AGRICULTURAL SYSTEMS ENGINEERING

Agricultural and Structural Engineering

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Farmstead Engineering, Livestock Housing
Manure Management, Ventilation Systems
Mastitis Control, Grain Handling/Storage
Electrical Systems, Extraneous Voltage
Milking System Design/Evaluation

EXTRANEOUS VOLTAGE

WOLBECK DAIRY
Sam, Jeanine, and Donald Wolbeck
Sauk Centre, Minnesota

Evaluation of Changes in Service Drop Configuration
and Herd Health Assessment

Report Prepared on Behalf of and Submitted to
Minnesota Department of Public Service

ASE Project No. 702:9369

Prepared by:
Gerald R. Bodman, P.E.
December 24, 1993

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Gerald R. Bodman, P.E.

Date 12/24/93 Registration No. 17199

Consultant's Report

The purpose of this report is to set forth the results of a review of various documents pertaining to changes in the electrical system servicing the Wolbeck dairy farm and data submitted regarding the herd health assessment which was conducted. This report has been prepared under contract with the Minnesota Department of Public Service.

BACKGROUND

Previously reviewed documents indicate substantial work has been conducted on this farm at various times. The background information previously reviewed was summarized in a report dated May 25, 1993. No attempt will be made to restate information previously discussed.

The present report is based upon review of the following documents:

1. "Stray Voltage Test and Reconstruction on Don and Jeanine Wolbeck Farm" dated November 15, 1993.

2. "Herd Health Assessment Data on Don and Jeanine Wolbeck Farm" dated December 1, 1993.

These reports were subsequently complemented with color copies of the dc voltage graphs for the two on-site test days. The color graphs replaced those presented in black and white as part of the listed November 15, 1993 report.

ELECTRICAL SYSTEM TESTS

The first series of tests was conducted September 24, 1993. These were intended to document conditions with the pre-existing or "as is" electrical system. The underground service drops and pad-mount transformers were subsequently replaced with pole-mount transformers and overhead service drops to the Wolbeck farm installation. A second set of tests was conducted October 12, 1993 after reconfiguration of the service drops. Information received indicates the tests were conducted under very similar conditions except that during the first series of tests the pumps at the Amoco Pumping Station near the Wolbeck dairy were not operational. The data indicate the underground primary system with the bare concentric neutral and the pad-mount transformers has been in place since October 1990. This configuration was requested by the Wolbecks as a result of extraneous voltage testing performed during the winter of 1989.

On-Farm Concerns

Prior to reconstruction of the electrical system, several areas of concern with the electrical system were identified. Under the heading "General Farm Wiring Configurations" these are noted as being a neutral wire which had been cut near the ground on the pole on the north side of the south house. In actuality, this was probably a grounding conductor, as compared to a grounded conductor. Had this been a neutral or grounded conductor, at least some components of the electrical equipment on the farm (115 Vac) would have been either inoperational or would have operated erratically. If, in fact, this was a grounding conductor, the decision to cut it would have been an error, since doing so reduces the safety of the electrical system. On the other hand, if it really was a neutral, i.e., grounded, conductor further documentation is warranted. In either event, care is necessary to assure an accurate record.

A second statement indicated that a wire coming out of the milkhouse window was hooked to the primary side of the pad-mounted transformer. The statement continues that after removal of the pad-mount transformer, the wire was attached to a buried concentric neutral. (Note: This appears contradictory as the report indicates the underground primary was replaced with a pole mount transformer and overhead secondary.) Under the original as-found condition, this would have represented a bypass of the neutral isolator.

The seriousness of these two deficiencies as stated in the report warrant further identification and clarification. Attachment of a conductor to the primary side of the transformer means someone was working with conductors charged with primary voltage (7200 V ?).

The diagrams of the farm do not give any indication of conductor size, length, or type. Thus, the appropriateness of the installation with respect to conductors cannot be assessed. The second diagram indicates that an overhead transformer with overhead secondary conductor was installed as noted above. That being the case, it is unclear where the connection of the wire passing through the milkhouse window was connected since there technically is no longer a bare concentric neutral servicing this farm.

ELECTRICAL TESTS

dc Voltage

Examination of the dc test data reflects voltages up to 0.72 V measured from the milkline to a reference half cell. However, since all readings were taken to the same reference point, the value of concern is the difference between individual tests. In this case, voltages were always of 0.4 Vdc or less, except during starting and stopping of tests and changing of equipment. The tests indicate the milkline and waterline are reasonably well bonded together. All tests reflect minimal voltage. They also demonstrate little or no current-producing capacity as evidenced by the decrease in voltage when the circuit was loaded with a 500-ohm resistor.

ac Voltage

Examination of the animal contact voltages reveal voltages of 0.3 Vac or less in all instances except for spikes which appear to be associated with equipment starts. These voltages are all of a magnitude considered non-problematic.

Voltage measurements between the phase conductor and the secondary neutral reflect supply voltages which are within the normal range of 120 ± 5% (114 - 126 Vac). A decrease in supply voltage (oftentimes referred to as a voltage sag) is evident on several occasions. This appears to be associated with equipment starts and is considered normal. Excessive dimming of lights during motor starts would suggest a bad connector or a phase conductor or improper sizing of the conductors.

Examination of the Wave Rider tests show voltage of 0.4 Vac or less within the cow environment except for several spikes which appear to be associated with equipment starts. The use of resistors revealed little or no current-producing capacity.

As contrasted to the earlier configuration, the graph of line voltage during the October 12, 1993 tests does show wider variation. Numerous spikes, presumably associated with equipment starts, show voltages dropping below 114 Vac. These would be reflected on the farm as dimming of lights during equipment starts and possible slow starts of motors. The data indicate a need to re-evaluate the size of the secondary service conductors which have been installed.

The data identified under VIII as Amoco information reflect little variation between the September 23 and October 12 test data. The recorded differences are believed to be nonconsequential and to have little or no influence on animal performance and behavior.

The dc test charts from the October 12, 1993 testing show maximum voltages of approximately 0.64 Vdc. Because the various contact points were measured to a reference half cell, the difference in voltages must be considered. In that instance, the maximum animal contact voltage recorded was approximately 0.34 Vdc. As in the previous tests, loading this circuit with a resistor revealed minimal or no current-producing capacity from the voltage source. All voltages are believed to be non-consequential.

HERD HEALTH ASSESSMENT

A herd health assessment session was conducted November 18, 1993. The evaluator at this time is believed to have been Richard Huston, DVM. Although it is not clearly stated, it is believed that the comments contained in the December 1, 1993 report are primarily those of Dr. Huston.

Restrictions imposed by the Wolbecks resulted in incomplete evaluation of the herd. Specifically, only those animals which were in the barn were allowed to be evaluated. No evaluation was conducted of other animals held in pasture or in other facilities.

In an attempt to evaluate the herd performance, data were submitted by the Wolbecks for the time period October 7, 1993 through November 16, 1993. The data included milk sold, herd size, milk temperature, butterfat content, protein, and somatic cell counts. Data were also submitted on water consumption for the time period October 8, 1993 through November 16, 1993. Two bulk tank cultures taken on October 6, 1993 and November 10, 1993 were included in the data. A list of the various animals and their freshening dates was also provided.

The submitted data are inadequate to perform any meaningful assessment of this herd. While snapshot-type data might be interesting, they are not nearly as significant in assessing a herd as variations over a period of time, i.e., trends. To allow a meaningful assessment will require that additional data be provided. In that regard, the requests as set forth by Public Utility Commission staff members and attached as Exhibit A to the December 1, 1993 report are considered appropriate. Data were requested from 1984 to present.

Cow Body Condition

The evaluator conducted body condition scoring on 18 selected animals. Along with a photograph of each cow, some comments were offered. In several instances the comments reflect an erroneous perception that body condition scores should be of one particular value at one particular point in the time of lactation. This is contrasted to a normal range of conditions for various stages of lactation or ages of heifers. To assist in evaluating this aspect of the report, a copy of a Michigan State University publication entitled "Body Condition Scoring--A Management Tool" is attached as an Appendix to this report.

Attempting to perform a body condition scoring exercise through the use of photographs is marginal at best. As noted in the Michigan State University publication, "accurate body condition cannot be judged without feeling the cow." Thus, in reality no opportunity was provided to refute or reinforce the judgement of Dr. Huston. As noted in the report, body condition scoring is, indeed, somewhat subjective. In that regard, a summary of the body condition scoring data has been prepared and is presented as Table 1.

The purpose in preparing Table 1 was to show that some of the comments presented by the evaluator are believed to be a bit erroneous and perhaps misleading. In some instances, body condition scores were listed as being low when they are, in fact, within the normal range. In other instances, they are listed as being okay when they are, in fact, in excess of a normal or reasonable range. This latter situation suggests overconditioning, excess feed energy intake, or perhaps low milk production and an animal which is not using body reserves to produce milk early in lactation. Also listed in Table 1 are example questions (areas of inquiry) which would need to be answered to help further evaluate the appropriateness of the body condition score of any given animal. As an example, animals can suffer poor body condition if they have experienced significant health problems at some time during their lactation. Such information must be considered prior to forming final evaluations as to the overall condition of this herd.

While it is true that having a cow with 366 days in milk (cow 155) does indicate poor reproductive performance, this tidbit of information by itself is inadequate to fully assess herd management or the appropriateness of having this cow in the herd. Other questions which should be asked include whether the animal is open or bred and if perhaps she is just being milked off before she is sold. These conditions could occur because of previous histories of calving difficulty, poor production, behavioral or temperament problems, etc. In any event, if reproductive failure is an on-going problem in this herd, the question still remains as to why such conditions have not been corrected.

Table 1. Summary of Body Condition Data.

Cow No.	DIM[a]	Assigned Score[b]	Evaluator's Comment	Reasonable Range[c]	Unanswered Questions[d]
155	366	3.5	OK	3.0 - 3.5	Reproductive status
187	15	3.5	OK	3.0 - 4.0	
207	185	2.75	Low	2.0 - 2.5	Reproductive status Health problems
215	Dry	3.25	Low	3.0 - 4.0	Days dry Freshening date
235	11	3.0	Low	3.0 - 4.0	Calving difficulties Size of calf (twins?)
241	209	2.25	Low	2.5 - 3.0	Production level Health Problems
247	Dry	4.25	OK	3.5 - 4.5	Days dry
257	84	2.5	OK	1.5 - 2.0	Production level
267	160	2.5	Low	2.0 - 2.5	Reproductive status Production level
274	22	2.5	Low	3.0 - 4.0	Calving problems (?) Production level Condition at dry off Days dry

Table 1. Summary of Body Condition Data.

Cow No.	DIM[a]	Assigned Score[b]	Evaluator's Comment	Reasonable Range[c]	Unanswered Questions[d]
288	204	2.5	Low	2.5 - 3.0	Production level Reproductive status Health problems (?)
299	113	3.0	OK	1.5 - 2.0	Production level
308	200	2.25	Low	2.5 - 3.0	Production level Reproductive status Health problems (?)
309	167	3.0	OK	2.0 - 2.5	Production level Reproductive status
311	36	1.0	Low	3.0 - 4.0	Health problems Age Calving difficulties
313	5	3.5	Low	3.0 - 4.0	Size of calf (twins?) Calving problems Health problems
317	11	3.25	Low	3.0 - 4.0	Calving problems Health status Age Size of calf (twins?)
318	64	1.25	Low	1.5 - 2.0	Production level Health problems

[a] Days in milk.
[b] As assigned by evaluator R. Huston, DVM.
[c] Adapted from Michigan State University publication "Body Condition Scoring--A Management Tool."
[d] Examples of possible contributing factors to be considered in final evaluation regarding appropriateness of assigned score.

Blood Profiles

Blood sample data do provide interesting comparisons between cows. However, by themselves they are inadequate to fully assess the nutritional program in any given herd. A more detailed evaluation of the nutritional program on this farm is warranted. In extracting samples for analysis, great care must be exercised that representative samples are obtained. Standard sampling and analysis methods should be used.

Cow Cleanliness

Many of the cows selected for body scoring and which were photographed were noted as being dirty. Comparing the notes regarding dirty cows and several of the comments regarding the positioning of cow trainers clearly shows that positioning of the cow trainer is not the only factor involved in keeping cows clean. At the same time, it is acknowledged that dirty cows greatly increase the risk of reduced milk quality and udder contamination--possibly leading to inflammation and mastitis. A clean, dry cow environment is paramount in any disease control effort, including the control of mastitis.

Milk Sales

The data regarding milk sales and presented as Exhibit D show very marginal milk production levels--range of 37.5 - 42.4 lbs. of milk sold per cow per day for the time period from October 7 through November 16, 1993. Based on the data presented, no determination can be made as to whether these production levels are the result of genetics, overall management, nutrition, or some external stressor, such as extraneous voltage or water quality problems, resulting in reduced or minimal water intake. A graph showing the data reviewed to date is contained in the Appendix. (The data points for October and November 1993 are believed to be inflated as they are based only on lactating cows (Exhibit D) vs. the total herd (Exhibit G).)

The milk production data presented in Exhibit D show much better than normal butterfat content for a Holstein herd. That parameter by itself indicates reasonable nutrition and adequate fiber intake.

Milk Quality

The somatic cell count data presented in Exhibit D reflect a herd that still has a significant mastitis problem. The data show a range from 210,000 - 480,000, a mean of 300,000, and an average of 308,000. These values are not significantly different from those discussed in the earlier report for the time period January 1992 through February 1993. Any herd with a somatic cell count in excess of 300,000 is considered to have a serious level of udder infection and to be a problem herd. (Some advisors use an SCC level of 200,000 or greater to indicate a problem herd.) In evaluating herd infection level, trend lines as reflected by monthly high scores are preferred to those which look only at the monthly lows. As stated previously, additional data are needed to allow full assessment as to whether the herd is making progress with respect to udder infection levels. Based on the limited data available, it appears minimal progress has been made since 1992. Two graphs of the data provided are attached as part of the Appendix.

Data regarding standard plate bacteria counts and sediment levels, as reflected in Exhibit D, are indicative of good care being exercised to assure a clean milk supply. Based on these parameters, the dirty condition of the cows appears to be having limited influence on overall milk quality.

The bulk tank culture results show data which are consistent with a reasonably well-managed herd. Specifically, both samples were reported as negative for contagious pathogens. In contrast, both samples have moderate to high levels of environmental pathogens. In all probability, the primary infective agents present in this herd are of an environmental nature. Despite comments by the Wolbecks that culturing of individual cows would not prove anything, such culturing is necessary to identify which pathogens are most prevalent and which quarters are infected. Culturing should be used in concert with a CMT or California Mastitis Test to evaluate individual quarters.

Water Consumption

The water consumption records presented as Exhibit E show water consumption levels which are much inadequate for a high-producing herd. Whether the water intake is low because of the low production or whether production is being depressed because of low water intake cannot be determined from the available data.

Lactation Data

The cow freshening data presented as Exhibit G show animals with days in milk ranging from 5 - 366. The data suggest the herd is being managed for minimal freshening during the winter months, with a heavier emphasis towards fall freshening. A summary of the stage of lactation as reflected in this Exhibit is presented in Table 2.

Table 2. Stage of Lactation as Reflected in Exhibit G. (Reference Date = November 18, 1993.)

Day in Milk	No. of Cows	% of Herd
0 - 60	16	22.2
61 - 120	9	12.5
121 - 180	11	15.3
181 - 240	11	15.3
241 - 300	11	15.3
301 - 335	3	4.2
> 335	2	2.8
Dry	9	12.5
TOTAL	72	

CONCLUSIONS

1. Based on the tests performed, there appears to be no problematic voltages (either ac or dc) present in this barn. However, the data and testing have failed to document whether there were problematic currents present in the animal environment. This

phenomenon has been identified in nine different herds and appears to be related to the situation that is found on a grounded or neutral conductor of an electrical system. Specifically, there can be substantial current flow with limited voltage. Stated differently, it is a situation where the current flow produces a small voltage or voltage drop. This is contrasted to the situation where the voltage, in fact, causes the current flow.

2. The herd is producing milk at a sub-standard level.

3. The herd is suffering from a moderate to severe infection level, as evidenced by somatic cell counts.

4. Changing the farm service wiring configuration had little or no influence on animal contact voltages.

5. The Amoco pumping station is not imposing voltages of a detrimental or problematic magnitude on the animal environment.

6. The data presented are inadequate to fully evaluate the nutritional program and its possible adverse effects on performance of this herd.

7. The condition of the cows (with respect to cleanliness or dirtiness) is consistent with the presence of environmental pathogens found in the bulk tank cultures.

RECOMMENDATIONS

1. Full assessment of this herd will require evaluation of data over a longer period of time. Herd health, milk quality, milk sales, herd size data, etc., from the period beginning in 1984 to present should be obtained and evaluated.

2. Additional testing for the presence of problematic currents within the animal environment should be performed. However, such testing appears unwarranted until additional herd performance data have been evaluated.

3. Great care is necessary in evaluating the currently available herd assessment data. Data which provide only a snapshot of the herd can easily lead to false conclusions of either a positive or negative nature with respect to the overall management of the herd.

4. A full assessment of the nutritional program used in this herd appears warranted as a part of the diagnostic procedures to assist in determining why performance and production are substandard. Use of an independent nutritionist without ties to any particular feed company is recommended.

BODY CONDITION SCORING— A Management Tool

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September, 1988

Adequate body reserves are necessary to maintain the health, reproductive and productive capacity of all dairy cattle. In the dairy cow fat covering is an indicator of the amount of stored energy. Cows without adequate body reserves are prone to disease, metabolic disorders, impaired reproductive efficiency, and reduced milk production. In heifers, lack of body reserves will delay breeding and will lower milk production after calving.

On the other hand, excessively fat cows are predisposed to calving difficulties, fatty liver after calving and often death. This condition has been termed Fat Cow Sydrome. Even cows that recover from this condition experience lower milk and butterfat production as well as increased risk of other disease conditions. Heifers that are fat at puberty fail to develop their full mammary gland capacity resulting in lower lifetime production. Problems of repeat breeding are also reported for overly fat heifers at puberty.

The body fat covering of dairy cattle changes with different stages of lactation. Fresh cows lose body fat because they are unable to eat enough to meet the energy requirements for their high milk production. Late lactation and dry cows can add large amounts of body fat because they are able to eat more energy than they require for the amount of milk they produce.

Dairy farmers need to be aware of what body condition their cows and heifers are in so that they can adjust management practices and feed rations as needed.

The body reserves of dairy cows are evaluated by a procedure known as body condition scoring. When body condition scoring, the fat covering around the rump and loin is evaluated and the cow is given a numeric score based on this evaluation. Body condition is scored between 0 and 5 with half scores in between. This gives a total of 11 possible body scores. A condition score of 0 is found only in animals near death and so will be ignored in this bulletin. Use of the body condition score system enables a farmer to accurately evaluate the body reserves of a cow and describe it to other people in a consistent way that everyone can understand.

Body scoring of dairy cattle can be learned with a little training and careful observation. Although the evaluator uses both sight and touch to evaluate the body fat covering, accurate body condition cannot be judged without feeling the cow.

*F. M. Hall is the manager of the Michigan Holstein Association.

HOW TO BODY CONDITION SCORE DAIRY COWS

Body condition score is largely determined by the amount of fat covering around the rump and tailhead area. The loin area is also evaluated. The final body condition score can be adjusted 1/2 score if the loin differs from the rump by more than 1 point.

Although most body condition scoring is done from directly behind the animal, it is a good idea to observe the cow from the side to get some idea of the depression in the loin area.

To begin scoring, stand directly behind the cow. Make sure the cow is relaxed before beginning the scoring procedure because muscle tightness will result in inaccurate scoring. Observe the degree of depression around the tail head. Then score the rump area by placing the hands on the pin bone and pelvic bone and feeling for the amount of fat covering. See Figures 1 and 2 for where to place your hands for the rump score. Always use the same hand to score cows. Score the rump to the nearest 1/2 score.

Figure 1. Correct hand placement for feeling fat covering over pin bones.

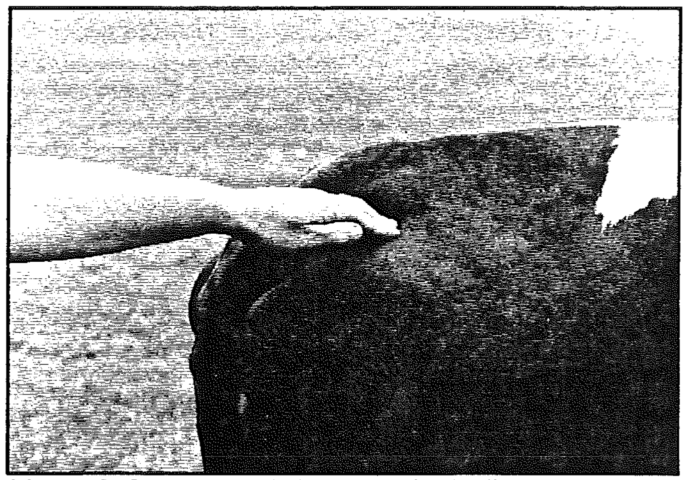


Figure 2. Correct hand placement for feeling fat covering over pelvic bone.

Then score the loin area in the same way, using the same hand. See Figure 3. Assess this score to the nearest 1/2 unit.

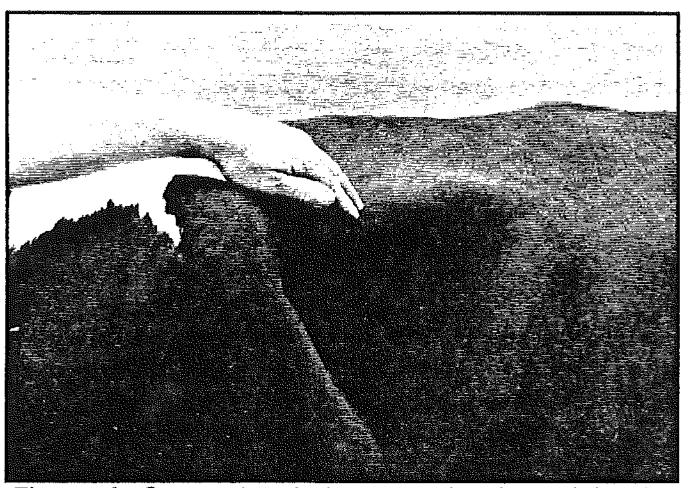
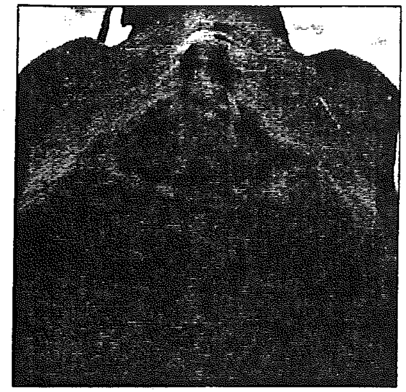


Figure 3. Correct hand placement for determining fat covering over short ribs and loin.

BODY CONDITION SCORE 1

Rump Area Deep cavity around tailhead. No fatty tissue felt between pins. Pelvic bone easily felt. Skin is supple.

Loin Area Ends of short ribs sharp to touch. Upper surfaces can easily be felt. Deep depression in loin.



BODY CONDITION SCORE 2

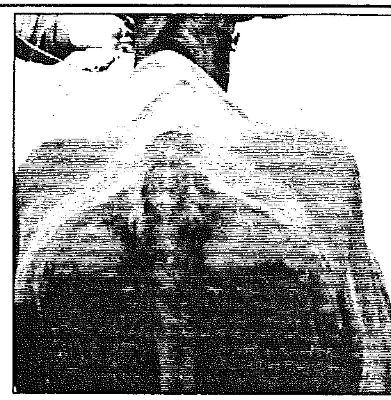
Rump Area Shallow cavity lined with fatty tissue at tailhead. Some fatty tissue felt under pin bone. Pelvis easily felt.

Loin Area Ends of short ribs feel rounded. Upper surface felt with slight pressure. Depression visible in loin.

BODY CONDITION SCORE 3

Rump Area No visible cavity around tailhead. Fatty tissue is easily felt over whole rump. Skin appears smooth. Pelvis is felt with slight pressure.

Loin Area Ends of short ribs can be felt with pressure. There is a thick layer of tissue on top. There is only a slight depression in the loin.



BODY CONDITION SCORE 4

Rump Area Folds of fatty tissue are visible around tailhead. Patches of fat are present around the pin bones. Pelvis is felt only with firm pressure.

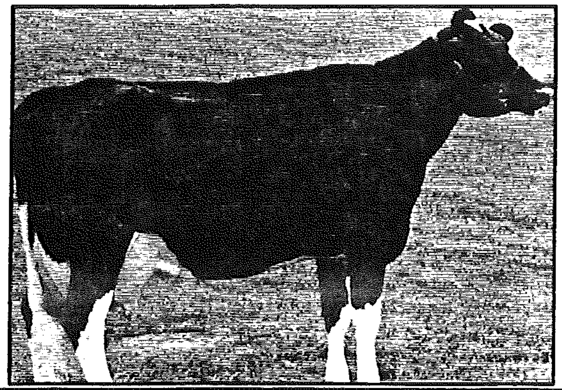
Loin Area Short ribs can't be felt even with firm pressure. No depression is visible in loin between backbone and hip bone.

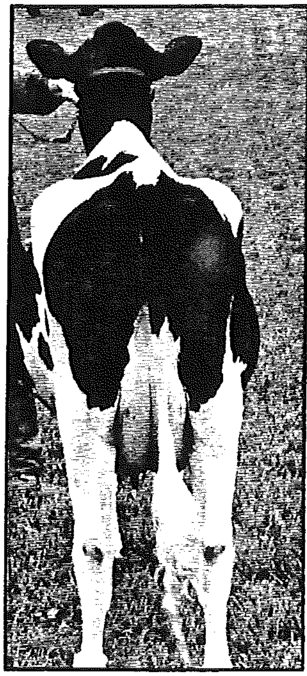
BODY CONDITION SCORE 5

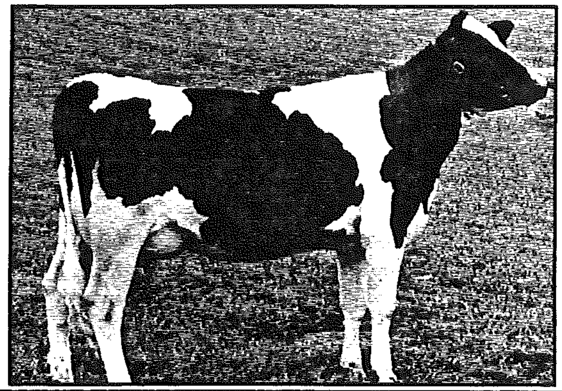
Rump Area Tailhead is buried in fatty tissue. Skin is distended. No part of pelvis can be felt even with firm pressure.

Loin Area Folds of fatty tissue over short ribs. Bone structures can't be felt.

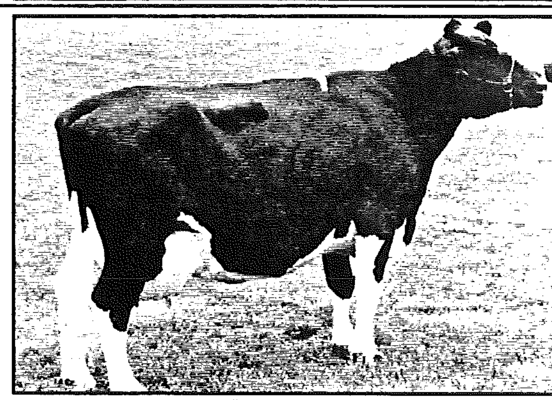

Body Score 1

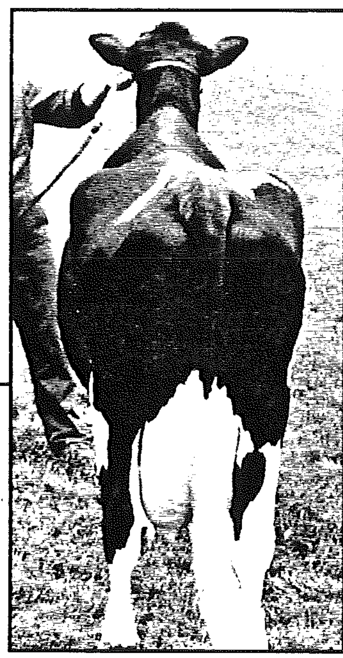


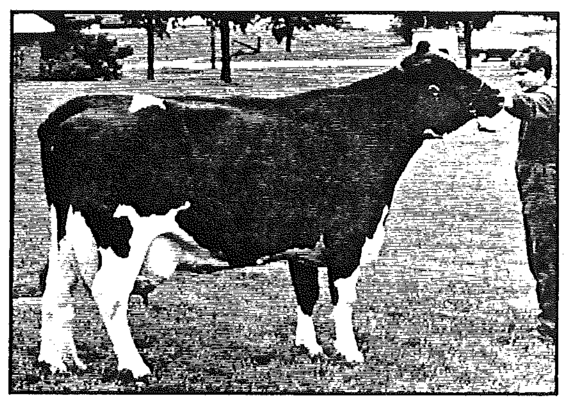

Body Score 2



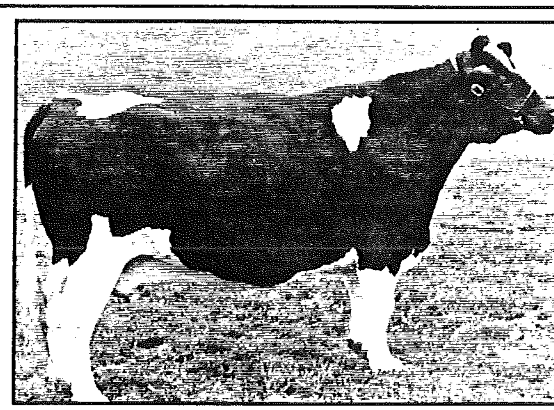

Body Score 3




Body Score 4




Body Score 5



If the loin area score is different than the rump score by more than 1 unit, adjust the rump score up or down 1/2 unit. This will be the final body condition score. An example of this adjustment is presented below:

Rump Score	Loin Score	Difference	Adjustment	Final Score
4.0	2.5	1.5	-0.5	3.5
3.0	2.5	0.5	0	3.0

On pages 4 and 5 are pictured dairy cows representative of the 5 major body condition scores along with the description of how each condition should look and feel. Use these photographs as guides when body scoring cows. After several hours of practice, you will become quite proficient at body condition scoring.

WHEN COWS SHOULD BE BODY SCORED

Ideally cows would be scored monthly or bimonthly. In most herds, especially those in free stall housing, this becomes a major undertaking. However, there are times when cows should be body condition scored and the scores written down if good use is to be made of the information. These times include:

For cows-
1. At calving
2. At 5-6 weeks after calving (at approximately peak milk production)
3. At 150-200 days after calving (in mid lactation)
4. At dry off

For heifers-
1. At six months of age
2. At breeding
3. At calving

At these times cows should score in the ranges listed in Table 1 below.

If the body condition scores of the cows are outside the reasonable range, management steps should be taken to correct the problem. The most important thing to look at is the change in body condition between one stage of lactation and another. Careful ration balancing and recommended management of cows at various stages of life will ensure proper body condition. A list of possible causes of undesirable body scores and their possible causes as well as suggested remedies is presented in Table 2 on page 6.

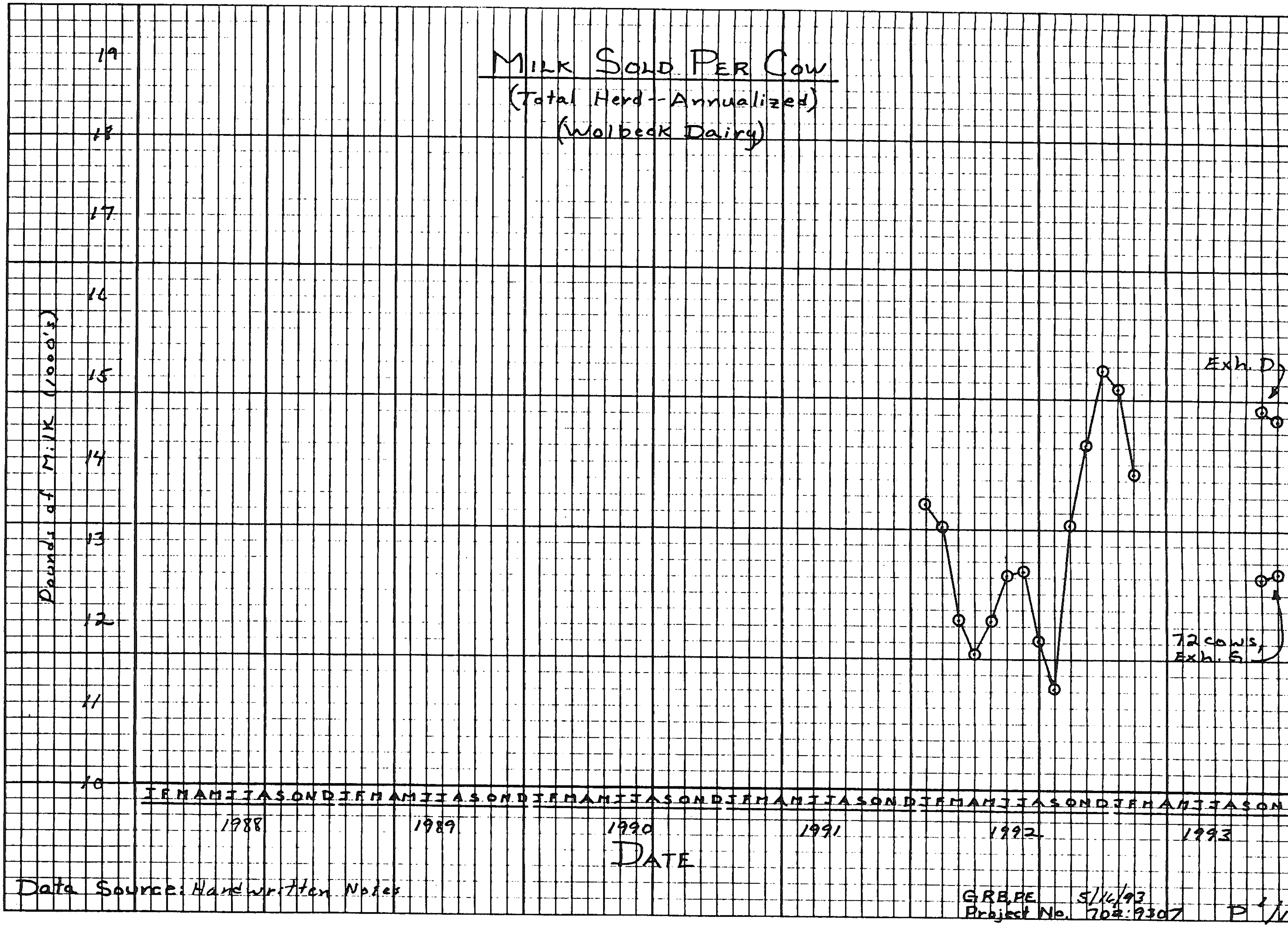
Use of body condition scoring is one more technique that will allow fine tuning the nutrition program of the herd and improve management ability. Preventing production losses as well as preventing disease and reproductive losses by ensuring proper body condition will be more than worth the small amount of time it takes to learn the body scoring technique.

Table 1. Desired and reasonable body condition scores of dairy cattle at critical times.

Time of Scoring	Desired Score	Reasonable Range
Cows		
Calving	3.5	3.0 - 4.0
Peak Milk	2.0	1.5 - 2.0
Mid-Lactation	2.5	2.0 - 2.5
Dry Off	3.5	3.0 - 3.5
Heifers		
6 Months	2.5	2.0 - 3.0
Breeding	2.5	2.0 - 3.0
Calving	3.5	3.0 - 4.0

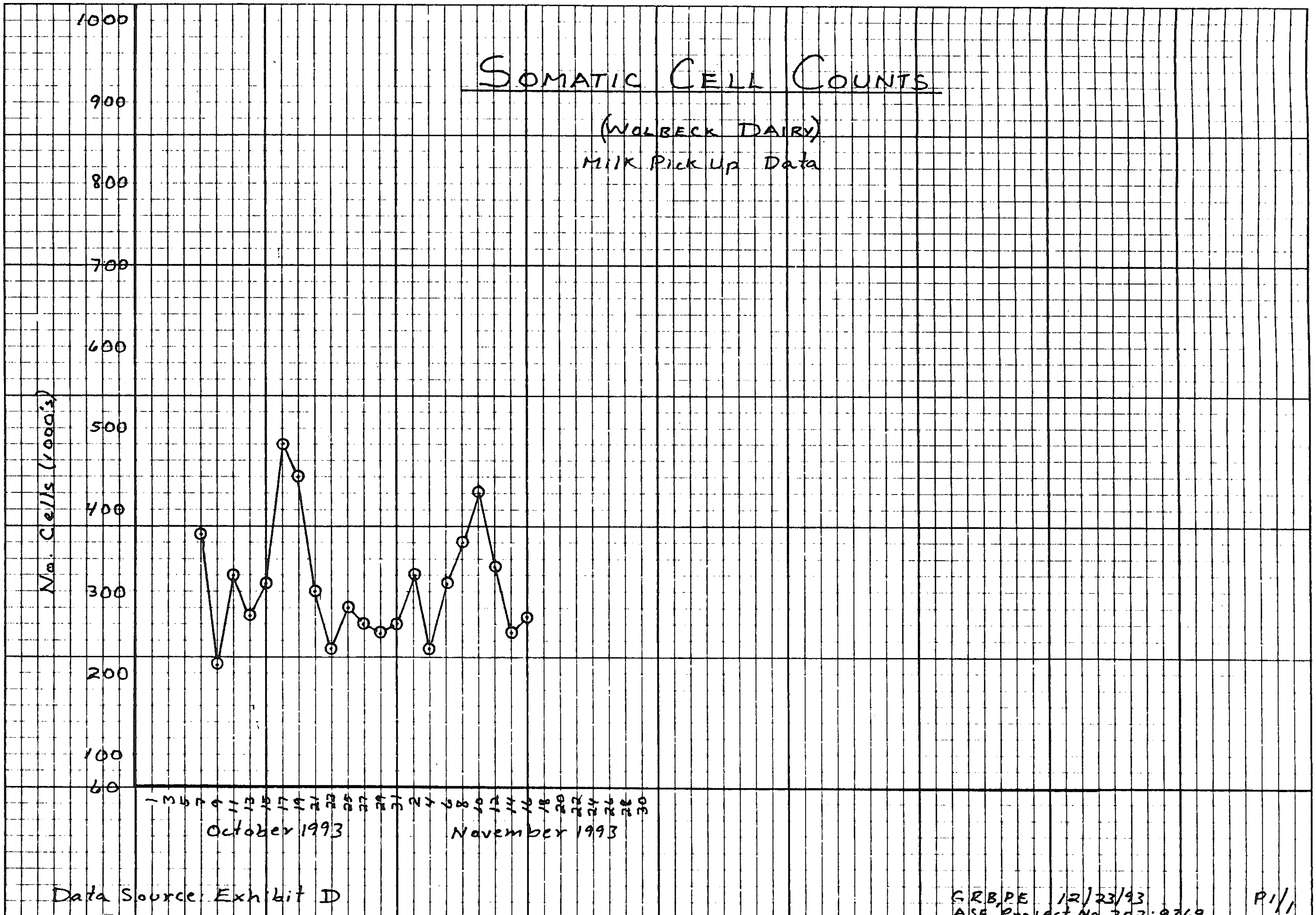
Table 2. Cause of Undesirable Body Condition Scores and Their Possible Remedies.

Time	Score	Possible Cause	Remedy
Cows			
Calving	High	Dry cows gaining excessive weight	Reduce energy in dry cow ration
		Cows dry off in excessive condition	Reduce ration energy in last 1/3 of lactation
		Cows dry too long	Limit dry period to 60 days
	Low	Dry cows losing weight on dry cow ration	Increase energy and/or protein
		Cows dry off in poor condition	Increase energy in last 1/3 of lactation
Peak	High	Cows fail to achieve peak milk production	Increase crude protein in ration to 17%
	Low	Cows too thin at calving	Adjust body condition in last 1/3 of lactation
		Cows lose weight excessively	Increase/decrease grain to .76 MCal per lb. of ration dry matter; raise fiber to 20% ADF, 30% NDF
Mid	High	Cows fail to milk	Cull cows that fail to milk or that fatten excessively
		Cows on high energy diet for too long	Balance ration to meet energy needs in late lactation
	Low	Cows not recovering from loss of condition in early lactation	Maintain energy density of .76 MCal/lb.; avoid switching to rations with much lower energy densities
Dry off	High	Cows receive excess energy in late lactation	Balance energy to cows' productive needs
		Cows not rebred on time	Consider culling
	Low	Cows not gaining adequate condition in last 1/3 of lactation	Increase energy in ration last 1/3 of lactation
Heifers			
6 months	High	Too much energy in diet	Reduce amt. of grain fed to 5 lbs./day
	Low	Too little energy in diet	Increase amt. of grain in diet; consider a commercial calf starter
		Disease	Consult veterinarian
Breeding	High	Too much energy	Reduce amt. of grain fed; limit amount of corn silage
		Lack of adequate protein	Raise protein in diet to 13-15%
	Low	Lack of energy in the diet	Increase energy as grain and/or switch to higher quality forage
Calving	High	Too much energy in diet	Little danger to 1st calf heifer unless body score approaches 5
	Low	Lack energy in diet	Increase energy as grain and/or feed quality forage. Heifers should gain 1 condition score from breeding to calving.

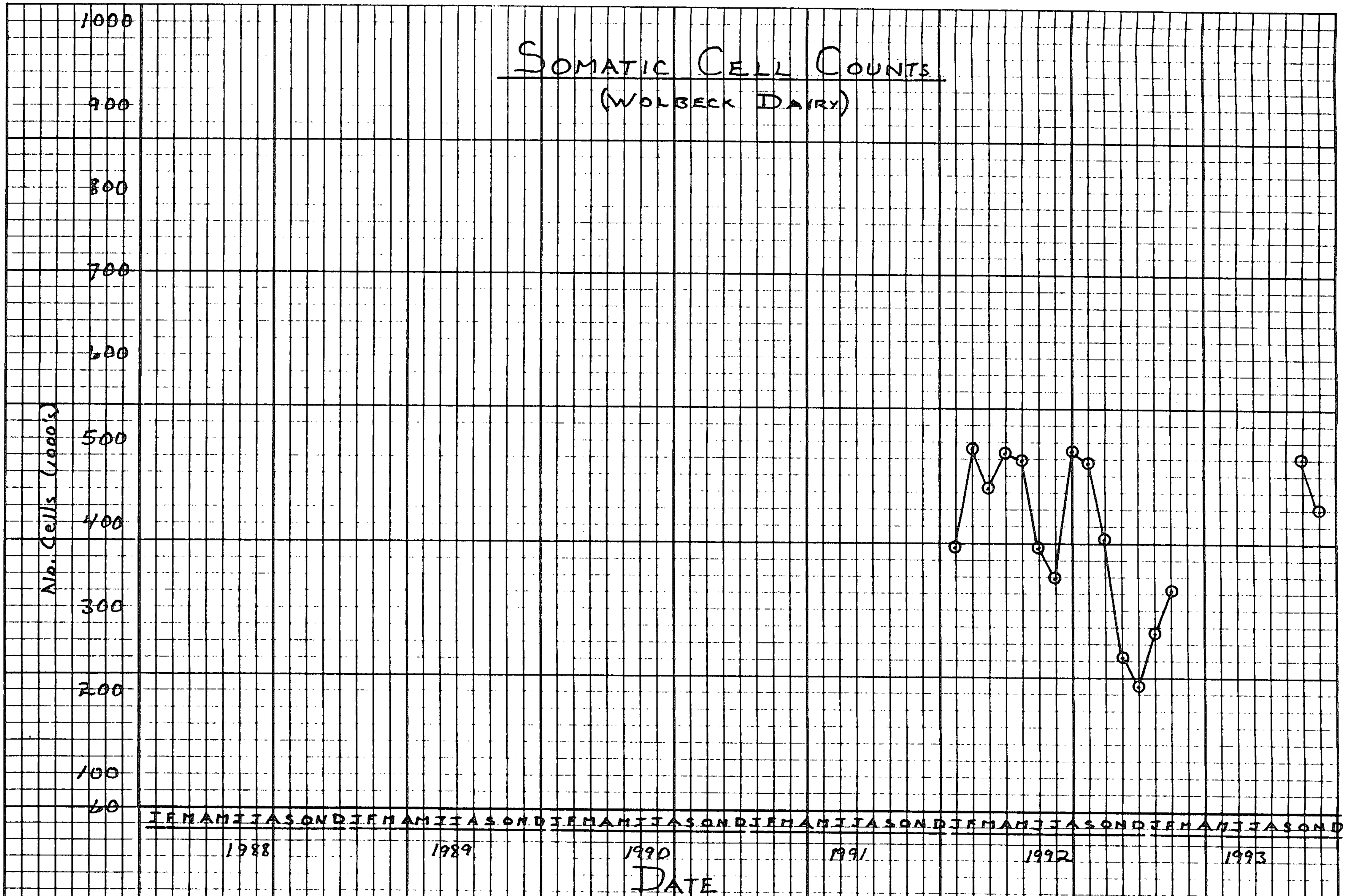


8 Squares to the Inch

NATIONAL 12-288



SOMATIC CELL COUNTS
(WOLBECK DAIRY)
Milk Pick Up Data
No. Cells (1000's)
1000
900
800
700
600
500
400
300
200
100
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
October 1993
November 1993
Data Source: Exhibit D
GRB, PE 12/23/93
ASE Project No 202:9369
P1/1



Data Source: Handwritten Notes

GRB,PE 5/14/93
Project No. 702:9307 P 1/1