratio (ATO).

All else being equal, the more effectively capital assets are being managed to produce and sell product the higher the ATO will be, which in-turn leads to a higher Return on Assets and ultimately a higher Return on Equity.

The second lever of profitability that impacts the Return on Assets is how efficiently inputs (expenses) are managed in creating and selling products. Said another way it is how efficient the manager is in keeping gross revenues after all expenses are paid. This is the “Earnings” lever and is measured by the Operating Profit Margin ratio (OPM).

All else being equal, the more efficiently inputs are used in creating net revenues from gross revenues the higher the Operating Profit Margin ratio will be, which in-turn leads to a higher Return on Assets and ultimately a higher Return on Equity.

The last profitability lever is “Leverage,” which is also known as the “Equity Multiplier.” If Return on Equity is low, but Return on Assets is adequate then lack of leverage is the reason for modest or low Return on Equity. Leverage is a measure of the level of your assets that are financed by creditors versus owner financing. In essence, leverage is measuring how well you are using someone else’s money to make profits for yourself.

I Found My Problem Lever – Now What?

The DuPont system is a good way to diagnose which lever of profitability needs work. Knowing that it resides in asset utilization, efficiency and/or leverage is useful, but now what does one do tomorrow morning after breakfast to fix it? Following are ideas for where management might spend its time depending on which lever is weak. Appendix 2 provides an example.

Low Asset Utilization (Asset Turnover Ratio – ATO)

The Asset Turnover ratio is:

$$\frac{\text{Gross Revenue}}{\text{Average Total Assets}}$$

The ratio can be low due to a relatively low numerator (Gross Revenue), a relatively high denominator (Total Assets), or a little of both. Depending on the problem, following are a few options for management action tomorrow after breakfast.

Increasing revenues from existing assets

- Production (total, per acre, per cow, per crate, per labor unit, average daily gain, etc.)
- Mortality rates
- Conception rates
- Feed conversion
- Timeliness of operations
- Fertility and nutrition programs
- Health protocols and cow comfort
- Days in milk
- Price and marketing
- Price premiums and discounts

Unused or underutilized assets

- Ability to manage assets
- Machinery/equipment (total, per acre, per cow, etc.)
- Excess machinery capacity
- Leasing versus owning
- Asset sharing
- Custom hire
- Land and buildings (total, per acre, per cow, etc.)
- Breeding livestock (total, per acre, per cow, etc.)
- Obsolete or inefficient assets
- Assets whose poor condition is impacting productivity
- Enterprises that have assets associated with them, but are not creating “big enough” revenues (enterprise budgeting/accounting might be useful in this case)

Low Efficiency (Operating Profit Margin Ratio – OPM)

The Operating Profit Margin Ratio is:

$$\frac{[\text{Net Income from Operations} + \text{Interest} - \text{Unpaid Labor and Management}]}{\text{Gross Revenue}}$$

Which equals:

$$\frac{[\text{Total Operating Revenues} - \text{Total Operating Costs} + \text{Interest} - \text{Unpaid Labor and Management}]}{\text{Gross Revenue}}$$

Anything that causes the numerator to be relatively low, the denominator to be relatively high, or both will cause the ratio and thus efficiency of operations to be low. Management changes that increase revenues more than a corresponding increase in costs, decrease costs more than a corresponding decrease in revenues, or both will lead to efficiency improvements. A few potential areas to consider include:

- Increasing yields per acres, per cow, etc. more than a corresponding increase in costs
- Feed waste
- Plant populations
- Pest control
- Animal health control
- Input costs: total, per acre, per cow, etc. (seed, fertilizer, feed, repairs, supplies, etc.)
- Livestock revenue per dollar of feed fed
- Quality of inputs
- Rental arrangements
- Labor (more production per laborer, maintain production with less labor, etc)
 - o Training, incentive plans, communications, better procedures
- Outsourcing
- Partnerships, alliances
- Quality of facilities
- Cost reducing technologies

Efficiency problems can be specific or a general systematic challenge coming from:

- Systematic management challenges where it is not just one or two items causing the efficiency problem, rather a general slippage in all areas caused by lack of tight control on expenses, chronic waste, lack of attention to detail, competing goals, etc. Solving this problem may mean a general personality change, not likely to happen. However, perhaps baby steps based on better procedures, processes, strategic planning, or even outsourcing is a step in the right direction.
- A particular enterprise where efficiency is poor, suggesting an adjustment/re-investment into areas where the producer excels and unload the poor efficiency area.
- A particular area such as poor facilities that create feed waste, spoilage, or other problems and thus a facility upgrade would improve efficiency.

Low Leverage (Derived from Debt to Asset Ratio – D:A)

The Leverage ratio, derived from the more common debt to asset ratio³, is:

$$\frac{\text{Total Assets}}{\text{Total Equity}}$$

The leverage value in the DuPont system is tricky. The value is almost always positive⁴. Thus, since it is a value that is multiplied to get Return on Equity then it gives the odd result that if one wants to increase Return on Equity then just increase debt! The trick, and somewhat hidden in the DuPont system, is that the debt must be managed in a way that returns a profit greater than the interest that is paid for its use. If it is not then there will be slippage that will show up in the other profitability levers. If the slippage is bad enough then the Return on Assets could be negative and multiplying a negative number by a positive one is also a multiplier, just a multiplier for a more negative Return on Equity! Even if Return on Assets is not negative, it may be significantly less after adjusting for interest costs.

To understand the value or danger of leverage it is useful to start with the universal accounting equation, Total Assets = Total Debt + Total Equity.

As the equation shows, any return to assets comes from those assets financed by the owner's money (total equity) and that by creditors (total debt). With respect to equity, if you invest \$100 of your own money and earn \$10 back then your equity has returned 10% (10/100).

The return to assets financed by debt is a bit more complicated because you have to pay someone for the use of the debt – interest. If the return to assets financed by debt is greater than the interest, then it is added to, or multiplies the return to equity. If the return is less than interest, then it is a deduction from return to equity.

For example, if the interest rate is 5% and the return to assets financed by debt is 7%, then not only can interest be paid, but there is 2% leftover to add to the return to equity. This is why the debt or leverage component of DuPont is sometimes called an “Equity Multiplier.” However, if the interest rate is 9% and the return to assets financed by debt is 7% then the owner is paying 9% and returning 7% for a loss of 2%. In the DuPont system that loss shows up as a reduction in return to assets⁵.

³ Total Assets/Total Equity = 1/1-D:A

⁴ The only time it is not positive is when total equity is negative, which is a much more challenging situation.

⁵ Recall that interest/total assets is deducted from ROA before multiplying by Leverage to get ROE. A positive multiplier occurs when ROE>ROA>interest rate. A discount to equity occurs when ROE<ROA<interest rate.

Another point to consider with respect to leverage is if it is low then while it may hold back the return on equity (smaller multiplier), it also means additional capacity to fix asset utilization or efficiency problems through increased debt financing that is well within normal ranges. For example, if facilities are poor and causing significant efficiency problems then use of debt to upgrade facilities might be an option. However, if one is already highly leveraged then it limits the use of the debt financing tool.

For more on debt financing see the article titled “*This Thing Called Debt – A Value or Danger*” (Bernhardt, Jan 2014. <http://cdp.wisc.edu/Management.htm>).

What’s in a Measure – Concluding Comments

Farm management always has an underlying debate as to what measure is best for understanding profitability performance. Is it net income, profit per cow or acre, Return on Assets, etc. The prize in the DuPont system is Return on Equity and Return on Assets. They are measures favored by economists whose driving goal is efficient use of resources and comparability. However, the producer may be more interested in the absolute dollars in their pocket at the end of the year. For example consider the following two farms:

- Farm 1:
 - o Profits = \$100,000
 - o Total Assets = \$3,333,333
 - o Total Equity = \$2,500,000
- Farm 2
 - o Profits = \$10,000
 - o Total Assets = \$83,333
 - o Total Equity = \$66,667

Farm	ROA	ROE	Profit in Pocket
Farm 1	3%	4%	\$100,000
Farm 2	12%	15%	\$10,000

The economist or person who is pursuing efficient use of invested dollars would say that Farm 2 is the hands down winner. However, the farmer who has \$100,000 in their pocket versus \$10,000 may beg to differ.

The point is that numbers, ratios, and systems for financial analysis are tools not final answers. However, they are tools that can help target where a manager might want to spend time tomorrow morning after breakfast.

Another challenge is that any comparisons and conclusions made from ratios or other measures are only as good as the accuracy of the data that went into their calculation. Comparisons and conclusions are most applicable when there is complete and accurate accounting that follows

principles laid out by the Farm Financial Standards Council (FFSC) and/or Generally Accepted Accounting Principles (GAAP).

For example, the Asset Turnover ratio divides total gross revenue by total assets. How assets are valued may result in a wide range. Consider the extreme of two farms that are alike in most all ways except that one farm values land at \$700 per acre and the other values land at \$10,000 per acre. Even if the valuing of assets are equivalent and “fair,” there is still the challenge of comparing one farm that primarily owns all assets with one that primarily rents assets. Another discrepancy in the data may be that one farm may include the home as a farm asset while the next does not.

It does not negate the use of DuPont ratios or the Ratio Scorecard, it does mean that caution is wise in assuring comparability. To repeat, they are tools not final answers that can help give direction to managers on where to spend time tomorrow morning after breakfast.

Appendix 1: Math of DuPont

The Asset Turnover ratio (ATO) is:

$$\frac{\text{NFIFO} + \text{interest} - \text{Unpaid Labor \& Management}}{\text{Gross Revenues}}$$

The Operating Profit Margin Ratio (OPM) is:

$$\frac{\text{Gross Revenues}}{\text{Total Assets}}$$

Multiplying the two gives the equation for Return on Assets (ROA):

$$\frac{\text{NFIFO} + \text{interest} - \text{Unpaid Labor \& Management}}{\text{Gross Revenues}} \times \frac{\text{Gross Revenues}}{\text{Total Assets}}$$

$$\text{ROA} = \frac{\text{NFIFO} + \text{interest} - \text{Unpaid Labor \& Management}}{\text{Total Assets}}$$

Subtracting the interest adjustment (interest/Total Assets) from the ROA gives the adjusted ROA (known as the Return on Investment (ROI) in the nonfarm business).

$$\frac{\text{NFIFO} + \text{interest} - \text{Unpaid Labor \& Management}}{\text{Total Assets}} - \frac{\text{interest}}{\text{Total Assets}}$$

$$\text{ROI} = \frac{\text{NFIFO} - \text{Unpaid Labor \& Management}}{\text{Total Assets}}$$

Multiplying by the Leverage ratio (Total Assets/Total Equity) results in the Return on Equity (ROE)

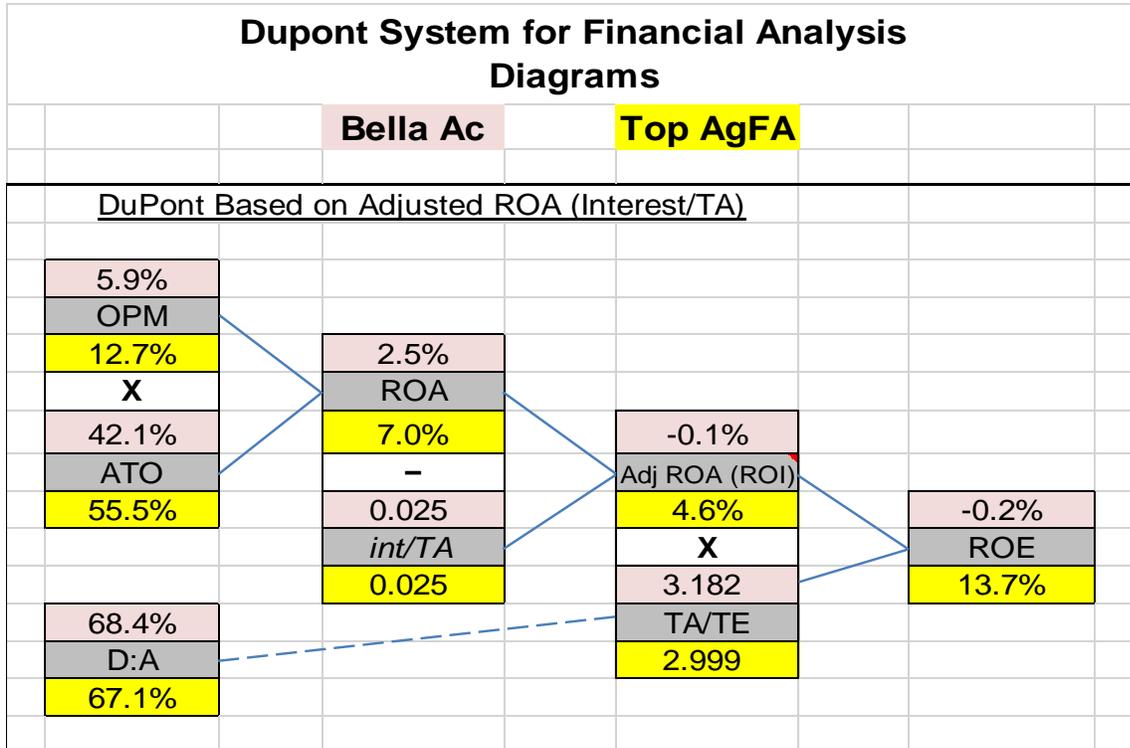
$$\frac{\text{NFIFO} - \text{Unpaid Labor \& Management}}{\text{Total Assets}} \times \frac{\text{Total Assets}}{\text{Total Equity}}$$

$$\text{ROE} = \frac{\text{NFIFO} - \text{Unpaid Labor \& Management}}{\text{Total Equity}}$$

Appendix 2: Bella Acres Case Study

The Bella Acres case study compares an example dairy farm from 2013 to a profitable benchmark based on the AgFA database for similar sized farms that had a Return on Assets greater than 5%. Figure 1 shows the DuPont ratio results. Bella Acre's Return on Equity is much lower than the AgFA comparison farms – Why?

Figure 1



The cause for a low Return on Equity is low Return on Assets, which in-turn is caused by both a lower efficiency (OPM) and asset utilization (ATO). A little further digging into asset utilization (information not shown) shows that Bella Acres' revenue is greater for almost all measures. The lower ATO is coming from land and building assets that are significantly larger than the comparable AgFA farms. Some question could be pursued such as use of the buildings, overvalued land, etc. However, the 42% value is near the benchmark for a strong value on the ratio scorecard. So, maybe some time can be spent on asset utilization next week versus tomorrow morning after breakfast.

Efficiency is a higher priority. The value of 5.9% is significantly in the weak range for the Operating Profit Margin ratio. Figure 2 shows the financial parts that make up OPM.

Figure 2: Factors Impacting Operational Efficiency (OPM Ratio)

OPM Numerator = NFIFO+interest-unpaid L&M

Rearranging terms (see comment attached to this cell) gives OPM numerator = TR - [Depreciation + All Labor + Basic Costs]

	Bella Ac	Top AgFA	Difference	Bella Ac	Top AgFA	Difference	Bella Ac	Top AgFA	Difference	Bella Ac	Top AgFA	Difference
Avg lbs milk per cow	28,090	25,226	2,864									
Avg milk price/cwt	19.99	20.02	(0.03)									
milk sales per cow	5,615	5,050	565									
	Per \$ Revenue			Per Cow			Per CWT			Per CWTEQ		
OPM Numerator per:	0.06	0.13	(0.07)	396	769	(372)	1.50	3.05	(1.55)	1.18	2.53	(1.35)
Total Revenue (TR)	1.00	1.00	0.00	6,696	6,066	630	25.34	24.06	1.28	19.95	19.95	0.00
Total Exp (less interest)	0.94	0.87	0.07	6,300	5,297	1,002	23.84	21.01	2.83	18.77	17.42	1.35
- Depreciation	0.07	0.08	(0.02)	436	502	(67)	1.65	1.99	(0.34)	1.30	1.65	(0.35)
- All Labor (hired and unpaid)	0.21	0.14	0.07	1,375	835	540	5.20	3.31	1.89	4.10	2.75	1.35
Hired Labor/benefits	0.15	0.11	0.05	1,012	641	371	3.83	2.54	1.29	3.02	2.11	0.91
Value of unpaid L&M	0.05	0.03	0.02	362	194	169	1.37	0.77	0.60	1.08	0.64	0.44
- Basic Costs	0.67	0.65	0.02	4,489	3,960	529	16.99	15.71	1.28	13.38	13.03	0.35
Dairy Expenses	0.29	0.35	(0.06)	1,958	2,127	(169)	7.41	8.44	(1.03)	5.83	6.99	(1.16)
Agronomic Exp	0.11	0.09	0.02	756	559	197	2.86	2.22	0.64	2.25	1.84	0.41
Car & truck expenses	0.00	0.00	(0.00)	0	9	(9)	0.00	0.03	(0.03)	0.00	0.03	(0.03)
Freight & trucking	0.02	0.01	0.01	159	55	104	0.60	0.22	0.38	0.47	0.18	0.29
Gas, fuel, & oil	0.04	0.03	0.01	263	185	78	1.00	0.73	0.26	0.78	0.61	0.18
Farm Insurance	0.02	0.01	0.01	108	57	51	0.41	0.22	0.18	0.32	0.19	0.14
Rent	0.04	0.02	0.01	248	134	114	0.94	0.53	0.41	0.74	0.44	0.30
Repairs	0.07	0.03	0.03	464	210	255	1.76	0.83	0.93	1.38	0.69	0.69
Storage & warehousing	0.00	0.00	(0.00)	0	1	(1)	0.00	0.00	(0.00)	0.00	0.00	(0.00)
Supplies	0.03	0.02	0.02	210	92	118	0.80	0.37	0.43	0.63	0.30	0.32
Taxes	0.01	0.01	0.00	57	35	22	0.22	0.14	0.08	0.17	0.12	0.05
Utilities (farm share)	0.02	0.02	(0.00)	116	107	9	0.44	0.42	0.02	0.34	0.35	(0.01)
Other	0.02	0.06	(0.05)	123	392	(268)	0.47	1.55	(1.09)	0.37	1.29	(0.92)
Accrual Exp Adj	0.00	0.00	0.00	26	-1	27	0.10	0.00	0.10	0.08	0.00	0.08

	Per \$ Revenue			Per Cow			Per CWT			Per CWTEQ		
	1.00	1.00	0.00	6696	6066	630	25.34	24.06	1.28	19.95	19.95	0.00
Revenue, resale items	-	-	0.00	0	0	0	-	-	0.00	-	-	0.00
Sales of raised products	0.94	0.87	0.07	6,285	5,267	1,018	23.78	20.89	2.89	18.72	17.32	1.40
Coop distributions	0.00	0.01	(0.01)	21	60	(39)	0.08	0.24	(0.16)	0.06	0.20	(0.13)
Ag prg payments	0.01	0.01	0.00	91	82	9	0.34	0.33	0.02	0.27	0.27	0.00
CCC loans under election	-	-	0.00	0	0	0	-	-	0.00	-	-	0.00
CCC loans forfeited	-	-	0.00	0	0	0	-	-	0.00	-	-	0.00
Crop ins/disaster prmts	-	0.00	(0.00)	0	18	(18)	-	0.07	(0.07)	-	0.06	(0.06)
Custom work	0.01	0.00	0.00	45	17	28	0.17	0.07	0.10	0.13	0.06	0.08
Sale of breeding lvsstk	0.05	0.05	(0.00)	319	303	17	1.21	1.20	0.01	0.95	1.00	(0.04)
Less base value/hd sold	(0.00)	(0.00)	(0.00)	(32)	(27)	(5)	(0.12)	(0.11)	(0.01)	(0.10)	(0.09)	(0.01)
Other	0.00	0.01	(0.01)	7	49	(43)	0.03	0.20	(0.17)	0.02	0.16	(0.14)
Accrual adjustment	(0.01)	0.05	(0.06)	(40)	297	(338)	(0.15)	1.18	(1.33)	(0.12)	0.98	(1.10)

	Per CWT		Per CWTEQ		Per \$ TR		Per COW		Per \$ TE		Per Acre	
	Bella Ac	Top AgFA	Bella Ac	Top AgFA	Bella Ac	Top AgFA	Bella Ac	Top AgFA	Bella Ac	Top AgFA	Bella Ac	Top AgFA
Dairy Expenses:												
Purchased Feed	6.11	7.62	4.81	6.32	0.24	0.32	1,615	1,922	0.26	0.36	657.43	941.91
Veterinary and Medicine	0.75	0.54	0.59	0.44	0.03	0.02	197	135	0.03	0.03	80.32	66.29
Breeding	0.16	0.28	0.12	0.23	0.01	0.01	41	70	0.01	0.01	16.84	34.25
Bedding	0.39	0.00	0.31	0.00	0.02	0.00	104	0	0.02	0.00	42.36	0.00
Custom heifer raising	0.00	0.00	0.00	0.00	0.00	0.00	0	0	-	0.00	0.00	0.00
TOTAL	7.41	8.44	5.83	6.99	0.29	0.35	1,958	2,127	0.31	0.40	796.96	1042.46

	Per CWT		Per CWTEQ		Per \$ TR		Per COW		Per \$ TE		Per Acre	
	Bella Ac	Top AgFA	Bella Ac	Top AgFA	Bella Ac	Top AgFA	Bella Ac	Top AgFA	Bella Ac	Top AgFA	Bella Ac	Top AgFA
Agronomic Expenses:												
Corn Yield per acre (bu)												
SB Yield per acre (bu)												
Forage Yield per acre (ton)												
Chemicals	0.00	0.14	0.00	0.12	0.00	0.01	0	36	-	0.01	0.00	17.41
Fertilizer/lime	1.10	0.48	0.87	0.40	0.04	0.02	290	122	0.05	0.02	118.24	59.68
Custom hire	1.22	0.94	0.96	0.78	0.05	0.04	322	237	0.05	0.04	131.14	116.17
Seeds & plants	0.54	0.45	0.43	0.37	0.02	0.02	143	114	0.02	0.02	58.30	55.65
Conserv exp	0.00	0.20	0.00	0.17	0.00	0.01	0	51	-	0.01	0.00	25.24
TOTAL	2.86	2.22	2.25	1.84	0.11	0.09	756	559	0.12	0.11	307.67	274.15

There are lots of numbers when you dig all the way back, but the highlighted ones – labor, repairs, and supplies – stand out, especially labor. A little more digging shows two interesting facts. Bella Acres dairy costs per cow are less than the profitable AgFA farms, yet Bella's production per cow is greater. This indicates that the problem is not the dairy. No pun intended, but the dairy appears to be a cash cow.

The Bella Acres farm also has enough acres that they sell crops and they have a feedlot for feeding out dairy steers. Given what looks to be relatively good financial performance in the dairy enterprise, one might spend time looking into the other enterprises. Is the labor used in these other enterprises paying for itself? Is the labor well trained? Do they have good processes and procedures?

It's a place to start!