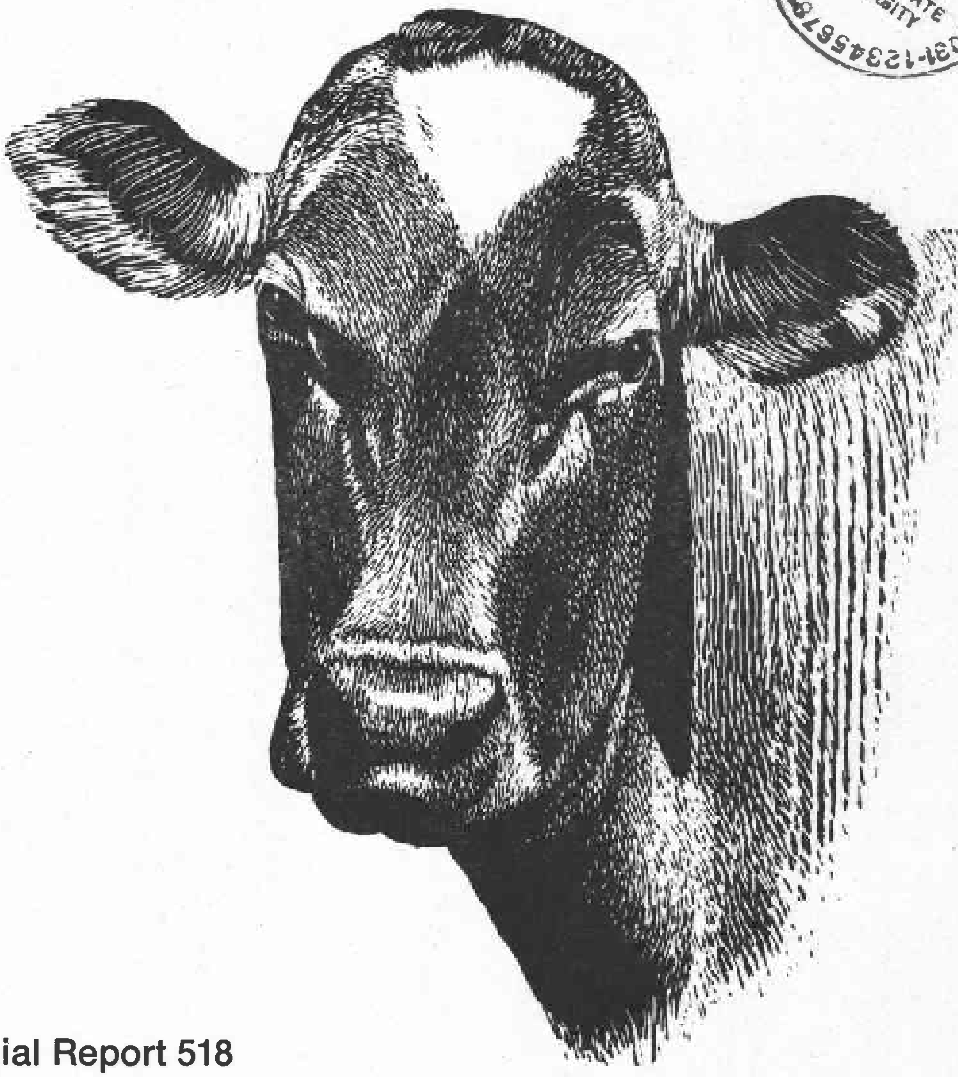
1978 DAIRY DAY



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Dairy Day 1978 is sponsored jointly by the Oregon State University Agricultural Experiment Station and Extension Service of the university as part of their mission to serve the dairymen and the State of Oregon.

PREVENTION OF RETAINED PLACENTAS

Lloyd Swanson
Department of Animal Science
Oregon State University

Retained placentas are a continuing problem for dairymen. Various prophylactic treatments are being used by dairymen in the belief that they aid in the prevention of retained placentas. We became interested in this problem to determine if such prophylactic treatments actually are effective and to determine the cause(s) of retained placentas. We began this experiment in 1976 and plan to conclude it in 1979. It will take that long to accumulate sufficient numbers of cows in each treatment so that we can have confidence in our results. The results discussed in this paper are tentative; we cannot make final conclusions until termination of this study.

Retained placentas constitute a major economic loss for dairymen. Previous reports indicate that this problem affects about 10% of our dairy cattle (Muller and Owens, 1974). Our results to date would indicate a similar incidence in the OSU herd (Table 1). This figure (10.8% incidence in control cows) may be conservative. Other dairy herds we have worked with on this study have reported an incidence of retained placentas varying from 11.3 to 27%. And a large dairy herd in Hawaii cooperating with us has an incidence of 34%. We are also observing that retained placentas tend to recur in the same cows.

Table 1. The incidence of retained placentas for nonlactating cows and heifers injected 24 days prepartum with 1 cc MU-SE[1] per 133 lb BW (SE 1/133), 1 cc MU-SE per 200 lb BW (SE 1/200) or 4 cc Injacom[2] (AD&E)

Treatment	No. observations	No. retained	% retained
Control	37	4	10.8
AD&E	142	19	13.4
Se 1/133	74	8	10.7
Se 1/200	75	2	2.7

[1]Each cc contains 5 mg selenium as sodium selenite and 68 IU vitamin E.

[2]Each cc contains 500,000 IU vitamin A, 75,000 IU vitamin D and 50 IU vitamin E.

Furthermore, the cows with retained placentas were five times more likely to have subsequent uterine infections and it took more care and treatment to treat these infections (Table 2). In other words, cows with retained placentas are likely candidates to have a uterine infection and to require twice the number of treatments as normal cows. Muller and Owens (1974) reported that cows with retained placentas has a 54% incidence of uterine infections whereas normal cows had a 10% incidence.

Table 2. The effect of retained placentas on the incidence of uterine infection and response to treatment.

	Retained placenta	Not retained
Number of animals	45	286
Uterine infections (%)	71.1%	14.3%
Treatments/uterine infection	2.53	1.34

Subsequent fertility is reduced in cows with retained placentas (Table 3). Though the interval from parturition to first estrus is similar, the cows with retained placentas required increased services per conception (.32) and a longer interval from parturition to conception (27 days). Muller and Owens (1974) did not observe a difference in reproductive efficiency although Pelissier (1972) observed significantly increased services per conception in cows having retained placentas. Pelissier also observed that cows having retained placentas were more likely to have milk fever.

Table 3. The relationship between retained placentas and reproductive efficiency

	Retained placenta	Not retained
Number of animals	39	273
Days to first estrus	44	41
Services/conception	2.38	2.06
Days open	119	92

In summary, then, we have evidence that retained placentas do extract economic losses in addition to their aesthetic detraction. If we project our data (OSU herd) to all the dairy cattle in Oregon (a reasonable assumption since our data are conservative according to the literature), we note a sizeable annual economic loss (Table 4). Retained placentas are costing Oregon dairymen more than 1/3 million dollars annually. Approximately 15% of this is a direct cost (treatments) while the major portion is an opportunity cost.

Table 4. Economic Loss Due to Retained Placentas in Oregon[1]

1. Number of cows affected: 93,000 cows (Oregon) x 10.8% incidence = 10,044 cows
2. Cost due to increased services per conception: 0.32 services per conception (2.38 - 2.06) x $5/service x 10,044 cows = $16,070
3. Cost due to increased average days open: 19 days (119 - 100) x $1.50 (cost per day for cows open greater than 100 days) x 10,044 cows = $286,254
4. Cost due to increased uterine infections and additional treatment: 56.8% increased incidence (71.1 - 14.3) x $5 (cost per treatment) x 1.19 (2.53 - 1.34) additional treatments per infection x 10,044 cows = $33,945

Total increased costs due to retained placentas = $336,269 ($33.48/cow)

[1]Based on cost estimates and incidence in the OSU herd.

We do not have data concerning the effect on milk production at this time. Muller and Owens (1974) were unable to explain the significantly increased milk production (840 pounds/lactation) they observed in cows having retained placentas. Considering the value of milk today, retained placentas may be desirable since the value of the milk (about $84) certainly exceeds the cost and loss of income ($33.48) of retained placentas. However, it is most probable that retained placentas do not cause increased milk production, but rather that high-producing cows are more likely to have retained placentas. Perhaps these cows would produce even more milk if they had not had retained placentas. There are no known increases in lactogenic hormones associated with retained placentas which could be responsible for increased milk production.

Trinder, Woodhouse and Renton (1969) first reported on the effectiveness of selenium in reducing the incidence of retained placentas in 1969 on experiments conducted in England. They nearly eliminated retained placentas in dairy herds in which untreated cows had an incidence ranging from 26 to 42%. They also reported that a combination injection of vitamin E and selenium was more effective than selenium alone. These same researchers (Trinder, Hall and Renton, 1973) later confirmed this observation and reported that the combination injection was most effective when given three weeks prior to parturition.

Because Oregon is a selenium deficient area, we became interested in determining if selenium might be effective in reducing the normal incidence (i.e. 10%) of retained placentas in dairy cattle. Furthermore, we were aware that many dairymen were administering an injection of selenium-vitamin E or vitamins A, D, & E during the dry period in the belief that these agents were effective in reducing the incidence of retained placentas and possibly in improving postpartum fertility. We wished to determine the efficacy of such treatments. Thus we began to administer either of two dosages of selenium-vitamin E (MU-SE[1]) or vitamins A, D & E (Injacom[2]) to all our dry cows and heifers at 24 days prior to expected parturition. Selenium-vitamin E was given at 1 cc per 133 or 200 pounds body weight (10 or 7 cc for 1,400 pound cow) while vitamins A, D, & E was given at 5 cc. These are the recommended dosages and are being used by dairymen. We also obtained blood samples from these cows to monitor changes in various components of blood (selenium, vitamins A and E, calcium, phosphorus, progesterone, and glucocorticoids). Records were kept at calving to note the incidence of twins, retained placentas, and calving difficulty. We determined this experiment would need to continue for three or more years to accumulate sufficient numbers in our various treatments. Cows having twins or reproductive disease are excluded from our analyses.

Shortly after we began this experiment, the Ohio State people reported that selenium and vitamin E were very effective in reducing the incidence of retained placentas from 51% in control cows to 9% in treated cows (Julien, Conrad and Moxon, 1976a). Like the English workers, they were working in dairy herds having an abnormally high incidence of retained placentas. So

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[1]MU-SE was generously supplied by Burns-Biotech, Inc. Each cc of MU-SE contains 5 mg selenium as sodium selenite and 68 IU vitamin E.

[2]Each cc contains 500,000 IU vitamin A, 75,000 IU vitamin D and 50 IU vitamin E.

there is little doubt that the prepartum injection of selenium-vitamin E is very effective in reducing the incidence of retained placentas. The Ohio State workers also reported that a single injection at 20 days prepartum was as effective as two injections at 40 and 20 days prepartum. Finally they established that prepartum feeding of selenium only was equally effective in reducing the incidence of retained placentas (Julien et al., 1976b). Thus, in their experiments, contrary to the English work, vitamin E did not improve upon the results of selenium alone.

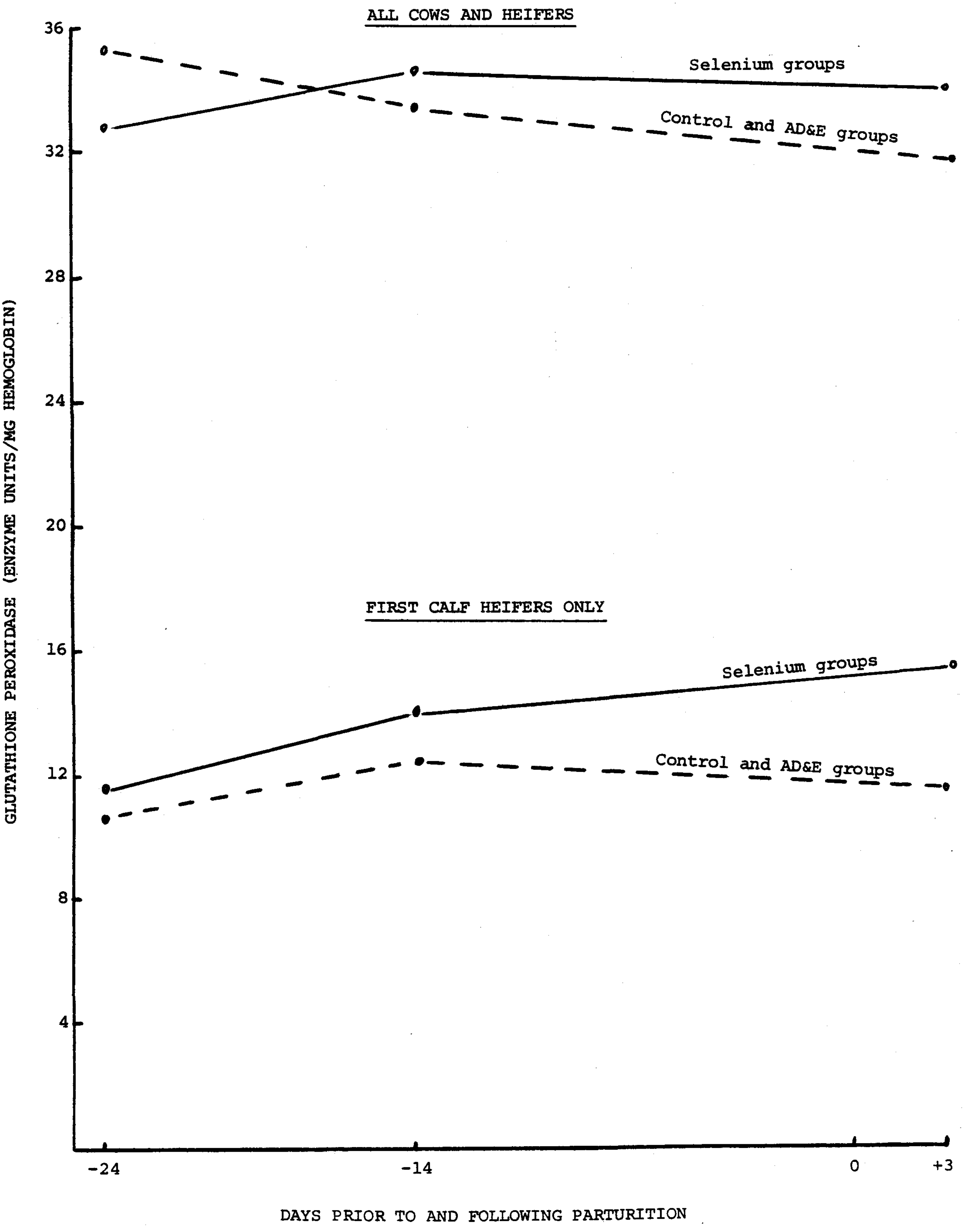
Our results indicate that the vitamin A, D, & E treatment has not been effective in reducing the incidence of retained placentas (Table 1). Thus it is safe to assume that vitamin E alone has no effect. This observation has also been confirmed by Cornell workers (Hartman, Natzke, and Everett, 1976). In a large survey study they observed that prepartum injections of vitamin A, D, & E had no effect on retained placentas, calving difficulty, calf health, subsequent dam fertility, or milk production. We can conclude that if dairy cattle are being fed good quality forages (which they should be), sufficient vitamins are present to provide the needs at parturition.

Next you will note that our results with selenium-vitamin E are varied (Table 1). The higher dosage was ineffective, whereas, the lower dosage reduced the incidence of retained placentas by 75% to a level of 2.7%. Because we have such few cows with retained placentas in these two groups, it is difficult to develop confidence or recommendations concerning these treatments. Naturally the inverse dose response is not what we would have expected.

We have obtained additional data from a cooperating local dairy herd in which the prepartum injection of selenium-vitamin E (10 cc MU-SE) resulted in a 37% reduction in the incidence of retained placentas from 27% to 17%. While this treatment was certainly effective, the reduction was not nearly as effective as that reported by Ohio State.

Our blood selenium data (Figure 1) indicate that the selenium injections were effective in altering blood selenium levels. We are monitoring blood selenium by measuring the levels of glutathione peroxidase, an enzyme in red blood cells whose level is directly related to selenium levels. The top portion of the figure shows that blood selenium was maintained from the time of injection to three days after parturition in the two groups receiving selenium-vitamin E. In contrast, the cows receiving nothing (control) or vitamin A, D, & E exhibited a continuous decrease in blood

Figure 1. RED BLOOD CELL GLUTATHIONE PEROXIDASE ACTIVITY AROUND PARTURITION



selenium. It is quite likely that blood selenium levels begin to decrease immediately when the concentrate portion of the ration is eliminated. Our forages are known to be very low in selenium, whereas, the concentrates contain cereal grains and protein supplements imported from the Midwest and California - areas known to have soils adequate in selenium.

The bottom portion of Figure 1 illustrates a very perplexing problem. Our first calf heifers are very low in blood selenium - about 1/3 the level of our cows - yet the incidence of retained placentas is the same in heifers as in cows. This tends to negate the importance of selenium-vitamin E in reducing the normal incidence of retained placentas.

In conclusion, we have attempted to cause a significant reduction in the normal incidence of retained placentas (10 to 12%). We have used prophylactic treatments which are being used by Oregon dairymen and shown by others to be useful in reducing an abnormally high incidence of retained placentas. Thus far, we can conclude that prepartum vitamin A, D, & E injections are not effective. We need more data before we can make conclusions on the prepartum selenium-vitamin E injections, but it appears that an inverse dose response exists which puzzles us. Such injections only slightly alter blood selenium levels in polyparous cows (3% increase over 3.5 weeks) whereas they cause a very significant increase in heifers (33% increase over 3.5 weeks). We do not observe a difference in the incidence of retained placentas between these two age groups. On the other hand, there is no doubt that selenium-vitamin E injections will reduce retained placentas in herds with an abnormally high incidence (20 to 50%). Retained placentas result in increased uterine infections which are more difficult to treat and cause a slight reduction in subsequent fertility. We have not analyzed the effect on milk production as yet nor have we analyzed the various blood components to determine the cause of retained placentas.

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PERFORMANCE OF DAIRY COWS IN EARLY LACTATION FED RATIONS OF DIFFERENT CRUDE PROTEIN CONTENT: PART ONE, PRODUCTION

Don Claypool
Department of Animal Science
Oregon State University

Magazine articles have appeared during the past few years recommending that dairy cows in early lactation be fed rations containing larger amounts of protein than is currently recommended. To test this claim, we conducted two 90-day feeding trials in which we fed groups of early lactating cows rations containing different levels of natural protein. Cows selected for these trials were judged capable of producing more than 70 pounds of milk per day at peak production.

The three groups of cows in the first trial were fed long alfalfa hay and one of three grain mixtures. The hay contained 20.2% crude protein and the grain mixtures contained 12, 16, and 25% crude protein. Together, the hay and grain provided a complete ration containing 16, 18, or 22% crude protein.

Table 1. Performance of cows in early lactation fed a 1:1 ratio of long alfalfa hay and grain of three crude protein levels for 90 days

Measurements	No. cows	Ration crude protein level 16%	18.3%	22.7%
Daily milk yield, lbs. 4% FCM	7	64.2	62.6	66.6
Milk fat, %	7	2.6*	3.1	3.0
Persistency, %	7	98	99	100
Body wt. change during treatment, lbs.	7	-.33	+.20	-.46

*Significantly lower in % milk fat than the other two groups.

Milk yield expressed as 4% fat-corrected milk (4% FCM), persistency, and body weight changes was not significantly different (Table 1). The difference in fat percent between the group fed the 16% CP ration and the groups fed the 18.3 and 22.7% rations is probably due to chance because milk fat was not considered when we allotted cows to the experimental groups.

The three groups of cows used in the second feeding trial were fed a completely mixed ration made up of 18% chopped alfalfa hay, 25% silage and 57% concentrate on a dry matter basis. The rations contained 12.7, 16.3, or 19.3% CP and were fed once a day in the morning. Cows calving between mid-November and May 1 were assigned to one of three rations on the fourth day of lactation, and remained on that ration for 90 days. Corn silage was fed as part of the ration through all but the last two and one-half months of the trial when it was replaced by grass silage.

Table 2. Performance of cows in early lactation fed a completely mixed ration of 57% grain, 18% chopped alfalfa hay and 25% corn silage at three crude protein levels for 90 days

Measurements	No. cows	Ration crude protein level		
		12.7%	16.3%	19.3%
Daily milk yield, lbs. 4% FCM	15	64.7	69.0	70.5
Milk fat, %	15	3.7^{b}	3.2^{a}	3.5^{b}
Persistency, %	15	102	102	101
Body wt. change during treatment, lbs.	15	-1.7	-5.9	-7.4
Daily feed intake, lbs. D.M.	group	39.0^{a}	40.1^{b}	41.2^{c}

[a,b,c]Averages in rows having different superscripts are significantly different ($P<.05$).

As in the first trial, no significant differences in 4% FCM production, persistency, or body weight changes were observed between cows on the three rations (Table 2). Again, differences between milk fat percentage are due to chance for the same reason as in trial one. There appears to be a trend toward higher production for cows receiving the higher protein rations which may be explained in part by the increased feed intake of the cows on the higher protein rations. Even so, these differences remain unconvincing when one considers that under the conditions of this trial, we can expect differences of this magnitude due to chance in one of every three similar trials.

From an economic standpoint, the cows fed the 16% CP ration made the greatest returns above feed costs from the milk they produced during the duration of the trial (see Table 2, page 13). As illustrated in Figure 1, maximum returns above feed cost probably would have been realized with a ration containing less protein; one that contained 15 to 15.5% CP.

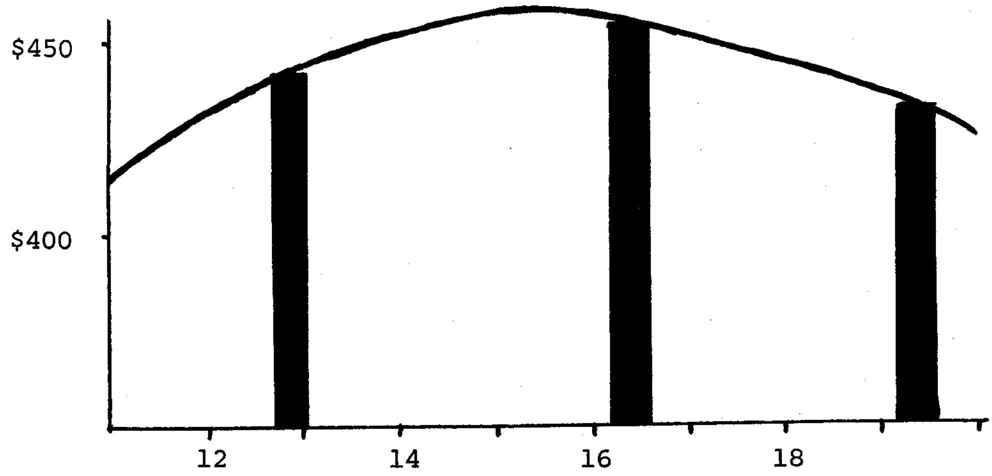

Figure 1. Estimated Maximum Return Above Feed Costs First 90 Days

The results of these feeding trials show that high-producing dairy cows in early lactation do not need rations containing more than 16% CP on a dry matter basis. Additional protein above this level is not desirable from either the production or economic standpoint. These conclusions are in agreement with the new Nutrient Requirements of Dairy Cattle (NRC, No. 3, 1978) as shown in Table 3.

Table 3. Expected milk production for dairy cattle of different body weight and fed varying levels of CP

Cow wt. (lbs)	Ration CP content, DM basis 13%	14%	15%	16%
	- - - - lb milk, daily - - - - -			
< 900	<18	18-29	29-40	>40
1000	<24	24-37	37-51	>51
1300	<31	31-46	46-64	>64
>1550	<40	40-57	57-78	>78

PERFORMANCE OF DAIRY COWS IN EARLY LACTATION FED RATIONS OF DIFFERENT CRUDE PROTEIN CONTENT: PART TWO, REPRODUCTION

Ellen Jordan
Department of Animal Science
Oregon State University

Adequate nutrition is important not only for lactation but also reproduction. There has been some concern among dairymen that high-producing cows do not begin cycling as soon postpartum or cease to cycle prior to when breeding is initiated. Consequently, we decided to monitor reproductive parameters on high-producing cows fed the three levels of crude protein (CP), discussed previously, to determine if reproduction was adversely or favorably affected by the level of crude protein in the ration.

Each of the cows on the experiment was observed for estrous behavior and artificial insemination started at 45 days postpartum provided the reproductive tract was normal as determined by rectal palpation. If the tract was not normal, the cow was not bred until the veterinarian had determined the tract had returned to normal. Cows fed 12.7% CP had fewer services per conception and fewer days to conception compared to cows fed 16.3% CP and 19.3% CP (table 1).

Table 1. Effect of dietary protein intake on the reproductive status of high-producing cows

	Reproductive Parameters	
Experimental Group	Average days open	Services per conception
19.3% CP	106	2.47
16.3% CP	96	1.87
12.7% CP	69	1.47
Overall groups	90	1.93

From this experiment, however, we have not been able to determine why the excess protein had a detrimental effect on reproduction. From work in nonruminants such as the chicken, rat and mouse we can speculate that there may be an increase in embryonic mortality. However, we cannot rule out the possibility that the viability of the spermatozoa or ovum was affected. Ideally we should repeat the present experiment to reaffirm the negative effects we found on reproduction and to determine the reason for the decreased fertility.

We monitored body weight changes over the 90 days but did not find a relationship with fertility. There has been some speculation that a cow must be gaining weight to be fertile; however, this did not prove true in the present experiment. It has also been conjectured that milk production is related to fertility. But we could not detect a relationship over the range of milk production and fertility in the 45 cows in this experiment. Some cows producing approximately 100 pounds of milk per day settled on the first or second insemination and most settled prior to 90 days.

One thing in particular to note is that the overall average days open was only 90 days, despite the fact these cows were producing greater than 70 pounds of milk per day at the peak of their lactation curves. Other researchers have indicated that if you are to receive maximum dollar returns, cows should be settled by 90 days postpartum. As you recall from the previous discussion (Part One), animals fed 12.7% CP had slightly lower milk production, but this was not significant. If we use a charge of $1.50 per day open after 90 days postpartum, feeding high protein becomes even more unfavorable (Table 2), although the 12.7% CP group does not differ from the 16.3% CP group.

Table 2. Economic analysis for three groups of cows fed rations of 12.7%, 16.3%, or 19.3% CP

Criteria	Experimental Group, (CP)[a]		
	12.7%	16.3%	19.3%
Total return from milk for 90 days	$672.38	$725.38	$737.73
Feed costs per cow for 90 days	184.47	228.16	268.74
Return above feed cost	487.91	497.22	468.99
Reproduction charge for days open past 90 days	0	9.00	24.00
Return above feed cost & reproductive charge	487.91	488.22	444.99

[a]Based on Sept., 1978 prices.

Not only did these cows settle rapidly, but they had also started to cycle quite soon after parturition (Table 3) and continued to cycle thereafter. The cows on the high protein ration were observed in estrus earlier than the cows on the medium and low levels of protein. However, these cows fed high protein did not conceive earlier than those fed the low or medium protein. There was no problem with anestrus in any of the three groups.

Table 3. Time intervals from parturition to initiation of estrous cycles in high-producing cows

No. of Cows	Postpartum interval to first estrus
	(days)
27	≤ 20
12	21-30
5	31-40
1	51

Heat detection aids such as KaMar patches and chalk on the tailhead were used to supplement visual observations for restlessness, mucus discharge and vaginal swelling. We had problems with the cows rubbing against the free stall dividers and partially triggering the KaMar, causing a large number of false positives and increasing labor. The most effective method for us was the chalk. Chalking the tail heads worked quite well and when a cow was detected in estrus the date was also written on her rump with the chalk so that we could increase surveillance of these cows approximately 21 days later when she should be returning to estrus.

The study on the reproductive performance of high-producing dairy cows fed 12.7%, 16.3%, and 19.3% CP, reaffirms the production data in that the optimum CP level should be between 12.7% and 16.3% CP. Feeding more than 16.3% CP may even be detrimental to reproduction, making the excess protein even more expensive.

APPLIED DAIRY CATTLE BREEDING

Clint Meadows
Department of Dairy Science
Michigan State University

Sometime after you cease to be a growing boy and become a mature young man you attempt to correct some obvious misconceptions. Now that I'm mature, my first step will be to make a correction. For twenty years I have been invited to speak to dairy farmers with specific instructions to deal with practical, applied breeding philosophy. There are only two ways to breed cattle: the right way and the wrong way.

There are two ways to explain the right way: you can use words, adjectives, analogies, stories, and illustrations, or you can use algebraic statements. The advantage of algebraic statements is the simplicity and you can in a sense prove what has been said. The disadvantage is that most dairymen are not trained to read the algebraic symbols. The disadvantage of words is the frequent misunderstanding of what has been said and sometimes the difficulty of explaining a simple algebraic statement in concise words. For example you could write all the principles of selection on two pages using only algebra, but it takes a 500-page textbook to explain what has been said.

Now that I have the "burr out of my craw" I'll proceed to discuss dairy herd management with special emphasis on applied breeding.

Every dairyman is faced with the problem of herd management, farm management, and total management. To manage the herd he must plan the breeding, feeding, herd health, and reproduction. He must decide on the milking system and waste handling. Feed must be produced, harvested, and stored. All these operations require labor and capital. It would appear foolish to rank these problems. Probably each of you could give an example of a herd that has failed because of any one of the management problems. From my standpoint, breeding is the most important, simply because I understand the problem better than the other phases of management.

The ideal herd management program should result in a herd of cows genetically capable of milking at a very high level, fed to produce at the maximum economical level, be healthy enough to eat and produce at that level, and have a calf every 12 months, preferably a heifer.

Most of you may be talking to yourselves, explaining that this is a whole lot easier to say than do. As a matter of fact, today it is not too difficult to have a Holstein herd capable of producing 20,000 pounds of milk (breeding). Every land grant university has from one to 40 persons who know exactly what nutrients a cow must eat to produce at any level. Herd health is a problem but any herd that takes full advantage of proven immunization programs and prophylactic procedures will have few serious health problems. Any herd systematically and carefully checked for heat and starting to breed at 50 days after calving will have a satisfactory calving interval. If you wish to raise 99% of the heifers born alive, get a quart of colostrum in the calf during the first 30 minutes of life and leave the calf with the mother for a couple of days.

In the past we have said and believed that if you were smart and lucky you could breed a good herd of cows in 25 or 30 years. Today you do not need to be smart, luck plays no part, and starting from scratch you can breed a herd capable of producing at the 20,000-pound level.

Now that I have made several general statements and probably some that you might like to argue with I'll cover a few specifics.

There is only one way that you can improve the genetic ability of your herd and that is through the addition of a heifer. Of course, you could buy a cow or heifer, but in general most of your herd replacements are from heifers you have bred and raised. To insure genetic improvement, the herd replacements must have more potential for production than the cows they replace. There is little or no choice in dams of herd replacements. All cows kept for milk are potential dams of replacements. Therefore, all the selection pressure must be placed on sires of herd replacements.

Choosing the sire of herd replacements is very simple in theory, just use the best bull available. There is one thing wrong with the theory - no one knows for sure which is the best bull. The practical solution is to use enough bulls each year to be sure you have included the best. There is much merit in using several bulls each year. No one has ever been in serious trouble with 5 or 6 daughters of a bull. Many herds have been dispersed due to the heavy use of one bull. A few herds have been lucky, especially those who sell cattle, by having many daughters of a popular bull.

If you have registered cattle and 75% of your herd were daughters of Elevation, then you have a good market. As a matter of fact, with $900 per cow invested in semen you must sell a few just to break even. About the time Elevation looked like a hot one, I can think of a couple of other bulls that also looked good. I shudder to think what your position would be if 75% of your herd was Flame or Tims.

There is another practical point. I do not think it very important but many of you spend a lot of time and thought trying to decide on what bull to use on the daughters of a bull. With only 4 or 5 daughters per bull you can worry about something else.

Early in the game you must decide whether you desire a herd that has the same combination of genes as some very admired animal, or that you have a herd that has all or most of the good genes in the breed. The first approach calls for some form of line breeding and this is inbreeding. I have nothing good to say about inbreeding as a practical form of selection. The second approach calls for the use of all or nearly all of the good bulls of the breed: this I endorse.

I have always been very positive about dairy cattle breeding, some might describe it as being "hard-headed," but today I can be extremely confident. The problem of the progeny test and bull proofs is to account for everything that causes one cow to differ from another. That we do today and with a high degree of skill and accuracy.

The most important change made in sire proofs was the introduction and acceptance of multiherd proofs. The second change of importance has been herdmate comparison. Since the introduction of herdmate comparison in my state there has been no serious mistake in the use of bulls. Prior to this time, a "hot" bull would come into A.I. and before we knew he was a real "dud," 30 to 40,000 cows were bred. The so-called "hot" ones cancelled out most of the progress from the good bulls. From 1973 to 1978, our state average has increased 2,000 pounds per cow with every month showing an increase. Almost all the change has been from the constant use of plus proven bulls where the proof is based on multiherd use.

The question you would like for me to answer is what kind of breeding program you should follow, and to answer this, you would need to define your goals. There is not sufficient time to obtain answers for each herd, and in all probability each would have a slightly different objective. In the interest of time, I'll consider two general goals. The great majority of you would like to have a herd genetically capable of milking 20,000 pounds or better, and have those physical traits that do not detract from good herd management. Given a little time, you might decide that good conception, freedom from mastitis, and gentle disposition are also important. There would be a limited number who would like to merchandize a few animals and have a high classification average. In general, I'm not overly sympathetic with the latter goal as it does not bring any new money into the industry.

The problem in suggesting a breeding program is that nearly everyone expects someone to say, "breed this cow to that bull and you will get a 30,000-pound offspring." The type conscious people would like to know which cow to breed to what bull to obtain an excellent cow. I cannot answer this question and do not apologize for the simple reason that neither can anyone else.

What we can do is outline a breeding program for a herd that will result in a 20,000-pound potential. If a herd makes 20,000, there will be one or more 30,000-pound cows. What mating produces her may surprise you, but you have her and do not try to figure out the mystery. You can have a herd with a good classification average and once in a while an excellent will show up and the mating that produced the excellent cow may surprise you.

For the herd whose primary goal is production, choose several bulls each year, say five or more -- with a PD of plus 1,000 or more, based on multiherd proof. To be practical, there are a few bulls who sire both type and production and semen becomes expensive. I doubt if you can afford a blend price of semen in excess of $12, but you can buy a lot of good bulls for this blend price. A common question is what level of repeatability for sire proofs to use as a guide. I trust completely a sire proof that has 20 herds involved in the proof. Twenty daughters in 20 herds is a 50% repeatability and few mistakes will be made.

The final conclusion is not very sensational - use five or more bulls each year and use the highest PD bulls you can afford. Currently, I think, you can buy bulls whose average PD is more than 1,200 for less than $12, possibly about $7 depending on your A.I. source. Having 100 cows sired by +1,200-pound bulls guarantees production. Having only five to eight daughters per bull guarantees that if you get something you do not like you will not get very much of it.

For those herds selecting for type, do the same thing except select your bulls for PD type. At the moment, I do not trust the Holstein type evaluation as much as I do production. I believe that the current Jersey type summary has almost equal merit with USDA production summaries.

Those herds desiring both type and production must use the bulls that are both high for type and production. These herds will have to merchandize some cattle just to pay for the semen.

Every herd in Michigan that exceeds 20,000 pounds DHIA average is bred as suggested here so there is not much theory involved.

EVALUATION OF WINTER ANNUALS FOR SILAGE PRODUCTION IN DOUBLE-CROPPING PROGRAM

Dan Lowrie
Clackamas County Extension Agent
Oregon State University

The concept of double-cropping silage crops in the Willamette Valley is certainly not a new idea. Many farmers are already following this practice. While good yield and quality information are available for most corn silage varieties, little data exist on the value of potential winter silage crops. To obtain this needed information, OSU agronomists and dairy scientists cooperated in establishing replicated field trials in the 1977-78 crop year.

Two locations were chosen for this plot work, the OSU Dairy Center and Hyslop Farm. The dairy center is representative of poorly drained clay soils of the Dayton series. Hyslop Farm is a moderately well-drained soil type representative of the Woodburn series. Seeding was done on October 8 at the dairy center and October 21 at Hyslop. No fall fertilizer was applied because soil test levels were more than adequate. Sixty pounds of actual nitrogen from ammonium nitrate were applied on February 26 to all plots. Forty pounds of actual nitrogen and 50 pounds of sulfur from ammonium sulfate were applied to all plots on April 10.

Harvesting was done on May 8 at the dairy center and on May 19 and 20 at Hyslop. A small-scale field chopper was used to direct chop the crop. It would be desirable to wilt the crop to a 28 to 35% dry matter content if it were to be ensiled. The varieties ranged from 15 to 22% dry matter when direct cut.

Yields for the various species were calculated and forage analysis made. The results are listed in the following tables:

Table 1. Evaluation of winter annuals for silage production in double-cropping system with field corn

	Special and varieties evaluated	Yield-D.M. (Ton/Acre) Dairy Center	Hyslop	C.P.[1]	A.D.F.[2]
1.	Wheat-Yamhill	4.39	4.06	9.74	33.38
2.	Barley-Casbon	4.17	3.56	10.23	33.38
3.	Spring oats-Cayuse	3.08	5.12	9.42	
4.	Winter oats-grey winter	3.36	4.53	9.42	27.81
5.	Rye-Kung	5.27	5.28	8.08	43.25
6.	Triticale-S-72	4.75	4.42	10.24	34.60
7.	Annual ryegrass-Gulf	3.97	4.14	10.75	33.42
8.	Annual ryegrass-Aubade (tetraploid)	4.07	3.38	11.68	29.33
9.	Austrian winter field peas	2.69	2.55	18.9	31.21
10.	Common vetch	2.62	1.90	19.76	
11.	Dekalb wintergraze 9060	3.92	3.21	9.69	31.77
12.	Wheat + peas	3.82	3.88	12.09	34.56
13.	Wheat + ryegrass (Aubade)	3.63	3.92	11.49	32.47
14.	Wheat + ryegrass (Aubade) + peas	4.13	4.36	11.93	33.96
15.	Wheat + grey winter oats	4.56	4.14	10.58	31.83
16.	Wheat + grey winter oats + barley	4.17	4.36	9.70	
17.	Wheat + grey winter oats + barley + peas	4.18	4.09	11.04	
18.	Wheat + barley	4.46	4.30	9.79	
19.	Wheat + rye	5.16	5.34	9.54	
20.	Wheat + triticale	4.21	3.93	8.73	33.88
21.	Grey winter oats + common vetch	3.35	4.53	13.42	31.08
22.	Dekalb forage wheat	4.88	3.61	9.31	
23.	Grey winter oats + peas	4.13	4.09	11.94	30.51
24.	Grey winter oats + spring oats	3.39	4.85	9.24	26.91

[1]Crude Protein

[2]Acid Detergent Fiber

Table 2. Evaluation of winter annuals for silage production in double-cropping systems with field corn

	Species/variety	Seeding rates LB/AC	BU/AC
1.	Wheat-Yamhill	150	2.5
2.	Barley-Casbon	120	2.5
3.	Spring oats-Cayuse	130	4.1
4.	Winter oats-grey winter	130	4.1
5.	Rye-Kung	100	1.8
6.	Triticale-S-72	140	
7.	Annual ryegrass-Gulf	30	
8.	Annual ryegrass-Aubade (tetraploid)	30	
9.	Austrian winter field peas	120	
10.	Common vetch	80	
11.	Dekalb Wintergraze 9060	90	
12.	Wheat Peas	100 40	
13.	Wheat Aubade ryegrass	100 10	
14.	Wheat Aubade ryegrass Peas	75 7.5 30	
15.	Wheat Grey winter oats	75 65	
16.	Wheat Grey winter oats Barley	60 52 24	
17.	Wheat Grey winter oats Barley Peas	43 37 17 34	
18.	Wheat Barley	100 40	
19.	Wheat Rye	100 33	
20.	Wheat Triticale	100	
21.	Grey winter oats Common vetch	87 26	
22.	Dekalb forage wheat	120	
23.	Grey winter oats Austrian winter field peas	87 40	
24.	Grey winter oats Cayuse oats	65 65	

DAIRY HERD MANAGEMENT FACTORS

Clint Meadows
Department of Dairy Science
Michigan State University

There is a tremendous variation in the amount of milk produced per cow on Michigan farms. We have a very good idea of why cows on the same farm may differ by 60 to 80 pounds per day. We do not have a clear concept of why the average cow production may vary from 20 to 65 pounds per day from farm to farm. Some dairy farms in Michigan will ship 60 pounds of milk per cow per day for a year while others may be as low as 20 pounds.

When we try to analyze management on a particular farm with the hope of improving production, quite often we are unable to derive satisfactory solutions. We know the principles that determine level of production. The herd must have the ability to milk, which we call breeding. Cows must receive and eat enough feedstuff to produce up to their ability and the herd must remain healthy.

Extension personnel, feed company representatives, veterinarians, DHIA supervisors, and A.I. fieldmen are frequently asked to review herd management and suggest how to improve production. Very often the individual asked for advice will consider the area of management that he is most knowledgeable about. Feed representatives will consider the feeding program, veterinarians the herd health status, A.I. representatives the breeding program, etc.

What is needed by each person asked to consult with a dairyman on herd management is a set of guidelines which would cover the entire herd management program, and to point out the critical areas of weakness. We have tried to collect enough data to establish a set of factors, or guidelines for your use.

There is one obvious fact, unless the herd has a good set of records (DHIA) and you know how much feed is being consumed, your chances of providing help are slim.

Management Factors

Breeding: A cow's genetic ability to milk is determined by the sire and dam. DHIA records reflect this information, and the predicted difference (PD) of the sires of the milking herd is a reliable guide for estimating genetic ability. Unfortunately, a number of other management factors affect the breeding estimate. Regardless of the sires we use, unless we get cows in calf, nothing is accomplished. Calving interval (CI) is important. If we get cows in calf, but a high percentage die, then sires do little to improve. To measure this, we establish a ratio of heifers to milking cows. There are other indirect measures such as culling percent, age of the milking herd, and purchases. These factors were included.

Feeding: The nutrient requirements of the milking cow have been determined. They are accurate enough so that if you know energy, protein and mineral content, you can predict milk production quite accurately. What is needed to analyze the feeding program is the kind of feed, quantity fed, quality, and opportunity to eat. This information was obtained.

Herd Health: Probably the most difficult part of management to review is herd health. If a herd just had the best cow die with bloat, then bloat is a problem at the moment. For the consultant, the best guide should be the routine health practices that fall in the category of prevention. Each herd owner was asked if he vaccinated for Brucellosis, BVD, IBR, PI_3, and Lepto, if they tested for Brucellosis and TB annually, if they tested for mastitis (CMT, etc.), if they dry treated and dipped teats, and pregnancy checked. Herdsmen doing these things certainly will be using veterinarian services, and should reduce herd health problems to a minimum.

Source of Information

The data used to derive this information were from the herd owners' DHIA annual summary and a questionnaire. DHIA records listed 30 herds of more than 50 cows and more than 18,000 pounds of milk. We chose at random 30 herds of more than 50 cows and at the levels 16,000 to 18,000, 14,000 to 16,000, 12,000 to 14,000, and under 12,000 for a total of 150 herds. A questionnaire was mailed which asked for the pounds of milk shipped that day, number of cows in milk, number dry, number of heifers, and number purchased. Owners were asked to check the herd health practice as discussed above and could receive a score of 0 to 11. Each owner was asked to report the total pounds of feed for the milking herd - corn silage, hay, haylage, high moisture corn, and dry grain. A place was provided for the addition of nonprotein nitrogen and percent protein in the grain mix. The owner was asked to score the roughage as average, good, and excellent. Total bunk space and frequency of feeding were reported. Opportunity to eat grain was times fed times 60 if fed in bunk or stanchion, and times fed times 15 if fed in the milking parlor.

Two mailings of the questionnaires were send with 123 replies. Of the replies, 93 were complete and used.

Analysis of the Data

Information from the questionnaire was combined with DHIA data for analysis. Average values for TDN and protein were used based on quality of feedstuff and the owner's estimate of percent moisture. Variance was analyzed to obtain the weighted averages as shown in Table 1, both for DHIA totals and average daily production on the date of the questionnaire.

For most of those who use this information, Table 1 should be the most useful. All the items listed should be available on the form from DHIA and the owner. By comparing the herd being studied with the averages shown, any glaring deficiencies should be obvious. The first column is merely the total number of females divided by the total that have calved. PD sires is the average of the sires of milking cows; if the cow was not identified by sire, the value used was zero. Percent grain, etc. was of the total dry matter. The column "Identified" was the percent of cows identified by sire.

These are some general observations: if you checked NRC feed requirements, all these herds are being fed more than required. Even when we look at the individual herds, very few were below NRC. Of course, there is some waste, and they may tend to overestimate the amount fed. This emphasizes the need to weigh forages. Table 1 also once again shows the importance of calving interval on daily milk. Apparently the low herds (30 to 35 pounds) have many cows milking in the latter stages of lactation. Table 1 also shows that age of herd and number purchased are relatively unimportant.

There are 18 independent management factors included plus the two independent factors - DHIA average and daily milk. Most would like to know which of these are the most important factors. A typical approach is to do simple correlations between the dependent and independent factors. Computing simple correlations permits everything to vary, but few of these factors are truly independent and simple correlations may be somewhat misleading. For example, pounds of protein and TDN are not independent of percent grain; neither PD sires and sires are identified. Table 2 shows the simple correlations. This merely reduces to numbers the trends you

Table 1. Management factors ranked by milk production (weighted averages)

	Herds Grouped by 2000-lb. Intervals					Herds Grouped by 5-lb. Intervals						
	10,894	13,245	15,038	16,894	19,157	30	36	42	46	51	55	63
No. females / no. cows	1.93	1.93	1.86	1.96	2.03	1.97	1.86	1.93	1.96	2.01	1.99	1.80
PD sires	298	249	393	455	572	284	239	418	382	493	614	550
Health	4.9	5.6	7.2	7.0	7.9	8	5	6	6	8	9	8
Dry matter	42	42	44	45	49	37	40	44	44	49	49	54
# TDN	30	32	33	34	36	28	29	33	33	35	36	41
# protein	5.3	6.0	6.4	6.9	7.5	4.6	5.0	6.3	6.5	7.5	7.9	8.0
% grain	32	36	37	39	38	36	29	38	38	37	41	53
% corn silage	38	32	33	27	21	38	44	30	29	23	19	26
% haylage	7	13	18	23	20	10	0	18	20	25	22	7
Forage opportunity	7	7	9	11	15	10	7	8	12	13	10	15
Grain opportunity	109	82	102	122	157	150	73	110	111	126	168	174
No. cows	81	118	152	120	88	93	87	133	132	95	87	135
No. purchased	4	2	3	4	4	5	1	5	5	3	3	1
Age	52	56	51	49	52	58	52	52	52	50	55	51
% culled	23	19	20	20	28	24	21	21	22	24	28	23
CI	384	391	384	379	378	403	391	390	375	382	369	358
Identified	33	53	72	64	88	57	24	74	62	71	99	98
% in milk	84	87	88	89	88	89	84	88	88	88	90	87

observe in Table 1. The simple correlations may be larger than you would expect from observation of the group averages in Table 1; however, the correlations were computed from the 93 herds rather than group averages.

Table 2. Simple correlations of DHIA (lactation) or daily milk production and various management factors

	DHIA	Daily
DHIA	1.00	--
Daily Milk	.86	1.00
PD Sires	.54	.48
Protein	.46	.52
% Milk	.43	.23
Sire Identity	.43	.34
TDN	.42	.48
Health	.39	.29
Dry Matter	.38	.45
Forage Opportunity	.36	.34
Grain Opportunity	.36	.28
Corn--% Silage	-.35	-.33
% Grain	.27	.30
% Culled	.26	.16
% Haylage	.24	.21
CI	-.18	-.30
Females/Cows	.12	.05
Age-Calving	.10	.14
No. Cows	.05	-.01
No. Purchased	.04	-.08

We usually have more confidence in correlations obtained by holding every thing constant except the factor of interest. This approach is called multiple correlation which is shown in Table 3. Correlations are ranked from high to low in both Tables 2 and 3 and you can see there is considerable change in rank.

Table 3. Multiple correlations and regressions of DHIA (lactation) or daily milk production and various management factors

	Multiple Correlation		Multiple Regression	
	DHIA	Daily	DHIA	Daily
PD Sires	.38	.35	4	.01
% Grain	.28	.37	66	.2
Health	.24	.16	222	.4
% In Milk	.18	-.06	148	-.1
Females/Cows	.17	.11	1549	.4
Forage Opportunity	.17	.23	65	.1
Protein	.15	.24	451	1.9
% Haylage	-.11	-.03	- 18	.01
No. Cows	.10	.07	4	.01
No. Purchased	.08	-.06	- 20	-.01
Calving	-.06	-.21	- 5	-.01
% Culled	.05	--	15	.01
Dry Matter	.04	.02	21	.01
% Corn Silage	.02	.10	- 4	.1
Grain Opportunity	.01	.01	--	--
Age	-.01	.01	- 2	--

You may note some negative correlations in both tables and these, too, have meaning. For example, in Table 2 where everything varies, there is a negative correlation between DHIA average and percent corn silage in the ration (-.35). However, in Table 3 where everything is held constant, percent silage is small but positive (.02). As calving interval increased, DHIA and daily averages decrease.

There is a second part to Table 3 and this is the regression values. We merely convert the correlation to unit of measure. For example, the regression for PD sires is four (4). For each increase of PD by one (1) pound, DHIA average increases four pounds.

Multiple correlation has additional value. The total correlation (R) between the dependent variable (DHIA average) and the independent variables is 80%. By squaring this (R^2) we have a good estimate of the percent of the total variation in DHIA average that we have accounted for (64%). In general terms, we would be 64% accurate in predicting herd averages from these factors.

There is a second advantage for multiple correlations. We can simply eliminate (delete) the least significant factor and see what happens to the R^2. If it remains about the same, then the factor can be ignored. You can continue to delete until a significant reduction in R^2 occurs. We have done this in Table 4. It may be easier for most to compute percent grain rather than pounds of TDN, thus we have eliminated percent grain in the first column and pounds of TDN in the second column.

We were able to delete all but five of the variables before the R^2=64% was significantly reduced (58%). It is not surprising but comforting to observe that breeding, feeding, herd health, and number of females for culling are the critical factors that influence production.

Table 4. Deletion (R^2) of factors not significantly associated with DHIA (lactation) or daily milk yield. The remaining factors are significantly associated with yield

	DHIA		Daily	
	W/lb TDN	W/% Grain	W/lb TDN	W/% Grain
PD Sires	.57	.51	.47	.34
Health	.37	.32	.24	
W/TDN	.35	--	.29	
Protein	--	.41	.25	.49
W/Grain	--	.36	--	.40
Females/Cows	.23	.22		
Dry Matter	-.21	--	-.23	--
CI			-.30	-.20
% Haylage			-.21	
Forage Opportunity				.27

Application

The information can be used to analyze herd management. For herds on test and weighing forage it should not take more than 30 minutes to record each factor shown in Table 1. By comparison with the averages, any weakness in management should become obvious. The only serious drawback will be that herds on test and weighing forage probably will not need much help, with the possible exception of balancing the grain mix. Your problem will be those herds not weighing roughage and worse yet, not on test. The good consultant will solve both. For herds not on test, daily milk weights are available, and possibly the critical factors other than breeding can be obtained.

For those interested and for my own use, I have prepared a MIC sheet. On one side is Table 1 and on the other a simple chart for ration estimation. It is enclosed in acetate on which a grease pencil can be used and erased for continuous use. The MIC heading is Meadows' Idiot Chart.