



Using DHI records to make culling decisions: Lactation Ratings, ERPA's, and Predicted Producing Abilities

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Culling decisions affect the profitability of the dairy herd. Feed resources and management skills used to maintain unproductive cows would generate more income if applied to productive cows. DHI records contain important information to help guide culling decisions. This guideline describes three systems for rating cows for production traits. Producers recognize that information about production must be combined with reproductive and health status, age, and other factors to make profitable culling decisions. Suggestions for combining information to make good culling decisions are offered.



Standardized milk records

Perhaps the most frequently used measure of production in DHI records is the "305d-2X-ME" record. These records are available for milk, fat, and protein and can be found on the Monthly Report DHI-210 and elsewhere in DHI reports. The adjustments standardize the length of a record to 305 days and frequency of milking to a twice per day standard. Age-season adjustments remove the major effects of differences between cows in age at freshening and season of the year when the lactation began. We suggest use of standardized instead of actual yields for culling decisions because the purpose is to evaluate performance of all cows in the herd. Comparisons based on actual yields would favor older cows freshening in the fall when feed supplies were consistent and generally plentiful. Cows must have 50 days in milk and at least two test days before DRMS Raleigh calculates 305d-2X-ME records.

Test day milk yield is an even more basic measure of production than a standardized lactation record. This estimate of yield is collected once a month (or less frequently) and is often a prediction of 24-hour milk yield based on a milk weight from a single milking. It is the basic unit of information from which total lactation yield is estimated, but it is subject to random change from day to day. Automated milk recording systems in modern milk parlors record rolling averages of milk yield for every milking during the previous week or some recent time period. These rolling averages eliminate much of the normal daily variation and are more useful for many purposes than a test day milk weight.

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For herds with access to such information, average daily milk yield can be very useful in identifying the least productive cows. Daily yield reflects very recent performance. However, it is not adjusted for stage of lactation or age of the cow. These factors must be considered if the least profitable cows in a herd are to be accurately identified.

DRPC Lactation Ratings

The DHI computing center at Raleigh, NC (DRMS Raleigh) processes DHI records for most herds in the eastern half of the country. The Lactation Ratings are found on the Monthly Report DHI-210 in the same location as 305-day, 2X, ME yield. The ratings range from A to E, and are based on 3.5% fat corrected milk (FCM) production. Dairy Guideline 358 explains how to adjust production records for fat content. The idea is that milk produced by cows, while variable in fat content, contains a certain amount of energy. The adjustment process converts pounds of milk containing 3.2% (or some other percentage) fat to an energy equivalent pounds of milk that contained 3.5% fat. Standardization for fat content adjusts milk records for the energy content and, therefore, the market value of milk produced. The Lactation Ratings are assigned as follows:

A = Top cows whose 305d-2X-ME FCM record is more than 110% of herd average

B = Above average cows with standardized FCM from 100 to 110% of herd average

C = Below average cows with standardized FCM from 90 to 100% of herd average

D = Marginal cows with standardized FCM from 80 to 90% of herd average

E = Probable cull cows with standardized FCM below 80% of herd average

The lactation rating system does not equalize the number of cows in each group. If the distribution of standardized yields is nearly normal and not extremely large, there will be more B and C cows than A and D cows, while E rated cows will be infrequent. Herds with lots of variation from high to low producers will contain more A and D or E cows and fewer B and C cows than herds with less variation in milk yield. E rated cows should justify their existence in the herd for reasons other than production. If they have reproductive problems or high somatic cell counts, they probably should leave the herd and increase the

resources available to other cows. Most herds would include D rated cows that aren't bred back, carry chronic elevated somatic cell counts, are difficult to manage, and so forth on the cull list. A and B rated cows will probably escape the cull list unless they have major reproductive or health problems. Decisions to keep or cull C rated cows likely will be based on reasons other than milk production.

Advantages of the Ratings system are that it is simple to understand and easy to use, it is readily available and updated monthly on the DHI 210 report, and it appears after the second test day with 50 days in milk or more. The disadvantage is that the Lactation Rating treats each ME record as equally informative, regardless of days in milk. Also, the Ratings system does not consider production in previous lactations or genetic merit of the cow.

Estimated Relative Producing Ability

Estimated Relative Producing Ability (ERPA) values are available to producers on the monthly DHI 210 report, and are also distributed through the DHI 206 report which appears each April and November. ERPA is specifically calculated to predict future milk production.

ERPA's include more information than a standardized milk record. A cow's ability to produce depends on her genetic ability and her environmental conditions. Genetic ability affects all records of the cow, but some environmental conditions are temporary (like the quality of corn silage in a particular year) while others are permanent, such as the impact of pneumonia as a calf on milk yield in each lactation. ERPA calculations are based on a cow's performance in all lactations, not just the current lactation. ERPA is a better predictor of production in the next lactation than the Rating system because it uses the extra information of previous lactations and it separates the temporary and permanent parts of previous yields.

ERPA calculations use herdmate deviations rather than a percentage of the herd average ME record. Herdmates are other cows in the herd that calve in the same season, May through October and November through April. Herdmate deviations – the average difference between a cow's standardized milk record and the average record of those herdmates – are used in the ERPA calculation. ERPA's are based on all records on a cow because each of those records is subject to a different set of temporary environmental effects. The

average of several records is a better predictor of future production than is a single record. However, only older cows, the ones more subject to culling, have lots of previous lactation information. Most cows in a herd will have only one or two records included in ERPA calculations.

The formula to calculate ERPA is

$$\text{ERPA} = [N / (N + 1)] * [\text{average herdmate deviation}]$$

“N” is the number of lactations available on a cow. If the current lactation is in progress, then it counts as a fraction of a lactation, and “N” is not a whole number for that cow. Examples of weights for incomplete records are 0.72 for 45 days in milk, 0.88 for 100 days in milk, and 1.00 if 286 or more days in milk are available. The term $[N/(N+1)]$ works out to 0.50 if a cow has one complete lactation, 0.67 if she has two complete lactations, and so forth to 0.83 for cows with five complete lactations.

The idea is that more records provide more information about herdmate deviations. If a cow has a herdmate deviation of +5,000 lbs. from a single complete lactation, her ERPA would be $0.5 * 5,000$ or 2,500 lbs. If she maintained that same deviation on her second record, her ERPA would increase to $0.67 * 5,000$ or 3,350 lbs. She receives a higher ERPA after the second lactation of +5,000 lbs. deviation because she has provided more justification for confidence that she is a superior producer.

The herdmate deviations used to calculate ERPA are available as a database item for management listings in the PCDART program distributed by DRMS Raleigh. The herdmate deviations in PCDART are not adjusted for number of lactations or days in milk. A deviation for one cow might be based on one record with 100 days in milk while the deviation on an older cow might include four complete lactations. Herdmate deviations can be informative, but ERPA is recommended for culling decisions because it considers information across all lactations and is adjusted for short, in-progress lactations.

One advantage of ERPA is that the calculations reduce the effects of temporary environmental deviations that might strongly affect one record, but not the next. Deviating lactation records from herdmate averages also helps remove environmental effects that could confuse culling decisions. ERPA values are expressed across a wide range of at least 10,000 lbs. in larger herds, so interpretation can be more complicated than for the Lactation Ratings system. PCDART, or other

computer programs, can sort cows by ERPA, which will group the most probable cull cows at the low end of a sorted list.

Predicted Producing Ability

Predicted Producing Ability or PPA is calculated by the United States Department of Agriculture as part of the national genetic evaluations for yield and management traits. PPA's are included on pedigree records from breed associations and are available in “hard copy” to herds on DHI test in Virginia through the Dairy Extension Genetics program. As this guideline was written, PPA was not available to producers through the DRMS Raleigh reporting system, but it is calculated from DHI data and its purpose is to predict future production. PPA offers many advantages to producers in identifying cull cows. Hopefully, it will be included in DHI reports and databases in the future.

The USDA animal model genetic evaluation system (see VCE Publication 404-086) uses statistical procedures to evaluate the impact of different factors on production records of a single cow. The factors are effects of management group (herdmates to the cow), the additive or heritable part of genetic differences between cows, effects in common with other paternal half sisters in the same herd, permanent environmental effects that act on all lactations of one cow, and everything that is left over. Published genetic evaluations are called PTA's, and are half of the additive genetic value for a cow or bull. Genetic merit for each trait is halved because the purpose of PTA is to predict the part each parent transmits to progeny.

PPA has a different purpose from PTA. PPA predicts how much milk a cow herself will produce in subsequent lactations compared to her herdmates. PPA includes the entire additive genetic component rather than half, because all of those genes will affect cow performance. PPA also includes two other factors in the animal model that repeat from one lactation to another, effects common to all paternal half sisters of the cow in her herd, and the permanent environmental effects specific to the cow. One very valuable feature of PPA is that the USDA system combines genetic information from all other relatives of a cow that can be found in the national database. The advantage of this feature is considerable. ERPA relies entirely on milk records of the cow and her herdmates and does not consider performance of relatives at all. PPA is the best prediction of future production available anywhere in the country. Unfortunately, we have not made very good use of PPA for within herd management.

PPA is the most complete and accurate predictor of future production that is currently calculated. The disadvantage is that PPA values are not widely available for use by dairy farmers. Unlike the Ratings system, which is re-evaluated following each monthly test, USDA calculates PPA values four times per year. ERPA's are calculated twice a year, which does affect their utility as a culling guide. The time lag between test day and a new PPA means that the information is not as timely as the Ratings system. Also, PPA must be transferred from the USDA computer system to one of the DHI processing centers before being merged into DHI records. PPA is only available on cows that pass USDA edits for parentage identification, birth date and so forth, whereas Lactation Rating or ERPA can be calculated on cows of unknown parentage.

Combining production, reproduction, and cow health

The best predictor of performance in the next lactation is PPA, with ERPA being an acceptable substitute. However, the best predictor of daily milk production in the immediate future is the most recent test day milk production. For problem breeders, PPA and ERPA have limited use, as there is no assurance that there will be a future lactation. Why try to predict a next lactation on a cow that will not breed? For such cows, last test day milk production may be the best culling guide. Once a cow is declared pregnant, future lactation performance becomes an issue in culling

decisions, though the combination of current test day yield and days until next parturition are also important considerations.

Cow health should be used as a supplemental factor in the culling decision unless some health crisis issue demands immediate removal from the herd. Frequently, culling decisions will be affected by the history of mastitis for a cow, as cows with mastitis incur extra health costs, produce less milk, and are a potential source of infection for otherwise highly profitable cows in the herd. Cows with chronic foot and leg problems or digestive problems may be sick enough that they don't become pregnant and are culled for low milk production.

Look to the future when making culling decisions on individual cows. Use pending due dates, when available, to determine when future income will be bolstered by the value of a newborn calf and a period of high yields from the mother. PPA and ERPA are the best tools to predict performance in that future lactation. For open cows, use the Ratings to identify potential culls and current test day milk weights combined with knowledge of the lactation curve to project yields into the future. Poor health affects milk yield, but also adds to costs of production and increases risk of infection of otherwise profitable animals. Use such information to modify culling priorities established by production and reproductive status.