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Nutrition of Early Dry and Transition Dairy Cows

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The dry period of dairy cows has frequently been characterized as the time of lowest nutrient requirements, or as a resting phase in which the cow prepares for her next lactation. This has tended to give dairy producers the impression that this period is of lesser importance to the cow and that the quality of virtually all inputs including feedstuffs, housing and management can be minimized. In fact the dry cow is undergoing many essential processes within her body during this period which prepare her for the next lactation. Thus the dry period, and in particular the late dry period, should be considered a critical period in which the quality of all inputs will directly impact the productive performance in the next lactation as well as the incidence of disease associated with calving.

The most recent (1989) publication of the National Research Council (NRC) defines only one set of nutrient requirements for dry pregnant dairy cows. However, during the past five years there have been significant changes in thinking relative to dry cows, particularly in the areas of dry matter intake, protein requirements, most desirable energy status, causes of metabolic diseases associated with calving, and the most effective ways to group and manage dry cows. In general, all of these findings suggest that it is imperative that the dry period of dairy cows be considered to consist of the *early dry period*, from 8 through about 3 weeks prepartum, and the *transition period* from about 3 weeks prepartum until calving.

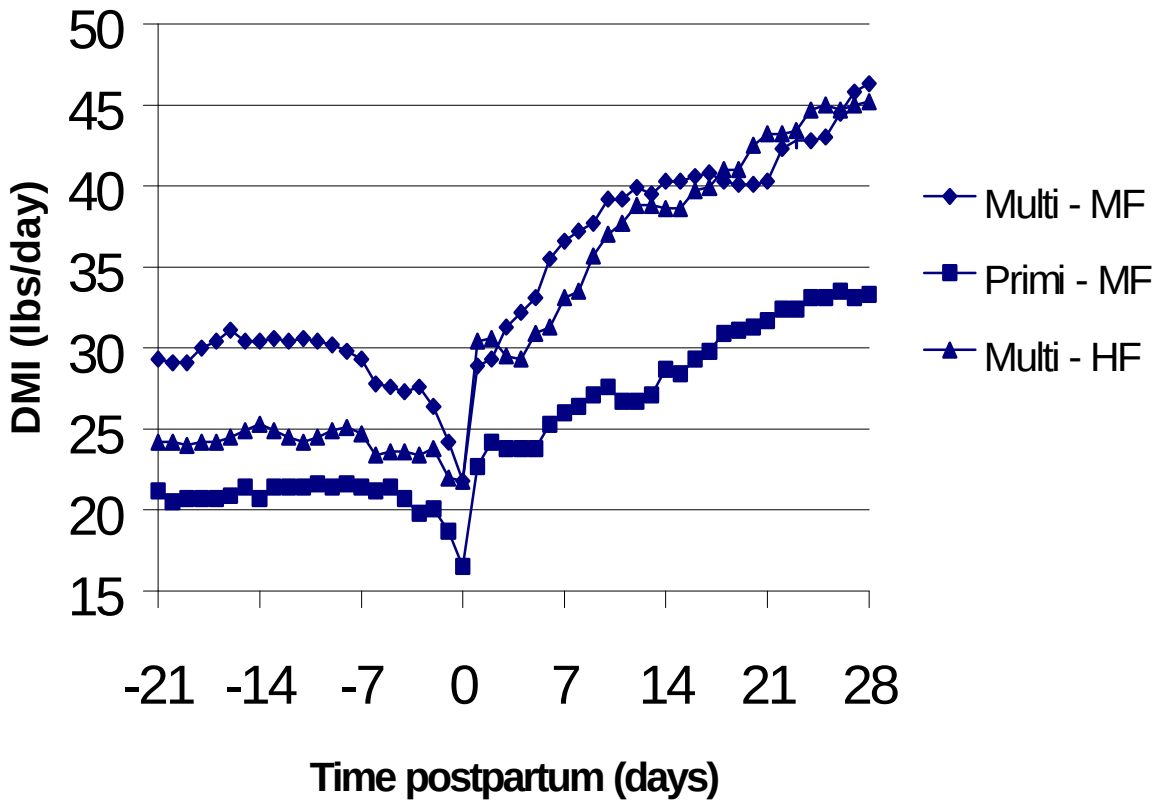
The purpose of this article is to summarize the most current information available relative to dry matter intake patterns of dairy cows as well as their protein and energy requirements.

Dry Matter Intake

The dry matter intake (DMI) of dairy cows during the dry period has long been considered to average between 1.8 and 2.1% of body weight (BW). However this is not a constant value and it can be influenced by the ration that is fed, the stage of the dry period, and the parity of the dry cows. For example, data in the graph show that mature dry cows fed a diet with a very high level of neutral detergent fiber (NDF), 66% of DM, only consumed about 24 lbs of DM per day, or 1.49% of BW [multi – HF], whereas those cows fed a diet with a moderate level of NDF, 43% of DM, consumed about 30 lbs

of DM per day, or 1.90% of BW [multi – MF]. This same data shows that cows entering their first lactation that were fed the moderate NDF diet consumed substantially less DM than the mature cows, at about 22 lbs of DM per day, or 1.73% of BW [primi – MF]. In addition, this data also demonstrates that the DMI of dry cows begins to decline 7 to 10 days prepartum for mature cows and 4 to 7 days for cows entering their first lactation. Other research groups have demonstrated similar prepartum DMI intake patterns.

The reasons for these prepartum declines in DMI have been attributed to a number of factors including changes in hormone levels or an inability of the animal to utilize nutrients absorbed from the gastro-intestinal tract. However the repeatability of these declines in DMI, relative to time of calving among research studies, as well as their relative proximity to calving suggests that declines in DMI are more likely caused by



repositioning of the fetus in preparation for calving. This is supported by observations that DMI of cows carrying twins is lower than that of cows carrying single calves in late pregnancy (i.e. the *early dry period*), and that it starts to decline sooner relative to the time of calving.

The bottom line is that DMI of cows in the *early dry period* can be influenced by manipulating the NDF level of the diet, but that the maximum achievable DMI will start to decline in advance of calving and that, while it cannot be prevented, it must be anticipated and managed. Indeed, the data in the graph show that regardless of the NDF level of the *transition period* diet, and the level of DMI at the end of the *early dry period*,

that DMI declined to about 22 lbs per cow on the day of calving. These findings suggest a number of practical recommendations:

1) Mature cows in the *transition period* require a higher nutrient density diet than mature cows in the *early dry period* due to reduced DMI.
2) Cows entering their first lactation require a higher nutrient density diet in *the early dry period* than mature cows due to lower DMI.
3) Cows carrying twins require a higher nutrient density diet in the *early dry period* than those carrying single calves due to lower DMI.

Protein Requirements of Dry Cows

The level of CP in the diet of dry cows that has been recommended by the NRC has been rising since their 1971 publication (Table 1). In addition, the protein to energy ratio has also been rising reflecting a recognition of the beneficial effects of feeding higher levels of CP in the dry period. However experiments that have been completed since the most recent publication in 1989 suggest that even higher levels of CP may be advisable, at least for the *transition period*. Research reported from both the US and the UK has shown that higher levels of CP than those recommended by the NRC (1989), in the *transition period*, have been associated with numerous positive effects on cow performance including reduced incidence of retained placenta and ketosis, higher body condition score (BCS) at calving, reduced days open in the next lactation, as well as higher milk yield and higher milk protein percentage in the next lactation. Not all of these benefits have been reported in all studies, although overall trends indicate positive benefits to higher levels of dietary CP, and rumen undegradable protein (RUP), in the *transition period*.

National Research Council (NRC) nutrient recommendations for dry cows since 1971*.

	1971	1978	1989**
Crude protein (% DM)	8.5	11	12
NEl (Mcal/lb of DM)	.50	.61	.57
TDN (% DM)	53	60	56
CP/TDN ratio	.16	.18	.21
Calcium (%DM)	.34	.37	.39
Phosphorous (% DM)	.26	.26	.24
Salt (% DM)	.25	.25	.25
Selenium (ppm DM)	.10	.10	.30
Vitamin A (IU/lb DM)	45,200	48,000	48,000

* - The NRC only recognizes one dry period for dairy cows.
** - 1989 is the most recent NRC dairy publication. A revised edition is due in 1999.

Reasons for the benefits of higher levels of CP in rations fed to dry cows in the *transition period* are not well defined. It is known that dairy cows have very small supplies of body protein that can be mobilized in early lactation to support milk production. Nevertheless, most proposed theories revolve around a scenario in which short term feeding of high CP levels in the *transition period* acts to maximize these relatively small protein supplies so that in early lactation they can be utilized to support milk production. An alternate theory is that feeding higher levels of CP in the *transition period* allows the cow to increase maintenance protein use during this period, so that early lactation maintenance protein requirements can be reduced, for a short period, allowing more of the protein absorbed from the diet to be utilized for milk production in the critically important first 10 to 14 days of lactation.

While there is a substantial amount of evidence to support productive benefits to higher levels of dietary CP, and RUP, in the *transition period*, there are no experimental results to suggest a positive impact on animal performance of feeding such high levels in the *early dry period*. Indeed, limited data suggests that higher CP levels fed in the *early dry period* may increase the incidence of downer cow syndrome at calving.

These findings suggest that:

1) The level of CP in diets for dry cows in the *transition period* should be higher than current NRC (1989) recommendations.
2) The level of CP in diets for dry cows in the *early dry period* need not, and probably should not, exceed current NRC (1989) recommendations.

Energy Requirements of Dry Cows

The energy requirement of dry dairy cows is the most traditional of the dry cow research areas and much of what we currently know about the effects of BW gains and losses during the dry period, as well as calving cows that are considered to be too thin or too fat, predates 1990. Nevertheless, this information is not utilized as effectively as it should be, or could be, on many dairies.

It is well accepted that the ideal BCS of cows at calving ranges between 3.50 and 3.75 (five point scale from 1 to 5). Cows calving with a BCS below 3.00 have a dramatically higher risk of exhausting energy reserves in early lactation which results in large declines in milk yield leading to cows that are bone-racks and will have to be culled. These animals have a very small ability to survive incidences of off-feed from any cause due to their low body fat stores. In contrast, cows that calve with a BCS above 4.00 have a dramatically higher risk of showing signs of 'fat cow syndrome' which is associated with low, and slowly rising, postpartum levels of DMI which is associated with clinical ketosis. While these animals are seldom lost to the herd, if veterinary intervention is timely, they seldom achieve the performance level of which they are genetically capable.

The traditional thinking relative to changes in BCS during the dry period was that the dry cow should be fed to maintain body condition and that changes to body condition should

have occurred prior to the end of the previous lactation. The problem with this approach is that many cows leave lactation underconditioned, in spite of the best management efforts to increase it. In fact, the risks of calving underconditioned cows far outweigh possible negative effects on rumen function by feeding a higher energy density diet, to increase BCS, during the dry period. The other problem is that the BCS of cows in the dry period, particularly the *transition period*, is extremely difficult to judge accurately due to weight gains associated with the fetal growth. Thus it is not uncommon for cows in the dry period to be losing non-fetal body weight while their BCS is not judged to be changing. Thus it is important that management of dry cows emphasize maintaining true BW, and BCS, of properly conditioned cows, while feeding underconditioned cows to gain condition during the dry period. In contrast to underconditioned cows entering the dry period, cows that enter the dry period with excessive condition should be fed to maintain body condition. While it may seem attractive to underfeed overconditioned cows during the dry period to encourage them to lose weight, subsequent problems at calving and in early lactation that are associated with weight loss of overconditioned cows during the dry period far outweigh the benefits of cows calving with a lower BCS. However, cows drying off with BCS in excess of 4.0 are likely to have been low producers in the previous lactation and culling may be an attractive option.

These findings suggest that:

1) Cows carrying insufficient body condition at the start of the dry period should be fed higher energy density rations during the *early dry period*.
2) Cows carrying excessive body condition at the start of the dry period should be fed to maintain body condition, or be culled.
3) Cows carrying adequate body condition at the start of the dry period should be fed to maintain body condition.

Summary

In order to prepare dairy cows to achieve their maximum potential lactational performance, it is critical that they be fed to meet their dry period nutrient requirements. Larger dairy producers have advantages over smaller dairies since the large size of their operations makes multiple dry cow strings, and rations, possible on their commercial dairies.

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