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*Proceedings of the
3rd Western Dairy
Management
Conference*



Las Vegas, Nevada

March 13–15, 1997

Schedule:

Thursday March 13

OUR INDUSTRY TODAY

- "Marketing Beef From Dairy Cattle – Now And In The Future", Gary Smith, Colorado State University
- "The Outlook For Dairy Product Trade: Will The U.S. Be A Competitor?", David Dyer, National Milk Producers Federation
- "Team Building", Earl Giacolini, Sunsweet Corp., Fresno, California

REPLACEMENTS

- "Raising Replacement Heifers; Birth To Weaning", James Quigley, University of Tennessee
- "Management Considerations From Weaning To Calving", Edward Fiez, University of Idaho

MANAGING EMPLOYEES AND FACILITIES

- "Management Implications Of Parlor Size", John Smith, Kansas State University
- "Producer Experiences With Freestall Housing", C.A. Russell, Yosemite Jersey Dairy, Hilmar, California
- "Solutions To Manure Management Problems", Deanne Meyer, University of California-Davis
- Panel Discussion – Labor Management
- Panel Discussion – 2X, 3X and 4X Milking, Including The Expansion Period
- RECEPTION FOR ALL CONFERENCE ATTENDEES BEGINS AT 5:30 P.M.

Friday March 14

HERD HEALTH

- "Vaccination Programs: Is There An Answer?", Vic Cortese, Pfizer Animal Health, Exton, Pennsylvania
- "Biosecurity On The Dairy Operation", Thomas Fuhrmann, DVM, Phoenix, Arizona
- "How Faulty Management & Nutrition Can Increase Herd Lameness", Paul Greenough, Saskatoon, Saskatchewan, Canada

REPRODUCTION AND BREEDING

- "New Strategies For Heat Detection And Timed A.I.", Ray Nebel, Virginia Polytechnic Institute
- "Extending Calving Interval", Dave Galton, Cornell University
- "Selecting Sires Other Than For Milk Production", Dennis Funk, American Breeders Service, DeForest, Wisconsin

ECONOMICS OF DAIRYING

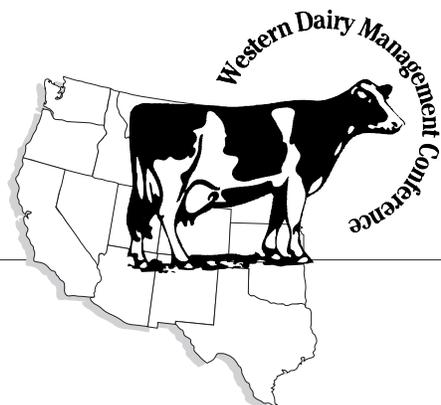
- "Dealing With Dairy Financial Variables", Don Bennick, North Florida Holsteins, Bell, Florida
- "Controlling Costs On The Dairy", David Kohl, Virginia Polytechnic Institute

Saturday March 15

NUTRITION

- "Adjusting Rations For Forage Quality, And Suggested Criteria To Use In Buying Forages", Carl Coppock, Laredo, Texas
- Panel Discussion – Grouping Strategies
- Additional presentation to be announced.





Welcome!

to the 3rd Western Dairy Management Conference, presented by the Cooperative Extension Services from the Western United States. We have prepared a program that we believe will assist you in continuing to be the leaders in the world's most efficient milk production industry, and thereby in maintaining a healthy industry.

Dennis Armstrong, University of Arizona – Co-chairman

Mike Gamroth, Oregon State University – Co-chairman

John Smith, Kansas State University – Co-chairman

Donald Bath, University of California-Davis

Ron Bowman, Utah State University

Dean Falk, University of Idaho

Dennis Halladay, The Western Dairyman Magazine

Donald Klingborg, University of California-Davis

Steve Larson, Hoard's Dairyman Magazine

William Wailes, Colorado State University

Chris Woelfel, Texas A&M University

Ned Zaugg, Washington State University



Conference Organizing Committee members (front row, l-r): Chris Woelfel, Mike Gamroth, John Smith, Dennis Armstrong, and Don Bath. (Back row, l-r) Dennis Halladay, Ned Zaugg, Ron Bowman, Steve Larson, Bill Wailes, Dean Falk, and Don Klingborg.

Index Of Presentations:

	<u>page</u>
• “Marketing Beef From Dairy Cattle – Now And In The Future”, Gary Smith	5
• “The Outlook For Dairy Product Trade”, David Dyer	11
• “U.S. Cooperative Success Story: Sunsweet Sells The World On Prunes”, Earl Giacolini	19
• “Replacement Heifers From Birth To Weaning”, James Quigley	23
• “Management Considerations For Replacement Dairy Heifers”, Edward Fiez	35
• “Labor Management Considerations In Selecting Milking Parlor Type & Size”, John Smith	43
• “A Producer’s Experience With Freestalls”, C.A. Russell	51
• “Alternatives To Manure Management Problems”, Deanne Morse	57
• Panel Discussion – Labor Management	67
• “Milking Frequency”, Dennis Armstrong	79
• “4X Milking”, Don Logan	85
• “Vaccination Programs: Is There An Answer?”, Vic Cortese	89
• “Biosecurity On Dairy Operations”, Thomas Fuhrmann	93
• “Understanding Herd Lameness”, Paul Greenough	97
• “New Strategies For Heat Detection And Timing Of Artificial Insemination”, Ray Nebel	107
• “Extending Calving Intervals With The Use Of BST”, Dave Galton	115
• “Selecting Sires Other Than For Milk Production”, Dennis Funk	123
• “Dealing With Dairy Financial Variables”, Don Bennick	133
• “Adjusting Rations For Forage Quality, And Suggested Criteria To Use In Buying Forages”, Carl Coppock	137
• Panel Discussion – Grouping Strategies	145

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Cover Photo:

The double-36 her-ringbone milking parlor at Hettinga Farms in Pixley, California. (Photo by Dennis Halladay, courtesy of *The Western Dairyman Magazine*.)



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Marketing Beef From Dairy Cattle – Now And In The Future

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Marketing Beef From Dairy Cattle – Now And In The Future

According to Galton and Knoblauch (1996), "For dairy farm sustainability... producers will continue to manage their dairies as businesses and continuously analyze their businesses to increase competitiveness and profitability. Producers will place greater emphasis on producing competitively priced milk for a more market-oriented industry. Producers must remember that their businesses are a part of the total U.S. economy and of the global economy as well. Producers need to position their businesses to achieve the desired standard of living. They should strive for farm profitability increases of at least 10% per year to maintain a standard of living, and farm and off-farm investments. Family income may come from dairy farm income only (milk, cull cows, bull calves, sale of breeding stock) or a combination of dairy farm income, non-dairy farm income and/or non-farm income. As a farm family relies more on dairy farm income, they are subject more to the economic forces of the dairy industry" (Galton and Knoblauch, 1996).

Paraphrased, and in the context of the narrower focus of the present topic... For dairy farm producers to increase competitiveness and profitability they must optimize marketability of cull cattle (surplus cows/bulls) and bull calves, so long as such optimization does not negatively impact on income received from sale of fluid milk and/or breeding stock. Be assured that the caveat, in the latter half of the previous sentence, must not be trivialized. Because the relative proportion of dairy farm income that comes from the sale of cull cows/bulls and bull calves is small, essentially no selection pressure and no change in husbandry or management would be warranted if there was concurrent or concomitant lessening of capacity to produce milk or to produce valuable stock for herd replacement or sale.

Gardner et al. (1994) cites a personal communication with Dr. Dennis R. Buege of University of Wisconsin-Madison in saying that "Holstein meats comprise approximately 15% of total beef consumption in the U.S." A

large part of that 15% would undoubtedly be lean beef from cull dairy cows/bulls that is used to manufacture ground beef and processed beef (like roasts for Arby's restaurants) but Smith et al. (1995) said that 4.8% of 1995 fed-beef supply was from dairy cattle (largely Holstein steers).

Optimizing The Value Of Surplus Cows/Bulls

Neither beef cattle producers nor dairy cattle producers spend lots of time thinking of ways to improve the merit of one of their most valuable byproducts-surplus cows and bulls-but they should. According to Cattle(Fax (1995), sale of cull cows and bulls for slaughter, depending upon the operation, represents 15 to 20% of farm/ranch revenues. And, with no need to spend money to do it, the value of surplus cows and bulls can be enhanced-marginally to markedly-just by paying attention...just by appropriately managing, monitoring and marketing surplus cattle.

Professors and graduate students at Colorado State University, in 1994, conducted a study-The National Non-Fed Beef Quality Audit-using dairy cattle and beef cattle checkoff funds that was designed to identify ways of enhancing value of surplus cows and bulls (Smith et al., 1994). The CSU scientists: (a) conducted Face-To-Face Interviews with industry leaders to identify and quantify "quality defects," (b) completed a National Audit At Packing Plants to quantify "quality defects" in the holding pens, on the slaughter floor and in the coolers, and (c) held a Strategy Workshop to identify strategies and tactics for improving quality, consistency and competitiveness of U.S. non-fed beef.

From the Face-To-Face Interviews it was determined that the Top Ten Defects Of Cull Cows And Bulls were: (1) Excessive Bruises, (2) Excessive Condemnation Rates, (3) Excessive Hot-Iron Brands, (4) Too Small Ribeyes In Cow Carcasses, (5) Inadequate Muscling In Cows, (6) Excessive External Fat, (7) Excessively Heavy Live Weights In Bulls, (8) Low Dressing Percentages, (9) Advanced Lameness, and (10) Too Frequent Disease.



Presented in Table 1 is the frequency of defects in live cattle at packing plants. The breakdown into categories of beef cattle vs. dairy cattle was for informative, not comparative, purposes.

Areas in which dairy cattle producers can make immediate progress to reduce quality defects include: dehorning; moving as many as possible of side and shoulder brands to the upper hip region; lessening scratches and cuts on the hide; and, getting cull cattle to market (auction or packing plant) before they become too skinny, emaciated or too lame.

Presented in Table 2 are economic costs for quality losses in non-fed cattle. The \$69.90, average loss due to quality defects for every cull cow/bull sent to harvest in 1994, represents a huge loss to the industry, as a whole, and to the production sector, specifically.

During the Strategy Workshop, ten strategies were identified as means for improving the quality, competitiveness and value of cull cows and bulls and the products they produce. Those strategies are: (1) Minimize Condemnations By Timely Marketing, (2) Accomplish End-Product Improvements, (3) Decrease Hide Damage, (4) Reduce Bruises, (5) Encourage Competitiveness And Accountability, (6) Assure Equity In Salvage Value By Equalizing Plant-To-Plant FSIS Inspection, (7) Ensure Beef Safety (especially its microbiological safety), (8) Prevent Chemical Residues And Injection-Site Lesions, (9) Enhance Price Discovery and (10) Encourage On-Farm Euthanasia Of Downer Animals And Animals With Advanced Cases Of Cancer Eye.

In summary, of the \$69.90 for every cull cow/bull harvested... catlepersons could recover:

Table 1: Frequency Of Defects In Live Cattle In Holding Pens At Packing Plants.

condition	incidence in:	
	beef	dairy
low muscling	37.4%	57.5%
low body condition	3.5%	4.6%
high body condition	8.6%	3.0%
severe cancer eye	1.6%	0.3%
moderate cancer eye	2.0%	0.0%
prolapse	1.2%	0.2%
udder/teat problems	5.0%	14.5%
sheath damage	10.2%	5.3%
knots/abscesses	5.8%	13.4%
horns	24.2%	11.9%
scratches/cuts on hides	26.3%	34.1%
insect damage on hides	7.8%	11.5%
side brands on hides	30.1%	4.8%
shldr/hip brands on hides	24.9%	13.6%
multiple brands on hides	27.9%	3.0%
downer cattle	0.9%	1.3%
stifled cattle	3.4%	5.8%
lumpy jaw	1.9%	0.6%

Table 2: Economic Costs For Quality Losses For Non-Fed Cattle.

Whole Cattle/Carcass Condemnation	\$11.99
Carcass Cooking & Parts Removed	2.16
Carcass Loss-"Zero Tolerance (FSIS)"	1.87
Condemnations of Edible Offal	3.99
Hide Loss; Brands/Scratches/Insects/Disease	6.92
Injection-Site Lesions	.66
Bruise Trim (Includes Primal Devaluation)	3.91
Disabled Cattle & Dark Cutters	.84
Yellow External Fat	2.27
Inadequate Muscling	14.43
Excess External Fat	17.74
Light Carcasses (Includes Primal Devaluation)	3.12
Total loss	\$69.90

\$14.60 by managing cattle, to minimize defects and quality deficiencies, \$27.65 by monitoring cattle, to ascertain their health and condition, and \$27.65 by marketing cull and surplus cattle in a timely manner. Additional information and a bulletin entitled "The National Non-Fed Beef Quality Audit; Special Section:Dairy Cattle" can be obtained by writing Dr. Gary L. Cowman or Michael T. Smith at National Cattlemen's Beef Association, P.O. Box 3316, Englewood, CO 80155).

Optimizing The Value Of Dairy Bull Calves

Dairy producers seldom feed, or retain ownership during the finishing of, the steers derived from their surplus bull calves but it should be of interest for them to know as much as is possible about the U.S. fed-beef supply. Professors and graduate students of Colorado State University, Texas A&M University and Okla-

homa State University, in 1995, conducted a study-The National Beef Quality Audit-using dairy cattle and beef cattle checkoff funds that was designed to identify ways of enhancing value of slaughter steers/heifers (Smith et al., 1995). The CSU/TAMU/OSU scientists (A) conducted Face-To-Face Interviews with industry leaders to identify and quantify "quality defects"; (b) completed a National Audit At Packing Plants to quantify "quality defects" on the slaughter floor and in the coolers; and (c) held a Strategy Workshop to identify strategies and tactics for improving the quality, consistency, competitiveness and market-share of U.S. fed beef.

From the Face-To-Face Interviews it was determined that the Top Ten Quality Concerns based upon the aggregated responses of purveyors, retailers and restaurateurs were:

- (1) Low Overall Uniformity and Consistency
- (2) Inadequate Tenderness
- (3) Low Overall Palatability
- (4) Excessive External Fat
- (5) Beef's Price Is Too High For The

Marketing Dairy Beef... (continued from page 7)

Value Received

- (6) Insufficient Flavor
- (7) Excessive Weights Of Cuts And Boxes Of Cuts
- (8) Inappropriate USDA Quality Grade Mix
- (9) Incidence Of Injection-Site Lesions Is Too High
- (10) Low Overall Cutability.

The Top Ten Quality Concerns of packers were:

- (1) Lack Of Uniformity And Predictability Of Live Cattle
- (2) Liver Condemnation Rate Is Too High
- (3) Too Frequent Hide Damage Due To Mud/Manure
- (4 tie) Too Frequent Bruise Damage
- (4 tie) Too Many Dark Cutters
- (4 tie) Excessive External Fat
- (7) Cattle Of Too Heavy Weight
- (8) Inadequate Marbling
- (9 tie) Too Frequent Hide Damage Due To Hot-Iron Brands
- (9 tie) Beef's Price Is Too High For Value Received.

Presented in Table 3 is the frequency of defects in live cattle on the slaughter floor and in the cooler.

Areas in which dairy cattle producers could have impact on reducing quality defects in fed-beef would include: if they brand bull calves, moving as many as possible of side and shoulder brands to the upper hip region; dehorning; and selecting against wildness in cattle (cattle with poor dispositions are much more likely to be "dark cutters" and to have "blood splash" in muscle than are docile cattle).

Presented in Table 4 is the ideal consist of fed-beef carcasses, by USDA Quality Grades, in order to meet present and future demands for domestic/export trades.

Steers of all of the dairy cattle breeds have excep-

Table 3: Frequency Of Defects On The Slaughter Floor And In The Cooler.

<u>defect</u>	<u>incidence</u>
Butt Brands	38.7%
Side/Shldr Brands	19.8%
Multiple Brands	6.2%
Excessive Mud	5.1%
Horns	32.2%
Bruises	48.4%
Liver Condemnations	22.2%
Tongue Condemnations	3.8%
B Maturity	4.3%
C/D/E Maturity	.6%
Traces Marbling	3.7%
Practically Devoid Marbling	.1%
U.S. Standard	4.6%
Dark Cutter (1/3, 2/3 disc)	2.4%
Dark Cutter (full disc)	.4%
Blood Splash	1.0%

tionally high propensity to deposit marbling. So to the extent possible, steers of the dairy breeds should be finished for slaughter at liveweights of 900 to 1,400 lb in order to provide beef of Prime and Upper 2/3 Choice.

Presented in Table 5 are economic costs for quality losses in fed cattle.

During the Strategy Workshop, eight strategies were identified as means for improving the quality, consistency, competitiveness and market-share of fed beef. Those strategies are:

- (1) Assist Producers With Use Of Selection And Management Techniques To Produce Cattle That Fit Customer Expectations For Marbling, Red Meat Yield And Weight.
- (2) Establish Close-Trimmed Beef (1/4-inch or less) As The Industry Standard.
- (3) Develop A Cattle Identification System That Facilitates Data Collection And Information Feedback, And Reduces Reliance On Hot-Iron Branding.
- (4) Encourage Development Of Cattle-Pricing Systems That Accurately Identify And Reward Production Of Cattle With Zero Defects.
- (5) Encourage Development Of Cattle-Pricing Systems That Identify, Categorize And Price Product Attributes That Affect Consumer Satisfaction.
- (6) Continue To Discover, Develop And Apply Technology To Enhance The Quality Of Beef.
- (7) Identify Breeding Systems That Optimize Production, Palatability And Profitability.
- (8) Identify Procedures To Facilitate Improved Customer Satisfaction And Loyalty To The Beef Eating Experience.

In summary, the quality losses per steer and heifer from the 1995 NBQA totaled \$137.82. Of this total, it was determined that 34.7% could be recovered by increasing Red Meat Yield (\$47.76), 27.8% could be recaptured by Enhancing

Table 4. Ideal Consist Of USDA Quality Grades.

	<u>actual</u> <u>1995</u> <u>NBQA</u> <u>consist</u>	<u>retailers</u>	<u>food</u> <u>service</u> <u>purveyors</u>	<u>exporters</u>	<u>packers</u>	<u>aggregate</u> <u>ideal</u> <u>consist</u>
Prime	1%	3%	6%	30%	6%	7%
Upper 2/3 Choice	11%	18%	19%	42%	25%	21%
Low Choice	36%	27%	43%	28%	38%	34%
Select	47%	52%	32%	0%	31%	38%
Standard (and lower)	5%	0%	0%	0%	0%	0%



Taste And Tenderness (\$38.30), 34.1% was recoverable by Improving Management (\$47.76), and 3.4% was recapturable by Controlling Weight \$4.66). Additional information and a bulletin entitled "The National Beef Quality Audit-1995" can be obtained by writing Dr. Jim Gibb at National Cattlemen's Beef Association, P.O. Box 3469, Englewood, CO 80155).

Improving Muscling And/Or Quality In Dairy Bull Calves

Gardner et al. (1994) reported that the majority of Holstein steers are sired by a limited number of genetic-related bulls; accordingly, meat from Holstein steers is highly consistent and acceptable in sensory attributes. It is presumed that the sires of steers of other dairy cattle breeds in the U.S. (Jersey, Guernsey, Ayrshire, Brown Swiss, Milking Shorthorn) are also closely genetically related. Finished steers of all of the dairy cattle breeds have high propensities to deposit marbling and all produce carcasses with high USDA Quality Grades. Likewise though, finished steers of all of the dairy cattle breeds have thin and flat muscles, high percentages of bone in the carcass and/or low muscle-to-bone ratios.

Gardner et al. (1994; 1995) compared aggressively implanted and calf-fed Holstein steers, normally implanted and calf-fed Holstein steers and normal-implanted and yearling-fed Holstein steers to determine effects of age-class and implant protocol on carcass desirability. Results were as follows:

- (1) Carcasses from aggressively implanted calf-fed steers were more mature, had the least marbling and had the highest incidence of dark-cutters.
- (2) Carcasses from normally implanted, calf-fed steers had the most marbling, the smallest ribeyes, the least desirable Yield Grades and the most trimmable fat.
- (3) Yearling-fed, normally implanted steers produced carcasses that had the largest ribeyes, the most desirable Yield Grades, and the least trimmable fat.
- (4) No significant difference in boxed beef, lean trim or bone yields due to age or implant were detected.

(5) In comparison to hotel/restaurant/institution carcasses from traditional beef breeds, carcasses from Holstein steers had less trimmable fat and lower boxed beef yields as well as much higher percentages of bone.

(6) No significant differences were noted in tenderness of ribeye, top sirloin butt or top round steaks although variability in tenderness tended to be highest for top sirloin butt and top round steaks from aggressively implanted, calf-fed steers. Additional information on this study and a bulletin can be obtained by writing Brett Gardner or Dr. Glen Dolezal at Oklahoma State University, Department of Animal Science, 104 Animal Science Building, Stillwater, OK 74078-6051.

Finally, a colleague of mine at Colorado State University, Dr. George Seidel, is getting very, very close to being able to separate sperm into gender groups. When that is accomplished and becomes commercially feasible, the dairy farm producer will have the option of breeding cows that are not worthy of producing replacement females to male-gender semen of a breed other than that of the dairy cow.

It will be interesting to see when such semen selection is possible which crosses will occur in greatest frequency. My guess is that dairypersons with Holstein cows will favor crosses with Angus, Japanese Black Wagyu, Limousin and Charolais. Of the latter four crosses, Holstein X Wagyu steers would yield the highest quality carcasses but they would lack muscling. Holstein x

Angus steers would yield high quality carcasses with desirable muscling and cutability – the best combination of characteristics – while Holstein X Limousin and Holstein X Charolais would produce Select grade carcasses with much more muscling than purebred Holstein steers. Crosses of Brown Swiss, Ayrshire and Milking Shorthorn cows with beef breeds would probably follow logic similar to that described for those with Holstein cows.

My guess is that dairyper-

Table 5: Economic Costs For Quality Losses For Fed Cattle.

Excess external, seam and trim fat	\$27.42
Inferior muscling	20.34
Inadequate palatability	7.64
Insufficient marbling	28.41
Too many hardboned carcasses	1.35
Too many bullocks	.90
Hide defects	24.30
Carcass pathology	.46
Offal condemnations	3.44
Injection sites	7.05
Bruises	4.03
Dark cutters	6.08
Grubs, blood-splash, yellow fat, calluses	1.74
Carcass weights <550 lbs. or >949 lbs.	4.66
Total loss	\$137.82

sons with Jersey or Guernsey cows will favor crosses with Angus, Limousin or Charolais. The problem with Jersey X Angus and Guernsey X Angus steers is that their carcasses would still be relatively small and not well-muscled; steers of Jersey or Guernsey crossed with Limousin or Charolais would be of moderate size, Choice in Quality Grade and very acceptable in muscling and cutability.

In conclusion, Smith (1995) said that for the beef industry and its products to be sold in domestic or foreign markets, the results of the National Beef Quality Audit, the National Non-Fed Beef Quality Audit, and the International Beef Quality Audit and the findings of appropriate position-papers, treatises and reviews have identified, as the primary inconsistencies in the quality of beef, (a) Insufficient Palatability, (b) Inadequate Marbling, (c) Problems With Color, Water-Loss and Shelflife of Beef Muscle, and (d) Production/Management Errors

Causing Blemishes, Bruises, Defects, Diseases and Condemnations. Beef from steers of dairy cattle breeds and crosses of dairy cattle with cattle of the beef breeds have much to offer in reducing inconsistencies in palatability, marbling and muscle color of beef. And, hopefully, dairy farm producers will take seriously their role in reducing errors in production and management of cull cows/bulls and of bull calves.

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The Outlook For Dairy Product Trade

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The Outlook For Dairy Product Trade

A good presentation would begin with a listing of "10 simple steps" the U.S. dairy industry must take to establish itself as the world's leading exporter of dairy products. Unfortunately, there are more than 10 steps, none will be easy and all are necessary. This paper outlines what steps are necessary, why they are important, and how to take them.

As recently as a few years ago, this paper would have been written much differently. The orientation of the dairy industry has changed, from a view of world markets as a "dumping" ground for products that could not be "disposed of" in the U.S. market to somewhat of a marketing orientation. Structural changes in the U.S. dairy industry have all greatly affected the outlook for world competitiveness. Important changes are productivity increases, reductions in cost of production, ongoing consolidation of industry, and a pronounced shift of production to the west and southwest where production costs are lowest.

Why Should Milk Producers Be Interested In Export Markets?

The simple answer is, you have no choice. You will soon be compelled to look overseas to find markets for dairy products if the U.S. industry is to grow.

The Federal Agricultural Improvement and Reform Act of 1996 bill phases down and terminates the dairy price support program after 1999. Absent federally-established price "floors", U.S. firms will have a much stronger incentive to find and build overseas markets. The earlier the U.S. begins to develop those markets, the more effective will be the efforts.

It is unlikely that the U.S. will succeed by trying to be the first supplier in many markets. The U.S. effort lagging behind the competition, by two generations, for example, in the case of the New Zealand Dairy Board, founded 1924.

And export tools that have been used successfully in the past to boost exports will be phased out. DEIP is fading away – the same DEIP that added about 50¢ per

cwt. to every producers' milk check in 1993.

Under the Uruguay Round (UR) GATT agreement, the U.S. must reduce the quantity of product exported with a subsidy and reduce the aggregate subsidy funding for DEIP bonuses every year through 2001. By the end of this decade, the U.S. will be able to export, using DEIP, only about two-thirds of the average export volume authorized for subsidy-impelled export in 1992-94. The limits are product specific and, for some products like whole milk powder, export subsidies will virtually disappear.

The implication is clear: firms in the U.S. must learn to export without subsidies, and begin exporting in earnest.

At the same time the U.S. is looking for overseas markets, the U.S. domestic market will also be a target for overseas competition. Under the UR GATT Agreement, the U.S. is obligated to provide increasing access to U.S. markets. Under the agreement, countries were required to convert all quotas or other non-tariff barriers to imports and further required to reduce those barriers by some 36% over six years, with a minimum reduction of 15% from 1986-88 levels. In addition, each country must provide, by the year 2000, a minimum access to its markets of at least 5% of estimated consumption.

This minimum access provision could result in a substantial increase in imports of dairy products into the U.S., most significantly, for cheese. Cheese imports will increase by as much as 20 million pounds, from a base level of about 245 million pounds. While this amount is small compared to the more than 3.1 billion pounds of American cheese produced in the U.S. each year (the cheese category where import competition is most likely to be felt), it represents about 13% of the total increase in at-home consumption achieved by producer-funded advertising expenditures in the 11-year period 1984-1996. In other words, the increased volume of imports adds to available supplies that essentially "displace" consumption of U.S.-produced cheese. To maintain the sup-



ply-demand balance that would prevail without imports, exports are necessary.

Aggressively exporting is a good strategy in any case – U.S. suppliers should find export opportunities attractive. Virtually every analysis of overseas markets reaches the same conclusion: Growth in consumption will take place as populations and incomes grow in overseas areas, primarily in Asia and Pacific nations. New Zealand, Australian, Ireland, and Argentina, collectively, are unlikely to be able expand production to meet the anticipated demand. And, as European subsidies are phased down, world prices will become increasingly attractive to US producers.

Where Are The Foreign Markets For Dairy Products?

Market demand for dairy products is increasing in many parts of the world. Prospects are especially good for exports to Asia and Mexico, while policy changes will be necessary to open up European and other western hemisphere countries, such as Canada.

Strong economic growth in Asian countries with large populations is boosting demand for many western foods, including dairy products, and Asia represents about one-third of world imports to emerging markets. Rapidly developing, high population, milk deficit countries such as China and India represent strong growth possibilities. However, market development efforts will be important because, in the past, these countries have preferred to forego dairy products rather than import products to cover shortfalls.

Japan is already the largest market for unsubsidized sales of U.S. dairy exports, ranking first for cheese, ice cream, whey products, and lactose. The "westernization" of the Japanese diet has made dairy products much more important, but consumption is still low by Western standards with more growth possible.

Dairy import growth in the rest of Asia – Taiwan, Hong Kong, Thailand, Malaysia and the Philippines – grew about 6 % per year in 1990-93. Import demand for cheese, butter, and whey grew at more than 10%.

Mexico is the largest export market for U.S. dairy products and export volume will grow further. Even with optimistic projections of increased milk production in Mexico, consumption growth will be even greater, spurred on by demographic factors: an estimated 50% of Mexico's 93 million people are less than 20 years old. As this market grows, it is vitally important for the U.S. to grow its exports, and the share of total supply in the Mexican market. There is no reason why the U.S. should not, as U.S. companies have advantages of physical proximity (and therefore short shipping times) and a con-

suming population familiar with U.S. foods.

What Stands In The Way?

A realistic assessment of the prospects for U.S. dairy exports helps to place the market opportunities and costs in perspective.

What limits the exports of U.S. dairy products? The limitations can be grouped into four areas: market access barriers; export subsidies paid by the European Union; internal pricing issues; and, a late start.

Market access barriers. Many major markets remain effectively closed to U.S. dairy exports because of high tariffs or less-than-full compliance with GATT/WTO rules. As one example, access to EU markets for U.S. dairy products continues to be almost zero, despite agreements to allow importation of at least minimum quantities because of unworkable import licensing requirements. Europe represents the largest, most attractive market for U.S. dairy products, but, absent a radical change in trade barriers, will remain closed.

Closer to home, Canada last year imposed new tariffs on dairy products – an action which is illegal under NAFTA. These tariffs, added after the UR GATT agreement eliminated Canadian import quotas, double or triple the cost of U.S. goods, effectively blocking U.S. exports. These tariffs cost U.S. milk producers access to a market of 29 million people, with the income and inclination to purchase dairy products. In dollar terms, the cost is some \$1 billion annually.

In 1996, a "NAFTA court", made up of academics, submitted its ruling on a dispute over dairy issues between the U.S. and Canada. Despite the expectations of most trade experts, both south and north of the border, that the U.S. would win, the panel ignored the iron-clad U.S. argument and ruled that Canada could maintain its illegal trade barriers. The result is not only detrimental to important U.S. industries – dairy and poultry – but it also calls into question the workability of the NAFTA dispute process. Harsher critics say the ruling proves that international panels cannot be impartial when the U.S. is a plaintiff, because international panels are siding against the major economic power, and with economic "under-dogs". If so, the scales of justice are rigged and need to be fixed.

Even with solid customers, trade barriers still limit sales. U.S. exporters are currently unable to sell nonfat dry milk, Mexico's leading dairy import, to any Mexican buyer other than the state trading enterprise CONASUPO, an organization roughly equivalent to USDA's Commodity Credit Corporation.

Subsidies and schemes. European subsidies continue to be a major distortion in world trade, despite ongoing

reductions negotiated during the UR talks. Under the UR GATT agreement, all agricultural export subsidies are quantified and limited. WTO member countries agreed to reduce both the volume of product subsidized and the funding allocated to export subsidies. In addition, no new subsidies can be instituted, nor can subsidy programs be extended to cover products not previously subsidized. The dollar value of EU subsidies dwarfs the funding level available from the U.S. Reduction in EU subsidies would be the single most beneficial change that would enhance export possibilities for the U.S. During a project last fall, USDEC and NMPF estimated that eliminating these EU subsidies would free up some \$750 million of market share (1994 dollars), which could represent more than \$1 billion of market opportunity by 1998. An increase in the general level of world prices would likely result and higher prices would discourage consumption somewhat, with the overall demand for the higher priced products may be less. Also, increased dairy production in importing nations could also be expected to increase.

However, expanding this estimate to represent all dairy import markets could mean as much as \$1.5 billion of new dairy exports. The U.S. could expect to benefit – and could be the primary beneficiary of the additional market for higher priced dairy products.

Unfortunately, the trade rules have been re-interpreted by the EU and others nations with an existing advantage in world markets. The benefits realized from trade have lagged significantly behind the benefits promised and it remains to be seen just how effective the export subsidy disciplines – the centerpiece accomplishment of the UR Agreement – will be.

Much work lies ahead to make the trading environment more receptive to U.S. marketing efforts.

Closing The Price Gap.

How much increase in world market prices would be necessary to make U.S. products competitive, at current U.S. market prices? Measuring competitiveness by relative cost of milk production, the U.S. should fare quite well. U.S. dairies are usually thought of as the third or fourth lowest cost producers in the world - behind the grass-based systems of New Zealand, Australia, and Ireland. Argentina is a major unknown, with ample capacity for production increases, but much more limited processing and distribution infrastructure. In short, cost per se should not be a limitation to expanding world-wide sales.

The gap varies by product, from about 30¢ per pound of cheese, about 20¢ per pound of nonfat dry milk, and about 35¢ per pound of butter. These differences in product prices translate into between \$2.45 to \$3.35 per cwt. [1] for milk used in cheddar cheese production, or for butter/powder. [2]

One of the interesting and important points to remember is that these gaps are not the result of the government support prices – market prices in the U.S. are well above support prices. U.S. prices are driven by consumer demand – what your customers are willing to pay for milk. An economic loss would occur if U.S. prices, across the entire domestic market, were adjusted downward solely to capture new markets abroad. In effect, U.S. consumers would be charged less than they are able and willing to pay for dairy products.

The U.S. Is Late Getting Started.

U.S. firms are behind international competitors in market development activity. For example, in January the New Zealand Dairy Board reportedly secured a major contract to supply mozzarella to Pizza Hut outlets in 30 countries, including the Middle East and five new markets in Asia. The new contract will give the NZDB about one-third of all cheese sales to Pizza Hut outlets outside the U.S.

Most other nations – our competitors – have a strong centralized effort to support dairy exports. The U.S. does not. However, a strong, focused effort can propel the U.S. dairy industry ahead during the five year "transition" period we face under GATT. The U.S. Dairy Export Council is one attempt, as discussed below.

What should the U.S. dairy industry – and milk producers – be doing to capture a share of the markets? What will it take to make the U.S. a major, reliable and profitable supplier of dairy products to world markets? Some changes will have to occur across the entire dairy industry. First, the overseas markets will have to be seen as integral to the overall marketing scheme of cooperatives and milk processors. To find and keep new customers in foreign countries will require commitment, creativity, adaptability, and a businesslike view toward world markets. Commitment because market development is an expensive long term process. The only thing that makes the process worthwhile is, there is no substitute. Creativity is necessary because the U.S. will be dealing with different customers, who want slightly different products, packaged differently. New sales strategies may be required. Adaptability will be important because no two



overseas markets will be the same.

Maintaining a businesslike view of export markets is important because, despite every effort, the U.S. will not be able to sell everything to everyone. The competition is tough and U.S. companies will not always be low-cost suppliers. Where the U.S. firms can be the low-cost suppliers, companies must demonstrate that they will be reliable – not in-and-out of the market, depending upon the U.S. supply situation. Where U.S. suppliers have an advantage – for example, in Mexico – all the resources of the industry and the U.S. government should be used to exploit it.

What Can You Do?

Quality maintenance efforts are crucial. Product quality issues and international food standards are important and will become more important. Increasingly, sanitary and phytosanitary standards will be a battleground for market penetration and perhaps even market share.

Quality assurance must be absolute. Reliable supplier of quality products. Treat overseas customers just like the best customers in the U.S.

Product quality is always a make-it-or-break-it issue for food companies. One bad customer experience will outweigh 10 positive experiences. International food standards will be important determinants of whether or not a product can enter a nation. In 1993, a process began to review, simplify, and harmonize all standards related to health and safety matters related to food. Ten of 50 existing international standards for dairy products have been revised through a complex, technical and arduous process. The other 40 are at various stages of review. In addition, food additives and food labeling standards will affect dairy products moving in international trade.

What is at stake? International food standards have been used in the past to restrict imports even more severely than the limitations imposed through tariff or quota barriers. With the UR Agreement, measures taken to protect human health and animal health must be based on scientific principles, and must not be maintained against available scientific evidence. Essentially, a standard must be created using sound science and cannot be enforced if it is not.

Which sounds great – until we recall that these international standards are created by committees. And committees are composed of people with points of view on how to help or hinder the export trade from their nation. The U.S. must work with these committees to accomplish at least two general goals: first, provide more real-

istic categorization of risk and biosecurity protections associated with animals and animal products entering the U.S. from high-risk areas, countries or "regions" of the world; second, assure international animal health standards and practices are harmonized so as to be equitable to U.S. dairy producers under/WTO and assure U.S. access to international markets.

A Few Recommendations:

You know best about how to manage your farm. Keep doing what you do best. Adopt the new cost saving technologies that come on line, pay attention to animal and financial management, explore ways to improve the quality of the milk you produce.

There are other actions you can take in the larger dairy community. For example, you might want to become an advocate at least two. The first is, push for a quality and animal health assurance program. The U.S. needs a program that can proactively address basic public and animal health concerns which potentially threaten the ability to market milk and dairy beef both domestically and internationally.

To make sure that consumers in the U.S., or anywhere in the world, never have a reason to doubt the safety or quality of dairy products produced in the U.S., a Total Quality Assurance protocol [3] should be developed, tested, and followed. The protocol should be effective in minimizing, and come as close as possible to preventing, the introduction of zoonotic diseases (for example, brucellosis and TB); in improving biosecurity and vaccination regimes to protect herd health; in reducing therapeutic costs, avoiding chemical and physical residues, minimizing risks from emerging pathogens and parasites. The protocol would drive use of cost-effective on-farm sanitation and milking practices with self-imposed monitoring and control, to meet Grade "A" Pasteurized Milk Ordinance requirements. It should utilize HACCP principles to permit independent monitoring outside of the current NCIMS rating program.

Other segments of animal agriculture are investing in total quality assurance programs using producer promotion ("check-off") funding. The dairy industry should be in the forefront of such efforts, not lagging behind.

The second action is, make sure your co-op is a member and its management is involved in the work of the U.S. Dairy Export Council (USDEC). USDEC, formed in 1996, works with all segments of the dairy industry to increase the volume and value of dairy exports from the U.S. It is a concentrated effort, funded mostly by milk

producers, to overcome many years of ignoring dairy export sales possibilities in foreign markets. USDEC has a mission to work with the U.S. dairy industry directly, to "play catch-up" in the area of foreign trade, where the U.S. is decades behind our foreign competitors in market development.

USDEC provides a broad range of services that will be increasingly important in the future - trade education, buyer contact and qualification, in-country assistance, including work to achieve or widen access to country markets. USDEC has a Washington, DC based staff and foreign offices in important export markets, such as Japan, Mexico and Korea.

USDEC is working with the National Milk Producers Federation to see that the U.S. dairy industry is well represented in international organizations where sanitary and phytosanitary standards can be set or adjusted to the advantage, or disadvantage, of the U.S. industry.

Conclusion:

Export trade development will be a long process, and the outcome of individual trade actions will always be somewhat uncertain.

The U.S. may have to take some short-term lumps in trade negotiations to win in longer term. For example, extending NAFTA to include Chile and Argentina without including of Brazil will probably not bring any benefit to the U.S. milk producer. The question for consideration is, can we keep our collective eyes on the prize - the long term benefits that accrue from fair trade - while many distractions and frustrations occur.

The U.S. and its trade partners have entered a new era with far-reaching agreements such as NAFTA and GATT. Increasingly, nations must rely on international dispute panels to resolve disagreements honestly if we are to avoid costly trade wars and reprisals.

The U.S. government must pay attention to the

proper implementation of the UR GATT agreement. We see an enormous amount of "back-sliding", that is, attempts to exclude agricultural trade from trade negotiations. The U.S. must be "hard nosed" and proactive. The World Trade Organization (WTO) disciplines are all that exist to work for expanded exports and, if the U.S. abides by those disciplines, so must all other nations.

The U.S. must be more diligent with respect to sanitary/phytosanitary issues, which means constant involvement and monitoring of international organizations such as Codex Alimentarius and the Office of International Epizootics. Without a history of involvement in the international markets, the U.S. has not paid sufficient attention to these important issues that will affect the future competitiveness of dairy farmers.

The U.S. must begin to work now for the next GATT round talks. The next round of talks will not cover as broad a front as the 1985-93 round. Agricultural issues are likely to stand alone and not be imbedded in a comprehensive GATT negotiation. During the talks, the U.S. negotiators should guard against "special treatment for agriculture" positions. The chief danger will be an attempt by major agricultural product importing nations of Asia (Japan, China, and South Korea) to exclude agriculture from the treaty. If they succeed, the potential growth of the U.S. dairy industry will be severely curtailed.

The U.S. must maximize activity use of permitted activities, such as Market Promotion Program funding and DEIP, for example, while preventing the European Union from circumventing limits on export subsidies.



Endnotes & Glossary:

[1] These estimates are based on a comparison made in early January 1997. The estimates are based a comparison of U.S. prices with reported Oceania prices. The following were used: Oceania prices of US\$2,100 to US\$2,300 per metric ton for cheddar cheese, compared to \$2821 per metric ton (\$1.28 per pound) at the National Cheese Exchange for 40 pound blocks; nonfat dry milk at US\$1,850 to \$1,950 per metric ton, compared to the Midwest price of \$2,435 per metric ton (\$1.105 per pound); and Oceania butter at US\$1,300 to US\$1,450 per metric ton, compared to Chicago Mercantile prices of \$1984 per metric ton (\$0.90 per pound). CCC yields and make allowances were used in all conversions of product value to milk prices.

[2] No adjustments were made to account for world butter containing 82% milkfat, compared to the CCC standard of 80 percent milkfat.

[3] Most ideas in this section were suggested by John Adams, Director, Milk Safety and Animal Health, National Milk Producers Federation,

who has been an advocate for a Total Quality Assurance Plan to safeguard the U.S. dairy industry.

Glossary:

CCC – Commodity Credit Corporation (U.S. Dept. of Agriculture)

DEIP – Dairy Export Incentive Program

EU – European Union

GATT – General Agreement on Trade and Tariffs

NAFTA – North American Free Trade Agreement

NZDB – New Zealand Dairy Board

USDA – U.S. Department of Agriculture

USDEC – U.S. Dairy Export Council

WTO – World Trade Organization

Notes

Notes

U.S. Cooperative Success Story:
**Sunsweet Sells The
World On Prunes**

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U.S. Cooperative Success Story: **Sunsweet Sells The World On Prunes**

I. INTRODUCTION: SUNSWEET GROWERS INC.

Formed in 1917

Number of members: 650 California prune growers

Headquarters: Yuba City, California

Other major location: Fleetwood, Pennsylvania

Crop Share: 55% or U.S.; 40% of world supply

Principle products: Pitted prunes, prune juice

Principle markets: U.S.; one-third of production is exported, primarily to European countries and Japan.

Market share: 70% of U.S. consumer market

Annual sales: \$225 million

II. STRATEGIES FOR SUCCESS IN GLOBAL MARKETS

A. Become the lowest cost processor

1. Invest in technology to improve efficiency and quality

2. Form a marketing agency in common to create more sales and distribution power at lower cost.

a. Sun-Diamond was formed in 1980 by three cooperatives: Sunsweet Growers, Diamond Walnut Growers, and Sun-Maid Growers of California. Each had the number-one brand position but saw a need to improve sales effectiveness and reduce costs by joining together for certain common needs.

B. Objectives:

1. Increase sales and market share.

2. Reduce sales and distribution costs.

3. Enhance political visibility and effectiveness.

b. Today's Sun-Diamond has five co-op partners.

d. Produce a product that commands premium pricing; invest in a brand.

e. Add value beyond the farm gate by ownership of pitting, processing, packaging, bottling, marketing, sales and distribution functions, thus eliminating the middleman.

Example: Bulk prunes are valued at \$1800 per ton. When those prunes are pitted, packaged, and sold under the Sunsweet label, that value is doubled for the Sunsweet prune grower.

III. SUNSWEET'S FUNDING TECHNIQUES

A. Normal retains: Sunsweet retains 7.5% of the grower's earnings for a 4-year cycle.

B. Retains and reserves from the profits of ancillary activities:

1. Co-packing: Bottling services for companies such as Ocean Spray and Snapple provide revenue and reduce fixed overhead.

2. Cogeneration: Reduces operating costs by producing steam as a byproduct from the production of electricity for the public utility company.

3. Sun-Land: Produces profits from the sale of non-member commodities and provides another source of retains.

4. Research and Development: Funded by a reserve program on a periodic basis from crop pools. The resulting new products such as flavored prunes provide new sources of profit. Our strategy is to introduce or acquire at least one new item per year in each major business area by consistently generating new concepts and reviewing old concepts.

C. Bank borrowing from conventional and cooperative lenders.

IV. BOARD AND MANAGEMENT STRUCTURES THAT WORK

The members, directors and managers of the cooperative form a circle:

Growers provide equity and elect board members.

Board chooses management and monitors their performance.

Management implements board policy and communicates back to members.

V. MEMBER COMMITMENT A KEY INGREDIENT

- The cooperative's mission is to maximize long-term economic returns of members in excess of independent packers.

- Sunsweet producers are committed to quality.



- The cooperative's strong performance, especially in recent history, has built a stable grower base. Membership is now closed, providing a more controlled, predictable supply of tonnage.
- An informed, responsive membership elects qualified representatives to lead the cooperative.

VI. CONCLUSION: SUNSWEET'S STRATEGY FOR SUCCESS INTO THE 21ST CENTURY

Through hard work and good fortune, Sunsweet has proven its ability to manage change through the better

part of the 20th century, and we now have in place a formal structure for viewing the future from a strategic position in order to continue to manage change. Though our five-year planning process, each year we focus on long-term planning for five years out. This year when the board meets for its strategic planning sessions, we will focus on the cooperative's needs in the year 2000. To the best of our ability, the 21st century will not take Sunsweet by surprise. We're enjoying success now and we're preparing ourselves for success into the 21st century!

Notes

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Replacement Heifers From Birth To Weaning

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Replacement Heifers From Birth To Weaning

The replacement enterprise is a pivotal component of most modern dairy farms. By providing a consistent and economical supply of high quality replacements to the lactating herd (or for sale to other herds), the replacement enterprise can be viewed as a profit (or loss) center for the dairy. This enterprise approach to calf rearing, which requires sound business and management decisions, can allow producers to evaluate the replacement enterprise and identify areas where the enterprise may be improved.

Calves are born with a predetermined genetic potential, which may be permanently affected by management decisions implemented throughout the rearing period and by environmental factors. A calf's genetic potential may be viewed as an upper limit that is expressed only if proper decisions are implemented at the appropriate time. Studies have shown that the level of management has a profound effect on calf morbidity and mortality (James et al., 1984; Curtis et al., 1985; Waltner-Toews et al., 1986a, 1986b; Jenny et al., 1981). Proper management of young stock, particularly during the neonatal period, can markedly reduce morbidity and mortality,

whereas improper management will lead to economic losses from increased cost of veterinary intervention, death losses, reduced growth, and suboptimal reproductive performance. In addition, poor management of young stock can reduce the lifetime productivity of the individual cow and the herd as a whole.

The most critical time in the life of the dairy replacement is during the first few days, when morbidity and mortality are greatest. A recent USDA study of farms throughout the U.S. with more than 30 cows (NAHMS, 1992) indicated that preweaning mortality of calves born alive was 8.4%, whereas mortality after weaning was only 2.2%. Clearly, the loss of calves prior to weaning is a major concern for all dairy producers.

Colostrum feeding

Regardless of the method of feeding colostrum, a key component to a successful calf management program is an adequate concentration of serum IgG. Because serum IgG concentration is so closely related to the calf's overall resistance to infectious agents (e.g., viruses, bacteria, parasites), it has been used as a measure of overall protection provided by the dam. Although the level of IgG that provides adequate protection will vary with the particular situation (pathogen load in the environment, stress, housing, feeding, etc.), a level of 10 g/L has been suggested as a reasonable goal for IgG in the serum of calves by about 24 hours of age. The condition of serum IgG 10 g/L is termed failure of passive transfer (FPT) and is associated with increased morbidity and mortality.

In the NAHMS study of U.S. dairy herds (NAHMS, 1992), 2,177 heifer calves (from 593 farms) were used to assess serum immunoglobulin (Ig) concentrations. Blood from these calves was sampled between 24 and 48 hours of age and serum was measured for immunoglobulin G (IgG), which comprises most of the Ig in blood. Serum IgG is responsible for most of the calf's resistance to disease and is obtained by consumption of colostrum

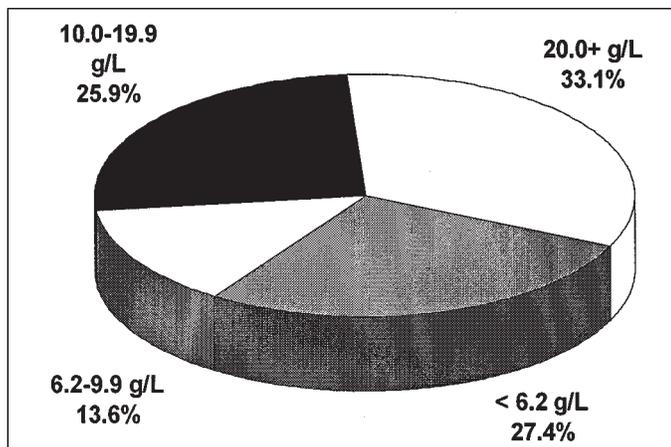


Figure 1



during the first 24 hours after birth.

Over 40% of all calves sampled had IgG concentrations below the recommended level of 10 g/L (Figure 1). Worse still, over 25% of calves were below 6.2 g/L, which put them at a much greater risk of disease than calves with higher IgG levels. Mortality rates of calves with serum IgG less than 10 g/L was over twice that of calves with higher IgG levels (Figure 2). Of course, many other factors contribute to calthood mortality, but this study indicated that over half of the death loss of calves with serum IgG levels less than 10 g/L (about 40% of dairy heifer calves) can be attributed to lack of IgG intake.

For many years, researchers, extension specialists and dairy professionals have recommended early feeding of a large amount of colostrum to provide Ig prior to closure of the small intestine. Recent research has indicated the continued importance of feeding colostrum and has further refined our understanding of the importance of colostrum to the young calf. Not only does colostrum provide vital Ig, but it also provides significant amounts of immune proteins and nutrients that support the calf during the first few days of life.

Allowing the calf to nurse the dam for one or more days has been shown to be an inadequate method of supplying colostrum in many research studies. Although many producers (>30%; NAHMS, 1992) allow their calves to suckle the dam, a considerable body of research indicates that many calves - up to 40% - may obtain insufficient Ig with this method of feeding. When calves suckle the dam, it is very difficult to know when the calf begins to nurse and how much colostrum it consumes. Calves having difficult births, and calves from heifers are at particular risk of FPT due to insufficient colostrum consumption. Further, calves often have a difficult time finding the teats of cows with large, pendulous udders, and may consume inadequate colostrum. Because of the high degree of FPT when calves are left to suckle the dam, most dairy professionals recommend separating calves from the dam and feeding colostrum by a nipple-bottle or esophageal feeder (if the calf will not consume enough colostrum by bottle).

Feeding calves by nipple bottles has two inherent advantages - it allows the producer to control the time at which calves are fed and allows the producer to control (at least partially) the amount fed to the calf. Feeding by nipple is the preferred method of feeding colostrum to calves. Most producers (64%) use nipple bottles to feed colostrum to calves

in the first 24 hours after birth.

The amount of colostrum to be fed by nipple bottle should depend on size of the calf, age at first feeding, quality of colostrum, and other factors. However, the mass of IgG in colostrum is the most important factor affecting successful transfer of immunity in calves (Bush and Staley, 1980). Traditionally, feeding of 2 liters (quarts) of colostrum at two feedings has been recommended. However, due to concerns about poor colostrum quality (low IgG concentration), many researchers and veterinarians now recommend 4 liters (quarts) at the first feeding (Besser et al., 1991). A recent producer guide (BAMN, 1994) suggested that if colostrum quality is estimated with a colostrometer, 2 quarts of good quality colostrum can be fed in each of two feedings; if quality is not determined, then 3 quarts of colostrum should be fed in the first feeding. Calves will generally consume 3 or more liters by nipple bottle when they are healthy and stand within about an hour of birth. However, if the producer desires to provide 4 liters (1 gallon) of colostrum to calves at the first feeding, an esophageal feeder may be necessary.

Use of an esophageal feeder is becoming an increasingly popular method of providing colostrum to calves. The esophageal feeder has several inherent advantages, including control of the time of colostrum feeding; control of the amount of colostrum fed; and the ability to force the calf to consume a known (usually large) amount of colostrum at the first feeding. Disadvantages of using the esophageal feeder include delivering the colostrum to the rumen and possibility of delivering colostrum into the lungs. About 2% of producers were regularly feeding colostrum by esophageal feeder in the U.S. in 1992 (NAHMS, 1992). However, many veteri-

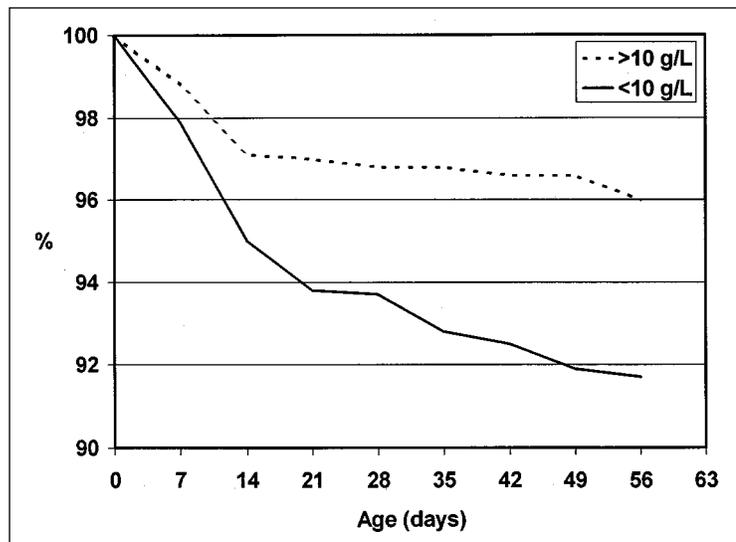


Figure 2

narians are recommending this practice, so the application is likely to become more prevalent.

Use of the esophageal feeder to feed large quantities of colostrum has been associated with lower apparent efficiency of IgG absorption (AEA) and slightly lower serum IgG concentration compared to feeding colostrum by nipple bottle (Lee et al., 1983). When colostrum is administered by esophageal feeder, the colostrum enters the rumen before moving into the abomasum and intestine (Lateur-Rowet and Breukink, 1983). It takes 2 to 4 hours for the colostrum to leave the rumen. This may actually be the reason for lower AEA, as the intestine matures during this time, reducing the number of actively absorbing cells in the intestine. However, many veterinarians recommend feeding four quarts of colostrum as soon as possible after birth, to ensure that all four quarts are consumed. Others (Adams et al., 1985; Molla, 1978) support the use of esophageal feeders to provide large amounts of colostrum without significant effect on serum IgG concentrations.

Use of the esophageal feeder is most useful when colostrum quality cannot be determined. Because it is not possible to determine with great precision the quality of colostrum, there is a risk that an insufficient mass of Ig will be provided to the calf in the first feeding. Additionally, the efficiency with which Ig are absorbed declines as the calf ages, so the first feeding may be the most important. Thus, the recommendation has been made to use a large first feeding (1 gallon) and not be concerned about significant consumption at a second feeding 12 hours later.

Colostrum Quality

The amount of IgG absorbed depends on the calf's ability to absorb IgG (efficiency of absorption) and the mass of IgG consumed. The mass of IgG consumed is a function of the quantity of IgG x the IgG concentration of the colostrum. The concentration of Ig in colostrum varies according to the cow's disease history, volume of colostrum produced, season of the year, breed, and other factors. Research from Washington (Pritchett et al., 1991) indicated the average concentration of IgG1 (a sub-fraction of IgG) in colostrum from 919 Holstein cows was 48.2 g/L with a range of 20 to >100 g/L. A Tennessee study (Quigley et al. 1994b) measured colostrum from 96 Jersey cows and found that samples averaged 66 g/L of IgG, with a range of 28 to 115 g/L. The difference between 20 and 100 g/L of IgG in colostrum can mean the difference between FPT and successful pas-

sive transfer.

The amount of Ig in colostrum depends on a large number of factors, including the disease history of the cow. That is, cows tend to produce Ig in response to pathogens to which they have been exposed. Therefore, cows exposed to a greater number of pathogens tend to produce colostrum with greater Ig than cows exposed to fewer pathogens. This is often why older cows will produce colostrum containing more Ig than younger cows. However, if older cows are not exposed to many pathogens, the colostrum produced may not have high levels of Ig. This is also why a good dry cow vaccination program can improve the quality of colostrum. Moreover, cattle raised on a farm will produce colostrum with antibodies specific for the organisms on that farm which is an added benefit. Finally, prepartum milking or leaking of milk from the udder prior to calving can reduce the concentration of Ig in colostrum.

Research has also indicated that the volume of colostrum produced will influence colostrum Ig concentration. In general, colostrum produced in large volumes will have lower Ig concentration than colostrum produced in smaller volumes. This is only a general rule, however, and the relationship between Ig concentration and volume is not constant.

Timing Of Colostrum Feeding

The time at which colostrum is first fed has a critical role in determining if the calf will acquire adequate passive immunity and whether it becomes ill. The timing of colostrum feeding is important for two reasons: loss of absorptive sites and bacterial colonization of the intestine.

As mentioned above, the maturation of the intestine begins shortly after birth. Current theories suggest that intestinal epithelial cells lose their ability to absorb macromolecules intact after about 24 hours due to maturation of the cells and development of the cellular digestive apparatus; however, this maturation begins shortly after birth. Rajala and Castrén (1995) reported a decline in serum IgG concentration of 2 g/L at 30 min after birth; regression of serum IgG concentration on age at first feeding in calves fed maternal colostrum (Abel and Quigley, 1993) also indicated a reduction of AEA within 1 hour of birth. Clearly, there is a compelling reason to feed calves as soon as possible after birth to maximize acquisition of passive immunity.

In addition to maturation of intestinal cells, the secretion of digestive enzymes in the abomasum and intes-



tine of the calf may also contribute to lower AEA by degrading IgG prior to absorption. At birth and for a limited period thereafter, the secretion of digestive enzymes remains limited to allow macromolecule such as IgG to escape digestion and allow absorption (Thivend et al., 1980). However, by about 12 hours, enzyme secretion becomes more marked, thereby reducing the ability of IgG molecules to reach the peripheral circulation.

The intestinal tract of the neonate is sterile at birth; however, within a few hours bacteria from the environment begin to colonize the intestine. This colonization can be hastened by an environment that promotes the growth of pathogens (ie., a dirty environment). If a calf is born into an environment containing large numbers of pathogenic bacteria, the chances of colonization by pathogenic bacteria is increased. This may lead to septicemia, leading to severe morbidity and, often, mortality. Further, James et al. (1981) reported that the presence of bacteria in the intestine may actually speed closure, thereby reducing the acquisition of passive immunity.

Logan et al. (1977) studied the effects of early colonization of pathogens on neonatal calves. Calves were fed colostrum and challenged with *E. coli*. The first group was fed colostrum, then challenged; group 2 were challenged, then fed colostrum. Nearly all calves in the second group became morbid, and about 75% of the group died. Conversely, calves fed colostrum prior to *E. coli* challenge did not become sick and none died. Quigley et al., (1994a) reported that calves removed from their dams at birth showed different temporal acquisition of enteric pathogens from birth to 35 days compared to those left with the dam for 24 hours. Clearly, the dam and the calving environment can contribute significantly to the amount and type of bacteria to which the calf is exposed shortly after birth.

Liquid Feeds For Preweaned Calves

Prior to rumen develop-

ment, the functional compartment of the calf's stomach is the abomasum. Milk, colostrum, or milk replacer feeding will bypass the rumen by closure of the esophageal (reticular) groove, causing the liquid to travel from the esophagus to the omasum and abomasum. Closure of the reticular groove occurs by a neural stimulation in response to feeding. Note that closure will occur when calves are fed from buckets or bottles, and whether the liquid is warm or cold. Also, water will not cause closure of the reticular groove, and enters the rumen when consumed.

Milk or milk replacer consumed by-passes the rumen; therefore, digestion of these liquids will occur in the abomasum (true stomach) and intestine. The site of digestion depends somewhat on the type of liquid. Whole and waste milk and colostrum will form a clot caused by the production of rennin in the abomasum. This acts to hold fat and casein in the abomasum, thereby slowing flow into the intestine. Most modern milk replacers contain little casein, so a clot will not form in the abomasum when milk replacers are fed. In most cases, this does not markedly affect digestibility or metabolizability of energy or protein.

Nutrient digestibility increases with age to about 3 weeks of age due to maturation of tissues secreting digestive enzymes. Calves 3 weeks of age are especially

Table 2: Typical ingredient and nutrient composition of milk replacers¹.

<u>ingredient, %</u>	<u>all-milk</u>	<u>soy isolate</u>	<u>soy protein concentrate</u>	<u>soy flour</u>	<u>animal plasma</u>
whey protein concentrate	44.5	7.0	9.2		41.4
delactosed whey	10.0	10.0	10.0	8.5	
dried whey	25.2	50.8	19.8	46.5	28.2
soy isolate		11.2			
soy protein concentrate			15.0		
soy flour				33.8	
animal plasma					7.5
fat	19	19.5	14.5	9.7	20.0
mineral/vitamin/amino acids	1.3	1.5	1.5	1.5	2.8
<u>Nutrient, %</u>					
protein	20.0	20.0	21.0	24.0	20.0
fat	20.0	20.0	15.0	10.0	20.0
fiber	0.15	0.15	0.5	1.0	0.15

¹: Composition of individual replacers may vary. Adapted from: Tomkins & Jaster, 1991; Quigley and Bernard, 1996.

susceptible to lower quality ingredients in milk replacer, although milk and milk ingredients in milk replacers are digested well.

Sources of liquids for calves prior to weaning include whole milk, waste milk, excess colostrum, and milk replacer. Most U.S. dairy producers use some combination of all of these sources. Whole milk is an excellent feed for calves prior to weaning, but is expensive compared to other sources of liquid feed. In most cases, whole milk is the most expensive source of liquid and, thus, is not the best liquid source for calves prior to weaning. However, whole milk contains more protein and energy than most milk replacers (Table 1), and is second only to excess colostrum in nutrient content. Anecdotal reports indicate that some producers have success in raising calves only when whole milk is used - this has been attributed to factor(s) inherent in the milk, such as Ig, protein, or other component. However, this may be more a function of level of management than some component of whole milk. The amount of whole milk to feed is approximately 10% of body weight, with consideration given to health of the calf and environmental conditions. Excessive milk feeding can lead to nutritional scours and delayed consumption of calf starter.

Milk replacers are an excellent option for feeding liquid calves prior to weaning. Milk replacers used in the U.S. are composed of whey and whey protein, fats and minerals and vitamins (Table 2). Some replacers utilize vegetable protein (soy, wheat, potato) or animal protein (fish, plasma, erythrocyte) to replace some or all of the milk protein from whey protein concentrate. Due to its high price, little skim milk is used in modern milk replacers. Milk replacers have been used successfully by many producers for many years - they are the feed of choice for most feeders of preweaned replacement as well as veal calves.

Composition of milk replacers will influence the performance of calves prior to weaning. Important factors include source and amount of protein and energy, vitamin and mineral supplementation, and inclusion of critical nutritional additives such as emulsifiers. Unfortunately, methods traditionally used to determine milk replacer quality are not useful with modern replacers used in the industry. For example, rennet coagulation was used as a method of determining the amount of casein in a milk replacer, and thus its "quality". However, few (if any) modern milk replacers contain casein (a component of skim milk), so none will form a rennet clot.

Table 1: Comparison of whole milk and selected milk replacers¹.

Item	Whole milk	20:20 All milk	22:15 SPC	22:20 All milk
DM, %	12.5	95.0	95.0	95.0
Protein, % of DM	26.4	21.1	23.2	23.2
Fat, % of DM	28.0	21.0	15.8	21.1
Crude fiber, % of DM	0.0	0.2	0.2	0.2
ME, Mcal/kg	4.9	4.5	4.2	4.5
Ca	0.95	0.8	0.8	0.8

¹: Composition of individual milk replacers may vary from data contained herein due to differences in ingredients and processing.

This does not mean that all replacers are poor quality. Whey proteins can support growth as well as casein protein. Another method of determining protein quality is crude fiber content. The crude fiber content of a milk replacer will indicate the relative amount of vegetable protein added to a milk replacer; it will not indicate whether that protein is digestible. Milk replacers can contain soy proteins that have been chemically modified to increase their digestibility and reduce the antigenicity of proteins such as glycinin and B-conglycinin and denature trypsin inhibitors. These milk replacers perform quite acceptably, and are usually available at a less expensive price compared to all-milk replacers. Furthermore, some vegetable protein sources (e.g., soy isolate) contain no crude fiber, and thus, measuring crude fiber will not necessarily indicate the presence of vegetable protein.

Determining milk replacer quality is best determined by animal performance. However, some factors that are related to performance include: 1) a reputable manufacturer; 2) analysis of replacer (protein and fat); 3) ingredients used; level of medication; and 5) other characteristics (Morrill, 1992). Milk replacers should not contain off-color materials, should mix quickly and evenly, and stay in solution. Method of preparation and feeding can influence performance of calves fed commercial milk replacers. Proper emulsification requires sufficient temperature - use warm, not cold water!

Excess colostrum is an excellent feed for young calves. It is high in DM and protein, and low in lactose. It may be stored refrigerated in small bulk tanks or refrigerators for several weeks. Due to its higher DM content, surplus colostrum may cause calves' feces to become somewhat "loose". However, this is not usually a significant problem, and can be alleviated by diluting the colostrum (3:1



or 4:1) with water. Recent research suggests that antibodies in surplus colostrum may contribute somewhat to intestinal immunity (Drew, 1994; Fowler et al., 1995), however, large-scale studies using surplus colostrum have not been completed.

Waste milk is that milk that is unsaleable due to mastitis or treatment with antibiotics. It is often considered a "free" source of liquid to feed to their calves. However, the opportunity cost of waste milk is significant – i.e., the value of that milk if it weren't waste. In most cases, it is more economical to reduce the production through management and/or culling and feed an alternative source of liquid. Several precautions should be followed when using waste milk: 1) do not use milk from the first milking after antibiotic treatment - this milk contains too much antibiotic and may lead to residue problems; 2) do not use milk that is excessively bloody or unusual in appearance; 3) do not feed waste milk to group housed calves; 4) do not use milk from cows infected with *Escherichia coli* or *Pasteurella*. Finally, do not feed waste milk to calves held for short periods (e.g., bull calves for sale). Antibiotics in waste milk can carry over in the animal's tissues resulting in significant antibiotic residues.

The amount of liquid (milk, colostrum, milk replacer) has often been associated with the amount of growth attained by calves prior to weaning. A closer evaluation of the amounts of energy and protein provided by liquids under current feeding programs indicates that this assumption is incorrect. Under most situations, milk or milk replacer feeding provides sufficient energy to support only a limited amount of body weight gain. Although the amount of gain supported by liquids depends on many factors (body weight of calf, climatic conditions, health of the calf, etc.), it will generally support less than 400 grams of body weight gain per day, and usually significantly less than 400 grams/day. Most body weight gain will be obtained by consumption of calf starter, not liquid feeds.

Effects Of Environment On Liquid Feeding

Because calves are fed for limited body weight gain from liquid feeds, the importance of the calf's environment becomes especially important. An amount of milk replacer that will support 250 grams of body weight gain in thermoneutral conditions will not support the same gain when the temperature is -30 degrees centigrade. Generally, when the temperature is below freezing, additional energy should be supplied. When feeding milk replacer, this can be achieved by increasing the amount of fat (e.g., increasing from 10% fat to 20% fat) or by increasing the amount of powder added to each bottle or bucket. When milk or colostrum is fed, added amounts are necessary. In addition, commercial fat supplements may be added to milk or milk replacer to increase the energy density.

Feeding equipment usually consist of nipple bottles, buckets, and nipple pails. Calves readily adapt to nipple bottles, and training calves to drink is much easier. Training calves to drink from a bucket is initially more difficult, but buckets are easier to clean, and research indicates that they generally result in lower mortality. Nipple buckets are most difficult to clean, and thus are a choice only when good management is involved. Calves fed from buckets (or from a nipple with an enlarged opening) will experience some spillage of liquid into the rumen. Sanitation of all equipment is critical to the health and growth of calves. Hot water and disinfecting solution are important to inhibit the growth of bacteria (milk is an excellent growth medium for bacteria) and reduce the spread of disease.

Recent developments in feeding methods include use of computerized milk replacer feeding systems (Quigley, 1996) and group ("mob") feeders. Computer milk replacer feeding systems have been used in Europe for a number of years, and have been used on some farms in the U.S. over the past few years. Basically, the computer system is similar to the ones used to feed grain to lactating dairy cows. Each calf is fitted with a transponder that uniquely identifies it to the computer. When the calf enters the feeding station, it is identified by the computer that controls the system. Each calf is allotted a fixed amount of milk or milk replacer in a 24-hour period. This is usually divided into eight meals, each of which can occur every three hours. If a calf hasn't eaten in the past three hours, it is allowed to eat. When allowed to eat, the computer will measure a pre-

Table 3: Composition of the ruminant stomach at various ages.

Compartment % of total	(age in weeks)						
	0	4	8	12	16	20-26	34-38
Reticulorumen	35	52	60	64	67	64	64
Omasum	13	12	13	14	18	22	25
Abomasum	49	36	27	22	15	14	11

Adapted from Church (1976).

determined amount of milk replacer powder into a mixing bowl. Warm water is added to the proper concentration (usually to make a 500 ml meal) and mixed thoroughly. The reconstituted milk replacer is then transferred to a feeding bowl, which is connected to the heavy duty nipple. Calves then drink the reconstituted milk replacer. If a calf enters the station before it is allowed another meal, the animal is allowed to nurse on the nipple, but no milk replacer is delivered. Usually calves are allotted eight 500 ml meals per day to make 4 liters. Evaluations of such systems indicate that they can be used successfully in many types of calf rearing programs; they are especially useful when labor is particularly expensive.

Mob feeders are a simpler approach to group feeding. A large barrel is fitted with several (5 or more) heavy duty nipples. Calves may be limit-fed milk or replacer from the mob feeder, or liquid may be available for ad libitum consumption. Calves fed ad libitum will consume markedly more milk replacer, thereby increasing costs. In some cases, milk replacer is acidified to reduce intake.

Weaning

When calves are weaned, the cost of rearing declines considerably. Whole milk or milk replacer is markedly more expensive than calf starter and hay, and labor associated with feeding liquids is reduced also. Thus, it makes economic sense to wean calves as soon as is reasonable. Traditionally, many researchers and extension professionals have recommended that calves be weaned at four weeks of age. It was argued that at this age, calves have sufficient ruminal development to allow them to obtain adequate nutrients from calf starter alone. However, according to the NAHMS (1992) study, only about 10% of producers wean calves at 4 weeks of age, indicating that producers have discounted this recommendation for their own reasons. An informal survey of veterinarians also raises question about early weaning – many veterinarians recommend weaning at 8 weeks or later.

There are other economic benefits to promoting ruminal development in addition to reduced feed costs. After weaning, calves are less susceptible to disease and gain more body weight with lower labor and management costs. Therefore, it is usually most economical to manage calves to promote early rumen development and wean calves as early as is feasible.

According to the NAHMS (1992) study of dairy calf management practices, most dairy producers use age of

the calf as the primary criterion for weaning. The most common age at weaning is 8 weeks (32.9% of producers), although a few (2.3%) wean at 3 weeks of age and others (21.4%) wean at 10 weeks of age or later. Some producers wean calves when calves starter intake reaches a predetermined level (usually 700,000 grams /day) or when calves reach a preselected body weight.

Stress at weaning is often exacerbated by performing other management tasks at the same time. Some of these include dehorning, moving the calf into group housing, change in diet (offering different starter and/or hay), removing extra teats, etc. All of these stresses should be minimized at weaning, and should be performed at other times to minimize that stress.

Dry Feeds And Rumen Development

At weaning, the calf is forced to undergo several dramatic changes. Consider the following: 1. the primary source of nutrients changes from liquid to solid 2. the amount of dry matter the calf receives is cut dramatically at weaning 3. the calf must adapt from a monogastric type of digestion to a ruminant type of fermentation and digestion 4. changes in housing and management often occur around weaning which can add to stress.

At birth, the rumen and reticulum are under-developed, sterile and nonfunctional. Liquid feeds are shunted past the reticulorumen by the esophageal groove. However, by the time the calf is weaned, the rumen is the primary compartment of the stomach. It has increased in size, metabolic activity, and blood flow to the rumen has increased. Prior to weaning, the primary source of nutrients is liquid. During the transition period, both liquid and solid feeds provide nutrients to the calf. After weaning, only solid feeds (starter and hay) are available. Before solid feed is consumed, the abomasum is the primary compartment of the stomach and both energy (glucose and fat) and protein are derived from dietary sources. However, by weaning, the rumen has become an important compartment of the stomach, and all feed consumed is exposed to bacterial fermentation prior to reaching the abomasum. A net result of this fermentation is a change in the type of energy and protein available to the calf.

Not only does the activity of the stomach compartments change, but the size of each compartment changes as well. The percent of the stomach as reticulo-rumen increases from a low of about 38% to a high of 67% by 16 weeks of age (Table 3). Note, however, that by 4 weeks of age, the reticulo-rumen has increased to



52% of the total stomach capacity. In contrast, the proportion of the stomach as abomasum declines from a high of 49% at birth to a low of 11% after 32 weeks of age. The absolute size of the abomasum does not decline - the reticulo-rumen simply grows at a much faster rate than the abomasum during ruminal development.

Factors Required For Rumen Development

There are five requirements for ruminal development. They are:

1. Establishment of bacteria in the rumen.
2. Liquid in the rumen.
3. Outflow of material from the rumen (muscular action).
4. Absorptive ability of the tissue.
5. Substrate.

A number of other metabolic changes occur during ruminal development in the rumen and other tissues, but we will consider the above requirements for the rumen to begin to function.

When the calf is first born, the rumen is sterile - there are no bacteria present. However, by one day of age, a large concentration of bacteria can be found which are mostly aerobic (or oxygen-using) bacteria. Thereafter, the numbers and types of bacteria change as dry feed intake occurs and the substrate available for fermentation changes. The change in bacterial numbers and types is almost always a function of intake of substrate (Lengemann and Allen, 1959). Prior to consumption of dry feeds, bacteria in the rumen exist by fermenting ingested hair, bedding, and milk that flows from the abomasum into the rumen. The substrate ingested will also affect the types of ruminal bacteria that flourish in the young rumen. For example, calves fed mostly hay develop a different flora from those fed mostly grain.

To ferment substrate (grain and hay), rumen bacteria must live in a water environment. Without sufficient water, bacteria cannot grow and ruminal development is slowed. Most of the water that enters the rumen comes from free water intake. If water is offered to calves from an early age, this is not usually a problem; unfortunately, many producers in the U.S. do not provide free water to their calves until calves reach 4 or more weeks of age. Offering water in the winter can be a significant challenge in Canada and the northern U.S. However, calves still need water, even when it is cold. Sometimes, it may be necessary to bring warm water at an additional feeding to ensure that calves have enough liquid water

available. Free water has been shown to increase rate of body weight gain and reduce scours (Kertz, 1984).

Milk or milk replacer does not constitute "free water". Milk or milk replacer will by-pass the rumen by closure of the esophageal (reticular) groove. Closure of the groove is a neural response to feeding. Free water does not stimulate closure of the groove, so water enters the rumen. Feeding water can increase body weight gain, starter intake, and reduce scours score.

Proper ruminal development requires that material entering the rumen must be able to leave it. Measures of ruminal activity include rumen contractions, rumen pressure, and regurgitation (cud chewing). At birth, the rumen has little muscular activity, and few rumen contractions can be measured. Similarly, no regurgitation occurs in the first week or so of life. With increasing intake of dry feed, rumen contractions begin. When calves are fed milk, hay, and grain from shortly after birth, rumen contractions can be measured as early as 3 weeks of age. However, when calves are fed only milk, rumen contractions may not be measurable for extended periods. Cud chewing has been observed as early as 7 days of age, and may not be related to ruminal development per se. However, calves will ruminate for increasing periods when dry feed (particularly hay) is fed.

The absorption of end-products of fermentation is an important criterion of ruminal development. The end-products of fermentation, particularly the volatile fatty acids (VFA; acetate, propionate, and butyrate) are absorbed into the rumen epithelium, where propionate and butyrate are metabolized in mature ruminants. Then, the VFA or end-products of metabolism (lactate and β -hydroxybutyrate) are transported to the blood for use as energy substrates. However, there is little or no absorption or metabolism of VFA in neonatal calves. Therefore, the rumen must develop this ability prior to weaning.

Many researchers have evaluated the effect of various compounds on the development of the epithelial tissue in relation to size and number of papillae and their ability to absorb and metabolize VFA. Results of these studies indicate that the primary stimulus to development of the epithelium are the VFA - particularly propionate and butyrate. Milk, hay, and grain added to the rumen are all fermented by the resident bacteria to these acids; therefore, they contribute VFA for epithelial development. Plastic sponges and inert particles - both added to the rumen to provide "scratch" - did not promote development of the epithelium. These objects could not

be fermented to VFA, and thus did not contribute any VFA to the rumen environment. Therefore, rumen development (defined as the development of the epithelium) is primarily controlled by chemical, not physical means. This is further support for the hypothesis that ruminal development is primarily driven by the availability of dry feed, but particularly starter, in the rumen.

Bacteria, liquid, rumen motility, and absorptive ability are established prior to rumen development, or develop rapidly when the calf begins to consume dry feed. Thus, the primary factor determining ruminal development is dry feed intake. To promote early rumen development and allow early weaning, the key factor is early consumption of a diet to promote growth of the ruminal epithelium and ruminal motility. Because grains provide fermentable carbohydrates that are fermented to propionate and butyrate, they are a good choice to ensure early rumen development. On the other hand, the structural carbohydrate of forages tend to be fermented to a greater extent to acetate, which is less stimulatory to ruminal development.

Effect Of Physical Form Of The Ration

For many years, producers have fed forage – primarily hay – to calves to promote ruminal development. The common reason was to give the calf the "scratch" needed to start development of the rumen. In fact, the development of rumen function is primarily chemical and is caused by VFA in the rumen. Providing forage has less of an effect on ruminal epithelial development, thus on activity and function. The concept of "scratch" to develop the rumen is a myth. However, forage is important to promote the growth of the muscular layer of the rumen and to maintain the health of the epithelium. Rumen papillae can grow too much in response to high levels of VFA – when this happens, they may clump together, reducing the surface area available for absorption. Also, some "scratch" is needed to keep the papillae free of layers of keratin, which can also inhibit VFA absorption. Therefore, hay should be part of the diet – after weaning. A good recommendation is to wean at 4 to 5 weeks of age and offer hay from 6 to 7 weeks of age. If calves are not weaned until 8 to 10 weeks of age, it may be a good idea to feed a limited amount of hay (500 grams/day) from about 6 weeks of age. However, the

amount of hay should be limited to ensure that calves will consume sufficient starter.

There are other reasons to limit the hay offered to preweaned calves. The first is voluntary intake. Most calves do not eat significant amounts of hay if grain is also offered. Therefore, producers feed calves the best quality hay available on the farm, only to have it turned into bedding. Most of the intake of hay occurs only after 6 to 7 weeks of age. This is a good time to put hay in front of calves. Another reason not to feed hay to calves prior to weaning is the energy requirement of young calves. Calves have a high energy requirement relative to their ability to consume dry feed. Therefore, if calves consume significant amounts of hay, their intake of other feeds (ie., starter) will be limited. This has the effect of reducing intake of starter, which can slow growth. Finally, most hay has too little energy for calves. The energy requirement for calves can usually be met only when calves are fed milk or high quality milk replacer, and/or excess colostrum and calf starter. Even good quality legume hay generally has too little energy to support growth of preweaned calves.

Summary

Raising calves from birth to weaning must be directed toward the acquisition of passive immunity through proper colostrum feeding, feeding liquids and calf starter to ensure a smooth transition from preruminant to ruminant digestion, and housing to minimize stress and spread of pathogens. With proper management, it is possible to minimize death loss of young calves (< 5% of calves born alive) and thereby improve profitability of the replacement enterprise.



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Notes

Management Considerations For Replacement Dairy Heifers

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Management Considerations For Replacement Dairy Heifers

Management of the dairy replacement enterprise can minimize cost to first calving, reduce competition for resources with the milking herd, and result in first lactation cows that meet herd production requirements for profitability. Key factors include replacement expense in producing milk, measurements of first lactation performance, rearing expense, feeding and growth management and contract considerations.

Replacement Expense In Producing 100 Lbs. Milk

A number of factors influence the cost per 100 lbs. of milk for replacements. To illustrate these factors I would like to use examples based on a 20,000 pound Holstein herd with a 25% herd replacement rate, springer price at \$1,200, and 1,400 pound dairy culls at 50¢ per pound. These values were entered into a dairy enterprise budget computer program to generate the data in Table 1. The market price for springer heifers in our example ranges from \$1,000 to \$1,400, and price for cull cows varies from 30 to 70¢ per pound.

These data clearly illustrate the impact of springer heifer and cull cow prices on the cost of producing 100 lbs. of milk. The present cost of 63¢ per 100 lbs. milk for replacements in our example is located under the current value for springers (\$1,200) and cull cows (50¢ per pound). Each \$100 increase in heifer market price increases milk production cost by 13¢ per 100 lbs., or \$26 per cow annually. Each 5 cent change in cull cow price impacts 100 lbs. milk cost by 9¢, or \$18 per cow annually. The best to worse scenario in prices for culls and springers makes differences in excess of \$1 per 100 lbs. of milk.

Replacement costs per 100 lbs. of milk decrease with increased production. Production and culling rate are plotted in Table 2. The current cost of 63¢ is found under the 25% replacement range and 20,000 pound milk level. In our example, each 1,000 pound change in milk production impacts cost by about 3¢ per 100 lbs., or \$6 per cow. Each 5% change in culling moves the cost per 100 lbs. of milk by 16¢, or \$32 per cow.

Market price for springer heifers, cull cow price, replacement rate range, and herd annual milk production greatly impact the cost of replacements in dairy herds. Producers who raise heifer calves for herd replacements may have an advantage in that cash outlays are less if their costs are below market value. However, the true cost to the enterprise is fair market value for the replacement at time of calving.

First Lactation Cows: What To Expect

First lactation cows contribute significantly to herd production and profits. Currently in the Western United States, approximately 36% of all DHI Holstein cows are milking in their first lactation. Genetics, age and weight at calving, growth management and early lactation management all contribute to the replacement's level of milk production. Peak daily milk yield during the first 90 days of lactation is an excellent indicator of lactation production, and a measure of the success of heifer growing programs. To evaluate peak yield differences, DHI herds were summarized into peak milk yield categories (Table 3). Currently 19% of the DHI Holstein herds in the Western United States exceed 80 lbs. peak yields on first lactation cows. There is little question that these 240 dairies have quality replacements entering the milking herd. Key decisions related to rate of growth and age and weight at calving, along with sound genetics, account for much of the differences in peak yields in these herds. These first lactation cows are also very persistent in production with a calculated 30-day change in fat-corrected-milk production less than 2.0 lbs.

Knowing the genetics in replacement heifers is a must for high milk production. In Table 3, herds with highest 1st lactation peak yields also have the highest average value for the sire's predicted transmitting ability (PTA) for milk production. In addition, high peak yield herds have a higher percent of 1st lactation cows with sire IDs. The number of herds with sire information decreased, along with the sire PTA milk pound, with lower peak yields.

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A Breakdown Of Costs In Growing Dairy Heifers

Table 1: Replacement Cost Based On Springer And Cull Cow Price.

cull cow price/lb.	(cost per head for replacements)				
	\$1,000	\$1,100	\$1,200	\$1,300	\$1,400
	replacement cost per cwt. of milk				
\$0.30	0.73	0.85	0.98	1.10	1.23
\$0.35	0.64	0.76	0.89	1.01	1.14
\$0.40	0.55	0.67	0.80	0.92	1.05
\$0.45	0.46	0.59	0.71	0.84	0.96
\$0.50	0.38	0.50	0.63	0.75	0.88
\$0.55	0.29	0.41	0.54	0.66	0.79
\$0.60	0.20	0.33	0.45	0.58	0.70
\$0.65	0.11	0.24	0.36	0.49	0.61
\$0.70	0.02	0.15	0.27	0.40	0.52



Costs in this discussion are based upon a 1,284-lb. Holstein replacement calving at 24.4 months of age. Total weight gain is 1,194 lbs., with an average gain of 1.61 lbs. per day for 742 days. Average cost is 96¢ per pound gain, \$1.54 per day, and \$1,145 over the entire period.

Feed amounts to \$719, or 63% of the total cost. Rations are based on alfalfa hay, corn silage and concentrates to achieve the required daily gain to reach calving weight by 24 months of age.

Fixed and several variable costs are lumped into a yardage category. Yardage was set at 75¢ per day during the liquid feeding period and 25¢ per day from weaning to first calving. Labor, drugs, repairs and ownership cost for facilities are included in yardage, which represents \$215, or 19% of the total cost. Labor would account for about 40% of yardage. Also, roughly half the labor required from birth to calving is associated with a 60-day liquid feeding period.

Interest charges of \$142, or 12% of the total cost, are the combined total for operating capital and the capital investment in the growing heifer. These substantial costs are often overlooked as expenses in producing the ready-to-calve replacement.

Death loss was set at 10%, with the highest mortality occurring in the early growing periods. In this example, 10% of the heifers were culled throughout the growing periods. Death loss and culling accounted for 4% of the total expenses in our example herd. Usually unthrifty heifers are sold prior to breeding or calving and then represent a loss. These losses, similar to death losses, are spread over the remaining heifers as an expense.

Breeding cost represents semen cost plus any additional breeding fees. The \$27 breeding expense is based on 1.8 services per conception and represents 2% of the total cost.

This distribution of costs is based on the total time from birth to first calving, and is a reasonable method of expressing costs if heifers are started as

calves and held until calving. However, in many dairy heifer growing operations, heifers are bought, grown and sold at many different weights and ages. Purchase weight and price and sale weight and price become major factors in determining both cost and possible profits. In these type of operations, costs incurred in selected growing periods can be used to further break down the costs and evaluate growing expense.

In Table 4, the number of days represent the time the animals remain in each growing period. These days can be set (such as the liquid feeding period) or variable, depending on gain and target weights at the end of the period. Average daily gain is a key factor in determining how long a heifer remains in the time periods, i.e. weaning to 400 lbs. and 400 lbs. to breeding weight. Low rates of gain extend the number of days in both of these periods. Likewise, increasing target breeding weight requires more days on feed.

Average daily gains range from a low of one pound during the liquid feeding period to 1.8 lbs. from 400 lbs. to breeding. Average gain over all periods is 1.61 lbs. per day. Total weight gains are based on these averages and the days in each period.

Accumulated values in the table include all costs plus \$130 for the initial value of the calf. Accumulated values per pound represent sell break-evens at the end of each period. Market values are rough estimates for

Table 2: Replacement Cost Based On Replacement Rate And Herd Annual Milk Production.

herd average	(replacement rate)				
	15%	20%	25%	30%	35%
	replacement cost per cwt. of milk				
16,000	0.47	0.63	0.78	0.94	1.09
17,000	0.44	0.59	0.74	0.88	1.03
18,000	0.42	0.56	0.69	0.83	0.97
19,000	0.39	0.53	0.66	0.79	0.92
20,000	0.38	0.50	0.63	0.75	0.88
21,000	0.36	0.48	0.60	0.71	0.83
22,000	0.34	0.45	0.57	0.68	0.80
23,000	0.33	0.43	0.54	0.65	0.76
24,000	0.31	0.42	0.52	0.63	0.73

Figure 1: Cost Breakdown

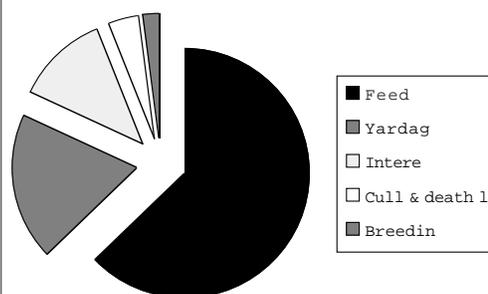


Table 3: Distribution Of DHI Holstein Herds In The Western U.S. By 1st Lactation Average Lbs. Peaked.

lbs. peak	avg. age (months)	% of herds	peak lbs. milk	30-day milk change (lbs.)	days to peak	extended 305d milk	sire PTA milk (lbs.)	% herds w/sire ID
80 and over	26.2	19	85.5	1.6	92	21,049	1,002	88
75 to 79	26.5	18	77.3	1.6	88	19,054	933	88
70 to 74	26.5	24	72.4	1.6	84	17,780	881	86
65 to 69	26.9	18	67.7	1.4	83	16,594	828	75
60 to 64	27.0	12	62.6	1.4	78	15,301	781	75
55 to 59	26.4	9	55.0	1.3	77	13,130	745	58
averages	26.6	100	72.1	1.5	85	17,684	887	81

Based on 1,386 Holstein herds in the Western U.S. with at least 25 first lactation cows, with records processed at DHI Computing Service. Data generated October 1996.

Replacement Dairy Heifers... (continued from page 37)

Holstein dairy heifers at the end of each period. Profit or loss is the difference in each period between accumulated values and these value estimates.

Age At First Calving

Age at first calving directly impacts cost to first calving. The number of days from birth to first calving impact time-related expenses like yardage and interest. Personal preference by the dairy operator will often influence decisions regarding age at first calving. However, 1,200 to 1,300 pound heifers are usually considered adequate, with this weight achieved by 23-25 months of age with reasonable growth rates. Production tends to increase with age, however, it is highly unlikely that additional milk income from heifers beyond 25 months will cover additional cost. Evaluations by the University of Idaho suggest no economic advantage of calving heifers prior to 22 months of age. Currently only a small percentage of the DHI Holstein herds in the Western U.S. have averages for age at first calving in categories below 25 months (Table 5). Over 50% of these herds fall into the range from 25-28 months on average age of first calving. Production data is included for each of the age categories. Little differences are apparent in peak yield, peak days, persistency and 305-day milk in categories greater than 24 months at calving. These data suggest opportunities exist in many herds to reduce age at first calving.

Weight At Breeding

Larger and/or older heifers cost more to produce. To produce

Table 4: Summary Of Birth To First Calving By Growing Period.

	growing periods				
	liquid feeding 60 days	weaning to 400 lbs.	400 lbs to breeding wt. of 790 lbs.	breeding wt. to 90 days pregnant	90 days pregnant to calving
number of days	60	156	217	115	194
gain per day, lbs.	1.0	1.6	1.8	1.6	1.6
total gain, lbs.	60	250	390	183	310
ending wt., lbs.	150	400	790	973	1,284
ending age, mos.	2.0	7.1	14.2	18.3	24.3
feed cost	\$54	\$123	\$190	\$120	\$232
feed cost/lb. of gain	89¢	49¢	49¢	65¢	75¢
non-feed cost	\$57	\$62	\$96	\$100	\$111
non-feed cost/lb. of gain	95¢	25¢	25¢	54¢	36¢
accumulated cost ¹					
per head	\$111	\$296	\$582	\$802	\$1,145
per lb. of body wt.	74¢	74¢	74¢	82¢	89¢
accumulated value ²					
per head	\$241	\$426	\$712	\$932	\$1,275
per lb. of body wt.	\$1.60	\$1.06	90¢	96¢	99¢
market value ³	\$200	\$400	\$700	\$800	\$1,200
profit (or loss)⁴	(\$41)	(\$26)	(\$12)	(\$132)	(\$75)

- ¹: Cost from beginning of period 1 to end of each period.
- ²: Total accumulated cost plus the beginning value of the heifer
- ³: Expected and/or current market value at the end of each period
- ⁴: Profit or loss is the difference between market value and accumulated value.

a larger heifer, breeding is usually delayed. This increases the growing cost prior to breeding. In addition to this cost, it requires more feed to carry the larger heifer from breeding to first calving. Cost estimates for delaying breeding are presented in Table 6. These estimates are based on least-cost rations formulated for the time periods between 750 and 950 lbs. and from breeding to calving. These are based on breeding weights of 750 lbs., 850 lbs. and 950 lbs. The average daily gains after breeding were considered to be the same. A 100 pound increase in breeding weight from 750 to 850 lbs. and from 850 to 950 lbs. adds a cost of \$87 and \$91, respectively. These costs can be related to first lactation milk yields. For example, to pay for the increased cost of \$87, another 725 lbs. of milk (at \$12) from the heifer is required during her first lactation. First lactation break-even milk increases generated for this example and others are summarized in Table 7.

Larger heifers at calving do produce more milk. The relationship between weight at first calving and lactation yield has been investigated in several extensive field studies and research trials. A study including 618,366 Holstein heifers demonstrates the relationship between

Table 5: Average Age At First Calving For DHI Holstein Heifers In The Western U.S.

months at calving	avg. age	% of herds	peak lbs. milk	30-day milk change (lbs.)	days to peak	extended 305d milk
<24	22.7	2	74	1.2	92	18,113
24	24.6	14	73	1.4	88	17,982
25	25.4	21	74	1.5	87	18,178
26	26.4	20	72	1.8	84	17,616
27	27.4	15	72	1.6	84	17,368
28	28.4	10	70	1.6	82	17,036
29	29.4	7	70	1.6	80	16,932
>30	31.6	11	69	1.5	78	16,563
total	27.0	100	72	1.5	84	17,590

Based on 1,386 Holstein herds in the Western U.S. with at least 25 first lactation cows, with records processed at DHI Computing Service. Data generated October 1996.



weight after calving (first DHI test date after calving) and first lactation. Records were adjusted for age and month of calving. These data show that the weight at freshening has more influence on milk produced than month and age at calving. Production increases substantially until the 1,250 pound point, with smaller increases with each 50 pound change in calving weight above this level.

Herd owners in colder climates often time the breeding of replacement heifers to prevent winter calvings. This non-calving period may range from two to four months. To offset extra costs associated with the delayed breeding, adequate growth rates are essential during this period to ensure higher production from larger size at calving in addition to older heifers at calving. The additional milk from these heifers will help to recapture costs. Producing an older but not larger heifer in this situation reduces the likelihood that extra milk will cover the extra cost. An alternative to delayed breeding is to early breed a portion of the heifers to calve prior to the winter non-calving period. This could be especially effective if the heifers selected for early breeding could be fed for slightly higher gains after puberty. Producers might elect to calve some heifers two months earlier and the remainder two months older than the standard for their management program.

Most would agree that dairy heifers are important to the milking herd. I think we could also agree that adequate growth rates are critical to the production of a quality, low cost springer for herd replacement. We may not be able to reach an agreement on the size and age of this heifer. Economics based on current information still must be the deciding factor. In all heifer rearing programs, there is a point at which the added cost for larger, older heifers is not recaptured in milk sales once the heifer enters the herd. I have tried to demonstrate this relationship by expressing added cost to break-even milk increases in the first lactation. Few herd owners

Figure 2: Action Plan For Feeding And Growth Management

1. Establish a target age, weight or stature at breeding and calving for heifers.
2. Follow growing period breakdowns: liquid feeding; weaning to 400 lbs.; 400 lbs. to breeding; breeding to 90 days pregnant; and breeding to calving.
3. Based on selected target age, weight or stature at calving, set intermediate growth goals for the time periods. Consider age, weight, average daily gain, body condition and stature growth.
4. Determine roughage quality available to each of the growing periods. Allocate higher quality roughages to the younger age groups.
5. Supplement roughages as required with protein and energy to reach target growth requirements. Using least-cost ration computer programs to determine grain supplementation allows for least-cost formulation based upon individual feeds.
6. Monitor progress of each group using criteria outlined in step 3 above.
7. Track first lactation performance.

take the time or have the data to determine when this point is reached. Furthermore, most heifer programs lack any type of growth measurement to monitor performance through the critical periods prior to breeding. I am convinced the lack of significant improvement in the lowering of the average age at first calving is the lack of performance indicators from birth to first calving. If daily growth rates were reported along with the milk in the bulk tank, heifer performance would improve.

Feeding And Growth Management

Feeding is the main factor in producing an economical, adequate sized heifer at the time of calving. Replacement heifer growth rate directly impacts time related expense. Only two situations can exist in herds with heifers calving at ages above 25 months: growth rates are adequate and heifers are bred at weights well above recommended levels, or low rates of gain delay breeding until the breeding weight is reached.

The two time periods (weaning to 400 lbs. and 400 lbs. to breeding) are extremely important. Low growth rates (less than 1.5 lbs. average daily gain) during these periods delay age at breeding and age at first calving. Excessive rates of gain during these time periods may reduce future milk production and increase growing costs. In general, total growing costs increase with delays in breeding and advancing age at first calving.

Table 7: Milk Increase Required During First Lactation To Offset Higher Cost Of Replacement Heifers.

est. added cost (refer to Table 6)	increased breeding weight from:		
	750-850 lbs.	850-950 lbs.	750-950 lbs.
	\$87	\$91	\$179
at \$13.00/cwt.	669	700	1,377
at \$12.50/cwt.	725	758	1,492
at \$11.50/cwt.	757	791	1,556
at \$10.50/cwt.	829	867	1,705

Table 6: Added Cost Estimates For Dairy Heifer Breeding Weight Comparisons.

added cost	750-850 lbs.	850-950 lbs.	750-950 lbs.
feed for extra growth	\$54	\$57	\$111
feed during gestation	\$11	\$11	\$23
yardage for extra days	\$10	\$10	\$20
interest for extra days	\$12	\$13	\$25
total added cost	\$87	\$91	\$179

The time interval from breeding to calving is fixed by the length of the gestation period. Gains during this period (usually around 1.5-1.7 lbs.) usually depend on body condition at breeding and personal preference for body condition at calving.

It has been well established that the growing period prior to puberty is related to lactation performance. High rates of gain tend to reduce the amount of milk-producing mammary cells (parenchyma cells). Consequently, these heifers produce less milk in their first lactation and lifetime compared to herdmates with lower rates of gain. Researchers might argue on the upper level of average gain that contributes to reduced mammary growth. However, most agree it is an important consideration in growing replacement heifers. In monitoring performance prior to and near puberty, stature measurements in addition to daily weight gain should be considered. This is especially critical when gain exceeds 1.8 lbs. per day.

The use of body condition scoring might be the best alternative to tracking stature growth in each of the growing periods. Heifer body condition scoring has been used very successfully in California heifer growing operations, where heifers are targeted at a 2.5 body condition score through one year of age.

I strongly believe that many heifers are overfed and become too fat prior to first breeding. High quality roughages, especially corn silages, combined with high concentrate feed will often produce gains above two lbs. per day. These higher gains have not contributed to increased stature growth in trials at the University of Idaho. Heifers on these diets may be 50 lbs. heavier at breeding time, but not taller than same age heifers fed for lower average daily gains. In our dairy heifer feeding trials, differences in stature growth between treatments have not been apparent above 1.5 lbs. average daily gain. If feeding programs are designed to provide adequate nutrition during the feeding periods we discussed earlier, extremely high gain during any period should not be necessary. Our studies indicate that reaching calving weight (1,250 lbs.) in less than 23-25 months of age offers little, if any, economic advantage. Maximizing high quality forages with grain supplements fed sparingly will produce ready-to-calve replacements at the least possible cost. Ionophores can also be used to improve feed efficiency and reduce growing cost.

Contract Considerations For Dairy Replacements

Increasing herd production through improved genetics is the main reason to retain ownership in calves from the dairy herd. Contract rearing of dairy heifers can allow the dairy operator to focus resources on the milking herd while still maintaining a supply of quality replacements of known genetics. Effective agreements must be mutually beneficial to the herd owner and replacement grower. These agreements must also consider the basic fundamentals in producing well grown, low cost, correct body con-

dition ready-to-calve replacements. Contract agreements must be competitive with home grown cost. Agreements and/or conditions of the contract should optimize future production potential of a quality ready-to-calve replacement.

The cost summaries in Figure 1 and Table 4 (section on growing costs) reflect typical costs from birth to first calving and respective costs for the five growing periods. Agreements may be made to only transfer replacements to second parties for segments of the total growing period. These might include birth to weaning or more typically from around 400 lbs. to calving. The average cost per day and/or pound average daily gain differs greatly during the five growing periods summarized in Table 4. The liquid feeding period and breeding to calving period have the highest cost per day or per pound gain. Typically, the growing periods after weaning to breeding have low feed cost with efficient rates of gain.

Dairy calves. Labor expense increases with longer liquid feeding periods. Non-feed expense exceeds feed expense in the example cost summary in Table 4. Labor requirements during the liquid feeding period account for the majority of non-feed expense. This is directly related to the length of the liquid feeding period. Our example is based on 60 days. Substantial increases occur with liquid feeding periods of 90 and 120 days. Death loss is a main consideration in working out contract agreements for growing dairy calves.

Growing heifers. Starting weight and breeding weight are key considerations for growing heifer contracting. Heifers are often started on the dairy followed by contract growing. Usually these heifers are in the 400 pound range at the time of transfer. Feed intake increases and efficiency of gain decreases with body weight gains. Consequently, cost per day and cost per pound gain increase with size. The starting weight of contract heifers directly impacts the average cost to return of the ready-to-calve replacement. This calculated cost advantage with lighter starting weight has been documented in research feeding trials conducted by the University of Idaho. In these trials a steady increase in average cost occurred with increases in Holstein heifer starting weights.

Increasing the weight at breeding results in a corresponding increase in the weight of the ready-to-calve replacement. Replacement heifers that exceed 1,350-1,400 lbs. prior to calving are usually past 900 lbs. at breeding. Based on heat detection efficiency and service per conception, most heifers conceive about 25 days or 45 lbs. after going into breeding groups. This management decision results in only small increases in daily- and gain-based ration costs. However, total feed cost due to an increased number of days on feed (56 additional days on feed prior to breeding) results in much higher growing cost to the owner of the replacement. Total non-feed costs also increase with increased weight at breeding. These added costs for larger replacements were discussed in



the section on breeding weight (Tables 6 and 7).

An unlimited number of contract arrangements are being used to compensate the grower for rearing dairy heifers. Feeds, feeding, and facilities are usually provided by the grower for a set fee. Death losses, breeding fees, drugs, veterinary services, and transportation are often negotiated within general agreements based on gain, daily head charge or feed plus yardage. The bottom line to the replacement owner is "what is it going to cost?". The cost to the dairy owner is highly variable and will depend on the share of economic responsibility that is transferred to the grower. The following is a brief discussion of possible methods of establishing cost for replacement contracts.

Gain-based contracts. Many contracts for rearing dairy heifers are based on weight gain. A specified price is established for the total gain from receiving weight to the return weight prior to calving. Fees for breeding are often charged directly to the owner. The grower is usually expected to provide lockup breeding pens. Heat detection may be the responsibility of the grower or the AI technician provided by the replacement owner.

Advantages for contracting on a gain basis include a fixed cost over the feeding period and ease of calculations. Changes in feed price over the feeding period will not impact the cost to the replacement owner but will impact the grower. Gain-based agreements must take into account differences in the receiving weights of incoming replacements and breeding weight considerations. Some stepwise pricing schemes are being used to compensate for receiving weights; for example, a 2 cent increase in contract price for each 50 pound increment over 450 lbs. Since the cost per unit gain decreases with higher average daily gains, some conflicts can develop over the degree of body conditioning on replacements under gain-based contracts.

Daily charges per head. Contracts are also being based on a daily charge per head. Daily charge is determined for the feeding period. Receiving and breeding weights require consideration in this arrangement as with gain-based contracts. This provides easy monthly billing to the replacement owner and aids in cash flow planning. Rate of gain becomes less important to the grower. The replacement owner in this arrangement will usually specify expected rates of growth or performance. Feed costs per day increase with larger heifers. Likewise, starting weight of incoming replacements will impact average daily ration cost to calving to the grower. As with gain-based contracts, other expense items are negotiated. Contracts based on a daily charge per head are more common for starting dairy calves.

Feed plus yardage. Feed plus yardage is a common method to feed beef cattle on contract. Feeds at cost are charged to the cattle owner, with a daily yardage charge of 15-30¢ per head assessed to cover feeding, facilities and grower operating cost.

Gain is less important to the grower. Total costs for rearing replacements become more variable to the owner. Risk for major changes in feed price are shifted to the replacement owner. Feed plus yardage reduces any possible conflicts between the grower and replacement owner on rate of gain. Discussions are usually necessary to establish the items covered in the yardage charge (heat detection, veterinary and drugs, death loss, etc.).

Ration cost only. Ration cost includes feeds, feeding and other expenses normally considered yardage. Gain is not important to the grower unless minimum levels are set by mutual agreement between the owner and grower. The owner may have input into ration specifications and/or requirements. This method allows for monthly billing, however, exact billing amounts are less predictable. Cost for additional expenses are negotiated.

Option to purchase. Option to purchase contracts are also used to farm out replacements. The owner sells the calf or starter replacement heifer but reserves the right to buy the springer that results at current or a pre-determined price. The owner may retain a small partial interest in each animal that is transferred to the grower. This method transfers all growing cost to the grower (owner) of the replacement. Often major decisions, such as age and weight at breeding, are also made by the grower.

Summary. Contract rearing of replacement heifers can be good for both parties. It is an excellent way to market high quality roughage by the grower. For dairy calves, days on liquid feed and early calf mortality are key considerations. In growing cattle, receiving and breeding weights impact the average cost per day and per pound gain for the time on feed. Conflicts in rate of gain and body condition can occur on gain-based contracts. Contracts based on daily head charges and feeds plus yardage prevent this possible conflict.

Conclusion

Replacements represent a major expense in the cost of producing milk. The milk production performance of these replacements is critical since first lactation cows account for over 30% of all milking cows. Management decisions related to rate of growth, age and weight at breeding and calving, along with genetics, account for much of the first lactation milk production differences among herds. The bottom line for replacement programs is to produce a well-grown, ready-to-calve heifer at the lowest possible cost. In many operations, replacement management is an opportunity area to reduce costs and improve herd productivity and profits.

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Notes

Labor Management Considerations In Selecting Milking Parlor Type & Size

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Labor Management Considerations In Selecting Milking Parlor Type & Size

Typically, milking parlor performance has primarily been evaluated using time and motion studies. This procedure has also been used to evaluate the effect of different factors on milking parlor performance (pre-milking hygiene, level of milk production, parlor type, mechanization, type of construction).^(2, 3, 5) The information provided by these studies has been used to implement management procedures to improve parlor efficiency.

In recent years producers have shown interest in constructing larger milking parlors. double-50 parallel parlors and a double-40 herringbone parlor has been constructed. Some producers feel that operating one large parlor versus two smaller parlors simplifies the management of the milking center. However it does appear that the net parlor return over a 15 year period may favor constructing 2 smaller parlors versus one larger parlor.

(4, 6, 7, 8, 9, 10)

Although larger parlors are being constructed and operated little information has been published concerning the factors affecting parlor efficiency of large parlors or operator walking distance in different types and sizes of milking parlors. This paper will discuss how parlor size and type affect the pre-milking hygiene, milking routine, labor efficiency, and operator walking distance.

For discussion purpose in this paper pre-milking hygiene will be defined as attach, minimal or full. The definitions of the three different pre-milking hygiene procedures are listed below:

Attach = Attach milking units with no udder prep

Minimal = Strip or wipe and attach milking unit

Full = Strip, pre-dip, wipe and attach milking units

On average it will require 4-6 seconds to strip a cow,

4-5 seconds to pre-dip, 6-8 seconds to wipe and 8-10 seconds to attach the milking unit. Minimal pre-milking hygiene will require 14 sec/cow and a full pre-milking hygiene will require 25 sec/cow. The additional time needed for a full pre-milking hygiene is the time required for two additional passes by the cow to apply the pre-dip and to wipe it off. Published information would indicate that pre-dipping will reduce throughput (cows/hr) 10-20 percent.^(2, 3, 5) The total time required to prep 30 cows using a minimal versus full pre-milking hygiene will be 420 seconds (7 min) and 750 seconds (12.5 min) respectively. Table 1 lists the time required for minimal or full pre-milking hygiene, after cows have entered one side of a double-30 parlor.

As the number of operators increase the total time from when the cow is in the first stall until all units are on decreases. However, the time required to perform the pre-milking hygiene routine does not allow time for

Table 1: Time Required For Minimal Or Full Pre-Milking Hygiene On One Side, After The Cows Have Entered The Parlor (double-30)

<u>pre-milking hygiene</u>	<u>no. of operators</u>	<u>1st cow in all units (seconds)</u>
minimal (14 sec/cow)	2	210
	3	140
full (25 sec/cow)	2	375
	3	250
	4	188

the first cow to walk from the holding area In Table 2 the entrance time of the first cow and the walking distance to the first stall is presented for 19 parallel and herringbone parlors. In parallel milking parlors the time required for a cow to walk from the entrance gate to the first stall will increase from 23 seconds to 49 seconds as



the parlor size increases from a double-25 to a double-50. The significance of increasing the entry time is that the time from when the entrance gate is opened until all units are on a side increases as parlor length becomes longer.

If the goal is to have all units on a side in 4 minutes the turns per hour will be 4 for 2x milking, 5 for 3x milking and 6 for 4x milking. Managers of large parlors can calculate the time required for the first cow to enter and pre-milking hygiene per side using the formula listed as follows:

$$\frac{(\text{No. of Stalls Per Side} \times \text{Time Required for Pre-milking Hygiene}) + \text{First cow entry time}}{\text{Number Of Operators}}$$

Many times operators of parlors are put in difficult situations when the pre-milking hygiene is changed from minimal to full. Calculated below is an example for a double-40 milking parlor with 4 operators using a minimal or full pre-milking hygiene routine:

Minimal Pre-milking Hygiene:

$$\frac{(40 \times 14) + 34}{4} = 149 \text{ seconds} / 2 \text{ minutes } 29 \text{ seconds}$$

Table 2: Walking Time of Cows From Entrance Gate to First Stall^a

parlor type	cows /hour	no. of operators	pre-milk hygiene	milking frequency	stall length (inches)	walking distance to 1st stall (feet)	entrance time 1st cow (seconds)	range (seconds)
double-25 parallel	255	4	Full ^a	3x	28	58	23	17-49
double-25 parallel*	208	4	Full ^a	3x	28	58	29	16-57
double-28 herringbone	252	3	Min ^b	3x	45	105	39	29-94
double-30 parallel ^a	272	3	Full ^a	3x	27	68	25	19-51
double-30 parallel*	275	3	Min ^b	3x	28	70	33	26-53
double-30 parallel	285	3	Min ^b	3x	28	68	25	20-42
double-32 parallel	268	3	Full ^a	2x	27	72	28	23-51
double-35 parallel	352	3	Min ^b	3x	27	79	30	26-55
double-35 parallel	280	2.5	dip, strip no wipe	2x	28	82	31	27-59
double-40 herringbone	408	4	attach ^d	3x	38	127	51	44-121
double-40 herringbone	392	7	Full ^a	3x	38	127	47	27-81
double-40 parallel	491	4	Min ^b	4x	27	90	33	25-76
double-40 parallel	385	4	Full ^a	3x	29	93	34	27-69
double-45 parallel	395	5	Full ^a	3x	27	101	49	29-75
double-45 parallel	395	5	Full ^a	3x	27	101	40	36-81
double-45 parallel	399	5	Full ^a	3x	27	101	63	30-101
double-50 parallel	608	5	Min ^b	4x	27	112	42	37-71
double-50 parallel*	460	5	Full ^a	3x	28	117	49	39-61
double-50 parallel	610	5	Min ^b	4x	27	112	43	36-76

*: Cow identification at cow entry gate
a: Smith, Armstrong and Gamroth 1996
b: Strip, attach
c: Strip, pre-dip, wipe, attach
d: Attach units
e: No detachers

Table 3: Comparison of Milking Procedure in a Double-40 Herringbone Milking Parlor^a

Pre-milking Hygiene	Number of Operators	Cows/hr	cows per Operator Hr.	Operator Walking Distance (ft)/Cow	Total Walking Distance (ft)/Cow	Operator Walking Distance (ft)/Hr.	Operator Walking Distance miles/shift
Attach ^b	4	408	102	9	36	3684	4.9
Full ^c	7	392	56	9.5	66.5	3743	4.9

a: Smith & Armstrong 1996; stall width = 38 inches
b: Attach units with no udder prep
c: Strip, pre-dip, wipe, attach

Selecting Parlors... (continued from page 45)

Full Pre-milking Hygiene:

$$\frac{(40 \times 25) + 34}{4} = 259 \text{ seconds/4 minutes 19 seconds}$$

If the goal was to have all the units on a side 4 minutes after the first cow starts entering the parlor the operators would be put in an impossible situation when a full pre-milking hygiene routine was implemented. Producers can be satisfied with a reduction in the number of cows milked per hour or add additional operators to maintain the number of cows that were milked with a minimal pre-milking routine. In table 3 is an example of a double-40 herringbone in which the milking procedure was increased from attaching units (requires 9 sec/cow) to a full pre-milking routine (requires 25 sec/cow). Notice that to maintain throughput the number of operators was increased from 4 to 7. The negative affect is that labor efficiency was decreased from 102 to 56 cows/labor hour. It is crucial that producers wishing to construct large parlors realize the additional labor cost associated with implementing a full pre-milking routine. This information should not be interpreted that only a minimal pre-milking hygiene should be used. We would all agree that if your going to milk cows there will be times the pre-milking procedure is altered to improve or maintain udder health. Milking parlors should be designed and managed to include the possibility of using a full pre-milking routine.

Milking Routine

Typically 3 types of milking routines

(Batch, Territory, and Rotating) are used in large parlors. Batch milking occurs when both sides of the parlor are loaded at the same time. When all the cows have been milked on both sides, all the cows are released at the same time. Territory milking occurs when milkers are assigned a number of stalls to milk and they do not work as a team. For example in a double-20 with 2 operators, milker 1 would milk the first ten stalls and milker 2 would milk the ten stalls closest to the holding pen.

A rotating routine requires that the operators work as a team. For example (minimal routine, Double-20) when a cow enters the first stall the first milker will begin stripping cows and work towards the holding pen. The second milker would follow the first milker and attach units. Milking of the two sides of the parlor would be alternated. Batch or Territorial milking routines can reduce throughput (cows/hr) by 20-30 percent when compared to a rotating routine.^(3, 5)

In table 4 the performance of a double-16 and a double-50 parallel operated under different milking routines is presented. In the double-50, switching from a rotating to a territory milking routine reduced throughput (545 to 431 cows/hr), decreased labor efficiency (136 to 107 cows/operator/hr), and increased the time until all units

Table 4: Effect of Different Routines in Parallel Parlors.

parlor type	pre-milking hygiene	number of operators	cows per operator hr.	turns/hr.	cows/hr.	1st cow in (sec.)	1st cow on (min.)
Double-50P ^a	Rotating	4	136	5.45	545	46	4.01
	Territory	4	107	4.31	431	53	5.81
Double-16P ^b	Rotating	2	68	4.31	135	19	4.21
	Batch	2	52	3.24	104	18	4.19

a: Fritz Tumm data, Babson Bros. Co.

b: D. Armstrong, Univ. of Ariz.

Table 5: Operator Walking Distance in Auto-Tandem (side-opening) Milking Parlors^a

parlor type	number of operators	pre-milking hygiene	cows/hr	operator walking distance (ft)/cow	total walking distance (ft)/cow	operator walking distance (ft)/hour	operator walk dist. (miles) per 7-hr. shift
double-3	1	minimal ^b	58	66	66	3,828	5.1
double-4 (2X)	1	minimal ^b	53	46	46	2,332	3.1
double-5	1	minimal ^b	66	74	74	4,884	6.5
double-5	1	minimal ^b	65	76	76	4,940	6.5

a: Armstrong, Smith and Gamroth 1996

b: Strip or wipe and attach



are on (4.01-5.81 minutes). The throughput and labor efficiency is also reduced in the double-16 when the milking routine is changed from a territorial to a batch milking routine. A rotating milking routine will increase throughput and labor efficiency. However, operators must work as a team and not independently. As parlors become larger and the number of operators increase, training teams of operators may become more difficult.

Parlor Type

Operator walking distance for rotary, auto tandem, parallel and herringbone milking parlors was collected. The range of operator walking distances per hour and shift are listed as follows:

auto tandem	2,332-4,940	3.1-6.5
rotary	1,010-1,543	1.4-2.0
herringbone	2,154-3,684	2.9-4.9
parallel	2,500-3,251	3.3-4.3

Operator walking distances tended to be highest in auto tandem parlors and lowest in rotary parlors with 2 operators. The specific data for individual parlors is presented in tables 5-8. A comparison of walking distances of operators working in double-10 and 40 parallel and herringbone parlors is presented in table 9. Operator walking distance is 300-400 ft/hr less in double-10 and 40 parallels than herringbone parlors of the same size. The difference is equal to .4-.6 miles in a 7 hr shift. This difference can be explained by the length of the stalls (27 vs 38 inches). It is also very clear in table 9 that as

$\frac{\text{ft/hr/operator}}{\text{miles/7 hr shift}}$
 $\frac{\text{operator}}{\text{operator}}$

Table 6: Operator Walking Distance in Rotary Milking Parlors^a

parlor type	number of operators	pre-milking hygiene	cows/hr	operator walking distance (ft)/cow	total walking distance (ft)/cow	operator walking distance (ft)/hour	operator walk dist. (miles) per 7-hr. shift
22-stall (2X)	1	minimal ^b	92	17	17	1,543	2.0
40-stall (4X)	2	minimal ^b	203	6	12	1,276	1.7
48-stall (3X)	3	full ^c	192	5	15	1,010	1.4

a: Armstrong, Smith and Gamroth 1996

b: Strip, attach

c: Strip, pre-dip, wipe, attach

Table 7: Operator Walking Distance in Herringbone Milking Parlors^a

parlor type	number of operators	thruput cows/hr.	cows per operator hour	operator walking distance (ft)/cow	total walking distance (ft)/cow	operator walking distance (ft)/hour	operator walk dist. (miles) per 7-hr. shift
double-8	1	67	67	37	35	2,479	3.3
double-10	1	80	80	35	35	2,812	3.7
double-16 (2X) ^b	2	120	60	18	36	2,154	2.9
double-40 ^d	4	408	102	9	36	3,684 ^e	4.9
					aggressive operator	4,370	5.8
					non-aggressive operator	1,627	2.2

a: Armstrong, Smith and Gamroth 1996

b: Full pre-milking hygiene = strip, pre-dip, wipe and attach

d: Attach only, no udder prep

e: Average of aggressive and non-aggressive operator

Selecting Parlors... (continued from page 47)

parlor length is increased, operator walking distance increased 700-800 feet per hour in both parallel and herringbone parlors. This equals to a difference of 1.0-1.2 miles per 7 hour shift. Changing the milking routine in a double-40 herringbone and increasing the number of operators had little effect on operator walking distance but increased total walking distance per cow 31 feet.

Summary

As the length of milking parlors increases developing management techniques to maintain parlor efficiency will become more challenging. Managers of large parlors can maintain throughout when using a full pre-milking hygiene regimen by adding additional operators to compensate for the additional time required to pre-dip and wipe. The total time required to carry out a pre-milking routine can be calculated to estimate the number of operators that will be needed. In large milking parlors it is essential to train teams of milkers to use a rotating milk-

ing routine. As parlors become larger and the number of operators increases, training teams of milkers may become more difficult. Operator walking distance is the highest in auto-tandem milking parlors and lowest in rotary parlors. The walking distance in parallel parlors is 300-400 ft/hr less in parallel vs herringbone parlors. As the length of parallel & herringbone parlors increases the operator walking distance increases 700-800 ft/hr.

When planning to construct a large milking parlor, managers need to be aware of how entrance time of the first cow and using a full pre-milking hygiene will effect labor efficiency and parlor performance. Management can minimize those affects, however, training teams of skilled milkers will be essential. Milking facilities need to be sized to allow the use of a full pre-milking hygiene when needed to maintain or improve udder health.

Table 8: Operator Walking Distance in Parallel Milking Parlors^a

<u>parlor type</u>	<u>number of operators</u>	<u>thruput cows/hr.</u>	<u>cows per operator hour</u>	<u>operator walking distance (ft)/cow</u>	<u>total walking distance (ft)/cow</u>	<u>operator walking distance (ft)/hour</u>	<u>operator walk dist. (miles) per 7-hr. shift</u>
double-10	1	100	100	25	25	2,500	3.3
double-40	4	465	116	7	28	3,251	4.3
double-45 ^b	5	399	80	6.5	33	2,604	3.5
double-45 ^d	5	395	79	6.8	34	2,690	3.6

a: Armstrong, Smith and Gamroth 1996

b: Full pre-milking hygiene = strip, pre-dip, wipe and attach

Table 9: Comparison of Operator Walking Distance for Herringbone (H) & Parallel (P) Parlors^a

<u>parlor type</u>	<u>milking frequency</u>	<u>number of operators</u>	<u>thruput cows/hr.</u>	<u>cows per operator hour</u>	<u>operator walking distance (ft)/cow</u>	<u>total walking distance (ft)/cow</u>	<u>operator walking distance (ft)/hour</u>	<u>operator walk dist. (miles) per 7-hr. shift</u>
double-10 H	3X	1	80	80	35	35	2,812	3.7
double-10 P	3X	1	100	100	25	25	2,500	3.3
double-40 H ^b	3X	4	408	102	9	36	3,684	4.9
double-40 H ^c	3X	7	392	56	9.5	67	3,743	4.9
double-40 P	4X	4	465	116	7	28	3,251	4.3

a: Smith, Armstrong and Gamroth 1996

b: Pre-milking hygiene = attach units

c: Pre-milking hygiene = full (strip, dip, wipe & attach)



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Notes

Notes

A Producer's Experience With Freestalls

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A Producer's Experience With Freestalls

Over the past 10 years, the transition to freestall facilities in the dairy industry has greatly increased the profitability of many dairies perhaps none more so than dairies in the West. Once seen as a luxury for dairy producers, freestalls are now becoming a necessity as dairy size increases and land costs continue to rise. Freestalls can provide producers with a crucial edge in today's competitive environment. Properly designed and maintained freestalls will add to the profitability and efficiency of your dairy as they have our operations. Our freestall facilities have reduced cow stress, which has increased production, improved reproduction efficiency and overall herd health. Freestalls have also improved the productivity of our labor force.

We operate three Jersey dairies consisting of 2600 registered milking cows in California's Central Valley. During the past seven years, we have transitioned two of the dairies from dry lot housing to freestall facilities. Yosemite Jersey Dairy is a 1,300-cow dairy with freestalls for 90 percent of the milk cows. Clauss Dairy is a 700 cow facility which has been converted to freestalls over the past two years now housing 80 percent of the herd in freestalls. Sunwest Jersey Dairy is an older 650-cow dairy which was purchased in 1995 with no freestalls. Our climate and location were key factors in our decision to transition the facilities to freestalls. Winters are wet and muddy. Summers can be oppressively hot and dry with temperatures over 100 degrees Fahrenheit. Milk production and reproduction results dropped significantly during the peak winter and summer months. Mastitis was also a significant problem during these peak months. Another factor in our decision to convert to freestalls was land cost. We realized that in order to grow in an area with land costs at \$6,000-\$7,000 per acre we must make better use of our existing land. Freestalls provided an excellent way to comfortably house more cows per acre.

Although freestalls were not the only option, our experience with alternative housing methods brought us to the conclusion we needed to try something different.

We had tracked both labor and material costs for several years on our drylot housing, which during the winter months included temporary fencing in adjacent fields, straw to provide dry spaces in crowded loafing barns and almond shells to maintain lanes. A review of these costs alone justified the initial capital investment of freestall barns.

One the major reasons most dairy farmers choose not to incorporate freestalls as part of their operation is the high capital investment. Freestall facilities in our area can cost between \$500-\$600 per cow for barns, lanes, stanchions, and flush systems. Constructing a 120-cow freestall facility can cost \$70,000. However, a two pound per cow increase in milk production will more than pay for the facility in less than nine years. Our cost analysis is illustrated below.

We essentially manage all three dairies the same. All

Figure 1: Cost Analysis, 120-Cow Facility

120 cows @ \$580/cow = \$70,000
Lanes/Barn/Stanchions/Walls/Flush

Annual Debt Service Of \$\$\$ Borrowed:

@10% X 15 years = \$9,026.00
@10% X 10 years = \$11,100.72
@10% X 5 years = \$17,847.48

Payback Time Based Upon Milk Increase:

2 lbs/cow = \$12,264/year = 8 yrs 6 mos
3 lbs/cow = \$18,396/year = 4 yrs 10 mos
4 lbs/cow = \$24,528/year = 3 yrs 6 mos

feeding is centralized in one facility and cows at each dairy receive similar rations based on production groups. A computer software program with an interfaced scale module on the feed trucks provides us with accurate daily feed intakes and costs. Figure 2 illustrates how our experience with production at each dairy justified the freestall investment based on increased production and feed efficiency.



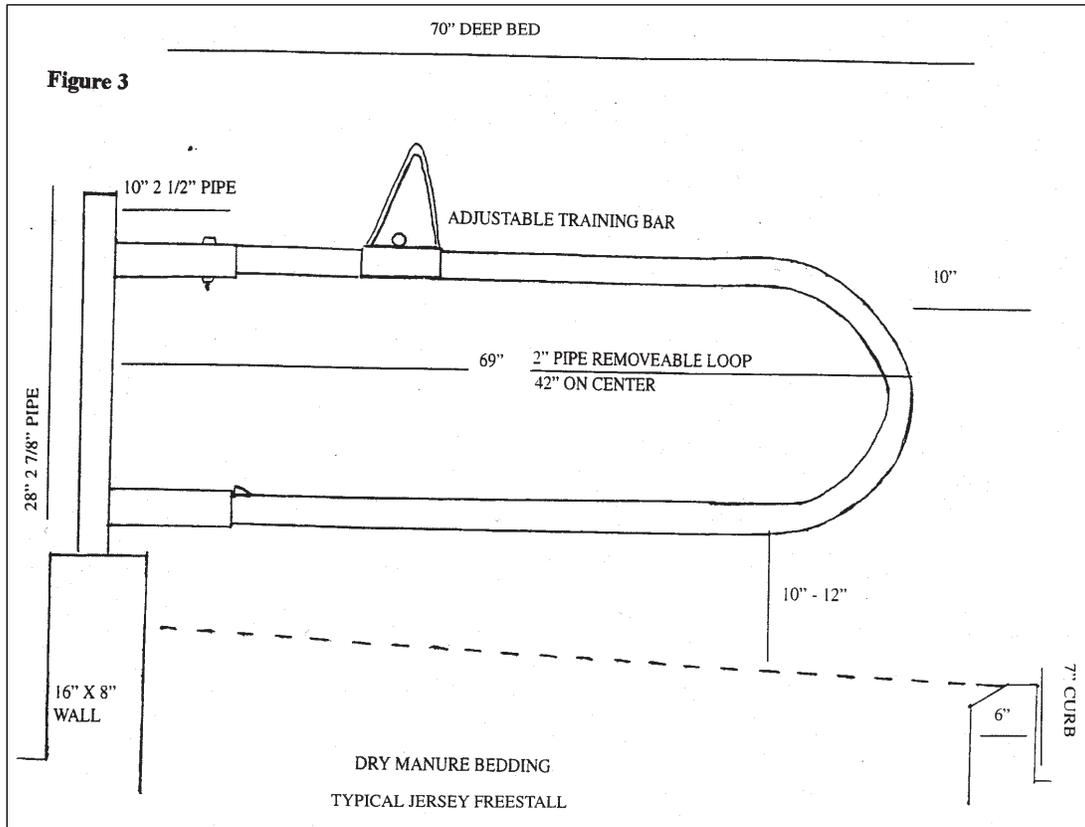
Figure 2

	avg. cows milked	percent freestalls	avg. lbs. milk per cow/day ¹	value @ \$14/cwt.	avg. daily feed cost ²	\$ over feed cost
Clauss Dairy Farms	580	80%	53.33	\$7.46	\$3.66	\$3.80
Yosemite Jersey Dairy	1,100	90%	54.00	\$7.56	\$3.66	\$3.90
Sunwest Jersey Dairy	510	0%	51.00	\$7.14	\$3.59	\$3.55

1: Daily bulk tank weights divided by cows milked 5/1/96-1/25/97.
 2: EZ Feed dairy reports 5/1/96-1/25/97.

Many dairy producers cite increased problems with feet and legs as another reason to avoid freestalls. Poorly designed freestalls can be a nightmare situation for cows. Cows will continue to stand or lie on the concrete rather than struggle to maneuver in and around a difficult stall. Proper design which allows cows just the right amount of space to get up and down comfortably is the first step to avoiding feet and leg problems. Our stalls are 40 inches wide, 70 inches deep and bedded with a 2 1/2-inch fall from head to tail. Loops are completely removable to provide for easy access to a downed cow. An adjustable training bar prevents cows from going too far forward in the stall and can be set for either cows or heifers. Figure 3 shows a cross section of our standard freestall.

A common stall dimension for Holsteins used in our area is 45 inches wide, 84 inches deep with a 78-inch loop. A grooved concrete surface provides the cows with good footing for traveling to and from the barn and feed mangers. We are also more likely to catch a cow showing standing heat on this type of surface. Rocks are routinely removed to prevent sore feet. Lanes are flushed twice daily with recycled lagoon water. We provide 1 inch per 20-foot fall on each lane. Our cows are kept locked in the freestall facility for 6 months during the wet winter. From April thru September cows have access to an exercise pen. They have access to this pen only during the evening. During the warm summer days we want them to be eating at the mangers or lying in the shade of the freestalls. Above the mangers we have a water



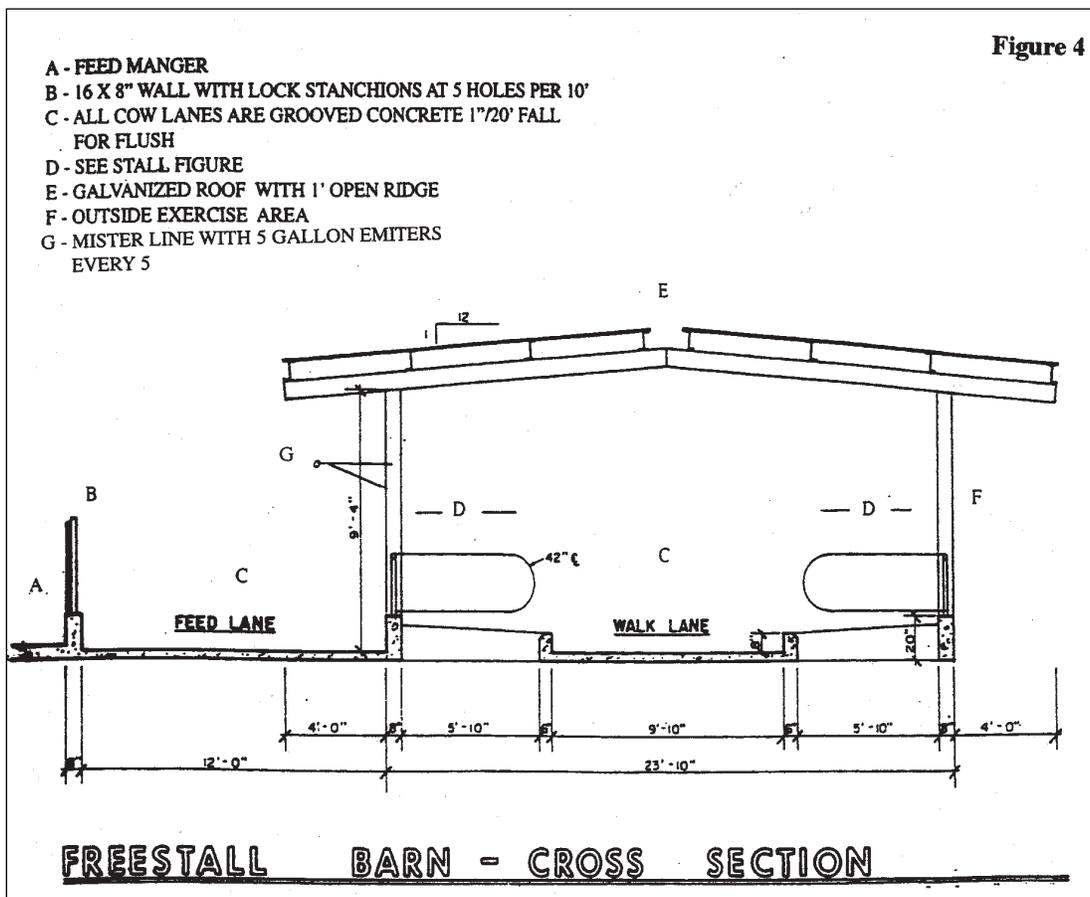
mist system which emits a continual cool mist providing relief for cows while they eat.

Concerns about maintenance are another reason many dairy producers choose not to invest in freestalls. 'Freestall' does not imply free of maintenance. A neglected freestall facility is virtually useless to you. Proper design and layout should allow room for maintenance equipment and cow traffic to and from the milking parlor. Through simple and religious maintenance practices, we are able to keep our freestalls in optimal condition for the cows. We spend an average of one man hour per 100 stalls per week. This is equivalent to 1/2 hour per year per stall on upkeep for our freestalls. Every three weeks freestalls are filled with dry manure that has been stockpiled during the summer months and allowed to go through a heat period to eliminate many mastitis causing bacteria. When the bedding is placed in the stalls it is 85 percent dry matter. By using our own dry manure for bedding there is no material cost for filling the freestalls. Each week we rake and fluff the stalls with an implement attached to the back of a tractor. This "fluffer"

breaks up any crust that might have formed as well as levels off the stall making it more comfortable for the cow to lie down. Occasionally we do need to repair broken loops. We always make these repairs as soon as possible to avoid cows digging holes between the stalls.

Freestalls need to be designed based on your specific location and weather conditions. Our barns are open sided with a 1-foot open ridge in the roof for good ventilation. Cows will choose not to lie down in a poorly ventilated environment. Roofs should be kept low as possible to prevent rainfall from entering the stalls but must be high enough to allow for maintenance equipment. Barns are positioned North to South to keep stalls dry as our weather systems come from these directions. Figure 4 outlines our typical freestall barn design.

Because of the different housing situations at each dairy, we are able to see on a daily basis the significant impact freestalls can have on a commercial dairy operation. Freestalls are integrated as part of our overall management plan. Within the next two years we plan to complete the transition to freestall facilities. Our freestalls



have reduced cow stress. Cows are able to convert feed more efficiently. Less of their energy is spent dealing with a challenging and changing environment. They have a dry comfortable and well ventilated environment in close proximity to feed and water. This has increased production significantly. Reduced cow stress has also improved our average days open, services per conception and overall reproductive efficiency. A cleaner and drier environment has also reduced mastitis and lowered our somatic cell count. This improvement has a direct economic effect on us as our processor pays 15¢/cwt. for milk with SCC below 200,000. These trends are noted in Figure 5.

Freestalls have benefited not only our cows but also our employees. Large numbers of cows can be housed in close proximity to the milking parlor reducing the amount of time spent bringing in cows to be milked. Cows come into the parlor cleaner from freestalls saving prep time for each milking. The herdsman is able to manage a larger group of cows in less time. We now use the lock stanchions for herd checks, vaccinations, BST and pen movements. We have also incorporated tail-chalking and breeding in the lock-stanchions as another time saving measure of our freestall facility.

Figure 5.

	<u>percent freestalls</u>	<u>average days open</u> ¹	<u>SCC</u> ²
Clauss Dairy Farms	80%	98	232,000
Yosemite Jersey Dairy	90%	102	182,000
Sunwest Jersey Dairy	0%	111	250,000

1: DHIA summary, 1/96-12/96.

2: Hillmar Cheese Co. weekly quality reports, 1/96-12/96.

Employees at the dairies with freestalls notice the significant improvement freestalls make on their daily routine.

Making the decision to invest in freestalls needs to include a well thought out plan for how freestalls will fit into your dairy operation. Producers need to examine all their areas of concern and determine how a freestall facility can be designed to address those issues for them. A profitable freestall facility hinges on the keys of proper location, design and maintenance. Incorporating these elements in your plan will make freestalls a successful investment for you.

Notes

Notes

Alternatives To Manure Management Problems

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Alternatives To Manure Management Problems

One of the least popular areas to discuss with dairy producers is manure management. Yet, herd expansions and survivability may well depend on adequate manure management. Large dairy herds translate to large amounts of manure nutrients to be managed in a timely basis. The definition of proper management will vary if identified by an operator, a neighbor, an environmentalist, or a regulatory staff person. Adequate manure management will minimize complaints associated with flies and odor. Also, it will minimize contamination of natural resources.

Manure management on large dairies must incorporate nutrient and solids collection, treatment, storage, and utilization. Management tools include dietary manipulation to reduce nutrient intake and/or improve nutrient utilization, relocation of manure off site, solid liquid separation, seasonal scraping instead of flushing, agronomic application of manure nutrients and reduction of imported bedding material. Site specific conditions must be considered to accomplish adequate manure management in a cost effective manner.

Reducing Excessive Nutrients

Often, and increase in herd size comes with no additional increase in crop land. Also, land is taken out of production to accommodate the new animals. The net result is much less crop land available for manure nutrient utilization. If large amounts of crop land were available before the expansion, the additional growth and reduction in crop land may not be a problem. A different scenario will exist if land was adequate or a bit short for manure nutrient utilization prior to the expansion.

Numerous creative techniques can reduce the quantity of manure nutrients that must be managed. The first is to reduce the amount of nutrients excreted. The second is to reduce the amount of excreted nutrients that need to be managed. Both of these alternatives will be discussed.

Dietary Manipulation

Much discussion has occurred during the last decade to utilize dietary manipulation to alter manure nutrients. If you don't put the nutrients in the front end of the ani-

mal, they can't come out the rear end of the animal. Dietary manipulation can be effective if nutrients are fed in excess of dietary needs. Plenty of data exist to indicate that dietary manipulation can reduce excretion of nitrogen (N) or phosphorus (P). Concerns related to excess N application are often associated with poor quality soils and shallow depth to groundwater (nitrate contamination) or fish kills in surface waters (high soluble ammonia). Phosphorus is usually carried in eroded soil and released in surface waters. Under normal conditions, P is usually in low concentrations in surface waters. The addition of P to surface waters can result in algal blooms and subsequent eutrophication of waters.

Dietary manipulation of nutrients can alter nutrient excretion (Tamminga, 1992; Wholt et al., 1991). Cows need a particular amount of a nutrient. The quantity needed depends on the cow's production level, age, stage of gestation, and body condition. Diets are formulated that provide the appropriate nutrients to cows assuming a given dry matter intake.

Formulating feed for cattle based on undegradable intake protein (UIP) and degradable intake protein (DIP) can be challenging. The need to have consistent feedstuff product quality and to be able to accomplish testing for UIP and DIP with a reliable test that has a quick turn around time are particularly important. Also, depending on local situations, a least cost diet may be one of higher protein content. Such circumstances would increase the cost of feeding diets with lower CP concentrations. Whole farm costs must be evaluated and not merely the cost of feed per unit milk produced. One must evaluate whole farm costs to include feed per unit production as well as nutrient management costs. It may be less expensive to minimize N excretion and potential ammonia volatilization than to increase costs associated with manure management to reduce ammonia volatilization.

Fecal and urinary losses of N can be minimized by feeding N relative to energy needs. Feeding of N to meet energy needs, and not as a source of N for protein synthesis, will result in excess excretion of N by the animal.



Further reductions in N excretion can result when rumen N and energy concentrations are synchronized; and by shifting the site of digestion of protein and starch from the rumen to the small intestine (Tamminga, 1992). Tomlinson et al. (1997) used data from a nutrition experiment to predict urinary and fecal excretions of N as:

$$\text{Urine N (g)} = 80.07 + .624*(\text{N intake grams}) - 11.32*(\text{DMI kg})$$

$$\text{Fecal N (g)} = 33.21 + .125*(\text{N intake grams}) + 4.877*(\text{DMI kg})$$

Milk yield was not included in these calculations, since dry matter intake was highly correlated to milk yield and milk yield was not significant. A summary of N utilization by animals is presented in Table 1.

Theoretically, increases in ruminal ammonia would increase absorption of ammonia across the rumen wall, and potentially increase circulating blood urea N. Urea clearance would be via kidneys and could explain the increases observed in urinary N excretion. Additionally, the increased circulating urea N concentrations could increase milk urea N concentrations.

The association relationship between milk urea nitrogen (MUN) and nitrogen utilization in the lactating dairy cows is unknown. However, some have suggested that it might be possible to use MUN to evaluate nutrition programs of lactating cows in regard to nitrogen metabolism (Baker et al., 1992; Ferguson, 1996). Reducing

nitrogen losses in the urine and feces from lactating cows would help to prevent environmental contamination (Anonymous, 1996; Baker et al., 1992; Nelson, 1995).

Milk urea N does offer potential as an indicator of dietary N utilization in regard to N excretion in milk and urine. However, it is unlikely that MUN will be used alone without additional parameters. Further research is required to define the parameters needed to use MUN as a monitor of N excretion by the lactating dairy cow.

The proportion of N excreted in urine and feces is receiving greater focus as a result of air quality concerns. As an example, diet A results in an excretion of 500 g of N/d and the N is excreted equally in feces and urine (250 g each). If diet B results in a reduction of N excretion by 10% and does not alter pathway of excretion, total excretion would be 450 g/d and the urinary component would be 225 g/d (a 10% reduction in urinary N). Diet C reduces N excretion by 5% but alters urinary N to contain only 40% of N excreted, for an excretion of 190 g/d (a 24% reduction in urinary N). Given that the predominant form of N in urine is urea and that this is readily cleaved to ammonia and potentially volatilized, diet C provides the greatest potential for reduced ammonia volatilization. Reduced ruminal ammonia concentrations should also reduce urinary N excretion. This may be accomplished by using UIP/DIP formulations instead of the traditional CP formulations.

Table 1: Summarization of nitrogen excretion studies.

source	animal (n)	body weight	N intake	Nmilk+ retained	N feces	N urine
Crooker et al 1990	calves (F 6)	104 kg	99		30*	
Cummins et al. 1982	cCalves (M 54)	110 kg	66.8	+20.1	29.2	17.7
Sechen et al. 1989	3.6 yr (6) 62d pp	603+52	585	171-1	172	241
		BST	579	189	170	213
Wohlt et al. 1991	multiparous (40) 21d pp	12% CP	387	144+30	136	77
		16% SBM	621	185+78	164	194
		16% FM	580	179+86	150	165
		16% CGM	515	155+39	156	165
Tyrrell et al. 1988	multiparous	588 C	429	136-21	145	164
		602 BST	410	144-35	142	155
Tomlinson et al. 1996	(34)	SBM		100+38	179	195
		BM		100+?	208	183
		FM			162	112
		12% CP		+16	158	99
		15% CP		+43	179	138
		18% CP		+55	199	228

*: fecal N excretion is total N excretion; pp=post partum; F=female; M=male; BST= bovine somatotropin; C=control; SBM=soybean meal; CGM=corn gluten meal; BM=blood meal; FM=fish meal; CP=crude protein.

Most locations in the west are not immediately concerned about P contamination. Certainly the possibility exists that over time the maximum P adsorption to soil will be reached. Environmental problems associated with P and surface waters have occurred in the Northeastern US (including the Chesapeake Bay Region) and in Florida dairies. In both areas, legislation was promulgated to reduce surface water contamination by P from dairy areas. Phosphorus is not found in its elemental form. It readily adsorbs to soil particles or other particulate matter, but can contaminate surface waters when soil or organic compounds are eroded.

The primary production concern related to P concentration is reproduction. Effects of P deficiency on efficiency of reproduction have been inconsistent. Observations from areas where soils were deficient in P indicated that there was reduced efficiency of reproduction due to frequent anestrus and reduced conception rates. In some cases, deficiency of P was confounded with poor quality and/or low quantity of feeds. This resulted in other nutrient deficiencies such as energy, protein, and minerals. Other researchers reported that reduced intake of dietary P did not alter reproductive performance.

As with N, P excretion can be minimized through balanced diets. First, it is important to realize that P bound to phytic acid is readily available to ruminants (Morse et al., 1992b). Second, it is recommended to feed adequate P. Current NRC recommendations are not being questioned at this time. Data from Morse et. al (1992a) indicated a potential reduction of P excretion by reducing intake. Reductions in amount of P fed will reduce P concentration in feces. This is beneficial to land receiving manures. When manure is applied to meet N requirements of plants, P and K are inevitably over applied and will build up in soil over time.

Relocation Of Manure

Housing design dictates manure collection and storage forms. Manure nutrients are collected in solid, semi-solid, slurry or liquid forms. Liquid forms of manure are utilized through irrigation techniques. Solid manures require field spreading. The more dry matter that is in manure, the greater the opportunity there is for manure to be hauled any great distance. Relocation of manure off of farms is one method to reduce the amount of manure and nutrients remaining for land application. Certainly, solid manure lends itself to be transported off farm much easier and less expensive than does liquid manure.

The amount of water in liquid manure makes it costly to transport any great distance. Densification of nutrients is required to allow more feasible transportation of liquid manures.

Efficiency Of Solid Liquid Separators

People are under the impression that many dairies use solid liquid separators. A 1995 survey in California indicated that 54.1% of dairies accomplished some type of solids separation with only 14.9% of dairies utilizing mechanical solid liquid separators (Meyer et al., 1997). Each operator must identify the objectives of having a separator on their property. Possible reasons include: reduce solids loading rate to the storage pond, reduce frequency of clean out of storage pond, allow exportation of solids (nutrients), improve the ease of handling liquid with standard pumping and piping equipment for irrigation, reduce odors and flies, reduce water use by recycling separated liquid as flush water, or reduce the need to purchase other solid materials for bedding (reuse solids as bedding). A separator can provide positive benefits in many of the above mentioned categories. The question an operator should ask is what is the primary reason for installing a separator and will the separator perform as needed?

Typically, separators are selected based on their initial cost, estimated operating and maintenance costs, management required to deal with solids (regular or intermittent solids removal), adequate capacity to handle peak manure flow, and location. The concept of efficiency of solids removal doesn't usually make the list. How well does the particular separator work? Unfortunately, few data are available to identify the efficiency of separation--especially with dilute (0.5 to 2.5% total solids) solutions.

Solid liquid separators have long been promoted as useful tools to remove solids from liquid waste streams. Few studies have evaluated the efficiency of solid liquid separators with dilute dairy manure. Most studies available in the literature report information on swine manure and on dairy manures with higher solids concentrations. Pain and Hephherd (1980) evaluated the benefits of mechanical separation in the United Kingdom. They utilized a roller press machine fitted with a screen with 1 mm diameter perforation. The influent material ranged between 3 and 14% total solids (dry matter). The solids removal efficiency ranged from 22 to 65%. A linear relationship existed between the 3 and 10% total solids and percent removal. The greater the input solids percent



the greater the removal. Extrapolation of their results to a more dilute solution would suggest an anticipated 10 to 20% removal of solids from a 1 to 3% influent solids material.

Auverman and Sweeten (1992) summarized results obtained from sampling

six different solid liquid separators during a South-west Dairy Field Day. Three influent and effluent samples were obtained from each separator. Influent samples ranged in total solids from 0.6 to 1.5%. The separator types were from Dairyland Automation, Innovative Resources, Agpro, Agkone, American Environmental Systems and Environmental Protection Technologies International. The percent reduction in total solids ranged from (-)12.0 to (+)19.4%. No data were reported for the Environmental Protection Technologies International separator.

Recently, research has been conducted on California dairies to evaluate the efficiency of solid liquid separators. Seven different separators were evaluated: two moderately inclined conveyor scrapers, two slightly inclined conveyor scrapers, and four stationary inclined screens. Between five and 15 paired influent and effluent samples were taken. Separator efficiency for removal of total solids from the influent stream ranged from 0 to 15.9%. The influent stream to most separators was flush-water on its way to a storage pond. The lower values were obtained from separators where water from a storage pond was used as the influent stream. All dairies used recycled wastewater for flushwater. The colored water component of the flush water (previously unfil-

tered solids) consisted of fine suspended solids. Samples from four of these dairies are being evaluated for particle size. The size of the particle will provide the greatest insight to the potential efficiency of the separator.

An Alternative Method

If the main goal of installing a separator is to reduce the solids loading rate to the storage pond, maybe an alternative method should be evaluated. Historically, flush systems were installed on dairies to reduce labor costs associated with scraping freestall and feed lanes. This was identified as the solution to labor costs. The ramifications of the solution to labor costs were an increase use of water and the subsequent need to store larger volumes of manured water. Although ponds may have been designed to hold the capacity of water, they may not have been designed to hold the additional total solids in the water. Also, increases in herd size may not have been coupled with increases in pond capacity to store additional total solids. An alternative method to reduce the amount of solids collected through the flush system is to discontinue flushing and revert to scraping of corrals. This need not occur during all months of the year.

A comparison of manure collection systems provides food for thought. For the sake of discussion, the following assumptions are used for a freestall facility where cows have access to corrals. Winter conditions exist for 4 months (no access to corrals). Two months exist in transition when cattle utilize corrals on the average of 8 hours daily. The remainder of the year (6 months) cattle use corrals 13 hours and freestalls 8 hours, daily. Cattle

Table 2: Calculation of annual manure collection based on daily manure deposition locations and manure collection systems.

season	nonths	milking	freestall	corral	no separator		separator	
					noscr	scrape	noscr	scrape
			-----hr/day-----		-----% solids collected-----			
separator efficiency assumed to be 15%								
winter	4	3	21	0	0.0	0.0	15.0	15.0
transition	2	3	13	8	33.3	33.3	43.3	43.3
summer	6	3	8	13	54.2	87.5	61.0	89.4
annual percent of manure solids collected					32.6	49.3	42.7	56.9
separator efficiency assumed to be 7.5%								
winter	4	3	21	0	0.0	0.0	7.5	7.5
transition	2	3	13	8	33.3	33.3	38.3	38.3
summer	6	3	8	13	54.2	87.5	57.6	88.4
annual percent of manure solids collected					32.6	49.3	37.7	53.1

spend 3 hours daily in the milking mode. This includes transportation to and from the parlor, time in the holding pen, and time in the parlor. Manure is distributed proportionally to where cattle spend their time. As an example, if 3 hours in 24 are spent in the milking mode, 12.5% ($3/24 \times 100$) of the manure occurs. All milking and freestall manures are collected through a flush system. Corral manure is scraped (collected as a solid). Estimations of the amount of solid manure collection are calculated for 1) no separator, no additional scraping; 2) with a separator that separates solids at 15% or 7.5% efficiency, no additional scraping; 3) no separator, summer scraping of freestalls instead of flushing; 4) with a separator that separates solids at 15% or 7.5% efficiency, summer scraping of freestalls instead of flushing (Table 2). The traditional corral scraped manure only, collects 32.6% of solid manure. Addition of a separator would improve the collection to 37.7 (separator efficiency of 7.5%) or 42.7% (separator efficiency of 15%). Scraping of freestall/feed alley lanes during 6 months of the year with no use of a separator would improve collection from 32.6 to 49.3%. An additional 3.8 or 7.6% can be recovered if a separator was used with the liquid portion of the scraped scenario. The differences are due to the efficiency of separation.

The economics associated with the various options must also consider available labor, equipment, storage capacity, farming practices, market for solids, water needs, and nutrient concentration of remaining water. There is no universal answer for a producer to adopt. Many avenues must be considered prior to altering manure collection and treatment systems.

Manure Nutrient Management

Solid and liquid manure should be managed. The cumbersome task to apply nutrients at agronomic rates must utilize information from soil nutrient availability, plant nutrient needs, irrigation water management and manure nutrient concentrations. Some amount of record keeping is required to accomplish nutrient management.

Sampling Nutrient Sources

Samples of both solid and liquid sources should be obtained near the time of use. Solids should be analyzed for total N, ammoniacal-N, P, K, Ca, Mg, Na, Cl and EC. Also, moisture or dry matter (100%-Moisture%) should be determined. Dry manures are 10 to 20% moisture. Compost may have as much as 50% moisture. Solids straight from a separator can be 85% moisture. Table 3 lists average values for nutrient composition of solid

manure samples taken in California.

Manure liquids should be evaluated for the same chemical elements as the solids. However, an evaluation of moisture would be quite difficult and not necessarily useful. Also, it is helpful to know the flow rate of the manure water. Then, the results of analytical analysis can be calculated in terms of pounds of nutrients applied per hour of manure water application. Table 4 is a summary of such data evaluated during the summer of 1996.

Determining Application Rate

Solid or liquid manures should be applied based on soil nutrient concentrations, crop needs and nutrient concentration in the manure. First, it is important to determine how much manure should be applied to a particular crop given the nutrients already present in the soil and the needs of the crop. Second, it is necessary to identify how the nutrients will be applied. Various application methods exist for different types of manures. As an example, a crop needs 250 lbs of N for its production. If soil nitrate levels indicate that there are already in excess of 250 lbs of nitrate N in the soil, maybe no manure is needed. Maybe manure is needed. That may in fact be the case if there is a potential for nitrate to leach beneath the crop root zone during the growing season. This can occur when excessive irrigation water is applied and nitrate (a very mobile nutrient) is leached.

It is important to consider the method of application when determining the application rate. For instance, if solid manure should be applied at 4 tons per acre. Can the manure spreader or truck apply that rate? Equipment used for spreading manure should be calibrated annually.

The method of application is important to consider. If the irrigation method is flood (versus sprinkler) then a non-uniform distribution of water and nutrients will occur. This is a particular concern in areas of poor soils and shallow water tables. Irrigation water management is very critical. It becomes increasingly important to manage irrigation water if the site has a shallow water table and poor quality soil.

Commonly, a single pump is available to pump manure water. Therefore, alterations in application rate require the ability to alter the amount of fresh water commingled (dilution rate). Can the irrigation piping system accommodate delivery of manure nutrients at the right time? Most operations only have one set of pipes or ditches and one or two pumps capable of pumping manure water to the appropriate field. Logistically, it is



difficult to transport manure water great distances during the summer irrigation months.

Challenges In Using Manure

First and foremost, one must consider the nutrient content of the manure. Crops use much more N than P. As a result, if manure is applied to meet crop N needs, P and salts will be over applied. Will this affect the crop or the soil? Two methods can be used to overcome this poor N:P ratio. The first is N conservation once manure is excreted from the cow. Current research efforts are focusing on techniques to accomplish N conservation. A second method to enhance N:P ratio includes incorporation of fertilizer N.

A second consideration is distribution uniformity of nutrients. Spreaders that shoot out large clumps of manure may not distribute nutrients evenly. Is this acceptable in the particular farming scheme? Also, spreaders compact soil which can be detrimental to the cropping system. This practice may be undesirable in permanent crop systems. Although liquid manure does not compact soil, some producers have reported crop loss or damage, and poor water infiltration. Will water be able to infiltrate into the soil? This is an especially important consideration in orchards or vineyards where soil tillage is less than that of forage or row crops. Crop loss or damage can be associated with high salt, high ammoniacal N, or high organic content (which as it decomposes removes oxygen from the soil resulting in crop death due to lack of oxygen). Also, it has been suggested that fines in manure water (bacteria and small particles) seal the soil surface and prevent oxygen from entering and other

gases from leaving the soil.

A third consideration is viable weed seeds. The inside of composted manure or stacked manure piles that has undergone static composting will be virtually weed-seed free. However, wind blown weed seeds can be embedded in the pile surface. Corral manure and manure liquids will contain viable weed seeds. Organic growers and others may choose to further analyze manure utilization potentials based on the risk of broadcasting weed seeds. Weed control around piled manure is important to minimize plant maturation. Solid liquid separators have not been evaluated on their ability to remove weed seeds.

Certain cropping systems are better suited to receive manure waters than others. Cropping systems that remove large amounts of N or that have deep roots are desirable. Deep rooted plants have a deeper root zone from which to remove nitrate. This may aid in reducing the amount of nitrate ultimately leached into underlying groundwater.

The nutrient availability of manure will depend on its chemical analysis, soil microbial activity (which depends on temperature) and the presence of cations and anions in the soil.

The solids in liquid manure can be a challenge. Most manure water is less than 1.5% solids. When thicker liquids are applied, solids will settle out of the liquid stream. Often, solids accumulate in the top 50 to 200 ft of a check. The deeper the solids, the greater the probability the solids will hinder cultivation practices. A 1' deep solid build-up immediately after an irrigation will dry down to 2 to 4" of material. The soil under such a thickness of solids takes longer to dry to allow equipment use without getting stuck. Solids settle as a result of their particle size and density and the reduced flow velocity that occurs as water exits the valve into a check. Flow rate

can be increased or check width can be reduced in an attempt to distribute solids further. Alternatively, the first third or half of the irrigation can be with fresh water, with manure water added toward the middle of the irrigation. One-half as much time running manure water will reduce total solids applied to the field, thereby reducing solids settling

Table 4: Nutrients applied per (lbs.) hours of manure pump operation.

Concentration	Org-N	NH4+-N	P	K	Ca	Mg	Na	Cl
Low	9.0	7.9	1.7	10.8	8.5	1.8	4.8	2.3
High	99.7	115.5	33.2	202.3	90.7	39.9	69.4	98.3

Table 3: Nutrients applied from solid manures and compost.

source	moisture(%)	Org-N	NH4+-N	P	K	Ca	Mg	Na	Cl
Freshly separated solids (n=56)	85.0	4.5	0.4	1.0	1.1	3.6	0.8	0.4	0.3
Fresh manure (n=3)	84.2	7.5	0.3	2.0	1.9	5.8	1.7	0.4	1.1
Old dried manure (n=16)	38.8	25.6	0.4	7.8	15.3	32.1	7.6	3.4	5.0

at the top of the field. Solid liquid separators can be effective at removing larger sized fiber particles (>2mm). Unfortunately, this size particle makes up a small portion of the total solids in liquid manure. To date, settled solids at the head of a field have not been evaluated for particle length. Application of manure solids to fields where solids from manure water irrigations have settled should be done in consideration of the solid settling pattern (e.g. apply solids in the solid form to areas of the field that didn't receive considerable amounts of solids from the liquid form).

Manure As A Bedding Source

Most research has focused on the animal health ramifications of bacteria in bedding. Numerous waste products and byproducts have been identified as a potential source of bedding material. A more recent emphasis on food safety requires additional information. Pathogenic organisms responsible for food borne diseases have been weakly linked to cattle waste in popular press coverages. The objective of this study was to evaluate manure pile temperatures and moisture, coliforms, gram negative organisms, and absorbency in core samples.

Dried manure piles used for bedding freestalls were evaluated on twenty-five dairies located in the Central Valley of California. Piles consisted of solids from solid liquid separators, corral scrapings, or a combination of these materials. Piles were sampled four times during a two week period. Each sampling consisted of temperature measurements at 1, 2, and 3 ft depths and core sam-

pling of manure for chemical and microbial analyses. Temperatures at 1 ft depth ranged from 33 to 59 C and from 38 to 64 C at the 3 ft depth. Percent moisture ranged from 16.3 to 85.2 and absorbency of material on an as used basis ranged from 62.2 to 216.2 percent. The combination of corral solids and separated solids was frequently used. Straight separated solids tended to have the disadvantage of being easily removed from stalls.

Summary:

Manure can be used on farm or relocated off farm. There are many options available to dairy producers to accomplish manure management. One of the keys is to identify the objectives for each component and then to periodically assess components to see if they meet objectives. Although it may be easier to remain status quo with respect to manure management, economics usually would benefit if evaluations were accomplished on an annual basis.

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Notes

Labor Management Roundtable:
**Moving The Dairy
Industry Into The
21st Century**

Tina Wright, King Farry, NY
George Segura, Mesquite, NM
Mike Veeman, Loveland, CO
Tom Thompson, Buckeye, AZ

panel coordinator: Bill Wailes,
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Labor Management Roundtable: **Moving The Dairy Industry Into The 21st Century**

Moving the dairy industry into the 21st century will be a challenge that all dairy farmers will face in the near future. How labor on dairy farms will relate with management will be even more critical in the future. All of us will need to be able to think outside of the box with innovative and new ideas with our employees as well as our management teams.

Supervising people will be an important challenge for us in the future. Building more productivity and moral, getting things done on time and financially on target. How will owners manage conflict effectively and at the same time still give easy instructions to follow with all enterprises on your dairy farm. How do we delegate and get more done and be cost effective in doing that? These will be issues as we move our industry into the 21st century.

Boosting the moral and energy of your farm employees will only come with better means of communication and being able to try new and innovative ideas on your farm. Overcoming employees' resistance to change will be the ultimate satisfaction to everyone's operation.

In this roundtable we have challenged four individuals to give us some ideas that will help us all formulate new ways of thinking about labor management into the future:

- **Tina Wright**, Head Milker
Fessenden Farms, King Farry, NY
- **George Segura**, Manager
"Big Sky" and "Bright Star" dairies
and a heifer facility, Mesquite, NM.
- **Mike Veeman**, Partner/Owner
Veeman Dairy, Loveland, CO.
- **Tom Thompson**, Partner/Owner
Stotz Dairy, Buckeye, AZ.

Question #1: Give one example of a change you or your operation have made this past year in regard to labor/manage-

ment that has been successful.

Wright: As our dairy has expanded from 300 to 400 milking cows (soon to be 500), Fessenden Farms has hired more part-time labor, significantly relief milkers. Previously, relief milking was done mostly by full-time milkers doubling up on their weekend shifts. Hiring and keep part-time help can be tougher than running a farm with full-timers only. The very nature of part-time and relief work can mean more turnover and schedule juggling. On our farm, I think we're being challenged to tighten our procedures and increase communication because relief people often come on the job site "cold" and lack the full-time worker's luxury of knowing what's going on day-to-day.

Segura: We really haven't had any major changes in our operation or in management. I have good communication with all of my employees and I try to take care of any problems as they occur so as to keep things running smoothly.

Veeman: During the last year we have started cross training several of our employees. The employees enjoy it and seem interested in learning a different job. It is easy to become very specialized on a large commercial dairy. When an employee does not show up for work, it has the potential of disrupting the work day. When employees have been cross trained it allows flexibility in scheduling and it turns potentially chaotic situations into minor adjustments. Cross training is a form of risk management. It allows you to plan for the inevitable and manage labor versus reacting to it.

Thompson: In the past, the night milkers were supervised by the herdsman for their respective barn. That arrangement required special effort for the herdsmen to supervise and communicate with these employees, since these milkers arrived after the two herdsmen finished their days and left before the herdsmen started their next shift. Furthermore, if the milkers had problems in the middle of the night, the herdsman



would be summoned to the barn during his rest period making his life less enjoyable. To alleviate this situation we shifted the responsibility for these employees to the night herdsman. His job duties now include supervising both night crews of milkers. Since his work schedule is concurrent with the night milkers, he is available to routinely communicate and help facilitate problems that they might need assistance with.

Question 2: How do employees get involved with the problem-solving process on your farm?

Wright: At Fessenden Farms, workers are individually engaged by the owners to solve problems as they arise. John, the partner who "runs the cows," asks for our input around milk quality and other problems. Meetings are rare, though John and the herdsman confer frequently. The management style is strongly from the top. The strength of this style is efficiency and focus. We don't spend a lot of time chatting or passing the buck on responsibility. A weakness of this style is that employees are reluctant to initiate discussion or stick their necks out on possibly contentious issues.

Segura: When an employee encounters a problem that is beyond his control, he notifies the herdsman who in turn brings it to my attention whether or not it was taken care of. In this manner we are all aware of what happened and can handle the problem should it happen again. Most problems are handled with team effort.

Veeman: Only those persons who have responsibility, capability and concerns for our interests are put in a position of having regular input into the problem solving process. When we meet with these lead employees and discuss the projects we are going to schedule for the day, we weigh their input heavily. They are the ones working directly with the specific situation and they are responsible for the success of the particular tasks. During our worker training sessions we open up the discussions to everyone. We encourage open communication and ask for input. When the employees see us acting upon their input it is a valuable motivational tool and it encourages them to stay involved.

Thompson: We try to involve every knowledgeable employee when we have a problem on the dairy. This is accomplished by informal discussions as well as through organized employee meetings. Our consultants are also involved with this process. Sometimes we ask a specific employee or team of employees to troubleshoot an area that we are having problems with.

Question 3: language barriers and cultural differences can present unique challenges with labor/management. How do you handle these challenges?

Wright: Leadership from above is the first important ingredient in handling the challenges that language barriers and cultural differences provide. Diplomacy, charisma and sensitive social politics are all elements of leadership that management must use to promote a workplace that welcomes diversity. Since I've heard many viciously racist, anti-Semitic and otherwise prejudiced remarks in my years in the industry, I'd like to see management make clear to new employees at orientation that their farm tolerates no prejudice on the job. We should be clear and direct in opposing behavior and speech such as sexual harassment, violence, threats and put-downs on a racial, ethnic or religious nature. We have to mean what we say and lead by example. Successful dairy farm crews can be a varied bunch. We don't have to go to the same church, belong to the same political party or even be fans of the NASCAR driver. Fessenden Farms is not especially diverse in its workforce, though women have worked there! But the owners do foster a professional environment, somewhat impersonal, where the work comes first. This is a positive climate for diversity. And diversity leads to more diversity. On larger crews, it helps if you're not the only oddball... the only woman, the only black, the only Hispanic... it helps even if you don't like the other oddballs! Dairy farms which can successfully include employees from many walks of life will benefit from a larger recruiting circle.

Segura: Because I am bilingual, I am able to communicate well with all of my employees without difficulty.

Veeman: The majority of our employees are Hispanic. We handle the language barriers in two ways. First, our senior lead employees are bilingual and do all the translation. Second, as owners and managers it is important that we are able to communicate with our employees, therefore we study basic Spanish ourselves. We also need to understand that many of our employees have family in Mexico. In the Spanish culture, family is very important. That is why many of our employees return home on a regular basis. We have to make adjustments for this seasonal type of employment. We have also found that it is important that we are present when our lead employees are addressing a group of employees. This shows the entire workforce that management is serious about backing up supervisors and any questions can

be handled immediately.

Thompson: Every manager must speak the language of the employees that he directly supervises. We utilize the abilities of bilingual employees as needed. Every written communication is published in English and Spanish. Educational programs are conducted in either a bilingual format or as two separate classes. Hispanic managers are regularly consulted about how new programs or policies will be received from a cultural viewpoint. An English speaking class is offered weekly to employees and their spouses to help them assimilate into the society that they have chosen to migrate to.

Question 4: Discuss the hiring process on your farm. Do your employees have proper training, timely initiation periods, and/or a probation period?

Wright: Fessenden Farms is better than average on training, probationary periods and so on. I'm not sure how it's going with the recently hired part-time milkers, but my training as a milker was very good. A young man, only 17 years old, trained me very professionally. Some of my other instruction, around vaccinations for example, was less thorough and may not have sufficed for a less experienced employee. Though I'm not part of the hiring process, I feel that Fessenden's, like most expanding businesses, will need to fine tune job descriptions and training. Many procedures are written down. More could be. More farmers today are compiling employee procedures and otherwise formulating policy, instead of just winging it.

Segura: We accept applications for employment during regular working hours. These applications are kept on file and are referred to as employees are needed. They are then hired and given very basic training and a two-month probation period. Once this probation period is completed, they are given further training for a permanent position.

Veeman: All perspective employees are interviewed and references are checked. All new employees receive a basic initiation briefing. During that initiation we collect and copy all needed documents. We review the pay schedule, quality bonus program, vacations and basic job expectations. If the employee is Spanish speaking, an interpreter is present. Our initial training period lasts almost one week. Senior employees do the training. After the initial training period we will review the

employee and follow-up with additional training if needed. All employees are subject to a three month probation period.

Thompson: 4 -Our management team aggressively recruits for all new positions or openings. The goal is to encourage as many qualified candidates as possible to apply for every opening. This is accomplished by placing ads, posting in-house job opportunity bulletins, visiting with other dairymen, consultants, and extension agents, and keeping a current list of job applicants. Since the dairy prefers to promote from within, many new employees start in a trainee position and previous dairy experience is not required. There are two objectives that we try to accomplish during the process of interviewing all top candidates. First, we try to convince the candidate why they should want to work with us. Second, we try to identify the most ideal person for the position. Personal and previous work references are thoroughly checked out. Once the position is filled we start our educational process. We start by providing a complete job description to the employee. With some positions a video tape presentation of the job he will be performing is viewed. Then the new employee is placed with an existing employee who is empowered to show the new employee how to do the job. After sufficient time watching the trainer, the new employee is encouraged to work alongside the trainer. Eventually the trainer stands back and watches the new employee perform the job by himself. We find it beneficial to not only show how the job needs to be done, but also why it needs to be done and the implications if the job is not done correctly. This process can take one to three weeks depending on position, previous work experience, immediacy to fill the position, and the abilities of the individuals involved. During this orientation period we indoctrinate the new employee with information about our dairy, our philosophies, and potential career paths the employee can take while employed with us. Follow-up training is provided after the employee has been in the new position for awhile. Since all employees are hired at will, no probation periods are necessary.

**LABOR MANAGEMENT ROUNDTABLE
MOVING THE DAIRY INDUSTRY
INTO THE 21ST CENTURY
By George Segura, Manager
Big Sky and Bright Star Dairies**



and Heifer Facility, Mesquite, NM

I've been around dairy cattle all my life. My father worked on a dairy farm in California and that's where I grew up. I learned a lot from my father just be being around him on the dairy as he treated and bred cows. I was very eager to learn anything and everything about the dairy and was always nearby asking questions.

In 1973 we moved to New Mexico and lived on the dairy where my father worked. I was hired at a young age to do light chores around the dairy such as feeding calves and helping keep the dairy clean. As time passed my duties and responsibilities increased. I learned how to milk, detect sick cows, treat them and pull calves.

I always enjoyed working at the dairy, and I think my enthusiasm made my job easier. The dairy was a challenge for me. There was something different to learn everyday. My job became even more challenging when I learned how to heat-detect and breed. Soon after I was given the opportunity to be a Herdsman, and with this position came other responsibilities and duties such as proper maintenance of equipment and managing some of the employees.

I was offered a management position on a somewhat small dairy that would be quickly expanding. I didn't hesitate to accept the new job since I had different ideas as far as employee management and procedures. This was my opportunity to be able to do things my way. I have always had good support from my employer and am able to try new things and give my opinion about important matters.

Currently, I am managing two dairies and a heifer feedlot. I have approximately 40 employees under my supervision. I have learned a lot about employee management from my boss. He really stresses good communication with all employees and I think this is what makes business run smoothly. His thought is to treat a person the way you would like to be treated.

I continue to enjoy my work and life on the dairy. I am grateful to be given the opportunity to do what I like best, dairying.

**LABOR MANAGEMENT:
THE STOTZ DAIRY PERSPECTIVE**

**By Tom Thompson
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Fifteen years ago if I were asked to discuss labor management I would have thought about the delivery of calves that went on in our maternity unit. Back then I felt that giving a cow two hours of labor before I pulled the calf was proper labor management. Today many dairy-men have more employees than their ancestors had cows. As we approach the twenty-first century, we are learning that people management is as important as cow management and much more challenging. I have been asked to share my dairies' perspective on employee management. Let me start by giving a brief background on Stotz Dairy.

Stotz Dairy is located in the picturesque Sonoran Desert of central Arizona. The dairy started in 1981 with 539 cows and has slowly grown to its current milking herd size of 3,676. The herd has been the highest producing dairy in Arizona for ten of the past thirteen years with a 1996 rolling herd average of 26,154# 3.5% FCM. The cows are milked three times a day in two milking parlors. Cattle are housed in open dry lots with shade and cooling provided to partially mitigate the effects of the extreme desert heat. An alfalfa and corn silage based diet is blended with various commodities and by-products in a total mixed ration fed five times per day. A nutritionist and a veterinarian are the main consultants to the dairy.

The labor force of 38 full-time employees includes; 6 lead milkers, 6 assistant milkers, 6 trainee/cow pushers, 4 relief milkers, 4 outside and relief men, 3 feeders, 3 calf feeders, 3 herdsman, an assistant manager, an office manager and myself. The organizational structure enables each manager to supervise a manageable number of employees. This enables these supervisors to act as team leaders and to personally know and care about each individual on his team. Leadership's role is to provide focus and direction, allowing employees to deliver top performance. It is the leader's job to help the employee remove the obstacles that stand in the way of the employee becoming a great performer. This bottom up management approach is utilized to insure that each employee is treated as if he were the only employee on the dairy.

The goal of our labor management is to create a motivating work environment where people are passionate about milking cows and making an impact on the bottom line. At Stotz Dairy, we use an empowerment approach to enable each employee to treat each cow as if she were their only cow. Empowerment means giv-

ing the responsibility to the individual to do whatever is necessary to do the job and improve the system. This process allows the employee to perform the job to the best of their ability and continuously strive to improve that ability. Management needs to provide all the necessary tools, including knowledge, to help the employee perform the job well. This process encourages the employee to develop ownership of his area of responsibility and take self-directed actions. For example, when an unexpected storm moves in at 2:00 A.M., the calf manager will close the curtains at the calf barn so that the calves will remain warm and dry.

Stotz Dairies' mission statement is, "To maximize profitability by efficiently producing the maximum amount of high quality milk per cow while consistently treating employees with respect and cattle with care." To the average employee, this statement may not be highly motivating, compelling, or memorable, so we utilize a vision statement to more concisely keep our efforts in focus. Our vision is, "To be the highest producing dairy in Arizona." We have had better success communicating this vision because it is simple, easy to remember, and (thanks to the University of Arizona Monthly Newsletter) the results are monitored regularly and effortlessly. Some people criticize this vision because they feel that we should focus solely on profitability instead of high production. While I agree that the bottom line profit is extremely important, it would be tremendously difficult to inspire employees with the vision, "Let's make the owner rich."

The establishment of protocols or procedures for the jobs or tasks that are performed routinely on the dairy is essential. New procedural systems are created and existing systems are modified on a continuous basis. These systems include: how to milk cows; how to treat problem animals; how to feed cows, calves and newborns; how to sanitize equipment; etc. The axiom "if it ain't broke, don't fix it", does not apply here. We are constantly looking for ways to improve or simplify these processes. Employees are encouraged to question, challenge, and help improve those systems that prevent them from delivering top performance. Management's job is to create an environment where people can focus on the cows. The goal is to build systems and structures that focus people on our vision.

Proper recruitment of new employees is another key to helping the dairy realize its goals.

Our management team aggressively recruits for all

new positions or openings. The goal is to encourage as many qualified candidates as possible to apply for every opening. This is accomplished by placing ads, posting in-house job opportunity bulletins, visiting with other dairymen, consultants, and extension agents, and keeping a current list of job applicants. Another area that has helped us as we have grown in size, is the ability to establish entry level or trainee positions. These trainee positions allow us to employ individuals with little or no previous dairy experience, providing us the opportunity to hire the personality and train for the task. Whenever possible promotion from within is faithfully practiced. There are two objectives that we try to accomplish during the process of interviewing all top candidates. First, we try to convince the candidate why they should want to work with us. Second, we try to identify the most ideal person for the position. Personal and previous work references are thoroughly checked out. Putting great effort into the recruitment process insures that we start with the highest quality person available and reduces employee turnover.

Once the position is filled we start our educational process. We start by providing a complete job description to the employee. With some positions a video tape presentation of the job he will be performing is viewed. Then the new employee is placed with an existing employee who is empowered to show the new employee how to do the job. After sufficient time watching the trainer, the new employee is encouraged to work alongside the trainer. Eventually the trainer stands back and watches the new employee perform the job by himself. We find it beneficial to not only show how the job needs to be done, but also why it needs to be done and the implications if the job is not done correctly. This process can take one to three weeks depending on position, previous work experience, immediacy to fill the position, and the abilities of the individuals involved. This orientation period includes indoctrination of the new employee with information about our dairy, our philosophies, and potential career paths the employee can take while employed with us. Follow-up training is provided after the employee has been in the new position for awhile.

This education process continues indefinitely through annual or semi-annual schools performed on the dairy for milkers, breeders, and herdsmen. Cross-training of employees is practiced not only to prepare personnel for potential opportunities but also to make them aware



of the coordination and cooperation needed to make the dairy function efficiently. Due to the number of Spanish speaking employees, a weekly on-farm English speaking class for employees and their spouses is conducted. Outside education is also encouraged. All costs incurred are reimbursed when the education directly benefits the dairy. With prior approval non-dairy related courses are eligible for partial reimbursement. The goal of this continuous learning process is to increase the employees responsibilities as he increases his knowledge and demonstrates the ability to make good decisions.

As herd size has increased over the years, our management has had to evolve from a practical ("hands-on") cow managing style to a supportive ("coaching") people management style. As this transformation has occurred, the managers have tried to maintain a high degree of cowmanship to fill the role of consultant or teacher as the need arises. The manager's role as coach varies from employee to employee. With newer employees I find myself asking questions like "What are our options?... What do you think is best?... Why don't you do that?". After awhile the employee discovers that he is the one making the decisions. As the employee matures through our system he realizes he has the ability and power to make all but the most difficult decisions by himself. On those difficult decisions he knows that he will get management's full attention and cooperation as we try to collectively make the right decision. In this system it is the coach's job to help the employee learn from bad decisions while not chastising him for making a mistake. Some employees need more structure in their job environment, and the coach's job is to be more directive with those people. This direct approach is also used when an employee just plain doesn't know what to do in a specific situation.

We believe that if you can measure something, you can manage it. Goals are mutually established and results are measured and posted regularly. Since each employees viewpoint is valued, all employees are involved in solving problems and individuals and teams are recognized and praised when their ideas are utilized. Some managers feel that when people are happy they perform better. I feel that when people perform better, they are happier. Everyone wants to excel and to be part of a winning team. They take pride in their accomplishments. The ultimate goal is to have empowered employees establishing their individual and teams goals, monitoring their own performance, and subsequently recognizing

and celebrating their successes. Various performance indicators include; milk per cow, per shift, and per man hour; cost per CWT, per cow and as a percentage of the milk check; percentage of cows and heifers leaving the herd for various reasons; conception and heat detection rates per technician; daily dry matter intakes and feed refusals; etc. These results are compared to our own previous results, as well as with the results from other dairies that we regularly exchange information with.

Routine management meetings, periodic team meetings, written notices, softball matches, volleyball games, family bar-b-ques, costume contests, and pizza parties have all been used to improve communication, enhance camaraderie, and celebrate achievements. Competitive wages, paid vacation, regular days off, health insurance, life insurance, modern well maintained housing, a 401K profit-sharing/retirement plan, and the potential for key managers to become a partner in the dairy are utilized to adequately compensate employees. A semi-annual review is used to communicate performance satisfaction between employee and supervisor. The goal is to build a compensation system that rewards great performers and encourages not-so-great performers to improve.

In summary, labor management at Stotz Dairy starts with a vision. Every employee needs to hear it, understand it, believe it, repeat it and act on it incessantly. The best available people are recruited and hired. Employees are taught their new responsibilities through a job description, teaching aids, and peer training. Everyone is empowered to perform the job to the best of their ability. Systems are created and continuously updated as needed for all routine tasks. The education process is continued throughout the employee's tenure. Employees are provided consistent support as needed. Performance is measured and superior achievement is compensated.

To simplify what we are trying to accomplish, just remember the 4-L's. For a person to be content with their lot in life they need to: live, love, learn, and leave a legacy. This is essential in the workplace as well. **To live** – we try to provide fair compensation in a clean, safe work environment. **To love** – we try to build an environment where mutual trust, respect, security, and communication prevails. **To learn** – we continuously provide the opportunity and encouragement for people to grow and develop their skills and responsibilities. **To leave a legacy** – we provide an avenue where people can belong to a winning team by contributing to the accomplishment of

a mission that transcends their individual tasks and encourages them to be their best.

The most challenging aspect about labor management is that it is a never ending process. Success is a valuable teacher, providing you don't get lulled into complacency. Most dairies have similar cows and facilities. We all have the ability to use basically the same systems and techniques. The only real difference is the people and how they do what they do. After all success is not measured by what you know, but by what you do with what you know.

LABOR MANAGEMENT: THOUGHTS AND POLICIES

By Mike Veeman

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The dairy industry has changed a lot in the last twenty years. Improvements in nutrition, genetics, biotechnology, milking management and disease prevention has enabled us to yield more milk per cow and we are doing it more efficiently. Through the years we have faced many challenges. One constant challenge that remains for most of us is labor management.

While we may have different goals and methods, I believe we all desire our dairy operations to function smoothly and our labor force to perform at high levels of productivity. Labor management is important and requires specialized attention. Properly trained and motivated employees enable us to attain our goals. A properly functioning labor force should also be an extension of the owner's management philosophies. Many of the problems we deal with regarding labor today are the same problems we have faced in the past. Logic would indicate the need for change of direction to change the outcome. This might seem like an oversimplification, but sometimes old habits and management styles are hard to change.

During the last five years we have made several changes at Veeman Dairy in the area of labor management. We have made it a priority to improve the quality of our labor force. A few key areas are as follows; A quality bonus program, educational programs, regular review and analysis. We have seen a great deal of for-

ward progress since implementing these new programs and feel the time and effort has been a good investment. Employee turnover is costly. Not only because we are paying a non productive employee during the training period, but also because a new employee lacks experience. We have made a conscious decision to invest in our current workforce in an attempt to minimize turnover and improve productivity.

We are fifth generation cowmen at Veeman Dairy. Quality cow care has been the key to our success. In the future as we grow, our success will be directly dependent on how we motivate and educate our employees to make cow care their concern. Family members are directly in control at all levels of management. It is a challenge for us to delegate and encourage our employees to think for themselves in finding solutions to problems.

Recruitment, Initiation, Training and Motivation are the four main Labor Management areas I will cover in this presentation. I will explain our philosophies and policies. It is important to recognize that each dairy operation is unique with different; management styles, state labor laws, goals and priorities.

Recruitment

When an individual looking for work stops at our dairy, we do a brief interview and collect basic information. We can utilize this information in the future if we need to fill a vacant position. If a position becomes available and we do not have a qualified applicant in our files we start the recruitment process. First, we inform all our employees that there is a position available. There is a good chance a current employee has a relative or friend that is seeking employment. Second, we contact other dairyman in the area to see if they know of a potential prospect. Third, we communicate with other sources; veterinary, mastitis tester, DHI, etc.. The last resort is a newspaper classified. Recruitment for a herdsman is a complicated process and involves a broader search area. I have read several help wanted ads looking for a herdsman on Dairy-L and I believe the internet will become an effective tool in the future for locating herdsman and dairy manager candidates.

We schedule an interview when we find a qualified applicant. During the interview we ask for references, which we do check. We also check basic identification and verify that the individual has the proper documentation to work. Housing is an issue in our area. We check housing and transportation status. It is a problem to find out after a week of training that an applicant does not



have a place to live or a way to get to work. A few other things we look for are; punctuality, cleanliness, courtesy, reading and writing skills. It is important to note that experience is not the most important qualification. We can teach a quality applicant most job skills if the individual has the proper attitude and some basic qualifications. We require experienced applicants to demonstrate milking skills in the milking barn. This is part of the interview process. We cross train most of our employees and we feel everyone should have some basic milking skills on a large commercial dairy.

Initiation

All new employees receive a basic initiation briefing at the beginning of work. The initiation involves collecting and copying all important information; social security card, driver's license, work visa and alien registration documents. Then we distribute tax papers and I-9 forms to the employee to complete. Then we explain the pay schedule, quality bonus program, vacations, and basic job expectations. We give the employee a chance to ask questions and discuss any concerns. If the employee is Spanish speaking, an interpreter is present.

Our initial training period will last from four days to one week. During this time the applicant will work alongside an experienced employee. During this time, management continually checks with the new employee to see if things are proceeding properly. It is always a concern that the other employees might not accept the new applicant and not cooperate during the training process. The senior employees are responsible for training. All employees are subject to a probation period of 3 months.

Training and Education

Training and education are the areas we have seen the most return on time invested. Switching gears from management activities to the role of an educator is not always easy. It is difficult to take the time out of a busy day to gather a group of five or six employees to have a training session. We schedule meetings just as we would schedule barn service or an appointment with a banker. There must be a commitment to the training process for employee training to be routine and effective.

"Selling Quality Milk Is Our #1 Priority."

Following proper milking procedures is essential to achieving that goal. Therefore, we review these basic items at every training session. It is important that all employees understand what the goals are so that every-

one on the team is heading in the same direction. It is easy to confuse a milker about whether cowflow is more important or doing a thorough job, if mixed signals are being sent. Goals and priorities should be clear.

Before attempting to educate employees it is important to first do an analysis of the current situation. This step is the most critical. What are we doing right? What are we doing wrong? What skills do our employees have? How are you measuring current performance? Measurement is a key area, because without measurement it is very difficult to manage and effect change. A few examples of measurements would be; SCC, production per cow, PI, SPC, heat detection, clinical cows, clinical cows pulled by third party, all DHI statistics, safety records, financial records, measuring devices for temperature or volume, closed circuit camera, etc. Once you determine the proper measurement, it is possible to track progress. Graphs are very effective tools in analyzing and presenting data.

Taking the proper care to determine exactly what the problem is prior to finding a solution sounds easier than it is. A good example would be a situation where you develop a problem with liner slip. If you assumed that the problem was machine adjustment and never explored the possibility of liner performance you might blame employees, whereas the problem was something out of their control.

Before we focus on the actual training it is important to look at the tasks we are asking our employees to perform and the goals we are setting. Would we or could we actually do ourselves what we are asking others to do? One of the oldest and most important leadership principles is: Lead from the front. This does not mean you have to work side by side all the time. It does mean that the lines of communication are open and management is available at all times to guarantee that the employee has the proper tools and supports to accomplish the given tasks.

Preparing for a worker training meeting is a lot like a teacher preparing for class. We review our employees performance and decide what to include in the lesson plan. The subject matter determines the location of the meeting. If we need to demonstrate milking procedure we will bring cows in the barn and actually hold the meeting in the milking parlor. Usually we hold the meetings in a heated shop or the front lawn of the dairy on a picnic table. The goal is to hold the meeting in an area that is comfortable and free of distraction. We schedule meet-

ings during a time when all team members are free to attend. Attendance is mandatory. We try to create an atmosphere of open communication. We allow a relaxed atmosphere, but require that all attendees pay attention. During most meeting the employees usually share information regarding equipment performance and maintenance. Since most of our employees speak Spanish, an interpreter is always present. We keep a written record of all training sessions and the names of all those that attend. The training sessions last about one hour. We start with a quick review of our current situation. Did we accomplish the goals from our last meeting? Sometimes an individual might have made forward progress and it would be appropriate to recognize that accomplishment in front of the entire group. Possibly the entire team received a specific quality bonus for a positive CMT mastitis screening with no clinical cows.

**"Positive Consequences Encourage
Good Future Performance"**

Then we cover new educational material. We usually go into detail, while keeping the concepts basic. We try to explain why we want things done a certain way. We might explain past experiences. We might also explain the economics of a particular situation. In most situations the discussion centers around the fact that we do things that are best for the cows, not what is easiest for the people. The cows pay the bills. At the end of all training sessions we review the items covered and ask for any questions or comments.

Motivation

Understanding what motivates people is difficult. The quality of work or the dependability of an employee has very little to do with how much money is being paid as long as the pay scale is reasonable and people are treated fairly. It is important that employees understand that the job they are doing is important. It is also important that they understand that they are part of a team and that the whole team must work together towards success. If an employee comes to work believing these things, chances are the employee will feel good about coming to work.

A few things I believe motivate employees are; extra care and concern during stress times, invitations to dinner or sporting events and special presents at Christmas other than cash bonuses. These types of perks should be reserved for special situations and should be handled in a sensitive manner. When an employee has made a special effort or has come up with a novel solution to a

problem, the proper recognition at the right time can be a tremendous motivator.

There is a big difference between an employee that cannot do something correctly because of ignorance or lack of proper equipment and an employee that will not do something. If an employee will not do something correctly it is time for reprimand. We try not to embarrass any employees during a meeting or while working. That would be counter productive. We do however, reprimand employees that violate established rules and show a lack of commitment to the common goals. Reprimands are done in private. All reprimands are short and to the point. Our quality bonus program allows one verbal warning and one written warnings prior to action. Both warnings include the rule violation and the potential discipline action if violations continue. The employee gets a copy of the Quality bonus report and the other copy goes in the employee's file. Discipline can range from a minor quality bonus reduction to termination. The goal is to correct the inappropriate behavior and hopefully to prevent having to terminate the employee. If the behavior continues termination is the proper action. Consistency is extremely important when dealing with employees. Make the rules and stick to them. People want limitations and they lose respect for an employer that does not follow through on policy.

Conclusion

Labor Management is one of the biggest challenges we face at Veeman Dairy. We are attempting to improve the quality of our work force through regular worker training and a Quality Bonus Program. We have been successful in reducing our labor turnover and continue to strive for increased productivity, while maintaining a high quality product. We have yet to find the silver bullet that solves all our labor challenges. As our herd size grows and the number of employees increases our labor management skills must evolve to meet the new challenges. Producing Quality Milk is our number one goal. Quality Employees are a basic key to reaching that goal.

WHAT I LOOK FOR IN A JOB

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Employee-employer relations really is a loaded topic in an industry in which people management is in its infancy. People management is messy and emotional,



especially in dairying. Dairy farms often combine family and friends, usually dealing with each other as employers, employees or partners. Also, in dairying there are long hours, low pay and tough working conditions for everyone. Those conditions can produce big-time stress.

I feel I should know. I grew up on a small Moravia, New York, dairy and have worked most of my life in the industry. I spent an interesting year as a farm sitter and relief milker on dairies all over the northeast.

I've seen a lot of farms and a lot of changes in the past 20 years. What I'm saying here reflects a composite of all my experiences. I guess you could call this my disclaimer! My comments don't reflect any one farm I've worked on. But I think a lot of farm workers feel their bosses don't care whether they like their jobs or not.

What am I looking for in a job? Well, the perfect job, of course! Excellent cows and working conditions, high pay and benefits, wonderful colleagues... just as you owners look for the perfect employee. But, perfection isn't out there, so an employee looks for the best possible farm, just as you should seek the best possible employee.

Good pay and benefits are important. Dairy magazine articles on labor stress that pay is not our top priority. Okay, I'll agree that it's not our only priority. Benefits such as insurance, housing, utilities, use of a farm vehicle, and so forth, can help make a farm job competitive with non-farm work.

As I get older, my desire to work long hours seems to be slipping. Dairies in the future will need to offer a living wage at fewer hours and more time off. Good cows and facilities matter, too. We cannot all have the best cows and the newest parlors. Even if you don't, employees need to feel that the dairy is headed in the right direction with a positive future.

Morale is everything. Sometimes you must be like the coach of a basketball team that has just lost eight in a row. We employees are looking for leadership and good management ability from our bosses.

As a milker, I'm looking for a job in which people don't treat me like a flunky. Milkers can rate very low on the totem pole. The outside guys are "cool," the boss is "cool," the herdperson is "cool," but the milkers often are "nobodies" on the farms which the owner complains that he can't get any good help to milk his cows.

A hoof trimmer once asked me about a new milker. I told him a little about the guy. "Just a milker, huh?" he responded. I said, "Wait a minute. A good milker is a herdperson's best friend." Sometimes I think the auto-

matic takeoff milking machines have lulled us into thinking any warm body in the parlor will do. Sometimes we herdspersons, managers or owners aren't training or working with our milkers at all. They often are our best sources of information about mastitis, heats, sick and lame cows, and milking equipment and cooling problems. Some of the milkers whom we might dismiss as mediocre could be better motivated to our benefit as "cow people."

Now I realize it's easy for me to say these things. I'm not paying wages or recruiting. Availability of good people at a wage farmers can afford is among the industry's toughest problems, but recruiting is something on which farmers need to work harder. Often a farmer will hire anyone, especially for a less-skilled, part-time job. A night milker might say, "Hey, boss, a friend of mine is out of work," and, if he seems okay, he's hired. Be careful. The night milker might just want a buddy to drink beer with nights they're on together. Also, being casual about part-time workers is dangerous because they often are tapped for full-time positions that open up.

Certainly, some recruits recommended by employees are family can be just the people you want. But it can lead to cliques of workers that exclude other crew members, even to the extent of the clique running good people off your farm. Don't let hiring and handling employees just happen. Actively manage.

Why do I care so much about whom you hire? Well, these people are my colleagues. I have to work with them. As dairy crews get bigger, the importance of team work grows. This brings me to a big point...hire "people-people" for every job on the farm.

What do I mean by "people-people?" Workers who have the emotional maturity to be team-players aiming for a common goal; workers who routinely treat others with respect are "people-people." Good team players can have very different personalities, from talkative and outgoing to quiet and introspective. Not all "people-people" have the bubbly aura of game-show hosts.

Different job descriptions demand different relationship-skills... some jobs still can be filled by loners; but many farmers today recognize that even in lower-level jobs, one really impossible-to-get-along-with employee can put an entire workforce through an unpleasant soap opera.

I saw a recent help-wanted ad for a maintenance position on a large local dairy looking for someone "self-motivated and able to work well with others." A cliché, per-

haps, but just the qualities we seek when hiring.

Labor demographics for the future forecast that young white men are a shrinking proportion of the workforce. Dairying may need to expand its recruiting circle to include more non-traditional workers, such as more women, older workers and minorities of all kinds. More and more dairy employees were not raised on dairy farms.

These employees will demand jobs more like those off-farm. Farmers looking to the future should be studying the labor management of everyone from Wal-Mart to their local farm supply store. I encourage everyone involved in people management to brainstorm with human resource managers in other walks of life.

When I was a herdsman, I occasionally commiserated with my brother, a psychologist in the Syracuse, New York, school system who had moved to a low-level administrative position.

"Don't you hate how you have to suck up to people

all the time to get them on your side?" I complained to him one day about not having the power of a "real boss."

Jim replied that he had seen so many employees sabotage their bosses when they didn't buy his/her agenda that the persuasion was worth the trouble. He was right. The persuasion is worth the trouble.

Again, don't let hiring and handling employees just happen. Actively manage.

Notes

Notes

Milking Frequency

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Milking Frequency

The majority of present dairy owners and managers probably think that the milking frequency and schedule on the majority of North American dairy farms in the past was twice a day milking at approximately 12-hour intervals. In fact, many variations in milking frequency or different lengths of inter-milking intervals have been tried over the last few decades. Usually these have been for social, production management, or economic reasons. As milk production per cow and herd averages have increased, the interest in milking frequency and interval by dairy farm management has also increased. Practices which were considered to be common in the early part of the century, such as once a day milking, twice a day with intervals of 9-14 hours between milking, and even skip-a-milking a day, would not be considered as acceptable in present milking management of high producing cows. A review of past milking practices may help understand what and why about the practices of milking management used today.

Once-A-Day Milking

Milking a cow once a day still is a common practice in some areas of the world where maximum milk production is not always the goal. Once-a-day milking may be more acceptable in some social-labor relationships. It is also common where dairy cattle calve (seasonal) to coincide with the availability of feed. For example, the cows are grazed with the calves for approximately half the day, and then the calves are separated and the cows are milked by hand, usually just before the calf is returned to the cow. The effect of the calves frequent nursing during the day may stimulate milk production was suggested in a trial in 1963 at the University of Minnesota (24).

Even on today's modern dairy farms, with ice storms, blizzards, and other violent type storms, it is not uncommon to have power outages of over one day. What cows to milk first when the power returns is a management dilemma. The results from a research trial in 1963 (5) which omitted one and two milkings on a weekly basis would indicate that the middle to late lactation will decrease the largest percentage. This could suggest that they should be milked first after a short interruption of the normal milking procedure.

Once-a-day milking has occurred on many dairy farms

in the past, although not always a planned event. These unusual happenings, would occur on New Years morning or after a family celebration such as a wedding, were the favorite times of the once-a-day milking. The result of these once-a-day milkings have not been documented as to the loss of milk production.

A trial by Auburn University (5) reported that cows which had one milking a week omitted lost 7% of their milk production, and cows with two milkings a week omitted lost 14%. Similar results were reported by Illinois State University (27), with a loss of 7% for cows with one milking a week omitted.

In New Zealand and Australia, milking cows once-a-day in late lactation has been researched. In several trials (9) milk production losses of 18 to 35% have been reported. In a 1953 study at the University of Connecticut (16) cows in late lactation milked once a day produced 10.8 lb per day compared to 17.4 lb per day for twice-a-day cows on a 10-14-hour schedule.

Twice-A-Day Milking (2X)

2x milking is the most common milking schedule of dairy cattle. Only in the last 30 years has the practice of milking on 2x schedule been at twelve-hour intervals. Even today in Midwestern U.S. where the dairyman also is a crop farmer, milking on a 10 to 14-hour schedule is a common practice. In Europe, Australia, and New Zealand 12-hour milking schedule for 2x milking are not common practices. The major reason for the 10 to 14-hour milking interval is usually a social factor.

Research is not conclusive as to the benefits of a 12-hour interval as compared to a 10-14 schedule. In a 1963 Cornell study (34) cows milked at an 8- to 16-hour interval milked only 4.3% less than a 12-hour interval for 2x milking. In the same trial cows milked at a 10- to 14-hour interval produced only 1% less than a 12-hour interval, milk production per cow per year was 15,000 lbs of milk for the Cornell trial. In research trials with cows which had a relatively low daily milk production of 17-28 lb at the University of Minnesota in 1954 (20), New Zealand in 1956 (26) and Australia in 1955 (37), an unequal daily milking interval of 10 to 14 hours for 2x milking did not have a significant decrease in daily milk production when compared to a 12-hour interval. Level of milk production may have contributed to the results of these trials.



A more recent study by the University of Illinois (36) with cows milking over 70 lb of milk daily, a 2% decrease was observed with cows milked at a 9- to 15-hour interval as compared to cows milked on a 12-hour interval. It is an observation by the author (3) that dairy herds with a daily milk production of more than 60 lb per cow per day on a 10- to 14-hour interval would increase milk production 4 to 6%, when changing to a 12-hour schedule within two weeks of the change.

There is no data available from research trials on intervals between milking to indicate any effect on udder health of different intervals for 2x milking. Therefore, one could hypothesize that the present practice of milking high producing herds on a 12-hour interval for 2x milking will result in higher milk production.

Three-Times-A-Day Milking (3x)

Milking cows 3x has become a common milking frequency in recent years. From 1920 to 1950 milking 3x was usually done only on purebred registered herds to increase milk production on selected cows. The rising cost of facilities per cow, the increase in labor efficiency through parlor mechanization, and higher production per cow have increased the interest in milking 3x to improve the profitability of the dairy enterprise. A response percentage of 3 to 39% for cows changed from 2x to 3x milking intervals has been reported in research literature (6, 11, 14, 15, 25, 30, 31, 39). Management and facilities certainly have an important role in the percentage response to 3x milking. Nutrition requirements for any potential increase in milk production must also be met, with 3x herds being fed three times or more each day. Milking management and milking systems must be of top quality to assure udder health. Walking distance in the lane from the corral or housing area to the milking parlor should not exceed 600 to 700 feet, and group size should not exceed one hour of milking capacity of the parlor. The lack of proper facilities or management can result in a low response to 3x milking frequency.

An additional milking shift will increase labor requirements, although the total time required to milk the same herd size will be approximately 8 to 10% less for 3x than 2x herds (35). For example, a 2x herd which requires 8 hours per milking shift will require 8 to 10% less on 3x or a milking shift of 7 hours. For large dairy herds using hired labor for milking, the organization of the milking shift is less difficult than for smaller farms where family labor is used.

The response to 3x milking also varies by lactation number. In a comparison of seven herds in California in 1986 (1), the increase in milk production for first lacta-

tion cows was 19.4%, second lactation 13.5%, third lactation 11.7%, and four or more lactations 13.4%. Another California study in 1986 (13) analyzed monthly herd summaries of 28 herds prior to and for the first 36 months after switching to 3x milking and reported a 12% increase on 3x milking, with first lactation cows increasing 14% in milk yield. In an Arizona study (23) of DHIA records on herds changing from 2x to 3x increased 15% in milk yield within 12 months after changing milk frequency. In a Connecticut study in 1977 (14) of six herds which changed from 2x to 3x, milk yield was increased 7% for second lactation cows and older, and 11% for first lactation cows above their projected 2x yield. British research (32) evaluated 3x milking during the first 20 weeks of lactation and reported an increased milk yield of 19% for multiple lactation cows and 13% for first lactation cows.

The majority of research studies on 3x milking have been to measure milk production. There is less data on the effects of milking on reproduction and udder health, and the data is not conclusive. No effect of 3x milking on reproduction performance was reported in a Georgia research trial in 1985 (2). A California trial in 1986 (1) reported a difference in reproductive performance by lactation number for cows milked 2x vs 3x. Cows during the first lactation milked 3x had more breeding and days open than 2x milked cows, second lactation and more cows showed no difference in days open for 3x vs 2x cows. De Peters et al. in 1985 (10) reported a trend for reproductive performance of 3x milked cows to be poorer than cows milked 2x a day. Gisi et al. in 1986 (13) reported a trend in reduced reproductive efficiency for 3x cows when compared to 2x cows, with days to first breeding less for 3x cows. Cows during the first and second lactation milked 3x had more breeding (0.2) than 2x milked cows; with no difference in

third and fourth lactation. Some research reports have suggested that higher milk yields adversely affect reproduction efficiency of cows, even of cows milked 2x (21, 29).

A summary of previous research data would indicate that reproduction efficiency may be lower during the first two lactations for 3x milked cows with no effect on later lactation cows. The decrease in reproductive efficiency if lower is very small and in most of the trials was not statistically significant. Cow longevity was evaluated in the 1986 California trial (1), with fewer cows being culled from the herds milking cow 3x vs. the 2x herds.

Udder health was not affected by 3x milking in a number of research trials. a California trial in 1986 (13) reported no difference in California mastitis test scores.

Pearson et al (30) reported no difference in udder health for 3x milked cows. When compared to 2x cows in a 1983 trial by Kentucky research workers (39) somatic cell count was lower, and there was no difference in the number of new bacterial infections between 3x and 2x milked cows.

Therefore, if a dairy farm has properly installed and maintained milking equipment and acceptable milking practices, no increase in somatic cell count or clinical mastitis should occur. In conclusion, if herds are well managed 3x milking should increase milk production by 10 to 18%, reproduction efficiency in first and second lactation cows may be slightly lower, and somatic cell count and clinical mastitis may be lower. Conversely, in poorly managed herds or herds with inadequate facilities for 3x milking, this may only aggravate existing problems and would not be advantageous.

Two-And-A-Half-Times-A-Day Milking?

Many dairymen have pushed their facilities past the time necessary to milk all their cows either 3x or 4x. For example, a herd may require 27-28 hours to complete 3x milking. Although there is little research to study the effect of these types of milking intervals, such as 2=x, research in Holland (18, 19) would indicate that a cow does have a biological clock. That is, a cow will have higher milk production if she is milked and fed on the same daily routine. Therefore, if the time of milking is moved 3 to four hours each day, the benefits of the increased frequency in milk production will be reduced. If your milking frequency is 2=x you do not get one-half the benefit of 3x milking. If a dairyman is milking more cows than the milking parlor and labor can milk in a 24-hour period, it probably is preferable to decrease the milking frequency so that milking and feeding are done on the same routine each day.

Four-Times-A-Day Milking (4x)

4x milking is not a new milking practice. There are more research reports prior to 1940 on 4x milking than 3x milking. The practice of milking cows 4x for a short period of time, one to two weeks before a 24-hour milk recording period, was common for registered herds. Many of the high individual lactation production records were with 4x milking. There are also research reports of 4x milking for the entire lactation (8, 12, 28) with increases of 5 to 12% for cows milked 4x when compared to 3x. Although the milk production in these research reports were not as high as present milk production, it would have been considered high at the time.

A Danish report of high producing cows in Denmark in 1944 (22) compared 4x milking to 3x with a 15% increase in milk production. Hillerton et al. in England in 1990 (17) found a 12% increase in milk yield in a split-udder trial at approximately 150 days postpartum. More recently dairy herds in Washington, Idaho, New York, and Arizona have used 4x milking for several years or for short periods of time when milk price or milk quotas would make the practice profitable. The effects of milking 4x on milk production was 29-30% from 2x and 9-14% from 3x reported by Armstrong (4) for the first month after changing. In Holland cows being milked in a Robotic milking system (19), where cows had access to a milking stall 24 hours a day, 83% of the cows would voluntarily enter the stall between 3 to 5 times a day, with the average being 3.9 milkings per day, but 17% of the cows with a 16% increase over 2x milking did not volunteer to be milked at all. One large Saudi Arabia dairy company with over 16,000 cows in several herds has been milking 4x for over five years (3). Their November 1996 herd average of milk sold per cow per year is 25,752 lb of milk, with a very low daily rate of 0.20% of clinical mastitis. The maximum walking distance to the parlor for these herds is less than 425 feet. In the Danish (22) with cows which were milked 4x for over three years there was no effect on udder health or longevity.

Hillerton et al. (17) found that somatic cell count of cows which were changed from a 2x milking frequency to 4x increased during the first four days after the change then returned to the original level, which was less than 100,000. Clinical mastitis was also lower in the 4x cows. Lower cell counts with more frequent milkings have also been reported from Dutch studies (33). Observations of herds in the U.S. and Saudi Arabia would indicate that with cows being milked 4x that the size of the top of inflation could influence teat-end conditions (3). using a liner with the size less than 21 mm or a silicon liner, the incidence of teat-end erosion was reduced on cows being milked 4x. Although there did not seem to be a correlation between severity of teat end erosion and the rate of clinical mastitis.

The profitability of milking 4x will be influenced by feed cost, milk price, and labor cost, with the expected percent increase less than 3x.

5x Or 6x Milking?

Milking cows 6x (7, 38) resulted in an increase of 9 to 10% in milk production when compared to 3x milking, with no increase in milk production in middle lac-



tation cows. Somatic cell count increased three-fold for the first two days of the experiment and then returned to normal. In the Israeli trial in 1992 (7), cows were milked 6x in the first six weeks postpartum and compared to 3x cows. Peak milk yields were higher for the 6x cows (94 lb), and 79 lb for the 3x. Dry matter intake was higher, daily body weight loss was greater, and body condition score loss was also greater. All cows were milked 3x after week six. Milk yield and dry matter intake remained higher. Gain of body weight and body condition score of the early 6x cows was delayed approximately 4 weeks. The number of pregnant cows was also lower in the 6x group after 120 postpartum. In several short-term experiments of 7 weeks in England (17), 5x milking only increased milk production (5.8 to 8.0%) over 2x milking with cows averaging 46 lb of milk per day. Teat end condition score of cows milked more frequently than 4x would indicate that an interval of more than five hours between milkings is necessary to maintain a healthy teat end.

Conclusions

1. Once-a-day or skipping a milking is not acceptable with high production dairy cows under intensified dairy systems.
2. Twice-a-day milking with intervals of 10-14 and 12-12 are acceptable with very little research information as to the benefit of the 12-12 interval.
3. Three-times-a-day milking will increase milk pro-

duction 10 to 18% over 2x. Reproductive efficiency will be slightly lower, and udder health may be improved.

4. Four-times-a-day milking will increase milk production 8 to 12% over 3x. Udder health will be improved, with no data available on reproductive efficiency.

5. When changing from 3x to 2x or 4x to 3x, dairy farm managers should not expect to see a 8 to 15% decrease in milk products. Research has shown (30, 32) that after 20 and 14 weeks of an increased frequency of milking there is a carry-over effect of 9 to 11%, which is the effect of lactation persistency.

6. Superior facilities and management are necessary to receive the height percentage increase from either 3x or 4x milking frequency.

7. Keep the daily milking and feeding schedule the same each day. Do not milk 3x or 4x with more cows than the capacity of the milking parlor capability in a 24-hour period.

8. Financial benefits of milking frequency greater than twice a day will be affected by feed cost, milk price, and labor cost.

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Notes:

4X Milking

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4X Milking

The last few years I was the manager of Hillcrest Dairy in Tolleson, Arizona. At one time the dairy had two herds, of which Hillcrest Dairy #1 will be the herd referenced at this report.

Hillcrest Dairy was milking around 2,000 cows with 250 dry cows in July, 1995. Rolling herd average had been 27,000m and 1,000f for several months. Feeling that everything was in place for producing 30,000 lbs. of milk per cow, we were still not having a constant production level. Production was ranging from 80 lbs. to 92 lbs. per day. Udders were stressed most of the year. Cows were dripping after seven to seven and one half hours of milking intervals, which was an indication that nutrition was there for higher production. Feeling that the labor and facilities were not being utilized to the fullest, we started milking 4X in August, 1995.

By the second day, all cows in the herd were being milked 4X. We milked 2,000 cows in a double-36 4X with two clean ups of the parlor per day. Our peak through put of the parlor was 2,200 cows per day. The peaks on cows increased an average of 7 lbs. per day within 5 months and heifers increased an average of 6 lbs. within 2 months. Heifers seemed to except 4X easier than older cows. All cows seemed to adjust very well as long as feeding

and management was worked around the cows scheduled. Dry matter intake increased around 2 lbs. per day per cow after a month and udder health was improved with the result of being a decrease in the somatic cell count.

As with about everything you do, there are disadvantages. Labor has to be better organized. The time for breeding, giving rBST, sorting cows, etc. is reduced. Therefore, labor has to be better organized to get the cows worked and released so the cows can rest before returning to the parlor for milking. Cows are pushed harder so there is less room for mistakes in nutrition, management, breeding, and cow comfort. Parlors are worked harder so maintenance is a must and inflations are required to be changed more often. The added milk isn't free. A 3-4% increase in milk production is required to cover cost from extra feed, labor, maintenance, and depreciation on the parlor.

Table 2: Milk Production

	milk	std. 150d	times	RHA milk	RHA fat	1st peak	2nd peak	3rd peak
July	85.9	94.8	3X	27,013	999	95	111	116
August	89.4	99.1	4X	27,208	1,002	100	112	118
September	87.6	98.1	4X	27,512	1,010	101	114	120
October	94.7	105.7	4X	27,876	1,020	99	118	122
November	79.2	89.4	3X	28,004	1,020	95	116	123
December	76.3	84.8	3X	27,733	1,007	96	116	123
January	84.5	92.0	4X	27,545	992	97	117	124

(all data compiled from official DHIA records)

Table 1: SSC Scores

June '95	123,000
July '95	176,000
August '95	218,000
September '95	114,000
October '95	136,000
November '95	107,000
December '95	173,000
January '96	136,000

Table 3: Body Condition Scores

	calving	early	1st service	preg. check	late lac	dry
July (3X)	3.2	2.8	2.7	2.9	3.0	3.5
August (4X)	3.2	2.7	2.7	2.8	3.0	3.4
September (4X)	3.3	2.7	2.7	2.8	2.9	3.5
October (4X)	3.3	2.7	2.7	2.8	2.9	3.5
November (3X)	3.3	2.7	2.8	2.8	3.0	3.5
December (3X)	3.3	2.7	2.8	2.8	2.9	3.5
January (4X)	3.3	2.7	2.7	2.8	2.9	3.5



There are a few problems that one needs to be aware of before attempting 4X. Nutrition must be first rate to get the extra production without losing body weight or suffering breeding problems. The distance from the farthest corral to the milking parlor must be kept at the shortest distance possible. Corrals, feed manger, and freestalls or loafing areas cannot be overloaded as heavily as when you milk 2X or 3X. Cows don't have as much time to eat and rest. Therefore if you do not provide enough area for eating or resting, the cow will miss out on one or the other. Milking equipment and procedures must be perfect since there is one more chance per day to cause mastitis. The time cows are away from the feeding area should be limited to one hour or less per milking to allow the cows plenty of time for eating and resting between milkings. Fresh feed needs to be in the manger for cows when they return from the parlor. Man-

agement needs to be good enough to handle the extra production and shorter time that cows can be locked up for routine procedures.

Summary

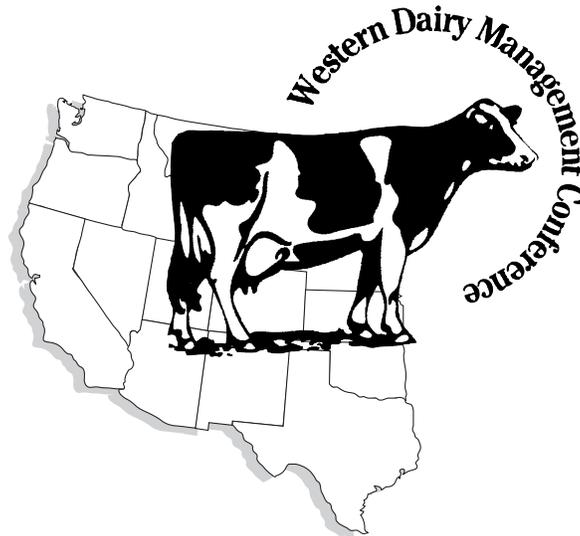
4X is not for everyone. It can work into most herds in several situations. A dairy that is starting up without full capacity can milk the cows another time until cow numbers increase. This will help increase cash flow, as well as, better utilize your labor and facilities. The other situation is some dairies can increase their production and efficiency. Cow through put was increased by about 10% at Hillcrest. Somatic cell counts decreased, dry matter intake increased, production increased while body condition stayed the same.

Notes

Notes

Vaccination Programs: Is There An Answer?

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Vaccination Programs: Is There An Answer?

In order to scientifically choose a vaccine or design a particular vaccination program it is necessary to consider many variables. Some of these include:

1. Presence and degree of challenge of the particular diseases on the farm or ranch.
2. Management practices available that lend themselves to vaccination programs.
3. At what times or ages are the disease problems occurring and are they associated with any stressor.
4. How the disease is protected against by the body.
5. Some basic immunology concepts.
6. Information available on products being considered, and the source and quality of the information.

Challenge

One thing to keep in mind is that challenge and protection are in a constant state of fluctuation. We like to think that when we vaccinate an animal, they all develop a certain level of protection. However, biological variability affects the level of protection. The same is true with the amount of exposure to a pathogen. Overwhelming challenge can override the immunity and lead to disease in vaccinated animals.

Timing Of Disease

Many of the farms we work with have a consistent time when certain diseases occur. The timing may give some insight into stresses that are occurring in the management of the cattle that can be dealt with and have more of an impact than vaccination. Furthermore, this type of a history is helpful to determine the timing of vaccinations. This is a tool that is often underutilized in veterinary medicine but if we know when a problem is occurring prevaccination schedules that will give maximum immune responses close to the expected trouble time can be very beneficial.

Designing A Vaccination Program

Vaccination programs in a cow herd need to be custom designed for the particular need of the herd. Vaccination programs in the replacement stock have two specific goals that need to be met. The first is to prepare

the calf against any pathogens that are causing disease problems in the calves. The second is to prepare the calf for entry into the adult herd with a good foundation of protection from which to build herd immunity. Although herd programs vary in pathogens contained for most cow/calf and dairy herds the minimum vaccination program should be built around the four major viral diseases (BVD, IBR, PI3 and BRSV) the five *Leptospira* serovars and for most parts of the country the major Clostridial diseases and Brucellosis. This should be the cornerstone of the program other pathogens are then optional and are added depending on herd or area problems. At least one four way modified live viral vaccine should be included for replacement animals to establish a strong baseline immunity against BVD and IBR.

Booster Importance

It is important to follow the label directions for administering vaccines. Killed vaccines and modified live BRSV require a booster before protection is complete. The first time a killed vaccine is administered the primary response occurs. This response is fairly short lived and is not very strong. The predominant antibody is IgM. The response seen after a booster vaccination is called the secondary response or anamnestic response. This response is much stronger and long lived and is primarily IgG. Also, there is more memory made in response to the booster. If the booster is given too early, the anamnestic response doesn't occur; and if too much time elapses before the booster is given, it acts as a primary shot not as a booster. With modified live vaccines, the primary shots also stimulate the secondary response without needing a booster since the virus or bacteria is growing in the animal.

Adverse Reactions

Adverse reactions are a potential risk with any vaccination used. These reactions fall into three primary types:

1. Immediate hypersensitivity is mediated by IgE and the release of granules from basophils and mast cells. This reaction is seen within minutes of vaccination and



often begins with shaking or sweating. The majority of these animals respond very well to epinephrine.

2. Delayed hypersensitivity is mediated by a subset of T cells and is delayed by up to 24 hours following vaccination. The signs are similar to immediate hypersensitivity and treatment is again epinephrine.

3. One of the more common reactions seen in dairy cattle has been associated with the endotoxin found in some vaccines. This is seen primarily in Holsteins due some genetic predispositions and can be seen following administration of any gram-negative bacterin. The pre breeding yearling heifer appears to be the most sensitive. The signs seen vary depending on farm or individual sensitivity and/or the number or severity of the gram negatives in the vaccination program for the day and include:

- a. anorexia and milk drops
- b. early embryonic deaths
- c. abortions
- d. gram negative bacterial (endotoxic shock), requir-

ing steroids, antihistamines and fluids.

Summary:

Designing a vaccination program involves a good history of the individual farm as well as a basic understanding of the immune system. The vaccines chosen should have good solid efficacy studies as well as effectiveness and efficiency studies if possible to ensure that the product can fulfill the needs of the farm or ranch. Management decisions may be made that do not maximize the potential of the products chosen and realistic expectations of all products should be well explained to the producer before they are used. The owner should be involved in the vaccine decision process so that all the information on the product is shared.

The establishment of good baseline immunity of replacement heifers and the foundation vaccination program can determine much of the replacements future health status and should be stressed in vaccination programs

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Notes

Biosecurity On Dairy Operations

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Biosecurity On Dairy Operations

Dairy producers will continue to grow in the size of their operations through the year 2000. Much of this growth will be through purchased animals brought into a herd. Forty-four percent of dairy operations brought some dairy or beef cattle onto their operations in 1995 (Figure 1). Larger herds brought higher percentages of cat-

tle into their herds and this trend is likely to continue. Disease risk exists when new animals are commingled with those on an existing operation; the following are true stories:

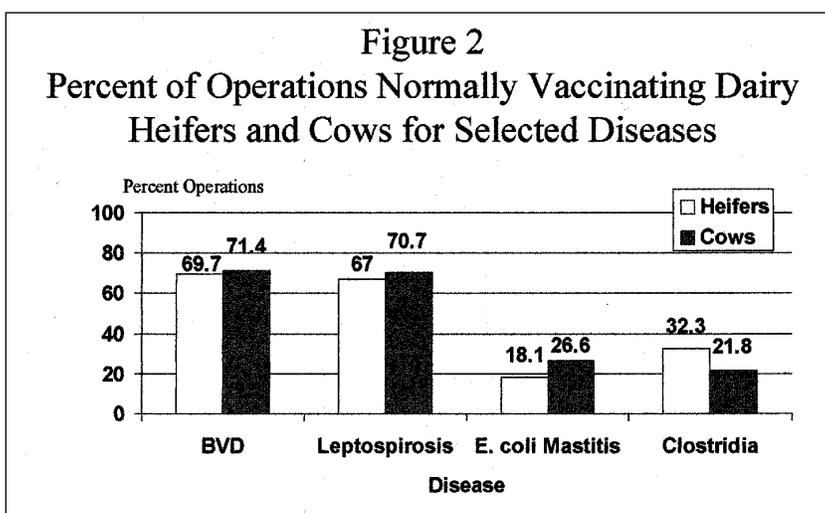
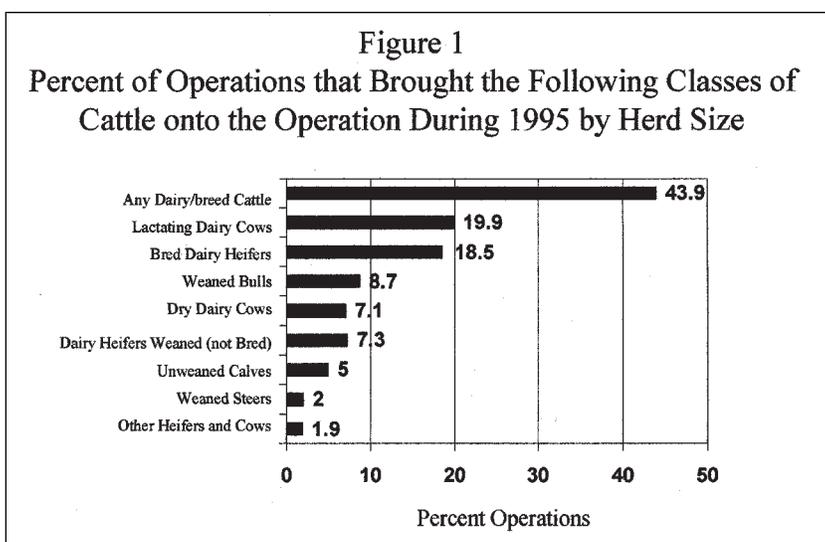
Example 1:

- 250 Holsteins expanding to 500 head through purchase of springing heifers.

- May, 1995 60 springers were purchased; by October of that year 52/60 heifers and 2 cows had died of BVD.

Example 2:

- High level of acute death loss began in calves with severe diarrhea on a large Southwestern dairy.
- Within 1 year, over 1,000 calves, heifers and some cows died of salmonellosis.



Biosecurity is preventing the introduction and spread of infectious diseases within a herd. Dairy operators need to know the risks that diseases can have on their herds and apply three basic principles to minimize these risks:

1. Vaccination to increase protective immunity.
2. Eradication or control of existing infectious diseases within the herd.
3. Prevention of infectious diseases from coming into the herd by appropriate testing and pre-arrival management and vaccination strategies.

The diseases which pose the highest risk to expanding dairy operations at present are: BVD,



Johne's disease, Salmonellosis, contagious mastitis and Clostridial diseases. Some of these diseases will be described in the context of examples of how to minimize disease risk in an expanding herd.

Vaccination of the herd to increase a protective immunity.

Many diseases can be controlled through vaccination; protective antibody levels established in the core herd can protect these cattle from potentially severe pathogenic disease brought in by "asymptomatic carrier" animals. BVD is one example. Persistently infected (PI) animals (perhaps 1-5% of animals in any herd) are those with BVD virus circulating in their bodies, but free of disease symptoms. When PI animals are commingled with unvaccinated, susceptible herd animals, the result is diarrhea, abortions, extremely sick animals and mortality rates that can exceed 50%. Vaccination against BVD is with the use of either chemically altered (modified live) or killed vaccines. Neither are 100% protective, but both significantly reduce risk of BVD compared to the unvaccinated, susceptible herd when applied properly.

IBR, similar to BVD, can cause viral abortion in susceptible animals. Unlike BVD, it is not known to exist in a latent persistently infected state. Without this constant exposure because animals are not carriers, IBR vaccination is extremely reliable in protecting against abortion. Clostridial diseases cause acute death in normal cattle when this organism is present in the environment. Vaccination against this disease is highly effective when applied properly. Despite the availability of highly efficacious vaccines, many herds remain unaffected and susceptible to disease when purchased animals are added to the herd (Figure 2).

Vaccination of herd additions prior to their arriving in the herd can sometimes be accomplished. Logistics of cattle movement and timing from point of sale to arrival on the dairy make this protective effort difficult. Figure 3 indicates the percent operations by number of cows requiring vaccinations before bringing animals

Figure 3: Vaccinations normally required by operations by herd size before bringing animals on farm.

vaccination type	percent operations number of cows			
	under 100	100-199	200+	all operations
Brucellosis	48.9%	61.8%	73.8%	52.9%
BVD	43.1%	59.3%	59.3%	46.8%
IBR	39.2%	57.1%	8.9%	43.4%
Leptospirosis	41.9%	58.2%	55.8%	45.4%
Other	8.2%	12.0%	15.2%	9.4%
None	42.0%	28.3%	15.4%	37.7%

Figure 4: For Operations bringing on dairy cows during 1995, percent that normally required tests or proof of health by herd size.

proof type	percent operations number of cows			
	under 100	100-199	200+	all operations
individual cow somatic cell count	24.7%	32.1%	25.8%	25.7%
herd bulk tank somatic cell count	13.4%	21.1%	27.4%	15.3%
individual cow milk culture	9.1%	7.8%	9.8%	9.0%
herd bulk tank milk culture	3.9%	8.7%	23.4%	5.8%

Figure 5: Tests normally required by operations by herd size before bringing animals on farm.

proof type	percent operations number of cows			
	under 100	100-199	200+	all operations
brucellosis	28.5%	39.7%	40.1%	31.0%
Johne's Disease	8.5%	14.6%	4.7%	9.1%
BVD	15.1%	21.5%	13.7%	15.9%
bovine T.B.	22.3%	29.0%	24.8%	23.4%
other	2.3%	4.1%	2.9%	2.6%
none	%68.7	%58.4	57.5%	66.3%

on farms during 1995.

Eradication of control of existing infectious diseases within the herd.

Contagious mastitis remains a costly disease for dairy producers. In those herds where *Staphylococcus aureus* and *Streptococcus agalactiae* persist, exposure of newly acquired, uninfected cattle to those harboring these infections almost guarantees contamination of the new animals. Conversely, purchasing infected additions to a herd where these mastitis pathogens have been eliminated puts the entire herd at risk. Figure 4 identifies the percent of dairies requiring tests of proof of mastitis health by size.

Prevention of infectious diseases from coming into the herd by appropriate testing.

Some infectious diseases are virtually impossible to control or eradicate once established in a herd. Prohibiting their entrance into a herd can only be done by strategic testing of animals prior to purchase and/or acceptance of cattle at the dairy. Johne's disease is an

example. *Mycobacterium paratuberculosis* bacteria (Johne's disease) is spread among calves, and infected animals remain asymptomatic until after first calving. Once the infection is evident, treatment is unrewarding and slaughter for salvage is the only alternative. Testing technology to identify asymptomatic carriers is available. Figure 5 identifies the percent of operations in 1995 that required tests for Johne's disease and other disease conditions that are best managed by identification of positive animals prior to arrival in dairies.

Summary

Biosecurity management procedures are the expanding dairy owner's opportunity to reduce the risks of disease in his/her herd. The first step is for owner's to realize their risk. The second step is to utilize the expertise of veterinary professionals to devise strategies that minimize risks through application of sound scientific principles of disease control.

Reference:

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Notes

Understanding Herd Lameness

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Understanding Herd Lameness

With the exception of a few diseases of the nervous system, lameness in cattle is caused by an animal adjusting its movements or way of standing in order to avoid pain. The pain resulting from the various diseases that cause lameness is the most severe form of discomfort suffered by animals. For this reason, lameness has attracted the attention of European animal-rights activists. The economic importance of lameness has been well documented. Financial losses occur as the result of reduced milk production, loss of body condition, reduced fertility, culling, veterinary costs and medication, as well as time devoted to nursing an animal by the dairyman. It has been estimated (Esslemont, 1990) that a single case of sole ulcer could cost \$US 260-360 and one case of interdigital disease might cost \$US 100-200. In a later study (Esslemont and Spincer, 1993), the average cost of an incident of lameness was placed at \$US 150. Earlier estimates indicate that financial annual losses from lameness may amount to \$US 2,000 per 100 cows (Whitaker et al., 1983) and the loss to the dairy industry of the UK could be \$US 30 million each year.

Reduced fertility makes up a significant proportion of these losses (Collick et al., 1989). Lame cows were found in this study to take 14 days longer to conceive than did normal animals. Among animals affected with sole ulcers, conception might be delayed for 40 days. Lame cows have been shown to contract other diseases more frequently (usually indirectly), such as mastitis.

Lameness has been the subject of a number of surveys. The annual incidence of lameness has been estimated by a number of workers as 5-30% (Politiek, et al., 1986) and 21% (Reurink and Van Arendonk, 1987). Philipot et al. (1990) found the incidence of lameness to be 8.2%, but 25% of the animals examined had claw lesions. The incidence of lameness from non-infectious causes has increased considerably in recent years. Figures from milk-recording organizations in Germany indicate that culling due to claw and leg problems nearly

doubled from about 4-5% to 7-9% over a ten-year period starting in 1983 (Distl, 1994). The increase is probably associated with the introduction of more and more intensive nutrition and complex management systems. These, in turn, have led to an increased awareness of the importance of a phenomenon referred to as 'sub-clinical laminitis' which was first described by Peterse in 1979 who considered it to be the underlying cause of diseases such as sole ulcer, white line disease, toe ulcer, etc. The infectious diseases causing lameness will not be discussed in this paper.

Sub-Clinical Laminitis

The term 'sub-clinical' is used because the signs of the disease are not obvious. To the eye of the keen observer, an affected animal will walk more carefully than normal. Sometimes the skin around the coronary band and dew claws will be pink and puffy. Very often the only reason for suspecting that sub-clinical laminitis is causing problems is because there is an increase in the occurrence of diseases such as sole ulcer, white line disease, double sole and possibly heel erosion. Hemorrhage of the sole is considered to be a very significant characteristic sign of sub-clinical laminitis and is used by many workers to evaluate the severity of laminitis in a herd or group of cattle.

The disease process involves damage to the blood vessels supplying the horn-producing tissues. As a result, subtle changes in the quality of the sole horn occur. The texture of the horn softens and becomes vulnerable to infection, wear and damage. For many years nutritional mismanagement was considered to be the cause of this condition. The disease is essentially one of intensive management of animals in high-production herds so, in 1982, Mortensen and Hesselholt introduced the idea that sub-clinical laminitis was more likely to occur if factors other than nutrition were stressing the herd. In this paper the 'risk factors' (predisposing causes, Vermunt 1994b) associated with this disease will be discussed.

Nutrition



Carbohydrate

Sudden increases in carbohydrate intake or the continued intake of high levels of carbohydrate cause changes in the microbe population of the rumen (Peterse et al., 1986) and the rumen becomes very acidic. The operative word here is 'sudden'. The sudden introduction to free choice total mixed ration is likely to result in a problem. Increasing the post-calving ration too rapidly can cause a problem. If the cattle are component fed, it is preferable to feed the concentrate four times a day to high-yielding cows rather than just twice a day.

Several authors (Nilsson, 1963; McLean, 1966, 1970; Weaver, 1971; Little and Kay, 1979) associate feeding barley with an increase in the incidence of laminitis. It is probably wise to avoid including more than 40% barley in dairy cow rations because it is highly digestible. Finely ground or moist grains are also highly digestible.

Fibre

Fibre has two important functions, firstly it counteracts the acid produced by the rapid digestion of carbohydrate, and secondly, the hard stems of the forage stimulate rumen movement and rumination. Therefore, forage should not be chopped too fine (25% of particles of hay should be greater than 2" in length). Some long hay should always be fed to provide stimulation to the rumen. Ideally, forage should not fall below 40% of the dry matter intake.

Heavy manuring of pasture or the generous use of nitrate fertilizers can sometimes cause problems. Nitrate is converted to nitrite in the rumen. Nitrite can reach toxic levels in grass, pasture crops and silage. Nitrate may contribute to laminitis (Vermunt, 1990). About ten days after a spell when the weather is warm and wet, pasture will have grown rapidly and nitrate in the vegetation will be at its highest level. High levels of nitrate are also present during the period immediately prior to the plant developing its seed.

Lead Feeding

At the end of the dry period, the dry matter intake of a cow may be reduced by as much as 30%. Heavy concentrate feeding prior to calving can increase an animal's predisposition to laminitis. It is recommended that the pre-calving feeding program should be based upon the animal's body condition. The safest method of managing the pre-calving feed management is with a total mixed ration. However, in the case of component feeding, it must be remembered that a cow will take concentrate before she will consume forage. Therefore, in the case of component feeding, the concentrate offered

each day should be limited to 0.75% of the animal's body weight.

After-calving Rations

After calving, the cow must be introduced gradually to a ration if it is formulated to be high in energy. Peterse (1982) recommended that until the concentrate offered reaches 8 kg per day the daily offering should not be increased by more than 1 kg per day. Once the cow is consuming 8 kg of concentrate per day, further daily increases should be limited to 0.5 kg per day.

Buffers

A buffer is a component of a ration that can neutralize acid. Fibre is a natural buffer. Some producers add sodium bicarbonate to the ration at 1% of the dry matter. Including more buffer may reduce the palatability of the ration. Although not a buffer, providing rock salt licks will increase salivation in cows and the saliva increases the rumen pH.

Protein

The literature is controversial on the role of protein in the pathogenesis of laminitis. In some cases, feeding protein at levels in excess of 18% is associated with laminitis (Manson and Leaver, 1988; Bargai et al, 1992). In other instances no such relationship could be established (Greenough et al., 1990). There is no evidence that any particular source of protein is more dangerous than any other. However, protein-rich grass has been associated with the occurrence of laminitis (Vermunt, 1992). It is unclear to what extent allergic reactions to protein exist. It should also be borne in mind that grass growing extremely rapidly tends to be low in fibre.

Heritability of Lameness

Russell, Bloor and Davies (1986) demonstrated that the daughters of some bulls were more likely to suffer from lameness of digital origin than those of other sires. Heritability estimates for a 'single eye-scored claw angle' average about 0.10 (McDaniel, 1994). McDaniel also indicates that animals with steep claw angles (50-60) have greater longevity. The most common claw traits were discussed by the EAAP Working Group "Claw Quality in Cattle" (Politiek et al., 1986; Distl et al., 1990). These traits consisted of an evaluation of the claw shape, the quality of claw horn and features of the inner structure of the claw. Several studies demonstrated that these traits had sufficiently high additive genetic variation to achieve genetic improvement. Claw measurements are significantly correlated genetically and phenotypically to

the prevalence of claw disease, longevity and lifetime performance (Nielsen and Smedegaard, 1984; Reurink and Van Arendonk, 1987; Rogers and McDaniel, 1989; Rogers et al., 1989; Baumgartner and Distl, 1990).

Because the angle of the joints of the limb are difficult to measure, their significance has been studied less intensively than have been the characteristics of the claw. Variations in posture contribute to the difficulty of making accurate evaluations. Scores or even actual measurements of individual cows often show large changes when they are observed after the cow moves a few steps (Te Plate and McDaniel, 1990). Since the advent of photogrammetric methods for measuring hock angle (Greenough, 1987), more precise measurements have been possible. In one study, Vermunt (1994a) found that the range of the hock angle was from 154.3-177.4 (and that there is a decrease in the angle with age. McDaniel (1994) states that the 'mildly straight leg' can be associated with survivability. However, it must be appreciated that the very straight limb is correlated to a high incidence of joint disorders (Bailey, 1985). McDaniel (1994) also points out that 'rear leg rear view' scoring is extremely valuable in assessing overall limb conformation.

Strategies for improving leg and claw quality are being developed. Distl (1994) states:

"Important parameters for claw and leg quality can only be identified when traits used in breeding work are closely related to claw health, longevity, life-time performance and functional efficiency of the animal. This definition implies that claw and leg quality cannot be recorded by just one trait. The traits necessary seem to be more complex and may be of different importance in dependence of the exposure to environmental effects. Particularly, claw shape is a result of the interaction between individual factors and environment. Genetic components may respond differently to specific environments and in each specific environment other genetic components may play the prominent role."

In the late seventies the Nordic countries introduced a system whereby claw and leg traits were given an economic rating which was included when the total merit index was being calculated. Research during the past decade has established a rationale for contributing to

the control of lameness through improving claw and limb quality. Still further work is needed to establish claw and limb traits as useful parameters for the epidemiologic investigation of herd lameness.

Management

The study on lameness in dairy cows conducted by the University of Liverpool considered the role of management in foot lameness in UK dairy cattle (Ward, 1994a). How important is the farmer as a cause? They found that the amount of lameness was closely related to his/her knowledge, training and awareness. The necessity of providing short courses for dairy farmers and dairy-men is obvious. However, as a corollary to this problem, the education of the veterinarian should also be taken into account. In some countries the knowledge of the veterinarian is limited to the treatment of foot rot and some simple semi-surgical procedures. In other countries (Italy and Spain) veterinary practices specializing in digital disorders exist.

Functional Hoof Trimming

The term 'functional hoof trimming' implies that the 'Dutch method' of hoof care, which was originated by Toussaint-Raven (1989), is being applied. Correctly performed hoof trimming is considered to be beneficial (Manson and Leaver, 1988). However, undue stress can be counterproductive to milk production (Stanek et al., 1994) as can poor trimming technique. The use of a tipping table and older type of equipment can cause the trimming period to be extended to as much as 30 minutes. The modern Danish or Dutch claw-trimming crushes, combined with contemporary hydraulic hoof cutters and metal bladed, electric angle grinders, can permit the procedure to be completed in as little as seven minutes with minimum distress to the cow. The conclusion reached by the Liverpool workers seems to be highly appropriate (Clarkson et al., 1993). It is believed by some producers that regular claw trimming can add one lactation to the average life of a herd. "Foot-trimming can be beneficial, but not always. It would seem that correct training in the correct technique is essential."

Cow Comfort (ecopathology of lameness)

Significant improvement in milk production per cow has taken place during the past ten years. During the same period there has been a tendency for size of the herd to increase, concrete to take the place of pasture,



and cubicles to be favoured over straw yards or tie stalls. The economics of contemporary dairy farming demand intensive management. In some cases this demand creates stresses in the cow, caused by a conflict between its normal behaviour and the environment in which it must exist.

Several factors link housing/behaviour to the incidence of lameness. Maximum lying time increases the period of rumination. Saliva generated during rumination increases the alkalinity of the environment of the rumen, thereby counteracting acidosis which is a major factor in the etiology of laminitis. Furthermore, when a cow is lying down almost twice as much blood perfuses the udder than is the case when she is standing. It may be assumed that increasing blood perfusion of the udder may cause increased milk production. Cermák (1990) hypothesizes that if cows lie longer in cubicles their exposure to slurry deposited in passageways will be subsequently shorter. This, in turn, would reduce the environmental challenge to the foot as well as reduce the likelihood of falls on slippery concrete surfaces.

Cermák (1990) goes on to point out that there is a forward space demand (0.7 to 1.1 metres for a 600 kg Holstein dairy cow) as she lunges forward to rise. The cubicle partition should be of 'space-sharing' design and provide three zones of free space for the head, rib cage and pelvic area. The bottom division rail should be set at from 34-40 cm and the top rail at from 111-117 cm from the floor. The width of the cubicle should be from 115-122 cm. The base and the bedding of the cubicle have a profound effect on the lying time of the cow. The more resilient and soft the lying surface, the longer the cow will rest. Cows will lie for as many as 14 hours in the most comfortable cubicles. A sand bed seems to be the most acceptable to cows, but sand bedding requires modifications to the drainage system. However, experimentation is taking place with a variety of bedding systems that may use automobile tires, chopped rubber and canvas mattresses.

The design of the loose-housing system is important. Potter and Broom (1987; 1990) point out that space is used very competitively between rows of cubicles, around drinking troughs in milking collecting yards and at entries and exits. Space available in these 'strategic sites' must be generous if a cow is to have sufficient personal space for flight to accommodate aggressive encounters between the various animals in the social hierarchy. It is desirable that the width of alleyways behind

the cubicles should be 3 to 3.5 metres. 2.5 to 3.0 metres should be added if feed bunks face the cubicles. The loafing or exercise area should be calculated at not less than 3.3 m² per cow (Sainsbury and Sainsbury, 1979; Zeeb, 1987). If computerized feeding devices are used, enough of them should be provided to prevent cows spending prolonged periods waiting for access to the equipment.

The floor surfaces over which cows walk have also received a great deal of attention. New (green) concrete often causes an increase in the prevalence of lameness for up to nine months after it has been laid. Anecdotally, some producers recommend dragging a heavy weight over the fresh concrete before it has finally set.

Slurry contains a mixture of organisms and chemicals, many of which can attack the horn of the claw or the skin between the claws. Good hygiene is essential to reduce the incidence of infectious diseases. Excessive moisture in the environment softens the horn, which wears more rapidly and is more prone to mechanical damage.

There has been much study of the interaction between housing and behaviour. Housing that is conducive to 'social confrontation', (that is to say, there is a high risk of a dominant cow confronting a submissive one) will cause an increased stress in the herd. Mortensen and Hesselholt, (1986) demonstrated that changes in the blood vessels seen in laminitic claws are also seen in other organs of the body. If the incidence of lameness in a herd is high, it should be assumed that the environment is interacting adversely with the behaviour of the animals. Careful observation of the behaviour of the animals, vis-à-vis aggressive behaviour and/or amount of time spent resting, can provide a useful indicator of the importance of negative social interaction in the herd.

Footbaths

Footbaths provide a traditional technique aimed at reducing the reservoirs of organisms on the interdigital skin. In recent years the installation of permanent footbaths is being discontinued in favour of portable equipment, usually fabricated from fibreglass. Trials have been conducted to evaluate efficacy of different solutions. Formalin or formalin with copper sulphate is the most potent (Serieys, 1982). Other chemical agents such as iodides or cresols fail rapidly due to the high levels of organic matter present in the washing fluid. Formalin in a concentration of 5% is considered to be effective if the ambient temperature is more than 12°C. Formalin footbaths are effective in

reducing the incidence of interdigital dermatitis. Reports concerning the use of formalin for the control and treatment of digital dermatitis are extremely contradictory. It should be noted that formalin is poorly biodegradable and that there are reports of milk taint when the product is used.

Footbaths should always be placed at the exit of the milking parlour. Cleansing the digits by running the animals through a clear bath water prior to entering the parlour not only reduces the bacterial burden on the skin but extends the life of a medicated footbath by minimizing contamination of the bath with organic matter (Blowey, 1994). Since digital dermatitis has become a major problem, various antibiotic solutions have been used (oxytetracycline or tetracycline-HCL, <6 g/l; lincomycin, 0.15g/l). The antimicrobial activity and concentration of these products reduce significantly after a herd uses the bath possibly due to absorption in faeces and soil particles (Keulen et al., 1992). A minimal solution footbath is now marketed (Ward, 1994c) that has a soft foam base lying beneath a waterproof membrane. When a cow steps into the bath, the fluid moves to bathe her feet. The bath needs only 10-15 litres of fluid compared with 125-200 litres in a traditional footbath. Fluid is used at the rate of about 4 litres for every 25 cows (Ward, 1994b).

Management of Replacement Animals

The corium of the claws of cattle aged between 8 and 13 months is more susceptible to nutritional and management stress than is the case with older animals (Greenough et al., 1990; Greenough and Vermunt, 1991). Solar hemorrhages are a consistent finding in the claws of animals affected with sub-clinical laminitis. Beef steer calves fed high levels of energy have more hemorrhages in the soles of their claws than those fed lower-energy levels. Heifers that increased in weight at rates greater than 750 grams per day showed more hemorrhages in the soles of their claws than those that increased in weight less rapidly. However, there is yet no objective evidence that establishes a link between solar hemorrhage in the young animal and claw disease in later years. From a circumstantial perspective, in the dairy herds in which laminitis is recognized as a major problem, a significant number of heifers are found to have hemorrhages in the soles of their claws. The number of cubicles available per animal may be important, particularly for heifers (Leonard et al., 1994), some of which are sensitive to social confrontation when first introduced into the

milking herd (Greenough and Vermunt, 1990). Heifers should be introduced into the milking herd in groups and care should be taken to ensure that each is properly trained to use a cubicle. Heifers that stand for long periods tend to have a greater preponderance of hemorrhages in the sole of their claws. Hemorrhages are both an indication of bruising and the presence of laminitic changes.

It has become more and more an accepted practice to calve heifers at 24 months of age or earlier. It is argued that a heifer will produce more milk between 22 months of age and 60 months of age. This is only true if the average age of the herd exceeds 60 months. Another perspective on this controversy is that the size of the claws of a heifer of 24 months of age is significantly less than a animal that is 30 months old, the weight-to-claw-size ratio is different. Added to this problem is the recommendation that heifers should be of a certain wither height and weight before they are bred. Frequently, small-framed heifers are unable to meet these standards unless they are force fed and this practice undoubtedly has negative side effects.

Exercise

Movement causes blood to circulate freely through the tiny blood vessels of the foot. Lack of movement allows blood to pool in the digit and the tissues have less opportunity to be oxygenated. Any change in management that reduces the opportunity for an animal to walk freely is detrimental. This situation can occur when young animals are taken from pasture and placed in relatively confined spaces. It can also occur if heifers stand for prolonged periods when they are introduced to the dry herd. Aggressive social interaction with dominant cows, together with unfamiliarity with the cubicle system, cause this to happen. In some cases, this may be the first time that the animal has walked on concrete, and it is also a time at which the diet changes. The cumulative effect may stress the animal. Over the past decade interest has focused on the finding that laminitis commonly affects dairy heifers (Peterse and Van Vuuren, 1984; Moser and Divers, 1987; Bradley, et al., 1989; Colam-Ainsworth et al., 1989; Vermunt, 1990; Greenough and Vermunt, 1991; Bargai et al., 1992; Frankena et al., 1992; Leonard, et al., 1992, 1994). The fact that so many workers have identified laminitis-like problems in young is probably the most significant finding of recent years. Too high a rate of growth during puberty, the stress of social interaction, sudden



changes in diet, reduced exercise and negative reaction to a new and hostile environment are all factors that cumulatively predispose heifers to the occurrence of laminitis. There is evidence that once damage to the small blood vessels of the foot has occurred the animal will become increasingly sensitive to future insults.

Discussion

Historically, the dairy industry has accepted lameness in cows as an accidental problem that is unavoidable. Contemporary information derived mainly from European sources now points out that lameness can be a herd problem. The dairy producer faced with a herd lameness problem must accept the fact that appropriate nutrition, combined with suitable management practices, can reduce the incidence of

lameness without interfering with the productivity of the cows. New approaches to investigating herd lameness are being developed, (Greenough and Vermunt, 1994).

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Notes

Notes

New Strategies For Heat Detection And Timing Of Artificial Insemination

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New Strategies For Heat Heat Detection And Timing Of Artificial Insemination

Observing cows for signs of heat and inseminating them at the optimum time are necessary steps for effective reproductive management of a dairy herd. Artificial insemination (A.I.) has become one of the most important agricultural technologies of this century and most dairy producers have adopted some aspect of this technology in order to maintain a competitive agricultural business. However, inefficiency reproductive performance in modern dairy herds has not only been a source of frustration to producers and their consultants but has also substantially reduced potential profits in dairy operations. Several of these costs, such as increased semen, veterinary, and drug costs, receive inevitable attention because they are entered directly in the balance sheet. However, the major opportunity costs (potential profit due to fewer days open, fewer cull cows, lower days in milk, and increased replacements from A.I. sired heifers) are often overlooked because they can be difficult to accurately calculate and are not entered directly in the balance sheet.

Increases in herd size and milk yield have been implicated as contributors to the decreased reproductive efficiency experienced by many U.S. dairy farms. For example, during the past ten years the average Virginia DHI dairy herd has experienced a 33% increase in milking cows and a 20% increase in milk yield per cow without the same increase in additional labor force. During this same time period the average calving interval has increased from 13 to 14 months. This decrease in reproductive efficiency conservatively cost \$7,700 per year per herd if one assumes a \$2 loss per day open and the average herd is 128 cows.

The major factor limiting optimum reproductive performance on many farms is failure to detect heat in a timely and accurate manner. Using November 1996 Dairy Herd Improvement information from 9042 dairy farms that process their records at the DRPC@Raleigh the average days to first breeding was 95 days compared

to the stated goal of 70 days. Thus, 25 days or approximately one estrous cycle (time interval between two consecutive heat periods) was lost presumably due to failure to detect heat. Historically the approach taken by management has been passive, by waiting for cows to cycle and be detected in heat for A.I., rather than proactive which now can be accomplished by the incorporation of a systematic breeding program that induces heat or allows for appointment breeding without the need for heat detection.

Systematic Breeding Programs

Systematic breeding programs have been developed and are being used to some degree. The two most promising systematic breeding programs, OvSynch and Target Breeding, will be discussed. The principal benefit of these programs is that they provide an organized approach for administering first service A.I. Both programs provide the flexibility to set the start of A.I. breeding, if the desire is 45 or 70 days. These systems facilitate the breeding of more cows A.I., provide an increase in the number of inseminations within a given period, and eliminates natural service from at least the start of the breeding program. Systematic breeding programs have the potential to increase the reproductive performance of the dairy herds while maintaining A.I. as the dominant breeding option. These programs do require daily heat detection to identify cows that return from the initial injection scheme. Moreover, reproductive management is based on a systematic approach to whole herd rather than on the health and status of individual cows.

Regulation of estrus in lactating dairy cows has been primarily limited to the use of prostaglandins (Ferguson and Galligan, 1993; Kristula et al., 1992; Pankowski et al., 1996; and Stevenson et al., 1989;). Two prostaglandin (PG) products are commercially available for use in lactating dairy cows, Lutalyse and Estrumate . These PG products are from a class or group of hormones which generally cause regression of the corpus luteum of the



ovary and usually subsequent expression of heat and ovulation within 2 to 5 days after administration. However, heat is not precisely synchronized because it does not take into account the follicular population at the time of luteal regression, some cows require 48 hours and others 120 hours to mature a dominant follicle for ovulation. Thus, appointment breeding is not practical for two reasons: 1) not all cows are in the luteal phase of the cycle and thus will not respond to PG; and 2) the variation in follicular development due to the timing of the next follicular wave does not allow for consistent timing of a follicle that will produce estrogen for behavior expression and release of an ova for fertilization. Numerous schemes have been developed to systematically schedule PG administration and periods of observation for signs of heat that can be adapted to most any farm routine.

An excellent study conducted in New York with three commercial herds and 1624 cows compared two reproductive management scenarios using PG with a program based on routine rectal palpation, intrauterine therapies, and veterinary intervention (Pankowski, et al., 1996). One program was based on the following assumptions: 1) rectal palpation is not sensitive for correctly identifying functional corpus lutea, 2) controlled studies have indicated that uterine infusions may not be beneficial, and 3) heat induced by therapeutic use of PG may cleanse the uterine environment and increase fertility. The second program included the following concepts in addition to those of the first program: 1) PG at a scheduled interval may result in synchronization of estrus and improved reproductive efficiency, and 2) a higher pregnancy rate may result from PG administered at 14 day intervals than at the original recommendations of 11 day intervals.

The reproductive program which included a therapeutic injection of PG at 25-32 days postpartum (no rectal palpation) and another PG injection just prior to the end of the voluntary waiting period (VWP) resulted in similar reproductive performance to the program consisting of routine rectal palpation and intrauterine therapies. Pregnancy rate, first service A.I. rate, first service conception rate, overall conception rate, percentage of cows that became pregnant, and culling rates were not different between these two programs (Table 1). Although no difference in reproductive performance occurred among programs, partial budgeting indicated that PG treatment costs were \$4.46 and \$15.61 less per cow for the 2x and 3x PG programs respectively, when compared to the cost of rectal palpation and veterinary intervention. Therefore, compared with a traditional repro-

Table 1: Reproductive performance and partial budget and sensitivity analysis for postpartum therapeutic PG (2 PG) and PG at scheduled 14 day intervals (3 PG) compared with routine rectal palpation and veterinary intervention (RP).

<u>Term</u>	<u>RP</u>	<u>2 PG</u>	<u>3 PG</u>
Number of cows	472	443	461
First service conception rate, (%)	43	45	47
Overall conception rate, (%)	51	53	53
Cows culled, (%)	21	21	20
Days open			
all cows	113	114	107
pregnant cows	111	111	104
Doses of PG	1289	1630	1890
Rectal palpations	944	0	0
Cost of therapy ¹	1055	435	163
Net cost per cow (compared to RP) ²		-4.46	-15.61
PG \$3 per dose		-3.88	-14.70
PG \$3 per dose and rectal palpation \$.90		-1.01	-11.87
PG \$4 per dose		-3.12	-13.33

1: Includes all prebreeding palpations (excludes pregnancy palpations)

2: Rectal palpation \$2.25 per palpation, PG \$2.25 per dose, value of saved day open \$.2. Adapted from Pankowski et al., 1996. J. Dairy Sci. 78:1477-1488.

ductive program based on rectal palpation, use of PG without rectal palpation could result in equivalent reproductive performance at lower costs. When PG was used for postpartum reproductive therapy and synchronization of estrus, reproductive performance and net economic benefit were increased compared with the other two programs. Increased cost for PG did lower the advantage of the 2x and 3x PG programs; however, even when PG was figured at \$4 per dose the advantage of the 3x program was \$13.33 over the routine rectal palpation and veterinary intervention program.

Target Breeding Program

An aggressive proactive program, termed Target Breeding, has been advanced by which cows are administered PG prior to the end of the VWP combined with 14 day PG administration until detection of heat and A.I. The intention of this treatment is to set up cows into a stage of the cycle which contains a mid cycle corpus luteum, where it is most responsive to the second administration of prostaglandin 14 days later. Generally with this program, cows are not inseminated if they exhibit

heat following the initial PG injection.

Once a VWP has been established for a herd, cows are listed chronologically according to calving dates. Cows within 14 days of the VWP are administered the setup PG injection, for convenience injections are usually given once a week for all cows that surpassed the specified target date. Fourteen days later, cows receive the first breeding injection of PG and are observed for heat and inseminated accordingly. Cows that are not observed in heat are reinjected 14 days later, observed for heat, and inseminated. The PG administrations are continued at 14 day intervals until heat is detected. Some producers and veterinarians may prefer to examine cows that fail to exhibit heat after the third PG injection. Others may appointed breed at a specified time (usually 80 hours) after the third or fourth PG injection.

OvSynch Breeding Program

Researchers have shown that administration with GnRH 6 to 7 days prior to PG increased percentage of cows synchronized and reduced the time and variability to estrus in beef cows (Thatcher et al., 1993; and Twagirungu et al., 1992). A new program has been developed that synchronizes ovulation allowing better pregnancy rates to timed A.I. than with PG (Pursley et al., 1995). An injection of gonadotropin releasing hormone (GnRH) followed seven days later with PG and followed 36 to 48 hours later with the second injection of GnRH has been shown to synchronize ovulation not estrus. An important point is that cows are not observed for signs of heat but inseminated at a specified time following the second GnRH injection.

The first injection of GnRH is given at a random stage of the estrous cycle and causes either luteinization or ovulation of the largest follicle in approximately 85% of all cows injected. The PGF2 injection regress the corpus luteum or luteinized follicle induced by GnRH. A new dominant follicle forms and is available to be ovulated by the second GnRH injection given 36 to 48 hours after the PG injection. According to preliminary results from relatively small number of breedings OvSynch program may be effective in improving the percentage of cows pregnant by 60-100 days in milk and may reduce the days to first breeding.

Cost effectiveness of the two programs (Target Breeding and OvSynch) are presented in Table 2. Two cost for PG and GnRH were used in the analysis along with two levels of heat detection (60 and 80%). High efficiencies for heat detection were used because with a synchronization program higher than average levels are easily obtained. Labor cost were difficult to estimate and will vary across operations but the point is cows will be sorted slightly less with a Target Breeding program because the initial group detected will not receive the third injection.

The cost per pregnancy was derived by dividing the total cost per cow by the estimate percent pregnant. No cost for heat detection was included in the analysis because heat detection must still proceed for all cows to catch returns are repeat services. However, the OvSynch program uses appointment breeding without heat detection which would reduce cost especially on large farms where cows could be grouped and whole

corrals could be managed without the need for heat detection until after appointment breeding similar to synchronization programs used by large western U.S. beef cattle ranches. The least cost method was the Target Breeding program with \$2.50 PG and 80% heat detection efficiency. The OvSynch program which used \$2.50 for PG and \$4.00 for GnRH was only \$4.81 more expensive

Table 2: Cost analysis per pregnancy of Target Breeding and OvSynch systematic AI programs.¹

<u>program</u>	<u>PG \$</u>	<u>GnRH \$</u>	<u>heat det. %</u>	<u>% A.I.</u>	<u>% preg.</u>	<u>labor cost</u>	<u>cost per pregnancy</u>
Targeted Breeding	\$2.50	--	60%	73%	34%	\$1.26	\$20.04
	\$2.50	--	80%	80%	40%	\$1.19	\$15.44
	\$4.00	--	60%	73%	34%	\$1.26	\$31.80
	\$4.00	--	80%	87%	40%	\$1.19	\$24.85
OvSynch	\$2.50	\$4.00	--	100%	45%	\$1.50	\$24.83
	\$2.50	\$7.00	--	100%	45%	\$1.50	\$38.16
	\$4.00	\$4.00	--	100%	45%	\$1.50	\$28.16
	\$4.00	\$7.00	--	100%	45%	\$1.50	\$41.50

¹: Assumes 80% of cows given PG exhibit estrus, 45% pregnancy rate for both programs, labor cost at \$.50 per sorting (excluding AI), three PG injections with Target breeding, OvSynch consist of two doses of GnRH and single dose of PG.



per pregnancy than the Target Breeding program that had similar cost for PG and 60% heat detection efficiency.

What Causes Cows To Show Heat?

The hormonal condition that can lead to expression of heat in the cow is a high blood level of estrogen (estradiol 17) in the presence of a low level of progesterone. The absolute amount of estrogen is probably not critical as long as it is above a threshold (approximately 10 pg/ml). The amount of progesterone is critical and it needs to be below a relatively low threshold (approximately 0.6 ng/ml). This hormonal situation normally exists when there is a mature pre ovulatory follicle secreting estrogen in the absence of a functional corpus luteum. Other conditions that can lead to expression of heat include presence of follicular cysts and presence of high levels of estrogen and low progesterone near term in pregnant cows.

Some physiological signs of heat such as edema and hyperemia of the vulva and secretion of cervical and vaginal mucus are involuntary meaning the cow herself has no control. These involuntary signs of heat are set in motion by the hormonal condition of the cow. But the more important behavioral signs such as standing, mounting, licking, butting and head resting are voluntary reflexes that are influenced greatly by existing conditions in the cow's immediate environment.

What Affects Expression Of Heat?

Involuntary signs of heat are not influenced by a cow's immediate environment. For example, swelling and redness of the vulva and secretion of mucus are not influenced by weather; however, footing conditions do have a major influence on mounting activity and can be influenced by freezing or rainy weather.

Voluntary behavioral signs of heat are subject to many influences. The ones that are most important on most dairy farms are:

- number of sexually active animals in a group,
- freedom for sexually active animals to interact,
- freedom from interfering activities,
- ambient temperature, and
- foot conditions.

Behavioral signs of heat require that at least two animals interact. Recent studies in our laboratory indicate that secondary behavioral signs such as butting, licking, and head resting are influenced less by a cow's immediate environmental conditions than are the primary behavioral signs, mounting and standing. Most experienced observers utilize these secondary signs to pick out cows that are most likely to be in heat even when the immediate environmental conditions limit mounting and standing activity.

A cow will not be detected to stand if there is no other animal willing to mount. Mounting activity is stimulated strongly by estrogen and inhibited strongly by progesterone. Thus, mounting frequency is considerably greater for cows in proestrus or estrus than for cows that are out of heat or in mid cycle. Once there are four or more sexually active animals (proestrus or estrus) in a group, then mounting activity will normally be sufficient for efficient detection of heat. However, mounting activity is influenced considerably by the cow's immediate environment.

Cows that have foot problems, regardless of whether the problem is structural, subclinical or clinical, apparently show less mounting activity. Many of the foot problems that affect mounting activity can be alleviated by proper foot care and trimming.

There is no firm experimental evidence that high levels of milk production per se influence mounting or standing activity. There is some evidence that energy balance during the early postpartum

period may influence whether a cow is detected in heat at the beginning of the first postpartum cycle. Apparently cows experiencing a severe negative energy balance can produce enough estrogen to elicit an LH surge and ovulate but not enough to cause heat. But once cycles have resumed, energy balance does not seem to affect intensity or duration of heat.

Extremes in temperature affect intensity of heat. Mounting activity is lower on "hot" or "cold" days than on days when the temperature is near the cow's thermoneutral zone. Heats may appear to be shorter when the temperatures are extreme, but it isn't clear whether



Figure 1: Components of the HeatWatch® electronic heat detection system.

this is because of less mounting activity or because of less willingness to stand.

Timing Of Insemination

Optimal timing of insemination relative to stage or onset of heat has been under investigation for nearly 70 years. As early as 1918, research recommended that ideal timing of insemination occurred 10 to 24 hours after onset of heat. Early studies, prior to the late 1950's, used fresh semen in contrast to the frozen semen of today and the housing and production levels of the herds were much different.

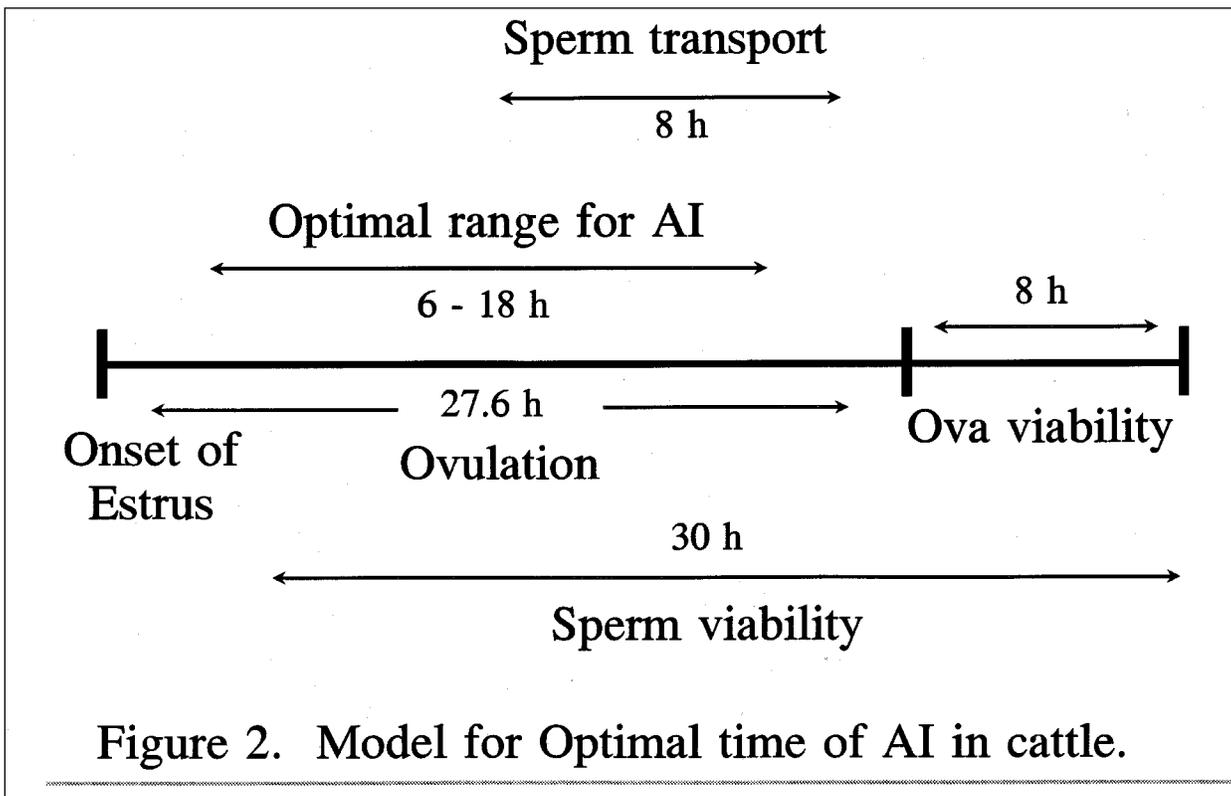
AM-PM Guideline

In 1943, Trimberger and Davis evaluated conception rates in dairy cattle at various periods during estrus and even today this research has been the most quoted for the timing of A.I. Cows and heifers were observed three times per day for signs of heat and once heat was identified that individual was observed every 2 hours. A few important points of the study should be noted: 1) a total of 295 cows and heifers and 489 breedings were evaluated; 2) Only 25 cows were bred before the middle of standing heat (in heat for at least 6 hours before and after insemination); 3) routine heat checks were performed 7 a.m., noon, and 6 p.m., while individuals due in heat were

observed every two hours, so intense heat detection was performed. The optimal interval to A.I. under these conditions was recommended to be from 6 to 24 hours after the onset of detected mounting activity. From Trimberger's pioneering research developed the industry standard "a.m. p.m." guideline, where cows first observed in estrus in the a.m. should be inseminated the afternoon of the same day, and cows first observed in the evening should be inseminated before noon the following day.

Once-A-Day A.I.

Two large field trials have evaluated the use of once a day versus a.m. p.m. A.I. In a trial conducted in New York state using professional A.I. technicians and fresh semen (not frozen), 44,707 cows were bred either before noon the same morning of observation, between noon and 6 p.m., or after 6 p.m. the same day (Foote, 1979). There was no difference in 150 to 180 day non return rates (a measure of pregnancy rates) for cows bred the same morning or during the p.m. following a morning detection. Non return rates for cows inseminated before noon on the day of detected heat (67.1%) were similar to those for cows inseminated between noon and 6 p.m. (69.9%) and after 6 p.m. the same day (68.9%), whereas non return rates the following afternoon were



less (62.7%). The second study was conducted in Pennsylvania again using professional A.I. technicians, but with frozen semen (Nebel et al., 1994). A total of 7,240 first service inseminations were evaluated. Half the herds bred cows using the a.m. p.m. guideline and the other half of the herds bred only once a day during a predetermined 3 hour period, after three months the herds switched so each herd used both method and at any one time half the herds were using each method. Non return rates (90 day) for the once a day was 58.4 versus 57.8% for cows bred following the a.m. p.m. guideline. A slight advantage was revealed for herds that used once a day during the mid morning.

Timing When Onset Of Heat Is Known

The HeatWatch estrus detection system is the first system that monitors cows 24 hours daily for mounting activity (Figure 1). The technology behind the HeatWatch system is known as Radio Frequency Data Communication. A miniaturized radio transmitter, powered by a replaceable 3 volt lithium battery, is placed inside a disposable 10 inch by 8 inch mesh nylon fabric patch which is glued to the tailhead of the cow. Activation of the pressure sensor, which is approximately inch tall, 2 inches wide and 3 inches long, sends a radio transmission (range .25 mile) to a receiver that is placed in a central location on the farm. Transmitted data includes date, time and duration of each mount a cow receives. The receiver is hard wired to a buffer which stores standing events information associated with estrus until downloaded to the HeatWatch software. The HeatWatch sorts information by cow and generates management list such as "standing heat", "suspect heat", "inactive cows", etc.

Recent studies using the HeatWatch system have demonstrated promise for this technology to resolve inefficiency stated earlier with the detection of estrus on dairy farms (Stevenson et al., 1996; and Walker et al., 1996). The mean estrus period, determined from mounting activity recorded by HeatWatch, consisted of 10 mounts over 9.5 hours (Walker et al., 1996). Mean ovulation time relative to first mount associated with estrus was 27.6 ± 5.4 hours and was not different for estrus periods induced by PG or spontaneously. If we assume that normal sperm have a viable life of 30 hours and sperm transport to the site of fertilization takes a minimum of 8 hours, and ova have a fertile life of 8 hours then the optimum time of insemination should be 6 to 18 hours after first mount or onset of standing heat (Figure 2).

The optimal time for A.I. was investigated in a recent field study using 17 herds that utilized HeatWatch electronic heat detection system (Grove et al., 1996). Inseminations (2661) were performed daily during a three hour period for all cows identified in heat the previous 24 hours. This allowed for inseminations to occur at all intervals from onset of heat (the first mount detected by HeatWatch) to breeding. The highest probability of pregnancy occurred when inseminations were between 5 to 16 hours after first mount. Other factors that were identified as having a significant effect on subsequent percent pregnant were days in milk at breeding, total number of mounts during heat, season, and differences due to other herd effects.

What does this mean for a farm that has not purchased this new heat detection system?

1) At least four visual observation periods are necessary – the average heat period is only 8 hours (time from first to last stand).

2) Other activities (scraping lots, filling freestalls, etc) must not be performed during the time allotted for visually observing cows – the average cow is mounted 10 times during the heat period.

3) All of the heat periods will never be detected without visually observing cows 24 hours a day, because many cows show very little activity – less than 3 mounts for only a few seconds.

When visual observations for heat are frequent (every 4 to 6 hours) it is recommended that cows be inseminated approximately 12 hours following detection, thus the "a.m. p.m. guideline". However, a common management practice is that only one or two daily visual observation periods are utilized; therefore, results following the a.m. p.m. guideline or using once a day A.I. usually result in similar pregnancy rates because the accurate timing of heat onset is not known. With HeatWatch the electronic heat detection system the first mount of "standing" heat can be identified, thus allowing accurate timing of A.I. was 5-16 hours after the first mount or onset of heat.

Conclusions

Historically the approach taken by management has been passive, by waiting for cows to cycle and be detected in heat for A.I., rather than proactive which now can be accomplished by the incorporation of a systematic breeding program that induces heat or allows for appointment breeding without the need for heat detection. Research has shown that PG programs are cost

effective and may improve herd reproductive performance compared with more traditional programs that treat individual cows. The cost effectiveness of the OvSynch program needs to be evaluated.

The AM PM guideline established in the 1940s has served as the standard for timing of A.I. A recent study using frequent ultrasonography to determine time of ovulation and the electronic heat detection system HeatWatch to determine onset of mounting activity verified Trimberger's findings that ovulation occurs approximately 28 hours after the onset of mounting activity. This study led to the reevaluation of the optimal time to insemination in lactating cows with the HeatWatch system which provides around the clock, 24-hour monitoring of standing activity. This field trial which was conducted in 17 herds using 2,661 insemination revealed

that the highest pregnancy rates occurred between 5-16 hours after onset of heat (first mount). Therefore, the frequency of visual observation for signs of heat is not sufficient to optimize timing of A.I. in most herds. Timing of insemination should be based on the frequency of observation for standing heat. In herds where observations occur less than four times daily, A.I. should be performed within 4-6 hours after first observation. In herds where observation for heat are more frequent (more than three times per day) insemination should occur approximately 6-12 hours after first observing standing heat.

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Extended Calving Intervals With The Use Of bST

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Extended Calving Intervals With The Use Of bST

Calving intervals of 12 to 13 months have been recommended for maximizing herd profitability. Recently, some dairy producers have justified longer calving intervals for high-producing herds and individual cows. However, even with higher milk production, the shape of the lactation curve remains similar with only the level of milk production changing. Thus, greater profitability is still highly correlated with calving intervals from 12 to 13 months, with greater number of days spent in early lactation (4, 7, 10,

13, 14, 16).

The rate of decline in milk yield after peak yield is correlated with the rate of accumulation of profit. Thus, persistency is important in determining the appropriate calving interval (7). However, increased milk yield per se does not affect the optimum profitable calving interval except for first lactation animals because of their higher persistency (4). Pregnancy, nutrition and management are all factors that affect the magnitude and shape of the lactation curve. Hormonal changes associated with pregnancy decrease the

activity of milk-producing cells and maintenance of cell numbers.

Supplementation of bST increases lactation milk yield by altering the lactation curve with an immediate increase in milk yield (1, 2, 3, 15). Furthermore, milk yield is maintained at a higher persistency with bST supplementation compared to lactation curves without bST (2, 3, 15).

Early simulations of bST use indicated that extension of the calving interval to 14 months and longer may be one of the changes in herd management which could optimize profitability (8, 11). Ferguson (8) indicated that if breeding was delayed until 150 to 200 days in

Table 1: A comparison for milk production per day of productive life in Holstein herds with 13.2 and 18.0-month calving intervals.¹

No bST		Initial bST response					
		8 lb/day		10 lb/day		12 lb/day	
13.2 mo	18.0 mo	13.2 mo	18.0 mo	13.2 mo	18.0 mo	13.2 mo	18.0 mo
Additional bST Increase							
46.91	44.26	Low-Med production					
.00		51.92	50.07	53.17	51.52	54.42	52.97
.02		53.45	52.88	54.70	54.33	55.96	55.78
.04		54.99	55.68	56.24	57.14	57.49	58.59
.06		56.52	58.49	57.77	59.95	59.03	61.40
55.49	53.22	Med production					
.00		60.50	59.03	61.75	60.49	63.00	61.94
.02		62.03	61.84	63.29	63.29	64.54	64.75
.04		63.57	64.65	64.82	66.10	66.07	67.55
.06		65.10	67.46	66.36	68.91	67.61	70.36
64.07	62.19	Med-High production					
.00		69.08	68.00	70.33	69.45	71.59	70.90
.02		70.62	70.81	71.87	72.26	73.12	73.71
.04		72.15	73.61	73.40	75.07	74.65	76.52
.06		73.69	76.42	74.94	77.87	76.19	79.33
72.66	71.15	High production					
.00		77.66	76.96	78.92	78.41	80.17	79.87
.02		79.20	79.77	80.45	81.22	81.70	82.67
.04		80.73	82.58	81.98	84.03	83.24	85.48
.06		82.27	85.39	83.52	86.84	84.7	88.29

¹: Production per day of productive life, using population solutions from the Cornell Test-Day Model. Animals are simulated in herd production levels ranging from low to high production and to no bST and bST. bST response is assumed to be for all stages of lactation or increase by .02, .04, or .06 lb per day starting on the first day of injection.



milk with bST use, improvements in energy balance, uterine health, number of estrous cycles, heat detection and conception rate would probably be observed. Marsh et al. (11) indicated the increased persistency of milk yield observed in bST-treated cows may allow pregnant animals to be milked longer and open cows to be retained in the herd longer before culling.

Herd life and animal health are additional considerations for increasing herd profitability. In a recent survey of dairy herd management practices (12), reproductive failure accounted for 26.7% of all culling decisions. Numerous studies (5, 6, 9) indicated that approximately 60% of veterinary costs are incurred during the first 45 days of lactation. Most metabolic disorders such as milk fever, ketosis, displaced abomasum, metritis and mastitis are observed during this period (6,9). Thus, increasing the calving interval may reduce the portion of the animal's lactation cycle associated with this high risk period and may potentially increase productive life.

Given the potential for altering the lactation curve through bST supplementation and the delayed pregnancy effect on persistency of milk yield, a field trial was designed to examine effects of extended calving intervals with continuous use of bST during lactation on animal performance and profitability.

Field Study

The field study was designed for four years of which two and one-half years have been completed. Nine New York Holstein herds were used that averaged during the first two years between 21,461 and 24,356 lbs of milk sold per cow per year. Herd size ranged between 220 and 1,327 cows with an average of 520 cows per herd. Five of the nine herds were on 3X milking compared to 2X milking.

Across herds, 108 second lactation animals were assigned to one of two treatments: 1) cows were bred beginning at 60 days in milk; and 2) cows were bred beginning at 150 days in milk. The cows were assigned to the same treatment for each subsequent lactation. Injections of bST began at 57 to 71 days in milk and were given until two weeks prior to drying-off date. Herdmates received bST at the discretion of management. The treatment cattle were housed and managed with the

other cattle in the herds. Culling decisions were determined by the individual farms.

Milk yield was measured monthly and milk samples were taken for measurement of fat, protein, and somatic cells. Lactation milk and component yields were analyzed using the Cornell Test Day Model. This Model adjusted the milk yield data for herd-test-day, age, days in milk, month-fresh, pregnancy, and management effects. Reproductive and health performance along with culling rates were monitored.

From the data for the first two and one-half years of the field study, lactation curves, milk production per day of life, and associated animal performance with the use of bST were determined and used for comparison of a 13.2 month calving interval and an extended calving interval of 16.5 months. For the economic analysis and lactation milk curves, an 18 month calving interval was used as the maximum length of extended calving inter-

Table 2. Economic comparison of calving interval lengths of 13.2 and 18.0 months.

Calving interval (CI)	Per calving interval ¹	
	13.2 month	18 month
Days/CI ²	401d	547d
Days dry/CI ³	55d	55d
Days milking/CI	346d	492d
	Per 2.9 lactations/productive life ⁴	
Days/productive life	1,163d+423d ⁵ = 1,586d ⁶	1,586d ⁷
Years of productive life/animal ⁸	3.19 yrs	4.35 yrs
Lactations/1,586d ⁸	3.95 lactations	2.9 lactations
Days milking/1,586d	1,384d	1,476d
Days dry/1,586d	202d	110d
Milking days w/o bST	245d ⁹	180d
Pregnancy cost/1,586d ¹⁰	\$99	\$73
Herd health cost/1,586d ¹¹	\$336	\$247
Culling rate (annual) ¹²	34.5%	25.3%
Replacement heifer cost /1,586d ¹³	\$.644d	\$.472d
Bull calf value/1,586d ¹⁵	(\$1,022) ¹⁴	(\$750) ¹³
	Added Receipts	
Bull calf value	\$35	
Milk income over feed costs ¹⁷		\$885
	Added Expenses	
Extra bST cost ¹⁶		\$46
Pregnancy cost	\$26	
Herd health cost	\$89	
Replacement heifer cost	\$272	
Added receipts-added expenses	(\$352)	\$839
	Profit Difference	
Difference/productive life (1,586d)		+\$1,191
Difference/yr of productive life		+\$274
Difference/day of productive life		+.75

val.

Results From The Current On-Going Field Study (2½ Years):

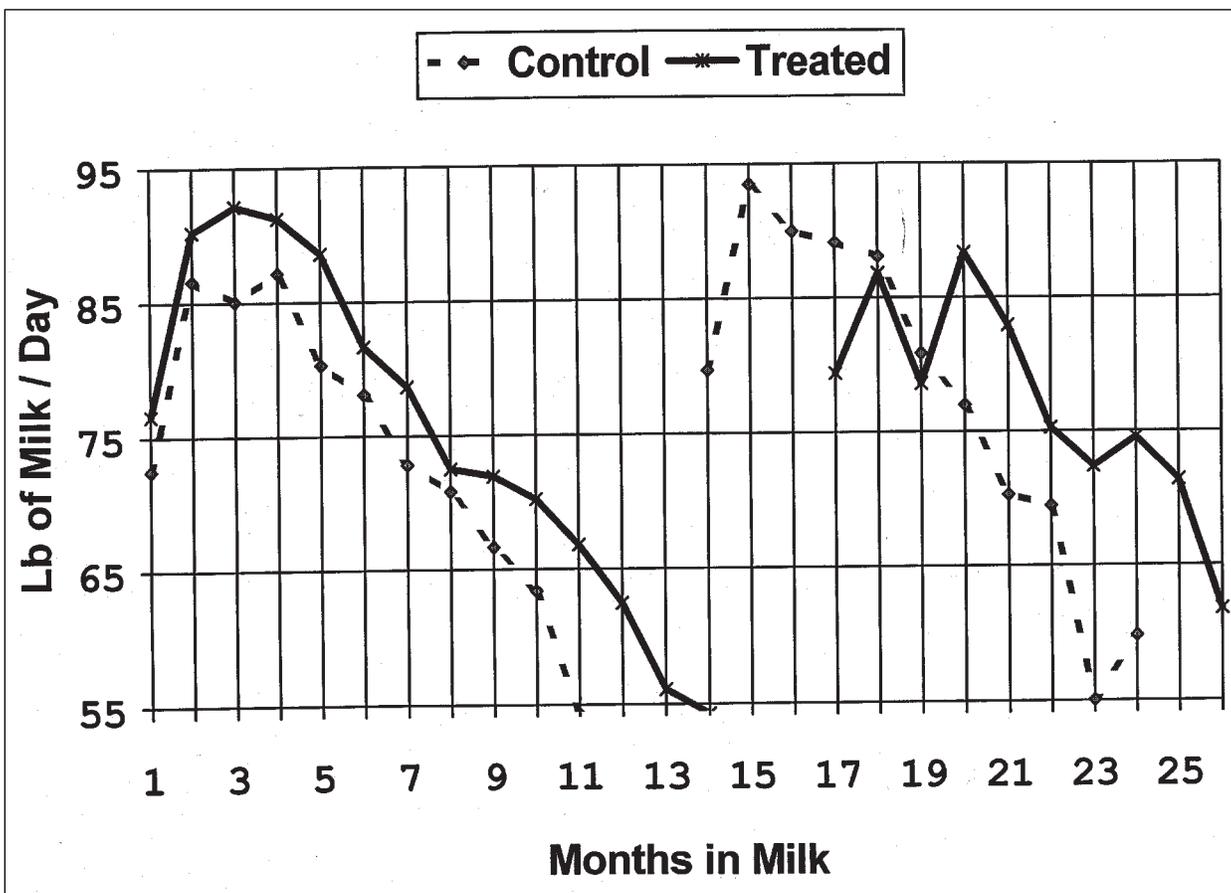
Milk Production Performance

- Average days in milk were 364 and 486 days for the 13.2 and 16.5 month calving intervals with lactation milk yield averages of 25,480 lbs. and 33,582 lbs. Average daily milk yield per lactation were 70.0 and 69.1 lbs. for the 13.2 and 16.5 month calving intervals, both supplemented with bST.
- Fat and protein percentages averaged 3.75% and 3.2% for the 13.2-month calving interval and 3.69% and 3.3% for the 16.5-month calving interval.
- Actual lactation milk curves that represent the second and third lactations for both treatments (control: 13.2 months CI; treated: 16.5 months CI) in the study are presented in Figure 1. The differences between the two curves represent the effects of

bST in achieving higher milk production with greater persistency. For the third lactation of the treated group (16.5 months CI), the data are more variable because of fewer animals calving at the time of the analysis which is a result of the longer calving interval.

- In Figure 2, the absolute and accumulated daily milk production is displayed by treatment group across the time of the study (26 months). The absolute daily milk production is presented by the open line and the accumulated milk production is presented by the solid line. Both illustrate the effects of peak yield, persistency, and days dry on the differences between the two treatments and the accumulated total production. At 26 months into the study, the cattle with the extended calving interval treatment have accumulated approximately

Figure 1: Lactation milk curves for 2nd and 3rd lactations by treatment (control = 13.2 months CI and treated = 16.5 months CI)



4,700 more pounds of milk than the cattle with the shorter calving interval, averaging 13.2 months.

Reproductive Performance

- Voluntary wait periods of 60 and 150 days resulted in calving intervals of 13.2 and 16.5 months.
- Days to first insemination averaged 68 and 161 days for the 13.2 and 16.5 month calving intervals.
- Overall heat detection efficiency rate and conception rate were 49% and 71% for the 13.2 month calving interval and 57% and 62% for the 16.5 month calving interval which yielded a pregnancy rate of 35% for both calving intervals.

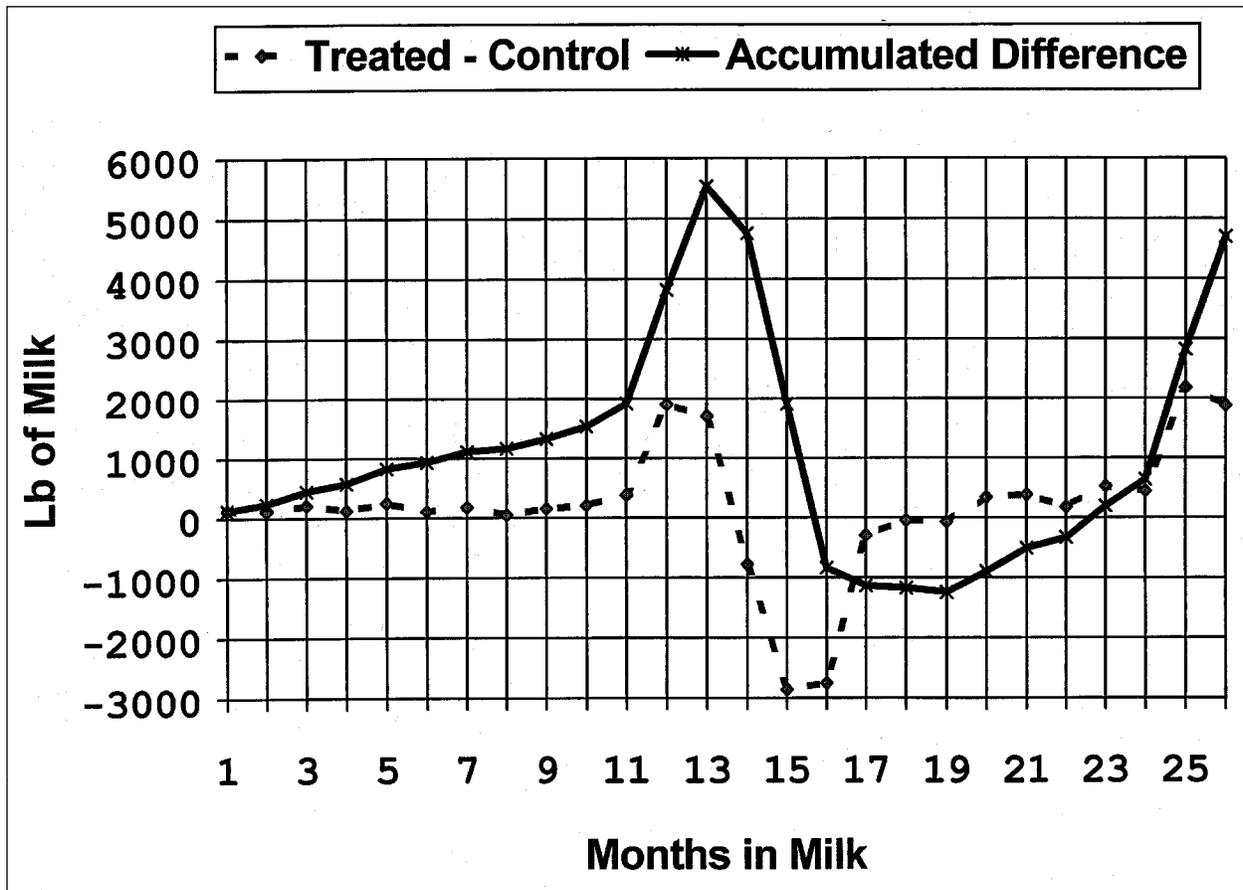
Culling Rates

- Annual culling rates for reproduction and low milk production were 16.6% and 9.2% for 13.2 and 16.5 month calving intervals. Culling rates for other reasons were similar both treatments. On an annual basis, the culling rates averaged 34.5% and 25.3% for the 13.2 and 16.5 month calving intervals.

Conclusions From The Current On-Going Study:

- Per life-time, the 16.5 month calving interval may average a higher percentage of days in milk and fewer days dry than the 13.2 month calving interval, thus greater total milk yield per life-time.
- With a lower annual culling rate for the longer calving interval, the cows may have longer herd-life, thus decreasing the heifer inventory (costs) needed to maintain herd size.
- The persistency of lactation milk yield is greater as days in milk increases because of the increased responsiveness to bST.
- The marked improvement in persistency of the bST milk production response significantly influences total lactation milk yield and milk production per day of productive life (Table 1).
- The lactation curves with the use of bST are changed by achieving a higher level of milk pro-

Figure 2: Absolute & accumulated milk differences between treatments (13.2 and 16.5-month CI)



duction with greater persistency. With the altered lactation curves, the length of calving interval needs to be based on profitability per day of productive life rather than total lactation milk yield in a given time interval (i.e. 305 days in milk). In addition, with the changes in the lactation curves with the use of bST, standard lactation curves cannot be used with accuracy in determining milk response, expected milk deviation, and lactation milk yield.

- For extended calving intervals, bST needs to be used on a continuous basis throughout lactation to maximize the bST milk production response. The use of bST early in lactation is essential to improve persistency throughout lactation in order to realize maximum profit. The greater persistency is achieved by maintenance and activity of more milk-producing cells throughout lactation.
- Cattle with longer calving intervals may have better overall health and longer herd life.

Economics Of Extended Calving Intervals With Use Of bST

The economics of 13.2 and 18.0 month calving intervals are presented in Table 2. An 18 month calving interval was used for the economic analysis as the maximum extended calving interval. Using the herd trial data for the analysis, the 18.0 month calving interval increased profitability approximately by \$.75 per day of productive life (\$274 per cow per year of life). This substantial

increase in profitability is mainly due to extended herd life, additional milk income over feed costs and reduced heifer costs per cow being replaced over a longer time, along with other savings in associated costs. The additional milk income over feed costs is a reflection of further dilution of maintenance costs and delayed pregnancy costs at lower daily feed costs, and the widening of the bST milk response as calving interval lengthens.

Summary:

Extended calving intervals of 16 to 16.5 months (maximum of up to 18.0 months) may be warranted, especially in high producing herds. An extra benefit of the extended calving intervals may be realized with the first lactation animals because of their greater persistency. In addition, the longer calving interval allows the young animals to have more time to reach mature body weight and desired body condition prior to the second lactation. With extended calving intervals, the herds need to be managed to maximize the bST milk response throughout the year in order to realize the profitability associated with longer calving intervals. Extended calving intervals may be utilized during times of problem breeding with individual animals and groups.

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Footnotes:

1: Calving intervals devised from data from a 9 herd field study 230.4 days per month.

2: 30.4 days per month.

3: Standardized days dry at 55 days/lactation.

4: Assumed 2.9 lactations per productive life regardless of calving interval data are compared against 1586 days (18 mon CI); 1,586 days derived from 2.9 lactations x 547 days/lactation.

5: Extra days beyond 1,163 days of productive life (2.9 lactations) for 13.2 mon CI to equal 1,586d.

6: Consists of full first and second lactations and .9 of third lactation of one animal and full first lactation of replacement (second) animal.

7: Consists of full first and second lactations and .9 of third lactation of

one animal.

8: Used length of calving interval per respective CI.

9: Reflects fourth lactation for 13.2 month CI; BST injections initiated at 63 days of lactation.

10: \$25 / pregnancy / CI x number of lactations.

11: \$85 herd health costs / CI x number of lactations.

12: Cull rates for respective CI.

13: \$1,150 used per replacement calving at 22 month minus \$400 salvage value; thus \$750 was used as the replacement cost.

14: Includes additional replacement costs for the 423 days of the second animal's first lactation.

15: \$75 bull calf value, 90% survival (sold) rate; total number of lactations used in calculation.

16: bST cost includes bST product, labor, and feed costs associated with the milk response from bST.

17: Milk income over feed costs; \$12.50 net milk price; 3.5% fat, 3.2% protein, milk production was determined by Test Day Model Deviation Method using actual milk production data from 9 field study herds; feed and ration requirements and costs determined by Cornell Nutrition Model; .486 Mcal (ME) / lb of milk; 1.19 Mcal (ME) / lb of feed; 8.6 cents / lb of feed (DM).

Notes

Notes

Selecting Sires Other Than For Milk Production

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Selecting Sires Other Than For Milk Production

Dairy producers in the U.S. have dramatically increased milk production per cow over the last 30 years. Increases in herd production are the result of improved management as well as improved genetics. In recent years, average genetic improvement for milk production in the U.S. has been approximately 210 pounds per cow per year (Van Raden et al., 1996). Because the majority of dairy producers in the U.S. make their income from the sale of milk, production traits receive primary selection emphasis in most breeding programs.

Cow profitability, however, depends not only on how much milk a cow produces each lactation, but also on how many lactations she produces. As production per cow continues to climb to new, higher levels, the stress that high production has on a cow is of greater concern to dairy producers. Additionally, semen price has an impact on breeding expense and needs to be considered. This presentation will address those areas that should be considered in a breeding program besides production in order to maximize herd profitability.

Correlated Response: A Concern For The Future?

Selection for higher production has been effective in developing cows with greater genetic merit for production. However, has selection for increased production been all positive? What has been the correlated response observed in other traits as a result of heavy selection emphasis for milk production?

Several studies (Bertrand et al., 1985; Hansen et al., 1979; Jones et al., 1994; Shanks et al., 1978) indicate that health costs tend to increase as production increases. Results would suggest that cows producing higher volumes of milk are under more physiological stress than

lower producing cows. Increased health costs have been associated with higher producing cows for traits such as mastitis, reproductive disorders, and ketosis.

Emanuelson et al. (1988) reported a positive genetic correlation of .20 between mastitis and production. Genetic correlations between Somatic Cell Count (SCC) and production range from .16 to .25. (Banos and Shook, 1990; Boettcher et al., 1992). These results suggest that continued selection for milk production will result in slow deterioration for mastitis resistance. Maintaining good udder health in the high producing herd will be necessary to maximize profitability.

Several studies (Hansen et al., 1983a; Oltenacu et al., 1991; Raheja et al., 1989) have shown a negative genetic relationship between milk production and reproductive performance in cows, suggesting that continued selection for production will result in poorer reproductive performance in cows. Getting cows bred back is a major concern for the high producing herd and is likely to become even greater as herd averages climb.

The increased health costs associated with high production cows is a growing concern with consumers. Consumers will not accept drug residues in milk and meat products from dairy operations. Efforts to breed for healthier cows so as to minimize the need to treat cows for diseases will bolster consumers confidence when buying dairy products.

Selection Tools To Consider
Udder health. Genetic estimates for somatic cell score (SCS) have been calculated by AIPL/USDA since January 1994. Daughters from bulls with low PTAs for SCS are predicted to have less problems with mastitis than daughters from bulls

Table 1: Genetic correlation between 1st lactation SCC and Holstein type traits¹.

trait	correlation with SCC
udder depth	-.42*
thurl width	-.21*
fore attachment	-.41*
dairy form	.18*
front teat placement	-.31*
stature	-.11
teat length	.20*
rump angle	.08
rear udder height	-.19*
strength	-.06
rear udder width	-.15
body depth	-.05
udder cleft	-.12
rear legs, side view	-.10
foot angle	-.06
final score	-.30*

*: Genetic correlations larger than 2X their standard error

¹: Rogers et al, J. Dairy Sci. 74:1087.



with high PTAs for SCS. One of the challenges with incorporating PTA SCS data into breeding programs is that the heritability of SCS is assumed to be about 10% (Wiggans et al., 1994). This means that most of the differences observed between daughters of bulls are due to management and environment and not genetics. The general recommendation is not to base selection decisions on PTA SCS independent of other traits. Instead, the best approach is to incorporate PTA SCS into a selection index. One such index that includes PTA SCS is Net Merit. Net Merit will be discussed in more detail later on.

Udder conformation also affects SCS and mastitis. Table 1 (Rogers et al., 1991) shows that cows with deeper udders, loser fore attachments, wider front teat placement, longer teats, and lower rear udder attachments tend to have higher levels of somatic cells. Selection emphasis for more shallow, tightly-attached udders would improve udder health. Part of the dilemma, however, is that important udder traits such as udder depth have a negative correlation with milk production. Higher producing cows tend to have deeper udders. Putting too much selection emphasis on udder depth will have a negative impact on milk yield. Moderate depth to the udder may be the most logical compromise. Extremely deep udders are susceptible to injury and mastitis, whereas extremely shallow udders are usually associated with cows that don't give enough milk. As such, both extremes are usually detrimental to the cow's herd life. High production from shallow udders is the ideal, but more realistic is high production from moderately deep udders that pose minimal management challenges.

Dairy producers tend to avoid bulls that are minus for udder traits. For example, Holstein bulls with minus STA values for udder traits as calculated by the Holstein Association are often avoided. However, the genetic differences between bulls for udder traits may be less than some realize. For example, Holstein bulls with an STA of -3 for udder depth have mature daughters with an average udder depth that is approximately .4 inches above the hock, whereas Holstein Bulls with an STA of +3 for udder depth

Table 2: Correlation between PTA Productive Life (PL) and various performance traits¹.

trait	correlation with PTA PL
PTA Milk	.51
PTA Protein	.51
PTA SCS	-.19
PTA Type	.31
TPI	.56
STA Udder Comp.	.35
STA Foot & Leg Comp.	.16
STA Stature	.02
STA Dairy Form	.28
STA Strength	-.19

¹: Based upon 2,722 Holstein bulls from July 1996 Sire Summary, with PTA PL Rel. >75%

have mature daughters with an average udder depth that is approximately 1.8 inches above the hock (see Holstein Type-Production Sire Summaries, July 1996, p. 13). The difference in average udder depth between these two extreme bulls is less than one and a half inches.

What many breeders many not realize is that STA rankings do not reflect the dramatic improvement the Holstein breed has made for udder traits in the past 25 years. Even though the STA rankings accurately rank the bulls for udder depth, the breed as a whole has improved to the point that even low ranking bulls for udder depth tend to sire udders that are above the hock. Breeders should be cautious about automatically excluding minus udder bulls

from breeding programs.

Longevity. As discussed previously, dairy producers want cows that can produce high volumes of milk over several lactations. In July 1994, AIPL/USDA began publishing a genetic estimate for Productive Life (PL). Productive Life is based on the months that a cow is in milk (up to a maximum of 10 months per lactation) until the cow dies or reaches 84 months of age (Wiggans et al., 1994). For living cows, predicted months of productive life are used. Predictions are based upon the cow's current age and lactation number and the production and linear-type profile of her sire. Productive life reflects a cow's ability to resist culling for all reasons: production, reproduction, mastitis, disease resistance and so forth. As such, low PL values indicates which bulls tend to have daughters that do not stay in the herd very long, regardless of reason.

Table 3: Confidence Range (CR) for PTA Protein at three levels of Reliability (R)

Trait = PTA Protein
 Genetic Standard Deviation for PTA Protein = 20 lbs.
 $CR = \sqrt{(1-R)} \times (GSD)$

R	(1-R)	$\sqrt{(1-R)}$	$\sqrt{(1-R)} \times (GSD) = CR \text{ (lbs.)}$
.36 (young sire)	.64	.8	16
.84 (1st crop proven)	.16	.4	8
.99 (2nd crop proven)	.01	.1	2

Table 2 shows the relationship between PTA PL and several other genetic measures for 2722 Holstein bulls from the July 1996 evaluation that had reliabilities greater than 75% for PTA PL. As expected, high producing cows tend to stay in the herd a long time. There was also a positive relationship between udder composite and PL and between feet and leg composite and PL. Daughters of bulls with high production, good udders, and good feet and legs tend to have higher PL.

Perhaps surprisingly, there was almost no relationship between stature and PL. Above average stature was no more associated with PL than below average stature. Results from Table 2 suggest that short cows with high production, good udders, good feet and legs, and low SCS are just as likely to stay in the herd as tall cows with high production, good udders, good feet and legs, and low SCS. Results would suggest that stature is probably a personal preference trait.

The heritability used by AIPL/USDA to compute PTA PL is 8.5%. Reliabilities for PTA PL will be below 60% for most AI proven bulls based on initial first-crop daughters. Producers should exercise caution before selecting

bulls independently for PTA PL. A better recommendation is to use a selection index which incorporates PL into the calculation, such as Net Merit.

Reproduction. One of the greatest management challenges facing the high producing herd is getting cows bred back. The reproductive performance of a herd is a complex interaction between management, especially nutrition, and genetics. High producing cows lose body weight early in the lactation, as the cow can not consume enough dry matter to meet her production and maintenance needs during this time period.

Is it possible that certain growth genes have an impact on production and reproduction at the same time? For example, Hansen et al. (1983a) showed a negative genetic correlation between cow reproductive performance and production, similar to the research results of others. High producing cows have inferior reproductive performance. However, Hansen et al. (1983b) also reported a positive genetic correlation between reproductive performance in virgin heifers and the heifer's subsequent first lactation milk production. Prior to the stress of production, heifers that had higher genetic merit for milk production had superior reproductive performance. Heifers with desirable growth genes may be the healthiest, most aggressive heifers and also have superior reproductive performance. The desirable growth genes may also be responsible for the higher milk production in these heifers after calving. The growth genes may be involved with aspects of nutrient partitioning that ultimately lead to reduced reproductive performance in lactating cows.

Although the underlying genetics for reproduction may have improved as a result of selection for production (as the heifer data would suggest), the improvement may be completely overshadowed by the stress of production in lactating cows.

Heritability estimates for most reproductive traits are very low, less than 5% in most cases (Berger et al., 1981; Hansen et al., 1983a; Schaffer and Henderson, 1972). Response to genetic selection for improved reproductive performance would be slow. Dairy producers should concentrate on management for improved reproductive performance, particularly in the area of nutrition to reduce the impact of negative energy balance early in lactation, rather than attempt to breed

Table 4: Economic comparison of an average young sire (57th percentile Net Merit) with a top proven bull (95th percentile Net Merit)

	random young sire	proven bull
Net Merit percentile	57th	95th
Net Merit (per lactation)	\$123	\$179
Net Merit (3 lactations)	\$369	\$537
semen price/unit	\$3	\$12
# units to get milking daughter	6 units*	6 units
semen cost to get milking daughter	\$18	\$72
Young Sire Benefits		
birth report: 2 calves from 6 units @ \$8	\$16	
milking daughter: 1 @ \$40	\$40	
INCOME		
Net Merit (3 lactations)	\$369	\$537
birth report	\$16	
milking daughter	\$40	
subtotal income	\$425	
EXPENSES		
semen cost	\$18	\$72
INCOME LESS EXPENSES	\$407	\$465

*: The number of units of young sire semen to obtain a milking daughter is typically close to 15 units.



directly for improved reproductive performance in cows.

Even though the heritability estimates for reproductive traits are low, any genetic differences that may exist between bulls for reproduction should be reflected in PL. As mentioned above, rather than select on PL directly, the preferred approach would be to use Net Merit, which incorporates PTA PL.

General Health. Although the United States does not have a systematic recording system for disease traits, other countries do. Denmark and Sweden are two countries which have extensive records for disease traits and have also imported a large amount of U.S. genetics over the past 25 years. Recent research (Gary Rogers, personal communication) has compared PL evaluations from the U.S. with genetic evaluations for disease traits for the same bulls in Denmark and Sweden. The most striking result is the strong negative correlation between STA dairy form from U.S. data and diseases other than mastitis from Scandinavia data. One interpretation is that extreme dairy form cows (extreme angularity) are under the most stress and are most susceptible to disease. Surprisingly, strength had little relationship with diseases other than mastitis. This study would suggest that high producing cows that don't look very angular may have less problems with disease than high producing cows that are very angular. In other words, cows that do not look like they are working too hard (when they actually are) are the cows more desired. Although the results are not yet published, this is likely to be an area that receives additional research attention in the future. How do we breed cows to maximize production and at the same time minimize metabolic stress?

Net Merit. Since July 1994, PTAs for PL and SCS are combined with PTA for Milk, Fat, and Protein Dollars (MFPS) into an economic index called Net Merit (Wiggins et al., 1994). The PTA MFPS is multiplied by .7 to account for feed costs. The relative emphasis on discounted PTA MFPS, PTA PL, and PTA SCS in Net Merit is 10:4: -1, respectively. The negative weight for PTA SCS is because lower values are preferred for this particular trait.

Net Merit considers those traits of known economic importance to most dairy producers. Results are expressed on a per-lactation basis in dollars. Differences between bulls reflect the expected differences in income per lactation, prorated over the expected lifespan of the bull's daughter. High ranking bulls for Net Merit should transmit a balanced combination of high production per

Table 5: Net Merit semen values index for 7 bulls at the 90th percentile or higher for Net Merit.

Bulls ranked by Net Merit			
bull	Net Merit	semen price	Net Merit value index
Action	\$210	\$30	\$450
Bucko	\$205	\$20	\$495
Credit	\$195	\$18	\$477
Dollars	\$185	\$16	\$459
Epic	\$180	\$15	\$450
Franco	\$175	\$8	\$477
Junior	\$164*	\$3	\$474

Bulls ranked by Net Merit Semen Value			
bull	Net Merit	semen price	Net Merit value index
Bucko	\$205	\$20	\$495
Credit	\$195	\$18	\$477
Franco	\$175	\$8	\$477
Junior	\$164*	\$3	\$474
Dollars	\$185	\$16	\$459
Action	\$210	\$30	\$450
Epic	\$180	\$15	\$450

*: PTA Net Merit for Junior prior to adjustment for pedigree slippage = \$184.

lactation, the ability to stay in the herd for multiple lactations, and good udder health.

Economic Considerations

Purchase decision are seldom made based on genetic merit alone. Other factors include semen price and reliability. In other words, the selection decision considers income potential (genetic merit), expense (semen price) and the amount of risk the producer is willing to take (reliability).

Risk. Risk management can be addressed with reliability. AI bulls can be grouped into 3 basic risk categories: young sires, proven bulls with first-crop daughters, and proven bulls with second group daughters. The reliabilities associated with each category are approximately 35% for young sires, 75-85% for proven bulls with first-crop daughters, and 99% for proven bulls with second-crop daughters.

Reliability is expressed as a percentage value and is therefore unitless. An equivalent value that expresses reliability in the same units as the trait of interest is called confidence range.

Confidence range is a direct function of reliability.

Confidence range is calculated by taking the square root of 1 minus reliability and multiplying this by the genetic standard deviation for the trait. Table 3 is an example of confidence ranges for three bulls with reliabilities of 36%, 84%, and 99% for the trait protein yield. Figure 1 is a graphic representation of confidence range. Confidence range allows us to visualize the amount of risk that we take when using bulls of various reliability. The larger the confidence range, the greater the opportunity for the true breeding value of the bull to still go up, or to still go down. Figure 2 is a graphic representation of the confidence range associated with three bulls with PTA (or Parent Average (PA) for a young sire) Protein of 60 pounds and with reliabilities of 36%, 84%, and 99%.

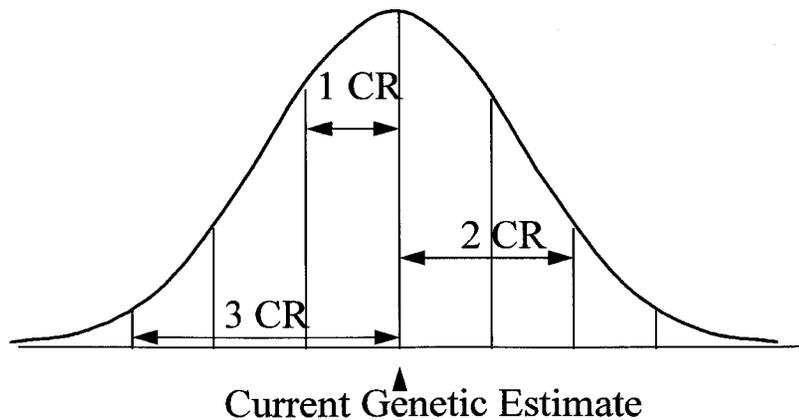
A.I. progeny-test bulls are a popular choice for many producers due to their good genetic merit and low semen price. However, the low reliability associated with progeny-test bulls means that the genetic estimate (PA) is still subject to rather large changes. To minimize the risk, the general recommendation is to use only a few units of progeny test semen from any one young sire,

and to use a several young sires to balance out the frequency of young bulls that will be lower than parent average (one-half of the bulls) with the frequency of young bulls that will be higher than parent average (the other half). Unfortunately, at the time of progeny testing, we don't know which bulls are the half that will be above PA after their daughter proofs and which half will be below PA after their daughter proofs, hence the need for progeny testing.

Genetic merit of A.I. young sires compared to proven bulls. How do young sires, as a group, compare to proven bulls? One point that is sometimes overlooked is that young sires usually end up with PTA values slightly lower than their PA. The probable explanation for this is that cow indexes for many bull dams are slightly overestimated. This may be more a reflection is typical management (most producers usually pay close attention to their best cows) than intentional bias, but the fact remains that the average PTA for progeny test bulls after their daughter proofs is slightly less than their PA at time of sampling. For protein yield, PA overestimates PTA by

Figure 1. Graphic representation of Confidence Range (CR).

- ± 1 CR = 67% of the time, true genetic estimate will be in this range when animal is at 99% Reliability
- ± 2 CR = 95% of the time, true genetic estimate will be in this range when animal is at 99% Reliability
- ± 3 CR = 99% of the time, true genetic estimate will be in this range when animal is at 99% Reliability



about 4 pounds. For milk yield, PA overestimates PTA by about 100-150 pounds. When comparing PTAs of proven bulls with PA of progeny test bulls, a slight adjustment for this "pedigree slippage" should be included.

Young sires do not receive a daughter proof until 4 years after their semen is distributed as young sires. Of interest is to compare the daughter proofs of young sires with the proven bulls that were available 4 years previously when semen from the young sires was first distributed for testing. Recent research at Virginia Tech (Weigel et al., 1995) indicates that the average PTA MFPS for AI young sires, relative to proven bulls available at the same time the young sire semen was distributed, is at the 57th percentile ranking.

It is also important to use young sire semen as soon as possible. The genetic merit of young sires is determined at conception. Young sires are the most competitive with proven bulls at their youngest age. By the time a young sire finally gets a daughter proof at about 4 1/2 to 5 years of age, the genetic merit of the young sires has declined to about the 12th percentile for PTA MFPS relative to the most recent group of proven bulls

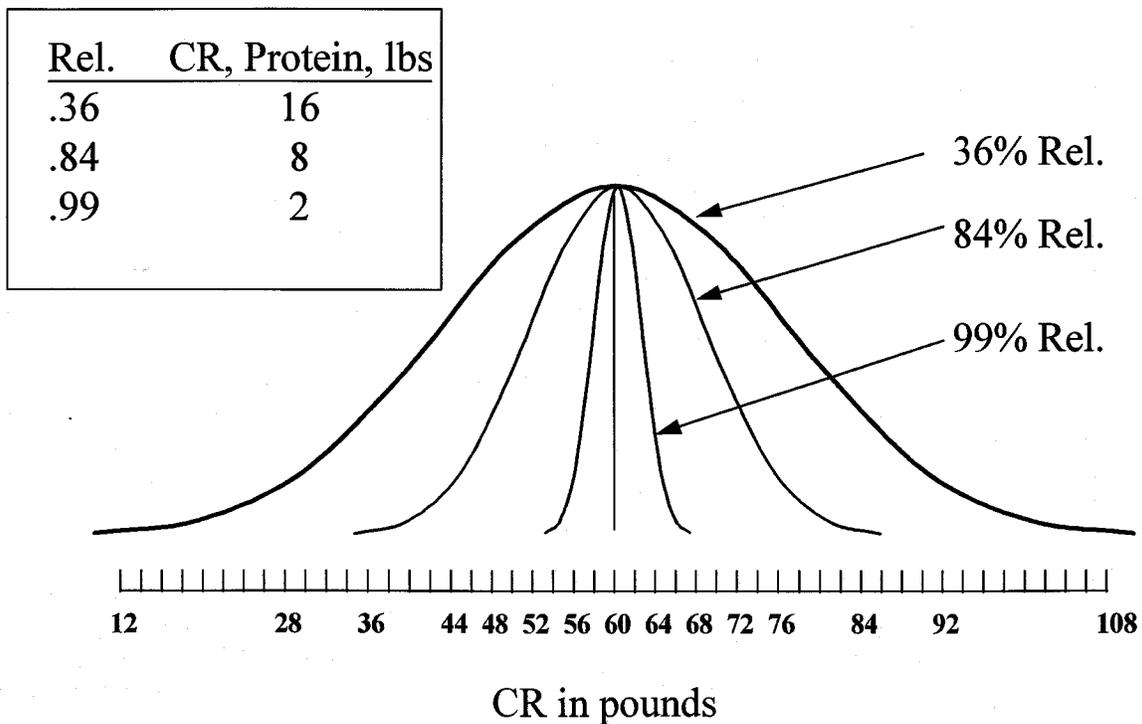
in Active AI.

The Virginia Tech study demonstrates that the average young sire is of higher genetic merit than the average proven bull if used when the young sire is just over 12 months of age. Producers using only average proven bulls could make greater genetic progress by using young sires only. However, there are still many proven bulls that are of higher genetic merit (at higher levels of reliability) than the average young sire. Breeders using 100% AI young sires are almost certainly not maximizing their genetic progress since they are not maximizing the higher reliability proven bulls of high merit.

There are other advantages proven bulls have over young sires. Proven bulls provide a greater opportunity to use known calving ease bulls on heifers if calving difficulty is a management concern. Fertility rankings are available for most proven bulls, so high fertility proven bulls may be logical choices on hard breeding cows or during summer heat stress. Type proofs on proven bulls are useful for breeders using mating programs.

Semen price must yet be considered. Semen prices for AI young sires are usually low, generally \$5 or less

Figure 2. Confidence Range (CR) for 3 bulls with PTA (or PA) Protein of +60 pounds at 3 different levels of Reliability.



per unit. Additionally, AI young sire programs usually offer various incentive payments for offspring data. For example, the herd owner may receive payments if calving ease information is reported and if the herd owner has one of the first milking daughters of the bull.

Table 4 is an economic comparison of an average young sire compared to a proven bull at the 95th percentile for Net Merit. The Net Merit value used for the young sire was \$127, which is equal to a current Active AI Holstein bull that would be at the 57th percentile for Net Merit. In this example, the proven bull's daughter is expected to generate \$58 more profit than the young sire's daughter, even after semen prices and incentives have been considered. The table can be easily modified into a spreadsheet so that herd owners can alter prices and genetic merit of young sires and proven bulls as needed.

Net Merit is probably the best index to use for producers wanting a balance of high production, longevity, and udder health. Net Merit does not consider semen price, however. A simple index that considers both Net Merit and semen price is as follows:

$$\text{Net Merit Semen Value Index} = 3 * \text{Net Merit} - 6 * \text{Semen Price}.$$

Net Merit is expressed on a per lactation basis. The multiplication factor of 3 for Net Merit assumes a daughter will stay in the herd for 3 lactations. This corresponds to a 33% cull rate. The number of lactations is easily calculated by dividing 1 by the cull rate percentage. For example, the average number of lactations for a herd with a 40% cull rate would be 2.5 lactations. Because the genetics are also transmitted to future generations, a multiplication factor of 3 is fairly robust even if cull rate is slightly higher than 33%.

The multiplication factor of 6 for Semen Price assumes that it takes approximately 6 units of semen to get a milking daughter in a well managed herd and the semen is used judiciously to get pregnancies. In reality, young sire semen is often used on difficult breeding cows or in the summer months when conception rates are lower. Assuming 6 units per daughter is probably too generous for the young sire, but if no adjustment is made for incentives, a value of 6 comes close to approximating overall income and expense for young sires and keeps the formula simple.

Many times the PA for Net Merit of young sires is not printed in bull books. Also, even if PA is listed, a minor adjustment to account for pedigree slippage should be

included. General guidelines to follow are:

1. If PA Net Merit is available, subtract 20 points to account for pedigree slippage. For example, if a progeny test bull has a PA Net Merit of \$180, use \$160.

2. If PA Net Merit is not available, multiply PTA MFPS by .7 to arrive at an approximate PA Net Merit. In this case, do not subtract an additional 20 points. The pedigree slippage is already included in the .7 multiplication factor. For example, if a progeny test bull has a PA MFPS value of \$200, use \$140 as an estimate of the bull's eventual Net Merit.

Table 5 is a comparison of 7 bulls. Six of the bulls are proven bulls, and the 7th bull (Junior) is a progeny test bull. In July 1996 bulls that had Net Merit values of greater than \$164 were in the 90th percentile and above. All of these bulls, including the young sire, would be in the 90th percentile group, so this is an outstanding group of bulls. In the case of Junior, \$20 was subtracted from his PA Net Merit to account for pedigree slippage.

Table 5 also lists semen price. Using the Net Merit Semen Value index, we see that the top 3 value bulls are Bucko, Credit, and Franco, followed by the young sire Junior. The three lower value bulls in this example are Dollars, Action, and Epic. Although all of these bulls are extremely good values, the second high bull for Net Merit (and second high bull for semen price) actually has the highest value after accounting for semen prices.

Conclusions:

When selecting bulls for the herd other than production, the simplest approach is to use an overall economic index such as Net Merit which accounts for factors such as longevity and udder health. If and when more health and fitness information is available for U.S. proven bulls, these values can easily be incorporated into an index similar to Net Merit. Young sires continue to be a good value relative to the average proven bull, but as a group the young sires are probably not as high in genetic merit as the best proven bulls. Because the best proven bulls are more expensive than young sires, consider calculating a Net Merit Semen Value index for bulls to determine best overall value.



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Notes

Dealing With Dairy Financial Variables

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Dealing With Dairy Financial Variables

We are witnessing and being part of the largest swings in agricultural prices in modern times. We have no more price supports to put floors and ceilings on prices. This will create greater opportunities for profits and greater opportunities for losses. To take advantage of this, we must use the good times properly and survive the hard times. Tax planning will become more critical.

Being profitable today and unprofitable tomorrow won't cut it. It's too stressful and it's too hard to get along with your banker. An example of this is that many dairymen got slack on cow care and cow comfort and got away with it when replacement prices were low and beef prices high. The last couple of years has eaten them alive. The successful dairymen of the future will be prepared to deal with widely variable milk, feed, cull cow and

replacement prices. Being at the total mercy of any one of these is unrealistically risky. Heavy emphasis will need to be placed on the following:

1. Forward planning.
2. Budgeting and cash flows.
3. Equity growth vs. paying taxes.

Sometimes we forget about the basics. Factors that are simple but forgotten about when in crisis. A key is that high cost facilities require high utilization and high production. A couple of years ago when it became obvious that we were going to go through a period of low milk prices, many dairymen in Florida and elsewhere decided they would just slow up and kind of coast through the bad times. The net effect of this, I will demonstrate below. We will break our costs down into feed costs and for simplicity all 'other costs'. Let's take a farm

with a parlor with a capacity to milk 1000 cows. The feed cost will be \$4.00 per milking cow per day and all others costs are \$2,500 per day. This is outlined in the table at left.

Our farms need to be well balanced. We need to do everything as well as we can and not over emphasize any one factor like herd average. Sometimes when we talk parlor efficiency, cows per man hour can be over emphasized. The profitability of the whole operation is determined by the milk produced in the parlor (see table at top of facing page).

When we discuss heifers, the topic is often the cost of raising vs. the cost of buying. I think there is a lot more to it than that. The big advantage to rais-

• 1000 Cows			
Daily Cost	(\$4.00/head to feed)		\$4,000
All other costs	(\$2.50/Cow/Day)		\$2,500
TOTAL	(\$6.50/Cow/Day)		\$6,500
Let's say the dairyman decides to slow up and only milk 800 cows.			
• 1800 Cows			
Daily Cost	(\$4.00/head to feed)		\$3,200
All other costs	(\$3.13/Cow/Day)		\$2,500
TOTAL	(\$7.13/Cow/Day)		\$5,700
• To break even with \$15 milk:			
1,000 Cows	\$6.50 cost	= 43 lbs. milk	
800 Cows	\$7.13 cost	= 47½ lbs. milk	
Milk Production	Gross Revenue Per Cow	Profit or Loss Per Day	
		1000 Cows	800 Cows
45#	\$6.75	\$250	(\$304)
50#	\$7.50	\$1,000	\$296
Parlor pressure is important. It doesn't pay to run on idle.			



Example: Double-12 Parlor

One person can milk 60 cows per hour or two people can milk 100 cows per hour (50 cows per man hour).

Cows milked in 7 hours:

1 Person 60 X 7 = 420 cows
 2 People 100 X 7 = 700 cows

Assume 50 pounds per cow and \$15/cwt.

420 Cows \$3,150 per day = \$1,149,750 per year
 700 Cows \$5,250 per day = \$1,916,250 per year

• A difference of \$766,500 per year!

ing, gets back again to the issue of parlor pressure. Too often those that buy, decide they need heifers too late and then they wait for:

1. Financing to come through.
2. Locating the quality and price desired.
3. Calving out their purchases.

In the meantime, the parlor is producing below capacity. The ideal situation is to have so many heifers calving that you have to find a cow to cull to make room for every new heifer. Another huge advantage to raising heifers is the extra flexibility they give you in tax planning and in weathering through hard times.

Let's look at the worksheet at the bottom of this page to see how replacement costs have affected the cost in producing milk.

Real cow comfort is our best investment. Why? The results are the following:

1. Cut involuntary turnover.
2. Cut veterinary treatment costs.
3. Increase production.
4. Get higher dry matter intake.

To achieve the above, the cow must have conveniently available a clean comfortable place to lay down and a minimum of environmental stress for the climate

she is in. In designing facilities, the involvement of more cow oriented people would really help. Sometimes we leave too much of this to the engineers. They may end up with most of the manure in the alley in free stall barns but we sure see a lot of banded up cows and cows rejecting free stalls. It is common for dairymen to miss major opportunities of balancing taxable income with equity growth. This is particularly important now that we don't have income averaging and have only minimal capital gain savings. Ways of getting equity growth over paying taxes plus making the good years ease the pain of the bad years are the following:

1. Get ahead on repairs and fix ups in the good years.
2. Raise heifers and raise more of them in the good years.
3. Keep bills current.
4. Keep up with budgets and cash flows. Know your likely potential taxable income ahead of time to keep surprises to a minimum.
5. Use cash basis deductions if you have the option and try to keep a form of business that allows it.
6. Get your ph's and fertility up to snuff in the good years.
7. Grow extra feed or plant extra feed in the good years.
8. Put together some facilities to improve foot health and reduce heat stress in the good years.

A major factor that many dairymen are missing out on from both a satisfaction and an economic standpoint is the importance of public relations. Be involved. Treat your animals well. Treat your employees well. Help the schools. Hire local if possible. Good neighbors pay. A letter to the DEP or to your state environmental agency can be expensive.

	<u>2 years ago</u>	<u>now</u>		
springers	1150	\$1250		
cull cows	\$700	\$350		
difference	\$450	\$900		
<i>Doubled our replacement cost.!</i>				
herd turnover rate	Increase in replacement cost per milking cow	total per cow	increase*	per cwt. milk
50%	\$225	\$450	\$1.40	
40%	\$180	\$360	\$1.13	
30%	\$135	\$270	\$.84	
*: 16,000 pounds sold per cow				

Notes

Adjusting Rations To Forage Quality, And Suggested Criteria To Use In Buying Forages

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Adjusting Rations To Forage Quality, and Suggested Criteria To Use In Buying Forages

The sharp increase in the milk fat differential during 1996 reminded dairy producers of the direct economic importance of ample fiber to maintain milk fat test. From 5.4¢ per point in March, to 15.9¢ per point in August, the penalty as well as the reward, came into clear focus. And quickly comes the question of how much effective fiber is needed to maintain fat test? And can forage quality be expressed with a single value or number? Historically, as forage quality has changed, we've adjusted the forage to concentrate ratio (F:C), but the limits to that adjustment are reached quickly and the definition of minimum forage becomes an involved exercise which includes the total ration fiber, its particle size, digestibility, etc. More recently it has been recommended (Mertens, 1996) that we should adjust rations to a constant neutral detergent fiber (NDF), but effective fiber again requires definition.

Another dimension relates to the need to substitute other forages and/or high fiber concentrate ingredients to increase the energy of the ration or in some cases, to reduce energy. Is alfalfa and/or corn silage required for high milk production? And when purchasing forages, what specifications are essential but reasonable? My objectives here are to define some expressions of forage quality, to recommend some specifications to use in purchasing forages, and to suggest some steps to use with forage substitutions in formulating rations.

Expressions Of Forage Quality

With respect to alfalfa hay, Marble (1986) notes that visual examination does not accurately reflect the maturity at harvest which has such a direct effect on both acceptability and digestibility. But chemical analysis does not usually show the presence of mold or reflect

how much foreign material is present in hay. So both visual inspection and chemical analysis are needed for a more complete evaluation. In Table 1 are several expressions of forage quality, based on nutrients and calculations from those nutrients. Different systems are used across the U.S. and each has merit. The American Forage and Grasslands Council (AFGC) has defined 6 forage grades, prime and 1 through 5, based on relative feed value. The Relative Feed Value (RFV) is an index system for ranking forages within classes, was developed in Wisconsin and is based on acid detergent fiber (ADF) and neutral detergent fiber (NDF). It uses ADF to predict digestible dry matter (DDM), and NDF to predict intake as a percentage of body weight. It then combines these 2 to give an index of quality, but comparisons are appropriate only within forage classes. A unit of RFV can be assigned a value in pricing hays. If an alfalfa hay with an RFV of 130 is sold for \$95 per ton, the value of a point of RFV is \$.73 and hays above and below this RFV can be priced based on an agreed upon standard RFV hay and its value.

California and some other western states (Bath and

Table 1: Some Expressions Of Forage Quality

Standard ^a	by Analysis			by Calculation			
	CP	ADF	NDF	TDN ^b	DDM	DMI	RFV
	(% of DM)			(% BW)			
Prime	>19	<31	<40	60	>65	3.0	>151
1	17-19	31-35	40-46	59-56	62-65	3.0-2.6	151-125
2	14-16	36-40	47-53	55-52	58-61	2.5-2.3	124-103
3	11-13	41-42	54-60	52-51	56-57	2.2-2.0	102-87
4	8-10	43-45	61-65	50-49	53-55	1.9-1.8	86-75
5	<8	>45	>65	48	<53	<1.8	<75

^a: Standard assigned by Hay Market Task Force of AFGC.

^b: California System, Bath and Marble, 1989, based on ADF.



Marble, 1989) use an equation ($TDN = 82.38 - (.7515 \times ADF\%)$) to predict TDN from ADF and DDM also is calculated from ADF. The price of hay is then calculated based on a standard hay and the percentage of ADF or Modified Crude Fiber (MCF) (dry basis) in the test hay.

Hutjens (1995) has suggested that because protein also has considerable value, it should be incorporated into the RFV system to more completely reflect the nutritive value of the forage. He uses a term Total Forage Index (TFI) to describe an index which builds on RFV, but adds a protein value and a physical value. In the above example for RFV, if the hay had a protein content of 18% and protein was relatively expensive, multiply 18 by 3 (54) and add this to the RFV to get 184 (130 + 54), the TFI. Then divide the cost of this hay \$95 by 184 to get \$.52, the value of one point of TFI. This addition to the RFV brings a more complete expression of the nutritive value of the forage. It is important to recognize which nutritive values are analyzed by forage testing laboratories and which expressions are calculated from analyzed nutritive values. Most laboratories now give protein, ADF and NDF even for the minimal package. Nearly all other expressions are calculated, including TDN, NEL, RFV and TFI. An expression which combines the 3 measured values should have an advantage and I believe that it does.

Purchasing Guidelines For Forages

We can gain some insights on this subject from two associations who trade cotton and cottonseed products. They have established "Trading Rules" for their members which are shown in Table 2. I don't know whether dairy producers use these rules when they buy cottonseed, but with a small range for each rule, they would be very helpful. For forages, certainly a maximum on foreign matter and moisture are good starting points. Then either, ADF, NDF (or both), RFV, and CP could also be included. Or a sum of ADF and NDF might simplify the expression. And a statement with regard to freedom from mold by sight or smell, should be included. I realize that much hay has and is being sold on the basis of trust established from years of purchasing, but today, hay is being transported over long distances, through brokers, handlers or truckers and the final purchaser may not know or be able to determine its original source. By establishing and specifying guidelines in the purchase order, the buyer is in a much stronger position to request an adjustment in price, when a forage is not of the standard or quality that the purchase order requires.

Corn silage is a unique forage with its variable pro-

portions of grain and stover. Soderlund (1996) states that a fair price for corn to be harvested and stored as silage should consider: 1) corn grain price, 2) predicted grain yield, 3) plant DM content, 4) NEL of grain and stover, 5) DM recovery, and 6) handling, storage and inoculation costs. He has shown an example of these 6 considerations at 2 grain/stover concentrations. The cost involved makes a comprehensive analysis worthwhile. Such an exercise is much more likely to ensure fairness to both the corn grower and the dairy producer.

Forage Concentrate Substitution

Historically when the goal was to increase the energy consumption of the ration or when a poorer quality forage had to be fed, the practice was to simply feed more concentrate. This approach was effective until a forage: concentrate ratio of about 35:65 was reached, because both the energy density of the total diet and voluntary DM increased to this point (Kawas et al. 1983). However, when this approximate ratio was reached, DM intake no longer increased and may have decreased slightly, fat test depressions often resulted and acidosis was a near or resultant problem. But fortunately there are better ways to describe minimum forage or better yet, minimum effective fiber. Because of the increasing genetic trend and the continually rising production capa-

Table 2: Trading Rules for Whole Linted Cottonseed

	NCPA ^a Prime	ACA ^b Prime	Premium
Foreign Matter (max) %	2	2	1
Moisture (max) %	13	13	11
Free Fatty Acids (% of the oil, max)	3	3	3
Crude Protein + Crude Fat (min) %	34	34	38

^a: National Cottonseed Products Association.

^b: American Cottonseed Association.

bility of dairy cows, it will be necessary to be on the edge of ample dietary fiber in order to present a diet as rich in energy as it is possible to formulate with good consumption.

The serious downside to insufficient effective fiber and/or excessively fermentable DM is the occurrence of acidosis and depressed milk fat percentage. Acidosis is the direct result of greater ruminal acid production than can be absorbed or neutralized. An excellent review of the causes, detection and prevention of acidosis in dairy cattle was given by Allen and Beede (1996). They

note the consequences of ruminal acidosis to be decreased energy intake and microbial protein production, but more severe acidosis can lead to ruminal ulcers, liver abscesses and laminitis. Acidosis can be an insidious problem, because its effects may be hidden for some time and then disastrous consequences may appear. Many of us may have thought that milk fat percentage is a good barometer of fiber adequacy, and it is has merit, but it is not perfect. As emphasized by Allen and Beede (1996), there are several reasons that milk fat percentage may not reflect well ruminal acidosis: 1) Cows in early lactation are especially sensitive to ruminal acidosis, but because they are mobilizing body fat, their milk fat percentage may be maintained at a near normal concentration; 2) dietary fat may elevate milk fat percentage; 3) and if bulk tank tests are used, these may not be sensitive enough to reflect problems in early lactation cows because of the dilution effect.

Effective Fiber (EF)

The most effective and direct way to control acidosis is to maintain ample effective fiber in the diet. Neither NDF, ADF, or any other chemical or nutritive fraction characterizes the EF or roughage value because feed samples must be ground before sampling for analyses. Effective fiber is the feed's property to stimulate initial chewing, subsequent regurgitation and rumination, and it reflects the particle size, the fibrous nature, and the fiber content of the feed. Chewing or rumination is especially important because it is directly related to the amount of saliva production and saliva contains 2 buffer systems, the primary one being sodium bicarbonate which provides most of the buffering action in the rumen. So the greater the fiber concentration (designated by NDF), the larger the particle sizes of the feed, the degree of coarseness and the more chewing that is required, the greater is the EF of the feedstuff. Therefore, several workers (Hutjens, 1993, Mertens, 1992) have calculated EF values for an array of feedstuffs and some of these are in Table 3. An important variable is particle size; Mertens (1992) has assumed that only particles retained on a sieve of 1.8 mm contributes to chewing activity and therefore this fraction was used to calculate the roughage value or EF. However, until recently, most dairy producers would had no way of easily determining the par-

Table 3: Effective Fiber Varies Greatly Among Feedstuffs

Feedstuff ^a	Percentage of NDF Which is Effective	X Total NDF (%)	= Effective NDF (%)
Alfalfa Hay	92	45	41.4
Alfalfa Haylage (3/8")	82	45	36.9
Alfalfa Haylage (1/4")	67	45	30.2
Grass Hay	98	55	53.9
Corn Silage (50% grain, (1/4")	71	50	35.5
Corn, Ground	48	9	4.3
Soybean Meal	23	16	3.7
Brewers' Grains	18	42	7.6
Whole Cottonseed	100	44	44.0
Beet Pulp	33	54	17.8
Soy Hulls	2	67	1.3

^a: After Hutjens, 1993.

title size of their forages or of the totally mixed ration (TMR) which would prevent acidosis. Recently, Heinrichs (1996) constructed a particle separator with 3 screens which allows one to screen a sample of forage, but especially a TMR, to determine whether a significant fraction of the particles are large enough to cause enough chewing to prevent acidosis. Guidelines for this screening method are in Table 4.

Several of the commodities or byproducts have a significant concentration of EF and this fact can increase their value when EF is especially needed. For example, Wisconsin workers (Swain and Armentano (1993) and Depies and Armentano (1995) showed that NDF from oat hulls, corn gluten feed, beet pulp, corn cobs and wheat middlings was about one-half as effective as NDF from alfalfa with respect to returning a depressed fat test to near normal from a low fiber-alfalfa based forage diet. Earlier it was found that NDF from linted whole cotton-

Table 4: The Penn State Forage Separator Has Three Sieves^a

	Recommended Particle Size	
		TMR
Upper Sieve ^b	> 0.75 inch	6 - 10%
Middle Sieve ^b	0.75-0.31 inch	30-50%
Bottom Pan ^b	< 0.31 inch	40-60%

^a: Heinrichs, 1996

^b: Portion remaining on the screen



seed and dried distillers grains was equal to NDF from alfalfa NDF for maintaining milk fat yield. Just how the EF of these byproducts would be measured by the Heinrichs (1996) screen separator, especially imbedded in a TMR is not clear yet. But a number of the byproducts have NDF which despite a modest particle size, are very effective at maintaining milk fat test. Firkins (1995) summarized the EF of a number of feed ingredients that he designated as nonforage fiber sources. He noted that whole cottonseed and cottonseed hulls are the best forage substitutes among the many byproducts available to dairy producers.

Forage-To-Forage Substitution

Many dairy producers feel that some alfalfa in the ration is a necessity if top production is to be achieved. You may recall an article published last year with the title: "24,000 pounds of milk... no corn silage, no alfalfa" (Merrill, 1996). The forages used were a combination of grasses, mostly stored, rather than pastured. Yes, high production can be achieved without alfalfa, but it is much easier with alfalfa. However, in some areas of the U. S., especially in much of Texas, the freight makes alfalfa hay very expensive. My advice to a number of clients has been this: grow the very best forage which you can grow on your farm, and you know better than anyone what that forage is, and we will build the ration on that forage. But what is it about alfalfa that makes it so special? Van Soest (1987) described 5 features of alfalfa which make it superior to grasses: 1) It incurs a small depression in digestibility with intake; 2) It has a moderate NDF content; 3) Its high cell wall density leads to higher intakes; 4) It has a high buffering capacity; and 5) It has a moderately fast rate of fermentation. If it were possible to more nearly define the "mystic" of alfalfa, then those of us for whom it is very expensive might be able to construct a ration which would equal or very closely approach the performance of rations based on alfalfa. And if that "mystic" is contained in 4 lbs of alfalfa, then under most conditions, we would not feed 6 or 8 lbs of it.

Another reason alfalfa may be superior to grasses is that it contains a higher concentration of pectin. Although a component of cell walls, pectin has some very desirable nutritional characteristics. Hall (1994) noted that: a) it is a highly digestible, fermentable carbohydrate energy source; b) during its fermentations it appears not to produce lactic acid; c) it tends not to depress ruminal pH, and d) it ferments little during silage

fermentation.

Many years ago, Ward et al. (1957) confirmed earlier studies which showed that alfalfa ash stimulated the digestibility of low quality roughages by sheep. Compared to grasses, alfalfa has a rich mineral profile. In addition to the 14 mineral elements for which requirements are defined by NRC (1989), there are at least 12 more which have been shown to be required by some animal (McDowell, 1992). My hypothesis is that alfalfa is a rich source of these exotic 12 compared to grasses. A comparison of 7 of these in alfalfa, corn silage, and brome grass hay shows this to be so.

A direct comparison of alfalfa with orchardgrass (Weiss, 1995) shows that under some conditions grasses produce results both with respect to DM intake and milk production comparable to alfalfa. Other work (West et al., 1996) shows that improved varieties of bermuda grass (Tifton 85) compared to alfalfa in corn silage based diets, can give similar results. Although NDF in grasses is usually higher and may be more digestible, it is more slowly digested which is a disadvantage in high yielding cows (Glenn, 1994).

Another forage which under some conditions has special properties is cottonseed hulls (CSH). This is an ideal diluent for an alfalfa hay that is too rich in protein and low in EF. These hulls are also an excellent diluent for corn silage which is too rich for late lactation cows, dry cows or heifers. Its relatively low potassium (1.13%) makes it ideal for transition cows. At concentrations in the order of 7 to 10% of the ration, its value often far exceeds its book value which categorizes it in the low quality forage class.

Among forages, corn silage is a special case because it is a combination of forage and corn grain. The best time to harvest corn for silage has traditionally been defined as a total plant DM of about 35%. For field application, it is easier to examine the kernel and describe its features in order to know when to begin harvesting. A recent Wisconsin study (Bal et al., 1996) showed that a kernel described as 1/4 to 2/3 milkline gave the greatest lactation performance compared to earlier and later maturities, and this coincides with a DM content of about 32 to 35%. However, based on the recent work of Johnson et al. (1996) this current ideal maturity range may be expanded or at least extended to drier more mature plants. This work suggests that processing whole plant corn by a roller mill prior to ensiling may improve nutritive value by crushing the kernels and increasing

starch digestibility by reducing whole kernel passage through the cow. This study used corn of 31.5% DM, so it did not address the question of whether the feeding value would be increased even more if more mature corn had been used to achieve greater DM yield per acre. But with harder kernels, greater benefit might have been seen. Field results suggest that such processing allows one to use a coarser chop and thereby obtain the value of a higher EF in the resulting silage. Much research is needed here, but the prospects are very encouraging.

One consideration in crop production is the lbs of water transpired by a plant per lb of above-ground DM produced. Values reported include 858 for alfalfa, 635 for oats, 372 for corn and 271 for sorghum (Peters, 1964).

Summary And Conclusions

Yes, forage quality can be expressed as a single number, but an index based on the 3 nutrients usually measured, CP, ADF, and NDF, gives the best indicator to date. It can be used to price forage given agreement on the value of a standard forage.

Purchasing guidelines or specifications for buying forages should begin with an acceptable range for moisture and foreign matter. There should be a statement to exclude visible mold and mustiness. Then reasonable ranges should be defined for nutrient content or an index based on measured nutrient values. This is an insurance policy which costs very little, and one which will pay back when delivery of a forage is made which is well outside the ranges specified and an adjustment in price is in order.

To formulate rations which ensure high intakes of

energy requires being near the canyon's edge of acidosis, where only careful inclusion of ample effective fiber will prevent a disaster. Many nonforage byproducts contain EF which should be included in the calculation for EF. The two best forage substitutes are whole cottonseed and cottonseed hulls, both with EF equal to their NDF. Fortunately, particle size separators are now available which give strong indications when particle sizes of the TMR are not sufficient to prevent acidosis.

No doubt alfalfa is a very special forage, but in some areas, its cost is difficult to justify. If the reasons for its special nutritive value can be more clearly defined, then rations can be formulated without alfalfa which will more nearly result in equal production to those with alfalfa. In turn some minimum amount of alfalfa which results in high production may be evident.

Corn silage is also special and its real nutritive value is much more difficult to assess because not only does it have a variable ratio of forage to grain, but the grain can become so hard that some of it passes through the cow undigested. New equipment which allows processing to crush the grain before or after ensiling offers much promise to make corn silage an even richer feed with more EF and a greater range of acceptable harvest dates.

Unlike feedlot rations for beef cattle where forage is optional, for dairy cattle, ample effective fiber is a physiological imperative, an absolute necessity for good health and longevity.

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Notes

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Grouping Strategies For Dairy Cattle

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Grouping Strategies For Dairy Cattle

Open-lot corrals, freestall housing and TMR feeding dictate that dairy producers adopt appropriate grouping strategies for feeding, milking, and managing dairy cattle. Proper grouping allows a producer to more closely approximate the feed consumption and cow activity requirements of individual cows. Herd size and physical facilities often limit the number of possible groups.

A. Dry Cow Groups:

Dry cows must be separated from the milking herd and ideally they will be further separated into "far-off" and "close-up" groups.

1. The "Far-off" or recently dry group of cows need a chance for the rumen to rest and recuperate from high energy rations. Long stemmed hay (with no concentrate or only limited amounts to supply the needed vitamins and minerals, and to maintain body condition) is the feed of choice to allow the rumen epithelium to regenerate itself.

2. Two to three weeks before calving the dry cows and springing heifers should be moved to a "Close Up" group. Here the ration changes with a reduction in long stemmed forages to include ingredients that will be present in the next group (Transition, High rations), as well as the use of anionic salts.

B. Milking Cow Groups:

1. The "Transition or Fresh Cow Group" (where cow numbers and facilities permit) should be made up of cows that are within the first two weeks of their lactation. Dry matter intake of this group is low relative to their requirements. Therefore, ration protein and energy, and effective fiber should exceed that of the high cow ration. This can be accomplished by including higher levels of protein (especially rumen undegradable protein), added fat, and some long stemmed hay. Higher levels of micro-nutrients and certain feed additives are added to compensate for the lower feed intake during this

period of transition.

2. The "Early Lactation or High Cow Groups" are made up of cows that have been 'transitioned' or somewhat adjusted to the higher energy/minimum fiber ration that these cows will receive. This ration is usually formulated for maximum milk production (90-120+ lbs). Cows stay in this grouping based on level of milk production, body condition, and reproductive status. Some high producing cows, that are not over conditioned or that are receiving rBST, may stay in this grouping for most of their lactation.

3. The "Heifer Group" is where all first lactation cows are kept together for the entire lactation. The grouping is popular where cow numbers and facilities permit. First lactation cows are smaller and usually less aggressive eaters. By grouping them by themselves they do not have to compete with bigger cows and are more free to eat, lie down, and chew their cud and make milk. They are growing and need extra nutrients for growth and are more persistent milkers (flat lactation curve). They usually stay in this group for the complete first lactation. Some producers will include smaller second lactation cows in this group depending on cow numbers and other conditions specific to a particular operation.

Some producers don't use this grouping because they find that 'first calf heifers' quiet down faster and are more easily managed when housed with older cows.

4. The "Middle Lactation or Production Group," where cow numbers and facilities permit, is usually designed for pregnant cows in adequate body condition that have peaked in milk production and are still producing moderately well. Feed costs can usually be reduced by having this group, if enough cows fit into this group to justify the extra ration mixing and feeding.

5. The "Late Lactation, Production, or Conditioning Group" is designed for pregnant cows of sufficient body condition that are close to being dried off. Feed cost savings can be realized with this group by lowering ration protein and energy density and using more forage in the



ration. Recent research from Arizona indicates that over-conditioned late lactation cows in adequate body condition receiving rBST produce as much or more milk on a low grain (10 lbs) ration as on a moderate grain (20 lbs) ration.

The higher production levels maintained in most herds (through rBST usage, high genetic potential, and superior management) have nearly eliminated the need for the last two groups.

C. Other Grouping Considerations:

1. Grouping is a tool to help in the overall quality of management of the dairy farm. Regardless of the number of groups sufficient feed manager and watering space must be provided. The very best grouping arrangement will not substitute for quality of nutrition and feed bunk management.

2. Avoid moving cows indiscriminately from one group to another. Move more than one at a time and when cows are otherwise occupied.

3. Cows per group are usually multiples of the number of parlor units.

4. Herd production simulation models indicate that the most effective grouping strategies are based on required nutrients (energy and protein) per unit of dry matter intake.

D. Stouder Holsteins Grouping Philosophy

There seems to be many opinions on the best method of grouping lactating cows. It has been suggested that grouping can be made by (1) milk production, (2) by age or parity of the animals, (3) by time of calving, (4) by udder quality and/or somatic cell counts, or (5) by body condition score. Although these are the most recommended methods, in reality, I'm sure there are numerous other methods that have proven useful.

I would like to describe the thinking that has gone into choosing the methods that are employed at Stouder Holsteins regarding grouping cows. Stouder Holsteins is a 600 cow 2X milking herd. The milking parlor is a double-12 herringbone utilizing one milker per milking. There is a holding pen which will accommodate no more than 130 cows. There are 5 lactating corrals with a feeding area in each of 305 feet in length. There are shades in each corral with a total area of shade of 6,250 square feet. In one corral, there are 150 self locking stanchions; in the other 4 corrals, there are 120 self locking stanchions. In addition, there is a small corral which is used for just fresh cows and treated cows. From the information above, it becomes necessary to have +120 cows per corral for proper usage of the barn, the holding area,

the feeding area, and the comfort areas. This then is my first point – Grouping strategies need to consider the dairy facility when they are made.

After establishing our need for nearly equal groups of approximately 120 cows, we then considered grouping strategies that would complement our style of dairying. Our philosophy of dairying is to maximize production to the fullest as long as our input costs continue to justify more production. At present, our RHA is 24,200 pounds of energy-corrected-milk; we feed a TMR which includes alfalfa haylage, alfalfa hay, and grain; we breed the entire herd by A.I. using both proven high PD sires and a percentage of young sires with high predicted PDs; we replace with our own heifers; and we strive to keep our income over feed costs at more than 55% of our gross income. This then is my second point – Grouping strategies need to complement a dairy's needs. In our case, we need to (1) make adequate space for maximum dry matter intake by all animals to maximize production (2) make lockup room for the entire herd to maximize management of our reproductive program (both estrus detection and physical breeding of the cows); and (3) maximize the genetics of our entire herd but especially the first lactation heifers.

After establishing the facility's and herd's needs, thought must be done to consider how grouping strategies will actually get done the most efficiently on the dairy. In our case, our milking parlor utilizes one milker per milking. The partners of our dairy are three sons, myself and my wife. All work actively on the dairy but not in the parlor. One son feeds the cows, one together with myself handles the reproductive and health areas, and the other son handles the calf feeding and the office management. In addition, we hire two outside men to assist wherever needed. Therefore in our case, it doesn't make sense to ask the milker to hold any cows in the parlor so that these cows can be moved to another string. Because there is much more help outside, moving cows needs to be done while strings of cows are locked up outside. This then is my third point – Grouping strategies need to complement the personnel of the dairy.

These three considerations should assist a dairyman in developing a personal grouping strategy. As with all other dairy management programs, there is no right or wrong method. Each dairy manager should develop programs that make sense for the dairy after considering physical facilities, management goals, and dairy personnel. Grouping strategies as all other management programs can't be made at the coffee shop, from the printed page of a dairy publication, or from a panel discussion

that occurs at the Western Large Herd Dairy Management Conference. Any of these forums can give food for thought processes, but ultimately the dairy manager will have to think out a rational program for his/her herd if it is to be successful.

And finally, after developing a grouping strategy, the process needs to be done regularly. A dairy is in constant flux (the status of cows are continually changing). Cows freshen; cows move past their voluntary waiting period and need to be bred; cows get pregnant; cows need to be dried; cows need to get warmed up prior to calving; and cows freshen again. During this cycle, some cows will develop health problems and have to be moved to a hospital string and then be moved back to a milking string and some cows will need to be culled. Therefore the grouping of cows is always necessary. It is my feeling that grouping needs to be done as regularly as the reproductive program, the drying off of cows, and the culling of cows. To recap, my last point is – Grouping of cows must be done on a regular basis.

E. Stouder Holsteins Grouping Strategy

We group lactating cows in the following way:

1. A first lactation high production string.
2. A high production string of second lactation and later cows that are less than 100 days in milk.
3. A middle production string of second lactation and later cows.
4. A low production string of second lactation and later cows.
5. A low production string of primarily first lactation cows, but may include some second lactation cows.

All of these strings will contain approximately 120 cows. Strings 4 and 5 will contain cows that are to be dried or culled. This then is our method for grouping on a regular basis. On alternate Mondays, the reproductive herd health program and the administration of rBST occurs. Herd test day also occurs on one Monday each month. On every Monday, close-up cows and heifers (approximately 14 days pre-partum) are moved from the far-off dry pen to the close-up pen. On every Tuesday, cows from strings 4 and 5 are dried and moved to the far-off dry pens. Also on Tuesdays, culling is done as necessary. It then has become a regular process to regroup the milk cows strings every Wednesday. This process is accomplished by determining the number of cows in each string. A computerized list is then produced that will list in descending order of ECM Relative Value of (1)

all heifers in string 1 that are over 150 days in milk, (2) all cows in string 2 that are over 90 days in milk, and (3) all cows in string 3 that are over 180 days in milk. This list includes cow identification, days in milk, days since bred, pregnancy status, all test days of milk, fat %, protein %, somatic cell count, relative value, lactation number and last body condition score.

We always try to keep the two low strings full. In this way, we minimize our feed costs by feeding as much low cow TMR as possible. Also in this way we try to make as much room as possible in the higher producing strings for the best feeding room and the most comfort for the highest producing cows. At times, there are so many cows coming fresh that there are more than 600 cows milking. If any strings will have to be fuller than 120, we only over-fill the two lower strings. These two strings contain mostly pregnant cows or cows that are to be culled so that estrus detection is less likely to be compromised by more cows than lockups. Also these cows usually have the most body condition so that overcrowding at the feeding area is less likely to affect their production. Likewise, by keeping the low strings full, we maintain as much room in the high production strings as possible for fresh cows and heifers that are entering these pens after their milk is determined to be safe to go to the bulk tank.

The reproductive program is helped by our method of grouping also. All first service inseminations are made in strings 1 and 2. The repeat inseminations should occur in either of these strings or in string 3. Therefore the cows are grouped so that the most estrus eligible cows will be together. It has been shown that the more cows in estrus together, the more likely they are to exhibit the signs of heat.

This grouping strategy works for us. It accomplishes the goals that we want to attain. It seems to be correct for us. Whether it will work for any other dairy is immaterial since it is our strategy. As stated before, every dairy must develop its own strategies to accomplish the goals that management has developed for it. If the goals of that dairy are reached, then the strategies are sound - at least until the goals change and additional steps to management strategies are needed to reach the higher goals that have been developed.



Notes

Notes

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