ABSTRACT

HERD HEALTH PROBLEMS
AFFECTED BY DRY COW MANAGEMENT
ON SOUTHERN MICHIGAN DAIRY FARMS

By

David John Kjome

Fifty-four Michigan dairy farms were studied to define present dry cow feeding and management practices and their effect on herd health.

Four (housing system, separation of dry cows, herd size and production level) primary sources of variation in dry cow management were examined statistically through an analysis of variance to determine their influence on herd health. Housing system had a significant influence on milk fever ($P<0.03$) while the separation factor affected milk fever ($P<0.11$) and mastitis ($P<0.10$). Also, the interaction of housing system and separation of dry cows affected metritis ($P<0.09$) and ketosis ($P<0.11$). Herd size, as a source of variation, had no significant effect on herd health but as an interaction with separation of dry cows, it affected metritis ($P<0.01$). Production level affected retained placenta ($P<0.06$), metritis ($P<0.04$), ketosis ($P<0.11$) and milk fever ($P<0.01$).

Quantitative secondary nutritional and management parameters were analyzed through a regression analysis to study their relationship to herd health. Secondary variables significantly ($P<0.10$) related to displaced abomasum were roughage fed per hundredweight to milk cows, dry matter intake at 270 days postpartum and dry days. Four nutritional variables including dry matter intake at 270 days, dry matter pounds of grain at 270 days, daily roughage intake to milk cows and dry matter per hundredweight in dry cows were related to retained placenta. Variables related to metritis were dry matter intake at 40 days postpartum, percent days in milk, milk cow daily roughage, roughage dry matter intake per hundredweight in dry cows and dry matter grain intake at 270 days. Milk level and daily roughage per hundredweight in milk cows were related to ketosis. Dry matter intake in late lactation, milk level and milk cow grain protein related to milk fever.

Relationships of significant primary sources of variation and significant quantitative secondary variables with a significant difference in means of that secondary factor within the primary category were studied with respect to herd health. Those studied were housing system and percent protein fed to milk cows in relation to milk fever, housing system and dry matter intake at 270 days postpartum to milk fever, dry cow separation and milk cow grain percent protein to milk fever, production level and dry matter grain fed to milking cows as related to retained placenta, production level and dry matter intake at 40 days postpartum to metritis and the relationship of production level and dry matter fed at 270 days to milk fever.

In summary, it is concluded that of the primary significant factors affecting herd health, production level is the most important. Separation of dry cows and housing system are also important factors relating to herd health while herd size was not significant.

Eleven of the eighteen named quantitative secondary summary nutritional and management factors were significantly related to herd health. It is concluded that milk cow feeding and management factors rather than dry cow are more related to herd health problems. Milk cow roughage dry matter per hundredweight in milk cows and total dry matter intake at 270 days postpartum were most frequently related to herd health.

In the study of relationships of significant primary and quantitative secondary factors with a significant difference in means of the secondary factor within the primary category, it is evident the milk cow secondary quantitative factors of pounds of roughage to milk cows, pounds of dry matter grain to milk cows at 270 days postpartum, milk cow grain protein and pounds of dry matter to milk cows have a significant relationship with housing system, separation of dry cows and production level.

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CHAPTER I

INTRODUCTION

The dry cow resides on 11,000 dairy farms currently producing milk in Michigan. The percentage of dry cows per herd was studied by Speicher and Brown (42) who utilized Michigan Telfarm records and found an average of 13 percent of all dairy cows in the state were dry while Michigan DHIA records, utilizing a 12 month rolling herd average, report a state average of 13 percent dry days for all cows in all tested herds. With an estimated 422,000 dairy cows in Michigan, it is postulated that well in excess of 55,000 dry cows exist at any one time in the state. Although dry cows are in the minority in relation to lactating cows, dairymen and researchers are becoming more cognizant that dry cow management today directly affects dairy profits tomorrow.

The validity of a 45 to 60 day dry period to restore and regenerate body tissue has been documented by researchers (19, 28, 41). The exact physiological functions and changes that occur during the dry period remain an unsolved mystery, but researchers (1, 9, 38, 41, 43) have shown that a dry period of less than 40 days has a negative effect on milk production the following lactation.

With the continual crusade toward higher production per cow to generate increased dairy income and profits, dry cow management becomes even more important as it is generally accepted to affect future milk production, livability of the unborn calf, and postpartum disorders such as displaced abomasum, retained placenta, metritis, ketosis, milk fever, and mastitis which most frequently occur within 45 days of calving.

With the present number of dairy farms in excess of 11,000 in Michigan, it is apparent that dry cow management occurs under the roof of different housing systems, herd sizes, and production levels. The field of dairy research, education, and extension must be in a position to extract dry cow management successes and failures to grant dairymen more useful tools and tips to obtain profitable production levels and goals with a minimum of addition herd health problems and expense. This search and service can lend itself to a more satisfying and profitable way of life for the future dairyman.

Future projections suggest fewer dairymen but larger herds. In 1970, 63 percent of the dairy cows in Michigan were in herds of less than 50 cows; however, herds of greater than 100 cows are projected to increase nearly three times and will account for over one half of the cows in Michigan by 1985 (5). Hoglund (26) in a recent study of the top ten dairy states, indicates that Michigan will remain constant in total milk output over the next decade

but milk will be produced by fewer dairymen with increased herd size and production per cow.

This study attempts to provide an analysis of dry cow management as carried out on present Michigan dairy farms. A special study is included on herds with over 200 cows to postulate what dry cow management may be in the future as we see larger dairy herds on the horizon.

The objectives of this study were:

1. To determine how dry cows are handled in different systems of housing.
2. To establish present feeding and management practices in different types of housing and if possible, to determine their effects on herd health.
3. To extract possible dry cow successes and failures in different types of housing.

CHAPTER II

REVIEW OF LITERATURE

The dairy cow in Michigan and across the United States is seen in many sizes, shapes, colors, and conditions. Much of her past and future contributions to the owner and dairy industry lie in her genetic makeup and the environment in which she has been subjected to since birth.

The dry cow is in a unique period of her productive life. It is a transition period from one lactation to another with a period of rest, regeneration and restoration. The art and science of feeding and managing the dry cow by her dairy husbandman determine to a great extent her future destiny and profit potential.

This literature review addresses itself solely to the areas of basic and applied dry cow management research which influences production and health during the next lactation.

Dry Cow Management

Ideally, dry cow management can be defined as the act or art of handling and directing a dairy cow through a 45 to 60 day dry period every 12 months with the end result relating directly to future milk production, livability of the unborn calf, and post calving disorders; therefore, a successful dry cow management program establishes its primary objective to prepare the dry cow for high production in the next lactation with a minimum of metabolic disorders.

Dry Period

The question of why a dry period must be allotted to a dairy cow has plagued the minds of dairy researchers for decades and continues to remain an area of unsolved mysteries.

Hutjens and Otterby (28) suggest that a dry period is needed to: (1) regenerate udder tissue, (2) replace body reserves used in the previous lactation, and (3) stimulate high production in the next lactation. Smith, *et al.* (41) stresses that the main physiological function of the dry period is to induce full involution in the mammary gland, which will allow full regeneration of mammary tissue so that there is maximum milk production after parturition. Harris (19) concurs with the above reasons for a dry period and emphasizes that good body condition at calving is important because many high producing cows cannot consume sufficient feed to meet their energy demands in early lactation, making it necessary to draw on body reserves during this period.

Dry Period Length

Length of dry period with respect to herd average, subsequent milk production, and disorders at calving has plagued the researcher's mind for many years.

Copeland (8) in his early work with dry cow management found that the percentage of dry cows on herd test was directly proportional to the herd average. His findings reveal that the percentage of dry cows carried in all herds averaged 15 to 39 percent or 56 days. Speicher and Brown (42) in a study of dairy herds utilizing Michigan Telfarm records indicated a range of 9 percent dry cows in the month of April to a high of 16 percent in late summer for an average of 13 percent dry cows when total cows in the herd are known.

Copeland (8) found that herds averaging less than 250 pounds of butterfat averaged 28.2 percent or 103 days and herds averaging 500 pounds of fat averaged 10.7 percent or 39 days dry. Also, small and medium sized herds contain a smaller percentage of dry cows than do large herds. Sargent (37) utilizing North Carolina DHIA summaries pointed out that as production per cow increases, the average dry days decrease which simply confirms that dry cows do not milk.

Early work by Arnold and Becker (1) indicates dry periods of 31 to 60 days had the highest maximum daily production in the succeeding lactation. Dry periods of longer than 91 days appeared to result in lower production than did shorter dry periods; however, dry periods of less than 30 days appeared to cause an early decline in milk yield.

In an attempt to establish the optimum length of dry period, Klein and Woodward (31) compared the loss of milk in the current lactation with gain the following lactation. Their results utilizing 0 to 1 month as the base comparison period, revealed 9.2 percent more milk with a dry period of

1 to 2 months, 13.5 percent more when dry 2 to 3 months and cows dry 3 to 4 months gave 14.9 percent more milk than when dry 0 to 1 month. Based on their study (31), a dry period of 55 days was found to be optimum for cows yielding 10,000 pounds of milk and calving at 12 month intervals. The work of Schaeffer and Henderson (38) substantiates the findings of Klein and Woodward (31); however, dry periods of 40 to 49 and 60 to 69 days were not greatly different on a practical basis.

Schaeffer and Henderson (38) also found that age and month of calving influenced the length of the dry period. Within a lactation, older cows tended to have a longer dry period than younger cows with a greater difference within second lactation than third and fourth lactations. Cows that freshened in the spring months of March, April and May tended to have longer than average dry periods; whereas, summer fresheners had shorter than average dry periods.

Heritability of dry days was found to be very low by Wilton, et al. (47) and stated that effects were largely of an environmental nature. Schaeffer and Henderson (38) cite within herd heritability estimates of days dry as .15, .33 and .34 for second, third and later lactations.

As milk production per cow increases, higher producing cows are often dried off at the 10th month of lactation at a daily production level of 35 to 45 pounds of milk. This profitable level has caused researchers to study the effects of continuous milking in comparison to different length dry periods.

Swanson (43) assigned one member from five sets of identical twins to a 60 day dry period and the other member was milked continuously throughout the dry period prior to the second and third lactation with all twins given dry periods of 60 days or more before the 4th lactation. Average milk yields of the continuously milked cows in the second and third lactation was only 75 percent and 62 percent respectively as much as the controls. Swanson (43) suggests that the inhibiting effect of continuous milking on the next lactation is more likely due to effects in the mammary gland and its regulatory factors than to nutritional factors.

Milk response was similar in work by Smith, et al. (41) in which the right front forequarter and left rear quarter of five cows was dried off with the other two quarters milked throughout the whole of pregnancy.

More recent research involving an extensive field trial in 65 New York DHI herds by Coppock, et al. (9) attempted to evaluate the effect of length of dry period on milk production and disorders at calving. Their findings revealed common disorders and udder edema at parturition were not associated with the length of the preceding dry period. However, cows which averaged from 10 to 40 days dry period averaged 990 to 1,440 pounds less milk in the following lactation than cows with average dry periods of 40 days or longer. The results of the field study are in agreement with previous work (1, 31, 41, 43) reaffirming that a 40 to 60 day dry period results in maximum milk production. Coppock, et al. (9) as does Swanson (43) pointed out that a dry period is not needed to replenish energy reserves, but unknown factors are responsible for a dry period requirement. Coppock, et al. (9) concluded that most New York dairymen strive for a six to eight week dry period and those outside this range are merely accidental.

Dry Cow Energy Needs

Prior to the early 1970's, some researchers (2, 44) considered the dry period essential to provide time for cows to replenish energy needs depleted during the lactation. However, Moe, et al. (34) utilizing energetic efficiency studies at Beltsville in 1971 found that body tissue lost during early lactation can be more economically replaced (74.7 percent) in late lactation rather than during the dry period (61.6 percent).

In question of the 1966 NRC (National Research Council) metabolizable energy requirements of pregnant cows, Moe and Tyrell (33) studied allowances for pregnancy and concluded that growth and development of the fetus of the cow is energetically a very costly process with the amount of metabolizable energy required at term about 175 percent above that of the nonpregnant cow of equal body weight.

Researchers and educators have strived to make dairymen energy conscious during the dry period. Huber (27) postulates that modern labor saving systems of handling cows in large groups with little attention to individual requirements have accentuated "mismanagement of energy" in many dairy herds and dry cows will eat about twice their requirements if allowed to consume all they want of the high quality ration needed for the milking herd. Hillman (22) in his recommendations to Michigan dairymen suggests that rations for dry cows must provide for: (1) maintenance of dry cows, (2) development of the unborn calf, and (3) proper balance of nutrients to prevent post calving disorders. Hillman (22) cautions dairymen to feed a weight reducing ration to cows carrying excessive body fat as they enter the dry period while cows completing their lactation in poor condition may require high energy feeds.

Grain Feeding-Prepartum

After reviewing the literature, one can hypothesize that more research has been done in the area of prepartum grain feeding than any other phase of dry cow management.

Profits in the dairy industry have been frequently correlated with level of milk production and with the added stress of increased milk production, has evolved new and higher incidence of post calving metabolic disorders possibly stemming from prepartum feeding and management practices. In an effort to maximize milk production and minimize postpartum metabolic disorders, feeding throughout the dry period has received much research investigation.

The feasibility and economics of additional prepartum grain levels to increase future milk production has caused researchers to study the effect of "steaming up" dry cows for the next lactation.

Blaxter (2) in early work on the use of home grown grains for milk production compared no feeding prior to calving versus feeding concentrates prepartum and concluded that cows which received concentrates gained more weight before calving, were in superior condition at calving, and peaked at a higher production level.

Swanson and Hinton (45) studied the effects of feeding extra grain during the latter part of the lactation compared to the last six weeks of the dry period. Results showed those fed eight pounds of grain for 38 days of the dry period gained 35 pounds more before calving than pairmates and produced 359 pounds more of fat corrected milk in the first 15 weeks and 573 pounds more in the first 30 weeks of lactation.

Gardner (15) built into his experiment digestible energy levels of 115 percent (low prepartum) and 160 percent (high prepartum) maintenance requirements during the last six to eight weeks of gestation. He concluded that cows producing 9,695 to 23,518 pounds of milk over a 305 day lactation need no more than 115 percent of their maintenance digestible energy needs during the dry period if they are fed adequate energy levels during lactation and a greater milk response is obtainable if extra feed is provided during early lactation rather than storing body fat during the dry period. Gardner (16) postulated that mobilization of body fat stresses the animal because of elevated blood ketone levels. Similar studies by Castle and Watson (7), Davenport and Rakes (11), Greenhalgh and Gardner (18) and Schmidt and Schultz (39) concluded that different levels of prepartum grain feeding had no significant effect on milk yield during the lactation that followed. Emery, et al. (13) studied the influence of grain feeding before calving on heifers and cows with insufficient response to cover additional grain costs and the practice was declared uneconomical when the animals entered late pregnancy in good condition.

Coupled with the future milk responses from varying prepartum grain levels, researchers have also studied the effect of various prepartum feeding levels upon postpartum metabolic disorders.

Schmidt and Schultz (39) studied varying prepartum grain levels and the relationship to herd health. Their findings revealed no significant differences in the severity of udder edema at calving and seven days postpartum but reported a doubling of ketosis incidence in the medium and high grain group versus the low. Gardner (16) reported similar results. Emery, et al. (13) reported increased edema in first calf heifers but not cows when fed grain prepartum while milk fever incidence increased twofold in heifers and somewhat less in cows. Retained placenta, metritis, and indigestion were not significantly affected by prepartum feeding.

Braund, et al. (6) fed two groups of dry cows experimental and control rations balanced to provide 100 percent on NRC crude protein and 85 to 100 percent of energy needs with the experimental ration composed of less corn silage, less concentrate, but eight pounds of hay more than the control ration. Cows on the control ration lost 1.5 pounds of body weight when dry while those on the experimental ration gained an average of 27.6 pounds during the dry period but the two dry period rations were reported as having little effect on cow health in the next lactation with hay having no apparent effect on herd health.

Coppock, et al. (10) looked at the effect of various forage to concentrate ratios in complete feeds fed ad libitum on feed intake prepartum and the occurrence of displaced abomasum. Noticeable increases in left displacement of the abomasum were observed 25 days following parturition in the lower forage to concentrate groups. Also, dry matter intake in the 28 days prior to parturition revealed a significant depression in intake as parturition approached in groups with low forage to concentrate ratios suggesting forage to concentrate ratios of no less than 60:40.

Ca:P Ratio and Relationship to Parturient Paresis (Milk Fever)

Jorgenson and Bringe (30) in a 1972 survey of dairymen found a milk fever incidence of six percent of all cows in Wisconsin with some herds experiencing incidence as high as 75 to 80 percent.

Parturient paresis, commonly called milk fever, is a metabolic disorder associated with parturition and initiation of lactation and is tied in closely with calcium and phosphorous levels in the dry cow ration and blood plasma. Jorgenson and Bringe (30) along with Boda and Cole (4) report normal plasma concentrations for calcium from 8.5 to 11.5 milligrams (mg.) percent (mg./100 milliliter) with a normal decline in plasma calcium at calving of 2 mg. percent with the degree of hypocalcemia (low plasma calcium levels) in the mild range of 7.5 to 8.5 mg. percent to severe at 5 to 6 mg. percent. When plasma calcium concentrations are less than 5.5 mg. percent, milk fever is likely to occur. Boda and Cole (4) reported that milk fever is the failure of normal homeostatic mechanisms (principally the parathyroid glands) to maintain a normal level of blood calcium in the face of a great loss of calcium from the blood to the milk at the initiation of lactation in the high producing cows.

Dry cow diets have been reported to influence the incidence of milk fever and prepartum feeding to prevent it is a constant challenge to researchers and dairymen. Hillman (20) reports feeding monosodium phosphate instead of mineral supplements containing calcium essentially eliminated the disease in Michigan test herds. In a field trial, Boda (3) divided milk fever susceptible cows into three groups and fed low calcium, high phosphorous prepartal diets consisting of oat hay, basal concentrate and varying levels of monosodium phosphate (1.5 to 5.0 percent). The lowest incidence of milk fever was observed in the ration with the least hay, highest concentrate and five percent supplemental phosphate.

Different prepartum energy intakes with varying calcium and phosphorous ratios and its effect on parturient paresis was studied by Gardner and Park (17). They reported lowest incidence of milk fever in the low energy intake groups with calcium to phosphorous ratios of 2.3:1 and 1.5:1. Hillman and Newman (24) recommended 2.3 parts calcium to 1 part phosphorous as the most desirable ratio to avoid milk fever.

This is in conflict with Jorgenson and Bringe (30) who are of the opinion that levels of calcium and phosphorous are more important than ratios. They reported high levels of calcium intake (over 100 grams per day) increase the incidence of milk fever and if sufficient phosphorous is fed during the dry period (25 to 40 grams per day), calcium intake may range from a very low level to 100 grams per day without markedly influencing the incidence of milk fever. They (30) postulate that a high calcium intake during the dry period may prevent the conversion of Vitamin D2 or D3 to their active metabolite which is 25-Hydrocholocalciferol.

Wiggers, et al. (46) conducted a field study in five Iowa Jersey herds to prevent parturient paresis by feeding a calcium-deficient diet prepartum. Dry cows with at least one lactation were divided into two groups with the control group maintained under the usual herd conditions while the other groups were fed one of the two designated calcium deficient diets 10 to 14 days prior to parturition. Sixteen of the 51 cows on control diets were treated for parturient paresis and none of the 36 cows on the calcium deficient diets developed milk fever.

Mastitis--Dry Cow Treatment

The dry period is described as a period of restoration and regeneration with little consideration given to the fact that the dry udder and its tissue are constantly being bombarded by infectous organisms, the precursors of mastitis which has been and continues to be recognized as one of the major disease problems confronting the dairy industry (15, 25, 29). Normally, more cows have infected udders at calving than drying off time simply because animals infected at drying off time usually remain infected at calving and in addition, about one third of all cows acquire new infections in the dry period. Smith, et al. (40) reported that 50 percent of all cows drying off were infected but in calving again, it had increased to 61 percent. With this increased incidence, it would appear that the major goal of any dry cow therapy and treatment program should be geared to eliminate subclinical infections present at the end of lactation and to protect the udder against bacterial invasion during the dry period.

It is postulated by Natzke (35) that the loss of milk due to new dry cow period infections is about the same as that caused by an infection that persists throughout the dry period. If the infection is eliminated early in the dry period, much of the tissue damage can be repaired before next lactation. Natzke (35) recommends treatment of all quarters on all cows at the time of drying off and it should be combined with a teat dip program.

Eberhart and Buckalew (12) subjected half of 120 cows to a post milking teat dip and dry cow therapy of all quarters while the other half were untreated controls. Findings showed the proportion among treated cows with infected quarters with Streptococcus agalactiae decreased 20.2 percent (21.8 to 1.6 percent) and Staphylococcus aureus decreased 6.6 percent (9.5 to 2.9 percent); whereas, controls showed much smaller changes.

In a three year mastitis treatment project at Cornell, Natzke (35) reported that 58.4 percent of all pathogens were eliminated with a commercial lactation treatment compared to a 92.5 percent elimination with dry period therapy at 1,000,000 units of penicillin and 1 g. streptomycin in a 3 percent aluminum monostearate in peanut oil.

In another dry cow therapy study, Pugh, et al. (36) utilized a long acting intramammary preparation containing high levels of procaine penicillin and dihydrosteptomycin sulfate in an oily base in all four quarters immediately after the last milking of their lactation. Staphylococci were isolated from 49 quarters of 150 cows at drying off and at four days after calving, 80 percent of these quarters were free from infection with streptococci eliminated from 97 percent of the infected quarters during the same period.

Research results by Smith, et al. (40) indicate that with the simple technique of infusing all cows at drying off and teat dipping, the proportion of cows calving and infected with mastitis can be reduced from 60 to 15 percent.

CHAPTER III

METHODS AND PROCEDURES

Two surveys were designed and utilized to obtain the necessary data for this research project. The first was a mail survey sent out to all dairymen enrolled in one of Michigan's three DHIA testing programs as of March, 1974. Its purpose was to identify possible dry cow management problems which then might be surveyed in a more quantitative manner through a personal survey. The data from the completed and returned mail surveys was analyzed (Appendix A). It did provide an appropriate base on which to study dry cow management but the validity of the results was in question based on the incompleteness and accuracy of the information provided by the dairymen on the mail survey. From the mail survey, a second and more in depth survey on dry cow management was developed and completed through 64 personal on the farm visits; henceforth, only the latter survey will be discussed.

Sample Size and Selection

Sample size was determined and limited primarily by the available time. Drs. John Gill and Ivan Mao were consulted to insure sufficient sampling numbers. It was decided to include in the basic study 54 herds plus a special study of ten large herds, each with over 200 cows, for a total of 64 herds. It was further decided to eliminate breed variation by including only Holstein herds. The geographic area included in the sampling pool was designated as the southern portion of Michigan specified by the northern boundary of Manistee and Iosco counties. A total of 670 dairymen who returned the mail survey fit the above characteristics and from this listing, 54 herds were randomly selected representing approximately eight percent of the defined population.

The author chose through the survey design to study four factors; namely, housing system, separation of dry cows, herd size and production level. These were believed to be primary factors in dry cow management and the author does recognize secondary factors do exist which might contribute to differences. Although they are not a part of the survey design, they were recorded as supplementary data in the survey.

The sample was first stratified by system of housing and (1) separation of dry cows or (2) no separation of dry cows from the milking herd. Three major types of housing in Michigan as determined from the mail survey analysis were utilized and they were (1) stanchion, (4) open-lot free stall and (5) covered-free stall (cold or warm). Each of the six strata was further stratified by including three herd sizes of (1) 20 to 49, (2) 50 to 99 and (3) 100 to 199 cows and three production levels of (1) under 12,699, (2) 12,700 to 14,699 and (3) herds above 14,700 pounds of milk based on the May, 1974 rolling DHI average. The following example illustrates the stratification.

4 Open lot free stall
1 Dry cows separated
2 Herd size of 50 to 99 cows
3 Production level over 14,700 pounds of milk

Each stratum required nine herds and a total of 54 test herds were selected from the cross classified classes by randomization within the smallest subclass. The author does recognize the survey design limits randomization and offers no replication with the four cross classification categories.

The Survey

A survey through individual on the farm contacts was designed requiring an estimated 75 minute interview time. In the formulation of the survey questionnaire, the theses projects of Erickson (14) and Kucker (32) were reviewed. After the initial formulation of the survey, it was submitted to each graduate committee member for his critique. From the suggestions and comments expressed on the initial survey, a second survey was designed and tested on eight farms in the immediate area of the Michigan State University campus. A special effort was made to include dairy farms with variance in the four chosen primary contributing factors to make certain the survey would be suited to broad spectrum differences in dry cow management which might arise from farm to farm. After the pretest farm interviews, additional modifications were made. The final survey utilized in the study contained five major sections; namely, housing, feeding program (roughage and grain) of dry cows, herd health, and general management of dry cows. A total of 192 questions were included in the final survey and a copy of it is included in Appendix B.

Interview Procedure

Immediately upon selection of the dairymen by randomization, a letter was addressed to them outlining the purpose of the study and soliciting their willingness to cooperate in the project. A self addressed return postcard was enclosed requesting their response, whether positive or negative, and also time of day preferred and any dates which would not be satisfactory for an interview on their farm. A special effort was made to adhere to their requests. Urgency of response was stressed in the initial letter but only about 25 percent responded within ten days so a followup contact was made by telephone in the essence of saving time. Many apologies were received but willingness to cooperate was very high when contacted by telephone. After definite commitments were received from the 64 required dairymen, a travel itinerary was formulated and each dairyman in the study was mailed a form letter 10 to 14 days in advance of the farm visit giving exact date and time of interview. The on the farm time to make acquaintance, view the setup and complete the survey was scheduled for two hours with interviews scheduled in the morning, afternoon, and evening where distance between visits was minimal; otherwise, two per day were scheduled.

Most interviews were completed in the dairyman's home which was most often quiet and free from disturbances. The wife or partners of the dairy operation were invited to participate and did contribute greatly to the completeness and accuracy of the survey. The interviewer utilized a tape recorder in early visits but terminated the practice because it was too distractive and involved one more piece of equipment to oversee. Notes and calculations were taken to back up any questionable areas and these were transposed to the back of the survey sheets when data was reviewed and finalized.

The 64 interviews commenced in mid August and were completed by late September, 1974. Of the original 54 selected dairymen for the basic study, five were dropped due to a misunderstanding in the interpretation of open lot free stall and covered free stall housing; therefore, an additional five dairymen were randomly selected and interviewed to fill the necessary subcells for the study. In the future, the author suggests types of housing be discretely defined to avoid such discrepancies especially when relying solely on the dairyman's judgment.

Methods of Analysis

Due to limited data with only 54 herds in the basic study, it was clearly recognized that an analysis of the data must be a "step by step" procedure.

The balanced portion or four chosen primary contributing factors including all two-way interactions were subjected to the Least Square Analysis of Variance to determine significance of the sources of variation affecting herd health. Secondary factors were ignored in this analysis. Significant primary major effects and interactions ($P<0.11$) between categories were examined two at a time using Tukey's test and the Student's t-test.

To look at the secondary factors which were ignored in the balanced design factors, a Multiple Regression Analysis was utilized to examine secondary nutritional and management factors related to herd health problems. Because of the limited scope of design, it was decided to test only summary nutritional parameters rather than the many facets of nutrition because of insufficient data. Although not part of the design, these secondary factors were recorded as supplementary data on the survey and were examined through a Multiple Regression Analysis to determine their effect on herd health problems.

Variable Number	Variable Name
90	Roughage pounds-milk cows
92	Roughage dry matter pounds per hundred pounds of body weight-milk cows
99	Dry matter grain at 40 days post-partum-milk cows
101	Dry matter grain at 270 days post-partum-milk cows
104	Dry matter grain protein-milk cows
143	Total dry matter at 40 days post-partum-milk cows
144	Total dry matter at 270 days post-partum-milk cows
202	Daily dry matter roughage intake-dry cows
204	Roughage dry matter pounds per hundred pounds of body weight-dry cows
231	Total dry matter pounds per hundred pounds of body weight-dry cows

Other secondary management factors which might have an effect on herd health problems were included. They were:

Variable Number	Variable Name
7	Production level
10	Percent days in milk
12	Age of owner
91	Weight of milking cows
300	Average number of dry days

A special statistical analysis adding the following highly significant nutritional variables was done on metritis, ketosis, milk fever and mastitis to determine their relationship on these specified herd health problems. This did reduce the available data from 54 to 31 herds or only about 57 percent of the original data was utilized in the analysis. The added nutritional variables were:

Variable Number	Variable Name
73	Pounds hay fed in winter-milking cows
155	Fixed pounds of corn silage fed in winter-dry cows
186	Pounds hay fed in winter-dry cows

Means and frequencies were run on all quantitative and qualitative data in the survey. Each quantitative variable and its mean is listed in Table 1, Appendix C. All questions in the survey requiring a yes or no response and followup questions relating to yes and no questions are listed in Tables 2 and 3, Appendix C. Other collected data of a qualitative nature is summarized based on responses and is found in Appendix B amidst the survey questionnaire.

CHAPTER IV

RESULTS AND DISCUSSION

Survey data for the study was collected on 64 dairy farms in Michigan; however, a heavy portion of the analysis centered around 54 herds interviewed in the basic study with ten herds over 200 cows included in a special study.

Primary Factors Affecting Herd Health

One of the objectives of the mail survey was to determine possible major sources of variation which might affect herd health. The four major primary sources of variation and all possible two way interactions are listed in Table 1.

It is noted that housing system affects only milk fever ($P<0.03$) with a significant increase in the incidence of milk fever in open-lot free stall housing versus stanchion and covered-free stall which showed the lowest incidence of milk fever (See Table 2).

TABLE 1. Significance of Sources of Variation Affecting Herd Health (54 Herds). (Probabilities of Type I Errors)

Sources of Variation	Herd Health Problems					
	Displaced Abomasum	Retained Placenta	Metritis	Ketosis	Milk Fever	Mastitis
Housing System	.280	.916	.337	.901	<u>.029</u>	.345
Separated	.429	.573	.462	.486	<u>.107</u>	<u>.100</u>
Herd Size	.626	.700	.736	.900	.941	.918
Production Level	.603	<u>.052</u>	<u>.036</u>	<u>.109</u>	<u>.003</u>	.767
Housing System X Separated	.728	.616	<u>.083</u>	<u>.105</u>	.869	.278
Housing System X Herd Size	.962	.880	.615	.257	.282	.444
Housing System X Production Level	.174	.263	.740	.942	.430	.632
Separated X Herd Size	.525	.373	<u>.005</u>	.956	.762	.636
Separated X Production Level	.977	.891	.210	.217	.779	.236
Herd Size X Production Level	.638	.582	.301	.909	.825	.777

TABLE 2. Milk Fever Percent as Affected by Housing Systems.

	System of Housing	Mean
1	Stanchion	6.4
4	Open-lot free stall	10.6*
5	Covered-free stall (warm or cold)	4.3

Standard error of means ± 1.55

* Significantly higher (P<0.03)

However, the two way interaction of housing system and the separation factor does affect metritis (P<0.09). In stanchion housing, a significant difference is noted between separation of dry cows from the milking herd and those housed and fed with the milking herd. One could make a solid recommendation favoring dry cow separation in stanchion housing with less difference in open-lot free stall and an inverse relationship noticed in covered-free stall housing as noted in Table 3.

TABLE 3. Metritis Percent as Affected by Separation of Dry Cows and Housing Systems.

	1 Stanchion	4 Open-lot Free Stall	5 Covered-Free Stall
Not Separated	25.8	23.4	19.2
Separated	7.6*	17.0	24.0

Standard error of means ± 3.00

* Significantly lower than non-separated (P< 0.05)

Also, housing system and the separation factor has a slightly lesser effect on ketosis ($P<0.11$). It can be seen (Table 4) that the incidence of ketosis is significantly lower in herds not separating dry cows from the milking herd. A strong case could be formulated to not separate dry cows in covered-free stall housing if ketosis is a problem with a lesser effect in open-lot free stall housing but to reduce incidence of ketosis in stanchion housing, dry cows should be separated.

TABLE 4. Ketosis Percent as Affected by Separation of Dry Cows and Housing Systems.

	1 Stanchion	4 Open-lot Free Stall	5 Covered-Free Stall
Not Separated	7.9	3.7	1.0*
Separated	3.5	5.9	7.4

Standard error of means ± 1.37

* Significantly lower from separated herds in same housing system ($P<0.05$)

Although the separation factor did not greatly affect herd health problems, it was a contributing factor to the incidence of milk fever ($P<0.11$) and mastitis ($P<0.10$) at lower significance levels. It is noted in Table 5 that milk fever is significantly higher in herds not separating dry cows versus those dairymen who do separate. Based on the results in Table 5, the practice of separating dry cows is a management factor which contributes to lower incidence of milk fever.

TABLE 5. Milk Fever Percent as Affected by Separation of Dry Cows.

	Mean
Separated	5.5
Not Separated	8.7*

Standard error of means ± .97

* Significantly higher (P<0.11)

A similar pattern is noted with the separation factor and its effect on clinical mastitis. Herds who do not separate dry cows show a significantly higher incidence of mastitis and it appears that separation is a sound management factor to reduce clinical mastitis incidence as seen in Table 6.

TABLE 6. Clinical Mastitis Percent as Affected by Separation of Dry Cows.

	Mean
Separated	18.0
Not Separated	25.8#

Standard error of means ± 2.27

Significantly higher (P<0.10)

Although herd size does not have any significant affect on herd health problems, the interaction of herd size and the separation factor was highly significant on metritis ($P<0.01$) as seen in Table 7. The low incidence in large herds separating dry cows is difficult to explain. First of all, it was obvious to the author when collecting the data that not all dairymen understand and recognize metritis; therefore, the reported results may not be as accurate as other herd health problems. One might hypothesize that smaller herd owners are less likely to recognize metritis. However, if incidence has been reported accurately, the results show large herds should be separating dry cows. All ten herds over 200 cows reported separation of dry cows and 16.3 percent incidence of metritis; therefore, one might be led to believe the actual incidence is closer to this figure than the 6.5 percent incidence of metritis reported in Table 7.

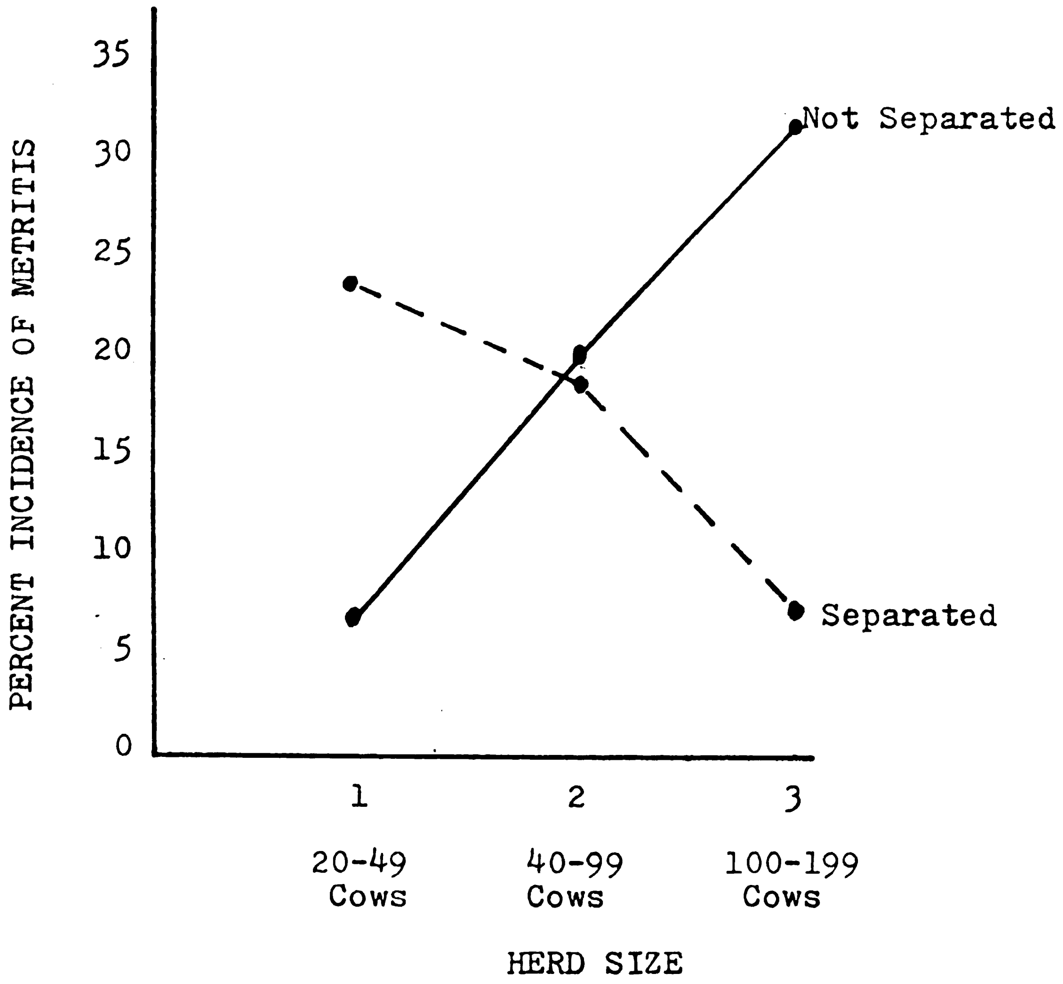
TABLE 7. Metritis Percent as Affected by Separation of Dry Cows and Herd Size.**

	(S) 20-49 Cows	(M) 50-99 Cows	(L) 100-199 Cows
Not Separated	6.9*	19.6	31.1*
Separated	23.5	18.0	6.5

Standard error of means ± 3.29

* Significantly different from separated herds in same size herd ($P<0.05$)

**Significant interaction ($P<0.01$)



Production level affects more herd health problems than any other source of variation. It has its effect on retained placenta ($P<0.06$), metritis ($P<0.04$), ketosis ($P<0.11$) and a very high significance level with milk fever ($P<0.01$). It is obvious in Table 8 that lower producing herds have a significantly lower incidence of retained placenta than do higher producing herds.

TABLE 8. Retained Placenta Percent as Affected by Production Level.

Production Level-Pounds of Milk	Mean
Low (<12,699)	10.8#
Medium (12,700-14,699)	15.4
High (>14,700)	17.9

Standard error of means ± 1.67

Significantly lower ($P<0.06$)

It is often reported that metritis follows right behind retained placenta and this statement is once again substantiated in the low and medium producing herds, but metritis incidence is quite a lot higher in high producing herds than is the incidence of retained placenta in high producing herds. However, the data in Table 9 once again bears out that as production increases, so does incidence of metritis.

TABLE 9. Metritis Percent as Affected by Production Level.

Production Level-Pounds of Milk	Mean
Low (< 12,699)	10.3
Medium (12,700-14,699)	18.1
High (>14,700)	24.6*

Standard error of means ± 3.10

* Significantly different from low production (P<0.05)

Production level does have an effect on ketosis, but not as strongly as with retained placenta and metritis. A significantly higher incidence of ketosis is noted in high producing herds versus low and medium herds as seen in Table 10.

TABLE 10. Ketosis Percent as Affected by Production Level.

Production Level-Pounds of Milk	Mean
Low (< 12,699)	3.4
Medium (12,700-14,699)	3.5
High (> 14,700)	7.9#

Standard error of means ± 1.39

Significantly higher (P<0.11)

The effect of production level on incidence of milk fever is highly significant with a higher incidence in high producing herds versus low and medium producing herds. Production level and its effect on milk fever as evidenced in Table 11 follows a similar trend of increased incidence as production level moves up. It would appear that higher incidence of herd health problems is a characteristic of higher producing herds and if a dairyman elects to set his goals and objectives above 15,000 pounds of milk, he must be willing to accept increased incidence of retained placenta, metritis, ketosis and milk fever.

TABLE 11. Milk Fever Percent as Affected by Production Level.

Production Level-Pounds of Milk	Mean
Low (<12,699)	3.8
Medium (12,700-14,699)	5.8
High (>14,700)	12.4**

Standard error of means ± 1.38

**Significantly higher ($P < 0.01$)

Nutritional and Management Factors Affecting Herd Health

Although four factors were chosen and earmarked in the study as primary contributing factors to the incidence of herd health problems, secondary feeding and management factors of a quantitative nature were recorded with selected summary nutritional and management parameters (see Methods and Procedures) subjected to a multiple regression analysis to determine their possible effect or relationship to herd health problems. Variables significantly affecting herd health problems are given and discussed in this section.

Variables are listed in descending order of standardized partial regression coefficients (beta weights) because they are free of units and can be compared on the basis of absolute magnitude. It is pointed out that it can be very misleading if only regression coefficients are used as variables might be expressed in other terms or units.

As was pointed out earlier, housing systems, separation of dry cows, herd size and production level did not contribute significantly to the incidence of displaced abomasum; however, 24.9 percent of the variation of incidence is explained by the three secondary variables listed in Table 12. When comparing the standardized partial regression coefficients of roughage per hundred pounds of body weight to dry cow days, roughage fed per hundredweight to milk cows has a three times greater effect on reducing incidence than does dry days. As total dry matter intake at 270 days postpartum is increased, an increase is noted in displaced abomasum but it indicates less than half the predictability strength of roughage per hundredweight and is much nearer to the strength of dry days. From a practical aspect, it would appear from these data that roughage pounds per hundredweight is the most critical factor affecting displaced abomasum. This inverse relationship is in agreement with earlier work by Coppock, et al. (10) who reported noticeable increases in left displacement of the abomasum within 25 days following parturition in lower forage to concentrate ratios.

The increased effect on incidence of displaced abomasum by total dry matter intake at 270 days postpartum might create more awareness of its importance but strength would dictate its lesser value or effect on displaced abomasum.

It would appear impractical to increase dry days to merely avoid displaced abomasum especially with its minimal strength of predictability. Coppock, et al. (9) showed in their work that common health disorders at parturition were not associated with length of dry period but did not measure displaced abomasum; therefore, one would conclude from this evidence that it is not a feasible management practice to increase dry days to decrease the incidence of displaced abomasum. Variables significantly related to incidence of displaced abomasum are given in Table 12.

TABLE 12. Variables Significantly Related to Incidence of Displaced Abomasum.*

	Variable Number and Name#	Regression Coefficient ± Standard Error	Significance Level
92	Daily roughage D.M. pounds per cwt.-milk cows	-0.0058 ± 0.0015	<.0005
144	Total daily D.M. intake at 270 days-milk cows	0.0013 ± 0.0008	.108
300	Dry days	-0.0005 ± 0.0003	.118

* 24.9 percent of variation of incidence (1.3 percent, variable 256) is explained by variables listed.

Variables are listed in descending order of standardized partial regression coefficients.

A total of 34.3 percent of the variation of retained placenta incidence is explained in Table 13. A study of the standardized partial regression coefficients reveals dry matter at 270 days postpartum has the greatest strength of predictability but is followed closely by dry matter grain at 270 days postpartum and roughage pounds fed. This is a difficult relationship to comprehend and defend. From the results, dry matter grain at 270 days postpartum and roughage pounds have a positive effect on retained placenta and when combined, should equal the total dry matter intake at 270 days postpartum which shows a negative affect on retained placenta incidence. Dry matter intake per hundred pounds of body weight in dry cows relates a negative affect on retained placenta incidence but its predictability is only one-sixth the strength of the other three significant variables. Variables significantly related to retained placenta incidence are listed in Table 13.

TABLE 13. Variables Significantly Related to Incidence of Retained Placenta.*

	Variable Number and Name#	Regression Coefficient ± Standard Error	Significance Level
144	Total daily D.M. intake at 270 days-milk cows	-0.0213 ± 0.0052	<.0005
101	Dry matter grain intake at 270 days-milk cows	0.0241 ± 0.0051	<.0005
90	Daily D.M. roughage intake pounds-milk cows	0.0229 ± 0.0053	<.0005
231	Daily dry matter intake per cwt.-dry cows	-0.0046 ± 0.0027	.096

* 34.3 percent of variation of incidence (14.7 percent, variable 258) is explained by variables listed.

\# Variables are listed in descending order of standardized partial regression coefficients.

The five secondary parameters explaining 26.1 percent of the variation of metritis incidence are given in Table 14 with total dry matter at 40 days postpartum having the highest standardized partial regression coefficient. Its strength is nearly double the impact when compared to other variables and in an increased manner on metritis incidence as dry matter increases at 40 days. Daily roughage pounds fed to milk cows and percent days in milk reveal about 60 percent of the relative magnitude of the strongest variable but both do have a negative correlation on metritis incidence. Roughage dry matter per hundredweight to dry cows is less than half the strength of the strongest variable with dry matter grain at 270 days postpartum having a similar strength of predictability. From this data, it is concluded that roughage pounds is a factor to reduce metritis while roughage fed to dry cows has a positive effect. The management factor of percent days in milk with a negative effect on metritis would tend to favor the dairyman striving to keep his percent days in milk at a high level. Variables significantly related to metritis are given in Table 14.

TABLE 14. Variables Significantly Related to Incidence of Metritis.* (54 Herds)

Variable Number and Name		Regression Coefficient	± Standard Error	Significance Level
143	Total daily dry matter intake at 40 days-milk cows	0.0167	± 0.0048	.001
10	Percent days in milk	-0.0138	± 0.0062	.032
92	Daily roughage D.M. pounds per cwt.-milk cows	-0.0199	± 0.0107	.068
204	Daily roughage D.M. intake per cwt.-dry cows	0.0168	± 0.0104	.114
101	Dry matter grain intake at 270 days-milk cows	0.0084	± 0.0056	.136

* 26.1 percent of variation in incidence (17.4 percent, variable 260) is explained by variables listed.

Variables are listed in descending order of standardized partial regression coefficients.

From a study of means within the major sources of variation, it was postulated that two additional nutritional variables might have a significant relationship to metritis incidence. These two variables were pounds of hay fed to milking cows in winter (variable number 155) and pounds of corn silage fed to milking cows in the winter (variable number 186). This did limit the use of only 57 percent of the original data (31 rather than 54 herds) because of fewer responses on these two variables. Again, total dry matter intake at 40 days postpartum remains the strongest predictor of metritis incidence with percent days in milk remaining in the same position as in 54 herds but with a slightly stronger magnitude from a standardized partial regression coefficient aspect. Pounds of corn silage fed to dry cows in the winter is recognized as a significant variable with about 55 percent the strength of the strongest variable. Pounds of hay fed to dry cows in the winter was not significantly related to metritis. The two nutritional variables of roughage dry matter per hundredweight in dry cows and roughage per hundredweight in milk cows carry about equal strength but are less than half that of the strongest variable. Each has an opposite significant effect on metritis incidence with increased roughage in dry cows having a positive effect while increased roughage in milk cows shows a negative affect on metritis incidence. In summary, one can conclude from the presented data that roughage variables contribute to decreased incidence of metritis incidence with the exception of roughage dry matter per hundredweight in dry cows which has a similar positive effect much the same as total dry matter at 40 days to metritis incidence. Variables significantly related to metritis incidence are outlined in Table 15.

TABLE 15. Variables Significantly Related to Incidence of Metritis.* (31 Herds with Two Added Variables)

Variable Number and Name#		Regression Coefficient ± Standard Error	Significance Level
143	Total daily D.M. intake at 40 days-milk cows	0.0234 ± 0.0059	.001
10	Percent days in milk	-0.0204 ± 0.0071	.008
155	As fed pounds of corn silage fed in winter-dry cows	-0.0065 ± 0.0023	.010
204	Daily roughage D.M. intake per cwt.-dry cows	0.0259 ± 0.0126	.051
92	Daily roughage D.M. pounds per cwt.-milk cows	-0.0266 ± 0.0143	.075

* 57.3 percent of variation of incidence (17.4 percent, variable 260) is explained by variables listed.

\# Variables are listed in descending order of standardized partial regression coefficients.

Only two variables explain 28.2 percent of the variation of ketosis (see Table 16). Milk level and roughage per hundredweight are virtually equal in predictable power when comparing the standardized partial regression coefficients. However, an opposite effect is noted in their affect on ketosis incidence with milk level portraying a positive effect and daily roughage per hundred pounds of body weight showing a decreased effect on ketosis incidence. From this set of data, one might postulate that increased ketosis incidence is characteristic of or a part of increased production. From a nutritional aspect, increased roughage per hundredweight to milk cows has a strong effect to decrease ketosis incidence. Variables significantly related to ketosis incidence are listed in Table 16.

TABLE 16. Variables Significantly Related to Incidence of Ketosis.* (54 Herds)

Variable Number and Name#		Regression Coefficient ± Standard Error	Significance Level
7	Milk level	0.00001 ± 0.000004	.001
92	Daily roughage D.M. pounds per cwt.- milk cows	-0.0117 ± 0.0033	.001

* 28.2 percent of variation of incidence (4.9 percent, variable 262) is explained by variables listed.

\# Variables are listed in descending order of standardized partial regression coefficients.

For analysis of ketosis, the same two additional nutritional variables; namely, pounds of hay fed to milking cows in winter (variable number 155) and pounds of corn silage fed to dry cows in the winter (variable number 186) were subjected to an additional analysis utilizing only 57 percent of the original data with the results listed in Table 17. It is evident that two variables explain 24.4 percent of the differences in ketosis incidence. Dry matter grain fed at 40 days postpartum has the greatest strength of predictability with roughage dry matter per hundredweight in dry cows portraying 76 percent of the strongest variable.

It is recognized that two different variables are significant in the 31 herds versus the data in the 54 herds but it might be explained by the fact that the 31 herds are evidently not a random sample of the 54 herds. Variables significantly related to incidence of ketosis are listed in Table 17.

TABLE 17. Variables Significantly Related to Incidence of Ketosis.* (31 Herds with Two Added Variables)

Variable Number and Name#		Regression Coefficient ± Standard Error	Significance Level
99	Dry matter grain intake at 40 days-milk cows	0.0053 ± 0.0020	.012
204	Daily roughage D.M. intake per cwt.-dry cows	0.0081 ± 0.0040	.051

* 24.4 percent of variation of incidence (4.9 percent, variable 262) is explained by variables listed.

Variables are listed in descending order of standardized partial regression coefficients.

Three variables explain 38.4 percent of the variation in incidence of milk fever and each is a near equal contributor to the strength of predictability when studying the standardized partial regression coefficients. Similarly, as evidenced in ketosis, milk level has an increased effect on milk fever incidence. It is interesting to note that milk cow grain protein has a suppressed effect on milk fever. One might postulate this variable to have a positive relationship to milk level; therefore, the two might be interrelated. From this set of data, it would appear that total dry matter intake at 270 days postpartum has a significant affect on milk fever. In conclusion, it is pointed out that the two significant nutritional variables listed are indicating a decreased effect on milk fever as they increase but both possibly are tied in closely to milk level which indicates an increased effect on milk fever per each pound of milk increase. Variables significantly related to incidence of milk fever are presented in Table 18.

TABLE 18. Variables Significantly Related to Incidence of Milk Fever.* (54 Herds)

Variable Number and Name#		Regression Coefficient ± Standard Error	Significance Level
144	Total daily D.M. intake at 270 days-milk cows	-0.0049 ± 0.0020	.016
7	Milk level	0.00001 ± 0.000004	.018
104	D.M. grain protein percent-milk cows	-0.0070 ± 0.0026	.009

* 38.4 percent of variation of incidence (7.0 percent, variable 264) is explained by variables listed.

Variables are listed in descending order of standardized partial regression coefficients.

Five variables listed in Table 19 account for 49.7 percent of the incidence of milk fever utilizing 57 percent of the available data. In this analysis, pounds of hay fed to milking cows in winter, pounds of hay fed to dry cows in winter and fixed pounds of corn silage fed to dry cows in the winter were added to the study. It is pointed out that hay fed in the winter to dry cows does have a positive effect on milk fever incidence. From a study of the results, it is recognized that milk level carries the greatest strength of predictability, and as it increases, so does milk fever. Of lesser magnitude are total dry matter fed 270 days postpartum and pounds of hay fed to dry cows in the winter, and both indicate an increased effect on milk fever incidence. The variables of percent days in milk and milk cow grain protein carry about 60 percent the weight of the strongest variable but both indicate a negative effect on the incidence of milk fever. In summary, one might conclude from the data that increased milk production is again characteristic with increased milk fever. The nutritional variables of total dry matter at 270 days postpartum and pounds of hay fed to dry cows in winter are factors which do not have the strength of milk level but do have implications on milk fever incidence. Again, grain protein is a significant factor but with the least strength of predictability. From a practical standpoint, it would be a sound management practice to increase percent days in milk to primarily generate greater dairy profits, but from this set of data, a bonus would be decreased incidence of milk fever. Variables significantly related to milk fever incidence are listed in Table 19.

TABLE 19. Variables Significantly Related to Incidence of Milk Fever.* (31 Herds with Three Added Variables)

Variable Number and Name#		Regression Coefficient ± Standard Error	Significance Level
7	Milk level	0.00002 ± 0.000006	.010
144	Total daily D.M. intake at 270 days-milk cows	0.0055 ± 0.0026	.043
186	As fed pounds of hay fed in winter-dry cows	0.0033 ± 0.0015	.040
10	Percent days in milk	-0.0053 ± 0.0028	.067
104	D.M. grain protein percent-milk cows	-0.0098 ± 0.0050	.062

* 49.7 percent of variation of incidence (7.0 percent, variable 264) is explained by variables listed.

Variables are listed in descending order of standardized partial regression coefficients.

Regarding mastitis, none of the offered variables remained in the analysis of 54 herds; therefore, no table is presented. However, the addition of pounds of corn silage (variable number 155) and hay fed to dry cows in winter (variable number 186) using only 57 percent of the data listed, six significant variables explaining 52.7 percent of the variation of incidence in mastitis. It is recognized that some of the listed variables may have been near significance levels with the larger set of data. It is obvious that all variables listed are nutritional in nature with total roughage pounds and roughage per hundredweight carrying the strongest predictability but each have an opposite effect on mastitis. It is hypothesized that both variables are closely correlated with each other and differences in cow weight must be a factor. Roughage per hundredweight in milk cows has about 88 percent the power of the strongest variable and reveals an increased effect on mastitis as does total dry matter intake at 270 days and in dry cows which are only about half as powerful as the strongest predictor. Both dry matter grain at 270 days postpartum and dry matter per hundredweight in dry cows indicate a negative response to mastitis but their power to predict is only about 25 percent of the strongest variable. From the data, it is apparent that nutritional variables are predictors and related to mastitis incidence, but the two at the top of the list exert the greatest influence with two at the mid point and the last two carrying only about one-fourth the power of the two strongest variables. Variables significantly related to incidence of mastitis are listed in Table 20.

TABLE 20. Variables Significantly Related to Incidence of Clinical Mastitis.* (31 Herds with Two Added Variables)

Variable Number and Name#		Regression Coefficient ± Standard Error	Significance Level
90	Daily D.M. roughage intake pounds-milk cows	-0.0859 ± 0.0286	.006
92	Daily roughage D.M. pounds per cwt.-milk cows	0.1062 ± 0.0300	.002
144	Total daily D.M. intake at 270 days-milk cows	0.0321 ± 0.0119	.013
202	Daily roughage D.M. pounds-dry cows	0.0336 ± 0.0109	.005
101	Dry matter grain intake at 270 days-milk cows	-0.0268 ± 0.0115	.028
231	Total daily D.M. pounds per cwt.-dry cows	-0.0181 ± 0.0084	.041

* 52.7 percent of variation of incidence (21.3 percent, variable 266) is explained by variables listed.

Variables are listed in descending order of standardized partial regression coefficients.

Relationship of Significant Primary and Secondary Factors Affecting Herd Health

It has been previously pointed out in tables and through discussion that certain primary sources of variation and secondary quantitative feeding and management factors do have a significant effect on specific herd health problems. Henceforth, the discussion centers around interrelationships of significant major sources of variation and significant quantitative secondary factors with significant differences in means within the primary category to extract possible effects they may have on herd health incidence. In essence, a cause and affect relationship will be discussed.

It was identified earlier that housing system as a primary source of variation revealed only a significant effect on milk fever incidence (see Table 1). When secondary summary variables were analyzed through a multiple regression analysis, dry matter grain protein was identified as one of the three significant variables explaining 38.4 percent of the incidence of milk fever (see Table 18). The relationship of housing system as a significant primary factor and dry matter grain protein (milk cows) as a significant secondary nutritional factor is presented in Table 21. The results show milk fever incidence significantly lower in covered-free stall housing with highest incidence in open-lot free stall and stanchion housing near the mean of 7.0. In studying the effect of grain protein on milk fever incidence, it is evident from the results that the lowest grain protein has the highest incidence of milk fever. From the regression analysis, a significant decrease of .69 percent in incidence of milk fever per one percent increase in protein is recognized.

In a study of the large herd data, the percent grain protein averaged 15.7 percent with a 3.6 percent incidence of milk fever which further substantiates the effect grain protein has on milk fever; however, 90 percent of the 10 herds in this study were in open-lot free stall housing which in the 54 herds showed the highest incidence of milk fever.

It is concluded from the results that the highest incidence of milk fever is in open-lot free stall with the nutritional variables the lowest in the same housing system. The lowest incidence is noted in covered-free stall housing but the nutritional variable is not significantly different from the highest. The relationship of housing system and milk cow dry matter grain protein to milk fever incidence is given in Table 21.

TABLE 21. Relationship of Housing System and Milk Cow Dry Matter Grain Protein to Incidence of Milk Fever.

	Housing System	% Incidence of Milk Fever#	Percent Grain Protein
1	Stanchion	7.3	15.5
4	Open-lot Free Stall	9.8	13.0*
5	Covered-Free Stall	4.0*	14.4

.69 percent decrease in incidence per one percent increase in milk cow dry matter grain protein ($P < 0.02$).

* Significantly lower than other housing systems ($P < 0.05$).

The interrelationship of housing system as a primary factor and total dry matter at 270 days postpartum as a secondary nutritional factor causing a .49 percent decrease in milk fever incidence per one pound increase in dry matter is presented in Table 22. It would appear outwardly from the means that milk fever incidence increases with pounds of total dry matter; however, a decrease is noted per pound increase in dry matter. This is a difficult relationship to explain and defend. It would appear from the means that a decrease is apparent in incidence as dry matter does increase for the stanchion housing; however, an opposite trend is observed in open-lot free stall. One might hypothesize that a decreased incidence is noted in housing systems with less than 38 pounds of total dry matter intake including large herds but an opposite effect appears as total dry matter intake surpasses the 40 pound level.

In conclusion, it is apparent that milk fever is highest in open-lot free stall and lowest in covered-free stall housing which is significantly different than other housing systems. Total dry matter at 270 days postpartum reveals a decrease in milk fever incidence as dry matter increases, but with no real concrete explanation for the decreased effect as dry matter increases. The relationship of housing system and total dry matter intake at 270 days postpartum to incidence of milk fever is given in Table 22.

TABLE 22. Relationship of Housing System and Total Dry Matter Intake at 270 Days Postpartum to Incidence of Milk Fever.

	Housing System	% Incidence of Milk Fever#	Pounds Total Dry Matter at 270 Days Postpartum
1	Stanchion	7.3	36.4
4	Open-lot Free Stall	9.8	40.2*
5	Covered-Free Stall	4.0*	37.8

.49 percent decrease in incidence per pound increase in total dry matter (P<0.01).

* Significantly different than other housing systems (P<0.05).

Separation of dry cows from milking herd as a primary factor indicated a significant effect on milk fever and mastitis (see Table 1). However, because none of the secondary variables offered in the multiple regression analysis remained in for mastitis at the stated significance level, only the relationship of dry cow separation and dry matter milk cow grain protein which are at the stated significant levels will be discussed in relation to their effect on milk fever.

From the results presented in Table 23, it is evident after studying the means that milk fever incidence is significantly lower in herds where dry cows are separated. The secondary nutritional factor of milk cow dry matter grain protein indicates a .69 percent decrease in incidence of milk fever per one percent increase in protein which is not sufficient to account for differences associated with separation.

A study of the 10 herds over 200 cows substantiates the above results as they reported a 15.7 percent mean grain protein and a milk fever incidence of 3.6 percent with 100 percent of herdowners indicating separation of dry cows from the milking herd. This very low incidence in large herds may be explained somewhat in part by production level which in the 54 herds was a highly significant factor on milk fever. The large herds had a mean production level of 756 pounds less milk than in the 54 herd study.

From the data, it is concluded that separation of dry cows has the lowest incidence of milk fever with a significant difference and also has the highest dry matter grain protein percent with a significant difference from the lowest. The relationship of dry cow separation and dry matter grain protein is presented in Table 23.

TABLE 23. Relationship of Dry Cow Separation and Milk Cow Dry Matter Grain Protein to Incidence of Milk Fever.

Dry Cows Separated	% Incidence of Milk Fever[a]	Mean Grain Protein
Yes	5.5[b]	15.3
No	8.5	13.3[c]

[a] .69 percent decrease in incidence per one percent increase in dry matter grain protein ($P < 0.02$).

[b] Significantly lower ($P < 0.11$).

[c] Significantly lower ($P < 0.03$).

As was pointed out previously, production level as a primary factor had a significant effect on retained placenta, metritis, ketosis and milk fever (see Table 1). It is apparent that production level has a greater effect on more of the studied herd health problems than any of the major sources of variation.

The relationship of production level as a primary factor and pounds of roughage fed to dry cows as a secondary factor with their effect to retained placenta is presented in Table 24. It is a direct linear relationship where retained placenta incidence increases as production level and pounds of roughage to milk cows with a 2.3 percent increase per one pound increase in roughage.

These results are further substantiated in the 10 large herds with a mean production level of 12,855 pounds of milk that average 27.3 pounds of roughage and reported a 13.5

percent incidence of retained placenta. From these data, it is evident that higher producing herds do feed higher amounts of roughage which one might postulate is a reason for the added production, but with the increased milk production and pounds of roughage goes increased incidence of retained placenta. The relationship of production level and milk cow pounds of roughage to incidence of retained placenta is presented in Table 24.

TABLE 24. Relationship of Production Level and Pounds of Roughage to Incidence of Retained Placenta.

Production Level (Pounds of Milk)	% Incidence of Retained Placenta#	Pounds of Roughage
Low ($<$12,699)	11.4*	26.3*
Medium (12,700-14,699)	15.7	29.1
High ($>$14,700)	17.1	29.5

2.3 percent increase in incidence per pound increase in roughage ($P<0.01$).

* Significantly lower than higher producers ($P<0.05$).

Also, the combination of production level and dry matter pounds of grain fed at 270 days postpartum team up to have an increased significant effect on both retained placenta and metritis as related in Table 25. An increase in retained placenta incidence of 2.4 percent per pound increase in dry matter grain at 270 days is revealed while a .8 percent increase in metritis is noted per pound of increase in dry matter grain at 270 days postpartum. It is recognized that as production level increases, so does retained placenta and metritis incidence.

Large herd owners reported an average of 10.5 pounds of dry matter grain with 13.5 percent incidence of retained placenta and 16.3 percent incidence of metritis. One might be confident in the accuracy of the pounds of grain fed at 270 days but question if large herd owners are as mindful or accurate in reporting incidence as those in the 54 herd study. This doubt arises after personally interviewing large herd owners.

In summary, these results indicate the lowest production level has the lowest incidence of retained placenta and metritis with a significant difference from the higher production levels and highest grain intake at 270 days postpartum in the high production level with a significant difference from lower production levels. The relationship of production level and pounds of dry matter grain intake at 270 days postpartum to incidence of retained placenta and metritis is presented in Table 25.

TABLE 25. Relationship of Production Level and Pounds of Dry Matter Grain Fed to Milking Cows at 270 Days Postpartum to Incidence of Retained Placenta and Metritis.

Production Level (Pounds of Milk)	% Incidence of Retained Placenta[a]	% Incidence of Metritis[b]	Pounds Dry Matter Grain
Low (<12,699)	11.4*	11.6*	9.4
Medium (12,700-14,699)	15.7	19.2	9.1
High (>14,700)	17.1	21.3	12.1*

[a] 2.4 percent increase in incidence per pound increase in total dry matter grain fed at 270 days postpartum ($P<0.01$).

[b] .8 percent increase in incidence per pound increase in total dry matter grain fed at 270 days postpartum ($P<0.14$).

* Significantly different from other production levels ($P<0.05$).

In the analysis of secondary factors affecting metritis, total dry matter intake at 40 days emerged as the strongest secondary variable affecting metritis. A study was made of the means within production level and a significant difference was noted between the means of total dry matter intake at 40 days postpartum. From the results in Table 26, it is evident that as the primary factor of production level and the secondary factor of total pounds of dry matter at 40 days postpartum both increase, so does metritis incidence in a linear fashion. A 1.7 percent increase in metritis incidence is noted for each one pound increase in total dry matter.

A somewhat different trend is realized in large herds which reported an average of 46.1 pounds of total dry matter at 40 days postpartum but with a 16.3 percent incidence causing a doubt on their accuracy in either recognizing or reporting metritis incidence.

In summary, lowest milk fever incidence is in the lowest production level at a significant difference from higher producing herds and highest total pounds of dry matter at highest production level with a significant difference from other production levels. The relationship of production level and total pounds of dry matter intake at 40 days postpartum is presented in Table 26.

TABLE 26. Relationship of Production Level and Total Pounds of Dry Matter Intake at 40 Days Postpartum to Incidence of Metritis.

Production Level (Pounds of Milk)	% Incidence of Metritis#	Total Pounds Dry Matter
Low (<12,699)	11.6*	41.5
Medium (12,700-14,699)	19.2	43.9
High (>14,700)	21.3	47.8*

1.7 percent increase in incidence per pound increase in total dry matter ($P<0.001$).

* Significant difference from other production levels ($P<0.05$).

Milk production as a primary factor showed a significant affect on ketosis (see Table 1), but none of the significant secondary variables related to ketosis showed significant differences between the means; therefore, a discussion of the relationship of primary and secondary factors is omitted.

The primary factor of milk production revealed a significant affect on milk fever (see Table 1). The secondary nutritional factor of total pounds of dry matter at 270 days postpartum in the multiple regression analysis had a significant decreased affect on milk fever (see Table 18) and a significant difference in the means of the variable under milk production was observed. A study of the relationship of production level and milk fever incidence in Table 27 indicates again that milk fever increases as milk production increases with the highest incidence in the highest production level and significantly higher than the other production levels. In the secondary nutritional factor of dry matter at 270 days, a .49 percent decrease in incidence of milk fever is noted per pound increase in dry matter which is opposite in trend from outward appearance. Based on secondary variation in incidence of milk fever and total dry matter intake holding all other nutritional variables and significant primary sources of variation constant at their mean values, the regression statement is free from confounding by other variables; whereas, means are confounded because of unequal representation of other nutritional variables in various subclasses. For example, the nutritional variable of corn silage moisture has a mean which is going up as incidence is going down. Even though total pounds of dry matter and incidence of milk fever appear to be increasing with increased production, corn silage moisture is decreasing with increasing production level. If corn silage moisture is correlated with dry matter intake, that relationship and other nutritional ones like it which may not even have been measured, may be causing such a discrepancy.

The large herds reported an average of 35.7 pounds of dry matter intake at 270 days postpartum with a 3.6 percent incidence of milk fever placing them in line between the low and medium production groups. Their average production was 12,855 pounds of milk. The relationship of production level and pounds of dry matter fed at 270 days postpartum on incidence of milk fever is given in Table 27.

TABLE 27. Relationship of Production Level and Total Pounds of Dry Matter Fed at 270 Days Postpartum to Incidence of Milk Fever.

Production Level (Pounds of Milk)	% Incidence of Milk Fever#	Total Pounds Dry Matter
Low (<12,699)	4.1	35.5*
Medium (12,700-14,699)	5.5	38.2
High (>14,700)	11.4*	40.8

.49 percent decrease in incidence of milk fever per pound increase in total dry matter intake at 270 days postpartum ($P<0.001$).

* Significantly different than other production levels ($P<0.05$).

SUMMARY AND CONCLUSIONS

Fifty-four southern Michigan dairy farms were studied through a personal on the farm survey to define present dry cow feeding and management factors and determine what effect they may have on herd health problems.

Four chosen primary sources of variation in dry cow management were examined through an analysis of variance to determine their effect on herd health problems. Housing system had a significant effect on milk fever incidence ($P<0.03$) while the separation factor of dry cows affected milk fever ($P<0.11$) and mastitis ($P<0.10$). The interaction of housing system and separated had an effect on metritis ($P<0.09$) and ketosis ($P<0.11$). Herd size as a primary factor had no significant effect on herd health problems; however, the interaction of herd size and separated did affect metritis at a highly significant level ($P<0.01$). The primary factor of production level appeared to have affected the greatest number of herd health problems with a significant effect on retained placenta ($P<0.06$), metritis ($P<0.04$), ketosis ($P<0.11$) and milk fever ($P<0.01$).

Summary quantitative secondary nutritional and management parameters collected as supplementary survey data were tested through a multiple regression analysis at a significance level of $P<0.10$ on each studied herd health problem with the exception of mastitis, which was tested at the $P<0.05$ level because all variables remained at the higher significance level.

Secondary variables significantly related to displaced abomasum were roughage per hundredweight to milk cows, total dry matter intake at 270 days postpartum and dry days. Four nutritional variables, namely, total dry matter at 270 days postpartum, dry matter grain at 270 days postpartum, daily roughage pounds to milk cows and dry matter per hundredweight to dry cows, were significantly related to retained placenta. With respect to metritis, total dry matter intake at 40 days postpartum, percent days in milk, milk cow daily roughage pounds, roughage dry matter per hundredweight in dry cows, and dry matter grain at 270 days postpartum all were significantly related to metritis incidence. Only two variables were significantly related to ketosis. They were milk level and daily roughage per hundredweight to milk cows. Three variables were significantly related to milk fever and they were total dry matter at 270 days postpartum, milk level, and milk cow grain protein.

Finally, relationships of significant primary sources of variation and significant quantitative secondary factors with a significant difference in means of that factor within the primary category were studied with respect to their joint effect on herd health problems. The relationships studied were housing system and the secondary nutritional variable of milk cow grain protein in relation to milk fever, housing system and total dry matter intake at 270 days postpartum as related to milk fever, dry cow separation and milk cow grain protein to milk fever, production level and pounds of roughage as related to retained placenta, the relationship of production level and pounds of dry matter grain fed to milking cows at 270 days postpartum to retained placenta, the effect of production level and dry matter intake at 40 days postpartum to metritis, and the relationship of production level and total pounds of dry matter fed at 270 days postpartum to milk fever.

In summary, it is concluded that of the four chosen primary factors affecting herd health, production level significantly affects four herd health problems which is twice as many as the next closest primary factor. Housing system affects only milk fever while separation of dry cows does affect milk fever and mastitis but not at highly significant levels. Herd size, the fourth primary source of variation, had no significant effect on herd health.

Eleven of the 18 named quantitative secondary summary nutritional and management factors were pinpointed as significantly related to herd health problems. From the analysis of the significant secondary quantitative factors related to herd health, it is concluded that milk cow feeding and management factors are much more related to herd health incidence than dry cow feeding and management variables. Two secondary nutritional variables of roughage dry matter per hundred pounds of body weight in milk cows and total dry matter intake at 270 days postpartum were related to more herd health problems than other factors.

In the study of relationships of significant and secondary factors showing significant difference in means of the secondary factor within the primary category, it is evident that only the milk cow secondary nutritional factors of pounds of roughage to milk cows, pounds of dry matter grain to milk cows at 270 days postpartum, dry matter percent grain protein to milk cows and total pounds of dry matter to milk cows have a significant relationship with the primary factors of housing system, separation of dry cows and production level to explain the effect on herd health incidence.

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APPENDIX A

SUMMARY OF MAIL SURVEY

A total of 2,210 mail surveys were sent out to Michigan dairymen on one of the three state testing programs. A total of 1,110 (50.2 percent) were completed and returned with seven discarded from the analysis because of PBB contamination in their feed supply and dairy herds. Of those returned, 76.7 percent (846 herds) had the following characteristics: (1) in either stanchion, open-lot free stall, or covered free stall (cold or warm) systems of housing, and (2) were of the Holstein breed. These herds were utilized in the analysis and the results are reported in the following tables.

The author points out that a misunderstanding by some dairymen in interpretation of the open-lot free stall and covered free stall housing systems was obvious when making the farm visits to complete a personal interview with selected dairymen. The figures reported in these tables would tend to understate the herds in open-lot free stall and overstate those herds in cold covered (cold or warm) housing systems. One should review and interpret the results in the following tables with this misunderstanding in mind.

TABLE 1. General Herd Characteristics Based on Type of Housing and Yes or No Response to Dry Cow Separation from Milking Herd. (May, 1974 DHI Rolling Herd Average Figures Utilized)

Housing System		Number	Mean	Std. Dev.
HERD SIZE: Range of 13 to 363				
11	Stanchion-separated	91	45.0	16.5
12	Stanchion-not separated	211	34.4	14.2
41	Openlot free stall-separated	122	94.6	44.4
42	Openlot free stall-not separated	108	62.4	25.9
51	Covered free stall-separated	132	89.3	47.8
52	Covered free stall-not separated	118	59.2	25.5
MILK PRODUCTION: Range of 6,380 to 20,178 pounds				
11	Stanchion-separated	91	14,159	1,973
12	Stanchion-not separated	211	13,667	2,232
41	Openlot free stall-separated	122	13,689	1,760
42	Openlot free stall-not separated	108	13,560	1,722
51	Covered free stall-separated	132	13,828	1,742
52	Covered free stall-not separated	118	13,353	1,705
FAT PRODUCTION: Range of 236 to 780 pounds				
11	Stanchion-separated	91	524	76
12	Stanchion-not separated	211	507	87
41	Openlot free stall-separated	122	508	69
42	Openlot free stall-not separated	108	504	70
51	Covered free stall-separated	132	509	69
52	Covered free stall-not separated	118	494	67

TABLE 2. Characteristics of Lactating Cow Feeding Programs.

Question: Is corn silage fed to milking cows and if yes, is it free choice or fixed, and if fixed, what is the amount in pounds?

	Number	Percent	Pounds per cow per day: Mean	Pounds per cow per day: Std. Dev.
No	81	9.6		
Yes	765	90.4		
Free Choice	116	15.2		
Fixed	649	84.8	35.0	1.1

Question: When is corn silage harvested?

	Mean	Std. Dev.
1=Early dent 2=Soft dent 3=Late dent	2.2	.68

Question: Is hay fed to milking cows and if yes, what are the pounds per cow per day?

	Number	Percent	Pounds per cow per day: Mean	Pounds per cow per day: Std. Dev.
No	101	11.9		
Yes	745	88.1	12.0	1.10

Question: Is haylage fed to milking cows and if yes, is it free choice or fixed amount, and if fixed, what is the amount?

	Number	Percent	Pounds per cow per day: Mean	Pounds per cow per day: Std. Dev.
No	467	55.2		
Yes	379	44.8		
Free Choice	197	52.0		
Fixed	206	48.0	23.0	1.03

Question: How is haylage harvested?

Housing System		Number	Mean	Std. Dev.
11	Stanchion-separated	22	2.2	.43
12	Stanchion-not separated	43	2.4	.61
41	Openlot free stall-separated	80	2.5	.50
42	Openlot free stall-not separated	63	2.4	.53
51	Covered free stall-separated	88	2.5	.55
52	Covered free stall-not separated	68	2.4	.52

1=Direct Cut 2=Wilted 3=Low Moisture

Question: Are you feeding dry corn? If yes, what amount and what is the percent protein of grain ration?

	Number	Percent	Mean	Std. Dev.
No	228	27		
Yes	615	73		
Pounds fed per cow per day (Range of 3 to 50 pounds)			16.7	6.17
Percent protein in grain ration (Range of 7 to 22 percent)			14.3	2.12

Question: Are you feeding high moisture corn? If yes, is it ear or shelled, and what is the amount and percent protein in your grain ration?

	Number	Percent	Mean	Std. Dev.
No	556	66		
Ear corn	106	13		
Shelled corn	180	21		
Pounds fed per cow per day (Range of 5 to 45 pounds)			17.3	4.93
Percent protein in grain ration (Range of 7 to 28 percent)			13.6	2.90

Question: Are you feeding vitamins, minerals, and trace mineralized salt to milking cows?

	Vitamins		Minerals		T. M. Salt	
	Number	Percent	Number	Percent	Number	Percent
No	137	19	24	3	96	12
Yes	585	81	781	97	700	88

TABLE 3. Characteristics of Dry Cow Feeding Programs.

Question: Is corn silage fed to dry cows, and if yes, is it free choice or fixed, and if fixed, what is the amount in pounds?

			Pounds per cow per day	
	Number	Percent	Mean	Std. Dev.
No	184	22		
Free choice	192	23		
Fixed	470	55	28.0	1.21

Question: Is hay fed to dry cows and if yes, what are the pounds per cow per day and quality of hay?

			Pounds per cow per day	
	Number	Percent	Mean	Std. Dev.
No	89	10		
Yes	757	90	15.0	1.09

Housing System		Number	Mean	Std. Dev.
11	Stanchion-separated	63	2.1	.56
12	Stanchion-not separated	131	1.8	.54
41	Openlot free stall-separated	78	2.0	.43
42	Openlot free stall-not separated	50	1.9	.47
51	Covered free stall-separated	94	2.0	.53
52	Covered free stall-not separated	57	1.7	.57

1=High quality 2=Medium quality 3=Low quality

Question: Is haylage fed to dry cows and if yes, is it free choice or fixed, and if fixed, what is the amount?

			Pounds fed per cow per day	
	Number	Percent	Mean	Std. Dev.
No	562	66		
Free choice	134	16		
Fixed	150	18	21.0	1.05

Question: What percent of dry cows receive grain by housing system?

Housing System		Number	Mean	Std. Dev.
11	Stanchion-separated	99	40	1.77
12	Stanchion-not separated	226	70	1.64
41	Openlot free stall-separated	131	25	1.61
42	Openlot free stall-not separated	113	40	1.81
51	Covered free stall-separated	147	30	1.71
52	Covered free stall-not separated	130	40	1.80

Question: Are you feeding dry corn? If yes, what amount and what is the percent protein of the grain ration?

	Number	Percent	Mean	Std. Dev.
No	505	60		
Yes	337	40		
Pounds fed per cow per day (Range of 1 to 50 pounds)			6.2	4.74
Percent protein in grain ration (Range of 6 to 20 percent)			12.3	3.07

Question: Are you feeding vitamins, minerals, and trace mineralized salt to dry cows?

	Vitamins		Minerals		T. M. Salt	
	Number	Percent	Number	Percent	Number	Percent
No	138	24	35	5	94	13
Yes	436	76	673	95	631	87

Question: How would you describe the condition of your dry cows?

Housing System	Number	Mean	Std. Dev.
11 Stanchion-separated	99	2.1	.34
12 Stanchion-not separated	225	2.1	.37
41 Openlot free stall-separated	131	2.2	.39
42 Openlot free stall-not separated	113	2.2	.41
51 Covered free stall-separated	147	2.1	.36
52 Covered free stall-not separated	130	2.2	.45

1=Under condition 2=Average condition 3=Over condition

Question: When do your cows peak in production after calving?

Housing System	Number	Mean	Std. Dev.
11 Stanchion-separated	97	4.0	1.1
12 Stanchion-not separated	222	3.7	1.1
41 Openlot free stall-separated	128	3.9	1.2
42 Openlot free stall-not separated	112	3.9	.9
51 Covered free stall-separated	144	3.7	1.1
52 Covered free stall-not separated	126	3.8	1.1

1=1 week 2=2 weeks 3=3 weeks 4=4 weeks 5=5 weeks 6=6 weeks

Question: What was your calf mortality in 1973?

Housing System	Number	Mean	Std. Dev.
11 Stanchion-separated	99	3.8	.71
12 Stanchion-not separated	224	3.2	.74
41 Openlot free stall-separated	131	9.8	1.13
42 Openlot free stall-not separated	111	7.9	.93
51 Covered free stall-separated	147	9.1	1.08
52 Covered free stall-not separated	128	8.8	1.23
Herd Size			
<30	144	4.1	.84
30-59	357	5.8	.98
60-89	161	8.9	1.10
90-119	96	8.9	1.01
120-199	50	9.0	1.04
200-400	10	12.0	1.13

Milk Level (Pounds)	Number	Mean	Std. Dev.
<10,000	18	10.6	1.35
10-12,000	122	9.4	1.28
12-14,000	299	7.1	1.01
14-16,000	253	5.3	.78
16-18,000	72	4.7	.86
>18,000	12	1.7	.58

TABLE 4. Herd Health Problems Related to Feeding and Management of Dry Cows by System of Housing, Herd Size and Production Level.

DISPLACED ABOMASUM

	Number	% of[a] Herds	% per[b] Herd	% All Cows[c] All Herds
Housing System				
11 Stanchion-separated	99	20.2	3.6	.72
12 Stanchion-not separated	226	16.4	4.5	.73
41 Openlot f.s.-separated	131	34.4	2.8	.96
42 Openlot f.s.-not sep.	113	26.5	3.0	.77
51 Covered f.s.-separated	147	32.7	3.3	1.08
52 Covered f.s.-not sep.	130	23.1	3.7	.87
Herd Size				
<30	147	14.3	5.8	.83
30-59	358	23.2	3.1	.73
60-89	182	26.9	3.9	1.04
90-119	96	37.5	2.6	.96
120-199	50	32.0	2.4	.78
200-400	10	40.0	2.9	1.16
Production Level (Pounds of Milk)				
<10,000	18	5.6	3.9	.21
10-12,000	124	15.3	3.5	.54
12-14,000	302	24.5	3.1	.76
14-16,000	254	29.9	3.5	1.03
16-18,000	72	31.9	4.2	1.34
>18,000	12	41.7	5.0	2.09

a Percent of herds reporting incidence.
b Percent of cows in herds reporting incidence.
c Percent of all cows in all herds of housing system.

RETAINED PLACENTA

	Number	% of[a] Herds	% per[b] Herd	% All Cows[c] All Herds
Housing System				
11 Stanchion-separated	99	55.6	10.2	5.4
12 Stanchion-not separated	226	52.7	11.1	5.7
41 Openlot f.s.-separated	131	64.1	10.5	6.4
42 Openlot f.s.-not sep.	113	61.1	11.3	6.8
51 Covered f.s.-separated	147	65.3	11.3	6.4
52 Covered f.s.-not sep.	130	54.6	9.9	5.4
Herd Size				
<30	147	47.6	12.5	6.0
30-59	358	56.4	10.8	6.0
60-89	182	59.9	10.7	6.2
90-119	96	76.0	9.3	7.1
120-199	50	64.0	10.1	6.4
200-400	10	60.0	9.9	5.9
Production Level (Pounds of Milk)				
<10,000	18	33.3	9.0	3.0
10-12,000	124	52.4	11.2	5.9
12-14,000	302	58.9	10.8	6.2
14-16,000	254	61.4	10.4	6.4
16-18,000	72	61.1	10.1	5.9
>18,000	12	66.7	12.1	8.1

a Percent of herds reporting incidence.
b Percent of cows in herds reporting incidence.
c Percent of all cows in all herds of housing system.

METRITIS

	Number	% of[a] Herds	% per[b] Herd	% All Cows[c] All Herds
Housing System				
11 Stanchion-separated	99	15.2	9.4	1.4
12 Stanchion-not separated	226	14.6	17.3	2.5
41 Openlot f.s.-separated	131	39.7	14.6	5.8
42 Openlot f.s.-not sep.	113	29.2	17.3	4.9
51 Covered f.s.-separated	147	28.6	12.7	3.6
52 Covered f.s.-not sep.	130	19.2	14.2	2.6
Herd Size				
<30	147	12.9	16.8	2.2
30-59	358	20.4	15.3	3.1
60-89	182	24.7	14.3	3.4
90-119	96	40.6	14.4	5.7
120-199	50	40.0	13.4	5.4
200-400	10	40.0	5.8	2.3
Production Level (Pounds of Milk)				
<10,000	18	27.8	17.4	4.8
10-12,000	124	12.1	16.0	1.9
12-14,000	302	24.8	14.4	3.5
14-16,000	254	27.6	13.1	3.6
16-18,000	72	26.4	20.6	5.1
>18,000	12	41.7	11.6	4.8

a Percent of herds reporting incidence.
b Percent of cows in herds reporting incidence.
c Percent of all cows in all herds of housing system.

KETOSIS

	Number	% of[a] Herds	% per[b] Herd	% All Cows[c] All Herds
Housing System				
11 Stanchion-separated	99	37.4	6.9	2.2
12 Stanchion-not separated	226	39.4	8.8	3.3
41 Openlot f.s.-separated	131	28.2	5.2	1.5
42 Openlot f.s.-not sep.	113	35.4	4.3	1.5
51 Covered f.s.-separated	147	34.0	4.8	1.6
52 Covered f.s.-not sep.	130	29.2	5.8	1.7
Herd Size				
< 30	147	36.1	9.9	3.6
30-59	358	34.9	6.4	2.2
60-89	182	31.9	5.4	1.7
90-119	96	32.3	4.5	1.5
120-199	50	42.0	3.2	1.3
200-400	10	20.0	1.4	.3
Production Level (Pounds of Milk)				
< 10,000	18	16.7	4.6	.8
10-12,000	124	23.4	5.3	1.2
12-14,000	302	33.4	6.0	2.0
14-16,000	254	37.4	6.3	2.4
16-18,000	72	44.4	7.2	3.1
> 18,000	12	66.7	6.4	4.3

a Percent of herds reporting incidence.
b Percent of cows in herds reporting incidence.
c Percent of all cows in all herds of housing system.

MILK FEVER

	Number	% of[a] Herds	% per[b] Herd	% All Cows[c] All Herds
Housing System				
11 Stanchion-separated	99	54.5	6.1	3.3
12 Stanchion-not separated	226	58.4	7.7	4.4
41 Openlot f.s.-separated	131	68.7	5.4	3.6
42 Openlot f.s.-not sep.	113	66.4	8.3	5.2
51 Covered f.s.-separated	147	63.3	5.4	3.4
52 Covered f.s.-not sep.	130	64.6	7.1	4.5
Herd Size				
<30	147	51.0	8.3	4.2
30-59	358	61.5	7.0	4.2
60-89	182	67.6	6.3	4.1
90-119	96	71.9	6.2	4.5
120-199	50	64.0	4.5	2.9
200-400	10	70.0	4.1	2.9
Production Level (Pounds of Milk)				
<10,000	18	44.4	5.7	2.5
10-12,000	124	48.4	5.8	2.8
12-14,000	302	65.2	6.7	4.2
14-16,000	254	68.9	6.5	4.5
16-18,000	72	66.7	8.2	5.2
>18,000	12	58.3	12.3	7.2

a Percent of herds reporting incidence.
b Percent of cows in herds reporting incidence.
c Percent of all cows in all herds of housing system.

APPENDIX B

APPENDIX B

PERSONAL INTERVIEW

DAIRY DRY COW MANAGEMENT SURVEY

		Variable Number
Date________________________	Herd Code_ _ _ _ _ _ _ _ _	1
Name______________________________________	Housing System _	2
Address__________________________	Dry Cows Separated_ _	3
County_________________ Telephone_________	Herd Size _	4
	Production Level _	5
HERD AVERAGE (JULY-1974)	Cows _ _ _ _	6
	Milk _ _ _ _ _	7
	Fat _ _ _	8
	Test _ _ _	9
	% DIM _ _	10
Number of owners _		11
Age of owner(s) _ _, _ _, _ _		12,13,14

1. Describe ownership of dairy enterprise (54 Responses)

__1. Sole ownership (57%)
__2. Father-son partnership (24%)
__3. Brothers partnership (6%)
__4. Other related family partnership (4%) _ 15
__5. Unrelated family partnership (4%)
__6. Family corporation (0%)
__7. Other-specify (5%) ____________________

I. HOUSING

2. Where are your milking cows housed? (54 responses)
__1. Stanchion (33%)
__2. Open lot-free stall (33%) _ 16
__3. Covered free stall-cold (30%)
__4. Covered free stall-warm (4%)

3. Years in this type of housing. _ _ 17

4. Are your milking cows in dry lot year around?
__1. Yes __2. No _ 18

5. Where are your dry cows housed? (54 responses)*
__1. Stanchion (19%)
__2. Open lot bedded (31%) Prim. _ 19
__3. Open lot-free stall (28%)
__4. Covered free stall-cold (19%) Sec. _ 20
__5. Covered free stall-warm (3%)

*Only one secondary response.

6. Years in this system of housing. _ _ 21

7. Are your dry cows housed separately from milking cows in the winter? __1. Yes __2. No _ 22

8. Are your dry cows housed separately from milking cows in the summer? __1. Yes __2. No _ 23

9. Are your dry cows housed with any heifers as a group? __1. Yes __2. No _ 24

10. If yes, what age heifers? __1. Springing _ 25
__2. Bred _ 26
__3. Open _ 27

11. Are your dry cows kept in dry lot year around?
__1. Yes __2. No _ 28

II. FEEDING PROGRAM OF MILKING COWS

A. ROUGHAGE PROGRAM

12. Is corn silage fed in your roughage program?
__1. Yes __2. No _ 29

13. If yes, what time of the year is it fed? (52 responses) _ 30
__1. Summer-May thru September (0%)
__2. Winter-October thru April (46%)
__3. Both (54%)

14. If corn silage is fed during the summer feeding period, how is it fed? (28 responses) _ 31
__1. Free choice (21%) __2. Fixed amount (79%)

15. If free choice, how many pounds per cow per day? _ _ 32

16. If fixed amount, how many pounds per cow per day? _ _ 33

17. If corn silage is fed during the winter feeding period, how is it fed? (52 responses) _ 34
__1. Free choice (23%) __2. Fixed amount (77%)

18. If free choice, how many pounds per cow per day? _ _ 35

19. If fixed amount, how many pounds per cow per day? _ _ 36

20. Is NPN (non-protein nitrogen) added at time of ensiling? __1. Yes __2. No _ 37

21. At what stage of maturity is corn silage harvested? (52 responses) _ 38
__1. Early dent (0%)
__2. Soft dent (48%)
__3. Late dent (52%)

22. What is the fineness of chop of your corn silage? (52 responses) _ 39
__1. Less than 1/4 inch (10%)
__2. 1/4 inch (52%)
__3. 3/8 inch (26%)
__4. 1/2 inch (6%)
__5. 3/4 inch (6%)
__6. Greater than 3/4 inch (0%)

23. What is the average moisture content of your corn silage? _ _ 40

24. What type of structure is utilized in corn silage storage? (52 responses) _ 41
__1. Bunker silo (14%) __3. Both types (2%)
__2. Tower silo (80%) __4. Sealed storage (4%)

25. How is corn silage distributed and fed to milking cows? (52 primary, 8 secondary)
__1. Mechanical feeder in bunk (61%, 38%)* Prim. _ 42
__2. Mechanical transport to fenceline bunk (10%, 24%) Sec. _ 43
__3. Mechanical feeder in manger (2%, 0%)
__4. Feed cart-manually (25%, 38%)
__5. Bunker silo-self feeding (2%, 0%)

*First figure prim. source, second figure sec. source

26. Is grass silage (haylage) fed? __1. Yes __2. No_ 44

27. If yes, at what time of the year? (39 responses)
__1. Summer-May thru September (38%)
__2. Winter-October thru April (5%) _ 45
__3. Both (57%)

28. If haylage is fed during the summer feeding period, how is it fed? (38 responses) _ 46
__1. Free choice (45%) __2. Fixed amount (55%)

29. If free choice, how many pounds per cow per day?_ _ 47

30. If fixed amount, how many pounds per cow per day? _ _ 48

31. If haylage is fed during the winter feeding period, how is it fed? (24 responses) _ 49
__1. Free choice (13%) __2. Fixed amount (87%)

32. If free choice, how many pounds per cow per day?_ _ 50

33. If fixed amount, how many pounds per cow per day? _ _ 51

34. At what stage of maturity is haylage ensiled? (39 responses)
__1. Prebud (10%) __4. 1/4 bloom (23%)
__2. Bud (8%) __5. 1/2 bloom (21%) _ 52
__3. 1/10 bloom (33%) __6. Full bloom (5%)

35. What cuttings do you utilize as haylage?
__1. First cutting _ 53
__2. Second cutting _ 54
__3. Third cutting _ 55
__4. Fourth cutting _ 56

36. What degree of fineness of chop do you use on haylage? (39 responses)
__1. < 1/4 inch (8%) __4. 1/2 inch (17%) _ 57
__2. 1/4 inch (37%) __5. 3/4 inch (10%)
__3. 3/8 inch (23%) __6. >3/4 inch (5%)

37. How would you describe your haylage? (39 responses)
__1. Direct cut-over 70% moisture (0%)
__2. Wilted-60 to 70% moisture (56%) _ 58
__3. Low moisture-less than 60% moisture (44%)

38. What type of structure is utilized in haylage storage? (39 responses)
__1. Bunker silo (13%) __3. Both types (0%) _ 59
__2. Tower silo (56%) __4. Sealed storage (31%)

39. How is haylage distributed and fed to milking cows? (39 responses)
__1. Mechanical feeder in bunk (80%)
__2. Mechanical transport to fenceline bunk (13%)
__3. Mechanical feeder in manger (0%) _ 60
__4. Feed cart-manually (7%)
__5. Bunker silo-self feeding (0%)

40. Why do you include haylage in your roughage program for milking cows?
__1. Easier to handle with less labor required to harvest and feed out. _ 61
__2. Fits into feeding system with highly mechanized harvesting and less field losses. _ 62
__3. Nutritive value plus savings on purchased protein supplement. _ 63
__4. Fits rotation and means to get crop off early. _ 64

41. Have you encountered any management problems with haylage harvesting and storage in the past five years? __1. Yes __2. No _ 65

42. If yes, what were they?
__1. Chopped too fine--fat test and herd health problems. _ 66
__2. Chopped too coarse--poor packing with excessive heating. _ 67
__3. Chopped too dry--excessive heating and loss of digestible protein. _ 68
__4. Chopped too wet--high seepage losses. _ 69

43. Is hay fed to milking cows? __1. Yes __2. No _ 70

44. If yes, what time of the year is it fed? (44 responses)
__1. Summer-May thru September (2%)
__2. Winter-October thru April (21%) _ 71
__3. Both (77%)

45. If fed during the summer feeding period, how many pounds per cow per day? _ _ 72

46. If fed during the winter feeding period, how many pounds per cow per day? _ _ 73

47. How would you describe the quality of hay fed to milking cows? (44 responses)
__1. Excellent (7%) __4. Fair (9%) _ 74
__2. Very good (36%) __5. Poor (5%)
__3. Good (43%)

48. Compared with the past 5 years, what amounts of hay are you feeding now? (54 responses) _ 75
__1. More (15%) __2. Less (26%) __3. Same (59%)

49. If either more or less is indicated, why? (22 responses)*
__1. Availability (9%)
__2. Herd health problems (23%) Prim. _ 76
__3. Recommendation of M.S.U. dairy extension personnel (0%) Sec. _ 77
__4. Recommendation of veterinarian or feed salesman (0%)
__5. Other-specify (68%)____________________

*Only one secondary response.

50. If herd health problems is indicated, what problems did you encounter?
__1. Displaced abomasum _ 78
__2. Retained placenta _ 79
__3. Metritis _ 80
__4. Mastitis _ 81
__5. Ketosis _ 82
__6. Milk fever _ 83
__7. Fat cow _ 84

51. How many times per day is hay fed to milking cows during the summer feeding period? (39 responses)
__1. Once (43%) __3. Three or more (8%) _ 85
__2. Twice (40%) __4. Free choice (9%)

52. How many times per day is hay fed to milking cows during the winter feeding period? (43 responses) _ 86
__1. Once (26%) __3. Three or more (16%)
__2. Twice (56%) __4. Free choice (2%)

53. Do you feel sufficient bunk space is available to give all milking cows equal access and time to available hay? __1. Yes __2. No _ 87

54. Are milking cows on pasture during the summer feeding period? __1. Yes __2. No _ 88

55. If yes, what are the number of days on pasture? _ _ 89

56. What is the average pounds of roughage fed per cow per day on a dry matter basis? _ _ 90

57. What is the average weight of milking cows? _ _ _ _ 91

58. How many pounds of roughage dry matter are fed per hundred pounds of body weight? _ _ 92

B. GRAIN PROGRAM--MILKING COWS

59. How would you describe the total grain ration of the milking cows? (54 responses)
__1. Complete purchased feed (4%)
__2. Purchased feed grains balanced with protein, salt, minerals and vitamins (4%) _ 93
__3. Home grown feed grains supplemented with protein, salt, minerals and vitamins (83%)
__4. Only home grown grains--no protein supp. (9%)

60. What is the major source(s) of energy in the grain ration? (54 primary, 27 secondary)
__1. Dry ear corn (48%, 8%)* Prim. _ 94
__2. Dry shelled corn (15%, 11%)
__3. High moisture shelled corn (13%, 4%)
__4. High moisture shelled corn (24%, 4%) Sec. _ 95
__5. Oats (0%, 71%)
__6. Other-specify (0%, 2%)______________

*First figure prim. source, second figure sec. source.

61. What rate of grain feeding do you follow on mature cows? (54 responses)
__1. Light 4:1 (33%) _ 96
__2. Average 3:1 (50%)
__3. Heavy 2:1 (17%)

62. What rate of grain feeding do you follow on two year olds? (54 responses) _ 97
__1. Light 4:1 (33%)
__2. Average 3:1 (50%)
__3. Heavy 2:1 (17%)

63. What is the average amount of grain fed per cow per day 40 days after freshening? As fed basis _ _ 98
Dry matter basis _ _ 99

64. What is the average amount of grain fed per cow per day 270 days after freshening? As fed basis _ _ 100
Dry matter basis _ _ 101

65. What is the maximum pounds of grain any one cow receives in your herd per day? As fed basis _ _ 102
Dry matter basis _ _ 103

66. What is the percent protein in the grain ration on a dry matter basis? _ _ 104

67. What is the source of supplemental protein in your grain ration? (49 responses) _ 105
__1. Vegetable protein (57%)
__2. Non-protein nitrogen (4%)
__3. Both (39%)

68. Is liquid protein supplement used in your feeding program? __1. Yes __2. No _ 106

69. What is the degree of coarseness of the feed grain? (54 responses) _ 107
__1. Coarsely ground (26%)
__2. Medium ground (46%)
__3. Finely ground (4%)
__4. Crimped or rolled (24%)

70. How is the grain fed to milking cows? (54 responses)
__1. As one feed ingredient (76%)
__2. Mixed and fed with roughage (13%) _ 108
__3. Both (11%)

71. Where is grain fed to milking cows?
__1. Manger in barn _ 109
__2. Milking parlor _ 110
__3. Outside bunk _ 111
__4. Magnetic feeder _ 112
__5. Other-specify________________ _ 113

72. If magnetic feeders are used, what percent of the cows have magnets? _ _ 114

73. Are milking cows grouped? __1. Yes __2. No _ 115

74. If yes, on what basis? (3 responses) _ 116
__1. Milk production (100%)
__2. Age (0%)
__3. Time of calving (0%)

75. If cows are grouped, are grain ration ingredients and amounts adjusted to meet production and maintenance requirements? __1. Yes __2. No _ 117

76. Are you feeding supplemental calcium and phosphorous? __1. Yes __2. No _ 118

77. If yes, how? (53 primary, 23 secondary) Prim. _ 119
__1. Fixed amount in grain ration (68%, 17%)*
__2. Fixed amount in roughage ration (8%, 4%)
__3. Free choice in bunk (24%, 79%) Sec. _ 120

*First figure prim. source, second figure sec. source.

78. What mineral(s) are you feeding to milking cows?
__1. Dicalcium phosphate _ 121
__2. Steamed bonemeal _ 122
__3. Limestone (CaCo3) _ 123
__4. Monosodium phosphate _ 124
__5. Commercial mineral supplement _ 125
__6. Other-specify________________________ _ 126

79. Define milking cow mineral supplementation program (53 responses)
__1. High calcium, no P (0%)
__2. High calcium, low P (47%) _ 127
__3. No calcium, high P (4%)
__4. Low calcium, high P (9%)
__5. About equal Ca:P (40%)

80. Have you changed your mineral program in the past two years? __1. Yes __2. No _ 128

81. If yes, why? (40 primary, 11 secondary)*
__1. Availability (48%, 18%)** Prim. _ 129
__2. Price (2%, 0%)
__3. Herd health problems (2%, 9%) Sec. _ 130
__4. Recommendation of vet or feed salesman (23%, 46%) Tert. _ 131
__5. Recommendation of M.S.U. extension personnel (7%, 0%)
__6. Roughage program change (18%, 27%)

*Only one tertiary response.
**First figure prim. source, second figure sec. source.

82. Are your milking cows regularly receiving? (54 primary, 10 secondary)
__1. Trace mineralized salt (80%, 30%)*
__2. White salt (18%, 30%) Prim. _ 132
__3. Medicated (2%, 40%)
__4. No salt (0%, 0%) Sec. _ 133

*First figure prim. source, second is sec. source.

83. How is salt fed?
__1. Fixed amount in grain ration _ 134
__2. Free choice loose in feeder _ 135
__3. Free choice block in feeder _ 136

84. Are you feeding supplemental vitamins to the milking cows? __1. Yes __2. No _ 137

85. If yes, what period of the year? (44 responses)
__1. Winter months only (7%)
__2. Summer months only (2%) _ 138
__3. Both (91%)

86. Have you had any fat test problems over the past 10 years? __1. Yes __2. No _ 139

87. If yes, what was the major cause? (15 responses)
__1. Feeding and management (73%)
__2. Season (27%) _ 140
__3. Genetics (0%)

88. If feeding and management is indicated, how did you get out of the problem? (11 responses)*
__1. Increased amount of dry hay (27%) Prim. _ 141
__2. Decreased shelled corn portion (18%)
__3. Addition of feed additives in ration (0%)
__4. Other-specify (55%)________________ Sec. _ 142

*Only two secondary responses.

89. What is the total pounds of dry matter consumed for cows 40 days in production? _ _ 143

90. What is the total pounds of dry matter consumed for cows 270 days in production? _ _ 144

91. Describe condition of cows at peak production. (54 responses)
__1. Thin (17%)
__2. Good milking cond. (83%) _ 145
__3. Fat (0%)
__4. Too fat (0%)

92. Describe condition of cows at 270 days of production. (54 responses)
__1. Thin (13%) __3. Fat (31%) _ 146
__2. Desireable (56%) __4. Too fat (0%)

III. <u>FEEDING PROGRAM--DRY COWS</u>

A. ROUGHAGE PROGRAM

93. Are dry cows fed roughage separately from milking cows? __1. Yes __2. No _ 147

94. Is corn silage fed to dry cows? __1. Yes __2. No _ 148

95. If yes, at what time of the year? (44 responses)
__1. Summer-May thru September (0%) _ 149
__2. Winter-October thru April (61%)
__3. Both (39%)

96. If corn silage is fed during the summer feeding period, how is it fed? (17 responses) _ 150
__1. Free choice (6%) __2. Fixed amount (94%)

97. If free choice, how many pounds per day? _ _ 151

98. If fixed amount, how many pounds per day? _ _ 152

99. If corn silage is fed during the winter feeding period, how is it fed? (44 responses) _ 153
__1. Free choice (13%) __2. Fixed amount (87%)

100. If free choice, how many pounds per cow per day? _ _ 154

101. If fixed amount, how many pounds per cow per day? _ _ 155

102. Is NPN (non-protein nitrogen) added at time of ensiling? __1. Yes __2. No _ 156

103. At what stage of maturity is corn silage harvested? (44 responses)
__1. Early dent (0%)
__2. Soft dent (52%) _ 157
__3. Late dent (48%)

104. What is the fineness of chop of your corn silage? (44 responses)
__1. <1/4 inch (9%) __4. 1/2 inch (7%) _ 158
__2. 1/4 inch (54%) __5. 3/4 inch (7%)
__3. 3/8 inch (23%) __6. >3/4 inch (0%)

105. What is the average moisture content of your corn silage? _ _ 159

106. What type of structure is utilized in corn silage storage? (44 responses)
__1. Bunker silo (18%) __3. Both types (2%) _ 160
__2. Tower silo (78%) __4. Sealed storage (2%)

107. How is your corn silage distributed and fed to dry cows? (44 responses)*
__1. Mechanical feeder in bunk (55%) Prim. _ 161
__2. Mechanical transport to fenceline bunk (18%)
__3. Mechanical feeder to manger (0%)
__4. Feed cart-manually (23%) Sec. _ 162
__5. Bunker silo--self feeding (4%)

*Only three secondary responses.

108. Is grass silage (haylage) fed? __1. Yes __2.No _ 163

109. If yes, at what time of the year is it fed? (31 responses)
__1. Summer-May thru September (45%) _ 164
__2. Winter-October thru April (0%)
__3. Both (55%)

110. If haylage is fed during the summer feeding period, how is it fed? (31 responses)
__1. Free choice (55%) __2. Fixed amount (45%)_ 165

111. If free choice, how many pounds per cow per day? _ _ 166

112. If fixed amount, how many pounds per cow per day? _ _ 167

113. If haylage is fed during the winter feeding period, how is it fed? (17 responses)
__1. Free choice (12%) __2. Fixed amount (88%)_ 168

114. If free choice, how many pounds per cow per day? _ _ 169

115. If fixed amount, how many pounds per cow per day? _ _ 170

116. At what stage of maturity is haylage ensiled? (31 responses)
__1. Prebud (12%) __4. 1/4 bloom (26%) _ 171
__2. Bud (10%) __5. 1/2 bloom (29%)
__3. 1/10 bloom (16%) __6. Full bloom (7%)

117. What cuttings do you utilize as haylage?
__1. First cutting _ 172
__2. Second cutting _ 173
__3. Third cutting _ 174
__4. Fourth cutting _ 175

118. What degree of fineness of chop do you use on haylage? (31 responses)
__1. <1/4 inch (11%) __4. 1/2 inch (13%) _ 176
__2. 1/4 inch (32%) __5. 3/4 inch (13%)
__3. 3/8 inch (26%) __6. >3/4 inch (6%)

119. How would you describe your haylage with respect to moisture? (31 responses)
__1. Direct cut-over 70% moisture (0%) _ 177
__2. Wilted-60 to 70% moisture (55%)
__3. Low moisture-less than 60% (45%)

120. What is the legume-grass content of your haylage? (31 responses)
__1. Alfalfa-greater than 75% alfalfa (58%) _ 178
__2. Alfalfa grass-3/4 to 1/4 alfalfa:grass (42%)
__3. Grass-less than 1/4 alfalfa (0%)

121. What type of structure is utilized in haylage storage? (31 responses)
__1. Bunker silo (13%) __3. Both (0%) _ 179
__2. Tower silo (58%) __4. Sealed storage (29%)

122. How is haylage distributed and fed to milking cows? (31 responses)*
__1. Mechanical feeder in bunk (71%) Prim. _ 180
__2. Mechanical transport to fenceline bunk (23%)
__3. Mechanical feeder in manger (0%)
__4. Feed cart-manually (6%) Sec. _ 181
__5. Bunker silo--self feeding (0%)

*No secondary responses.

123. Do you provide any green chop to dry cows during the summer feeding period? __1. Yes __2. No _ 182

124. Is hay fed to dry cows? __1. Yes __2. No _ 183

125. If yes, at what time of the year? (46 responses)
__1. Summer-May thru September (0%)
__2. Winter-October thru April (33%) _ 184
__3. Both (67%)

126. If fed during the summer, how many pounds per cow per day? _ _ 185

127. If fed during the winter, how many pounds per cow per day? _ _ 186

128. How would you compare the quality of hay fed dry cows when compared to milking cows? (46 responses)
__1. Lower quality (39%)
__2. Equal quality (61%) _ 187
__3. Higher quality (0%)

129. What type of hay are you feeding to dry cows? (46 responses)
__1. Alfalfa-greater than 75% alfalfa (35%)
__2. Alfalfa grass-3/4 to 1/4 alfalfa:grass (57%) _ 188
__3. Grass-less than 1/4 alfalfa (8%)
__4. Other-specify (0%)____________________

130. Compared to the past 5 years, what amounts of dry hay are you feeding dry cows now? (54 responses) _ 189
__1. More (35%) __2. Less (19%) __3. Same (46%)

131. If either more or less is indicated, why? (29 responses)
__1. Availability (7%) Prim. _ 190
__2. Herd health problems (48%)
__3. Recommendation of M.S.U. dairy extension personnel (0%) Sec. _ 191
__4. Recommendation of veterinarian or feed salesman (0%)
__5. Other-specify (45%) ________________

*Only three secondary responses.

132. If herd health problems are indicated what problems did you encounter?
__1. Displaced abomasum _ 192
__2. Retained placenta _ 193
__3. Metritis _ 194
__4. Mastitis _ 195
__5. Ketosis _ 196
__6. Milk fever _ 197
__7. Fat cow _ 198

133. How many times per day is hay fed to dry cows during winter feeding period? (46 responses)
__1. Less than once (2%) __3. Twice (65%) _ 199
__2. Once (31%) __4. Free choice (2%)

134. Are dry cows on pasture during the summer feeding period? __1. Yes __2. No _ 200

135. If yes, what are the number of pasture days? _ _ _ 201

136. What is the average pounds of roughage fed per cow per day on a dry matter basis? _ _ 202

137. What is the average weight of dry cows? _ _ _ _ 203

138. How many pounds of roughage dry matter are fed per hundred pounds of body weight? _ _ 204

B. GRAIN PROGRAM--DRY COWS

139. What percent of cows receive grain at specified times of dry period and in what amounts on dry matter basis?

Period	Percent	Dry Matter Lbs.	
End of dry period	_ _ _	_ _	205,206
1 week prior to calving	_ _ _	_ _	207,208
2 weeks prior to calving	_ _ _	_ _	209,210
4 weeks prior to calving	_ _ _	_ _	211,212
Entire dry period	_ _ _	_ _	213,214

140. If dry cows are fed grain during any part of the dry period, how? (34 responses)*
__1. Individually (68%) Prim. _ 215
__2. In a group with milking cows (12%) Sec. _ 216
__3. Group with dry cows (20%) Tert. _ 217

*Only one secondary and no tertiary responses.

141. If dry cows are fed grain, is it a different ration than milking cows? __1. Yes __2. No _ 218

142. If dry cows are fed grain, how would you describe the ration? (34 responses)
__1. Complete purchased feed (12%)
__2. Purchased feed grains balanced with protein, salt, minerals and vitamins (0%)
__3. Home grown feed grains supplemented with protein, salt, minerals and vitamins (70%) _ 219
__4. Only home grown grains-no protein supplement added (18%)

143. What is the major source of energy in the grain ration? (34 primary, 13 secondary)
__1. Dry ear corn (41%, 0%)* Prim. _ 220
__2. Dry shelled corn (12%, 15%)
__3. High moisture ear corn (12%, 8%)
__4. High moisture shelled corn (27%, 0%) Sec. _ 221
__5. Oats (0%, 69%)
__6. Other-specify (8%, 8%)______________

*First figure prim. source, second figure sec. source.

144. What is the percent protein on a dry matter basis in the grain ration? _ _ 222

145. What is the source of supplemental protein in the grain ration? (26 responses) _ 223
__1. Vegetable protein (38%)
__2. Non-protein nitrogen (12%)
__3. Both (50%)

146. Is liquid protein supplement used in dry cow protein supplementation? __1. Yes __2. No _ 224

147. What is the degree of coarseness of dry cow grain? (31 responses) _ 225
__1. Coarsely ground (26%)
__2. Medium ground (45%)
__3. Finely ground (0%)
__4. Crimped or rolled (29%)

148. Where is grain fed to dry cows?
__1. Manger in barn _ 226
__2. Milking parlor _ 227
__3. Outside bunk _ 228
__4. Magnetic feeder _ 229

149. When is the major weight gain put on cows in preparation for next calving? (54 responses) _ 230
__1. Last 4 months of lactation (15%)
__2. Last 2 months of lactation (70%)
__3. Dry period (15%)

150. How many pounds of dry matter per hundred pounds of body weight are consumed by average dry cow? _ _ 231

151. Are you feeding supplemental calcium and phosphorous to dry cows? __1. Yes __2. No _ 232

152. If yes, how? (47 primary, 6 secondary)
__1. Fixed amount in grain ration (17%,50%)*Prim._ 233
__2. Fixed amount in roughage ration (8%, 0%)
__3. Free choice in bunk (75%, 50%) Sec. _ 234

*First figure prim. source, second figure sec. source.

153. What minerals are you feeding to dry cows?
__1. Dicalcium phosphate _ 235
__2. Steamed bonemeal _ 236
__3. Limestone (CaCo3) _ 237
__4. Monosodium phosphate _ 238
__5. Commercial mineral supplement _ 239
__6. Other-specify________________ _ 240

154. Define dry cow mineral supplementation program. (47 responses)
__1. High Ca, no P (0%)
__2. High Ca, low P (38%) _ 241
__3. No Ca, high P (7%)
__4. Low Ca, high P (21%)
__5. About equal Ca:P (34%)

155. Have you changed your mineral program in the past two years? __1. Yes __2. No _ 242

156. If yes, why? (29 primary, 7 secondary)*
__1. Availability (52%, 14%)** Prim. _ 243
__2. Price (3%, 0%)
__3. Herd health problems (0%, 14%) Sec. _ 244
__4. Recommendation of vet or feed salesman (21%,43%)
__5. Recommendation of M.S.U. dairy staff (7%, 0%)
__6. Change in roughage program (17%, 29%) Tert. _ 245

*Only one tertiary response.
**First figure prim. source, second figure sec. source.

157. Are your dry cows regularly receiving? (54 primary, 4 secondary)
__1. Trace mineralized salt (87%, 0%)* Prim. _ 246
__2. White salt (11%, 25%)
__3. Medicated (2%, 75%) Sec. _ 247
__4. No salt (0%, 0%)

*First figure prim. source, second figure sec. source.

158. How is salt fed?
__1. Fixed amount in grain ration _ 248
__2. Free choice loose in feeder _ 249
__3. Free choice block in feeder _ 250

159. Are you providing supplemental vitamins to dry cows? __1. Yes __2. No _ 251

160. If yes, how? (26 responses)
__1. Grain ration (42%) _ 252
__2. Muscle injection (19%)
__3. Mineral (39%)

161. If yes, when is it offered? (26 responses)
__1. Winter (8%)
__2. Summer (0%) _ 253
__3. Both (92%)

162. How would you describe the condition of your cows at freshening time? (54 responses)
__1. Thin (3%) __3. Fat (9%) _ 254
__2. Good flesh (42%) __4. Too fat (0%)

IV. HERD HEALTH

163. Indicate the number of cows in your herd over the past year that have experienced the following herd health problems within 45 days postpartum.

1. Displaced abomasum
   a. Number of cows _ _ 255
   b. Percent of herd _ _ 256

2. Retained placenta
   a. Number of cows _ _ 257
   b. Percent of herd _ _ 258

3. Metritis
   a. Number of cows _ _ 259
   b. Percent of herd _ _ 260

4. Ketosis
   a. Number of cows _ _ 261
   b. Percent of herd _ _ 262

5. Milk fever
   a. Number of cows _ _ 263
   b. Percent of herd _ _ 264

6. Mastitis
   a. Number of cows _ _ 265
   b. Percent of herd _ _ 266

164. Have you diagnosed any positive cases of fat or downer cows in the past year? __1. Yes __2. No _ 267

165. If yes, number of cows _ 268
percent of herd _ 269

166. Displaced abomasum
1. Is this incidence normal for a one year period? __1. Yes __2. No _ 270
2. Have you ever had a greater incidence during any one year compared to the past year?
__1. Yes __2. No _ 271
3. If yes, what dry cow management factor(s) most greatly reduced incidence? (15 responses)*
__1. Increased length of chop of fermented silages (0%) Prim. _ 272
__2. Increased hay fed to dry cows (27%)
__3. Decreased amount of dry shelled corn (0%)
__4. Decreased amount of high moisture shelled corn to dry cows (7%) Sec. _ 273
__5. Reduced or eliminated grain to dry cows (0%)
__6. Fed dry cows in separate group (7%)
__7. Other-specify (60%)__________ Tert. _ 274

*Only one secondary and tertiary response.

167. Retained placenta
1. Is this incidence normal for a one year period? __1. Yes __2. No _ 275
2. Have you ever had a greater incidence during any one year compared to the past year?
__1. Yes __2. No _ 276
3. If yes, what dry cow management factor(s) most greatly reduced incidence? (9 responses)*
__1. Change in mineral program (0%) Prim. _ 277
__2. Change in roughage program (22%)
__3. Change in grain program (11%) Sec. _ 278
__4. Dry cow separation from milking herd (0%)
__5. Shorter dry period (0%) Tert. _ 279
__6. Other-specify (67%)____________

*Only one secondary and no tertiary responses.

168. Metritis

1. Is this incidence normal for a one year period? __1. Yes __2. No _ 280
2. Have you ever had a greater incidence during any one year compared to the past year?
   __1. Yes __2. No _ 281
3. If yes, what dry cow management factor(s) most greatly reduced incidence? (6 responses)*
   __1. Change in mineral program (17%) Prim. _ 282
   __2. Change in roughage program (66%)
   __3. Change in grain program (0%) Sec. _ 283
   __4. Separation of dry cows (0%)
   __5. Other-specify (17%)__________ Tert. _ 284

*Only three secondary and no tertiary responses.

169. Ketosis

1. Is this incidence normal for a one year period? __1. Yes __2. No _ 285
2. Have you ever had a greater incidence during any one year compared to the past year?
   __1. Yes __2. No _ 286
3. If yes, what dry cow management factor(s) most greatly reduced incidence? (18 responses)*
   __1. Reduction or elimination of grain during dry period (0%) Prim. _ 287
   __2. Putting on major weight gain in late lactation rather than dry period (6%)
   __3. Restricting fermented silage during dry period (12%) Sec. _ 288
   __4. Increasing amount of dry hay to dry cows (0%) Tert. _ 289
   __5. Separation of dry cows (6%)
   __6. Other-specify (76%)____________

*Only two secondary and one tertiary responses.

170. Milk fever
   1. Is this incidence normal for a one year period? __1. Yes __2. No _ 290
   2. Have you ever had a greater incidence during any one year compared to the past year?
      __1. Yes __2. No _ 291
   3. If yes, what dry cow management factor(s) most greatly reduced incidence? (18 primary, 4 secondary)* Prim. _ 292
      __1. Reduction of corn silage (11%, 0%)**
      __2. Reduction or elimination of hay (0%, 25%)
      __3. Increased hay to dry cows (6%,0%) Sec. _ 293
      __4. Reduction of legume percent in hay (6%,0%)
      __5. Change in mineral program (21%, 50%)
      __6. Separation of dry cows (6%,0%) Tert. _ 294
      __7. Prepartum treatment of potential milk fever cows (0%, 0%)
      __8. Other-specify (50%, 25%)________

   *Only one tertiary response.
   **First figure prim. source, second figure sec. source.

171. Mastitis
   1. Is this incidence normal for a one year period? __1. Yes __2. No _ 295
   2. Have you ever had a greater incidence during any one year compared to the past year?
      __1. Yes __2. No _ 296
   3. If yes, what dry cow management factor(s) most greatly reduced incidence? (17 responses)*
      __1. Adoption of dry cow mastitis therapy program (41%) Prim. _ 297
      __2. Adoption of new drying off procedure (0%)
      __3. Less grain during dry period (0%) Sec. _ 298
      __4. Less corn silage during dry period (6%)
      __5. Separation of dry cows (0%) Tert. _ 299
      __6. Other-specify (53%)_____________

   *Only one secondary and no tertiary responses.

V. GENERAL MANAGEMENT--DRY COWS

172. What is the average number of dry days per cow in your herd? _ _ 300

173. How many times after last normal milking is dry cow milked? _ _ 301

174. How many days does it take? _ _ 302

175. If dry cows are sorted from the milking herd, when are they moved out? (27 responses) _ 303
__1. Last normal milking (40%)
__2. One week after last normal milking (56%)
__3. Two or more weeks after last normal milking (4%)

176. Is roughage intake reduced at drying off time? _ 304
__1. Yes __2. No

177. Is grain intake reduced at drying off time? _ 305
__1. Yes __2. No

178. Which dry cow mastitis management program do you follow? (54 responses) _ 306
__1. Bacteriological culture and treatment (2%)
__2. Screening test reaction (treat only positive quarters) (0%)
__3. Treatment of previously clinical quarters (37%)
__4. Treat all--no test used (44%)
__5. Combination (6%)
__6. No treatment (11%)

179. How would you describe the mastitis incidence in your dry cows over the past 5 years? (54 responses) _ 307
__1. Increased (4%)
__2. Decreased (39%)
__3. No change (57%)

180. If decreased, why? (20 responses)*
__1. Better drying off practices (5%) Prim. _ 308
__2. More rigid dry cow mastitis prevention (70%)
__3. Better milking cow practices (0%) Sec. _ 309
__4. Better housing and handling facilities for dry cows (0%) Tert. _ 310
__5. Improved dry cow feeding program (25%)

*Only two secondary and no tertiary responses.

181. What percent of your cows have you treated for udder edema in the past year? _ _ _ 311

182. Where do your cows calve during the summer season? (54 primary, 15 secondary)*
__1. Special maternity stall (43%,13%)** Prim. _ 312
__2. Dry lot area (43%, 54%) Sec. _ 313
__3. Pasture (12%, 20%) Tert. _ 314
__4. Other (2%, 13%)

*No tertiary responses.
**First figure prim. source, second figure sec. source.

183. Where do your cows calve in the winter season? (54 primary, 16 secondary)*
__1. Special maternity stall (83%,13%)** Prim. _ 315
__2. Dry lot area (4%, 63%) Sec. _ 316
__3. Stanchion (9%, 6%) Tert. _ 317
__4. Other (4%, 18%)

*No tertiary responses.
**First figure prim. source, second figure sec. source.

184. If special maternity stalls are provided, what is the area in square feet? _ _ _ 318

185. Is maternity area cleaned and bedded after every calving? __1. Yes __2. No _ 319

186. What type of bedding is utilized in calving area? (48 responses) _ 320
__1. Straw (88%)
__2. Sawdust or shavings (2%)
__3. Other-specify (10%)______________

187. How would you describe bedding moisture at time of calving? (48 responses) _ 321
__1. Dry (50%) __3. Wet (2%)
__2. Damp (48%) __4. Very wet and sloppy (0%)

188. What is the calf mortality in your herd the past 12 months including stillborns? _ _ 322

189. What individual(s) in your dairy enterprise is given major responsibility of dry cow management including through calving? (54 primary, 15 secondary)*

__1. Owner(s) (94%, 13%)** Prim. _ 323
__2. Wife of owner(s) (0%, 33%)
__3. Children of owners (0%, 27%) Sec. _ 324
__4. Hired labor (6%, 27%)
__5. Other (0%, 0%) Tert. _ 325

*Only three tertiary responses.
**First figure prim. source, second figure sec. source.

190. What percent of the cows in your herd have peaked at the following levels in the first 45 days of calving within the past year?

		Percent
1.	Above 100 pounds	_ _ 326
2.	90 to 100 pounds	_ _ 327
3.	80 to 89 pounds	_ _ 328
4.	70 to 79 pounds	_ _ 329
5.	60 to 69 pounds	_ _ 330
6.	50 to 59 pounds	_ _ 331

191. Are you satisfied with your present dry cow management program? __1. Yes __2. No _ 332

192. If no, what would you like to change? (16 primary, 10 secondary)*

__1. Separate dry cows from milking herd (50%, 20%)**
__2. New feeding and housing facilities for dry cows (38%, 50%) Prim. _ 333 Sec. _ 334
__3. More individual attention to dry cows (0%, 0%) Tert. _ 335
__4. Feed more hay (0%, 20%)
__5. Other-specify (12%, 10%)__________

*Only two tertiary responses.
**First figure prim. source, second figure sec. source.

193. Plans for changes in dry cow management in next five years.

____

____

____

____

194. General comments about present dry cow management program.

____

____

____

____

____

APPENDIX C

TABLE 1. Means and Standard Deviations of Quantitative Variables of Survey Herds.

Variable Number and Name		54 Survey Herds			10 Large Herds		
		Number	Mean	Std. Dev.	Number	Mean	Std. Dev.
6	No. of cows	54	67.8	36	10	379.8	378
7	Milk level	54	13611	2064	10	12855	933
8	Fat level	54	501	80	10	477	35
9	% test	54	3.7	.1	10	3.7	.1
10	% DIM	54	87.0	3.6	10	87.1	2.4
11	No. of owners	53	1.5	.7	7	2.1	.7
12	Age-owner 1	53	47.6	11.2	7	53.9	10.7
13	Age-owner 2	21	34.4	11.6	6	36.7	8.4
14	Age-owner 3	5	26.2	6.2	2	25.5	6.4
17	Yrs. housing-milk cows	54	16.7	19.7	10	8.4	5.3
21	Yrs. housing-dry cows	54	12.3	16.3	10	9.7	5.6
32	Lbs. free choice corn sil.--summ. (milk cows)	5	62.6	20.2	2	66.0	5.7
33	Lbs. fixed corn sil.--summer (milk cows)	23	30.2	10.6	2	40.5	13.4
35	Lbs. free choice corn sil.--wint. (milk cows)	11	58.0	14.3	3	64.0	5.3
36	Lbs. fixed corn sil.--wint. (milk cows)	41	38.6	11.3	6	40.2	16.8
40	Corn sil. moist.	52	65.2	3.7	9	66.6	2.6

TABLE 1. (Cont'd.)

Variable Number and Name		54 Survey Herds Number	Mean	Std. Dev.	10 Large Herds Number	Mean	Std. Dev.
47	Lbs. free choice hayl.--summer (milk cows)	17	54.4	11.8	3	47.7	6.8
48	Lbs. fixed hayl.-summer (milk cows)	21	33.6	14.4	2	20.0	14.1
50	Lbs. free choice hayl.--winter (milk cows)	3	49.0	7.9	1	50.0	0.0
51	Lbs. fixed hayl.-winter (milk cows)	21	22.4	8.5	3	18.3	7.6
72	Lbs. hay-summer milk cows	35	12.4	5.2	8	8.5	3.8
73	Lbs. hay-winter milk cows	43	2.7	.9	8	9.5	4.8
89	Days on past.	9	116	46	0	0.0	0.0
90	Daily dry matter rough.-milk cows	54	28.3	3.6	10	27.3	2.3
91	Wt.-milk cows	54	1276	59	10	1272	42
92	Daily rough. D.M./Cwt. milk cows	54	3.3	.2	10	2.1	.2
98	As fed grain @ 40 days p.p.-milk cows	54	19.8	5.4	10	23.7	5.5
99	D.M. grain @ 40 days p.p.-milk cows	54	16.4	4.5	10	19.2	4.4
100	As fed grain @ 270 days p.p.-milk cows	54	12.4	4.8	8	13.1	3.2
101	D.M. grain @ 270 days p.p.-milk cows	54	10.2	3.7	8	10.5	2.1

TABLE 1. (Cont'd.)

Variable Number and Name		54 Survey Herds Number	Mean	Std. Dev.	10 Large Herds Number	Mean	Std. Dev.
102	Max. as fed grain-milk cows	54	25.8	8.2	10	27.3	6.1
103	Max. D. M. grain-milk cows	54	21.4	7.1	10	22.1	5.0
104	D. M. grain protein-milk cows	54	14.3	3.1	10	15.7	1.6
114	% magnets	3	34	15	1	16	0.0
143	Total D. M. @ 40 days p.p.-milk cows	54	44.4	5.0	10	46.1	4.4
144	Total D. M. @ 270 days p.p.-milk cows	54	38.2	4.7	10	35.7	5.3
151	Lbs. free choice corn sil.-summer (dry cows)	1	85.0	0.0	1	65.0	0.0
152	Lbs. fixed corn sil.-summer (dry cows)	16	24.9	10.7	3	44.7	8.1
154	Lbs. free choice corn sil.-winter (dry cows)	5	62.0	16.0	1	65.0	0.0
155	Lbs. fixed corn sil.-winter (dry cows)	39	31.1	12.6	9	39.3	9.6
159	Corn sil. moist.	44	65.4	3.3	10	66.4	2.5
166	Lbs. free choice hayl.-summer (dry cows)	16	55.3	12.2	0	0.0	0.0
167	Lbs. fixed corn sil.-summer (dry cows)	15	32.1	15.3	1	10.0	0.0
169	Lbs. free choice hayl.-winter (dry cows)	2	46.0	8.4	0	0.0	0.0
170	Lbs. fixed hayl.-winter (dry cows)	15	22.3	12.6	2	21.5	9.2

TABLE 1. (Cont'd.)

Variable Number and Name		54 Survey Herds Number	Mean	Std. Dev.	10 Large Herds Number	Mean	Std. Dev.
185	Lbs. hay-summer (dry cows)	31	15.0	10.0	8	14.6	8.7
186	Lbs. hay-winter (dry cows)	46	19.0	9.6	10	12.1	1.9
201	Days on past.	14	138	48	1	178	0.0
202	Daily roughage D. M. (dry cows)	54	27.9	3.5	10	27.3	3.9
203	Wt.-dry cows	54	1376	61	10	1380	33
204	Daily D.M./Cwt. (dry cows)	54	20.2	2.3	10	19.9	2.7
205	% cows rec. grain @ end of dry period	34	94.3	19.5	4	100	0.0
206	D.M. grain @ end of dry period	34	6.8	4.1	4	3.3	1.0
207	% cows rec. grain @ 1 wk. prepart.	34	90.0	22.6	4	100	0.0
208	D.M. grain @ 1 wk. prepartum	34	6.4	4.0	4	3.3	1.0
209	% cows rec. grain 2 wks. prepart.	32	88.0	25.1	4	100	0.0
210	D.M. grain @ 2 wks. prepartum	32	5.6	3.4	4	3.3	1.0
211	% cows rec. grain 4 wks. prepart.	25	87.8	25.7	3	100	0.0
212	D.M. grain @ 4 wks. prepartum	25	5.6	3.7	3	3.0	1.0
213	% cows rec. grain all dry period	25	86.1	28.4	3	100	0.0

TABLE 1. (Cont'd.)

Variable Number and Name		54 Survey Herds			10 Large Herds		
		Number	Mean	Std. Dev.	Number	Mean	Std. Dev.
214	D.M. grain all dry period	25	5.6	3.7	3	3.0	1.0
222	D.M. grain prot.	34	16.2	11.0	4	13.8	3.3
231	Daily D.M./cwt. (dry cows)	54	22.3	3.5	10	20.6	2.8
255	No. of Dis. Ab.	54	1.1	2.1	10	5.3	4.5
256	% Dis. Abomasum	54	1.3	2.4	10	1.5	1.6
257	No. Ret. Plac.	54	10.0	7.9	10	40.8	24.8
258	% Ret. Placenta	54	14.7	7.5	10	13.5	7.1
259	No. Metritis	54	12.5	14.8	10	51.3	33.3
260	% Metritis	54	17.4	15.5	10	16.3	10.1
261	No. Ketosis	54	3.0	4.7	10	7.6	12.3
262	% Ketosis	54	4.9	8.1	10	2.2	3.4
263	No. Milk Fever	54	4.7	6.9	10	9.7	4.4
264	% Milk Fever	54	7.0	7.1	10	3.6	2.1
265	No. Mastitis	54	13.1	9.5	10	50.4	30.8
266	% Mastitis	54	21.3	14.6	10	17.0	9.3
268	No. Downer Cows	54	.15	.5	10	.5	1.1
269	% Downer Cows	54	.22	.7	10	.2	.4
300	Number-dry days	54	55.2	9.6	10	57.7	13.2
301	X milked after last normal	35	3.1	1.8	3	4.3	3.1
302	Days to dry off	35	4.7	2.2	3	7.0	5.0

TABLE 2. Responses to Questions Requiring Yes or No Answers in Survey Herds.

Variable Number and Name		54 Survey Herds		10 Large Herds	
		Number	Percent Yes	Number	Percent Yes
18	Drylot-milk cows	54	85	10	100
22	Dry cows hous. sep. from milk cows-winter	54	50	10	100
23	Dry cows hous. sep. from milk cows-summer	54	44	10	100
24	Dry cows hous. with heifers	54	52	10	50
28	Dry cows drylot-all yr.	54	78	10	90
29	Corn sil. fed milk cows	54	94	10	90
37	NPN added at ensiling	52	38	9	28
44	Haylage fed milk cows	54	72	10	50
65	Mgt. problems haylage	39	23	5	0
70	Hay milk cows	54	81	10	80
87	Suff. bunk space-milk cows	43	84	8	87
88	Summer past.-milk cows	54	17	10	0
106	L. P. N.-milk cows	54	9	10	0
115	Milk cows grouped	54	6	10	90
117	Grain adj. for prod. and maint.-milk cows	54	6	10	10
118	Supp. Ca & P-milk cows	54	98	10	100
128	Mineral change-milk cows	54	72	10	50
137	Vit. supp.-milk cows	54	81	10	60

TABLE 2. (Cont'd.)

Variable Number and Name		54 Survey Herds Number	54 Survey Herds Percent Yes	10 Large Herds Number	10 Large Herds Percent Yes
139	Fat test problems	54	28	10	20
147	Dry cows fed rough. sep.	54	48	10	100
148	Corn silage dry cows	54	18	10	100
156	NPN added at ensiling	44	61	10	20
163	Haylage dry cows	54	57	10	30
182	Summ. green chop	54	9	10	20
183	Hay dry cows	54	85	10	100
200	Pasture dry cows	54	24	10	10
218	Diff. ration-dry cows	34	15	4	75
224	L. P. N.-dry cows	54	9	10	0
232	Supp. Ca & P-dry cows	54	87	10	90
242	Mineral change-dry cows	54	54	10	50
251	Vitamin supp.-dry cows	54	48	10	20
267	Fat cow problem	54	9	10	20
270	Dis. Ab. inc. normal	54	87	10	90
271	Greater Dis. Ab. inc.	54	28	10	40
275	Ret. Plac. inc. normal	54	67	10	80
276	Greater Ret. Plac. inc.	54	17	10	10
280	Metritis inc. normal	54	76	10	80
281	Greater metritis inc.	54	11	10	20
285	Ketosis inc. normal	54	87	10	90
286	Greater ketosis inc.	54	33	10	30

TABLE 2. (Cont'd.)

Variable Number and Name		54 Survey Herds		10 Large Herds	
		Number	Percent Yes	Number	Percent Yes
290	Milk fever normal	54	91	10	100
291	Greater milk fever inc.	54	33	10	20
295	Mastitis inc. normal	54	76	10	90
296	Greater mastitis inc.	54	30	10	10
304	Rough. red. drying off	54	13	10	10
305	Grain red. drying off	54	83	10	70
319	Maternity area cleaned	48	34	9	33
332	Satisfied with present dry cow management	54	70	10	80

TABLE 3. Subdivision of Certain Positive Responses to Dry Cow Survey.

Variable Number and Name		Number	
24	Dry cows housed with heifers? (52% yes)	28	
	25 Springing heifers		26
	26 Bred heifers		23
	27 Open heifers		7
44	Haylage fed to milk cows? (72% yes)	39	
	53 First cutting		39
	54 Second cutting		18
	55 Third cutting		16
	56 Fourth cutting		16
44	Haylage fed to milk cows, why? (72% yes)	39	
	61 Ease of handling and less labor		25
	62 Fits feeding system-highly mechanized		11
	63 Nutritive value		21
	64 Fits rotation and means to beat weather		17
65	What mgt. problems with haylage harvesting and storing? (23% yes)	9	
	66 Chopped too fine-fat test and herd health problems		0
	67 Chopped too coarse-poor packing		1
	68 Chopped too dry-excessive heating		8
	69 Chopped too wet-high seepage		1

TABLE 3. (Cont'd.)

Variable Number and Name		Number
	Herd health problems from more or less hay	
78	Displaced abomasum	2
79	Retained placenta	1
80	Metritis	1
81	Mastitis	0
82	Ketosis	0
83	Milk fever	1
84	Fat cow	3
	Where is grain fed to milking cows?	
109	Manger in barn	22
110	Milking parlor	23
111	Outside bunk	7
112	Magnetic feeder	3
113	Other	6
118	Are you feeding supp. Ca & P to milk cows? (98%) 53	
121	Dicalcium phosphate	10
122	Steamed bonemeal	3
123	Limestone (CaCo3)	3
124	Monosodium phosphate	4
125	Commercial	44
126	Other	3

TABLE 3. (Cont'd.)

Variable Number and Name		Number	
	How is salt fed to milk cows?		
	134 Fixed amount in grain ration		41
	135 Free choice loose in feeder		36
	136 Free choice block in feeder		16
163	Is haylage fed to dry cows? (57% yes)	31	
	172 First cutting		31
	173 Second cutting		12
	174 Third cutting		9
	175 Fourth cutting		2
	Herd health problems with more or less hay.		
	192 Displaced abomasum		7
	193 Retained placenta		3
	194 Metritis		3
	195 Mastitis		1
	196 Ketosis		2
	197 Milk fever		2
	198 Fat cow		6

TABLE 3. (Cont'd.)

Variable Number and Name		Number
	Where is grain fed to dry cows?	
	226 Manger in barn	14
	227 Milking parlor	7
	228 Outside bunk	14
	229 Magnetic feeder	0
232	Are you feeding supp. Ca & P to dry cows?	47
	235 Dicalcium phosphate	3
	236 Steamed bonemeal	3
	237 Limestone (CaCo3)	0
	238 Monosodium phosphate	4
	239 Commercial mineral supplement	45
	240 Other	1
	How is salt fed to dry cows?	
	248 Fixed amount in grain ration	11
	249 Free choice loose in feeder	34
	250 Free choice block in feeder	18