Dairy Session II

"Production Medicine Records: Computers and On-Dairy Records"

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The cost for this session was underwritten by a grant to AABP from American Cyanamid, Wayne, NJ.

Dairy Production Medicine and Herd Monitoring

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In a major shift toward preventive medical services in dairy practice, veterinarians are taking a more active role in the overall management and planning on dairies. [1,2] Veterinarians are routinely offering services like nutritional consultation, housing design, and financial advice that were considered outside the realm of veterinary medicine in the past. The dairy practitioner is adapting to the role of herd health and productivity consultant. This evolution will expand the opportunity for veterinary services to dairy farmers, and will be a profitable interchange for practitioner and producer alike. As is always the case, there is a price to pay for this new opportunity. Veterinarians will need to develop the new practice skills to complete in this arena. These areas include nutrition, computers and record systems, finances, and effective marketing of these services. We must convince dairymen to look to veterinarians for new and different services. Veterinarians need to develop effective ways to deliver these services to their clients and to charge for their efforts.[1-5]

The future for service to the dairy industry will belong to the person willing to work with records. Dairy veterinarians must become adept at information management and evaluation. [1-7] This need for information includes knowledge from outside the dairy, such as new facts about diseases, management systems, and nutrition. The dairyman also needs information about the dairy itself. It may seem odd that the dairyman needs an outsider to provide information about his own farm. A moment's thought should make it clear that this has always been true of dairies. Outside information has come from many sources: Dairy Herd Improvement Association (DHIA) reports, the accountant's report, or the veterinarian's remark that calf mortality seemed high and hutches might be useful. The role of "information coordinator" has the potential to be a major service provided by veterinarians in dairy practice. If veterinarians do not take the initiative and become the dairy's central information and analysis source, their other roles will be significantly weakened or lost. The person who identifies increased calf mortality or decreased milk production will be the first one asked to solve the problem. That person will not necessarily be a veterinarian.

There are several levels of record keeping on dairies (Table 1). Dairymen keep individual animal records to help them make decisions about single cows (or groups of them) and to feed data into monitoring systems. Monitoring is the "watchdog" part of record keeping. It does not include all aspects of dairy record keeping; it concentrates on the general herd status.

What is Monitoring?

Monitoring is an essential step in all systems that need to respond effecitively to outside influences[8]. In endocrinology, the organ that produces a hormone must have some signal that tells it whether there is enough of the hormone. For inventory control in a practice, there must be some way to signal when supplies are too low. On a dairy, there should be some mechanism to flag problems and motivate changes. Without such monitoring systems, problems can grow to serious proportions without needed remedy, e.g., Cushings disease, no bottle of calcium for the next milk fever, or loss of milk market due to an elevated bulk tank somatic cell count.

Figure 1 illustrates the role played by monitoring in the management cycle on a dairy. First, the herd's status is monitored. If the status is unacceptable, plans are devel-

TABLE 1
TYPES OF INFORMATION AND THEIR USES FOR DAIRIES

Type or records	Examples of use
1.)Individual animal records	Decisions about cows, culling, breeding, etc.
2.) Groups of individuals	Vet check lists, cows to turn dry, cows due to calve, etc.
3.) Monitoring	Has milk production improved?
4.) Problem investigation	Why has butterfat dropped? What causes these abortions?
5.) Research★	Do all my herds have poor conception in the summer? How does monensin work in growing heifers?

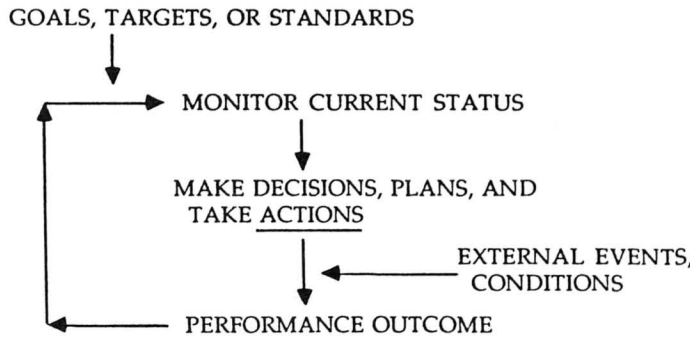
★ category contributed by Dr. Steve Eicker, and includes research beyond the veterinary practice, such as DHIA and dairy science, and veterinary research.

oped, decisions made, and actions taken. The status changes, and the cycle begins again. As Figure 1 illustrates, there are two aspects of the feedback system that are outside of the actual cycle. External influences affect the status of a dairy, things like feed changes, weather, management decisions, new pathogens, machinery failures, and financial changes. Without these external influences there would be no need to change or adapt to new circumstances. Happily for the veterinarian, these external influences are why dairymen need veterinary services. We help dairymen as they try to adapt to external forces and change. As we do so, we will open new possibilities for veterinary service to the dairy industry. It means, for example, that client education is a useful (and billable) veterinary activity, as are nutritional consultation, preventive program design, building design, and even financial advice. As individuals, we may not yet have the expertise to work in some of these arenas, but the opportunity exists for those who wish to develop the skills.

The second aspect that is external to the cycle is the goals, targets, or standards used to test current status for its adequacy. Without some sort of bench mark for comparison, there is no way to tell if you need to take action. Goals can be difficult to set. They may be influenced by economic targets and constraints, personal and emotional consideration, physical restrictions, and time constraints. Goals almost always are subject to change over time. Goal setting will be discussed later.

Monitoring serves several major roles in dairy herd health medicine. It can highlight problem areas and focus efforts and resources where they are needed. Monitoring may help restore the dairyman's perspective, shifting needed attention away form the day to day urgent items to less urgent but perhaps more important areas. Monitoring reveals problems and trends; trends that might otherwise escape notice in the day to day routine. Monitoring can help motivate change in clients and the practitioner. Monitoring also serves the practitioner by documenting the direction and time course of improvements on the dairy that adopts a production medicine approach.

Figure 1



Essential Components of Monitoring

1. *Keep only useful data and use data that you keep!*

The first and most important fact about monitoring is that monitoring is not an end in itself. Monitoring exists because the information will be used to influence plans, decisions, and actions. Keeping large volumes of data that no one uses will ultimately cause the entire system to lose credibility. Keeping unused data is a waste of time, effort, money, and the dairyman's limited supply of enthusiasm for record keeping.

2. *Collect data, but produce information.*

Data alone are usually not sufficient; data must be converted into information. On a 600 cow dairy, a list of somatic cell counts, lactation number, and days in milk of all lactating cows listed by cow ID number contains a wealth of data and has very little information value. Organize the same data into categories broken down by somatic cell count and stage of lactation and you would have a wealth of information.

3. *Encourage consistent, accurate records.*

The information stored and presented by a monitoring system must be accurate and consistent. If the records are inaccurate or incomplete, they lose their usefulness. When the information is useless, the dairyman will lose interest in keeping the data and accuracy suffers further. The practitioner can play a key role in breaking this cycle. Encourage good record keeping, reward the dairyman with thanks and acknowledgement for good records, and make sure to use the records as part of the herd health program.

4. *Make sure the information is available in time to be used.*

The information must return to the user (dairyman, milker, banker) in a timely fashion. Simple information available in time is better than sophisticated information available too late. Getting information after making the decision is useless. This means that monitoring systems must be efficient as they collect, store, analyze and report back to the dairyman. (There is nothing wrong with investigating problems after the fact. The information may be useful when a similar problem happens in the future.)

5. *Keep it simple, easy, and appropriate to the needs.*

The monitoring system should be as simple and easy as possible. Whenever possible, use information that the dairyman already collects. Record systems should be easy to use, readily available to the dairyman as the events occur, and should use terms familiar to the dairyman. At each step in development, the veterinarian should ask: "Will the payoff in information justify the effort to collect this data?". Wherever possible, it pays to collect data that can be used to create more than one type of information. For example, DHIA data on production can contribute to individual cow evaluation, herd feeding program management, economic evaluations, financial projections, culling decisions, etc. It will be far easier to motivate the dairyman to keep production data when it supports so many aspects of his enterprise.

6. *Use monitoring to clarify interactions on the dairy.*

The analysis of herd information should clarify relationships between factors that contribute to a problem and should provide perspective on the importance of what has occurred. Since all possible interactions cannot be predicted, a monitoring system should allow for ad hoc evaluations among various factors. Changes in milk production may reflect mastitis, feeding programs, season, or reproductive efficiency, to name a few. An effective herd health monitoring system should allow the veterinarian to pursue the impact of changes in one factor on other aspects of the dairy.

7. *Know your denominators.*

Herd monitoring is done on populations, not individuals. Be sure to consider the underlying population. Rates (deaths per 100 cows, mastitis per lactating cow, milk per cow, etc.) provide more information than raw numbers. Ten cases of milk fever this month becomes much more meaningful if you know that there were fifteen calvings this month, not five hundred calvings this year. The denominator information (number of calvings, number of cows milking, etc.) is just as important as the number of cases of the problem. Whenever achievable, the denominator used in the analysis should be a good estimate of the population at risk. For milk fevers this would be the number of cows calving, for abortion the number of cows that are pregnant.

8. *Present the information in graphic, understandable terms.*

Reams of undigested numbers look intimidating and no one uses them. The monitoring system should flag problem areas for closer scrutiny. Whenever possible, the information should be in a graphic form. The veterinarian should be present to explain and comment on results of analysis. Colored highlighting and handwritten notes will draw attention to specific areas. Information from a herd health monitoring system is best when presented personally, not by computer printouts.

What is the Dairy Herd Monitor?

The MONITOR is one spreadsheet component of the Dairy Production Medicine Software, a series of spreadsheets for distribution to dairy practitioners for use in their practices[8-10]. The spreadsheets include monitoring, nutrition/ration balancing, economic, lactation curve, and utility functions. Each spreadsheet runs using the LOTUS software package. The practitioner needs very little computer experience or knowledge to use the system. In addition there is a computerized bulletin board where veterinarians can phone to download new software, upload files for other practitioners, and exchange messages.

The MONITOR spreadsheet analyzes and presents the herd health and productivity status of the whole dairy herd. It does not keep track of the details or status of individual cows. It produces a two page report (Table 2 a,b) which summarizes this information on several major aspects of the dairy. The practitioner in cooperation with his client, sets a series of goals for each item. The MONITOR calculates an average for each item for the past year, and compares the average and the most recent month's performance to the goal. It flags items that do not reach the goal. The spreadsheet can also graph any item's data for the past year or for all of the stored data (see Graphs 1-18). Several items can be graphed simultaneously, in a variety of formats.

Computer Requirements:

Hardware:

A variety of computers can be used for the Dairy Herd Monitor. Many practices already have the necessary hardware. In order to run the Monitor, you need an MS DOS (IBM compatible) microcomputer with a minimum of 640 K of RAM memory. You should have a machine that has a color graphics card, even if you will only have a monochrome display screen. Color screens are nice, but not necessary. A hard disk drive with at least 20 Mbytes of storage is recommended.

Table 2a

DAIRY HERD MONITOR
EXAMPLE DAIRY

PAGE 1

MONTH AND YEAR	AVERAGE MONTH	GOALS AV. MO	GOALS THIS MO	AUG 88	JULY 88	JUNE 88	MAY 88	APR 88	MAR 88	FEB 88	JAN 88	DEC 87	NOV 87	OCT 87	SEPT 87	AUG 87
PROD, NUTR, FEED PROGRAM																
ROLLING HERD MILK	15672	*18500	18500 *	16071	15661	15414	15432	15409	15265	15341	15482	15628	15850	16121	16387	16656
ROLLING HERD % FAT	3.93	- 3.8	3.8 -	3.80	3.90	3.90	3.90	3.90	3.90	4.00	4.00	4.00	4.00	4.00	3.90	3.90
HFR PROJ ME MILK	18357	*19256	19256 *	18853	19522	19349	19285	19377	18239	17584	17174	17443	17711	17806	17940	17855
2nd PROJ ME MILK	0	*19900	19900 *	0												
COW PROJ ME MILK	18356	*19925	19925 *	18898	18969	18684	18648	18597	18136	17665	17637	17894	18044	18505	18599	18627
% COWS IN MILK	85	* 88	88 -	90	86	83	86	92	89	89	86	76	78	80	81	79
AVE DAYS IN MILK	182	* 160	160 *	163	162	169	180	166	159	156	176	180	199	227	249	251
AVE DAYS DRY	67	* 65	65 *	74	72	70	70	70	69	67	66	64	63	61	61	60
MILK/COW/DAY	52.8	* 58.0	58.0 *	54.3	58.1	59.0	60.7	62.4	58.9	53.1	50.0	51.2	43.8	43.7	38.7	42.1
ADJ CORR MILK	60.5	* 62.6	62.6 *	58.5	62.2	66.8	67.8	64.9	61.7	56.9	56.3	57.4	52.6	56.9	54.9	56.1
% FAT D.O.T.	3.85	- 3.80	3.80 *	3.60	3.60	3.90	3.70	3.50	3.70	3.90	4.00	3.90	4.00	4.10	4.30	3.80
MILK BLEND PRICE	14.65	-12.00	12.00 -	14.65	14.65	14.65	14.65	14.65	14.65	14.65	14.65	14.65	14.65	14.65	14.65	14.65
VALUE OF PRODUCT	6.60	* 7.00	7.00 *	6.96	7.22	7.08	7.80	8.21	7.69	7.05	6.44	5.62	4.99	5.27	4.83	4.90
FEED COST/COW/DAY	3.20	* 3.00	3.00 -	2.85	2.80	3.12	3.12	3.10	3.10	3.47	3.47	3.47	3.47	3.40	3.05	3.40
FEED COST/INCOME	49%	* 43%	43%-	41%	39%	44%	40%	38%	40%	49%	54%	62%	70%	65%	63%	69%
HEIFER PEAK MILK	65.4	- 65	65 -	69	70	70	70	70	65	62	61	61	62	62	63	62
2ND LAC PEAK MILK	77.0	* 82	82 *	77												
COW PEAK MILK	78.4	* 87	87 *	81	81	81	79	78	77	75	75	76	77	80	81	81
HFR LBS/DAY (40	50.0	* 59	59 *	50												
HFR LBS/DY 41-100	54.3	* 63	63 *	61	58	57	60	68	63	51	60	54	47	24	48	48
HFR LBS/DY 101-199	53.3	* 55	55 *	51	59	61	63	64	58	56	34	48	48	48	49	44
HFR LBS/Dy 200-305	43.6	* 46	46 -	50	53	54	56	38	38	38	38	38	38	43	39	38
COW LBS/DAY (40	57.0	* 60	60 *	57												
COW LBS/DY 41-100	67.9	* 80	80 *	66	68	72	78	78	75	71	66	69	59	59	54	61
COW LBS/DY 101-199	61.8	* 66	66 *	60	67	67	72	73	63	55	53	59	59	63	50	55
COW LBS/DY 200-305	45.4	* 49	49 -	49	55	52	50	46	47	43	40	39	40	44	40	44
DRY MATTER INTAKE	45.2	* 48.0	48.0 *	40	45	45	47	47	46	46	46	46	46	46	42	44
FRESH (40 DAYS	3.25	- 3.50	3.50 -	3.25												
FRESH 40-100 DAYS	2.25	* 3.00	3.00 *	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.50
FRESH) 100 DAYS	2.75	* 3.50	3.50 *	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
DRY COWS	3.25	* 4.00	4.00 *	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
INVENTORY																
1ST CALF HEIFERS	56	* 70	70 -	96	88	70	59	63	59	58	36	32	37	33	39	44
2ND AND OLD COWS	127	* 130	130 *	117	114	113	122	134	137	136	142	126	127	127	125	119
COWS MILKING	183	* 200	200 -	213	202	183	181	197	196	194	178	158	164	160	164	163
COWS DRY	33	- 30	30 *	24	33	37	30	17	25	23	29	55	47	41	38	43
COWS TOTAL	216	* 230	230 -	237	235	220	211	214	221	217	207	213	211	201	202	206
BIRTH TO WEANING	27	- 20	20 -	63	20	20	14	24	25	31	29	29	29	22	12	12
WEANING TO BREED	129	- 120	120 *	64	85	122	145	136	130	115	145	145	145	150	160	171
BREED TO CALVING	98	* 100	100 *	90	102	85	111	111	112	99	99	99	99	91	76	64
TOTAL YOUNGSTOCK	253	- 240	240 *	217	207	227	270	271	267	245	273	273	273	263	248	247
TOT ADULT VOL CULL	15	- 32.4		3	1	4	2	2	2	1	0	0	0	0	0	0
TOT ADLT INVOL CULL	72	* 32.4		10	3	7	3	13	5	16	1	6	0	4	4	2
TOTAL ADULT CULLS	87	* 64.7		13	4	11	5	15	7	17	1	6	0	4	4	2
custom item #1	0	- 0.0	0.0 -	0												
custom item #2	1	* 0.0	0.0 *	1												
custom item #3	1	* 0.0	0.0 *	1												
custom item #4	1	* 0.0	0.0 *	1												

Table 2b
DAIRY HERD MONITOR:
EXAMPLE FARM

PAGE 2

Description	AVERAGE MONTH		GOALS AV. MO		GOALS THIS MO		AUG 88	JULY 88	JUNE 88	MAY 88	APR 88	MAR 88	FEB 88	JAN 88	DEC 87	NOV 87	OCT 87	SEPT 87	AUG 87
REPRODUCTION																			
COWS CALVED	12.8	*	17.3		19.0	*	14	16	9	1	12	4	13	20	16	18	14	16	10
COW DYSTOCIAS	0.1	-	0.6		0.7	-	0	0	0	0	0	0	0	0	0	0	0	1	0
HEIFERS CALVED	9.0	-	8.6		9.5	-	13	18	19	1	6	9	21	4	4	10	3	0	0
HEIFER DYSTOCIAS	0.3	-	0.9		1.3	-	0	0	0	1	0	1	1	0	0	0	0	0	0
CALF DEATH @ BIRTH	2.5	*	1.7		2.2	*	4	3	3	0	4	4	2	0	2	1	1	6	0
RET. PLACENTA	2.1	*	1.1		1.4	*	5	1	6	0	1	1	2	0	0	2	1	6	2
UTERINE TREATMENT	7.5	*	3.0		4.3	*	12	14	5	2	3	9	13	8	7	6	2	9	2
CYSTS	8.6	*	3.5		5.0	*	6	1	7	9	7	15	12	6	11	17	4	8	4
% HEATS BRED	48	*	60		60	*	51	53	57	62	57	52	49	46	45	42	34	33	35
DAYS TO 1ST BREED	89	*	65		65	*	75	76	73	76	76	82	85	91	97	108	112	112	109
% PROBLEM COWS	18	*	10		10	*	16	18	18	18	16	15	12	14	16	18	25	29	29
TOTAL BREEDINGS	64.0	-	20		20	-	40	32	37	61	85	65	74	70	105	79	47	73	29
TOTAL PREG CHECKS	34.2	-	10		10	-	17	15	37	50	24	66	27	37	24	60	9	44	69
OPEN AT PREG CHECK	16.3	*	5.1		2.6	*	6	6	12	13	16	36	14	14	11	24	8	35	26
PREG, NOW OPEN	1.4	*	1.1		1.2	-	1	2	1	1	1	1	3	2	0	2	0	3	0
VISIBLE ABORTIONS	0.3	-	1.1		1.2	-	1	0	2	0	0	0	1	0	0	0	0	0	1
1ST SERVICE C.R.	43	*	60		60	*	42	42	42	39	40	43	45	45	46	44	43	43	43
SRV/PREG:ALL COWS	3.1	*	2.5		2.5	*	3.3	3.2	3.1	3.3	3.2	3.1	3.1	3.0	2.9	3.0	2.9	2.9	2.8
SRV/PREG:PREG COW	2.6	*	2.0		2.0	*	2.5	2.5	2.6	2.6	2.7	2.9	2.9	2.9	2.7	2.5	2.3	2.1	2.2
PD DOLLARS SIRES	154	-	150		150	*	147	153	154	154	154	154	158	156	154	155	156	158	154
MIN AVE DAYS OPEN	157	*	100		100	*	126	136	135	134	132	149	157	167	180	189	192	185	173
MIN CALVING INT	14.4	*	12.5		12.5	*	13.4	13.7	13.7	13.6	13.5	14.1	14.4	14.7	15.1	15.4	15.5	15.3	14.9
custom item # 5	0.0	-	0.0		0.0	-	0												
MASTITIS AND DISEASE																			
AV CELL COUNT CODE	3.5	*	3.0		3.0	*	3.2	3.1	2.5	2.8	2.8	3.3	3.7	3.9	3.6	4.4	4.3	4.3	4.5
MASTITIS: CLINICAL	21.9	*	5.5		6.4	*	19	21	15	13	15	30	26	28	28	23	26	19	18
UDDER EDEMA	0.9	-	1.1		1.4	-	0	2	0	0	1	0	4	1	2	0	0	1	0
BULK TANK SAMPLES																			
SOMATIC CELL CNT	413	*	200		200	*	233	233	233	233	233	542	542	542	542	542	542	542	437
TOTAL BACTERIA	4100	-	5000		5000	-	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	8000
PATHOGENS	1300	*	1000		1000	*	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
custom item # 6	0.0	-	0.0		0.0	-	0												
MILK FEVER	0.8	*	0.6		0.7	-	0	0	0	0	1	0	3	2	0	1	1	1	0
KETOSIS, OFF FEED	0.0	-	1.3		1.8	-	0												
DISPLACED ABOMASUM	0.5	-	1.3		1.8	-	1	1	1	1	1	0	0	0	0	0	0	1	0
COW DIARRHEA	0.0	-	1.1		1.2	-	0	0	0	0	0	0	0	0	0	0	0	0	0
RESPIR DISEASE	0.0	-	1.1		1.2	-	0	0	0	0	0	0	0	0	0	0	0	0	0
LAMENESS	1.8	-	4.3		4.7	*	6	2	2	4	0	1	2	0	2	0	1	1	2
OTHER	0.3	-	4.3		4.7	-	1	1	1	0	1	0	0	0	0	0	0	0	0
CALF AND HEIFER HEALTH:																			
BIRTH - WEAN:TREAT	4.6	*	1.3		3.2	-	1	11	0	0	0	4	18	10	3	8	0	0	0
BIRTH - WEAN:DEAD	0.4	-	0.5		1.3	-	1	3	0	0	0	0	1	0	0	0	0	0	0
WEAN - BREED:TREAT	0.4	-	2.6		1.3	-	0	3	0	0	0	0	0	0	2	0	0	0	0
WEAN - BREED:DEAD	0.0	-	1.3		0.6	-	0	0	0	0	0	0	0	0	0	0	0	0	0
BREED-CALVNG:TREAT	0.0	-	1.0		0.9	-	0	0	0	0	0	0	0	0	0	0	0	0	0
BREED-CALVING:DEAD	0.0	-	1.0		0.9	-	0	0	0	0	0	0	0	0	0	0	0	0	0
YOUNGSTOCK CULLING	2	-	7.6				0	2	0	0	0	0	0	0	0	0	0	0	0
AGE AT 1st CALVING	31.1	*	24.0		24.0	*	32	32	32	31	31	31	31	31	31	31	30	30	30
DIFF IN M.E. MILK	-1	-	669		669	-	45	-553	-665	-637	-780	-103	81	463	451	333	699	659	772
custom item #7	0.0	-	0		0	-	0												

Software:

The Monitor and the other associated parts of the Dairy Production Medicine package are written to use the LOTUS spreadsheet software. LOTUS is a widely used commercial spreadsheet software package that sells for around $300. Dr. David Galligan's nutrition and ration balancing program makes use of a LOTUS add-on software package, ENFIN, which costs approximately $90.

Sources of Data for Dairy Herd Health Monitoring

Dairy Herd Improvement Association (DHIA) Records

The single most important source of information for dairy herd monitoring is DHIA reports from the Dairy Records Processing Centers (DRPC). DHIA plays the central role in both individual and herd level dairy record systems. The monthly herd summary report is the cornerstone data source for herd monitoring. When followed month to month, the data summary will provide much of the information needed to evaluate the herd's status. [11] Monthly reports vary widely between different DHIA centers in the way they calculate and report information. This can cause problems when comparing parameters between DHIA regions.

Production data derived from DHIA reports are quite reliable. Information about herd somatic cell counts is one of the most cost effective sources of information regarding herd mastitis status. The quality of reproductive data derived from DHIA records depends on the accuracy and completeness of recording by the dairyman and the on-farm testing personnel. Where recording and reporting are accurate and consistent, these measures of herd reproductive performance are invaluable monitoring aids. Although most DHIA systems lack effective approaches for recording and reporting disease on dairy farms, some DHIA regions (including the Raleigh DRPC) are developing better schemes for monitoring health events.

DHIA centers have also developed systems for direct connection from the farm into the central computer database, and for linking on-farm computer record systems with the central system. The program for the Raleigh DRPC is an excellent example of this relatively new development. Their DART system (Direct Access to Records by Telephone) enables either the dairyman or veterinarian to dial directly into the farm's records and to generate a variety of standard or self-defined lists of cows for a variety of purposes. [12] The DART system can be used in several ways: as the primary record system for a dairy, as a way to generate routine herd monitoring reports and action lists, or as an analytic tool for problem investigation.

The DHIA system is perhaps the best example of efficient use of dairy record keeping resources. A system that initially came into existence for other reasons (progeny testing and genetic improvement) now serves many important functions that support dairy production management. For practitioners, DHIA records provide information without any added effort for the dairyman or veterinarian. Dairy veterinarians would be well served to form strong relationships with their local DHIA centers. The centers have developed a useful set of tools for dairy herd health practice. Dairy practitioners need to learn how to access and use these tools. These are the tools that allow a veterinarian to do a "physical examination" on a herd.

Individual cow records: paper and microcomputer systems

Depending on the dairy, individual cow record systems provide much of the data for monitoring the herd. There are many individual cow record systems, from whitewashed barn walls to individual cow card systems to on-farm or practice based microcomputer systems. The actual type of system is less important than the accuracy and completeness of the data. Accessibility of the data to answer herd related questions is often difficult with individual cow records. Particularly on large dairies, paper record systems may become too cumbersome. There are several excellent microcomputer based dairy record systems available commercially. Depending on their design, they significantly reduce the difficulty of gleaning information from individual cow histories. Several of these systems now communicate directly with some DHIA centers, exchanging data between the microcomputer and the central system. This is the next logical step in the evolution of dairy record systems for large dairies. The expense of such systems may make them impractical for small dairies (100 cows), unless the farm also uses the computer for other farm management and business activities. For smaller herds, veterinary practices may provide a microcomputer records bureauing service to their clients.

As the size of a herd increases, searching the individual cow records for important monitored items becomes difficult. These items include items like incidence of disease and treatment, inventory of all ages of animals, and events such as parturition and insemination. In addition, some routine measurements from each dairy are needed, such as body scores, feeding program information, and heifer growth rates. We designed a one page paper data collection form to collect that on-farm data. Each DHIA test day, the dairyman begins a new paper monitor and sends the completed one to the veterinarian. This form, along with the DHIA monthly summary report for the same period, provides the basic input data for the MONITOR.

Practice and laboratory records

Particularly for mastitis, laboratory results play a singnificant role in the monitoring of herd health. Bulk tank cultures done on a routine basis provide a picture of udder health, milking hygiene, and the types of pathogens present in the herd. [13] Whether done in the practice itself, or in outside diagnostic laboratories, these data are important parts of herd monitoring systems.

Structure of the Monitor

Table 2 a,b shows the complete analysis and results section of the MONITOR. There is an additional section (not shown) where goals for the dairy are set. Each row in the spreadsheet contains the information about a particular monitored item. The first column contains the name for the item, followed by the analysis section and then the data section. The columns in the data section on the right store the actual herd data, one column per month, with the most recent month on the left. The order of the data (newest on the left, oldest on the right), is worth emphasizing, since the left to right ordering is the same when graphs are drawn. The printed report in Table 2 shows only the past year's data. Data in months before August 1987 are stored in the spreadsheet farther to the right.

The first of the analytic columns calculates the average for the item over the past year. These are rolling averages. As a new month is added to the MONITOR, the same month a year ago is dropped from the calculations. After the averages column, there is a column for goals for an average month on the left and for goals for the current month on the right. These columns are not entered, they are calculated from the goals set in the first column in the goals section (further to the left). Look at the item "Retained Placenta" in Table 3, and the arrangement of the analytic section will become clear. The goal for retained placenta is set in the far left column at 5 percent of calvings. In August, 1988, the example herd had 14 cows and 13 heifers calve, a total of 27 calvings. These are entered in the data column in the first few lines in Table 3. The spreadsheet multiplies 27 calvings by 5 percent and sets the goal for retained placentas for this month to be 27☆ 0.05 = 1.4 cases of retained placenta. The actual herd performance was 5 cases of retained placenta. This exceeds the calculated goal and so the MONITOR flags the item by placing a star between the goal and the actual data. The process for the average month is the same. In an average month there have been 21.8 calvings in the herd (12.8 + 9.0). The goal for retained placentas for the average month is thus 21.8 ☆ 0.05 = 1.1 cases per month. The actual average number of cases is 2.1 and so it is flagged. The stars in both columns signify that the herd has had more cases of retained placenta than the goal in an average month in the past year, and that the trend has continued this month.

The need for two analytic goal columns should now be clear. In our example case of retained placenta, the MONITOR based the goals for an average month on the results for an average month. Goals for the current month were based on the data for the current month. As the retained placenta example shows, the year's average performance for a given item (number of calvings) may not be the same as this month's performance. The denominators for goal calculations are different for the two analyses. There were 27 calvings in the current month of the example, while there were 21.8 calvings in an average month.

The goals expressed in the analysis section are always in absolute numbers, so that they can be compared to the absolute numbers of performance. Again using our retained placenta example, the MONITOR displays the goals as cases of retained placenta, so that they can be compared to actual cases of retained placenta. We have tried to base goals on animals at risk of the disease. For example, the goal for retained placenta depends on the number of calvings, not the total herd.

The analysis columns can be scanned for starred items to locate problem areas in the herd. Stars in both columns mean that the herd is generally not doing well for that item. A star in the average column and a dash in the current month's column means that the herd is probably making improvement and has finally reached its goal. A dash in the average column and a star in the current month's column may signal that something has recently gone wrong in the herd relating to that item.

Besides the items displayed in the MONITOR, there are seven lines scattered in various areas that allow the veterinarian to monitor custom items of their choice. Different herds have different problem areas; the custom lines allow the MONITOR to adapt to changing needs. The items can also be redefined in the stage of lactation and

Table 3

DAIRY HERD MONITOR: GOALS SECTION (use ALT H for help) PAGE 2
EXAMPLE FARM

Value	Description	Source
	REPRODUCTION	
8	COWS CALVED goal: % of herd per month	MONITOR
5	COW DYSTOCIAS goal: % of cows calving	MONITOR
4	HEIFERS CALVED goal: % of herd per month	MONITOR
10	HEIFER DYSTOCIAS goal: % of heifers calving	MONITOR
8	CALVES BORN DEAD OR DEAD DAY 1 goal % of calvings	MONITOR
5	RET. PLACENTA goal: % of calvings this month	MONITOR

DAIRY HERD MONITOR: PAGE 2
EXAMPLE FARM

Description	AVERAGE MONTH	GOALS AV. MO	GOALS THIS MO	AUG 88	JULY 88
REPRODUCTION					
COWS CALVED	12.8	* 17.3	19.0 *	14	16
COW DYSTOCIAS	0.1	- 0.6	0.7 -	0	0
HEIFERS CALVED	9.0	- 8.6	9.5 -	13	18
HEIFER DYSTOCIAS	0.3	- 0.9	1.3 -	0	0
CALF DEATH @ BIRTH	2.5	* 1.7	2.2 *	4	3
RET. PLACENTA	2.1	* 1.1	1.4 *	5	1

body score sections. DHIA record centers split the stages of lactation differently; the MONITOR can be changed to reflect the local DHIA conventions.

Output from the Monitor:

There are two types of output from the MONITOR: tabular reports like the ones shown in Table 2, and graphics output. The report prints on 2 pages of standard 8.5 X 11 paper. In practice, the veterinarian should never simply mail the report to the dairyman. Dairymen will probably ignore it, just like they ignore their DHIA report. The best approach is for the practitioner to highlight the report and write notes on it, and then to hand deliver the report at the next herd visit.

The MONITOR'S ability to draw graphs is one of the major strengths of the program. Graphs visually evaluate trends in a herd in a way that tables of numbers cannot. By choosing from a series of menus, the user can create graphs of the dairy's data. Three types of graphs can be drawn: line, bar, and stacked bar. The past year's data can be graphed, or the graph can include all the data stored. Up to six different items can be selected for simultaneous display. Beyond these automated options, all of the graphics capability of LOTUS is also available to the user.

Graph 1 depicts the changes in rolling herd average (RHA) and mature equivalent (ME) milk production for cows and first calf heifers during the past four years. The time scale runs from right to left with the most recent month to the left. One can quickly see that the herd average increased from approximately 15,000 lbs. of milk in the spring of 1985 to a peak of 17,500 lbs. in the summer 1986. A major drop in rolling herd average production occurred since the summer of 1986. Examination of the data for mature equivalent production, however, reveals that mature equivalent milk production has generally improved over the whole period. We will discuss this further below, in the section on specific items and their interpretation.

Implementing the Monitor

When a dairy practice first begins formally monitoring the status of client herds, it is best to begin slowly, usually with only a few herds. The best start-up herds are those with good existing records, that have a good and stable relationship with the practice, and that have innovative dairymen. It is useful to start by meeting with the dairyman to discuss the program, including the tasks required of the veterinarian and of the dairyman. [3] Monitored herds must be part of the Dairy Herd Improvement Association (DHIA) records program. There will be a period of trial and error in getting started. Few practices are accustomed to routine computer record keeping for their clients and there will be a break-in period while everyone becomes computer literate. For practices already using computers and accustomed to analyzing DHIA records as a routine, the initiation period will be brief. Dairy herd monitoring is an art and a science. Like physical examination of an individual animal, monitoring becomes more efficient and effective with experience.

Obtaining the data to enter into the MONITOR is ninety percent of the battle. Motivating the client to keep additional records may prove difficult at first. Experience shows that the best way to begin is to enter a complete past year's DHIA data, even though the paper monitor data will be missing. The client will see the value of keeping the chronology of records, of graphical analysis, and you will spark their interest in keeping the additional data on the paper monitor. Trying to reconstruct the paper monitor data from the past is usually not a rewarding effort, unless the farm's records are particularly complete and organized. In the beginning, the DHIA data may have serious inaccuracies, particularly in the areas of reproduction and feeding program information. Routine use of the MONITOR may motivate the client to improve their reporting to the DHIA test personnel.

Setting Goals for the Monitor

After long term use of the MONITOR in several herds and discussions with practitioners who have been using the MONITOR, some basic approaches emerged about how goals can be set for different herds. Goal setting is not a static process. Goals will vary from farm to farm and will vary over time on a particular farm. A good starting point for goals is simply to take the average DHIA performance levels for similar herds and use them as the initial goals. Table 4 provides those averages, broken down by herd production levels, for the Dairy Records Processing Center at Raleigh.[14]

Starting with DHIA averages for goals has several advantages. It is easy to set the numbers and to set the goals. When explaining the goals to the dairyman, one can simply point out that these are the average values for other dairies at the same level of milk production. If the dairy is not at least reaching those averages, it is fairly clear that there is a problem in that area. For the factors that do not have DHIA summary data (i.e., that come from the paper monitor), we recommend that veterinarians begin with their own judgement and experience in their local area. Published data may also aid in the development of appropriate goals.[13, 15-23] As time goes by within a herd, the veterinarian will gain confidence about which areas in a herd need intervention and where goals should be adjusted, either up or down. This varies from farm to farm, over time, and particularly from manager to manager.

Major Monitored Items and their Interpretation:

Types of items:

Since most of the following discussion will be about

Table 4a

DHIA AVERAGES: DRPC PAGE 1
SUMMARY DATA BY PRODUCTION GROUP
HOLSTEIN HERDS

MONTH AND YEAR	AVERAGE HERD	GOALS AV. MO	GOALS THIS MO	)23 10	22-23 13	21-22 50	20-21 112	19-20 232	18-19 431	17-18 641	16-17 730	15-16 697	14-15 650	13-14 434	12-13 324	11-12 178
PROD, NUTR, FEED PROGRAM																
ROLLING HERD MILK	18079	-18079	18079 -	23918	22559	21488	20516	19515	18568	17559	16555	15546	14566	13581	12575	11674
ROLLING HERD % FAT	3.58	- 3.6	3.6 *	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
HFR PROJ ME MILK	18650	-18650	18650 -	23031	21986	21902	21256	20464	19414	18521	17550	16625	15590	14779	13677	12702
2nd PROJ ME MILK	0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
COW PROJ ME MILK	19314	-19314	19314 -	24019	22639	22421	21860	20992	20108	19011	18051	17138	16140	15208	14175	13294
% COWS IN MILK	87	- 87	87 -	90	89	89	88	88	88	88	87	87	86	85	84	84
AVE DAYS IN MILK	174	- 174	174 *	186	170	171	173	171	171	171	173	175	175	173	175	174
AVE DAYS DRY	65	- 65	65 -	57	60	60	62	62	63	64	65	68	69	71	74	76
MILK/COW/DAY	56.8	- 56.8	56.8 -	72.9	70.3	66.8	63.8	60.9	58.3	55.2	52.3	49.4	46.5	43.9	41.1	38.4
ADJ CORR MILK	62.0	- 62.0	62.0 -	81.9	75.8	71.4	70.4	66.7	63.4	60.2	57.3	54.2	51.0	46.9	44.9	41.8
% FAT D.O.T.	3.57	- 3.57	3.57 *	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.5	3.6	3.6
MILK BLEND PRICE	12.92	-12.92	12.92 *	12.83	12.70	12.40	12.75	12.74	12.79	12.90	13.02	13.16	13.27	13.24	13.26	13.32
VALUE OF PRODUCT	5.73	- 5.73	5.73 -	7.68	7.13	6.53	6.19	6.04	5.77	5.52	5.28	5.11	4.78	4.46	4.25	4.00
FEED COST/COW/DAY	2.34	* 2.34	2.34 *	2.65	2.60	2.82	2.44	2.44	2.38	2.26	2.25	2.15	2.08	2.03	1.93	1.89
FEED COST/INCOME	41%	- 41%	41%-	35%	36%	43%	39%	40%	41%	41%	43%	42%	44%	46%	45%	47%
HEIFER PEAK MILK	64.4	- 64.4	64.4 -	84	78	72	72	68	65	63	60	57	54	52	48	46
2ND LAC PEAK MILK	0.0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
COW PEAK MILK	85.3	- 85.3	85.3 -	108	103	99	95	91	88	83	79	76	71	68	63	60
HFR LBS/DAY (40	0.0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
HFR LBS/DY 41-100	57.8	- 57.8	57.8 -	78	72	66	62	60	58	56	53	51	48	45	44	41
HFR LBS/DY 101-199	54.2	- 54.2	54.2 -	70	67	62	61	58	56	53	50	47	45	42	39	37
HFR LBS/Dy 200-305	46.3	- 46.3	46.3 -	58	59	54	52	50	47	45	42	40	38	36	34	32
COW LBS/DAY (40	0.0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
COW LBS/DY 41-100	74.1	- 74.1	74.1 -	92	87	87	81	79	77	73	69	66	63	59	56	52
COW LBS/DY 101-199	64.7	- 64.7	64.7 -	83	81	76	72	69	66	63	59	57	53	50	47	45
COW LBS/DY 200-305	48.8	- 48.8	48.8 -	65	61	57	54	52	50	47	44	42	40	37	36	34
DRY MATTER INTAKE	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
FRESH (40 DAYS	0.00	- 0.00	0.00 -	0	0	0	0	0	0	0	0	0	0	0	0	0
FRESH 40-100 DAYS	0.00	- 0.00	0.00 -	0	0	0	0	0	0	0	0	0	0	0	0	0
FRESH) 100 DAYS	0.00	- 0.00	0.00 -	0	0	0	0	0	0	0	0	0	0	0	0	0
DRY COWS	0.00	- 0.00	0.00 -	0	0	0	0	0	0	0	0	0	0	0	0	0
INVENTORY																
1ST CALF HEIFERS	36	-36.08	36.08 *	34	38	30	38	35	36	39	40	38	39	34	32	30
2ND AND OLD COWS	55	-54.83	54.83 *	45	49	48	50	48	56	57	60	62	65	61	57	55
COWS MILKING	91	-90.91	90.91 *	79	87	78	88	83	92	96	100	100	104	95	89	85
COWS DRY	14	-14.25	14.25 *	13	16	10	14	13	12	14	16	14	17	16	16	16
COWS TOTAL	105	-105.1	105.1 *	92	103	88	102	96	104	110	116	114	121	111	105	101
BIRTH TO WEANING	0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
WEANING TO BREED	0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
BREED TO CALVING	0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL YOUNGSTOCK	0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
TOT ADULT VOL CULL	11%	- 15%		8	15	10	12	10	14	12	11	13	12	12	10	10
TOT ADLT INVOL CULL	25%	* 15%		27	24	23	24	25	26	27	29	26	29	27	24	22
TOTAL ADULT CULLS	36%	* 30%		35	39	33	36	35	40	39	40	39	41	39	34	32
custom item #1	0	- 0.0	0.0 -	0												
custom item #2	0	- 0.0	0.0 -	0												
custom item #3	0	- 0.0	0.0 -	0												
custom item #4	0	- 0.0	0.0 -	0												

Table 4b

DAIRY HERD MONITOR: PAGE 2

EXAMPLE FARM

Description	AVERAGE HERD	GOALS AV. MO	GOALS THIS MO	)23 10	22-23 13	21-22 50	20-21 112	19-20 232	18-19 431	17-18 641	16-17 730	15-16 697	14-15 650	13-14 434	12-13 324	11-12 178
REPRODUCTION																
COWS CALVED	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
COW DYSTOCIAS	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
HEIFERS CALVED	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
HEIFER DYSTOCIAS	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
CALF DEATH @ BIRTH	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
RET. PLACENTA	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
UTERINE TREATMENT	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
CYSTS	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
% HEATS BRED	35	- 35	35 -	38	49	42	41	42	38	36	35	32	28	24	19	18
DAYS TO 1ST BREED	87	* 87	87 *	96	88	85	87	87	87	85	86	85	88	86	87	89
% PROBLEM COWS	22	* 22	22 *	27	22	20	18	20	19	20	22	22	24	25	30	28
TOTAL BREEDINGS	0.0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL PREG CHECKS	0.0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEN AT PREG CHECK	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
PREG, NOW OPEN	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
VISIBLE ABORTIONS	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
1ST SERVICE C.R.	51	* 51	51 *	46	46	50	49	50	50	51	51	51	52	53	58	60
SRV/PREG:ALL COWS	2.2	* 2.0	2.0 *	2.3	2.6	2.2	2.1	2.1	2.1	2.1	2.2	2.2	2.1	2.1	1.9	1.8
SRV/PREG:PREG COW	1.9	- 2.0	2.0 -	2	2.2	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.7	1.7
PD DOLLARS SIRES	109	- 109	109 -	112	111	116	117	114	113	112	110	108	104	97	98	96
MIN AVE DAYS OPEN	134	- 134	134 *	143	132	130	130	126	127	128	130	133	139	141	149	148
MIN CALVING INT	13.6	- 14.0	14.0 -	13.9	13.6	13.5	13.5	13.3	13.4	13.4	13.5	13.6	13.8	13.9	14.1	14.1
custom item # 5	0.0	- 0.0	0.0 -	0												
MASTITIS AND DISEASE																
AV CELL COUNT CODE	3.4	- 3.4	3.4 *	3.5	3	3.1	2.9	3.1	3.3	3.4	3.5	3.5	3.7	3.8	4	4.2
MASTITIS: CLINICAL	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
UDDER EDEMA	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
BULK TANK SAMPLES																
SOMATIC CELL CNT	0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL BACTERIA	0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
PATHOGENS	0	- 0	0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
custom item # 6	0.0	- 0.0	0.0 -	0												
MILK FEVER	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
KETOSIS, OFF FEED	0.0	- 0.0	0.0 -	0												
DISPLACED ABOMASUM	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
COW DIARRHEA	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
RESPIR DISEASE	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
LAMENESS	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
CALF AND HEIFER HEALTH:																
BIRTH - WEAN:TREAT	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
BIRTH - WEAN:DEAD	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
WEAN - BREED:TREAT	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
WEAN - BREED:DEAD	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
BREED-CALVNG:TREAT	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
BREED-CALVING:DEAD	0.0	- 0.0	0.0 -	0	0	0	0	0	0	0	0	0	0	0	0	0
YOUNGSTOCK CULLING	0	- 0.0		0	0	0	0	0	0	0	0	0	0	0	0	0
AGE AT 1st CALVING	28.1	- 28.1	28.1 -	28	28	28	27	28	28	28	28	28	29	28	29	28
DIFF IN M.E. MILK	664	- 664	664 *	988	653	519	604	528	694	490	501	513	550	429	498	592
custom item #7	0.0	- 0	0 -	0												

specific items from the MONITOR, it seems reasonable to make some general comments about monitored items. There are three general types of monitored items: status, explanatory, and denominator items. A particular item may have characteristics of more than one type, but the distinction is valuable when interpreting an item.

Status items are those that monitor performance of the dairy, things like rolling herd average, milk per cow per day, average days open, or age at first calving. Status items are sort of "bottom line" items, the ones you look at first.

Explanatory items are the ones you use when the status items are not where you want them. Suppose, for example, that average days open is too big, say 134 days. A reasonable next question might be "Is it because of poor heat detection or poor conception?". Percent of heats bred and 1st service conception rate are items one can use to explain the poor status of average days open. In this situation, they are explanatory items. The distinction becomes blurry. Average days open was the status item in this example, but it could just as well be the explanatory item for poor milk per cow per day. Drawing the distinction emphasizes the difference between things you would like to change for their own sake (milk production, somatic cell count, butterfat, culling) from things that you want to change because they contribute to other problems (percent of heats bred, dry matter intake, heifer peak milk). If a farm had great conception and could achieve a 100 day open interval even with poor heat detection, you might not want to work on heat detection. Average days open, not heat detection, is the reproductive "bottom line."

Denominator items create standardized rates for evaluating status and explanatory items. If you want to know if the herd has too many milk fevers, you have to know how many calvings there were. Number of calvings in this example is a denominator item. The inventory section's principal role is to provide denominators.

The standard MONITOR items cannot answer all questions about what needs correcting on a dairy. It can point the way toward the likely cause of trouble, and track improvement as you work on the problem. Sometimes the data are there, but the relationship you need are not a set part of the MONITOR. One of the strengths of the system is that you have access to LOTUS and the custom items. A little bit of creativity can go a long way to answering questions.

Momentum:

Another useful idea is the "momentum" of items, both biological and computational. Biological momentum is the easiest to understand; veterinarians deal with it daily. Biological momentum is the resistance to quick change in the biology of the system. Youngstock programs are a good example of biological momentum. If a dairy has been doing a poor job of raising heifers (calving at 32 months), you can change everything overnight (housing, nutrition, parasite control, breeding, etc.) and for at least a year heifers will still be too old at calving. The past biology simply has too much momentum to change quickly. Dry matter intake is an item with little biologic momentum. If you change the ration to balance NDF, increase bunk space, provide shelter at the bunk, and start a new silo of better silage, then dry matter intake can increase tomorrow.

Computational momentum is a bit tougher to grasp, but important for monitoring. It depends on the item's calculation, particularly for DHIA production and reproduction figures. Rolling herd average, for example, has a high degree of computational momentum. Because it includes data from 12 test days, any single test report cannot change rolling herd average much. Mature equivalent milk has less computational momentum than herd average, but more than milk per cow per day. Items with high computational momentum are good for tracking general trends, those with low momentum for spotting new problems.

Average days open is another case of high computational momentum. If you can hire a new, tatented breeder and improve heat detection, the biology of reproduction will change overnight. Average days open will change slowly, because DHIA includes all pregnant cows bred under the old, poor management in the calculation. The only way to change items with high computational momentum quickly is to cull cows and remove them from the database. If average days open drops 30 days between two tests, be suspicious that cows were culled, not that a reproductive miracle has happened.

Page 1:

Page 1 of the MONITOR covers herd production, production by stage of lactation, feeding and body scoring, inventory, and culling. In addition, the first page includes four lines that can be customized by the practitioner to monitor some non-standard aspect of the dairy.

The first section covers a variety of productive parameters in terms of total milk production, mature equivalent productions, milk per cow per day, herd stage of lactation production, value of milk, and cost of feed. For the Raleigh DRPC, these are all taken from the DHIA report. There are two calculated items in the first section: adjusted corrected milk and feed cost as a proportion of income.

Rolling herd average (RHA) is a general measure of herd productivity. It is the bench mark for comparisons with other herds and is a crude estimate of the dairy's income from milk. Projected mature equivalent (ME) milk production is the average estimate of how each cow would milk if she were at her lifetime peak lactation. Graph 1 shows the example herd's performance for rolling herd average and cow and heifer mature equivalent milk production over the past 4 years. Mature equivalent milk production adjusts production for age and season at calving with factors specific for each DHIA region. On an individual basis, ME milk will allow comparison between first calf heifers and older cows on an "equal" footing. On

a herd basis, average heifer ME is usually 400 -600 pounds less than average cow ME (Raleigh DRPC). Although the genetics of heifers is usually better, the cows have been culled more heavily. Graph 18 illustrates the difference between the two ME milk productions.

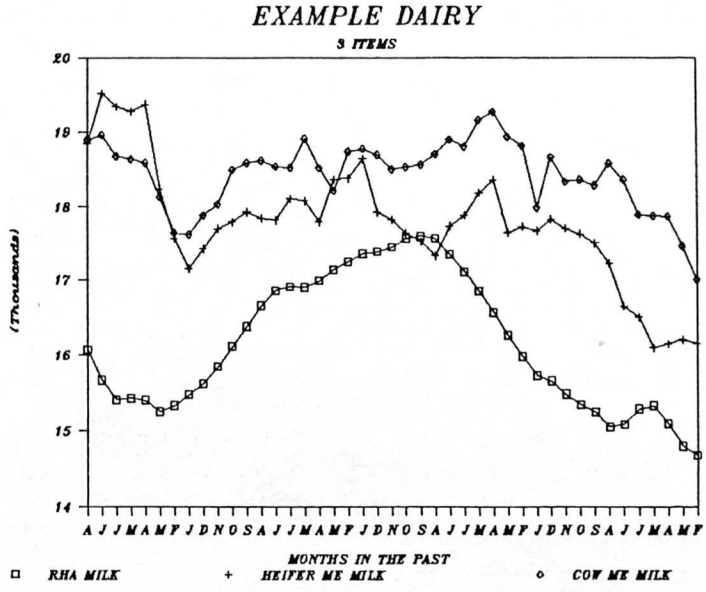
Graph 1 shows that rolling herd average milk has dropped over the past two years; a drop of as much as 2,000 pounds and a return to the herd's level when the MONITOR was begun. This drop translates into about $60,000 (2,000/100 ⋆ 14.95 ⋆ 200 cows) of lost revenue per year. Over the same period, mature equivalent production for both heifers and cows has gone upward. How can the mature equivalent go up while the herd average goes down? The drop in RHA cannot be blamed on individual cow productivity, so another explanation is needed.

1) *milk more heifers:* Graph 7 shows this to be true. Graph 8 shows it on a proportional basis (this is the result of using LOTUS to create a custom item). More than 40 percent of the animals in the milking herd are now heifers.

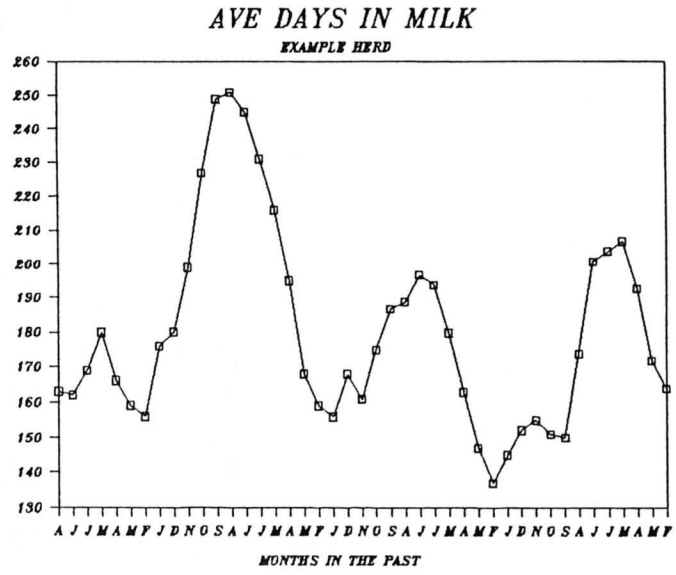
2) *milk more late lactation cows:* if the average days in milk increases because of long days open, the herd will spend more time in late lactation. This will reduce herd milk production without affecting mature equivalent averages. Graph 2 shows that average days in milk had increased dramatically about a year ago, paralleling increased days open (Graph 13). There has been some turn around lately, with a corresponding improvement in herd average. Graph 3 shows the effect of poor reproduction on average days dry. Note the lag time for the impact on days dry.

Graph 4 shows the herd's test day milk per cow per day and adjusted corrected milk. Adjusted corrected milk is a standardized measure of milk production per cow per day.[24] It is standardized as though the herd were always 150 days in milk, produced 3.5 percent butterfat, and had

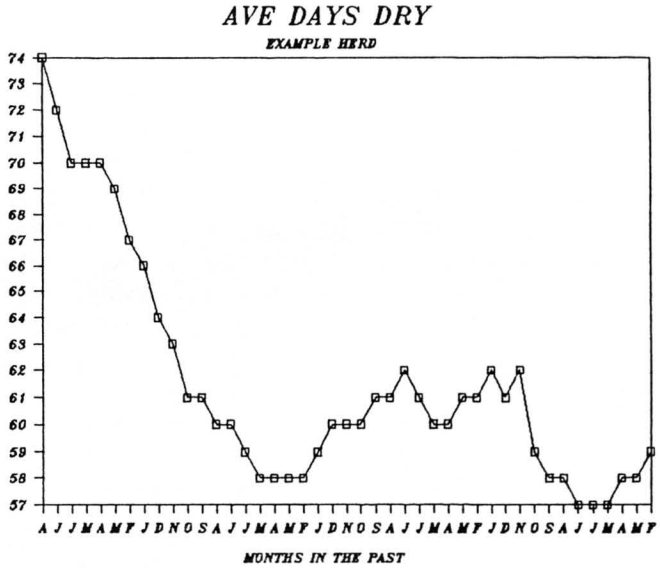
Graph 1



Graph 2



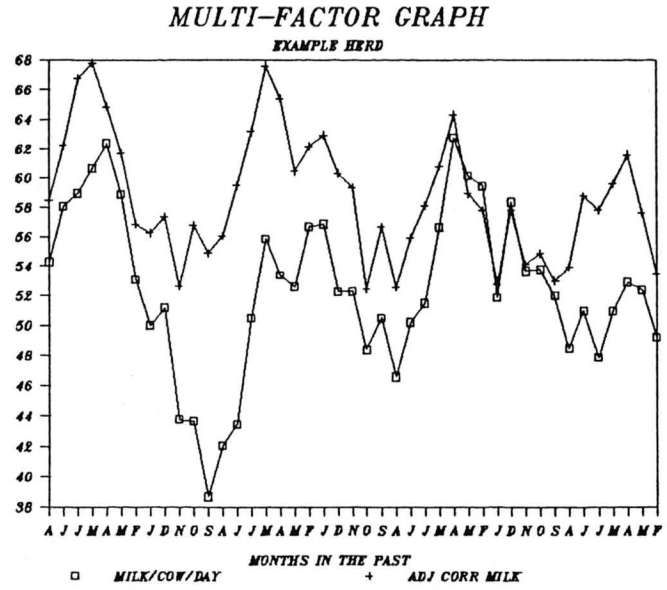
Graph 3



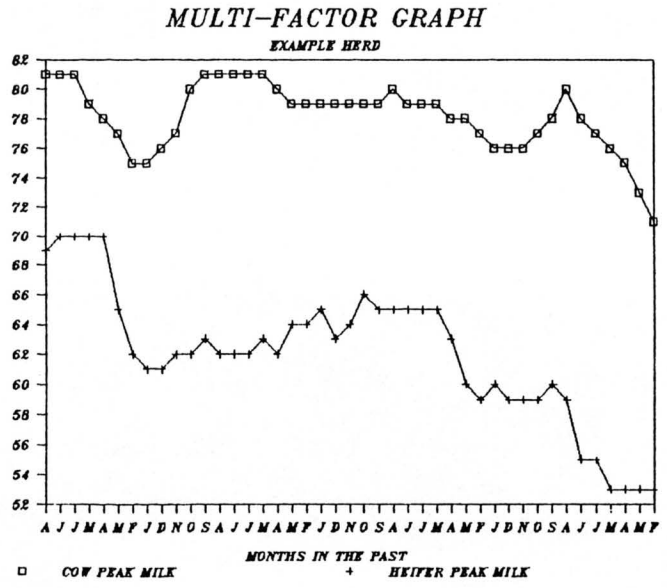
35 percent first heifers. It is a useful measure of herd production that is less confounded by change in herd status than milk per cow per day. Notice in Graph 4 how the general trend is upward, but how seasonally variable daily production is. Also notice how in the previous summer the actual production dropped much more than adjusted corrected milk. The actual drop was due to increased days in milk (Graph 2), not due to a feed management problem. Adjusted corrected milk shows that the herd was doing better for production than in any previous summer.

The second section of page 1 provides space for peak milk and productivity by stage of lactation. This section is a "poor man's lactation curve" for the herd. Graph 5 shows the gradual rise in peak milk for the herd. Peak milk is a cow's best test day production. Peak milk sets the rest of

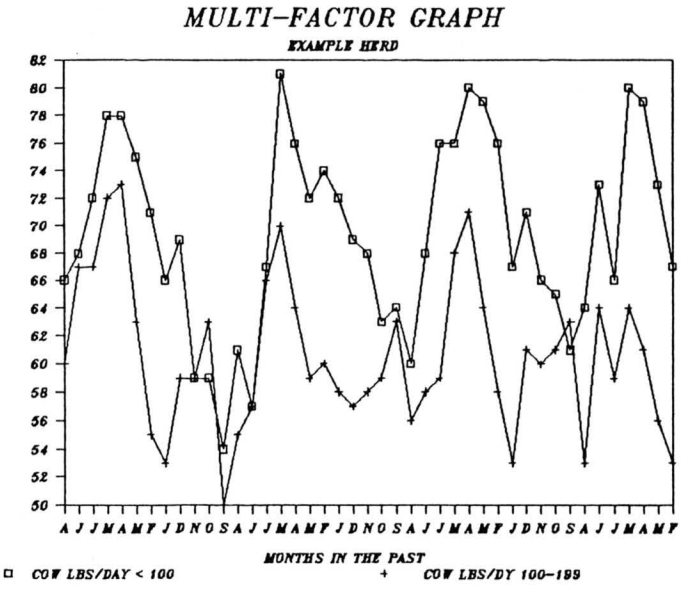
Graph 4



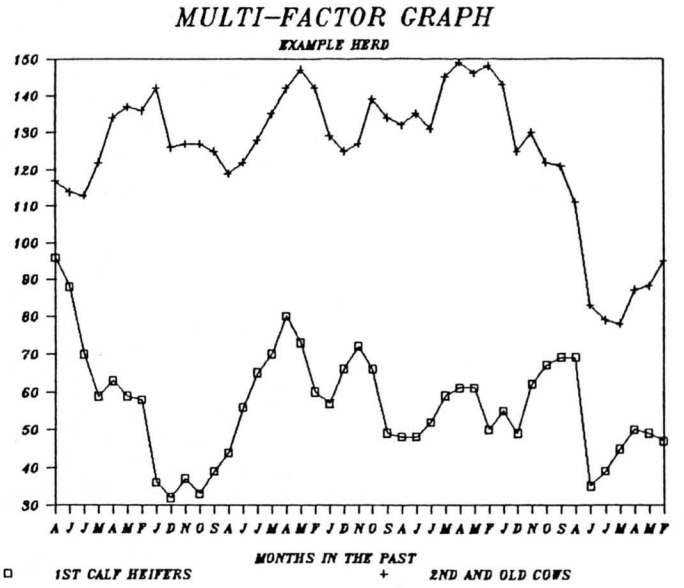
Graph 5



Graph 6



Graph 7



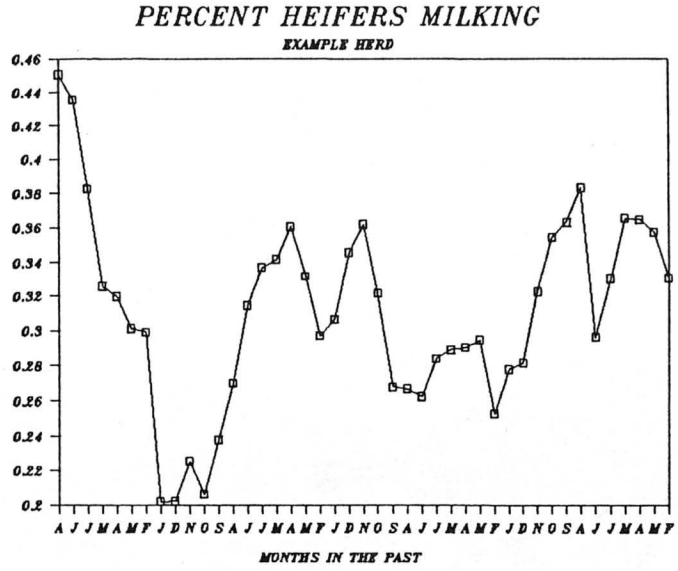
the cow's lactation curve. If you raise peak milk by 1 pound, then the total lactation production increases by more than 200 pounds. Besides peak milk, there are stage of lactation figures for several stages of lactation. Graph 6 shows production in the first and second trimesters of lactation for cows. Notice how something the previous summer severely hurt the cows in early lactation so that they were doing no better than cows in mid-lactation. The same thing happened in other summers (heat stress for dry, calving and early postpartum cows), but that particular summer was worse.

One warning about the preceding paragraph: look at Graph 9. Notice that there were only a few calvings leading into the previous summer. Maybe the whole "problem" of poor adjustment in early lactation that summer was the result of a couple of lousy milkers pulling the average down among a small group. In small herds, (and in this case 200 cows is still small), you have to watch some items carefully for the impact of small denominator groups. This is particularly true for items with small computational momentum.

The third section of Page 1 includes dry matter intake and body scores. Dry matter intake is a crucial element of monitoring a nutritional program. Body scoring is another valuable monitoring aid for nutrition. It is easy to learn and can track the gradual impact of feeding programs in ways that production alone cannot. Increasing production at the expense of herd average body scores will backfire in the long term.

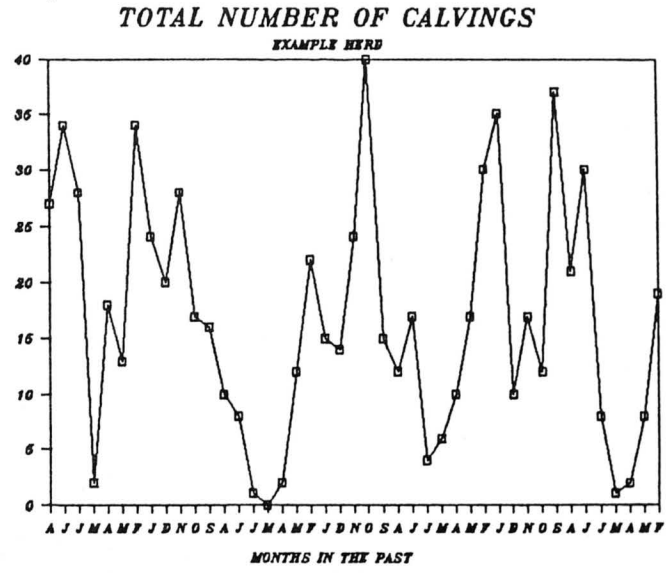
The fourth section of page 1 is the herd inventory. Keeping inventory accurate is important because many of the MONITOR's goal calculations depend on inventory figures as denominators. Inventory figures can also be important explanatory items, as Graphs 7 and 8 were for rolling herd average.

Graph 8

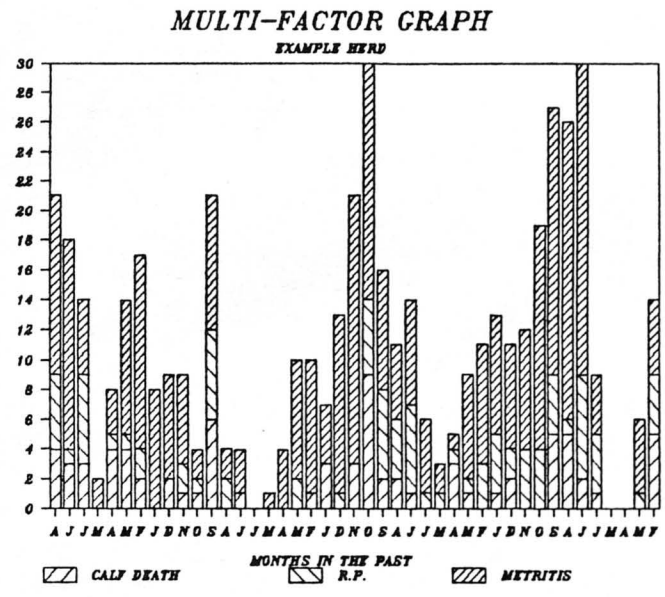


The final standard section of the first page is an analysis of the culling program. Culling is driven more by season, tax reasons, and setting milk production base, so goals to evaluate culling in a particular month make little sense. Rather than averaging each month, the spreadsheet sums cows culled and compares these to goals. For culling, goals are set as totals for the year. Our example herd has culled 87 cows in the last year, 40 % of the herd (87/216)! Most of those culls have been involuntary. I would suspect that the recent drop in average days open (Graph 13) reflects heavy culling for reproduction. There may also have been excess culling for clinical mastitis (see below).

Graph 9



Graph 10



Page 2

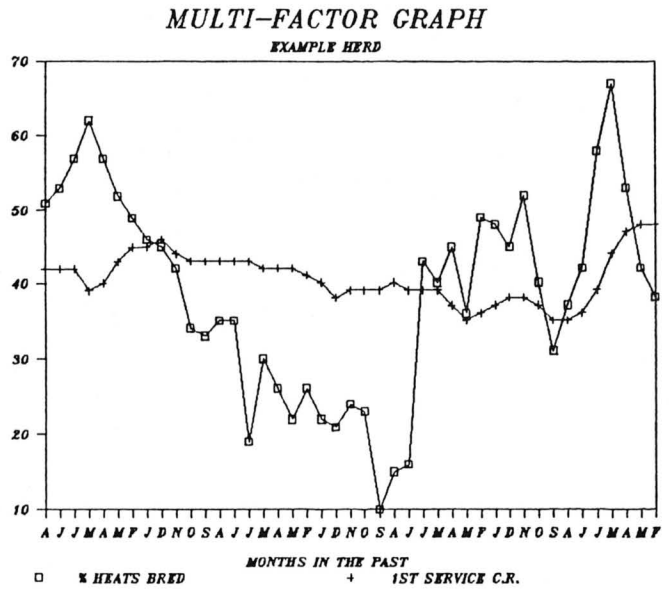
Page 2 monitors data pertinent to the reproductive program, mastitis and adult cow disease, calf and heifer health, and growth and age at calving. While DHIA records are the essential backbone of dairy herd monitoring, they are incomplete sources for the data needed to evaluate a herd's status. The MONITOR depends on the on-farm paper monitor for incidence data (dystocias and calvings, etc.). The reproduction section follows the normal reproductive flow on the dairy: calving, peripartum and early postpartum disease, breeding, pregnancy confirmation and loss, and overall reproductive performance.

When evaluating the herd's reproductive status, work from the bottom up. Start with average days open and work backwards to find the problem area. For the example herd, the record has been spotty. Average days open have been as high as 190; a remarkably poor performance (Graph 13). The recent improvement in average days open is encouraging, but keep in mind that culling probably made the improvement.

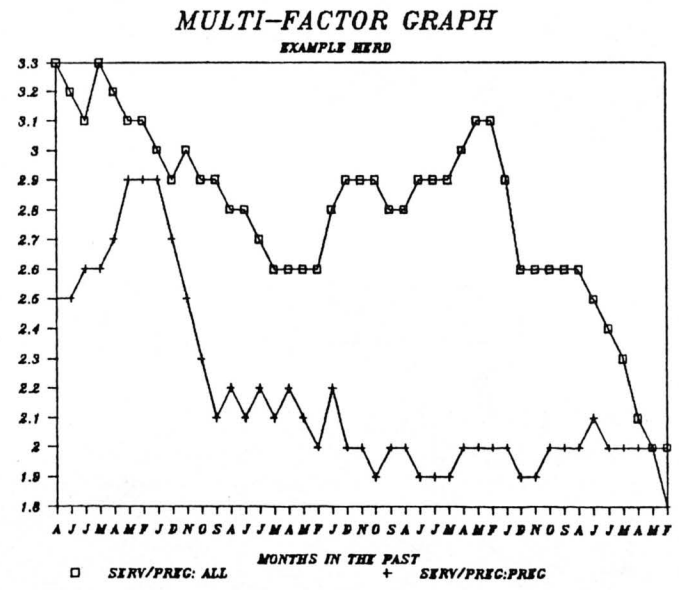
The major problem has been heat detection: percent of heats bred has dropped as low as 10 percent while first service conception rate has been fairly stable (Graph 11).The heat detection problem must have been a labor problem. Someone or everyone must have stopped looking.

Services per pregnancy: all cows (S/P: all) is a measure of the effectiveness of the AI programs. Services per pregnancy: pregnant cows (S/P: Preg) is a measure of the ability to breed fertile cows successfully. It is affected by semen quality, insemination technique, timing of breeding, and

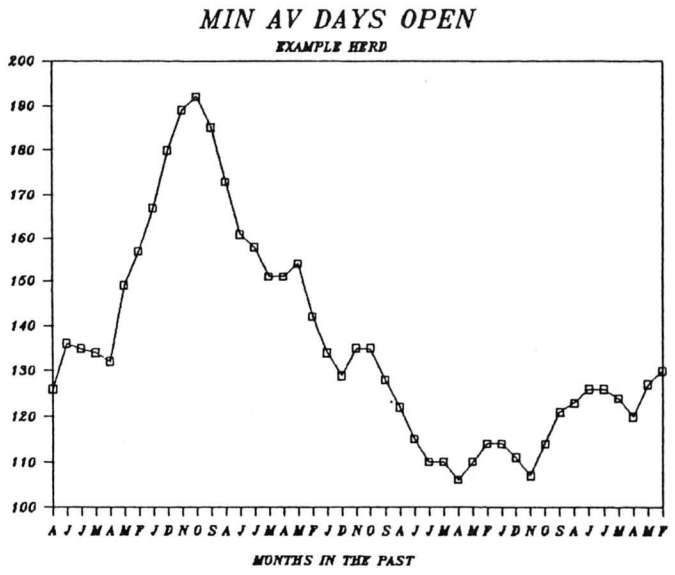
Graph 11



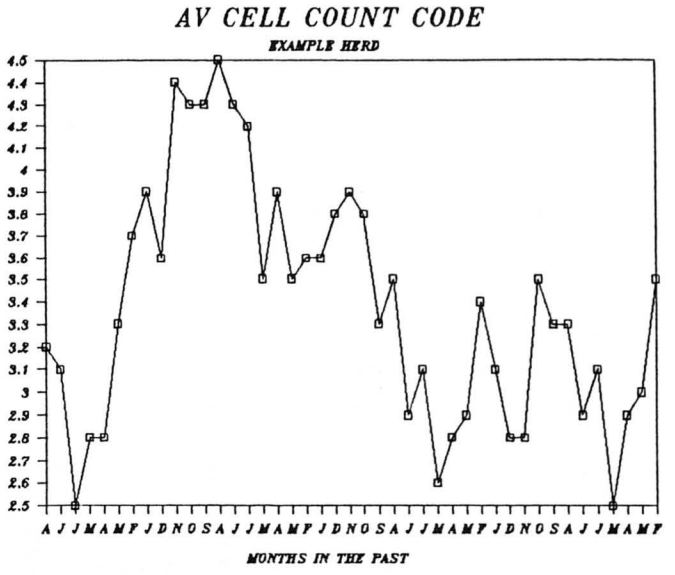
Graph 12



Graph 13



Graph 14

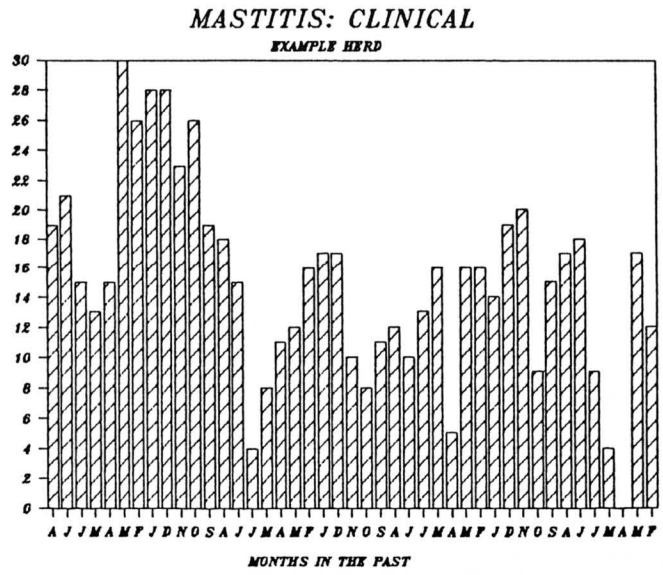


accuracy of heat detection. If S/P: all is substantially larger than SP:preg (S/P:all - S/P:preg o.5) then there are a substantial number of problem breeder cows in the herd. These may be infected cows, cystic cows, etc. A high difference may also reflect an unwillingness of the dairyman to cull chronic repeat breeders.

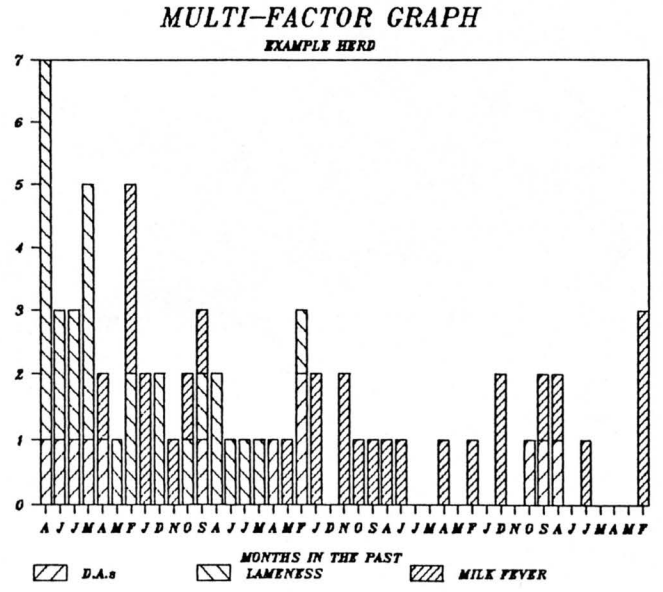
There has been a gradual upward trend in both services per pregnancy statistics for the example herd (Graph 12). The general upward trend in S/P:preg suggests that the herd may need to be evaluated for breeding technique or nutritional causes of infertility. The broad difference between S/P:all and S/P:preg indicates a problem cow problem.

Different peripartum diseases often occur together on dairies. Herds with high dystocia rates also have high rates of retained placenta, metritis, stillbirth, etc. These situations can be highlighted by drawing stacked bar graphs. Stacked bar graphs emphasize the accumulation of problems while de-emphasizing the particular type of problem. The very high incidence of peripartum disease problems (Graph 10) suggests a general breakdown in dry cow and calving management. The calving area may be filthy (metritis), dry cow nutrition may need attention (retained placentas) and workers may need training on how to handle dystocias (calf death). If these areas can be improved, then the number of problem breeder cows might be reduced. The apparent seasonal trend in Graph 10 is not real; it only

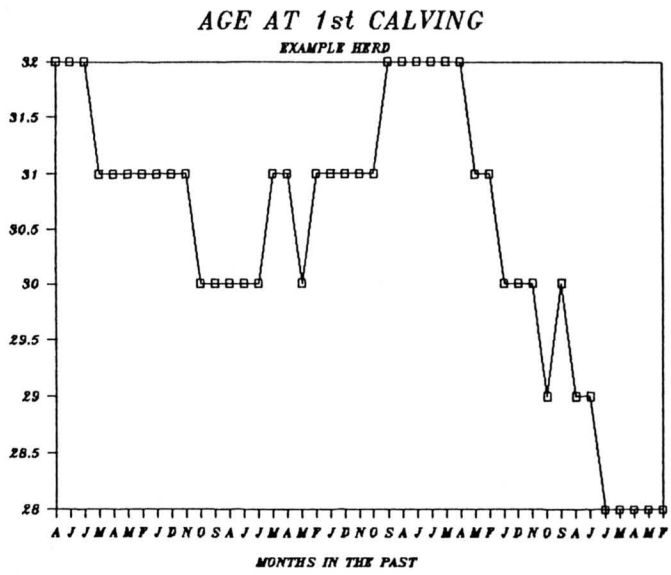
Graph 15



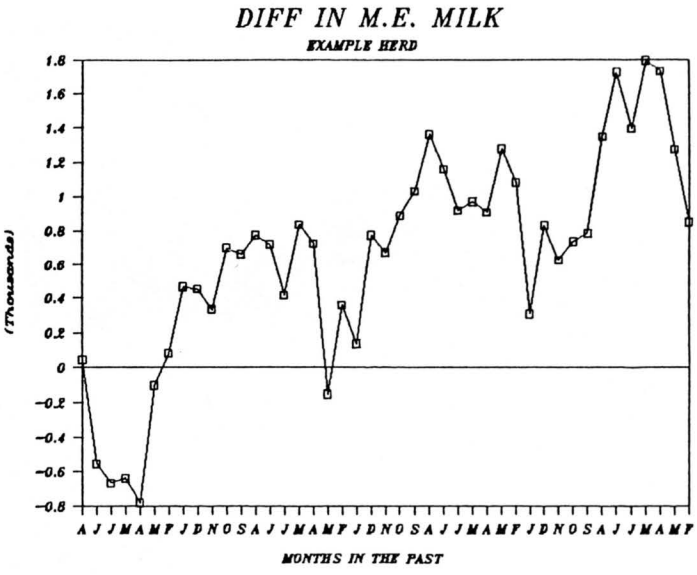
Graph 16



Graph 17



Graph 18



tracks with the number of cows calved. (To confirm this, lay Graph 9 on top of Graph 10).

Mastitis indices include somatic cell count data, clinical disease, and bulk tank milk evaluation. Goals for somatic cell counts are based on the log linear cell count code adopted by DHIA. For the example herd, the current average linear score is quite acceptable, although there was a serious rise in the previous summer (Graph 14). The current mastitis problem in the herd is not subclinical infection but rather clinical disease. The incidence of clinical mastitis in the herd is staggering (Graph 15). At an average of 22 cases per month, there were 264 cases of clinical mastitis over the last year; more than one case per cow in the herd! This must be an environmental organism problem. The somatic cell count would not be so low if the clinical mastitis were due to contagious pathogens like *Staphylococcus aureus* or *Streptococcus agalactiae.* Part of the herd's high culling rate reflects cows that were ruined by clinical mastitis.

The disease section tracks only the major diseases in adult cows. As discussed previously, it is important to be aware of what was chosen as the denominator for calculating goals for these items. There has been a gradual rise in the overall rate of three diseases related to nutrition in the example herd (Graph 16). This includes milk fever, displaced abomasums, and lameness. The last two of these suggest that the milking cow ration may have inadequate fiber. The scattering of milk fevers should direct attention

back to the dry cow feeding program.

The bottom of Page 2 is devoted to youngstock. The MONITOR tracks morbidity and mortality for the three major phases of the youngstock program: pre-weaning, pre-breeding, and bred heifers. Along with average age at calving and first lactation milk production, these items serve as a touchstone for monitoring the effectiveness of the youngstock rearing program. In the example herd, the ME milk of the heifers has gradually improved over time, catching up with the cows. (Graph 18). This would be more heartening if the average age at calving had not increased at the same time (Graph 17). Trading late calving for better first lactation production is false economy. Heifers that calve at 24 months will produce more milk over a lifetime than heifers that calve later, even though the older heifers milk better in their first lactation.

FINANCIAL EVALUATION:

There is another dimension to dairy herd monitoring: the financial evaluation of a herd's status. Asking about biological status (days open, average somatic cell count, age at first calving) is the first step, asking what the problems cost is the second. A series of additional spreadsheets distributed with the MONITOR can help the practitioner in this arena by providing templates for partial budget evaluation of a herd's financial performance in several critical areas.

CONCLUSION:

Much of the future of dairy veterinary medicine depends on whether practicing veterinarians add structured herd monitoring to their set of tools. All dairy practitioners monitor their herds. All too often, the monitoring is done on an informal or subconscious basis. Monitoring is both an art and a science, like most of what we veterinarians do. Monitoring is not a computer program, it is an attitude and discipline that veterinarians can adopt in their approach to serving their clients. Dairy herd monitoring is rewarding, stimulating, and fun. It is a skill worth learning.

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