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Feeding for Maximum Milk Production and Reproductive Performance[1]

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Advances in technology and research have had major impacts on dairy management practices and performance of dairy cattle. With higher levels of milk production, there is a continuing increase in the requirements for energy, protein, fiber, minerals and vitamins. Also, just as important as the nutritional needs of high producing cows are the various management strategies needed to achieve and maintain those higher levels of milk production. In short, the many scientific discoveries and advances in technology that are continually taking place are exciting and challenging to those managing dairy farms today. Total management becomes the objective when striving for efficiency and profitability. This is accomplished by understanding the different phases of lactation and how to cope with each phase in order to maximize performance.

Reproductive performance of dairy cattle is influenced by the way cows are fed during the dry period and early lactation. After parturition, cows should be fed rations balanced to maximize dry matter intake so that body weight losses are minimized. This allows the cow to attain a positive energy balance in a shorter period of time. In addition to feeding more energy in early lactation, perhaps more bypass protein is needed. The 1989 NRC nutrient requirements for dairy cattle has suggested 60 to 65% degradable and 35 to 40% undegradable protein (bypass) in the ration dry matter. Also, a slightly higher level of protein has been suggested during the first few weeks of lactation due to less dry matter intake. However, it has been suggested that feeding rations high in protein (18 to 20% of dry matter) over long periods may have an adverse effect on conception rate and days open.

Fertility in lactating dairy cows appears to have trended downward in recent years, at a time when rapid advances were being made in milk production. In a Cornell study, the lowest conception rate was for the highest level of milk production when herds were stratified into groups milking less than 15,000 lbs, 15,000 to 19,000 lbs, and greater than 19,000 lbs. In another study, Ferguson compared cows milking less than 20,000 to those milking in excess of 20,000 lbs. In the higher group, conception rate was significantly lower if inseminated before 100 days in milk. However, if cows were inseminated over 100 days, there was no difference in conception rate. Even so, since fertility has been shown in a number of studies to increase only modestly beyond 60 days postpartum, delaying breeding beyond this time period is not presently suggested.

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DRY COW BODY CONDITIONING

Good body condition at calving is important because many high producing cows cannot consume enough feed to meet their energy needs in early lactation, making it necessary to draw on body reserves during this period. Since the cow is losing weight in early lactation, she is in a negative energy balance. Having the cow in good body condition at the time of calving indicates that dry cows are adequately being fed (Table 1).

The body reserves of dairy cows are evaluated by a procedure known as body condition scoring. The cow is scored according to the fat covering over her rump and loin area and given a numeric score between 0 and 5 with half scores in between. A desired score at the time of dry-off for cows is 3.0 to 3.5 and at calving the same or slightly higher.

Conditioning of dairy cows for subsequent lactations should start near the end of lactation and not to any large degree during the dry period. The key to success is to have the cow in the right condition at dry-off and slightly higher at calving. Body condition at calving can affect feed intake, milk yield, and the magnitude of negative balance of energy.

The dry period can be separated into the early dry period and the prepartum period for ease of management. During the early dry period, there is a final mammary tissue involution and stability. It is a period of fetal growth and a period of tissue maintenance. The prepartum period is characterized by accelerated fetal growth, new mammary milk synthesis tissue growth, and certain hormonal changes that prepare the cow for calving and milk synthesis.

It has been shown that over-conditioned cows consume less dry matter, produce less milk, and have greater incidence of retained placenta, mastitis and cystic ovaries after calving. The severity of over-conditioning probably determines the impact of body condition at calving on reproduction and health. Cows with postpartum fatty infiltration of the liver often have reduced reproductive performance.

FEEDING DRY COWS

Dry cow feeding is important in attaining maximum performance after calving. The feeding of forages and minerals is probably the most frequently mismanaged component of the dry cow feeding program. The reason is probably due to the nutrient variation in forages and the easily accessible mineral mixtures used for lactating cows. Minerals of concern are usually calcium, phosphorus, magnesium, potassium and salt (sodium chloride). As an example, too much salt and potassium lead to udder edema; an imbalance of calcium, phosphorus and magnesium are associated with milk fever.

The lack of a good source of effective fiber or forages in the dry-cow feeding program increases health problems such as displaced abomasum. Suitable forages are good quality grass hay, limited amounts of silage (20 to 25 lbs) and by-product roughages such as cottonseed hulls. The key criterion is to keep the cows consuming a lower quality feed in order to maintain rumen volume and tone, especially in the prepartum cows. Since feedstuffs such as corn, corn silage and alfalfa hay tend to over-condition cows, limit their intake or avoid as much as possible during the prepartum period.

A variety of feeding programs can be used to feed dry cows. An example ration is in Table 2.

The protein concentration in the example ration is somewhat higher as compared to NRC (1989) recommendation but would assure adequate intake. A lower degradable protein is suggested for prepartum cows as compared to early dry cows in order to minimize ration changes at parturition. Beginning about three weeks prior to parturition, the amount of energy being fed should be increased in order to adapt the dry cow to consuming more feed. Continue with ample amounts of long grass hay during the prepartum and early postpartum period in order to avoid metabolic problems.

THE TRANSITION AND EARLY POSTPARTIUM PERIOD

As the dry cow enters the lactating herd, she will be under some stress for a few days. A fresh cow group is frequently maintained for a period of one to

two weeks or until such time the cow is declared healthy. Again, adequate amounts of long grass hay should continue to be fed to avoid problems such as displaced abomasum.

The most critical period in the cow's lactation is from parturition until peak production (which takes from five to eight weeks postpartum). During this period the "stage is set" for obtaining the highest possible peak in production and also for the onset of normal reproductive cycling, which may occur as early as two to three weeks in some cows. To be successful, strategies that promote good health such as the use of high quality feedstuffs, nutritionally balanced rations, feeding and management practices, feed bunk management, milking practices, and heat stress management should be applied. In general, cows entering the high group will be fed *ad libitum* for a period of three to five months or more depending on their performance. Afterwards, cows should be moved to lower producing groups as their performance dictates.

SUMMARY

Reproductive performance is affected by how cows are fed during the dry period and throughout early lactation. Dry cow feeding programs should be designed to minimize metabolic problems associated with calving. The body condition of the cow should be monitored. Other suggestions follow:

1. Monitor the dry cow feeding program closely.
2. Reach a desired body condition score at the time of dry-off for cows, 3.0 to 3.5, and at calving, 3.5 to 4.0.
3. Separate dry cows into two groups: the early dry period and prepartum period (3 to 4 wks).
4. After calving, design the feeding program to maximize energy intake so a positive energy balance can be achieved early in lactation.
5. Feed prepartum cows and early lactating cows rations containing 35 to 40% bypass protein.
6. Avoid high levels of degradable protein in early lactation that increase the amount of nitrogenous nutrients to ruminant tissues that may affect reproduction by toxic effects of ammonia on sperm cell, ova and embryo viability.
7. Manage stress by using shade, sprinklers and fans to improve reproductive performance.
8. Watch for marginal deficiencies of certain minerals and vitamins that may lower fertility.
9. Use fat and certain feed additives in early lactation that may have a favorable effect on reproductive performance.

See other fact sheets in the Dairy Production Guide for more information about these suggestions.

Table 1. Nutrient requirements during the dry period (last two months of gestation) NRC (1989)

Body weight	Crude protein	NEL	TDN	Ca	Phos
	(lbs)	(Mcal)	----------lbs----------		
1,000	2.16	10.3	10.0	0.07	0.04
1,200	2.47	11.8	11.5	0.08	0.05
1,400	2.78	13.2	12.9	0.10	0.06

NEL = net energy for lactation,
TDN = total digestable nutrients
Ca = Calcium
Phos = Phosphorus

Table 2. A typical dry cow ration for prepartum cows.

	lb	**DM (lb)**	**CP (lb)**	**TDN (lb)**	**NEL (Mcal)**	**Ca (lb)**	**Phos (lb)**
Bermuda hay	12	10.7	.84	5.28	4.80	.04	.01
Sorghum silage	25	7.5	.63	4.00	4.00	.02	.01
Grain mix (14)	8	7.2	1.12	5.44	5.60	.06	.05
	45	25.4	2.59	14.72	14.40	0.12	0.07
Requirements (1400 #BW)			2.20	13.90	13.20	0.10	0.06

NRC Requirements 1989; BW = body weight; 14 = 14% crude protein; DM = dry matter; CP = crude protein