Increasing milk production and feed efficiency

Gerald Poppy, DVM, MBA, PhD
DVM Dairy Business Consulting
32 Grealer Dr, Saint Louis, MO 63146
970-215-8550
drgpoppy@DVMDairy.com

2024 Pacific Northwest Animal Nutrition Conference Proceedings

Increasing dairy profitability should be the number one concern for dairy business consultants, nutritionists, veterinarians, and other advisors. How we achieve this goal is always a matter for discussion and debate as we can see in the different papers presented in this pre-symposium. I liked this quote I read by a Professor Mark Johnson from The Ohio State, "*Animal Science is a math-based degree. By that same token, production agriculture in general, and specifically beef production is a math-based enterprise. Why? Because the only way to make sound management decisions which will impact future profit potential is based on facts arrived at by mathematical analysis. Management decisions based on emotions and/or tradition seldom leads to the financial outcome we desire"(Johnson, 2023).* I think we can apply this to the field of dairy science as well.

Increasing feed efficiency and or increasing milk production are both great topics to discuss but both maybe easier said than done. The bigger question for discussion in this context is, how do we achieve the goal of greater profitability? One of my favorite sayings is, "There are multiple pathways to profitability". What is the best path or paths to choose? As consultants when we first walk on a dairy, it is important to recognize the business owner has asked us to visit the dairy for a purpose. It may be a sub-segment of the overall dairy enterprise that you specialize in, which they have identified as the area of focus, or it may be a wide-open question for you to analyze and bring to their attention.

All dairies in business today have been able to succeed so far by being better than average in one or more areas. Making milk is basically a commodity business. The average cost of production "over the long run" will be equal to the average price paid. The dairies that are below this mark, go out of business and the ones above this are the ones that stay in business. To make it to 2024 all the dairies had to be better than all the other dairies in some key areas that allowed them to survive. This might be better at converting raw materials, i.e., feed into milk, this is called feed efficiency. The dairy might not have the best feed efficiency, but it was able to buy or produce the feed at a lower cost and thereby drive more net revenue than the competitive market, the dairy may raise their heifers or purchase better replacements or cheaper replacements, have better labor costs, less disease cost, better interest rates, more fertile crops, better maintenance, better milk hedging/marketing, less shrink, or any combination of the above list. Dairies that are struggling to achieve profitability may be in economic markets where their operational strength may have been superior in a past market but with the change in market conditions, such as low milk high feed cost, may not advantage them currently. The key question then is how we can analyze and measure dairy production considering our knowledge of the economic market conditions such that we can help them

achieve sustainable profit and cash flow to stay in business. It is important that we analyze the right information and the factors around this information so that we can best predict the outcome of the intervention. Having the correct facts for making interventions and reducing the uncertainty around those decisions are the key to helping make the best suggestions to improve net profit for the dairy.

> *Rober Schlaifer said; "When all the facts bearing on a business decision are accurately known-when the decision is made "under certainty"-careless thinking is the only reason why the decision should turn out, after the fact, to have been wrong. But when the relevant facts are not all known - when the decision is made "under uncertainty, it's impossible to make sure that every decision will turn out to have been right in this same sense. Under uncertainty, the businessman is forced, in effect, to gamble. Under such circumstances, a right decision consists in the choice of the best possible bet, whether it is won or lost after the fact"(Schlaifer, 1959).*

Is using Feed Efficiency as a measure for monitoring dairy status a good metric? Does it help reduce the uncertainty around feeding decisions. I know that there are several papers and speakers that advocate for feed efficiency as a dairy monitoring measure. It has some appeal because it is simple to calculate, lbs. of dry matter divided by milk production or fat corrected milk or energy-corrected milk. In addition, from a nutritional status, we know that the more efficiently we can convert the most expensive unit in the dairy operation to revenue, i.e., milk production, the dairy will be better off. The biggest problem with feed efficiency is that it is a ratio. Ratios fail to encompass the absolute value or magnitude of what we are trying to measure. Dr. Hutjens has a really nice chart of factors for feed efficiency that is quoted a lot.

Table 1. Benchmarks for feed efficiency comparisons (Hutjens, 2010).

Group Milk/kg DM	Days in Milk	FE (kg milk/kg DM)
One group, all cows	150 to 225	1.4 to 1.6
1st lactation group	< 90	1.5 to 1.7
1st lactation group	> 200	1.2 to 1.4
2nd + lactation group	< 90	1.6 to 1.8
2nd + lactation group	> 200	1.3 to 1.5
Fresh cow group	< 21	1.3 to 1.6

It's easy to see what the first problem is with using feed efficiency to evaluate possible interventions for the dairy program. There is so much variation in the interpretation of what a FE number means. Often ratio indicators of performance in the dairy may have value

2024 Pacific Northwest Animal Nutrition Conference Proceedings

retrospectively to view change from one time to another, but extremely poor for making decisions. Alex Bach in an excellent paper lists out possible causes for changes in feed efficiency, *"1) physiological status of the cow (e.g., age, state of lactation, health, level of production, environmental conditions), (2) digestive function (e.g., feeding behavior, passage rate, rumen fermentation, rumen and hindgut micro-biome), (3) metabolic partitioning (e.g., homeorhesis, insulin sensitivity, hormonal profile), (4) genetics (ultimately dictating the 2 previous aspects), and (5) nutrition (e.g., ration formulation, nutrient balance*)"(Bach et al., 2020). While these are the different areas each of us specialize in providing information and expertise to the dairy, understanding the status and effect of these factors at any period of time provides a high degree of uncertainty to the meaning. I think this provides a great list once we understand there is an issue based on a good metric, to go back and examine which area we can work on or "intervene in" to improve profitability.

The problem is that while efficiency ratios tell us the output per unit of input, they fail to address our goal of making net income. All ratio numbers fall in this category. Another one that is problematic that is often used in dairy production is Cost / CWT. To make meaningful decisions a static operator needs to be employed that is not in ratio form. We need a better tool for measuring "economic efficiency." Income minus feed Costs (IOFC) meets this criterion. "*Economic efficiency is best measured as income over feed cost or gross margin obtained from feed investments*"(Bach et al., 2020).

To make the needed calculations, the "income" from the farm can be directly obtained from QuickBooks or other Profit Loss reports, as well as the feed costs for the month. IOFC can be calculated as pounds of energy corrected milk x the milk price – the cost of feed. You can look at this on a herd basis or by pen or lactation group. Because the Income portion of the calculation includes the adjustment for butterfat and protein you can be sure of capturing all the value that the cow is producing from her feed conversion by using ECM in your calculation. In comparing month to month, fixing the milk price will help demonstrate the improvement in converting feed into saleable milk due to interventions, usually ration changes from month to month. Table 2 is an example of some ways to use IOFC to look at a snapshot of the herd and where opportunities may exist. In this table made using a pivot table the herd is reported by pen for milk production and ranked by DIM. (If you are not familiar with making pivot tables in Excel, there are several quick tutorials on the internet. This is probably one of the easiest tools for a consultant to use.) To understand where issues are hiding within a herd it is necessary to "slice" the data up into usable units.

Table 2. Milk production by pen with metrics. Ranked by pen average DIM

Pens	AVG ECM	Pen Count	Avg DIM	Avg Pen Ration Cost	Avg of IOFC	Avg of FeedEff	Avg of $/CWT
H	**87.6**	**2533**	**149**	**$ 10.49**	**$ 7.16**	**1.48**	**$ 13.98**
L	**64.6**	**1579**	**271**	**$ 7.82**	**$ 5.19**	**1.21**	**$ 15.44**
Total	**78.8**	**4112**	**196**	**$ 9.47**	**$ 6.40**	**1.38**	**$ 14.54**
1	76.3	153	82	$ 9.97	$ 5.40	1.38	$ 16.22
2	87.5	196	115	$ 10.78	$ 6.85	1.49	$ 14.76
5	89.4	349	211	$ 9.63	$ 8.37	1.40	$ 12.22
6	88.4	445	127	$ 10.33	$ 7.47	1.54	$ 13.66
7	84.6	483	144	$ 11.09	$ 5.95	1.38	$ 15.48
10	91.2	358	138	$ 11.30	$ 7.08	1.47	$ 14.33
22	94.8	154	167	$ 11.41	$ 7.70	1.52	$ 13.72
23	88.8	124	186	$ 10.14	$ 7.75	1.62	$ 12.79
28	81.4	147	203	$ 9.34	$ 7.05	1.59	$ 13.06
29	92.4	124	125	$ 9.56	$ 9.06	1.76	$ 11.77
3	51.8	228	295	$ 7.95	$ 2.49	0.95	$ 18.45
4	76.9	397	245	$ 8.22	$ 7.26	1.34	$ 12.21
8	62.5	282	282	$ 7.31	$ 5.28	1.24	$ 20.62
9	64.2	310	292	$ 7.84	$ 5.09	1.17	$ 14.06
24	63.8	146	233	$ 9.06	$ 3.79	1.23	$ 16.20
25	61.6	131	280	$ 6.75	$ 5.66	1.31	$ 12.37
26	56.3	85	274	$ 6.84	$ 4.50	1.18	$ 13.63

Yellow highlighted rows represent the low ration pen. The rest are high ration.

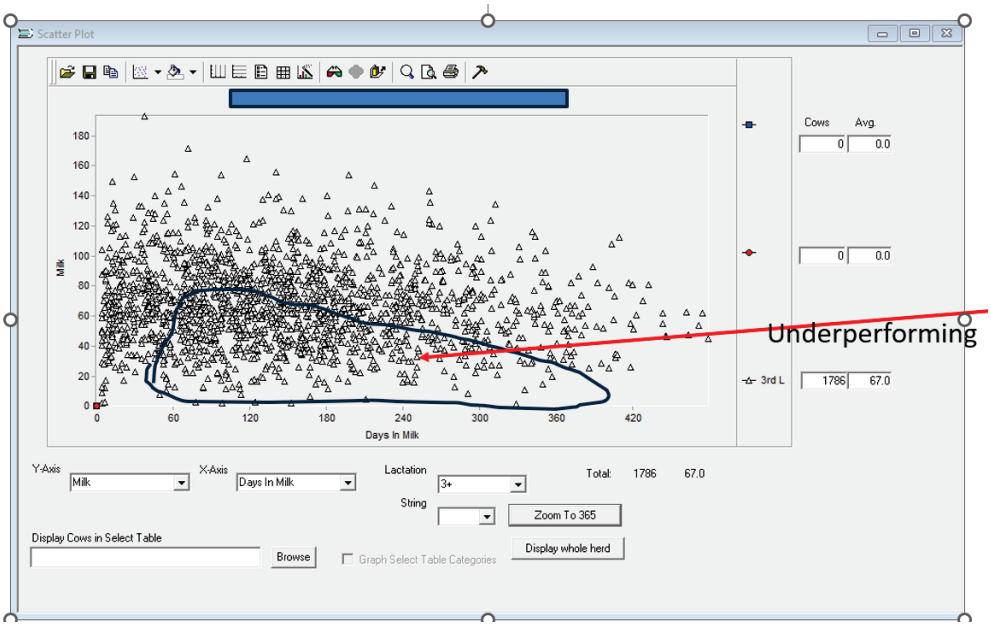
Table 2 is an example of slicing the data up into manageable bits to reduce the variation being explored. Knowing that the average ECM is 78.8 doesn't help us understand which pens are responding to interventions. Is the issue with low profitability due to specific pens, location on the farm, or ration issues or is it just DIM.

Table 3. Milk production by pen with metrics ranked by IOFC

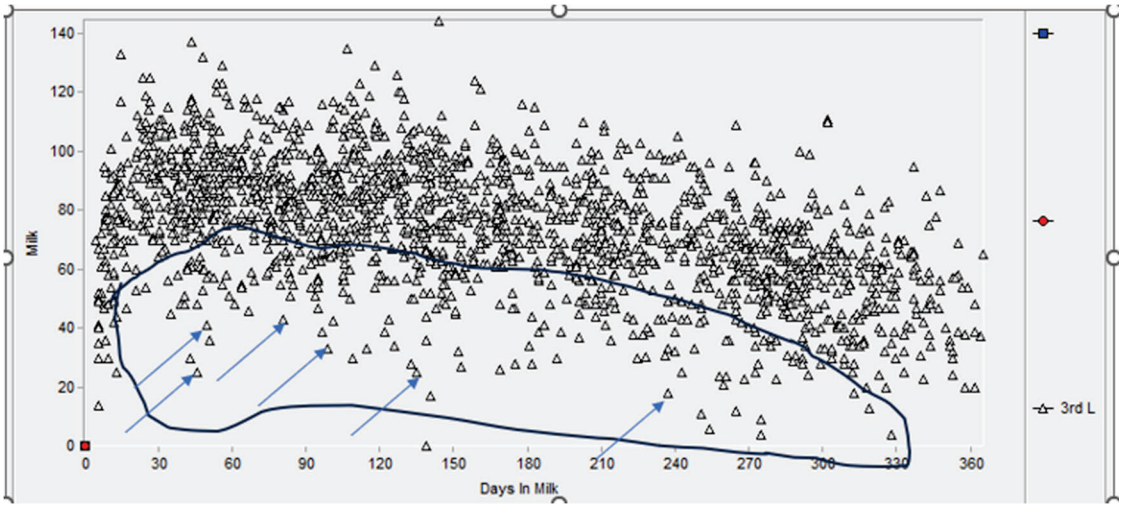
Pens	AVG ECM	Pen Count	Avg DIM	Avg Pen Ration Cost	Avg of IOFC	Avg of FeedEff	Avg of $/CWT
H	**87.6**	**2533**	**149**	**$ 10.49**	**$ 7.16**	**1.48**	**$ 13.98**
L	**64.6**	**1579**	**271**	**$ 7.82**	**$ 5.19**	**1.21**	**$ 15.44**
Total	**78.8**	**4112**	**196**	**$ 9.47**	**$ 6.40**	**1.38**	**$ 14.54**
29	92.4	124	125	$ 9.56	$ 9.06	1.76	$ 11.77
5	89.4	349	211	$ 9.63	$ 8.37	1.40	$ 12.22
23	88.8	124	186	$ 10.14	$ 7.75	1.62	$ 12.79
22	94.8	154	167	$ 11.41	$ 7.70	1.52	$ 13.72
6	88.4	445	127	$ 10.33	$ 7.47	1.54	$ 13.66
4	76.9	397	245	$ 8.22	$ 7.26	1.34	$ 12.21
10	91.2	358	138	$ 11.30	$ 7.08	1.47	$ 14.33
28	81.4	147	203	$ 9.34	$ 7.05	1.59	$ 13.06
2	87.5	196	115	$ 10.78	$ 6.85	1.49	$ 14.76
7	84.6	483	144	$ 11.09	$ 5.95	1.38	$ 15.48
25	61.6	131	280	$ 6.75	$ 5.66	1.31	$ 12.37
1	76.3	153	82	$ 9.97	$ 5.40	1.38	$ 16.22
8	62.5	282	282	$ 7.31	$ 5.28	1.24	$ 20.62
9	64.2	310	292	$ 7.84	$ 5.09	1.17	$ 14.06
26	56.3	85	274	$ 6.84	$ 4.50	1.18	$ 13.63
24	63.8	146	233	$ 9.06	$ 3.79	1.23	$ 16.20
3	51.8	228	295	$ 7.95	$ 2.49	0.95	$ 18.45

Table 3 is sorted by IOFC. The most profitable pens are highlighted in green in the IOFC column. We can see looking at the column for Feed Efficiency that while pen 29 is both the highest IOFC and Feed Efficiency, pen 5 appears to be low Feed Efficiency at 1.40, but the second highest net revenue for the farm. Making an intervention in this pen based on feed efficiency would be a mistake. Using the metric $/CWT which is often seen in financial reports is even less correlated with profitability than the other metrics as can be seen in Table 3.

One of the fastest and easiest ways to analyze a herd to start to build a case for where intervention should occur is in the use of scatter-graphs. Scatter-graphs have the advantage of allowing one to see a snapshot of the herd and the herd variability on test day. This scatter-graph is a graph of milk by DIM for lactation >2 directly out of DHI+ by Amelicor. It's easy to rapidly assess there are cows that are having trouble through transition and failing to peak by 60 DIM. Although some cows are peaking fairly high, a large majority of cows are peaking less than 100 pounds which also may indicate a problem with transition cows.



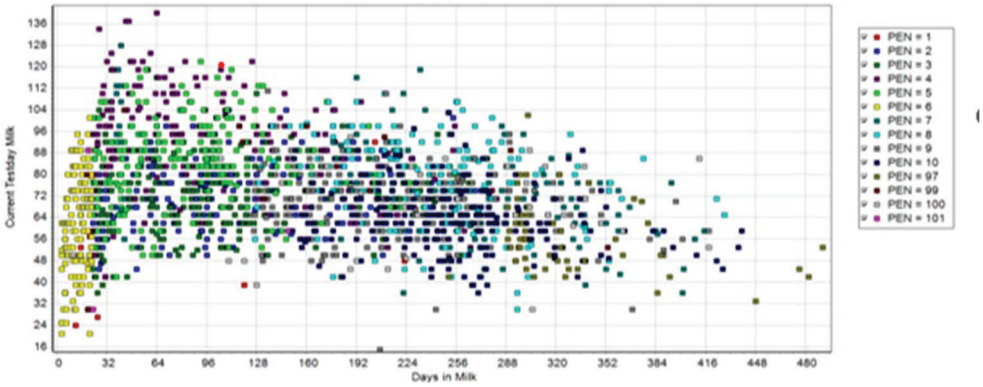
In this scatter-graph of the same herd 5 months later



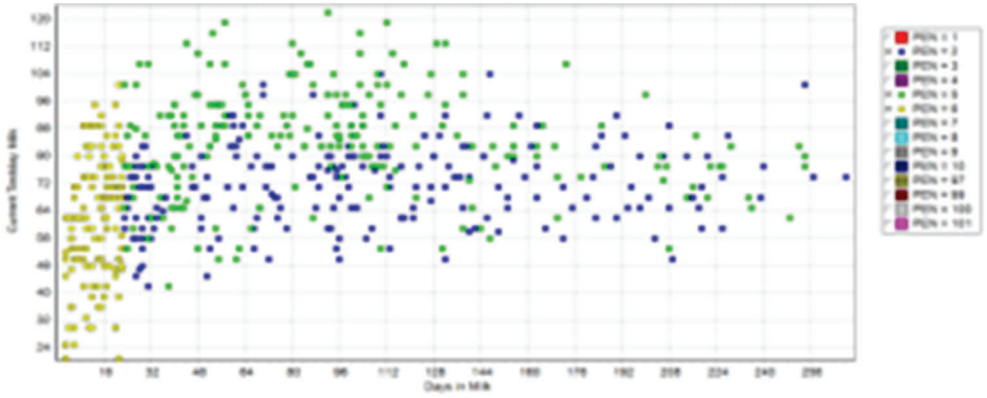
improved transition health is evident in the herd. Decreasing the variation in the transition cows can improve profitability. There are still issues in transition that can be worked on by identifying other problem-broken cows (arrows) which can aid in improving management functions. Management can individually examine these cows and look for common denominators in their history.

While the scatter-graphs are a good fast visual snapshot of the herd, another aspect is to assess the variability of the herd. We can use more formal ways of analyzing the animal cohorts statistically, such as the deviation in milk production for the cows that calved in August. The variation is important to keep in mind because we can look at milk productions as the results of the demographic of the herd. How many of each lactation and at what DIM they are in the herd. We can improve the average milk production simply by eliminating the cow milk that is less than the average milk production, i.e. cull out way out of the problem.

Another way to look at the herd is to look at a scatter-graph by pen. (Graph milk by dim for lact>0 by pen). Here we can see where the pens lay from a DIM standpoint, and how each pen may vary.



Reducing the number of pens to look at helps facilitate clarity. In this example the fresh pen and two subsequent high cow pens can been seen. The pen represented by green dots is outperforming the pen with blue dots and should be investigated.



Another important consideration of variability in the herd milk production and age demographics where an opportunity may exist is grouping for production and nutrition. Evidently about 40% of the dairy herds surveyed did not feed different groups within the herd based on nutritional needs (Contreras-Govea et al., 2015). Most large dairies feed multiple loads of TMR per day but only one ration. While many operations feed one TMR to simplify the feeding operation to decrease feeding errors, or to manage the cows for another reason than nutrition, such as reproduction, or parlor size, or for concerns that moving cows causes a permanent decrease in milk production, several studies have shown an economic advantage to grouping for nutritional

needs. Kalantari found an average of $39 advantage for 2 groups and $46/cow/year for a three-group strategy (Kalantari et al., 2016). Bach et.al found a difference of about $.22 / cow per day for one herd and Wu et.al using a proprietary algorithm found a simulated improved IOFC of $48/cow/year for a 2 group and $71/cow/year for a 3-group feeding program (Wu et al., 2019). In addition Bach found less impact on production from the pen moves that might have been anticipated (Bach, 2022).

While there are many things we can do as consultants or advisors on dairy farms to improve productivity, it remains essential that we have our focus on measuring the right outcomes and avoid making judgements based on averages that inherently have huge variations in the underlying biology. Across our industry there is a tremendous level scientific knowledge. We know more about feeding cows, treating cows, and raising cows than we have ever known. Applying all this knowledge to the right cows, at the right time at the right cost is the key to successful interventions.

References

Bach, A. (2022). Changes in milk production and estimated income over feed cost of group-housed dairy cows when moved from a high- to a low-production ration. *Journal of Dairy Science*, *105*, 311-311. <Go to ISI>://WOS:000898603301295

Bach, A., Terré, M., & Vidal, M. (2020). Symposium review: Decomposing efficiency of milk production and maximizing profit. *Journal of Dairy Science*, *103*(6), 5709-5725. https://doi.org/10.3168/jds.2019-17304

Contreras-Govea, F. E., Cabrera, V. E., Armentano, L. E., Shaver, R. D., Crump, P. M., Beede, D. K., & VandeHaar, M. J. (2015). Constraints for nutritional grouping in Wisconsin and Michigan dairy farms [Article]. *Journal of Dairy Science*, *98*(2), 1336-1344. https://doi.org/10.3168/jds.2014-8368

Hutjens, M. (2010). Benchmarking your Feed Efficiency, Feed Costs and Income over Feed Cost. 28th Annual West Canadian Dairy Seminar,

Johnson, M. (2023). Measure, Quatify and Document. *Drovers*, *Sept 5*. www.drivers.com/authors/mark-z-johnson

Kalantari, A. S., Armentano, L. E., Shaver, R. D., & Cabrera, V. E. (2016). Economic impact of nutritional grouping in dairy herds [Article]. *Journal of Dairy Science*, *99*(2), 1672-1692. https://doi.org/10.3168/jds.2015-9810

Schlaifer, R. (1959). The Problem of Decision under Uncertainty. In *Probability and Statistics for Business Decisions: An introduction to Managerial Economics Under Uncertainty* (pp. 2-65). McGraw-Hill Book Company, Inc.

Wu, Y., Liang, D., Shaver, R. D., & Cabrera, V. E. (2019). An income over feed cost nutritional grouping strategy [Article]. *Journal of Dairy Science*, *102*(5), 4682-4693. https://doi.org/10.3168/jds.2018-15302