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UNIVERSITY OF MINNESOTA

College of Veterinary Medicine

VETERINARY CONTINUING EDUCATION



ST. PAUL, MINNESOTA
UNITED STATES OF MINNESOTA

Analyzing Financial Performance of Dairy Units

*Art Madsen
Farm Credit Services*

I. Veterinarians as Information Sources

- A. Innovation Diffusion and Decision Making by Minnesota Dairy Farmers,
Earl W. Bracewell & others
 - Veterinarians most frequent source of information
 - Veterinarians most trusted source of information
- B. Opportunities and responsibilities

II. Foundation for Financial Analysts

- A. Accurate Balance Sheets
 - 1) Book value (cost)
 - 2) Market value
- B. Accurate Accrual Earnings Statements
 - 1) Operating period consistent with balance sheets
 - 2) Reconcile with balance sheet changes
- C. Enterprise Analysis

III. Five Areas of Analysis

- A. Liquidity
 - Measures unit's ability to meet current obligations without disrupting normal operations
 - Can I pay the vet bill without selling the cow?
- B. Solvency
 - Measures unit's borrowed capital in relation to equity capital
 - If business is sold, is there anything left?
- C. Profitability
 - Measures amount of profit generated from labor, capital and management
 - "If you expect a return to management, you need to manage" Dr. John Lawrence
- D. Repayment Capacity
 - Measures unit's ability to repay debt on a timely basis
- E. Financial Efficiency
 - Measures degree of efficiency that unit uses labor, capital and management

IV. Liquidity Measures

A. Working Capital

1. Total current farm assets
- Total current farm liabilities
Working capital
2. Should be positive
3. \$/Cow
4. Measures ability to meet ongoing operating expenses and debt payments

B. Current Ratio

1. Total current farm assets
Total current farm liabilities
2. Measures relationship of current assets and current liabilities
3. The higher the ratio, the more liquid the unit
4. Minimum goal > 1.25

V. Solvency Measures

A. Debt/Asset Ratio

1. Total farm liabilities
Total farm assets
2. Measures portion of assets owed to creditors
3. Higher the ratio, the greater the risk

B. Equity/Asset Ratio

1. Total farm equity
Total farm assets
2. Measures ownership and control of business
3. Higher the ratio, the lower the risk
4. Minimum goal 40%

C. Debt/Equity Ratio

1. Total farm liabilities
Total farm equity
2. Measures extent of combination of debt and equity capital
3. Higher the ratio, the higher the risk

VI. Profitability Measures

A. Return on Assets

1. Net farm income from operations
+Farm interest expense
-Value of unpaid operator and family labor, and management
Average total farm assets
2. Overall profitability index
3. Higher the ratio, the more profitable the business
4. Use market value balance sheets to compare units
5. Goal 5%+

B. Return on Equity

1. Net farm income from operations
-Value of unpaid operator and family labor, and management
Average total farm equity
2. Measures rate of return on owner's equity capital in unit
3. The higher the ratio, the more profitable the business, but...

High ratio may show a limited capital base and high leverage.

Low ratio may show a conservative high equity business

4. Goal 10%

C. Operating profit margin

1. Net farm income
+Interest expense
Family living draw
Value of farm production
2. The higher the ratio, the better
3. Goal > .35

VII. Repayment Capacity

- A. 1. Net farm income
+Non-farm income
+Depreciation
+Interest on term debt
+Interest on capital leases
-Total income tax expense
-Family living draw
Current principal and interest payments on term debt and capital lease
2. Higher the ratio, the greater the margin
3. Goal 1.3

B. Capital Replacement and Term Debt Repayment Margin

1. Farm income
+Non-farm income
+Depreciation expense
- Income tax and social security
= Capital replacement and term debt repayment capacity
- Payments on unpaid operating debt
- Total payments on personal liabilities
= Capital replacement and term debt repayment margin
2. Evaluate ability to service debt and replace capital
3. Evaluate risk margin

VIII. Financial Efficiency Measures

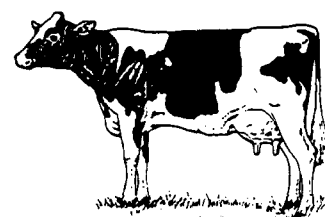
- A. Asset turnover ratio
 - 1. Value of farm production
Average farm assets
 - 2. Measures how effective farm assets generate revenue
 - 3. Higher the ratio, the more efficient the asset is used
 - 4. Goal >.35
- B. Operating expense ratio
 - 1. Farm expenses-interest-depreciation
Value of farm production
 - 2. Measures how much of each dollar of revenue is going to pay expenses
 - 3. Goal < .65
- C. Depreciation Expense Ratio
 - 1. Depreciation expense
Value farm production
 - 2. Measures how much of each dollar of revenue is used to cover depreciation
 - 3. Goal 10%?
- D. Interest Expense Ratio
 - 1. Interest expense
Value farm production
 - 2. Measures how much of each dollar of revenue is used to pay interest
 - 3. Goal < 12%

IX. Summary

- A. Veterinarians will have a major impact on the re-capitalization and profitability of the dairy industry in the Upper Midwest.
- B. The foundation for sound financial analysis is a sound accounting system.
Align with someone who can supply this system.
- C. Understand and use appropriate measures of
 - Liquidity
 - Solvency
 - Profitability
 - Repayment capacity
 - Financial efficiency
- D. Explore all opportunities available for your practice and your dairy customers.

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NOTES



**SURVEYS OF MINNESOTA & WISCONSIN DAIRY HERDS.
I: HERD HEALTH & PRODUCTION**

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The main purpose of this study was to collect more comprehensive information than had previously been available on the general health and milk production status of Minnesota & Wisconsin dairy herds. Some of the agencies and organizations that collaborated in the development of the Dairy Herd Health and Production Survey were particularly interested in dairy farmers' experiences with stray voltage and related electrical phenomena. Thus, a follow-up telephone survey was conducted in which all dairy farmers who completed and returned written surveys were called and asked some additional questions.

Materials & Methods

A stratified random sample with respect to herd size of 1,250 Minnesota and 1,250 Wisconsin dairy herds was drawn from sampling frames maintained by the Minnesota and Wisconsin Agricultural Statistics Services. In late November, 1996, survey forms and cover letters were mailed to the addresses of each

Table 1: Postal survey response rates.

STATE	SURVEYS MAILED	SURVEYS RETURNED COMPLETED & USABLE	RESPONSE RATE (%)
MINNESOTA	1,250	377	30.2
WISCONSIN	1,250	375	30.0
TOTAL	2,500	752	30.1

premises. Ten days later, reminder postcards were mailed to non-respondents. A total of 887 (35.5%) survey forms were returned by the cut-off date of February 20, 1997. Of these, 135 (5.0%) were returned blank, most with a notation that the farm no longer kept dairy cows. Thus, data from a total of 752 (30.1%) completed survey forms were entered into the computer system (Table 1.)

General Information: Due to the large number of usable survey responses, we consider this data set to be representative of all dairy herds in Minnesota (10,600) and Wisconsin (24,000), as of December, 1996. Moreover, as the number of responses per state is approaching 400, inter-state comparisons are valid. Responses were split evenly between Minnesota (377) and Wisconsin (373) dairy herds. In most cases (97%), survey forms were completed by individuals who regarded themselves as herd owners as opposed to employees (2%) or managers (1%.)

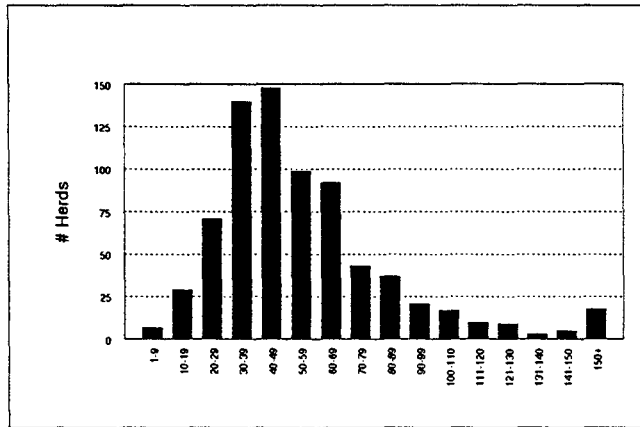


Figure 1: Dairy cows per herd (dry & milking)

Numbers of dairy cows (milking and dry) ranged between 10 and 385. The median dairy herd size was 47 and the mean 56.1 (Figure 1.)

Milk production (lb / cow / d) at the time of completion of the survey form was estimated for each herd. Daily milk yield (*How much milk (lb) was produced yesterday?*) was divided by the number of milking cows reported in

response to the question: *“How many dairy cows (dry or in milk) were in the herd yesterday?”* Calculated in this manner, our estimate of December 1996 average milk production for all Minnesota & Wisconsin dairy herds is 52.5 lb (23.9 kg) / cow / d for cows in milk, or 42.4 lb (19.3 kg) / cow / d when dry cows are included.

Lameness, culling, and mortality: The total number of milking cows at the time of completing the survey and the estimate of milking herd size one year previously was used as the denominator in providing crude estimates of annual average lameness, mortality, and culling rates. Herd owners were asked the question : *During the last 12 months, how many dairy cows were*

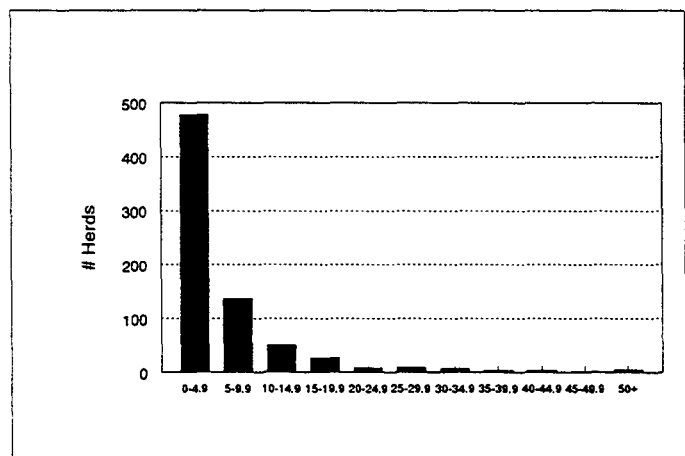


Figure 2: Estimated crude annual lameness rates (%)

treated or culled for lameness (not including foot trimming)? The mode of the distribution of crude annual lameness rates (Figure 2) shows that less than 5% of cows were treated or culled for lameness in 65% of respondent herds. Lameness rates between 10 and 50% were estimated for 15.6% of herds.

The estimated mean raw culling rate was 20.6% (Figure 3), with 9% of herds having culling rates in excess of 35%.

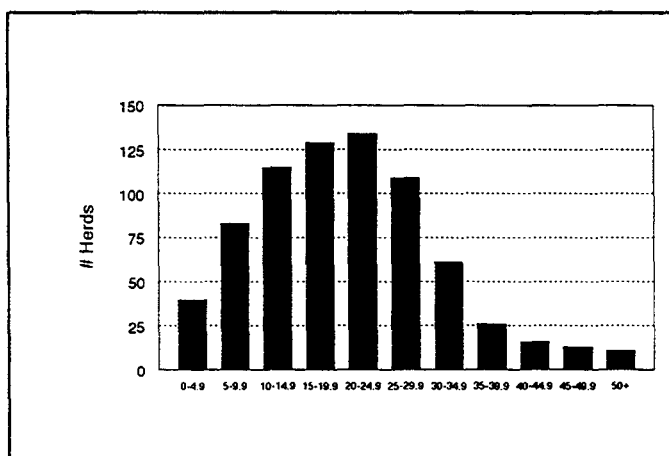


Figure 3: Estimated crude annual culling rate (%)

The estimated mean raw adult cow mortality rate was 4.3% (Figure 3.) Reported mortality in most (68.5%) herds was less than 5%. However, mortality rates of 5-10% were estimated for 20.2% of herds. These data also indicate that adult cow annual mortality rates in excess of 15% exist in approximately 2.7% of Minnesota and Wisconsin dairy herds.

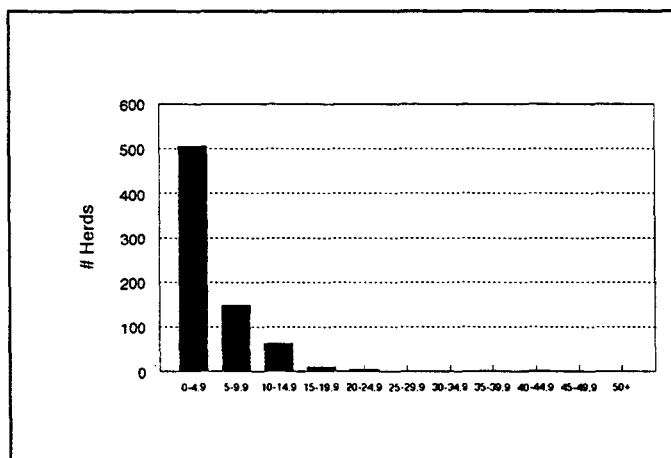


Figure 4: Estimated crude annual mortality rate (%)

Use of professional services: Just over one-half (52%) of respondent herds are enrolled as members of a Dairy Herd Improvement Association (DHIA) (Figure 5). More than one-half of

respondents employ the services of feed or dairy consultants (59%), test the nutritional value of their forages (66%), or have regularly-scheduled veterinary herd health visits (59%).

Housing systems: The predominant cow housing systems include tie stalls and stanchions which are in use in 58% and 54% of herds, respectively (Figure 6.) Milking parlors, either flat or elevated, are used in only 10% of herds, while free stalls and loose housing are used to some extent in 18 and 14% of herds, respectively. Stanchions are more popular in Wisconsin (67.1%) than in Minnesota (48.4%) production systems. Conversely, milking parlors are twice as likely to be used in Minnesota (13.5%) than in Wisconsin (6.4%) dairy production systems.

Records and management information systems: Manual farm business systems are the predominant record-keeping systems in use (58%), while 25% of herd owners own a computer that is used for business management purposes (Figure 7.). However, only 8% of Minnesota and Wisconsin dairy herd owners maintain their dairy production records using on-farm computers. Manual farm business records are favored more by Wisconsin (64.3%)

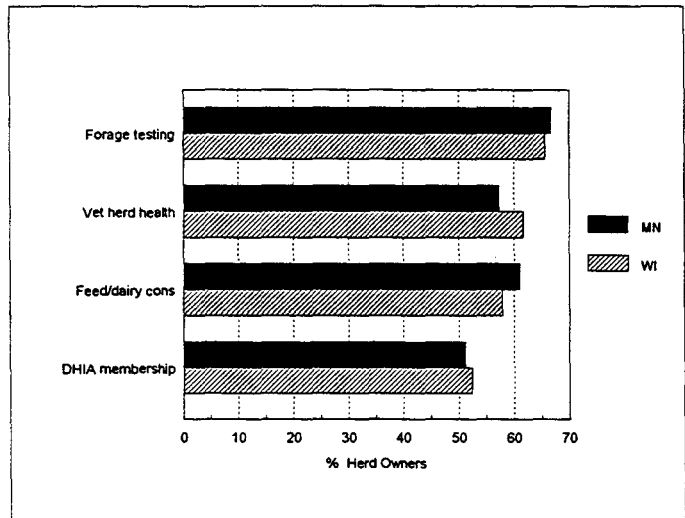


Figure 5: Use of professional services

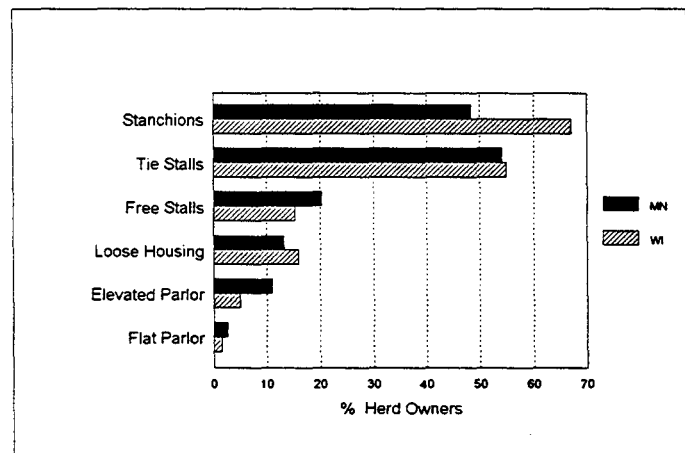


Figure 6: Dairy cow housing and milking facilities.

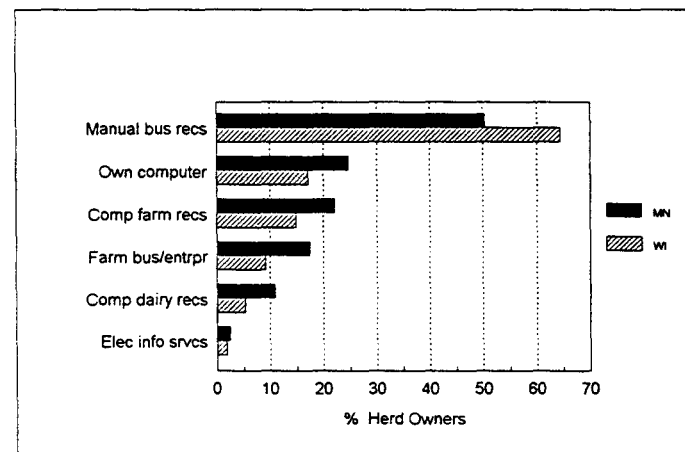


Figure 7: Records & management information systems.

than by Minnesota (50.31) dairy herd owners. While Minnesota dairy farmers have embraced computer technologies at a faster rate than their Wisconsin counterparts, the overall rate of computer use is low in comparison with the pork industry.

Rolling average milk production: Herd owners were asked to indicate their current rolling herd average (RHA) milk production (lb / cow / yr) by checking one of 5 categories (Figure 8.) Approximately 11% of respondents checked the "don't know" box. Of the 657 who responded, 295 (44.9%) indicated a rolling herd average milk production of at least 18,000 lb / cow / yr. A further 10.8% of herds reported a figure of less than 14,000 lb / cow / yr. As survey herds were selected at random from

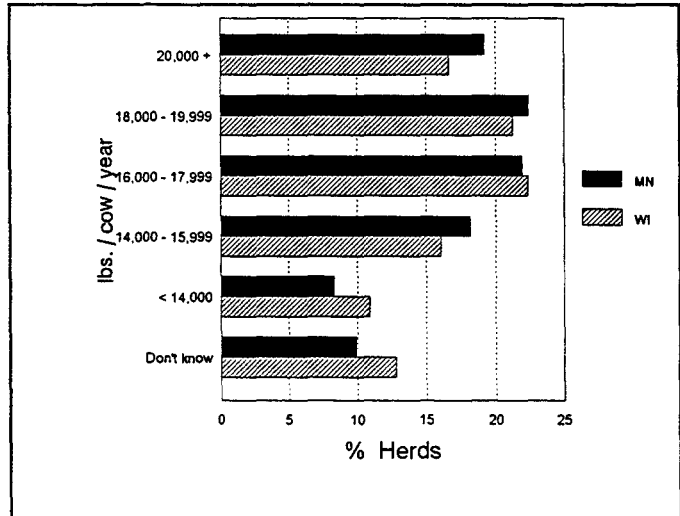


Figure 8: Rolling herd average milk production

Minnesota and Wisconsin Agricultural Statistics Services' sampling frames, it is very likely that some of the lower-producing herds are comprised of cows of breeds other than Holstein.

Satisfaction with RHA milk production: Herd owners were also asked to indicate their level of satisfaction with their level of milk production on a 1 to 5 integer scale. Thus, respondents expressed their degree of satisfaction between the extremes of 1 being "extremely dissatisfied" and 5 being "extremely satisfied." (Figure 9.) We observed a general trend towards a higher degree of satisfaction with increasing production. However, there was a higher degree of variation in satisfaction among herd owners producing > 20,000 lb / cow / yr, as indicated by the comparative length of the standard

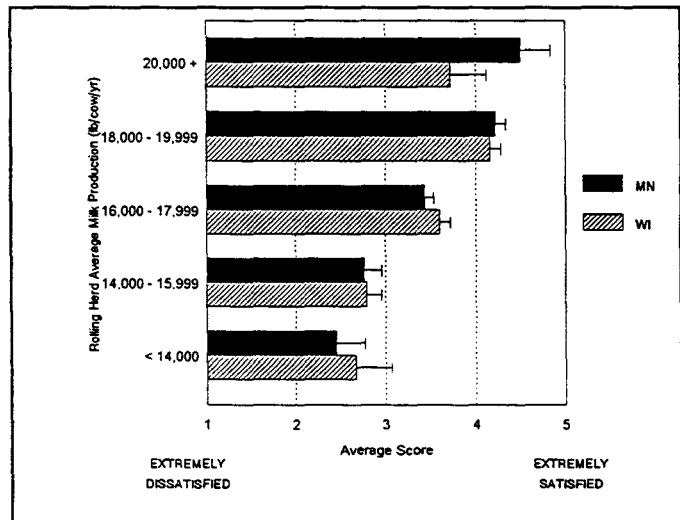


Figure 9: Satisfaction with RHA milk production

herd owners producing > 20,000 lb / cow / yr, as indicated by the comparative length of the standard

error bars in the figure. A possible explanation for this phenomenon is that the owners of high-producing herds are ambitious managers with goals of further increasing production. It is also likely that a herd owner whose RHA production had improved to 23,000 from 21,000 lb / cow / yr would be “satisfied;” while another whose RHA had fallen to 23,000 from 25,000 would tend to be “dissatisfied.”

Bulk tank somatic cell count:

Respondents were asked to mark a category consistent with the bulk tank somatic cell count (SCC) figure printed on the latest report provided by their milk processor. (Figure 10.) Approximately 60% of herd owners reported bulk tank somatic cell counts of less than 250,000. However, the proportion of Wisconsin herds with low SCC’s (67.2%) was greater than the corresponding proportion of Minnesota herds (51.5%.) Overall, 19.3% of herds reported a bulk tank SCC in excess of 350,000 in November - December, 1996.

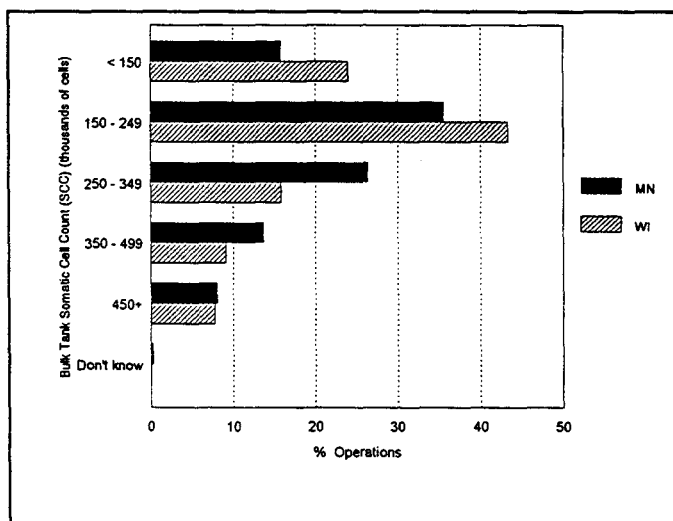


Figure 10: Current bulk tank somatic cell count (SCC)

Satisfaction with bulk tank SCC: As in the case of RHA milk production, herd owners were asked to indicate their level of satisfaction with their bulk tank SCC on a 1 to 5 integer scale. (Figure 11.) The figure indicates a strong trend of increasing satisfaction as SCC decreases.

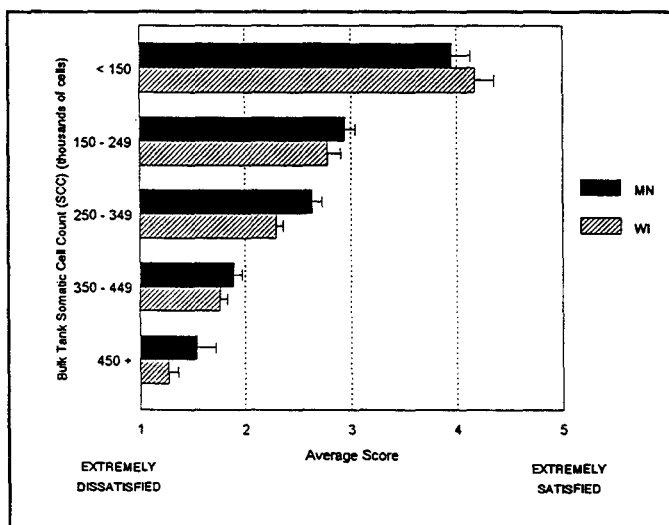


Figure 11: Satisfaction with bulk tank SCC.

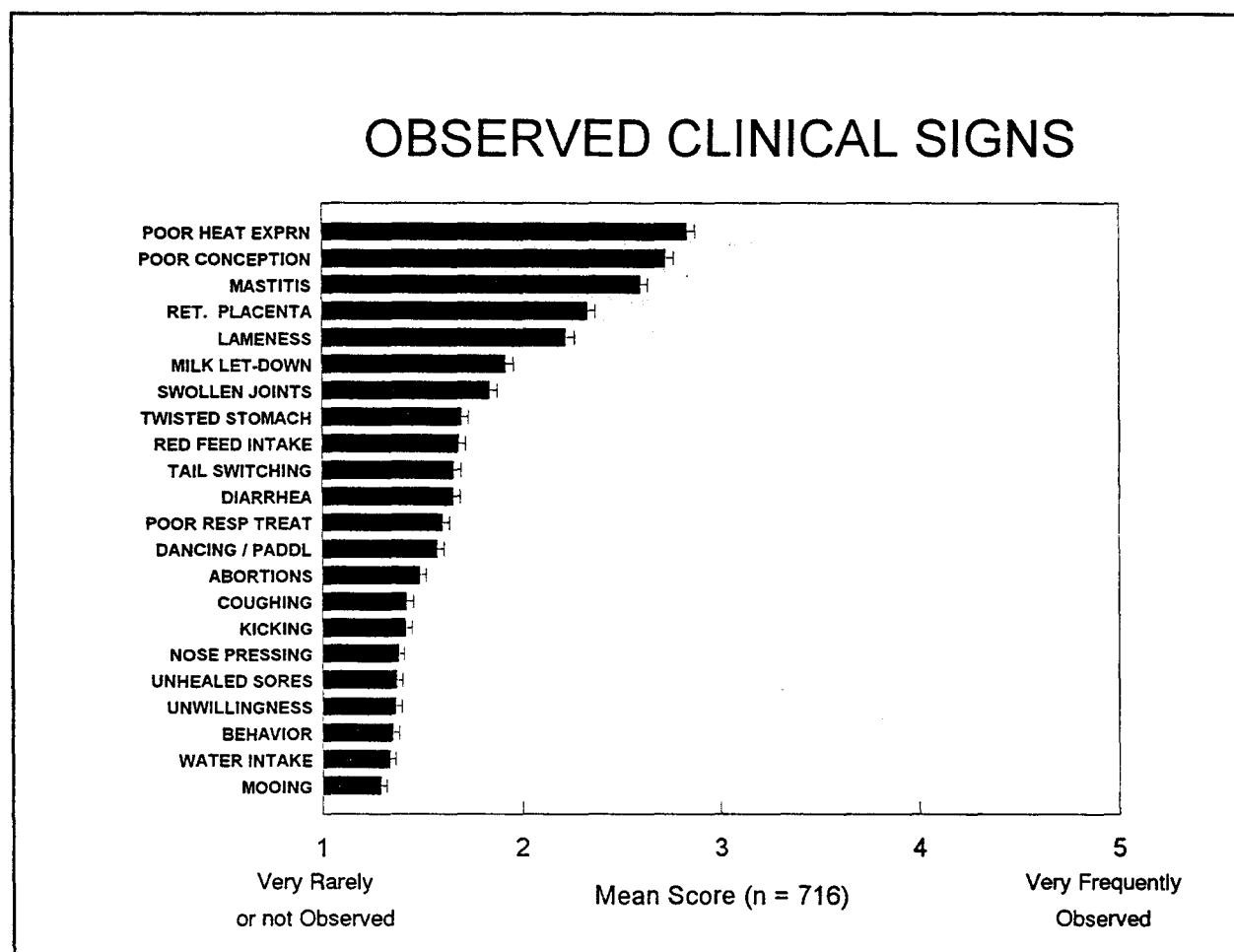


Figure 12: Frequency of observation of clinical signs of health & production problems

Clinical signs of health and production problems: Herd owners were asked to score 22 clinical signs of health or production problems according to their observations of cows in their herds during the previous 12 months. The frequency of observation of distinct clinical signs were scored between 1 (very rarely or not observed) and 5 (very frequently observed) (Figure 12.) Clinical signs with the highest mean scores across all herds were: poor heat (estrus) expression (2.83); poor conception rate (2.73); mastitis (2.60); retained placenta / vaginal discharge (2.33); and lameness (2.22). Clinical signs with the lowest mean scores (less frequently observed) were: coughing or rapid breathing (1.42); excessive kicking (1.41); nose pressing (1.38); unhealed sores on legs and body (1.37); unwillingness to enter barn or milking area (1.36); unusual behavior at water cup or feed source (1.35); reduced water consumption (1.33); and excessive mooing or bellowing (1.29). (Figure

12.)

In response to the question "Do you think cows in your herd now have or previously had persistent health and/or production problems?", 76 (10.2%) responded "Yes, now"; 149 (19.9%) "Yes, previously"; 422 (56.6%) "No"; and 100 (13.4%) "Don't know." Respondents currently experiencing persistent health and/or production problems observed clinical signs at a significantly higher overall rate (2.16) than "Yes previously" (1.80) and "No" (1.67.) (P < .0001.)

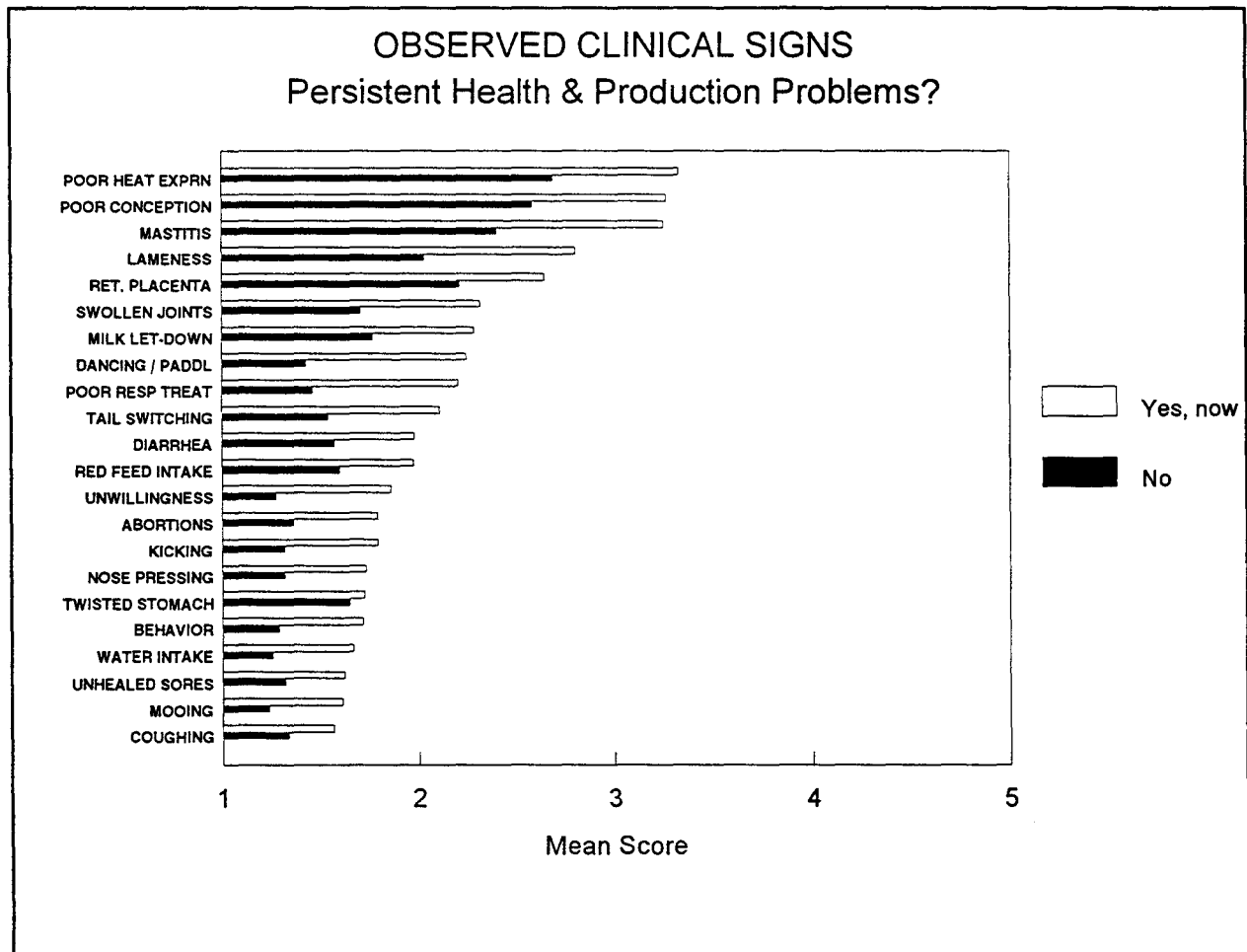


Figure 13: Comparison of frequencies of observed clinical signs

Comparison of the frequencies of observation of individual clinical signs between the 76 "Yes, now" and 422 "No" herds were made. The biggest differences were observed for dancing and foot

paddling (2.24 vs 1.42); poor response to veterinary treatments (2.20 vs. 1.46); and unwillingness to enter the barn or milking area (1.86 vs. 1.27). The only clinical sign in our list that did not show at least a 10% difference in frequency of observation between these two groups of herds was "twisted stomachs" (1.72 vs 1.65). (Figure 13.)

Another way in which to compare the frequency of observed clinical signs among groups of herds is by ranking. Rankings by State and by response to the "Do you think cows in your herd now have or previously had persistent health and or production problems?" are shown in Table 2. Clinical signs are ranked from 1 (most frequently observed) to 22 (least frequently observed.)

As illustrated by the figures in the first three columns of the body of Table 2, there is a remarkable degree of consistency in the rankings of observed clinical signs among Minnesota and Wisconsin dairy herd owners. Comparison of responses of owners of herds with and without current or previous persistent health or production problems shows no important differences within the rankings of the seven most frequently observed clinical signs. Regardless of perceptions or experiences of persistent health and/or production problems, poor heat (estrus) expression, poor conception rate, and mastitis are ranked as the first, second, and third most frequently observed clinical signs, respectively. Rankings of the next four clinical signs: retained placenta / vaginal discharge; foot or lower limb lameness; slow, uneven, or incomplete milk letdown; and swollen joints do not vary by more than one position across the columns. A similar pattern is observed in the bottom block of the table as the rankings of seven most infrequently observed clinical signs (ranked 16 - 22) remain fairly stable across columns.

Some differences (≥ 3 positions) in rankings of clinical signs between herds currently experiencing persistent health and/or production problems and those not experiencing are noted among certain middle-ordered clinical signs. Twisted stomachs (17th vs. 8th); unhealed sores on legs or body (20th vs. 16th); reduced feed consumption (12th vs. 9th); and coughing or rapid breathing (22nd vs. 15th) are less frequently observed in herds currently experiencing problems than those not. Clinical signs of increased prominence in herds currently experiencing problems include poor response to veterinary treatments (9th vs. 12th); dancing or foot paddling (8th vs. 13th); and unwillingness to enter barn or milking area (13th vs. 20th.)

Table 2: Comparison of rankings of observed clinical signs.

Ranking of Observed Clinical Signs	By State			Persistent health or production problems?		
	MN & WI	MN	WI	Yes, Now	Yes, Prev	No
Observed Clinical Signs						
Herds	716	356	360	76	146	401
Poor heat (estrus) expression	1	1	1	1	1	1
Poor conception rate	2	2	2	2	2	2
Mastitis	3	3	3	3	3	3
Retained placenta / vaginal discharge	4	4	4	5	5	4
Foot or lower limb lameness	5	5	5	4	4	5
Slow, uneven, or incomplete milk letdown	6	6	6	7	6	6
Swollen joints	7	7	7	6	7	7
Twisted stomachs	8	8	8	17	10	8
Reduced feed consumption	9	9	9	12	8	9
Excessive tail switching	10	11	10	10	13	11
Diarrhea - chronic or intermittent	11	10	11	11	9	10
Poor response to veterinary treatments	12	12	13	9	11	12
Dancing or foot paddling	13	13	12	8	14	13
Abortions	14	14	14	14	12	14
Coughing or rapid breathing	15	15	16	22	15	15
Excessive kicking	16	18	15	15	16	17
Nose pressing	17	19	17	16	20	18
Unhealed sore on legs or body	18	17	19	20	17	16
Unwillingness to enter barn or milking area	19	16	21	13	19	20
Unusual behavior at water cup or feed source	20	21	18	18	21	19
Reduced water consumption	21	20	20	19	18	21
Excessive mooing / bellowing	22	22	22	21	22	22

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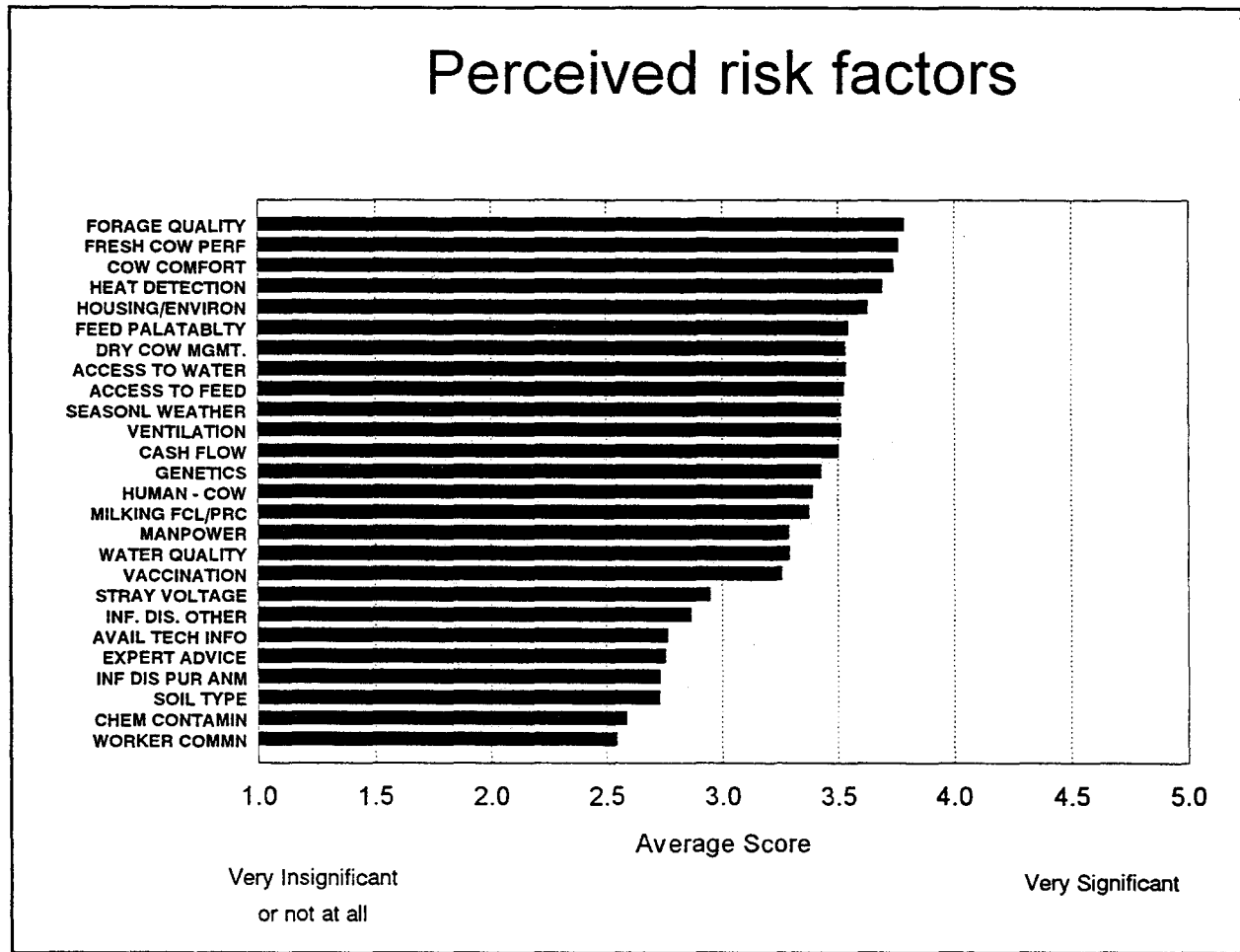


Figure 14: Ranking of perceived risk factors for animal health and or production problems

Perceived risk factors: Respondents were asked to indicate how significant they thought each of 26 risk factors were in causing animal health and/or production problems in their herds. Again a 1..5 scale was used where 1 indicated “very insignificant or not at all”, and 5 was “very significant.” Factors rated as being of the greatest risk to animal health and/or production were: forage quality (3.79); fresh cow performance (3.77); cow comfort (3.73); heat detection (3.69); animal housing or environment (3.63). Factors considered by dairy farmers to be of the lowest risk were: stray voltage or other electrical phenomena (2.93); infectious disease from either (a) adding new animals (2.72) or (b) all other sources (2.86); availability of technical information (2.76); quality of outside experts’ advice (2.75); soil type (2.72); chemical contamination of feed or water (2.57); and poor communication among workers (2.54.)

Comparisons of rankings among states indicate that Minnesota herd owners are more concerned with the importance of seasonal weather conditions (6th vs. 12th) and dry cow management (7th vs 11th); and less concerned about cows' access to feed (12th vs. 7th) as risk factors for animal health and or production problems than their counterparts in Wisconsin.

Some differences (≥ 4 positions) in rankings of clinical signs between herds currently experiencing persistent health or production problems and those not are noted among selected middle-ordered risk factors. Cows' access to feed (13th vs 7th) and water (11th vs. 6th); ventilation (14th vs. 10th); and human interaction with cows (18th vs. 13th); are ranked with less importance by herd owners currently experiencing problems than those not. Risk factors perceived to be of increased importance in herds currently experiencing problems are cash flow (5th vs 14th); seasonal weather conditions (7th vs. 12th); and insufficient manpower or time (10th vs. 18th.)

MAIN FINDINGS

- Just over 10% of all herd owners, or 3,600 of the approximately 36,000 in Minnesota & Wisconsin, think that cows in their herds are currently experiencing persistent health and/or production problems. These dairy herds tend to have lower rolling average milk production ($P = .0282$), higher somatic cell counts ($P = .0002$), and more frequently display certain clinical signs than herds for which no such problems were reported.
- During the past 12 months, herd owners *currently* experiencing persistent health and / or production problems in their dairy cows observed clinical signs at a higher overall rate (2.16) than those who had *previously* (1.80) or *not* (1.67) experienced persistent problems ($P < .0001$.)
- Poor heat (estrus) expression; poor conception rate; mastitis; retained placenta / vaginal discharge; foot or lower limb lameness; slow, uneven or incomplete milk let down; and swollen joints are the most frequently observed clinical signs. The relative rankings of frequency of observation of these clinical signs remain constant across all dairy herds, regardless of whether herd owners consider that their cows are currently or have previously experienced persistent health and/or production problems.

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Table 3: Ranking of perceived risk factors

Ranking of Perceived Risk Factors	By State			Persistent health or production problems?		
	MN & WI	MN	WI	Yes, Now	Yes, Prev	No
Herds	707	350	357	75	144	401
Forage quality	1	3	1	1	4	1
Fresh cow performance	2	1	2	3	1	3
Cow comfort	3	2	3	2	3	2
Heat detection	4	4	4	6	2	5
Animal housing or environment	5	5	5	4	9	4
Feed palatability	6	8	6	9	10	8
Dry cow management	7	7	11	8	6	9
Cows' access to water	8	10	8	11	11	6
Cows' access to feed	9	12	7	13	12	7
Seasonal weather conditions	10	6	12	7	8	12
Ventilation	11	9	10	14	7	10
Cash flow	12	11	9	5	5	14
Genetics	13	14	13	12	15	11
Human interaction with cows	14	15	14	18	14	13
Milking facilities / procedures	15	13	15	15	16	15
Insufficient manpower or time	16	16	17	10	17	18
Water quality	17	18	16	19	13	16
Adequacy of vaccination program	18	17	18	16	18	17
Stray voltage or other electrical phenomena	19	19	19	17	19	19
Infectious disease (not from purchased animals)	20	20	20	20	20	20
Availability of technical information	21	22	21	22	24	21
Quality of outside experts' advice	22	21	22	21	21	24
Infectious disease from adding new animals	23	23	24	25	22	22
Soil type	24	24	23	23	23	23
Chemical contamination of feed or water	25	26	25	24	26	25
Poor communication among workers	26	25	26	26	25	26

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- Clinical signs of lower but increased frequency in cows in herds currently experiencing persistent health and/or production problems include poor response to veterinary treatments; dancing or foot paddling; and unwillingness to enter the barn or milking area.
- Herd owners' consider forage quality; fresh cow performance; cow comfort; heat detection efficiency; animal housing and environment; feed palatability; and dry cow management to be the most significant causes of persistent health and/or production problems in dairy cows.
- In the opinion of herd owners, the least significant factors contributing to persistent health and/or production problems in dairy cows include: stray voltage or other electrical phenomena; infectious diseases; availability of technical information; quality of outside experts' advice; soil type; and chemical contamination of feed or water.
- There were minor changes in perceived significance among herd owners currently experiencing persistent problems compared with those not. The significance of seasonal weather conditions, cash flow, and insufficient manpower or time were increased; while the significance of cow's access to feed or water, ventilation, and human interaction with cows were decreased.

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**SURVEYS OF MINNESOTA & WISCONSIN DAIRY HERDS.
II: EXPERIENCES WITH STRAY VOLTAGE & RELATED ELECTRICAL PHENOMENA.**

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The main purpose of this study was to collect more comprehensive information than had previously been available on the general health and milk production status of Minnesota & Wisconsin dairy herds. Some of the agencies and organizations that collaborated in the development of the Dairy Herd Health and Production Survey were particularly interested in dairy farmers' experiences with stray voltage and related electrical phenomena. Thus, a follow-up telephone survey was conducted in which all dairy farmers who completed and returned written surveys were called and asked some additional questions.

Materials & Methods

A stratified random sample with respect to herd size of 1,250 Minnesota and 1,250 Wisconsin dairy herds was drawn from sampling frames maintained by the Minnesota and Wisconsin Agricultural Statistics Services. In late November, 1996, survey forms and cover letters were mailed to the addresses of each

Table 1: Postal survey response rates.

STATE	SURVEYS MAILED	SURVEYS RETURNED COMPLETED & USABLE	RESPONSE RATE (%)
MINNESOTA	1,250	377	30.2
WISCONSIN	1,250	375	30.0
TOTAL	2,500	752	30.1

premises. Ten days later, reminder postcards were mailed to non-respondents. A total of 887 (35.5%) survey forms were returned by the cut-off date of February 20, 1997. Of these, 135 (5.0%) were returned blank, most with a notation that the farm no longer kept dairy cows. Thus, data from a total of 752 (30.1%) completed survey forms were entered into the computer system (Table 1.)

General Information: Due to the large number of usable survey responses, we consider this data set to be representative of all dairy herds in Minnesota (10,600) and Wisconsin (24,000), as of December, 1996. Moreover, as the number of responses per state is approaching 400, inter-state comparisons are valid. Responses were split evenly between Minnesota (377) and Wisconsin (373) dairy herds. In most cases (97%), survey forms were completed by individuals who regarded themselves as herd owners as opposed to employees (2%) or managers (1%).

Follow-up telephone survey: Beginning December 28, 1996, attempts were made to contact each survey respondent by telephone to administer a 10-question survey specifically designed to gather information concerning respondents' experiences and

Table 2: Telephone survey response rates

STATE	CALLS ATTEMPTED	COMPLETED RESPONSES	RESPONSE RATE (%)
MINNESOTA	377	339	89.9
WISCONSIN	375	347	92.5
TOTAL	752	686	91.2

perceptions regarding stray voltage and other electrical phenomena on their farms. Of the 752 respondents to the mailed survey, 686 (91.2%) were contacted and provided answers to the telephone survey questions. (Table 2.)

Of 678 respondents, 201 (68%) thought that they had at some time, experienced an animal health and/or production problem that was caused mainly by stray voltage or other electrical phenomena. (Figure 1.) No differences in response to this question was observed between Minnesota and

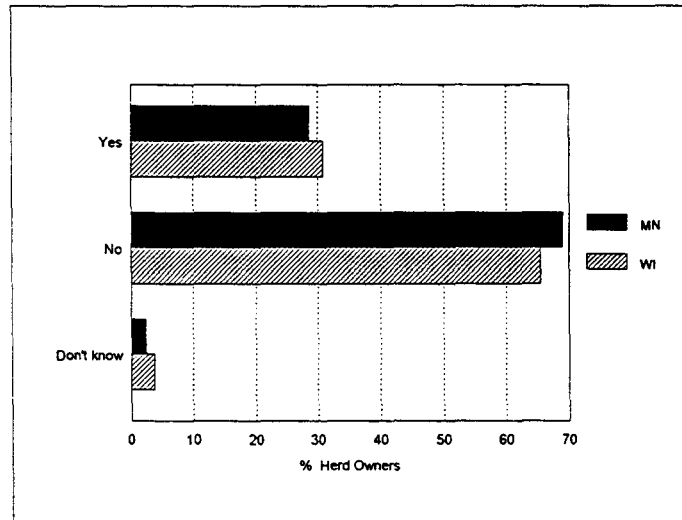


Figure 1: Problem attributable to stray voltage?

Wisconsin herd owners.

Most recent test: At some time in the past, many farm sites had been tested for either stray voltage (61%) or for other electrical phenomena (15%). Most of these sites had been most recently tested within the past ten years (Figure 2). Although the graph indicates an increase in testing activity on Wisconsin farms during 1996, averaging the observations over the three years period of 1994-96 shows that farms in Minnesota and Wisconsin have been tested at comparable rates in the recent past.

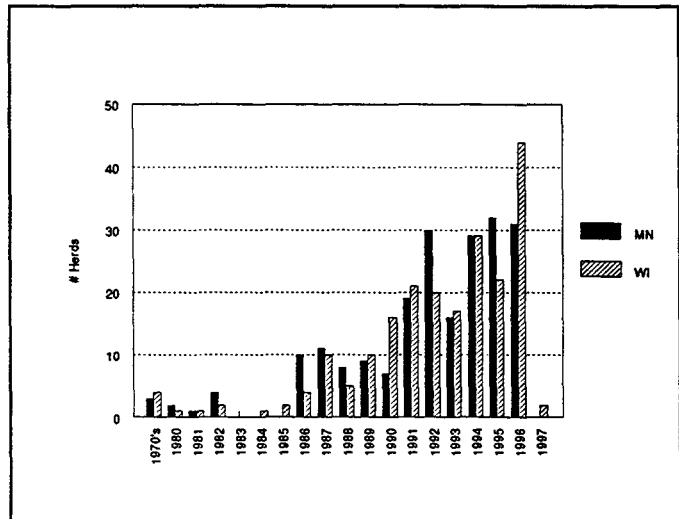


Figure 2: Year of most recent test.

Occupations of testers: Testing for the presence of stray voltage or other electrical phenomena was most commonly done by an employee of a utility company (65%) or by an electrician (30.5%). (Figure 3.) The most common explanation specified for the "other" category (22.5%) is "farm supply or service company field man." Minnesota herd owners are almost twice as likely to be involved in investigations themselves than Wisconsin herd owners (19.6 vs. 11.3%.) Veterinarians and extension agents were not involved in most investigations.

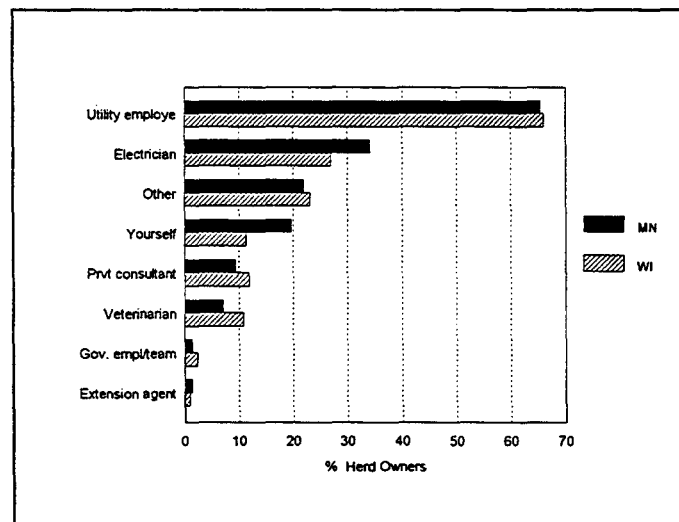


Figure 3: Occupations of those involved in testing

Veterinarians and extension agents were not involved in most investigations. Due to the fact that most investigations involved multiple personnel, it is not possible to make meaningful comparisons by investigator type.

Frequency of testing: During the past six years, the number of tests per site ranged between 0 and 100, with the most common response (47.3%) being "once." (Figure 4.) Almost 13% of herd owners had had their sites tested for stray voltage or other electrical phenomena between two and six different times during the past six years. Responses to this question were consistent across Minnesota and Wisconsin herd owners.

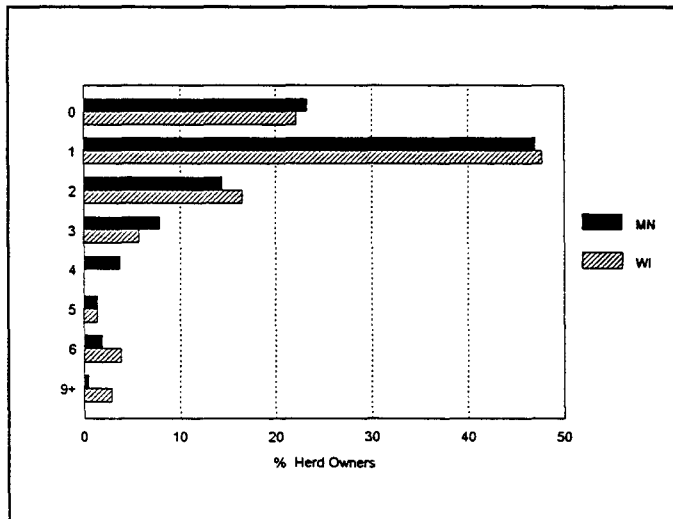


Figure 4: Frequency of testing over past 6 yrs

Recommendations resulting from testing activities: Approximately one half (49%) of the tests resulted in the farm owner being informed that there were stray voltage or other electrical conditions that should be corrected.(Figure 5.) Wisconsin herd owners (55%) were more likely to be advised to take steps to correct stray voltage or other electrical conditions than Minnesota herd owners (43.7%) (P = .017.)

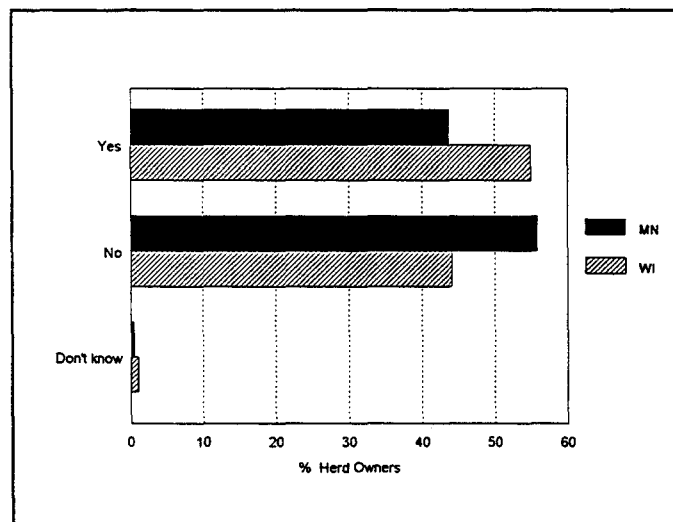


Figure 5: Conditions that should be corrected

Eighty-seven percent of people receiving advice to correct stray voltage or other electrical conditions report that they followed through and took steps to correct the problems. Also, one-quarter (25%) of herd owners who were told that inspections showed no problems took some form of corrective action anyway.

Satisfaction with corrective actions:

Overall, there appears to be a high degree (87%) of satisfaction among dairy herd owners following attempts to correct stray voltage or other electrical conditions on their farms. (Figure 6.) There is no difference in the proportions of satisfied herd owners between the two states (P = .519.)

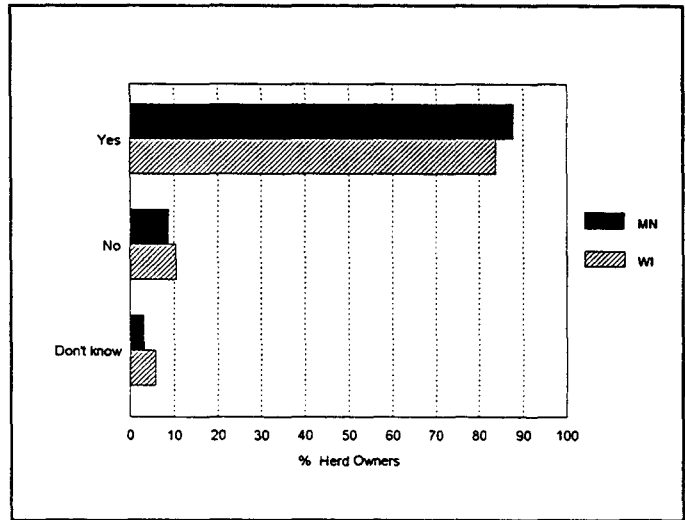


Figure 6: Satisfaction with corrective actions

Perceptions of negative effects of stray voltage or other electrical phenomena:

The final question posed to herd owners was "At the present time, do you think uncorrected stray voltage or related electrical conditions are having negative effects on the health and/or production of your dairy herd?" Responses to this question indicate that 11% of Minnesota and Wisconsin dairy herd owners believe that uncorrected stray voltage or related electrical conditions are having negative effects on the health and/or production of their dairy cows.

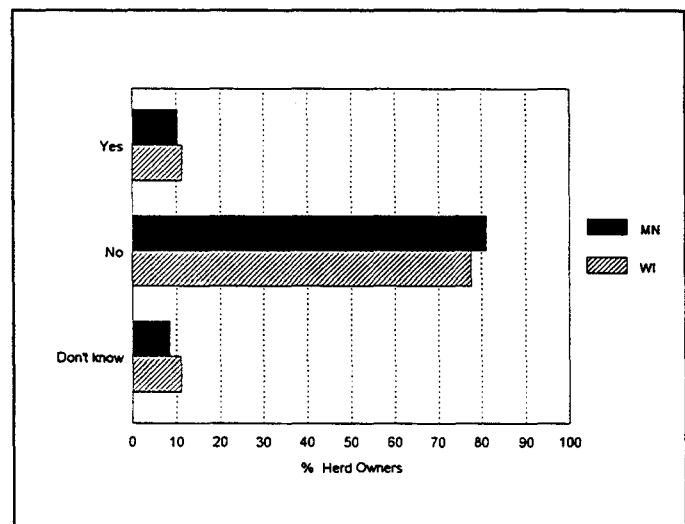


Figure 7: Negative effects of stray voltage etc.

Table 3: Degree of coincidence of "problem" herds across two surveys.

		<i>At the present time, do you think uncorrected stray voltage or related electrical conditions are having negative effects on the health and/or production of your dairy herd?</i>			
		YES	NO	DON'T KNOW	TOTAL
<i>Do you think cows in your herd now have or previously had persistent health and/or production problems?</i>	YES, NOW	8	51	8	67
	YES, PREVIOUSLY	18	107	11	136
	NO	39	314	30	383
	DON'T KNOW	8	69	16	93
	TOTAL	73	541	65	679

The proportion (11%) of Minnesota and Wisconsin dairy herd owners who believe that uncorrected stray voltage or related electrical conditions are having negative effects on the health and/or production of their dairy cows is similar to the approximate 10% of herd owners who responded on the mailed survey that cows in their herds are currently experiencing persistent health and/or production problems.

A cross tabulation of the responses to the two relevant questions that were answered by the 679 herd owners who responded to both the mailed and telephone surveys is provided as Table 3. Of particular interest are the 412 (8+51+39+314) that answered either "yes (now)" or "no" to both questions. Only 8 of 412 (1.9%) believe that (a) cows in their herds are currently experiencing persistent health and production problems AND (b) uncorrected stray voltage or related electrical conditions are currently having negative effects on health and/or production. Even when the analysis is expanded to include those who answered "yes, previously" to the first question, the sum becomes 26 (8+18) / 537 (8+51+39+314+18+107) = 4.48%

MAIN FINDINGS

- Approximately 30% of Minnesota and Wisconsin dairy herd owners reported that at some time they had a herd health and/or production problem that they thought was caused mainly by stray voltage or other electrical phenomena.
- Approximately 60% of dairy herd owners reported that their farms had been tested at least once for stray voltage and 15% for other electrical phenomena such as magnetic fields, electric fields, electro-motive force (EMF), ground currents, or earth currents.
- Nearly 50% of dairy herd owners whose farms had been tested reported that the persons who conducted tests on their farms informed them of stray voltage or other electrical conditions that should be corrected. Wisconsin herd owners were more likely to receive such advice. Herd owners have been responsive to recommendations, with 87% reporting that some action was subsequently taken to correct the conditions.
- Overall, 87% of herd owners are satisfied with investigations and attempts to correct stray voltage or other electrical conditions on their farms.
- Very few (1.2%) of Minnesota and Wisconsin dairy herd owners simultaneously believe that (a) cows in their herds are currently experiencing persistent health and/or production problems AND (b) uncorrected stray voltage or related electrical conditions are currently having negative effects on health and/or production.
- Projecting this finding to the state level, we estimate that 416 ($34,600 * .012$) Minnesota and Wisconsin herds are currently experiencing persistent health and/or production problems where the owner believes that stray voltage or related electrical conditions are contributing negatively to those problems.

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Minnesota Agricultural Statistics Service; Minnesota Department of Public Service; Minnesota Farmers Union; Minnesota investor-owned utilities; Minnesota Milk Producer's Association; Minnesota Public Utilities Commission; Minnesota Rural Electric Cooperatives; University of Minnesota, College of Agriculture; University of Minnesota College of Veterinary Medicine; University of Wisconsin; College of Agricultural and Life Sciences; Wisconsin Department of Agriculture, Wisconsin Agricultural Statistics Service; Trade and Consumer Protection; Wisconsin Farmers Union; Wisconsin Federation of Cooperatives; Wisconsin Public Services Commission.

AN ILLUSTRATION OF PARTIAL BUDGETING

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- Procedure to provide an estimate of changes in profit or loss associated with proposed changes in a business' plan.
 - Considers only items of:
 - income
 - expense
- that change with the plan.
- Useful in evaluating small changes in the business' plan.
 - Approach: Draw up a base plan and compare it against some feasible alternative.
 - Examples:
Purchase manure spreader or custom hire?
Vaccinate or do not vaccinate?
Purchase or raise replacement heifers?
 - General format (Proforma)
 - ① Additional Income
 - ② Reduced Expenses
 - ③ Reduced Income
 - ④ Additional Expenses

$$\text{Benefit} = (\text{①} + \text{②}) - (\text{③} + \text{④})$$

The following example illustrates how a partial budget might be set up to illustrate the financial benefits of a \$1,000 annual investment in a reproductive herd health program designed to reduce the mean calving to conception interval from 115 to 90 days in a 100 cow herd. It is also assumed that the herd health program will reduce calf mortality from 12 to 8% and lower the average age at first calving from 28 to 25 months (Table 1.) Intermediate calculations are shown in Table 2. The partial budget calculation (Table 3) shows a net benefit of $(37,450 + 4,520) - (6,000 + 11,960) = 24,010$ / yr (or \$240 / cow place / yr.)

Table 1	BEFORE	AFTER
Nominal herd size (cows)	100	100
Avg. calving -> conception interval	115	90
Annual culling rate (%)	32	20
Calf mortality (%)	12	8
Services / conception	2.2	2.0
Veterinary expense	\$4,000	\$5,000
Avg. age at first calving (months)	28	25

Table 2	BEFORE		AFTER	
Calves born / yr	$\frac{365 * 100}{(115 + 282)}$	92	$\frac{365 * 100}{(90 + 282)}$	98
Bull calves born / yr	(92 / 2)	46	(98 / 2)	49
Bull calves died / yr		6		4
Bull calves sold / yr	(46 - 6)	40	(49 - 4)	45
Heifer calves born / yr	(92 / 2)	46	(98 / 2)	49
Heifer calves died / yr		6		4
Heifer calves raised / yr	(46 - 6)	40	(49 - 4)	45
Maximum replacement heifers available / yr	$\frac{(24 * 40)}{28}$	34	$\frac{(24 * 45)}{25}$	43
Replacement heifer deaths / yr		2		1
Heifers required as replacements	(100 * 0.32)	32	(100 * 0.20)	20
Replacement heifers sold / yr	(34 - 2 - 32)	0	(43 - 1 - 20)	22

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PARTIAL BUDGET	Formula	Units	Value / unit	Total value
① ADDITIONAL RETURNS				
Increased milk production due to improvement in calving interval (1st lactation cows)	$(25 * 9 * 80)$	18,000	.12	2,160
Increased milk production due to improvement in calving interval (2nd+ lactation cows)	$(25 * 19 * 20)$	9,500	.12	1,140
Increased milk production due to increased average herd age	$(16,000 * 100 * .05)$	80,000	.12	9,600
Sale of surplus replacement heifers		22	1,100	24,200
Sale of extra bull calves		5	70	350
TOTAL ADDITIONAL RETURNS				37,450
② REDUCED EXPENSES				
Semen costs	$(.2 * 100 * 10)$			200
Raising costs for heifers	$(40 * 90 * \$1.20)$			4,320
TOTAL REDUCED EXPENSES				4,520
③ REDUCED INCOME				
Cull cow income		12	500	6,000
TOTAL REDUCED INCOME				6,000
④ ADDITIONAL EXPENSES				
Increased veterinary costs				1,000
Increased labor	1 hour / day	8	365	2,920
Increased feed to support increased milk production (calving interval)	$(3300 * .2)$			600
Increased feed to support increased milk production (increased herd age)	$(9600 * .3)$			2,880
Cost of raising additional heifers to 25 months.	$(5 * 760 * \$1.20)$			4,560
TOTAL ADDITIONAL EXPENSES				11,960

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PARTIAL BUDGET	Formula	Units	Value / unit	Total value
① ADDITIONAL RETURNS				
Increased milk production due to improvement in calving interval (1st lactation cows)				
Increased milk production due to improvement in calving interval (2nd+ lactation cows)				
Increased milk production due to increased average herd age				
Sale of surplus replacement heifers				
Sale of extra bull calves				
TOTAL ADDITIONAL RETURNS				
② REDUCED EXPENSES				
Semen costs				
Raising costs for heifers				
TOTAL REDUCED EXPENSES				
③ REDUCED INCOME				
Cull cow income				
TOTAL REDUCED INCOME				
④ ADDITIONAL EXPENSES				
Increased veterinary costs				
Increased labor				
Increased feed to support increased milk production (calving interval)				
Increased feed to support increased milk production (increased herd age)				
Cost of raising additional heifers to 25 months.				
TOTAL ADDITIONAL EXPENSES				

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