Herd-Based Evaluations for Nutritional and Metabolic Disease in Dairy Herds

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Herd-Based Biological Testing Procedures

Metabolic and nutritional diseases typically increase as milk production increases and as dairy herds become larger. These factors favor the use of rigorous, quantitative monitoring of metabolic and nutritional diseases whenever possible. This paper will focus on strategies for testing and monitoring three critical diseases in dairy herds - subacute ruminal acidosis (SARA), ketosis, and parturient hypocalcemia (clinical plus subclinical milk fever). Enough quantitative data about these diseases is available to allow for the development of a herd-based testing scheme. Additionally, these three disorders are gateway conditions for other problems such as laminitis, displaced abomasum, impaired immune function, retained placenta, and cystic ovarian disease. Other metabolic diseases can be important problems in dairies (e.g., hypomagnesemia, udder edema, hypokalemia, etc), but these are less common disorders and there are limited published data available to permit the development of a testing scheme.[15]

Sources of Error in Herd-Based Testing. Biological tests can be very useful in supporting other clinical evidence of a metabolic disease problem on a dairy. Veterinarians have tremendous experience in collecting, analyzing, and interpreting the results of biological tests. However, biological test results do not stand alone in making herd-based decisions. Biological test results are subject to errors from inadequate sample size, improper sample handling, inappropriate time of sample collection relative to feeding, and laboratory error. Thus, biological test results should be supported by other herd data. For example, a finding of a high proportion of cows with low ruminal pH collected by rumenocentesis is corroborated by findings of low fiber diets being consumed by the cows, thin cows in the face of high energy diets, a high prevalence of laminitis-related lameness, and/or milk fat test depression. Without supporting evidence, however, the finding of low ruminal pH alone is very suspect and likely is in error (perhaps due to analytical problems in measuring pH of the ruminal fluid).

Interpreting Test Results for Groups vs. Individual Cows. The interpretation of herd-based tests for metabolic and nutritional diseases is very different than interpreting laboratory results for metabolites from individual cows. Test results from individual cows are interpreted by comparing the laboratory result to a normal range established by the laboratory. Normal ranges are often derived by calculating a 95% confidence interval (or a similar statistic) of test results from clinically normal animals. This

approach is useful for making decisions about individual sick cows, but is not useful for interpreting herd-based test results. Interpretation of herd-based test results requires an understanding of how the each test affects cow performance (regardless of whether they are within the normal range or not), a statistically-based approach to determining subsample sizes, and an emphasis on monitoring subclinical disease prevalence instead of clinical disease incidence.

Interpreting Herd Proportions vs. Herd Means. Herd test results for metabolic diseases can be interpreted as either the mean test result of the subgroup sampled, or as the proportion of animals above or below a certain cut-point within the subsample. If a test is associated with disease when it is either above or below a biological threshold (cut-point), then it should be evaluated as a proportional outcome. For example, ruminal pH ≤5.5 puts cows at risk for SARA, with subsequent rumenitis and other complications.[4] High ruminal pH values are not important per se in the herd evaluation, as any value over 5.5 is considered acceptable. Therefore, interpret the proportion of cows with ruminal pH below the cut-point and do not be concerned with the mean value of the group tested.

Ketosis in dairy herds can be monitored by testing for blood β-hydroxybutyric acid (BHBA). Ketosis is also a threshold disease, and cows are affected only when BHBA concentrations are elevated. Lowering BHBA below a threshold concentration is of little to no biological significance to the cow. Therefore, herd-based BHBA test results are interpreted on a proportional basis, and the mean concentration for the group of cows tested is of no concern. Blood BHBA concentration above 14.4 mg/dl (1400 μmol/L) is the most commonly used cut-point for ketosis. This cut-point is considerably higher than the upper end of the typical laboratory normal reference range for BHBA in individual cows.

Non-esterified fatty acid (NEFA) concentrations in blood can be used to monitor energy balance in pre-fresh cows. Elevated NEFA prior to calving indicate negative energy balance are suggest increased risk for DA, ketosis, and other problems after calving.[1] Low NEFA concentrations are not biologically important. The threshold for NEFA in pre-fresh cows (2 to 14 days before actual calving) is 0.400 mEq/L. In herd testing situations, we evaluate the proportion of cows tested above this cut-point and not the mean.

The incidence of parturient hypocalcemia (clinical plus subclinical milk fever) in a dairy herd is evaluated by measuring serum calcium concentration within 12 to 24 hours of calving. A cut-point of less than 8.0 mg/dl (2.0 mmol/l) total serum calcium has been used to define parturient hypocalcemia.[13] Blood calcium results from fresh cows are interpreted as the proportion of cows below the cut-point.

Tests for herd-based evaluations of metabolic and nutritional diseases also require well-defined alarm levels for the proportion of animals above (or below) the described cut-point. Because of normal biological variation, a few individual cows are expected to be above (or below) the biological threshold. Alarm levels are established from research results and/or clinical experience with these tests in herd settings. Table 1 lists suggested cut-points and alarm levels for ruminal pH, BHBA, and NEFA test results.

Cows chosen to be sampled must come from the appropriate "eligible" or "at risk" group within the herd. It is of no clinical value to test cows for a condition for which they have little risk. Table 1 also lists the eligible groups for herd-based tests.

Table 1. Cut-points, alarm levels, and defined at-risk groups for metabolic tests and their associated diseases.

Test	Cut-point	Alarm level proportion	At-risk group	Associated disease risk
BHBA	≥ 14.4 mg/dl	>10%	Lactating cows 5 to 50 days in milk	Ketosis, DA
NEFA	≥ 0.400 mEq/l	>10%	Pre-fresh dry cows 2 to 14 days before actual calving	Ketosis, DA, fatty liver
Ruminal pH	≤ 5.5	>25%	Lactating cows 5 to 50 days in milk in herds where concentrate fed separately, 50 to 150 days in milk in TMR fed herds	SARA
Blood calcium	≤ 8.0 mg/dl	>30%	Lactating multiparous cows, 12-24 h after calving	Clinical milk fever

Adapted from Cook NB, Oetzel GR, Nordlund KV: Modern techniques for monitoring the health and productivity of the high producing dairy cow. Part I: General principles of herd level diagnoses. *In Practice*, 28:510, 2006.

Urinary pH in pre-fresh cows fed anionic salts is a useful test for herds that are feeding supplemental anions before calving to help prevent milk fever. Urinary pH is a marker of whether or not the feeding program is achieving the desired acidification. The biological threshold for urinary pH is not one-sided. Rather, the optimal range for urinary pH is about 6.75 to 7.25. Urinary pH values that are either above or below this optimal range have adverse consequences. Therefore, urinary pH testing is evaluated by the mean of the group of cows tested, and the proportion of cows with high or low urinary pH is not calculated.

Appropriate Sample Sizes for Herd-Based Tests. Adequate sample sizes are essential in herd-based testing. We must have reasonable confidence that the results (either a proportion or a mean) truly represent the entire population of eligible cows within the herd. In herd settings, we do not need to sample as many cows as a researcher would sample in order to achieve a 95% confidence ($P < .05$) in the results. Rather, a 75% confidence interval is both acceptable and practical.

The suggested minimum sample size for herd-based tests with proportional outcomes is 12 cows. This minimum sample size gives reasonable confidence (75% or more) that the herd classification from the test results of 12 cows will correctly represent the true classification for the entire group. Figure 1 shows an interpretation guide for ruminal pH testing results based on a sample size of 12 cows, and Table 2 shows interpretation guidelines for all of the proportional tests. Herd-based tests interpreted as means have a lower minimum sample size. For example, as few as 8 cows can be sampled for urinary pH testing.

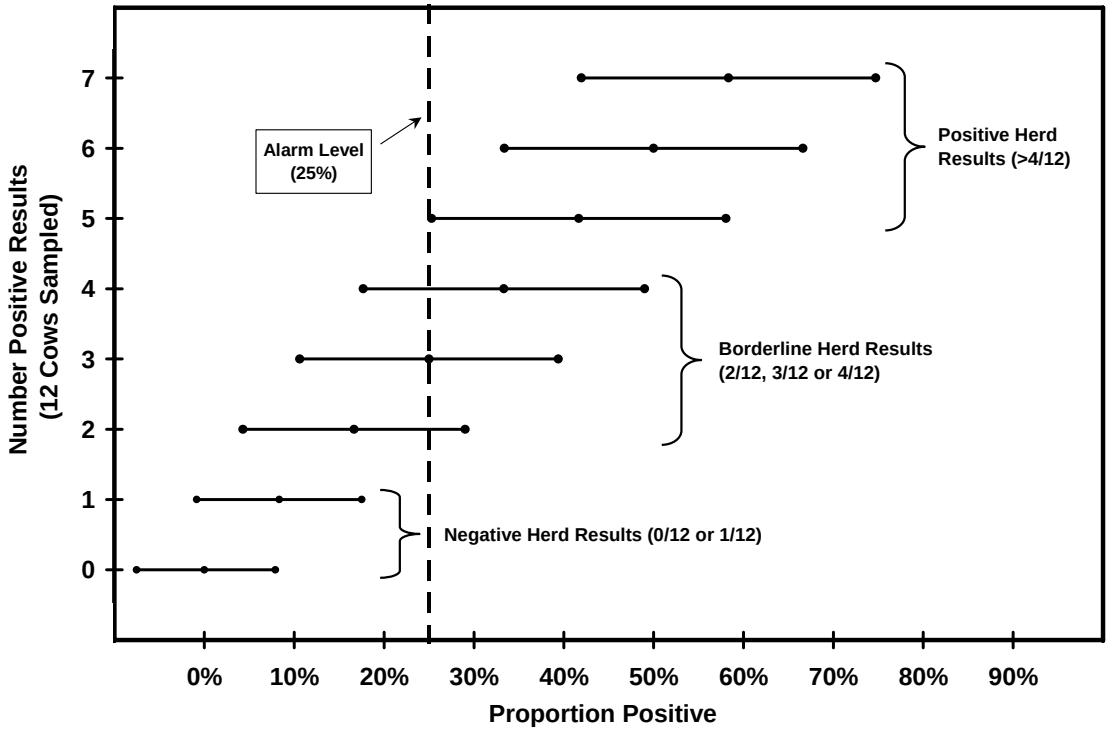

Figure 1. Interpretation of ruminal pH test results using 75% confidence intervals and an alarm level of 25% for test results from 12 cows sampled from within a group 100 cows. Adapted from Oetzel, 2004. Monitoring and testing dairy herds for metabolic disease. Vet. Clin. Food Anim. 20:651-674.

Table 2. Herd based test guidelines for interpretation using a 75% confidence level. Note that the interpretation of a negative, borderline and positive herd test varies with the alarm level used for each test.

Herd Test Diagnosis (75 % CI)	Test:			
	BHBA	NEFA	Rumen pH	Calcium
	(number of positive test results from 12 total cows tested)			
Positive	12	12	12	12
	11	11	11	11
	10	10	10	10
	9	9	9	9
	8	8	8	8
	7	7	7	7
	6	6	6	6
	5	5	5	5
	4	4	4	4
	3	3	3	3
Borderline	2	2	2	2
	1	1	1	1
Negative	0	0	0	0
Alarm Level:	>10%	>10%	>25%	>30%

BHBA = blood β-hydroxybutyric acid; NEFA = plasma non-esterified fatty acids.

Adapted from Cook NB, Oetzel GR, Nordlund KV: Modern techniques for monitoring the health and productivity of the high producing dairy cow. Part I: General principles of herd level diagnoses. *In Practice*, 28:510, 2006.

The risk for low ruminal pH appears to follow the cow's natural dry matter intake curve and peak somewhere between 100 and 150 days in milk in TMR-fed herds (Figure 2). Do not focus ruminal pH testing on early lactation cows in TMR-fed herds.

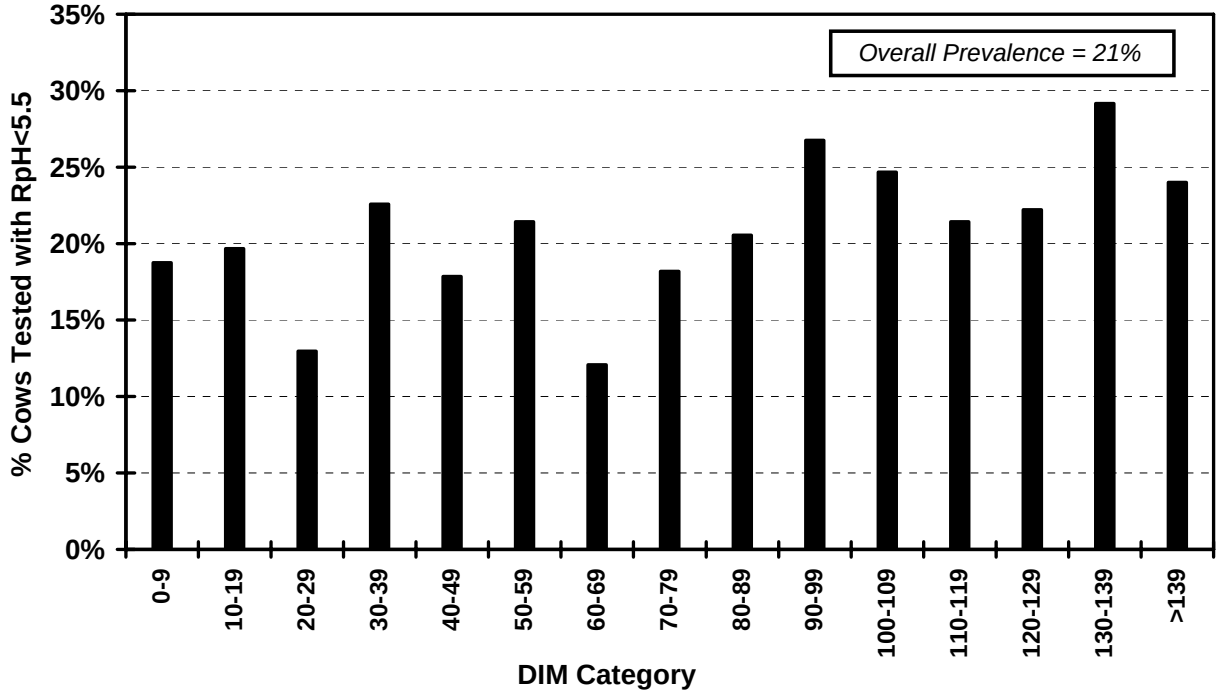

Figure 2. Risk for low ruminal pH (<5.5) by days in milk categories for 766 cows in 61 herds.

More cows than the minimum sample sizes can always be sampled, but value of sampling more cows has to be compared to the time and money required to sample the cows. Sampling additional cows is suggested when the results of a proportional outcome are very close to the alarm level, or when herd test results are not supported by clinical signs observed in the herd.

It is a common misconception that minimum sample sizes are larger for larger herds and smaller for smaller herds. This is incorrect – herd size actually has an inconsequential influence on the necessary minimum sample size.

In smaller herds, it may be possible to test the entire eligible group and still not meet the minimum sample size. This can be particularly true for pre-fresh cow testing (urinary pH and NEFA). For example, there might only be four cows in the pre-fresh group eligible for testing. All four should be tested; however, the sample size is probably too small to yield conclusive results. Additional cows can be tested later, as they enter into eligible group. Group results can interpreted after test results from about eight (for urinary pH) or twelve (for NEFA) test results have been accumulated. If cows are repeatedly tested for NEFA as they approach calving, only the last test result before actual calving for that cow should be interpreted. Multiple test results from the same cow should not be used to achieve minimum sample size goals.

Herd Monitoring for Subacute Ruminal Acidosis

Subacute ruminal acidosis (SARA) is diagnosed and prevented on a herd basis; there is no practical way to diagnose or treat in on an individual cow basis.[14] Clinical signs in dairy herds affected with SARA may include low or fluctuating dry matter intakes, low body condition scores, diarrhea, nosebleeds, unexplained deaths due to chronic inflammatory diseases, unexplained high cull rates due to vague health problems, milk fat depression, and decreased milk production in the second and greater lactation cows relative to the first lactation cows. None of these signs by themselves are diagnostic for SARA; however, considered together they form the basis for a presumptive herd diagnosis of SARA. It can be extremely useful to support a presumptive diagnosis of SARA in a herd with quantitative ruminal pH data.

Ruminal pH below about 5.5 for prolonged time periods is the apparent cause of the clinical signs observed in herds with SARA problems.[4] Evaluation of ruminal pH is challenging because it is difficult to obtain a sample for testing, and because ruminal pH varies from day to day within herds and time of day within cow. The methodology for collecting ruminal pH samples has been described in detail.[10,11]

A potential source of error in ruminal pH measurements is the calibration of the pH meter. A high-quality pH meter is recommended – pH paper is not sufficiently accurate and is influenced by the green color of the ruminal fluid. Field pH meters do not work well when operated at cold temperatures. It is best to conduct the pH determinations in a warm milking parlor or office during cold weather. The ruminal fluid samples can be capped in their syringe (with the air excluded) prior to determining their pH. Also, pH electrodes may become dry between uses and lose accuracy; soaking the electrode in a buffer solution prior to calibration can prevent this. It is good practice to calibrate the meter twice (or more) before pH testing. After the last calibration, put the pH 7 and pH 4 buffers back on the meter to verify the correct calibrations.

The testing scheme for SARA works very well for herds with high (>30%) or low (<15%) prevalences of cows with low ruminal pH. It is not intended as a means of 'fine-tuning' diets for optimal ruminal pH - this would require much larger sample sizes and quite frequent testing. Herds with intermediate (16.7 to 33.3%) prevalences of low ruminal pH may require additional testing. Immediate dietary intervention is probably not critical in herds with intermediate prevalences, so it is not unreasonable to take some additional time to test more cows.

Ruminal pH sampling should be done around the time of the expected lowest point (nadir) in daily ruminal pH. In component-fed herds, the nadir in ruminal pH occurs about 2 to 4 hours after a grain feeding and is probably the lowest after the last grain feeding of the day. In TMR-fed herds, the nadir in ruminal pH occurs about 6 to 10 hours after the first TMR feeding of the morning. Ruminal pH nadir occurs later in the day when dry matter intake is higher.

Figure 3 shows a distribution of herds I have categorized for SARA based on ruminal pH testing. With borderline herds, you either need to test more cows or use other herd information in order to make a diagnosis.

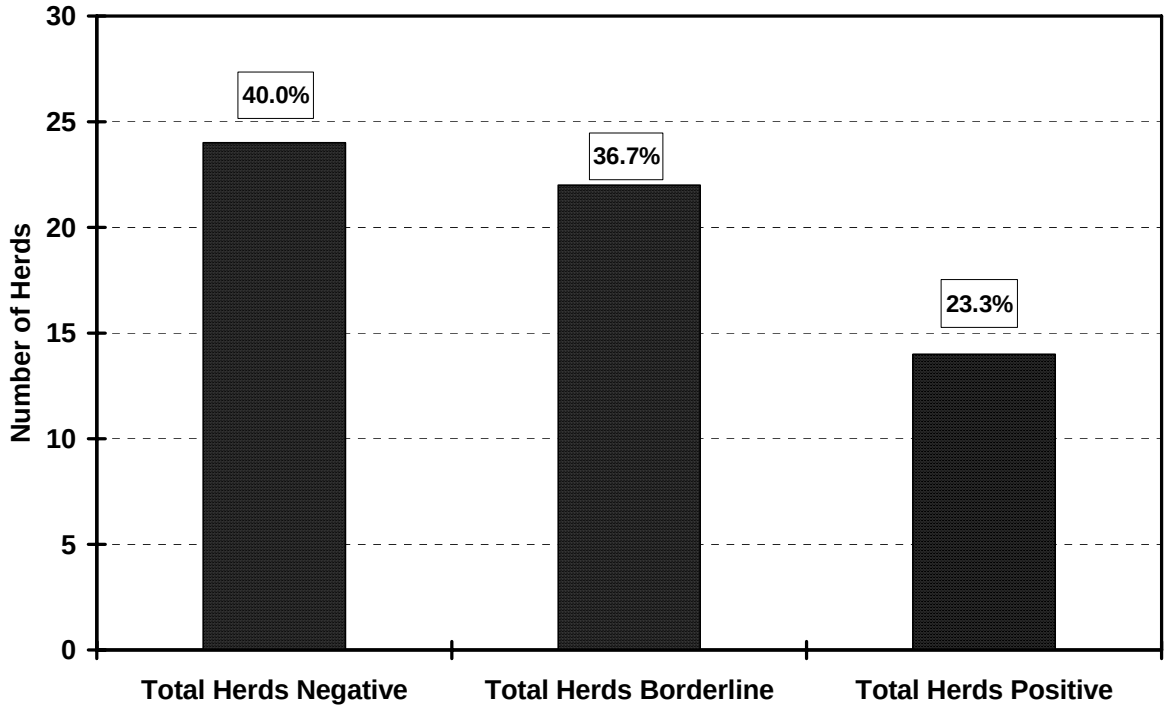

Figure 3. Distribution of SARA classification for 60 herds.

Herd Monitoring for Ketosis

It is difficult to assess the degree of ketosis problems that a herd may be experiencing without doing herd testing. Clinical ketosis rates (as determined by dairy producers) have very limited value in assessing the true ketosis status of a herd. Producers have dramatically different definitions for clinical ketosis, and also have dramatically different abilities to detect ketotic cows. Producers in smaller herds tend to overestimate the incidence of clinical ketosis, and producers in larger herds tend to underestimate the incidence of clinical ketosis.

Herds with ketosis problems in early lactation cows will typically have increased incidence of displaced abomasum and increased herd removals in the first 60 days in milk. High ketosis herds may also have a higher proportion (>40%) of cows with milk fat to true protein percentages above 1.4 at first test after calving.[2] These clinical findings by themselves are not sufficient evidence to make a definitive diagnosis of a ketosis problem in a herd. Herd-based testing is required before a definitive diagnosis can be made.

The "gold standard" test for ketosis is blood BHBA ≥14.4 mg/dl (1400 μmol/l). Clinical ketosis generally involves much higher levels of BHBA (25 mg/dl or more). The alarm level for the proportion of cows above the cut-point of 14.4 mg/dl has not been well defined. Published research studies show an average ketosis prevalence of about 15%, and I suggest using 10% as the alarm level for herd-based ketosis testing. Figure 4 shows an example interpretation guide for BHBA testing based on this alarm

level. Figure 5 shows the distribution of herd test results for ketosis. As for SARA testing, we should expect to have many borderline results.

As for SARA testing, the ketosis testing strategy described here is designed to identify herds with either very high or very low prevalence of ketosis. It is not intended to 'fine tune' or optimize a transition cow feeding and management program for ketosis prevention.

The BHBA test is performed on serum samples, and there are no special sample handling requirements. Blood samples for BHBA testing should not be collected from the mammary vein. Mammary vein blood is lower in BHBA because the udder extracts BHBA during milk synthesis.[8]

Blood BHBA concentrations do exhibit post-feeding patterns and typically increase after feeding.[9,3] Sampling times should be consistent and preferably about 4 to 5 hours after the first feeding of the days in order to capture peak BHBA concentrations.[3] The post-feeding peak in serum BHBA concentrations is caused by ruminal production of butyric acid. Surpluses of ruminal butyric acid (either from ruminal production or from silage) are mostly converted to BHBA in the wall of the rumen.

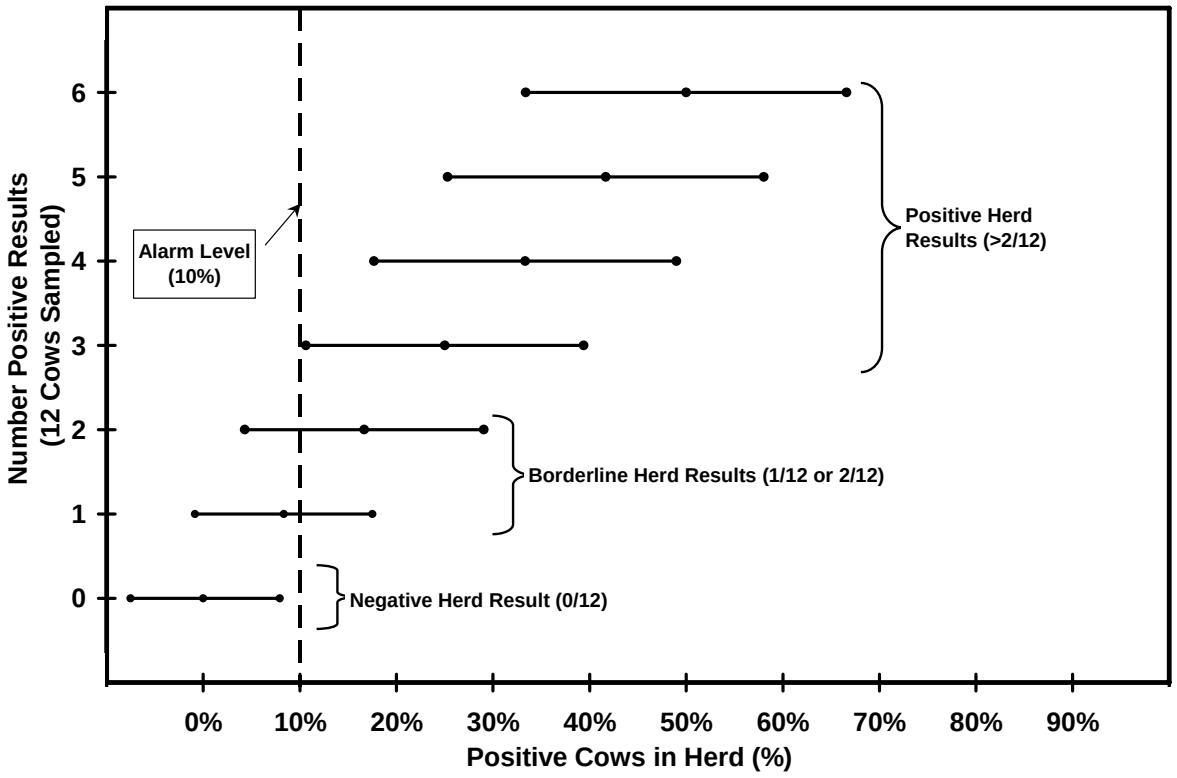

Figure 4. Interpretation of blood β-hydroxybutyric acid test results using 75% confidence intervals and an alarm level of 10% for test results from 12 cows sampled from within a group 50 cows. Adapted from Oetzel, GR: Monitoring and testing dairy herds for metabolic disease. Vet. Clin. Food Anim. 20:651-674, 2004.

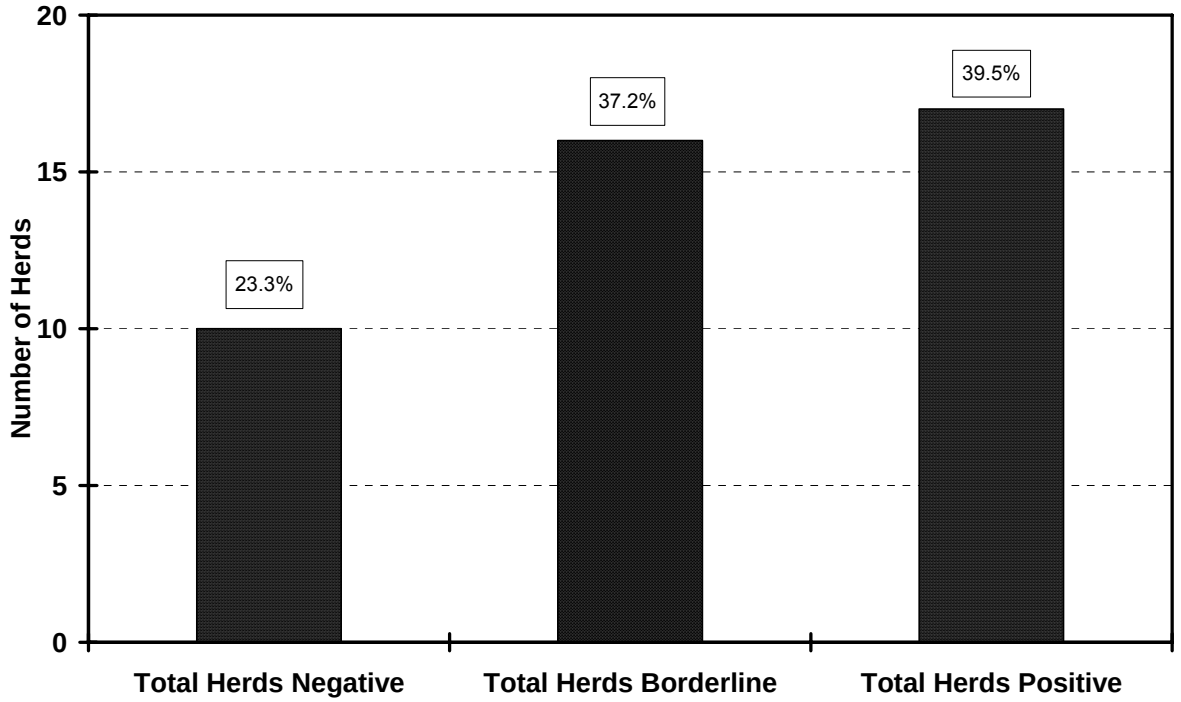

Figure 5. Distribution of 43 herds classified for ketosis.

A variety of cowside tests are available for ketosis testing of individual cows. However, no cowside test has perfect sensitivity and specificity compared to blood BHBA. It is best to use the gold standard ketosis test (blood BHBA) for herd-level diagnosis and monitoring. Cowside ketosis tests have lower costs, require less labor, and provide immediate results. This makes them useful for diagnosing clinical ketosis in individual, sick cows.

The blood NEFA test is used to evaluate energy balance prior to calving.[6] Dry cows should be in positive energy balance up until the last 24 to 48 hours prior to calving. Negative energy balance is expected in milking cows, so blood NEFA concentrations are high after calving and can be difficult to evaluate. The ketosis test of choice for post-fresh cows is blood BHBA.[1]

The NEFA test is best positioned as a secondary test in herds already known to have a high incidence of ketosis. The NEFA testing helps determine whether the post-partum ketosis is caused by negative energy balance prior to calving.

The most commonly used cut-point for NEFA is ≥0.400 mEq/L in pre-fresh cows between 2 and 14 days from actual calving. NEFA concentrations normally rise in the 48 hours prior to calving, so results from cows that calve this soon after the sample was collected are difficult to interpret. They are usually discarded or interpreted with caution (values below .400 mEq/l are definitely negative, but higher values are not necessarily proof of a problem).

The alarm level for the proportion of cows with elevated NEFA concentrations within a group is not clearly known. I suggest using 10% as a reasonable alarm level. Because this is the same alarm level as for blood BHBA in post-fresh cows (10%), the interpretation of NEFA results is the same as previously outlined for blood BHBA (Figure 2).

The window of eligibility for NEFA testing is very small – only about 12 days, and you cannot know whether a cow will fit in the window until after she calves. In small dairy herds it may be difficult to sample enough pre-fresh cows to meet the minimum sample size required. Samples can be collected, frozen, and later submitted as a group for NEFA analysis when actual calving dates are known and about twelve samples have been accumulated.

In large dairy herds, only a portion of the pre-fresh group needed may be sub-sampled for NEFA testing. In large pre-fresh groups, select cows that appear to be the closest to calving (based on due dates and visual observation), but avoid those cows in which calving appears to be imminent. In my experience, only about 75% of cows identified for NEFA testing using these criteria will actually calve 2 to 14 days later. Thus, expect to have to sample at least 16 cows in order to have 12 or more valid samples once actual calving dates are known.

Some pre-fresh cows may be in a maternity pen instead of the main pre-fresh pen(s). Do not avoid sampling cows in the maternity pen, as long as they do not appear to be imminently close to calving. Many of the cows in a maternity pen will not calve for several more days, and they are at very high risk for elevated NEFA concentrations because of the move to a new pen.

Concentrations of NEFA reach their nadir about 4 to 5 hours after the first feeding of the day[3] and peak just prior to the next major feeding. It is best to sample just prior to feeding in order to capture the peak NEFA value. It is acceptable to sample cows immediately after they have been locked up to new feed.

It is important to keep the plasma samples for NEFA testing cool or frozen from the time they are collected from the cow until the time they are received at the laboratory for analysis. At room temperatures some of the triglycerides normally present in blood may degrade to NEFA and falsely (but slightly) elevate the test results.

Herd Monitoring for Parturient Hypocalcemia

Both clinical milk fever and parturient hypocalcemia can be monitored in dairy herds. Limited data are available to assist in determining an alarm level for parturient hypocalcemia. Two studies with multiparous Holstein cows[16,7] record the incidence of both clinical milk fever and parturient hypocalcemia. In both studies, cows were fed control diets with and without anionic salts added. Feeding anionic salts reduced the incidence of clinical milk fever from 18.5% to 7.7% and the incidence of parturient hypocalcemia from 50.0% to 28.2%. I suggest alarm levels of ≥30% for parturient hypocalcemia and ≥8% for clinical milk fever in multiparous Holstein cows. Primiparous cows are at

very low risk for low blood calcium around calving and probably should not be included in the monitoring program.

Using an alarm level of 30% for parturient hypocalcemia in multiparous cows and a minimum sample size of 12 cows, the interpretation scheme would be 0, 1 or 2/12 is negative; 3, 4, or 5/12 is borderline, and 6/12 or more is positive. Herds that do not feed acidogenic diets are unlikely to be classified as negative for parturient hypocalcemia.

The best time to collect blood samples for monitoring hypocalcemia is about 12 to 24 hours after calving. In most situations the blood samples must be collected by on-farm personnel rather than by a veterinarian or technician. The farm then needs a means of separating the serum (or plasma) and storing it. Samples should be promptly picked up from the farm, processed, and submitted to an analytical laboratory for calcium analysis.

Urinary pH for Monitoring Anion Dose

Dietary acidification by feeding supplemental anions is a means of reducing both clinical and subclinical hypocalcemia.[12] Urinary pH is a good monitor of systemic acidification and should be about 7.0. Urinary pH is interpreted as a mean value, and the suggested minimum sample size is 8 cows. Testing should be done weekly, or even more frequently if urinary pH results are unstable or if monitoring for parturient hypocalcemia reveals a problem.

Urinary pH can be determined satisfactorily with pH paper – a calibrated pH meter is not required. On-farm personnel can conduct urinary pH testing (it is not technically difficult), but they actually tend to be very poor at doing this because they are often busy with other, more urgent tasks. Having a veterinary technician check urinary pH values once a week helps assure that the task actually gets done.

The effect of time post-feeding on urinary pH is small when cows have access to feed throughout the day.[5] If feed access is not good throughout the day for pre-fresh cows, then the problem of inadequate feed availability is much more important than monitoring urinary pH.

Urea Nitrogen Testing to Evaluate Protein and Energy Nutrition

Blood UN (BUN) or milk UN (MUN) are indirect measures of protein and energy nutrition in lactating cows. High UN's may be caused by either high dietary crude protein (especially soluble protein) and/or low dietary NFC. High UN's are a risk factor for infertility and body condition score loss due to the energy cost of detoxifying excessive ruminal ammonia into urea by the liver.

The effect of time relative to feeding on UN concentrations is great, particularly if the protein is fed as a separate component of the diet two or three times a day (see Figure 6). Lack of control of the time of UN sampling relative to feeding has greatly hindered the effectiveness of this test in the past. Sampling at

about 3 hours after a major protein feeding should assist in determining peak daily UN concentrations. Consistent time of sampling relative to feeding is necessary when monitoring a herd over time.

Milk UN concentrations are closely related to BUN concentrations (Figure 6). Therefore, either BUN or MUN samples are acceptable for evaluating herd UN. Bulk tank MUN is particularly attractive because it provides a mean value for a large group of lactating cows with a single test, without concerns of getting an adequate sample size. Wet chemistry procedures for MUN are preferred over NIRS tests (e.g., MUN testing provided through DHI) because of they are more accurate. Because bulk tank MUN testing is inexpensive and accurate (as long as a wet chemistry analysis is used), and because UN is evaluated on a basis of the group mean, bulk tank MUN screening it is a reasonable procedure to conduct on a routine basis. Individual cows (or milking strings) could then be evaluated for UN if the bulk tank MUN value falls outside the normal range for a group of animals.

In general, I have found UN testing to be the least useful of all of the herd-based tests described in this paper. Whenever I have found a UN problem in a herd, I already knew what the ration problem was that caused it. Other tests have been more useful in that they described problems that were more subtle or difficult to diagnose based on the ration evaluation.

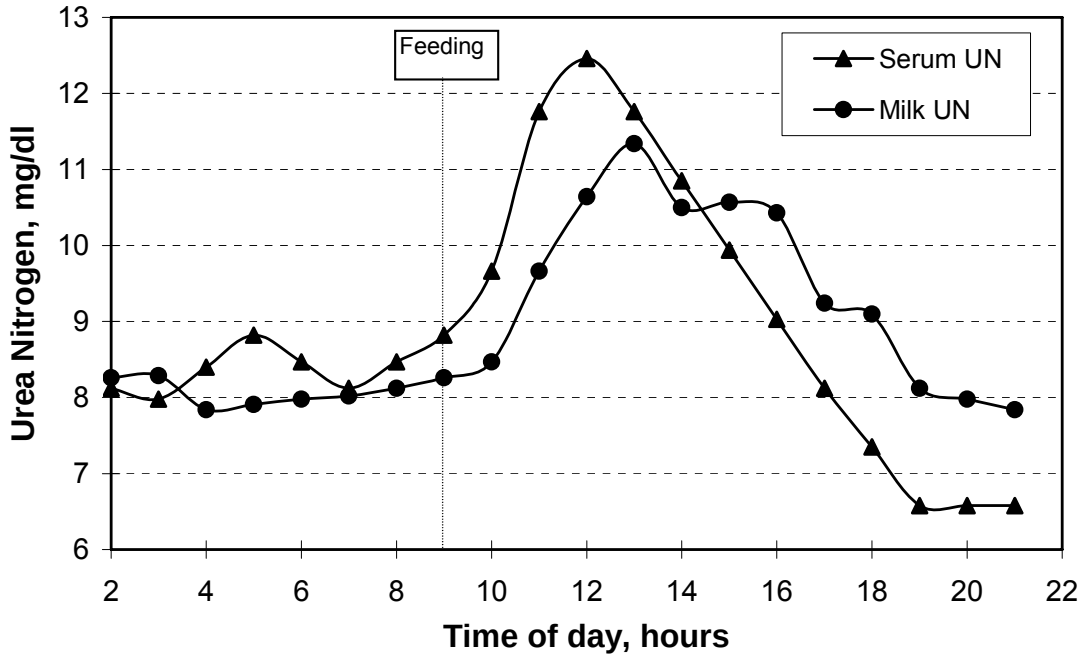

Figure 6. BUN and MUN variations after feeding. Adapted from Gustafsson, A. H., and D. L. Palmquist. Diurnal variation of rumen ammonia, serum urea, and milk urea in dairy cows at high and low yields. J. Dairy Sci. 76:475-484, 1993.

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Appendix 1 - Using Dairy Comp 305 Records for Herd-Level Health Evaluation

I. On-Farm Review of Dairy Comp Records

A. Display and Print Events Table by Month

Command: EVENTS FOR LACT>0 \5

LACT>0 excludes calves and replacement heifers from the table

\5 selects the "Events Table by Month" option automatically

Note: EVENTS commands automatically include both live and dead cows

Note: dead cows in Dairy Comp 305 means any cow no longer in the herd (i.e., includes both SOLD and DIED cows)

Note: this table automatically includes events for the last year only

Evaluation: look at the events table to see the EVENTS that are defined for this herd (note that events are not necessarily disease diagnoses)

Evaluation: check the number of fresh cows, both for the entire year and by month (note that the months are always arranged from Jan through Dec – not chronologically; the column for the current month includes data from both this and the previous year)

Evaluation: check the number of SOLD cows by month (there should be some cows SOLD for each month – if not, then an archive file is probably missing or is not being read by Dairy Comp)

B. Calculate Baseline Herd Health Data from the Events Table

Calculate Average Herd Size for the Last Year

(needed for the denominator of subsequent calculations)

Note: average herd size (milking plus dry cows) for the last year is not usually calculated by Dairy Comp 305, and is not presented in the events table. There are four options for getting an estimate of average herd size for the last year:

1. If the herd is on DHI, the herd summary sheet will display the rolling average herd size (see the "No. Cows" column to the left of the rolling herd average; use the value for the most recent month).

2. Check the herd monitor (type MONITOR from the command line) and see if total herd size (milking plus dry cows) is included in the monitor. You can look at the configuration of the monitor to see how this number was determined. The herd size you are looking for is calculated by the Dairy Comp command COUNT LACT>0. If this calculation has been done, you can compute the average herd size from the monthly data presented in the monitor.

3. If the herd is not on DHI and historical herd size information is not available in the Dairy Comp 305 monitor routine, you can determine the current herd size (milking plus dry cows) using the Dairy Comp command COUNT LACT>0. If herd size has been stable over the last year, then the current herd size is a reasonable estimate of average herd size for the last year.

4. Another option for estimating average herd size over the last year is to multiply the number of cows fresh in the last year (from the Dairy Comp 305 events table) by .93. If herd size has been stable and the turnover rate is not very high or low, this estimate works fairly well. It

could be useful to compare or average the results from this calculation and the current herd size when these are the only methods available for estimating average herd size for the last year.

Calculate Turnover Rate: (Cows SOLD + Cows DIED) / Average Herd Size

Goal is <30% annual turnover rate, with adjustments for herds that are expanding or for herds that sell some fresh cows to be dairy cows in other herd.

Calculate Turnover Rate for the First 30 Days in Milk:

Enter the command EVENTS FOR LACT>0 DIM<31 \2SI

LACT>0 excludes calves and replacement heifers from the table

\2 selects the "List Cows and Events" option automatically

\S allows you to select the date range for events to be included on the list
(you will be prompted to select the date range – the last year is the default)

\I inquires as to which event(s) you will select for the list
(you will select SOLD and DIED when prompted)

This command will generate a list of all the cows removed from the herd (SOLD or DIED) before 30 days in milk. Calculate the removal rate between 0 and 30 days in milk by dividing the total number of cows on the list by the average herd size.

The goal for herd removals in the first 30 days in milk is <4%. Higher removal rates suggest problems with fresh cow health. An exception would be herds that sell recently fresh cows for dairy purposes; they would have a high herd removal rate in the first 30 days in milk that is not indicative of a fresh cow health problem.

Calculate Turnover Rate for 31 to 60 Days in Milk:

Enter the command EVENTS FOR LACT>0 DIM>30 DIM<61 \2SI

This command will generate a list of all the cows removed from the herd (SOLD or DIED) between 31 and 60 days in milk. Calculate the removal rate between 31 and 60 days in milk by dividing the total number of cows on the list by the average herd size.

The goal for herd removals between 31 and 60 days in milk is <2%. Higher removal rates suggest problems with fresh cow health, as described above.

Calculate Turnover Rate for the first 60 Days in Milk:

Sum the number of cows SOLD and DIED between 0 and 60 days in milk (as done in the two steps above) and divide by the average herd size,

The goal for herd removals between 0 and 60 days in milk is <6%. Higher removal rates suggest problems with fresh cow health, as described above.

Determine the Number of Cows Fresh in the Last Year:

(needed for the denominator of subsequent calculations)

The best way to get the number of cows fresh in the last year is from the Dairy Comp 305 events table (as described above). If you have only DHI records and know the average herd size in the last year but not the number of fresh cows in the last year, You can estimate the number of fresh cows by dividing the average herd size by .93. If herd size has been stable and the turnover rate is not very high or low, this estimate works fairly well.

Calculate Death Loss Rate: Cows DIED / Cows FRESH in Last Year

Goal is <4% annual death loss rate. Unfortunately, average death loss in medium to large dairies is now about 8%. If death loss is a problem in a herd, an optional exercise is to evaluate death loss by days in milk (see later for details).

C. List All of the SOLD and DIED Cows for the Last Year

Command: EVENTS ID LACT ME305 FOR LACT>0 \2SI

ID, LACT AND ME305 adds useful items to the list for later analyses
(be careful – some herd setups do not use ME305 as an item)

Once the list is displayed, you can print it (unless the herd is very large and the list is very long). The list will include the DIM when the event occurred, and the reason(s) that the producer entered for why the cow was sold or died. The REM (remark) column is limited to eight characters, so these are often cryptic and inconsistent from cow to cow. Remarks cannot usually be interpreted unless the dairy producer first explains them to you.

Back in the office, you can export the sold and died list out of Dairy Comp 305 and import it into Excel for more detailed analysis and better graphical display. To export the list, hit the "diskette" icon on the Dairy Comp 305 taskbar and save the file as a text file in the desired subdirectory. You can then import the text file into Excel. Once in Excel, you can sort, analyze, and chart the list as needed.

D. Optional - Plot the SOLD and DIED Cows for the Last Year by Days in Milk
(only necessary if the herd is not on AgSource DHI, doesn't have WiscGraph, and/or you don't want to export and plot the data in Excel)

Command: PLOT EC \W60D

EC (event code) allows you to select which events you want to plot. When prompted, select SOLD and DIED. You can specify the starting and ending dates here (the default is the last year). You should then specify graphing by "days in milk." The number of sold and died cows will then be plotted as separate bars for each 60-day time period.

\W60D sets the time interval for each plotted bar (60 days in this case).

Note: This plot is similar to a WiscGraph plot, except that the WiscGraph plot includes sold and died cows together for each 30-day interval. You can replicate the WiscGraph plot in Excel after by exporting the Dairy Comp data to Excel (as described above) and then manipulating the data using various Excel functions.

E. Determine the Number of Cases of DA in the Last Year and Calculate DA Rate

Command: EVENTS ID LACT ME305 FOR LACT>0 \2SI

\I inquires as to which event(s) you will select for the list
(you will select DA, or perhaps LDA and RDA, when prompted)

Cows with repeat DA events should be considered as only one DA case. So, look at the list and record only the number of cows with DA, not the number of DA events.

DA's may be subdivided into LDA and RDA for some herds; in this case, add them up to get the total number of DA's.

Many herds do not enter DA as an event for cows that are diagnosed with a DA but are sold (or die) instead of receiving treatment or surgery. Producers often (incorrectly) enter only SOLD or

DIED as the event, then enter "DA" somewhere in the REM column. So, check the REM column to find these additional cases of DA. Add these to your total number of DA events.

Back in the office, you can export the DA list out of Dairy Comp 305 and import it into Excel for more detailed analysis and better graphical display. To export the list, hit the "diskette" icon on the Dairy Comp 305 taskbar and save the file as a text file in the desired subdirectory. You can then import the text file into Excel. Once in Excel, you can sort, analyze, and chart the list as needed. It is particularly useful to calculate the median days in milk at DA event (expected range of 10 to 12 days in milk).

Calculate Displaced Abomasum Rate: Cows DA / Cows FRESH in Last Year

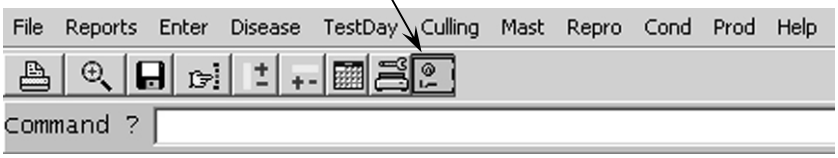
Goal is <4% annual DA rate

Note: Displaced abomasum is the easiest disease to diagnose and monitor on a herd-level basis. We usually do not specifically evaluate the rates of other diseases, because either the disease diagnostic criteria are inconsistent and/or the disease is not usually recorded. If a herd does correctly diagnose and record other disease events, then feel free to evaluate these diseases using the same pattern as described above for DA events.

II. Downloading Dairy Comp Files to Bring Back to Office

A. Do not use the "Daily Backup: option from the Dairy Comp menu for this purpose! The necessary herd archive files will probably not be included in this backup (due to file size / floppy disk size limitations), unless the herd is small. Without all of the necessary archive files, you will have missing data from any cows sold or died since the last herd cleanup.

B. Click on the backup ("safe") icon on the Dairy Comp main menu (see picture below)



Then follow the Dairy Comp prompts. It usually works best to have the backup files copied to a USB drive. Select the "consultant backup" from the menu options. This will create a zip file of all the needed files, archives, etc. You will have to unzip it to your computer.

C. If the backup menu option does not work, you can hand copy all "dat" (data) and "arc" (archive) files to your computer media. This can be difficult at times, and you need to bring a variety of media with you to the farm. Follow this protocol:

Exit Dairy Comp 305

Go to "My Computer" (or the Command Prompt) and find the subdirectory containing the Dairy Comp program and data files (usually C:\DC305).

Find all of the herd data files (cowfile*.dat) and herd archive files (cowfile*.arc), where * is a number between 1 and 9. If the computer is set up so that filename extensions are not displayed, you can view the 'file type' column to determine the filename extension ('dat' files are displayed as 'DAT' file type, and 'arc' files are usually displayed as 'WinZip' file type, even though they are not zipped files).

Copy all of these files to your disk media. If you copy the files into a subdirectory on your disk media, give the subdirectory a name that is less than eight characters long. Dairy Comp 305 cannot read files that are contained in a subdirectory name with more than eight characters.

The media you use depends on the type of computer, disk drives available, USB ports available, etc. Follow this flowchart for choosing which media to use:

1. If a USB port is present and open, insert a USB external disk drive and then copy the cowfile*.dat and cowfile*.arc files directly to the USB drive. This is the fastest and best option, and usually works on later model computers. If the on-farm computer uses Windows 98 or Windows 95, you may need to first install the driver for the USB drive on the computer. So, it is a good idea to bring along a floppy disk that contains the necessary driver for the USB drive you are using. This file should have been provided by the manufacturer of the USB drive. Alternatively, you may be able to download the necessary driver from the web site of the USB drive's manufacturer. Windows 2000 and higher systems usually recognize USB drives and automatically install the necessary drivers for them.
2. If #1 doesn't work, then check for a zip drive (internal or external) on the computer. If a zip drive is available, then copy the cowfile*.dat and cowfile*.arc files directly to the zip drive.
3. If neither #1 nor #2 work, then check for a CD writer drive on the computer. If one is present, then use the computer's software (varies by machine!) to burn the cowfile*.dat and cowfile*.arc files directly to a blank CDR.
4. If none of the above work, then your last option is to use the floppy disk drive. This is often the case for older on-farm computers. Unfortunately, most dat and arc files are >1.44 MB in size and must be compressed before they will fit on a floppy drive.

   Some newer computers may already contain the Windows-based WINZIP program, which can be used to compress the files to floppy disks. But older computers do not have this program. On these machines, you must use the DOS-based "PKZIP.EXE" utility program to compress the files and copy them to the floppy disk drive. This program is usually included with the Dairy Comp 305 software files and resides wherever the Dairy Comp 305 program files are located (typically C:\DC305). Go to the command prompt (or DOS mode) and find the subdirectory containing this file. Then zip the needed files to your floppy disk(s). The syntax for using PKZIP.EXE is:

   PKZIP destination file name source file name

   Example commands to zip the needed data and archive files could be:

   PKZIP A:\herd-name-1.zip C:\DC305\COWFILE*.DAT
   (this puts all of the data files into one zipped file) and

   PKZIP A:\herd-name-2.zip C:\DC305\COWFILE*.ARC
   (this puts all of the archive files into one zipped file)

   If the data and archive files are very large, you may need to zip each one individually to a single floppy disk for each cowfile. For example:

   PKZIP A:\herd-name-1.zip C:\DC305\COWFILE1.DAT
   (this puts cowfile1.dat into a single zipped file, which should be <1.44 MB in size)

   Sometimes it takes four or more floppy disks to get one herd's files downloaded, so take plenty of floppies along in case you need them.

C. If you copied the herd files to a USB drive, zip drive, or a CD, you can logon to the file copies you just made to verify that you indeed have all of the correct files. If you copied the herd files to floppies as zip files, then you cannot do this extra check.

Follow this protocol for checking the files you copied onto a USB drive, zip drive, or CD:

1. Leave your USB drive, zip drive or CD in the on-farm computer.
2. Invoke Dairy Comp 305 on the computer. There is usually an icon on the desktop for this purpose. Otherwise, you should be able to find Dairy Comp 305 via the "Start" and "Programs" menu options on the computer's desktop.
3. Dairy Comp 305 will likely open with the current, on-farm cowfile (from the computer's hard disk drive). You now need to manually ask the program to logon to the cowfile you just copied onto your computer media.

   Command : LOGON - a pop-up window should appear next

   click on the BROWSE button that should appear on the right side of the window

   navigate through the dialog box to find the herd files you just copied
   (for example, the path to a USB drive file might be E:\Herdx\)

   click to highlight the file named cowfile1.dat, then click 'open'

   the cowfile should open and the date dialog box should appear

   the date displayed should be today's date; press OK. This is one check that you have copied the right file

   Command: EVENTS FOR LACT>0 \5 – this should generate the exact same table that you created earlier from the on-farm version of the cowfile.

   Command: EXIT - then click on 'Exit Immediately' to leave Dairy Comp 305; do not make a daily backup (as mentioned above, this backup is usually incomplete)

   remove you media from the on-farm computer and bring it back to the office.