



**ARIZONA AND NEW MEXICO
DAIRY NEWSLETTER**

**COOPERATIVE EXTENSION
The University of Arizona
New Mexico State University**

JUNE, 2003

This month's article:

**Practical Application of New Forage
Quality Tests
R.D. Shaver, Ph.D.**

**(reprinted from the Western Dairy Management Conference Proceed-
ings, March, 2003, Reno, Nevada)**

New Mexico State University Extension Dairy Website:
<http://www/nmsu.edu/~dairy>

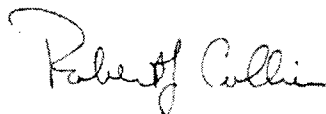
The following videos are available for checkout from New Mexico State University. To obtain a video call Kathy Bustos, (505) 646-3326 or kbustos@nmsu.edu and the video will be sent in the mail, pending availability. There is only one copy of each video available, so we request that videos be returned within two weeks. Note that four of the videos contain an English and Spanish version.

1. The Milking School. Utah State University. Spanish and English. 30 minutes
2. Fitting and Showing Your Dairy Animal....A Winning Experience. Department of Dairy Science, University of Wisconsin. 20 minutes
3. Proper Milking Procedure. University of Florida. Spanish and English. 12 minutes
4. Milking Machine Maintenance. University of Florida. Spanish and English. 16 minutes
5. The Basics of Vacuum and Milking Systems. DHIA Services, 1991. 53 minutes
6. Understanding Dairy Cattle Behavior to Improve Handling and Production. Livestock Conservation Institute, 1992
7. Managing Milking/Ordenar Lecheria. Spanish and English. 1999. 33 minutes
8. Get Milk! Joining A Dairy Crew. University of New Hampshire, 1999. 45 minutes

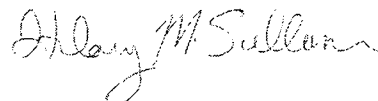
Need to Calculate Production Costs?

University of Wisconsin dairy farm management specialist, Gary Frank, has developed a Excel spreadsheet to calculate variable cost of production and total cost of production. To access the spreadsheet, go to <http://www.wisc.edu/dairy-profit>, click on Decision Making Tools, then go to costcwt.xls.

Issued in furtherance of Cooperative Extension on work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of agriculture, James A. Christenson, Director, Cooperative Extension, College of Agriculture, The University of Arizona. The University of Arizona College of Agriculture is an Equal Opportunity Employer, authorized to provide research, educational information and other services only to individuals and institutions that function without regard to sex, race, religion, color, national origin, age, Vietnam Era Veteran's status, or disability.



University of Arizona
Department of Animal Sciences
P O Box 210038, Shantz Bldg, Room 205
Tucson, AZ 85721



New Mexico State University
Extension Animal Resources
Box 30003 Dept. 3AE
Las Cruces, NM 88003

Practical Application of New Forage Quality Tests

R. D. Shaver, Ph.D., Professor and Extension Dairy Nutritionist, 1675 Observatory Drive, Room 280 Animal Sciences Building, University of Wisconsin, Madison, WI 53706. Phone: 608-263-3491 Fax: 608-263-9412. Email: rdshaver@facstaff.wisc.edu

Department of Dairy Science, College of Agricultural & Life Sciences, University of Wisconsin-Madison

University of Wisconsin-Extension

Introduction

Routine evaluation of forage quality by the grower, crop consultant, feeder, or nutritionist has generally been related to the fiber content of the forage measured in a commercial forage testing laboratory and the energy content of the forage predicted from its fiber content. Indexes of forage quality, relative feed value (RFV; Rohweder et al., 1978) and milk per ton of forage dry matter (Undersander et al.; 1993), were based on energy content of the forage predicted from acid detergent fiber (ADF) content and dry matter (DM) intake potential of the forage predicted from neutral detergent fiber (NDF) content. The RFV index has evolved to the point where it is commonly available on commercial forage test reports, used routinely in evaluations and comparisons of hay-crop forage quality, and used in the marketing of hays. Data from Wisconsin quality-tested hay auctions show that hay buyers pay \$0.90 per point of RFV above the RFV of a base quality alfalfa (Undersander, 2002). The milk per ton index has evolved to the point where it is commonly used in agronomic performance trials, because an estimate of forage DM yield often obtained in these types of trials multiplied times the estimate of milk produced per ton of forage DM provides an estimate of the milk produced per acre which combines yield and quality into a single term. This index, milk per ton or per acre, has become the focal point of corn silage commercial hybrid performance trials (Lauer et al., 2001; Lauer et al., 1997) and the corn silage hybrid-breeding program (Coors et al., 2001) at the University of Wisconsin - Madison.

The University of Wisconsin Marshfield Soil and Forage Analysis Laboratory, Cumberland Valley Analytical Services (Maugansville, MD), and Dairy One (Ithaca, NY) perform wet chemistry in vitro NDF digestibility (NDFD; % of NDF) measurements. At the time of writing this paper, Dairyland Laboratories (Arcadia, WI) is developing a wet chemistry in vitro NDFD analysis. Near infrared (NIR) calibrations for determining NDFD on hay-crop forage and corn silage samples are available at the UW Marshfield Soil and Forage Analysis Laboratory and some commercial forage testing laboratories. A summative energy equation (Weiss, 1996) has been used at some commercial forage testing laboratories to calculate the energy content of forages for several years; equation components include crude protein (CP), fat, non-fiber carbohydrate (NFC) and NDF, and the corresponding digestibility coefficients for these nutrients. Use of the summative energy approach is becoming more common with its inclusion in NRC, 2001.

We (Shaver et al., 2002) revised the summative equation of Weiss (1996) as follows:

- the CP and fat components were not altered,
- the NDF digestibility coefficient calculated using a lignin and NDF based equation was replaced by a direct laboratory measure of NDFD,
- the NFC component with constant digestibility was left unchanged for alfalfa and grasses, and
- the NFC component for corn silage was replaced with starch and non-starch NFC components with the starch digestibility coefficient varied in relationship to whole-plant DM content and kernel processing (Schwab and Shaver, 2001).

The revised summative energy equation has been made available to commercial forage testing laboratories and some have programmed it into their reporting system. Forage energy values generated from the revised summative energy equation (1x-maintenance TDN and 3x-maintenance NE_L) can be used in ration formulation packages that allow feedstuff energy values to be inputted, which does not include the NRC-2001 model or packages that incorporate its energy system completely. With the NRC-2001 model, NDF digestibility (% of NDF) can be inputted directly in the feed composition screen; this will influence the calculated energy value of the ration. However, the NRC-2001 model does not recognize the influence of NDFD on DM intake that was reported by Oba and Allen (1999).

The milk per ton index of Undersander et al. (1993) has been modified (Schwab and Shaver, 2001), and an easy to use Excel 5.0 spreadsheet called Milk2000 has been developed (<http://www.uwex.edu/ces/forage/pubs/milk2000.xls>). MILK2000 uses forage energy content estimated from the revised summative equation (Shaver et al., 2002) and forage DM intake calculated from NDF (Mertens, 1987) and in vitro NDFD (Oba and Allen, 1999) to predict milk production per ton of forage DM. In MILK2000, the intake of energy from forage for a 1350 lb. milking cow consuming a 30% NDF diet is calculated and the cow's maintenance energy requirement (proportioned according to the percentage of forage in the diet) is then subtracted from energy intake to provide an estimate of the energy available from forage for conversion to milk (NRC, 1989). Use of NDFD in the calculation of a revised RFV has been proposed (Shaver et al., 2002).

Fermentation analyses have long been used in university and industry research trials to assess silage quality. These analyses are now available for evaluating silage quality on farms through some commercial forage testing laboratories (Cumberland Valley Analytical Services, Maugansville, MD; Dairy One, Ithaca, NY; Dairyland Laboratories, Arcadia, WI; Rock River Laboratories, Watertown, WI).

Use of Milk2000 Spreadsheet

Milk per ton and milk per acre calculations provide relative rankings of forage samples, but should not be considered as predictive of actual milk responses in specific situations for the following reasons:

- equations and calculations are simplified to reduce inputs for ease of use,
- farm to farm differences exist, and
- genetic, dietary, and environmental differences affecting feed utilization are not considered.

Do not use different values for yield or quality measurements that are not statistically different. Animal response calculations are more sensitive than our measurement techniques of yield and quality. The spreadsheet will show a milk/ton difference when yield and quality may not be statistically different.

Standard inputs that are needed for MILK2000 include DM percentage and yield, CP percentage, 48-hour in vitro NDFD (not dry matter digestibility), NDF percentage, and starch percentage (corn silage only). Ash and ether extract should be entered if available, but book values can be entered instead (for normal corn silage, 4.3% for ash and 3.2% ether extract and for alfalfa/grasses, 10.0% ash and 2.7% ether extract, are recommended). Non-fiber carbohydrate and non-starch NFC are calculated values within the spreadsheet.

The MILK2000 alfalfa/grass worksheet contains NRC (2001) RFV100 and high quality alfalfa in rows 12 and 13 as a quality reference. You can begin entering your samples in row 14: sample identification in column A, quality data in columns B through G, and DM yield in column H. Calculated results are found in columns I through T. Depending on your spreadsheet settings, it may be necessary to push F9 after entering data for calculation of results.

The MILK2000 corn silage worksheet contains NRC (2001) “normal” corn silage in row 12 as a quality reference. An example sample entry is included in row 13. You can begin entering your samples in row 14: sample identification in column A, processing in column B, quality data in columns C through J, and DM yield in column K. Calculated results are found in columns P through AC. Depending on your spreadsheet settings, it may be necessary to push F9 after entering data for calculation of results.

Application of MILK2000

Corn Silage

Harvest timing

The optimum whole-plant corn silage DM content is about 35% with lower milk yield found for corn silage harvested too wet and especially too dry (Bal et al., 1997). The economic impact of harvesting corn silage at DM contents ranging from 25% to 45% was calculated using MILK2000 to determine milk per ton and assuming a \$12.00/cwt.milk price; the loss in gross milk revenue incurred by harvesting corn silage too dry was \$15,000 to \$20,000 annually per 100 cows.

Kernel processing

The results of corn silage kernel processing trials have been mixed; Bal et al. (2000b) reported a 3.3 lb/cow/day increase in 4% fat-corrected milk yield and a 4.2 percentage unit increase in total-tract starch digestion due to processing, while Dhiman et al. (2000) found no advantage to processing on milk yield or starch digestibility by dairy cows in two of three studies. The economic impact of corn silage kernel processing was calculated using MILK2000 to determine milk per ton and assuming a \$12.00/cwt.milk price; the gain in gross milk revenue related to kernel processing was about \$6,000 annually per 100 cows. This calculation was done on 40% DM corn silage, and the estimated response to processing would be less on 30% DM corn silage and greater on 45% DM corn silage. Potential benefits of processing beyond starch digestibility related to chopping at a longer length of cut with less sorting of cobs in the feed bunk were not considered in this calculation. To be considered excellent for degree of processing there should be more than 95% kernel breakage and no cobs should be greater than a 1/8th concentric ring.

Height of cutting

Increasing corn silage height of cutting by 14 inches reduced whole-plant NDF and ADF contents by 7%- and 4%-units, respectively (Satter et al., 2000). High cutting would also be expected to increase NDFD, because the more highly lignified portion of the stalk would be left in the field. Satter et al. (2000) projected the DM per acre yield loss associated with high cutting at 5% to 8%. The economic impact of high cutting was calculated using MILK2000 to determine milk per ton and assuming a \$12.00/cwt.milk price; the gain in gross milk revenue related to high cutting equates to about \$8,000 or \$3,000 annually per 100 cows for milk \$/ton DM or milk \$/acre, respectively. Height of cutting offers some flexibility for manipulating the quality of corn silage. In some situations, potential benefits of high cutting for reducing nitrates, mycotoxins, and (or) soil erosion may have merit. High cutting increases whole-plant DM content (Satter et al., 2000), which may be a plus for custom operators hoping to get started early in the harvest season on immature corn silage.

Hybrids

The estimated economic impact of various corn silage hybrids is presented in Table 1. Only bm₃ and nutri-dense hybrids show a significant positive deviation from the mean of all hybrids tested for milk per ton of corn silage DM. Milk per acre for the nutri-dense hybrids was similar to the average for all hybrids tested. Although milk per ton was highest for bm₃ of the hybrid categories compared, milk per acre for bm₃ was lowest of the hybrid categories compared and was \$347 per acre lower than the average of all hybrids tested. Dairy producers buying corn silage from a grower and dairy producers growing

their own corn silage may have a widely different view of bm₃ hybrids. There were no advantages to leafy hybrids. This observation agrees with the results of feeding trials with leafy hybrids (Bal et al., 2000a; Kuehn et al., 1999), but not Clark et al. (2002). High-oil and waxy hybrids were worse than the average of all hybrids tested for milk per ton and per acre (high-oil) and milk per acre (waxy).

Hay and Hay-crop Silage

Milk production decline with diminishing alfalfa quality (increasing ADF and NDF contents) is well established (Nelson and Satter, 1990). The MILK2000 spreadsheet was used to assess the impact of alfalfa quality on estimated milk per ton of DM and per acre. For the first scenario, alfalfa NDF content was varied from 40% to 50% while holding NDFD constant at 50% of NDF. The milk per ton and milk per acre results and gross milk returns are presented in Table 2.

The estimated milk per ton benefit for alfalfa with a relative feed value (RFV) of 175 (40% NDF) over alfalfa with an RFV of 125 (50% NDF) equates to about \$10,000 annually per 100 cows. Because of reduced yield for the immature alfalfa, the estimated milk per acre benefit for 175-RFV alfalfa over 125-RFV alfalfa equates to about \$3,000 annually per 100 cows. Data from Wisconsin quality-tested hay auctions show that dairy producers pay \$0.90 per point of RFV above the RFV of a base quality alfalfa (Undersander, 2002). So, 175-RFV alfalfa would sell for \$45 more than 125-RFV alfalfa. Based on the estimated milk per ton, the 175-RFV alfalfa was worth \$49 more per ton than 125-RFV alfalfa. Because of the premium price paid for high-quality alfalfa, it needs to be targeted to high producing cows with the potential for a production response from the high quality. Average-quality alfalfa can be targeted to low-producing cows and replacement heifers.

Table 1. Impact of various corn silage hybrids on estimated milk per ton and per acre^{1,2}.

Hybrid	Milk lb/ton DM	Milk \$/ton DM ³	Milk lb/acre	Milk \$/acre ³
bm ₃ (n=12)	3410	409	21500	2581
Bt (n=130)	3140	377	25000	3000
High Oil (n=12)	3040	365	22500	2701
Nutri-Dense (n=10)	3240	389	24300	2917
Leafy (n=70)	3110	374	24600	2952
Waxy (n=56)	3090	371	22600	2712
All Hybrids (n=2407)	3110	374	24400	2928

¹From MILK2000 (Schwab and Shaver, 2001; Schwab et al., 2001).

²Source: J.G. Lauer, UW-Madison Agronomy, 1995-2000 UW Silage Trials.

³Calculated using a \$12.00/cwt. milk price.

Table 2. Impact of alfalfa quality on estimated milk per ton and per acre¹.

Alfalfa (%CP, %NDF, RFV)	Milk lb/ton DM	Milk \$/ton DM ²	Milk lb/acre	Milk \$/acre ²
(22, 40, 175)	2755	330	12398	1488
(19, 45, 150)	2549	306	12106	1453
(16, 50, 125)	2342	281	11710	1406

¹Calculated using Milk2000 (<http://www.uwex.edu/ces/forage/pubs/milk2000.xls>).

²Calculated using a \$12.00/cwt. milk price.

For the second scenario, alfalfa NDF content was set at either 40% or 50% while NDFD was varied from 40% to 60% of NDF within each concentration of NDF. The milk per ton results and gross milk returns are presented in Table 3. As NDFD decreased from 60% to 40% of NDF, milk per ton and \$ per ton declined 671 lb and \$80, respectively. This decline was greater than that observed with increasing NDF content from 40% to 50%, where milk per ton and \$ per ton declined 413 lb and \$50, respectively. Hay or hay-crop silage with low NDF content (40%) and low NDF digestibility (40%) shows lower predicted milk (lb or \$) per ton than high NDF (50%), high NDFD (60% of NDF). The digestibility of NDF is a significant quality parameter that has been ignored in past forage evaluation schemes.

Table 3. Impact of alfalfa quality on estimated milk per ton and per acre¹.

CP%, NDF%	NDFD % of NDF	Milk lb/ton DM ²	Milk \$/ton DM
(22, 40)	60	3057	367
(22, 40)	50	2755	330
(22, 40)	40	2440	293
(16, 50)	60	2697	323
(16, 50)	50	2342	281
(16, 50)	40	1973	237

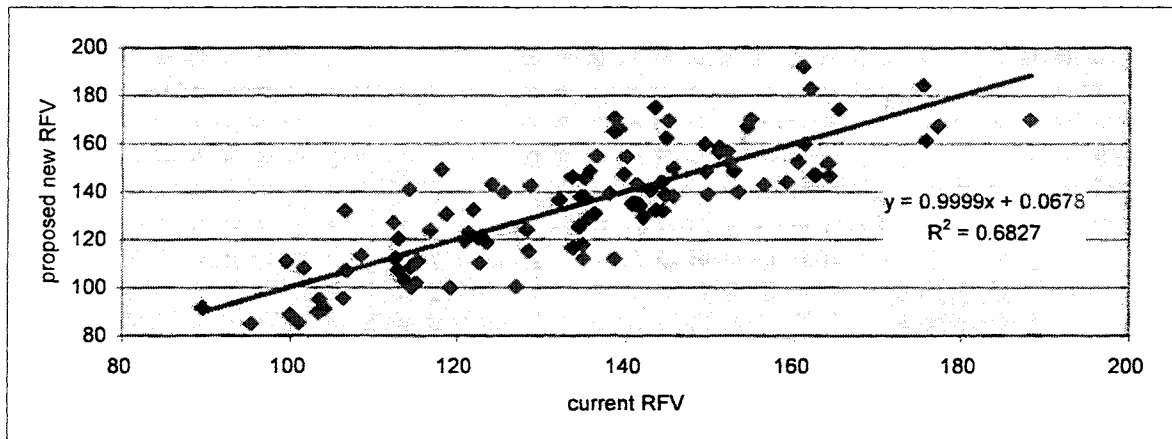
¹Calculated using Milk2000 (<http://www.uwex.edu/ces/forage/pubs/milk2000.xls>).

²Calculated using a \$12.00/cwt. milk price.

The RFV estimates used for forage evaluation and hay marketing are based on NDF and ADF concentrations, and have not considered differences in NDF digestibility. We (Shaver et al., 2002) proposed incorporating NDF digestibility measurements into the RFV calculations, where forage NE_L and DM intake would be estimated in a manner similar to that described for estimating milk per ton. The regression of current versus proposed RFV estimates is presented in Figure 1. The graph and its low R-square value (0.68) show that the proposed RFV varies above and below its line of equality with the current RFV. For example, samples with a current RFV of 140 have proposed RFV ranging from 110 to 170. The use of NDF digestibility measurements in forage evaluation schemes may detect variation in forage quality not previously detected in schemes based solely on fiber concentrations. The foregoing discussion may partially explain why dairy producers often report widely different animal performance from lots of hay with the same RFV under the current system. Factors that cause NDFD to vary include plant species, varieties within a species, stage of maturity at harvest, climatic condition that the crop was grown under, and interactions between these factors. We are hopeful that the proposed

system, which incorporates NDFD into the calculation of RFV, will yield a better relationship with animal performance, but this has yet to be confirmed in feeding experiments.

Figure 1. Current versus proposed relative feed value calculations.



Silage Quality

Analyses commonly included in silage fermentation reports are pH, lactic, acetic, propionic and butyric acids, ammonia, and ethanol (Kung and Shaver, 2001). The pH of an ensiled sample is a measure of its acidity, but is also affected by the buffering capacity of the crop. In general, legume silages have a higher pH than corn or other grass silages and take longer to ensile because of their higher buffering capacity. Seldom do corn silages have a pH higher than 4.2. Such cases may be associated with extremely dry (>42% dry matter) silages that are overly mature or drought stricken. Because of its normally low pH (3.8), corn silage intake usually benefits from the addition of sodium bicarbonate prior to feeding to neutralize its acidity. Common reasons for legume silages having a pH higher than 4.6 to 4.8 include: ensiling at <30% dry matter (DM) which causes a clostridial fermentation, and ensiling at > 45-50% DM, which restricts fermentation. In the first example, a high pH due to clostridia is a definite indicator of an undesirable fermentation that has led to poor quality silage. However, in the second example, a high pH due to restricted fermentation is not always indicative of a poor fermentation or poor silage. But, silage from a restricted fermentation usually is unstable when exposed to air because insufficient amounts of acid were produced to inhibit secondary microbial growth.

Lactic acid should be the primary acid in good silage. This acid is stronger than the other acids in silage (acetic, propionic, and butyric), and therefore is usually responsible for most of the drop in silage pH. Further, fermentations that produce lactic acid result in the lowest losses of DM and energy from the crop during storage. Lactic acid should be at least 65 to 70% of the total silage acids in good silage. Extremely wet silages (< 25% DM), prolonged fermentations (due to high buffering capacity), loose packing, or slow silo filling can result in silages with high concentrations of acetic acid (>3 to 4% of DM). In such silages, energy and DM recovery are probably less than ideal. Silages treated with ammonia also tend to have higher concentrations of acetic acid than untreated silage, because the fermentation is prolonged by the addition of the ammonia that raises pH. A new microbial inoculant (*Lactobacillus buchneri*) designed for improving the aerobic stability of silages causes higher than normal concentrations of acetic acid in silages. However, production of acetic acid from this organism should not be mistaken for a poor fermentation and feeding treated silages with a high concentration of acetic acid does not appear to cause negative effects on animal intake.

The effect of high concentrations of acetic acid (> 4-6% of DM) in silages fed to animals is unclear at this time. In the past, some studies can be found where DM intake was depressed when silage high in acetic acid concentration was fed to ruminants. However, the depression in intake to high acetic acid in the diet has not been consistent. There has been speculation that decreased intake may be actually due to unidentified negative factors associated with a poor fermentation and not to acetic acid itself. For example, in recent studies, animals showed no indication of reduced intake when fed silages high in acetic acid due to inoculation with the bacteria *Lactobacillus buchneri* for improved aerobic stability. If a producer has intake problems due to silages with excessively high acetic acid (> 5-6% of DM), the amount of that silage should be reduced in the TMR.

A high concentration of butyric acid (>0.5% of DM) indicates that the silage has undergone clostridial fermentation, which is one of the poorest fermentations. Silages high in butyric acid are usually low in nutritive value and have higher ADF and NDF levels because many of the soluble nutrients have been degraded. Such silages may also be high in concentrations of soluble proteins and may contain small protein compounds called amines that have sometimes shown to adversely affect animal performance. High butyric acid has sometimes induced ketosis in lactating cows and because the energy value of silage is low, intake and production can suffer. As with other poor quality silages, total removal or dilution of the poor silage is advised.

High concentrations of ammonia (>12 to 15% of CP) are a result of excessive protein breakdown in the silo caused by a slow drop in pH or clostridial action. In general, wetter silages have higher concentrations of ammonia. Extremely wet silages (< 30% DM) have even higher ammonia concentrations because of the potential for clostridial fermentation. Silages packed too loosely and filled too slowly also tend to have high ammonia concentrations. Theoretically, high amounts of ammonia (by itself) in silage should not have negative effects on animal performance if the total dietary nitrogen fractions are in balance. However, if the high ammonia contributes to an excess of ruminally-degraded protein (RDP), this could have negative consequences on milk and reproductive performances. Blood or milk urea nitrogen can be used as an indicator of excess RDP. Often times, silage with high concentrations of ammonia coupled with butyric acid may also have significant concentrations of other undesirable end products, such as amines, that may reduce animal performance.

High concentrations of ethanol are usually an indicator of excessive metabolism by yeasts. Dry matter recovery is usually worse in silages with large numbers of yeasts. These silages are also usually very prone to spoilage when the silage is exposed to air. Usual amounts of ethanol in silages are low (< 1 to 2% of DM). Extremely high amounts of ethanol (> 3 to 4% of DM) in silages may cause off flavors in milk. We do not know the level at which ethanol becomes a problem in dairy cattle diets. Most ethanol that is consumed is probably converted to acetic acid in the rumen.

References

- Bal, M. A., J. G. Coors, and R. D. Shaver. 1997. Impact of the maturity of corn for use as silage in the diets of dairy cows on intake, digestion, and milk production. *J. Dairy Sci.* 80:2497-2503.
- Bal, M. A., R. D. Shaver, H. Al-Jobeile, J. G. Coors, and J. G. Lauer. 2000a. Corn silage hybrid effects on intake, digestion, and milk production by dairy cows. *J. Dairy Sci.* 83:2849-2858.
- Bal, M. A., R. D. Shaver, A. G. Jirovec, K. J. Shinnors, and J. G. Coors. 2000b. Crop processing and chop length of corn silage: effects on intake, digestion, and milk production by dairy cows. *J. Dairy Sci.* 83:1264-1373.

- Clark, P. W., S. Kelm, and M. I. Endres. 2002. Effect of feeding a corn hybrid selected for leafiness as silage or grain to lactating dairy cattle. *J. Dairy Sci.* 85:607-612.
- Coors, J.G., T.J. Frey, and R.D. Shaver. 2001. Breeding for nutritional quality and yield in silage maize. p. 55. Abstracts. Proc. XVIth Eucarpia Congress. 10-14 September 2001. Edinburgh, Scotland.
- Dhiman, T. R., M. A. Bal, Z. Wu, V. R. Moreira, R. D. Shaver, L. D. Satter, K. J. Shinnors, and R. P. Walgenbach. 2000. Influence of mechanical processing on utilization of corn silage by lactating dairy cows. *J. Dairy Sci.* 83:2321-2528.
- Kuehn, C. S., J. G. Linn, D. G. Johnson, H. G. Jung, and M. Endres. 1999. Effect of feeding silages from corn hybrids selected for leafiness or grain to lactating dairy cows. *J. Dairy Sci.* 82:2746-2755.
- Kung, L., and R. Shaver. 2001. How good is your silage making? *Hoard's Dairyman*. Sept. 25, 2001. pg. 597.
- Lauer, J., K. Kohn, and P. Flannery. 2001. Wisconsin Corn Hybrid Performance Trial Results: Grain and Silage. A3653. Univ. WI Extension. Madison, WI.
- Lauer, J., K. Kohn, P. Flannery, and K. Hudelson. 1997. Wisconsin Corn Hybrid Performance Trial Results: Grain and Silage. A3653. Univ. WI Extension. Madison, WI.
- Mertens, D. R. 1987. Predicting intake and digestibility using mathematical models of ruminal function. *J. Anim. Sci.* 64:1548-1558.
- National Research Council. 2001. Nutrient requirements of dairy cattle. 7th rev. ed. Natl. Acad. Sci., Washington D.C.
- National Research Council. 1989. Nutrient Requirements of Dairy Cattle. 6th rev. ed. Natl. Acad. Sci., Washington, DC.
- Nelson, W. F., and L. D. Satter. 1990. Effect of stage of maturity and method of preservation of alfalfa on production by lactating dairy cows. *J. Dairy Sci.* 73:1800-1811.
- Oba, M. and M. S. Allen. 1999. Evaluation of the importance of the digestibility of neutral detergent fiber from forage: effects on dry matter intake and milk yield of dairy cows. *J. Dairy Sci.* 82:589-596.
- Rohweder, D.A., R. E. Barnes, and Jorgensen, N. 1978. Proposed hay grading standards based on laboratory analysis for evaluating quality. *J. Anim. Sci.* 47:747-759.
- Satter, L. D., V. Moreira, H. Santos, Z. Wu, and F. Kanitz. 2000. Relative feeding value of diverse corn silage hybrids. Pages 31-46 *in* Proc. of UW Arlington Dairy Day. Arlington, WI.
- Schwab, E. C., and R. D. Shaver. 2001. Evaluation of corn silage nutritive value using MILK2000. Pages 21-24 *in* Proc. of 25th Forage Production and Use Symposium. WI Forage Council Annual Mtg. Eau Claire, WI.
- Schwab, E., R. Shaver, P. Hoffman, J. Lauer, and J. Coors. 2001. MILK2000 Corn Silage Variety Evaluation. <http://www.wisc.edu/dysci/uwex/nutritn/spreadsheets/Milk2000v31.xls>.

Shaver, R. D., D. J. Undersander, E. C. Schwab, P. C. Hoffman, J. G. Lauer, D. K. Combs, and J. G. Coors. 2002. Evaluating Forage Quality for Lactating Dairy Cows. Proc. Intermountain Nutr. Conf. Salt Lake City, UT.

Undersander, D. J. 2002. Wisconsin tested hay auctions. <http://www.uwex.edu/ces/forage/pubs/auction.htm>.

Undersander, D.J., W.T. Howard, and R.D. Shaver. 1993. Milk per acre spreadsheet for combining yield and quality into a single term. J. Prod. Ag. 6:231-235.

Weiss, W. P. 1996. Estimating available energy content of ruminant feeds. Pages 1-11 *in* Proc. California Nutrition Conference, Fresno, CA.

HIGH COW REPORT

May, 2003

MILK

Arizona Owner	Barn#	Age	Milk	New Mexico Owner	Barn #	Age	Milk
* Withrow Dairy	1249	3-1	38,860	* Hide-Away Dairy	2906	5-06	40,080
* Withrow Dairy	1423	3-1	36,920	* Hide-Away Dairy	3343	4-03	38,010
* Stotz Dairy West	15030	3-5	36,400	* Providence Dairy	4675	2-10	37,370
* Stotz Dairy West	15433	3-1	36,390	* Do-Rene Dairy	3485	5-06	37,160
* Mike Pylman	6023	3-4	35,890	* Hafliger Dairy	7034	4-03	36,480
* Hillcrest Dairy	1255	5-11	35,612	S.A.S. Dairy	4451	4-01	35,481
* Mik Pylman	6185	3-2	35,320	* Hide-Away Dairy	3186	4-03	35,430
* Red River Dairy	2610	3-8	35,171	S.A.S. Dairy	90	6-04	35,389
* Stotz Dairy West	19709	3-3	35,030	* Providence Dairy	3623	5-00	35,380
* Withrow Dairy	4531	3-0	35,070	* Do-Rene Dairy	1628	8-06	35,290

FAT

* Red River Dairy	1222	5-6	1666	* Hide-Away Dairy	2906	5-06	1438
* Red River Dairy	4193	7-7	1537	* Hafliger Dairy	891	6-06	1336
* Red River Dairy	3293	4-2	1414	* Hide-Away Dairy	2963	5-06	1331
* Red River Dairy	320	5-6	1412	Price's Roswell Farm	4089	2-10	1310
* Stotz Dairy West	14884	3-6	1388	* Milagro Dairy	4647	5-06	1274
* Stotz Dairy West	15433	3-1	1360	* Providence Dairy	3623	5-00	1273
* Stotz Dairy West	12075	5-8	1356	* Hafliger Dairy	7903	3-04	1269
* Mike Pylman	4039	5-7	1354	* Providence Dairy	7612	4-09	1267
* Red River Dairy	1921	4-2	1330	* Hide-Away Dairy	3074	5-06	1266
* Dairyland Milk Co.	9473	9-7	1314	* Hafliger Dairy	6356	5-06	1262

PROTEIN

* Red River Dairy	3265	4-2	1070	S.A.S. Dairy	4451	4-01	1079
* Red River Dairy	5790	2-6	1068	S.A.S. Dairy	90	6-04	1061
* Withrow Dairy	1249	3-1	1063	* Hide-Away Dairy	2906	5-06	1060
* Red River Dairy	3677	4-2	1059	* Hide-Away Dairy	4209	4-03	1059
* Red River Dairy	470	5-4	1054	* Goff Dairy	5347	6-06	1055
* Stotz Dairy West	15433	3-1	1052	* Hide-Away Dairy	4021	4-03	1052
* Stotz Dairy West	15030	3-5	1052	S.A.S. Dairy	3021	6-03	1052
* Mike Pylman	4039	5-7	1051	* Goff Dairy	9654	5-06	1039
* Red River Dairy	1921	4-2	1018	S.A.S. Dairy	3966	4-01	1039
* Stotz Dairy West	19726	3-3	1018	* Hafliger Dairy	7034	4-03	1036

*all or part of lactation is 3X or 4X milking

ARIZONA – TOP 50% FOR F.C.M. ^b
MAY, 2003

<u>OWNERS NAME</u>	<u>Number of Cows</u>	<u>MILK</u>	<u>FAT</u>	<u>3.5 FCM</u>	<u>R.R.</u>
* Stotz Dairy West	2044	28,139	1037	28,985	33
* Red River Dairy	4381	27,074	967	27,390	27
* Mike Pylman Dairy	2522	25,336	893	25,437	34
University of Arizona Holsteins	180	25,357	888	25,366	26
* Arizona Dairy Company North	2639	25,036	882	25,130	35
* Danzeisen Dairy, LLC	1255	24,492	875	24,780	42
* Stotz Dairy East	1190	24,424	874	24,735	33
* Arizona Dairy Company South	3364	24,749	856	24,584	32
* Wigwam Dairy	1404	23,780	863	24,278	32
* Zimmerman Dairy	1143	23,617	864	24,224	29
* Hillcrest Dairy	2343	24,254	838	24,078	44
* Del Rio Holsteins	1229	23,542	848	23,933	36
University of Arizona Brown Swiss	103	22,457	868	23,788	23
Paul Rovey Dairy	434	22,949	821	23,237	32
* Treger Holsteins, Inc.	498	22,941	818	23,185	26
* Del Rio Brown Swiss	186	21,326	810	22,358	39
* Saddle Mountain Dairy	2141	23,259	749	22,202	31
* Dairyland Milk Company	2777	21,908	769	21,944	23
* Butler Dairy	614	21,768	766	21,835	37
* RG Dairy, LLC	1253	21,554	756	21,580	24
* Dutch View Dairy	1580	21,269	742	21,229	32
Mountain Shadow Dairy	1195	17,648	837	21,205	23
Goldman Dairy	2077	21,009	746	21,182	34
* Caballero Farms LLLP Holsteins	1739	21,067	737	21,062	29

NEW MEXICO TOP 50% ACTUAL MILK – OFFICIAL & UNOFFICIAL HERDS

<u>OWNERS NAME</u>	<u>Number of Cows</u>	<u>MILK</u>	<u>FAT</u>	<u>3.5 FCM</u>	<u>R.R.</u>
* Pareo Dairy #1	1366	26,813	955	27,080	19
* Hide-Away Dairy	2209	25,853	880	25,449	25
Providence Dairy	2703	25,127	837	24,438	22
* Hafliger Dairy	1661	24,896	902	25,392	38
McCatharn North Dairy	1047	24,593	---	---	37
Ken Miller Dairy	370	24,505	838	24,185	27
* Tallmon Dairy	486	24,344	830	23,986	35
* Do-Rene Dairy	2291	24,156	840	24,066	34
Pareo Dairy #2	2828	23,611	884	24,544	19
* S.A.S. Dairy	2041	23,467	832	23,639	32
* Goff Dairy	4409	23,532	836	23,732	36
Breedyk Dairy	2784	23,252	747	22,168	28
Vaz Dairy	1780	23,000	792	22,788	28

* all or part of lactation is 3X or 4X milking

^b average milk and fat figure may be different from monthly herd summary; figures used are last day/month

* ARIZONA AND NEW MEXICO HERD IMPROVEMENT SUMMARY
FOR OFFICIAL HERDS TESTED MAY, 2003

		ARIZONA	NEW MEXICO
1.	Number of herds	53	23
2.	Total cows in herd	74,485	40,444
3.	Average herd size	1405	1758
4.	Percent days in milk	91	87
5.	Average days in milk	215	197
6.	Average milk – all cows per day	63.8	62.7
7.	Average percent fat – all cows	3.5	3.5
8.	Total cows in milk	67,781	35,003
9.	Average daily milk for milking cows	70.5	72
10.	Average days in milk – 1 st breeding	82	74
11.	Average days open	158	149
12.	Average calving interval	14.0	14.0
13.	Percent somatic cell – linear 0-4	86	82
14.	Percent somatic cell – linear 5-6	5	11.5
15.	Percent somatic cell – linear 7 & above	9	5.5
16.	Average previous days dry	63	68
17.	Percent cows leaving herd	33	31
		STATE AVERAGE	
	MILK	22,198	22,207
	Percent butterfat	3.6	3.6
	Percent Protein	3.0	3.0
	Pounds fat	797	795
	Pounds protein	666	654

ARIZONA COOPERATIVE EXTENSION
U.S. DEPARTMENT OF AGRICULTURE
The University of Arizona
Tucson, Arizona 85721

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, \$300

PRESRT STD
POSTAGE & FEES PAID
USDA
PERMIT NO G-268



THE UNIVERSITY OF
ARIZONA®

COOPERATIVE EXTENSION

Department of Animal Sciences

P O Box 21 0038

Tucson, AZ 85721 -0038

Phone: 520-621-3375

Fax: 520-621-9435

Email: arettig@ag.arizona.edu

Upcoming Events:
Arizona Dairy Production Conference
October 16, 2003
Sheraton Phoenix Airport Hotel
Phoenix, Arizona