Economics of Lactating Dairy Cow Grouping Strategies

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Abstract

The main objective of grouping cows by nutrient requirement or lactation stage is to reduce overall feed cost by feeding lower producing cows a lesser cost ration. However, the main concern expressed by producers and their nutrition advisors when moving from a one-ration to a multiple-ration lactating cow grouping system is lost milk production. Unfortunately, there is little data available in the literature where the magnitude of loss in milk production or its economic value relative to feed cost savings was evaluated across grouping systems. Furthermore, attempts to quantify the costs of implementing multi-group feeding systems are not apparent in the literature.

To answer the question, "Does it pay to group cows?" this study calculated recently available feed cost savings from a grouping strategy and a minimal-typical cost to mix an additional batch of feed to implement the process. The values of additional management options were also identified for comparison to that available from lowering feed cost/cow/day through a grouping strategy. Results indicate that economic returns from multi-ration grouping systems from feed savings alone appear to offer limited potential relative to the cost of implementation.

Even though potential feed savings calculated are consistent with those cited in the general literature, the costs to implement a multi-group system are likely higher than before and, in the absence of other savings, milk production or health enhancement benefits may not justify the change. Although not well quantified, grouping dry, first lactation and early lactation cows does

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seem to offer profit potential through improved milk production and cow health. Other cost reduction/efficiency enhancement options such as optimizing rations for Income over Feed Supplement Costs (IOFSC) given feed supplement cost, milk price and based on production level may individually offer 6.4 - 8.0 times the economic impact of lowering feed cost to a portion of the lactating herd.

An attempt to answer the "Does it pay to group lactating cows?" question is made given feed and milk prices for the time period studied. Perhaps the more important issue is to establish an assessment process to evaluate specific time bound economic potential than it is to broadly answer the question.

Introduction

Minimizing cost to feed lactating dairy cows is a concern as old as the relationship between man and beast. Once commerce developed and dairy producers not only realized income from the sale of milk but also expense for feeds they could not produce themselves, a concern about out-of –pocket expenditures soon followed.

In an effort to better maximize milk output relative to feed input individual cow feeding systems developed. However, as herd size grew individual cow management gave way to managing groups of dairy cattle. Both systems offer management advantages and disadvantages, many unique to each system. The multi-ration grouping system for lactating cows in not only an attempt to lower overall herd feed costs, but also to facilitate the offering of rations more closely balanced to the needs of a greater percentage of the herd.

While this paper focuses on the economics of various lactating cow grouping strategies, the research base is somewhat limited. Until more recently there seemed to be little standardization in how economic evaluation was approached. From a herd management point of view it is very difficult to narrowly evaluate the comparative economics of grouping strategies based only on feed cost minimization. The many cow nutrition, social, herd and facility as well as broader business management issues further complicate the issue. Therefore a review of the literature on these concepts was conducted to establish a foundation of present knowledge as well as to develop perspective of other important issues that need to be considered for making informed management decisions relative to cow grouping strategies. The results of this review are presented below.

Nutrition and Feeding Management:

Lactating cows

Various methods, benefits, strategies and cow responses have been studied relative to cow grouping. Grouping strategy based on cow nutrient requirements was addressed by Earleywine (2001) in an extensive review of numerous trials in which the number of groups needed to address nutritional and management needs while maximizing profit (undefined) were evaluated. A novel method of grouping based on cow nutrient requirements was developed by McGilliard et al. (1983) based on identifying a "seed cow" or the individual with the highest nutrient requirement in the group and each subsequent cow for the group was chosen based on her requirements compared to those of the last chosen cow.

A 2008 field study by Tolp et al. (2008) utilized three dairy farms in Estonia of 1000, 600 and 200 cows. Cows were grouped according to stage of lactation and milk production. Conclusions from this evaluation as well as from the general literature were "to form as many groups as possible on large farms based on nutritional requirements to enable the lowest use of concentrates". It was also observed that, homogeneous herds for milk production require fewer groups. Neither body condition score (BCS), metabolic disorders, fertility parameters nor profitability were evaluated.

Earleywine (2001) also reported that Akinyele and Spahr (1974) and Clark (1980) evaluated the effect of feeding varying grain to forage concentrations across groups on lactation performance, but without economic analysis. Clark (1980) as cited by Earleywine (2001) also observed a fat test increase with a single-ration group. Britt (1977) suggested that the primary benefits of grouping were more effective utilization of management resources and more opportunity to maximize output per cow.

Earleywine (2001) reported on the Bath and Sosnik (1992) work in which they observed the highest feed efficiency from feeding cows individually based on size and milk production. Production potential as a criterion for TMR feeding strategy was evaluated by Spahr, et al., (1992) using individual yield relative to body weight from calving to 30 weeks into lactation.

On the topic of time needed for the cow to acclimate to a diet change, Earleywine (2001) cited Moseley et al. (1976) who observed that cow adaptation to dietary changes occurred within 15 days when rations were changed between 40:60 and 60:40 forage to grain diets.

Social behavior in groups of cattle

Coppock (1977) referenced earlier work on social interactions between cows in his study of management of group housing systems in commenting that, "Those of us in the discipline of animal science have been slow to appreciate the importance of social and taste behavior in cattle and slow to integrate the available knowledge into our management systems. A Complete Ration (an early reference to a Total Mixed Ration (TMR)) fed ad libitum will minimize effects of social dominance at the feed manger".

Coppock (1977) reported a drop in milk production often occurred when cows changed ration groups from high to lower energy diets and identified the two main changes that occur when cows are moved from one group to another; dietary and social.

Grant and Albright (2001) evaluated cow grouping effects on feeding behavior and intake of dairy cows concluded, "Grouping should not only minimize social interactions and encourage positive interactions, but a proper grouping strategy will also decrease within-group variation and increase across-group variation. Although the effect of grouping on feeding behavior remains largely unquantitated at this point, the effect is potentially large and requires further research to describe the impact of cow dynamics within a group on feed intake. "

Grant and Albright (2001) identified factors that interact in determining optimal group size include; feedbunk space, social interactions between cows, available space per cow, holding pen size and parlor capacity, animal body size and age, body condition, days in milk (DIM), stall size and equity (sufficient number of stalls for the number of cows), and ventilation adequacy. Concluding, "The upper limit of group size is dictated by parlor size and time spent in the holding pen. Following these considerations, management of feeding and housing facilities determines group size."

Grant and Albright (2001) suggested the minimum number of groups for a herd would be two; a milking plus a dry cow group. Nutritionally, three feeding or production groups plus two dry cow groups are often preferable. A fresh cow group for the first three weeks of lactation can serve as a transition from dry to high milk production groups. The authors commented on the scarcity of data on the topic but stated, "The fact is clear that grouping strategy can have a significant impact on feeding behavior and feed intake in dairy cattle". They reported the negative social consequences of moving cattle between groups persist for 3 to 7 days.

When primiparous cows were grouped separately their eating time increased by 11.4%, meals per day increased by 8.5%, dry matter intake (DMI) increased by 11.8%, lying time increased 8.8% and lying periods increased by 19% per day as reported by Konggaard and Krohn (1978) and cited in Grant and Albright (2000; 2001).

Cook (2008) summarized field observations of cow interactions between duration of exposure to the close-up ration and herd mates within group, movements between pens, feed space per cow and freestalls per cow. He observed, "Only around 30% of the variation in change in DMI may be explained by diet and animal factors, suggesting that management factors account for 70% of the variation. It takes about 48 hours after a cow move before social stabilization and the development of a stable hierarchy occurs within the group. Effects on individuals such as first lactation animals and subordinate animals in particular, during a high risk period, such as the transition period may be greater and last for longer. Although detected changes in milk yield may be small, there may be longer term effects on animal health that have yet to be identified that are of greater significance."

Economic Evaluations

Rakes et al. (1971) reported greater IOFC for a 100 cow dairy fed conventionally with forages produced on the farm compared to an all purchased CR (TMR) as cited by Coppock (1977). As with dairy producers, researchers also experience a sense of heightened economic awareness when production margins are narrow. Smith (1976) reported at the time feed costs had moved from 50 to 70% of the total cost to produce milk and that IOFC was a major determinant of profits in a dairy production enterprise. Smith (1976) commented, "The dairy industry tends to operate in an environment of considerable uncertainty regarding quantitative evaluation of production response-cost relationships. Hence, economic optimum is seldom attained and if attained is primarily by chance".

Smith (1976) concluded that over four sets of grain and forage prices with grain valued at $110 or $170/T, forage valued at $25 and $70/T and milk at $7.00 and $9.00/cwt that forage quality may be a bigger factor in IOFC than quantity of grain fed. Even under conditions of high feed costs, early lactation cows responded profitably to added grain to the point where milk fat depression was encountered. At the prices used in the analysis a two-ration group system had an advantage of $60/cow/year even though the one-ration group system cows produced 264 lb. more milk per lactation. Smith (1976) also recognized, but did not quantify, that increased costs associated with the extra ration group in order to realize this savings would be of greater concern to small than large herd operators.

Tauer (1995) suggested that New York farmers tend to put more emphasis on cost minimization than on profit maximization, but in 1998 as cited by Gloy et al. (2002), he reported farmers do change output in response to changes in both input and output values.

Earleywine (2001) reporting on earlier work that the IOFC response to increased milk production was linear. Earleywine (2001) also noted previous research documenting IOFC differed between cows due to lactation stage and genetic ability and on the law of diminishing returns related to grain feeding.

Williams and Oltenacu (1992) created and ran a simulation model for ten years on 100 cows to evaluate the appropriateness of criteria for evaluating cow grouping strategies. Each grouping strategy was simulated for five years. Milk was valued at $12.50 per CWT. Grouping based on nutrient concentrations was most effective for maximizing IOFC, whereas a method based only on test-day milk yield was least effective. Bishop et al. (1988) analyzed records from 655 herds and reported the standard deviation (SD) for herd average 4.0% Fat Corrected Milk (FCM) decreased as lactation progressed and increased as the number of herd groups increased. Higher levels of management were associated with higher yields and greater variability throughout lactation. Bishop et al. (1989), using partial budgeting, reported increased IOFC and milk production from increasing the number of ration groups from one to two or three, of $46.65 - $88.11 per cow 1.72 – 5.05%, respectively.

Earleywine (2001) using models to evaluate the profitability of various dietary grain concentrations and grouping strategies concluded "…even at $5.00 corn and a low milk price of $9.54 per CWT that additional corn supplementation can be profitable in early (less than 13 weeks) of lactation. With corn at $1.70/bu. and the same milk price additional corn is warranted until 19-27 weeks into lactation. Under the majority of economic scenarios studied more than one lactation-stage nutrition group provided $0.20-0.85 higher IOFC/cow/day than a single group. Concentrated calving provided no IOFC advantage. With low grain and average to high milk prices there was $0.08 – 0.27 higher IOFC/cow/day with concentrated calving and one nutrition group. Dietary reformulation weekly or every two weeks in concentrated calving herds provided a small (up to $0.07 per cow weekly) advantage over once every four weeks." A major part of this study focused on the economic response of grain for forage substitution rates. Prices utilized were from November, 2000 and mean, minimum and maximum monthly prices from 1980 – November, 2000. Optimal grain concentrations were determined based on IOFC only and did not consider BCS changes.

In a similar light as that expressed by Smith (1976) on the effect of forage quality on IOFC, others have explored the contribution forages make to feed cost. Dyk and Shaver (2009) utilized the decision making tool "Impact of feed prices on cost of simulated average and high corn silage diets" (http://www.uwex.edu/ces/dairynutrition/spreadsheets.cfm) to assess the question, "Should more corn silage be fed during times of high purchased and home grown feed costs?". Costs and prices used in the analysis were from July, 2008. Home-grown feed costs were set at $30 for 35% dry matter (DM) corn silage, $48 for 40% DM haylage, and $3.20/bu. for corn. Purchased feed prices used in the analysis included: corn - $5.50, corn silage (CS) - $45 (35% DM basis), and haylage - $68 (40% DM basis). The selected milk price was $19. Three scenarios were evaluated; Forages & corn produced on-farm; Forages produced on-farm and corn purchased and both purchased. The "high" corn silage ration contained 27 lbs of forage DM and the 50:50 corn silage: haylage ration contained 15 lb. each of corn silage and haylage DM.

Conclusions reached include; as the amount of feed purchased increased, IOFC declined; the high corn silage diet was the most expensive; IOFC per cwt, of milk favored the 50:50 diet, but

IOFC per cow favored the high corn silage diet; with lower cost supplements the high corn silage diet was less costly than the 50:50 corn silage: haylage diets.

Dyk (2010) reported results of an eleven-herd field study and suggested that comparing IOFC between herds may not be very helpful to the individual dairy farmer due to differences in how various producers account for purchased feed. Some may or may not include heifer feed, forage purchases and dry cow feed or grain in the total. Study herds averaged 84-91 lbs milk/cow/day with 3.6% BF. Most were larger farms with significant buying power.

Purchased feed costs for milking cows only varied from $1.73 to $4.39/cow/day. Every farm had different ingredients purchased. The author standardized all forage and grain costs using October 2008 prices which narrowed the feed cost range to $4.13 - $6.15/cow/day. When analyzed based on the value of purchased feed only, Income over Feed Supplement Costs (IOFSC) difference among herds narrowed to just over $1.30 per CWT of milk produced. Dyk postulated that different levels of risk management, which affected milk price contributed to the variance in IOFSC per CWT. Also identified as contributing factors to IOFSC variance were differences in feed efficiency, feed contracts, additives, forage quality, ration balancing and margins on feeds. Both of the above findings by Dyk and Dyk et al. 2009 point out feed cost savings opportunities that may be used without or in addition to the grouping of lactating cows.

Also addressing feed cost reduction opportunities in Dairy Herd Management, Industry News Schroeder (2009) suggested DM loss associated with silage fermentation and feeding should be less than 10%, yet on some farms losses can be as great as 25% or more. Minimizing loss reduces cost. In a similar vein Weiss (2010) as quoted in Dairy Herd Management, Profit-Tips observed that if average feed $/dry cow/day was reasonable but the average days dry was 90, then too much was spent on feeding dry cows. The same thing is true of calving heifers at 26-28 months rather than 22-24 months. Both observations underscore that dairy farm cost control opportunities associated with feeding exits beyond feed efficiency and IOFC factors.

Discussion

From the above review of the literature perhaps the best answer to the question “Does it pay to group cows?” is, “It depends”. The number of variables involved make this a multifaceted issue which could lead to the conclusion that it may be more productive to address a method of collectively evaluating specific variables on individual farms rather than attempting a single global answer. The “all things being equal” qualifier isn’t very helpful when the number of variables require linier programming to evaluate.

Other areas of opportunity are to quantify the expense to realize feed savings and of milk loss/gain when grouping cows compared to potential feed savings. A second level of this comparison could then be to compare the net IOFC to the breakeven point of implementing the grouping strategy. Recognizing and minimizing negative social effects of cow grouping at any point in her lactating and dry periods seem to generate income gain and expense control advantages. Another not yet quantified factor is the maximum number of cows/group without the cows experiencing significant negative social consequences.

The economics of grouping first lactation heifers separate from mature cows seems to offer economic potential along with limiting days open for lactating cows and the number of days dry. Managing the late lactation cow thorough her dry period, the pre- and post-fresh transition periods, and early lactation with emphasis on BCS and DMI may offer dividends as great as or larger than feed savings during lactation from not over-feeding low producing cows. If the percentage of over conditioned cows at dry off is sufficiently high to justify the extra cost of implementing additional groups then doing so may lead to added return. When this is the case, addressing other areas of management like the length of the voluntary waiting period to breed and days open seem to be indicated as well.

Similar considerations/comparisons can be made with forage quality and reducing harvest, storage and feeding losses. I would be remiss not to address the syndrome of reduced feed allocation to lactating cows when cash flow is strapped. A general knowledge that even expensive feed is typically cheap compared to milk price and new facilities or equipment, serves the successful producer and consultant well. Labor, as long as it is available, can often be considered in a similar vein. Early workers researching cow grouping were perhaps not as interested in economic comparisons as long as a savings might be realized, because profit margins were not as narrow as at present and price volatility risk was minimal. An understanding is also needed that cash flow is not "profit" and that IOFC, although associated with profit, simply sets the stage for improving financial performance while not guaranteeing it.

As mentioned by Smith (1976) moving from financial outcomes by chance or assumption to informed decision making holds great promise. Fully informed decisions followed by complete economic evaluation of the change to assess impact on both the enterprise as well as the entire business are required to accurately answer the "does it pay" question posed above. Towards that end two decision making aids were utilized, the "Wisconsin Feed Cost Evaluator" (Cabrera and Shaver, 2009) and "Optimizing Income over Feed Supplement Cost" (Cabrera et al., 2009) to evaluation the potential economic consequences of reduced feed expense relative to milk income in the dairy enterprise during the recent economic downturn. Having up-to-date feed cost savings data allows the manager to compare potential savings with the cost to make the change needed to capture them.

IOFC Appraisal

Three sets of feed and milk prices from February, 2009 (high feed/$12.47 milk prices), December, 2009 (slightly lower feed/ $16.44 milk prices) and February, 2010 (slightly higher feed and $15 milk prices) were used to evaluate Total Feed Cost/Cow/day and IOFC under two grouping systems; 1) a 500 cow one-group system with average production of 89 lb. milk/cow/day or, 2) a two group-system with the same average production but with a High Group representing 2/3 the total herd size (375 cows) producing 95 lb milk/cow/day and a Low Group representing 1/3 of the herd (125 cows) producing 70 lb. milk/cow/day. Milk prices and itemized feed prices for each time period evaluated appear in Table 1.

No loss in milk production was assumed in changing from a one-group to a two-group system and the same forages were fed in the same proportions to both groups. Energy and protein feeds were balanced for each production level to appraise available feed cost reduction and net IOFC from feeding late lactation cows a ration of relatively lower nutrient density. The analysis was completed with the "Wisconsin Dairy Feed Cost Evaluator" (Cabrera and Shaver, 2008). IOFC results for each grouping system appear in Tables 2-4.

According to the analysis, even under the relatively high feed and low milk prices evaluated, potential best-case IOFC gains as indicated from the difference in IOFC range from a high of $0.24/cow /day in December, 2009 to a low of $0.18/cow/day in February, 2010 from implementing a low production group. These values are consistent to slightly lower than cited in the general literature. In addition to different feed cost – milk price relationships it is doubtful that today's cows are similar in their production persistency, maintenance requirements or challenges to maintain and regain BC during lactation as compared to those evaluated one or more decades ago so it follows that these values and production responses will vary.

The results place the breakeven amount of milk relative to feed cost savings from using a two-group feeding strategy at 6.8 lb milk/cow/day in February-2009, 5.8 lb milk in December-2009 and 4.8 lb milk in February-2010. Any milk loss from implementing the strategy over these amounts would negate any financial advantage to do so assuming it can be implemented at no increase in cost. Any accumulated milk loss per day during the 3-7 day transition period should be considered as well as the steady state production level following acclimation.

Another approach to evaluating the impact of these potential savings is to determine what the breakeven implementation expense would be assuming no loss in milk production. The above feed cost savings over 500 cows could provide an extra $90/$120.00 per herd/day. Utilizing the "Analysis of TMR Cost " spreadsheet by Holmes and Jones (2010) to calculate the costs, including variable, labor and ownership costs, to mix one extra batch of feed in order to realize potential feed savings given typical to conservative assumptions of Holterman (2010) yields a cost of $76.88-$82.23/hr. Therefore the maximum amount of time to mix and dispense the extra batch could be 1.2-1.5 hours to breakeven on implementing the strategy. Given the $0.85/cow/day maximum savings calculated by Earleywine (2001) and 500 cow herd size, a $425/day savings may be realized allowing a $305/day savings over the cost to mix one extra batch of TMR assuming one additional hour of mixing time is required.

Income over Feed Supplement Costs (IOFSC) Appraisal

Rotz et al. (1999) found that profitability of dairy farms could be improved by decreasing Crude Protein (CP) intake and adjusting for Rumen Un-degradable Protein (RUP) and Rumen Degradable Protein (RDP) through a better selection of feed ingredients, which vary according to market prices of feed stuffs as cited by Cabrera et al. (2009). Cabrera et al. (2009) also observed it is usual on many dairy farms for forages produced either on-farm or that are locally available to be considered a fixed proportion in the diet, at least in the short-run. Consequently, the optimization problem can be simplified by discounting the DM and CP provided by fixed amounts of forages from the total needs. The problem to solve then becomes one of optimizing IOFSC given feed supplement costs, milk price and the cow's milk production response to dietary CP.

An IOFSC analysis was completed using feed prices in Table 1. Base energy and protein feed ingredients considered were dry cracked corn, soybean oil meal (SBOM) and Distiller's Dried Grain. Each ration was optimized for RUP at 7.00%, RDP at 11.98% and CP at 19.0% by substituting either corn for protein supplements or SBOM for energy supplements. Results for each of three time periods are recorded in Tables 5-7.

Data from Table 5 shows a $1.34 difference with a ration balanced for 95 lb./milk/cow/day between IOFSC of the "Current" ration as compared to that potentially available from an "Optimal" ration ($9.35 - $8.01 = $1.34). This available IOFSC increase compares to a $0.21 potential IOFC enhancement/cow/day from implementing a two-group feeding strategy during the same time period. Similar comparisons can be made from the analysis results for the time periods evaluated in Tables 6 and 7 of $1.92/cow/day vs. $0.24/cow/day and $1.26/cow/day as compared to $0.18/cow/day. The data suggests that optimizing energy and protein nutrition by substituting appropriate energy and protein supplements based on market conditions may offer economic gains of 6.4 – 8.0 times those of implementing a two-group feeding strategy. Each of the above analysis was completed at 98% of expected DMI.

Interesting aspects of the IOFSC analysis is that in two of nine comparisons the return from optimizing rations for the 70 lb milk\cow group exceeded that for the 95 lb cows. This is likely due to the lower producing cow's inability to pay for energy supplements when priced high relative to protein. A similar explanation is plausible when comparing 70 lb. milk/cow/day IOFSC when DMI is 90% vs. 98% of expectation. These considerations may help maximize IOFSC during periods of summer heat stress when intakes are depressed. It also underscores the impact of DMI and optimum nutrient concentration on IOFSC. Each of the evaluated IOFSC scenarios optimization of the grain and supplement fed reduced the amount of grain and increased the amount of protein supplement in the ration indicating the protein supplements were priced favorable relative to corn during these periods of time.

IOFSC Sensitivity Analysis

The IOFSC evaluator also performs two levels of sensitivity analysis; 1) on expected IOFSC and milk production when substituting energy for protein or vice versa and 2) on the change in IOFSC at upper and lower limits of selected prices, including milk price. Each of the above analysis was run at upper and lower price limits of +/- 20%.

Similar to the finding of Williams and Oltenau (1982), under the assumed conditions IOFSC began to decline at a lower ration protein concentration than did milk production which is generally expected to continue to increase with higher protein levels. Given February-2009 prices and a ration optimized for energy price, cows producing 95 lb/milk/day were expected to continue to increase milk production at ration protein concentrations exceeding 18.7% but IOFSC began to decline at 18.2% CP. The IOFSC indicated a diminishing return on investment at the higher energy cost range ($4.15/bu. x 1.2 = $4.95/bu.) at 18.2% CP, but at the lower energy cost range ($4.15/bu. x 0.8 = $3.32/bu.) returns continued to increase until ration protein reached 18.4%.

For lower producing cows averaging 70 lb./milk/cow/day and February-2009 prices, milk production was predicted to peak at well above the 18.8% CP ration level however, maximum return to IOFSC occurred at 17.6% CP. When analyzed for higher and lower energy costs IOFSC peaked at the higher corn price at 17.6% CP but continued to show returns at the lower corn price at the 18.2% CP%. When the price of protein was floated higher and lower, maximum IOFSC occurred at around 18% ration CP with the milk production response continuing beyond 18.8% CP. At the 20% higher SBOM price IOFSC peaked close to 17.5% CP while at the lower SBOM price IOFSC declined when CP levels exceeded 18.2% CP. A similar response to 20% higher or lower milk prices was documented as to the higher/lower protein prices although at the higher milk price IOFSC didn't decline until ration CP% exceeded 18.5%.

Different assumptions would produce varying results. Thus, perhaps indicating that because of changing economic and management conditions it is of highest importance to analyze various ration and cow grouping opportunities in real time than it is to assume a general conclusion applies to most situations.

Dairy producers and those who advise them are quick to consider lowering feed cost per cow when cash flow margins are narrow to nonexistent. Feed cost is easy to identify particularly for purchased feed and represents the highest percentage of variable costs. Financial advisors strongly recommend managers target these relatively high expenditures to evaluate for potential lowering. The key is in the word “evaluate”; to compare potential savings to expected costs as well as any reduction or increase in revenue.

Options that may positively impact the return on lowering feed cost/cow/day from a grouping strategy include the following;

1. When possible, eliminate the need to mix an extra batch of feed. If conditions allow, consider mixing the forage portion of the TMR for two different rations together at one time. Then blend in the energy, protein and mineral supplements for the low-nutrient concentration ration and dispense that portion of the mix. Return to the energy, protein and mineral source if required, adding enough of each to bring the concentration up to the high - producing group’s needs. Evaluate whether the reduced cost justifies the expense.

2. Mix full TMR batches.

3. Use depreciated equipment to lower the cost of feed preparation, but adjust repair costs upward accordingly.

4. Lot, parlor and mixer sizes are appropriately matched to justify additional grouping.

5. Grain or protein supplement cost becomes prohibitive relative to milk value. This has not been recorded for early lactation cows.

6. The variation between lactating cow production groups is greater than the 25 lbs. of milk difference studied.

Recommended grouping strategies may include;

1. Place an emphasis on appropriate grouping of dry, pre-fresh, post-fresh and first calf animals and on available cow comfort and optimal nutrition opportunities.

2. Strive for peak reproduction performance. This typically starts with lowering the number of days to first service.

3. Group first lactation animals separate from mature cows, but feed the high group ration to first lactation cows.

4. Emphasize BCS, cow comfort and positive socialization management before feed cost minimization.

5. Evaluate all of above based on IOFC relative to the base condition.

6. Realize that maximizing returns to the dairy is an enterprise analysis. Also evaluate the impact of these cost and revenue changes on the whole farm business.

Conclusions

The question of whether feed cost/cow or feed cost/CWT of milk produced is the appropriate measure remains and deserves additional investigation. As demonstrated by Dyk (2010) each approach produces different information. It may be that IOFC/cow is an acceptable measure when comparing with-in farm management alternatives but may offer challenges when used between herds due to differences in how feed is classified as “purchased” a well as differences in milk revenue received. While similar disparities may exist for IOFC/CWT it does offer an additional measure of production and efficiency standardization. The bottom line is still the overall ability to generate net revenue for the whole-farm business and to do so efficiently and in sufficient quantity to provide a competitive return to labor, management and equity capital. Therefore, perhaps evaluating feed cost as a percentage of gross revenue is an appropriate alternative as a relative cost to revenue versus an absolute dollar comparison,

Evaluate the available returns of other management changes; they may be of larger economic potential than those offered through grouping. Exceptions may be in larger herds where the investment in facilities has already been made, are utilized at full capacity and fixed costs may be averaged over a larger number of cows. Herds with more than a 25 lb/milk/cow/day average production difference between groups as evaluated in this study, with a significantly large number of cows producing at the lower production level and/or over conditioned cows may find additional returns from a mutiple-group lactating cow strategy.

While a specific answer to the question “Does it pay to group cows?” may be attempted it is only relevant to the time period referenced and is not static. Therefore a more comprehensive approach may be to commit to evaluating lactating cow rations for opportunities to exact savings throughout the feed harvest/purchase, storage and feeding processes as well as those available from optimizing ration nutrients, timely breeding and housing first lactation cows separate from mature cows. Using a process to periodically calculate IOFC or IOFSC along with other potential savings from grouping low producing cows separately from high producers can then be compared to the cost to realize projected benefits to make informed, real time decisions.

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Table 1

Prices Used For IOFC [2] Calculations – all values on as-fed basis

Time Period	**Milk $/CWT. [3]**	**Corn/bu.[4]**	**SBOM [5] /T. [6]**	**Alf.[7] Hay/T.[6]**	**Corn Silage/ T.**	**Distillers/T.**
Feb. 2009	$12.47	$4.15	$341	$149	$40	$123
Dec. 2009	16.44	4.57	393	107	31	123
Feb. 2010	15.00	3.33	287	107	33	123

2 Income over Feed Cost; 3 hundredweight; 4 bushel; 5 soybean oil meal; 6 ton; 7 alfalfa

Table 2

IOFC [2] Results –February, 2009 Milk = $12.47 – all feed on dry matter basis (DM)

Ration	**lb. [8] Corn**	**lb. Prot. [9] Supp. [10]**	**Total Feed Cost/Cow**	**IOFC/ Cow/ Day**	**lb. Milk**	**#[12] Groups**	**Total Rev. $[11] /Cow/Day**	**# Cows**
High	11.2	10.06	$4.25	$6.85	89	1	$11.10	500
High -2	11.2	10.06	4.25	[redacted]	95	2	[redacted]	375
Low	9.0	6.0	3.40	7.06	70		11.10	125
Difference				$0.21				

2 Income over Feed Cost; 8 pound; 9 protein; 10 supplement; 11 dollars; 12 number

Table 3

IOFC [2] Results –December, 2009 Milk = $16.44 – all feed on dry matter basis (DM)

Ration	**lb.[8] Corn**	**lb. Prot.[9] Supp. [10]**	**Total Feed Cost/Cow**	**IOFC/ Cow/ Day**	**lb. Milk**	**#[12] Groups**	**Total Rev. $[11] /Cow/Day**	**# Cows**
High	11.2	10.06	$4.03	$10.60	89	1	$14.63	500
High-2	11.2	10.06	4.03	[redacted]	95	2	[redacted]	375
Low	9.0	6.0	3.07	10.84	70		14.63	125
Difference				$0.24				

2 Income over Feed Cost; 8 pound; 9 protein; 10 supplement; 11 dollars; 12 number

Table 4

IOFC [2] Results –February, 2010 Milk = $15.00 – all feed on dry matter basis (DM)

Ration	lb.[8] Corn	lb. Prot.[9] Supp. [10]	Total Feed Cost/Cow	IOFC/ Cow/ Day	lb. Milk	#[12] Groups	Total Rev. $[11] /Cow/Day	# Cows
High	11.2	10.06	$3.45	$ 9.90	89	1	$13.35	500
High-2	11.2	10.06	3.45	[redacted]	95	2	[redacted]	375
Low	9.0	6.0	2.73	$10.08	70		13.35	125
Difference				$ 0.18				

2 Income over Feed Cost; 8 pound; 9 protein; 10 supplement; 11 dollars; 12 number

Table 5

IOFSC [13] Results –February, 2009 Milk = $12.47 – all feed on dry matter basis (DM)

Ration lb. [8] Milk	lb Corn	lb. Prot. [9] Supp.[10]	Current [16] MP [14]	Opti -mal MP	Current IOFSC/ Day	Opti- mal [17] IOFSC/ Day	Optimized for : (+/- 20%)	% Expected DMI [15]
95	8.88	21.47	86.32	94	$ 8.01	$ 9.35	Energy	98
70	8.47	17.33	78.79	83.5	7.07	8.43	Energy, Protein, Milk	98
70	8.12	15.57	72.93	78.7	6.34	8.00	Energy, Protein, Milk	90

8 pound; 9 protein; 10 supplement; 13 Income over Feed Supplement Cost; 14 milk production; 15 dry matter intake; 16 not optimized ration; 17 optimized ration for protein

Table 6

IOFSC [13] Results –December, 2009 Milk = $16.44 – all feed on dry matter basis (DM)

Ration lb. [8] Milk	lb Corn	lb. Prot. [9] Supp.[10]	Current [16] MP [14]	Opti -mal MP	Current IOFSC/ Day	Opti- mal [17] IOFSC/ Day	Optimized for : (+/- 20%)	% Expected DMI [15]
95	8.88	21.47	86.32	94	$11.10	$13.02	Energy	98
70	8.47	17.33	78.79	83.5	9.86	11.68	Energy, Protein, Milk	98
70	8.12	15.57	72.93	78.7	8.90	11.06	Energy, Protein, Milk	90

8 pound; 9 protein; 10 supplement; 13 Income over Feed Supplement Cost; 14 milk production; 15 dry matter intake; 16 not optimized ration; 17 optimized ration for protein

Table 7

IOFSC [13] Results –February, 2010 Milk = $15.00 – all feed on dry matter basis (DM)

Ration lb. [8] Milk	**lb Corn**	**lb. Prot. [9] Supp.[10]**	**Current [16] MP [14]**	**Opti -mal MP**	**Current IOFSC/ Day**	**Opti- mal [17] IOFSC/ Day**	**Optimized for : (+/- 20%)**	**% Expected DMI [15]**
95	9.32	21.04	86.32	94.0	$10.61	11.87	Energy	98
70	8.47	17.33	78.79	83.5	9.48	10.66	Energy, Protein, Milk	98
70	8.12	15.57	72.93	78.7	8.60	10.11	Energy, Protein, Milk	90

8 pound; 9 protein; 10 supplement; 13 Income over Feed Supplement Cost; 14 milk production; 15 dry matter intake; 16 not optimized ration; 17 optimized ration for protein

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