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Management Options for Maximizing Dry-cow Performance

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Dry-cow management has been a topic of great debate. Traditionally, optimal dry-period length is the last 60 days of pregnancy. This recommendation is based on the time required for the cow to recover body condition and repair and regenerate mammary epithelial tissue before beginning the next lactation cycle. Advancements in feeding systems, milking frequency and the use of other technological advances have caused producers to consider a shorter dry-cow period (28 to 45 days).

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Dry-cow Programs

The first phase of the dry period, commonly termed the far-off dry period, begins after the last milking and continues until approximately 21 days prior to calving. This first phase of the dry-cow program is a critical time in the lactation cycle since this is when cows actually begin to prepare for the next lactation (Hutjens, 2007). Some basic goals for a successful dry-cow program include addressing the changes associated with udder involution, fetal needs, body condition, the immune system and cow comfort before preparing the rumen prior to the next lactation.

For involution to take place, milk secretion must end. To perform dry-off, milk production must to be at a manageable level. If a cow still is producing more than 40 to 60 pounds of milk per day when approaching dry-off, producers have several ways to decrease milk production, including decreasing the energy density of the diet and limiting water supply. Once milk yield is reduced, milking should be stopped abruptly.

To reduce the risk of new mastitis infections during the dry period, each quarter should be infused with an appropriate intramammary antibiotic. The risk of mammary infection is greatest following dry-off due to bacterial infection from open teat sores, cracks or previous mastitis occurrences. Ideally, each quarter should be treated with antibiotics. In addition, a teat sealant may reduce the chance of introducing bacteria during the dry period. After cows have been removed from the milking group, dry-off usually requires an additional seven to 10 days to occur. Keep in mind that complete udder involution (cessation of milk synthesis) requires about 30 days.

From a nutritional perspective, maintaining a desirable body condition score (BCS) and monitoring weight gain are important management tools. A desirable BCS (on a scale of 1 to 5, where, 1 = thin and 5 = fat) for cows at the start of dry-off generally is regarded to be between 3.25 and 3.75. If cows have less condition, replacing body condition during the later stages of lactation (last three to four months) and prior to dry-off is preferable since cows gain weight more efficiently during lactation than during the dry period. In addition, feeding a high-energy diet during the far-off dry period with the goal of replenishing body condition may increase the risk of metabolic disorders in the subsequent early lactation period.

Body condition reflects how well the dairy manager follows the nutrient guidelines for both far-off and close-up (21 days prior to calving until parturition) dry cows. Those needs are presented in Table 1 *(page 2)*.

The far-off dry period is also an excellent time to bolster the immune status of the cow by treating for internal and external parasites. The benefits of treatment include

Table 1. Nutrient recommendations (dry-matter basis) for dairy cows in different stages of the dry period.

	Dry Cows	
Nutrients	**Far-off**	**Close-up**
Dry-matter intake (DMI), lbs	31.7	22.2
Metabolizable protein (MP), (% of DM)	6.0	8.0
Rumen-degradable protein (RDP), (% of DM)	7.7	9.6
Rumen-undegradable protein (RUP) (% of DM)	2.2	2.8
Crude protein (CP) (% of DM)	9.9	12.4
Total digestible nutrients (TDN)	51	63
Net energy for lactation (NE_L), Mcal/lb	0.63	0.69
Acid detergent fiber (ADF), Minimum %	21	21
Neutral detergent fiber (NDF), Minimum %	33	33
Minerals (% of DM)		
Calcium	0.44	0.48
Phosphorus	0.22	0.26
Magnesium	0.11	0.16
Potassium	0.51	0.62
Sodium	0.10	0.14
Chloride	0.13	0.20
Sulfur	0.20	0.20
Vitamins (IU/lb)		
Vitamin A	12,293	18,175
Vitamin D	3,351	4,958
Vitamin E	179	265

Adapted from National Research Council. Nutrient Requirements of Dairy Cattle. Seventh Revised Edition, 2001. Washington D.C.

reduction or elimination of milk that otherwise would be withheld from sale due to treatment during lactation. Likewise, vaccines administered late in the dry period will not only immunize the cow, but also generate antibodies that can be passed onto the calf via colostrum. Be sure to read all the directions and warnings carefully or consult an experienced veterinarian about which products are recommended and the appropriate site of injection. Some modified live-virus vaccines and certain drugs may cause abortion in cattle. Finally, the dry period is also a time of well-earned rest for the dairy cow. During the far-off dry period, the tissues of the udder, as well as the rumen, have time to regenerate before the next lactation before transitioning into the close-up portion of the dry period.

The close-up dry period generally is defined as the last three weeks prior to calving. This time is critical in adapting cows to the rigors of parturition and lactation. Moreover, rapid fetal growth, mammary gland development and colostrum synthesis are processes that occur during this time. Maintenance of cow health during this period is essential to ensuring delivery of a healthy calf and a successful transition to a productive lactation.

One important aspect in preparing for the ensuing lactation is adapting the rumen to higher concentrate diets to minimize digestive upsets and metabolic disorders in early lactation. This approach is important because feed intake is depressed as cows approach calving, and dietary nutrient density must be increased in early lactation to meet the nutrient requirements for milk production. Dietary changes that promote rumen adaptation include a greater ratio of concentrates to forage to prepare the rumen microbial population to utilize diets higher in energy. The added energy facilitates an increase in the length of rumen papillae (absorptive capacity) and adapts the rumen microbial population to a diet higher in concentrates. These adaptations allow for greater nutrient absorption, which can reduce the severity of negative energy balance following calving.

Calcium (Ca) is especially important for close-up dry cows. Hypocalcemia (milk fever) is a disorder in dairy cows that occurs when the cow is unable to compensate for the dramatic increase in calcium needs due to colostrum production at calving. Calcium is also important to many biological processes and organ functions. Low blood Ca levels often lead to higher incidences of birthing problems, along with increased risk of retained placenta and ketosis.

Decreased blood Ca concentrations cause Ca stores to be drawn from the bone or kidney, while the animal becomes more efficient in absorbing Ca from the diet. The ability of the cow to mobilize Ca to meet her requirements can be affected by controlling the dietary cation-anion difference (DCAD). Cations are positively charged ions, including potassium, sodium, calcium and magnesium, whereas anions are negatively charged ions, including chloride, sulfur and phosphate. Feeding a diet that is balanced for a slightly negative DCAD "turns on" the mechanisms responsible for bone Ca mobilization, thereby allowing the cow to respond to the large increase in Ca demand prior to and immediately following calving.

A solution to reducing the risk of milk fever is to supplement anionic salts to the animal during the close-up dry period. Anionic salts can be supplemented using a blend of feed-grade salts (e.g., magnesium sulfate, calcium chloride, ammonium sulfate, calcium sulfate) or commercially available

supplements (BIO-CHLOR, Church and Dwight Co.; SoyChlor, West Central Cooperative). Anionic salts may impair dry-matter intake if not blended correctly or if they are included at excessive levels. Consult your nutritionist when implementing an anionic salt supplementation program.

One inexpensive way of monitoring anionic salt effectiveness is to implement regular urine pH testing. This technique helps producers determine whether the diet is formulated accurately and adjust if necessary. Cows that are being supplemented with anionic salts should have a urine pH between 6 and 7. A pH of 8 to 8.5 is considered normal for cattle that are not supplemented with anionic salts.

If the pH is above 7 and anionic salts are being fed, this may mean that not enough anions are being fed or forage cation concentrations are greater than anticipated. A pH of below 6 indicates anionic salts are being oversupplemented. Keep in mind that not all cows maintain the same pH; some may be slightly above or below what is recommended. A key component of successful prediction of DCAD is regular forage testing to monitor mineral concentrations.

High-quality colostrum is vital for the survival of the newborn calf. Colostrum synthesis is a hormonally stimulated and controlled process that takes place during the last 15 days of pregnancy. If the cow calves earlier than expected or is predisposed to udder leakage, colostrum quality may be decreased. Other factors that affect colostrum quality are the age of the cow, length of dry period, prepartum nutritional status and vaccination regimen.

Multiparous cows typically produce higher quality colostrum that contains a greater concentration of antibodies. In addition, cows recently vaccinated (during far-off dry period) will transfer the antibodies produced as a result of the vaccination (immunoglobulins) to the colostrum, making them available to the calf.

Colostrum quality is determined by the amount of immunoglobulins present in the colostrum. The three primary immunoglobulins that are beneficial to the calf are IgG, IgA and IgM. IgG is the most abundant immunoglobulin and lasts within the bloodstream for the greatest amount of time. IgG concentration in colostrum can range from 20 to 100 grams per liter (g/L).

One way of measuring immunoglobulins in the milk is by using a colostrometer. This device measures the specific gravity of the colostrum (ideally measured at 72 F), which is correlated to the amount of immunoglobulins present. Many professional calf raisers are adapting this important practice to assure that calves are consuming the appropriate amount of antibodies.

Extreme cases of edema, or swelling in the mammary system, need to be monitored during the last stage of pregnancy. This mammary swelling is the result of a buildup of fluid between tissue layers of the mammary gland. Although the exact cause is unknown, extreme udder edema is believed to be inherited or influenced by diet. One common cause is an excess of sodium and potassium in the diet.

While all cows are affected to some degree with edema, only in severe cases must it be treated to avoid swelling to the point of damaging the udder support system. Prevalence of udder edema tends to be higher in older, first-calving heifers. Since heifers beyond 28 months of age have a higher incidence of edema, breeding heifers to calve near 24 months of age is beneficial.

In severe cases of udder edema, milking may be initiated pre-partum as one way to decrease the fluid buildup. The release of milk allows greater blood flow through the mammary gland and functions to absorb the accumulated fluid. However, once colostrum is released pre-calving, the quality of colostrum at calving will be very low and the calf likely will need a supplemental source of colostrum.

During the last two to three weeks prior to calving, cows will experience a depression in dry-matter intake as a result of decreased rumen capacity and changes in maternal hormonal environment. Dry-matter intake depression, coupled with increased nutrient requirements for fetal growth, parturition and lactation, contribute to a negative energy balance experienced prior to calving and during early lactation.

A primary goal of the dry-cow program should be to reduce the extent and duration of the negative energy balance because almost all cows experience negative energy balance to some degree. The primary factor that can bring cows out of negative energy balance in early lactation is promoting high feed intake, which is directly related to pre-partum management and postpartum health.

Shortening Dry-cow Period

Recent research has challenged the notion that cows require a 60-day dry period. However, research has established that omitting the dry period is detrimental to milk production and that losses are not recovered despite longer lactations. Research shows that cows not allowed a dry period have a reduction in milk yield of 20 percent to 25 percent in the next lactation (Grummer and Rastani, 2004).

Some advantages of a short dry period (approximately 28 days) include reduced risk of metabolic disorders, improved fertility, reduced days open and increased lifetime milk production. Some disadvantages include decreased daily milk production, more pressure on the milking parlor due to more lactating cows, increased labor needs and less time for mammary tissue regeneration.

Short dry periods appear to be detrimental to cows entering their second lactation. This may be related to the fact that these cows still have nutrient requirements for growth, thus mammary tissue regeneration is impaired. Older cows (second lactation and older) can regenerate mammary tissues in as little as 30 days. For planning purposes, these cows will need at least 15 days for complete mammary involution, plus another nine or more days in a pre-fresh group while regenerating mammary tissue. If the cow dry period is approximately 28 days, then cows can continue to be fed close-up or lactation diets due to the short time between lactations. This short dry period will eliminate time needed for rumen adaptation and prevent the risk of overconditioning cows.

A decreased length of dry period can have some facility advantages, such as less overall pen space required and reduced number of pens needed for dry cows, thus allowing more room for lactating cattle. Another advantage is more milk production for each cow during its lactation cycle due to longer days in milk.

Longer lactations may cause a decrease in average daily milk during subsequent lactations, although the length of lactation usually compensates for the loss in daily milk production (Grummer and Rastani, 2004). Research done by Ammen et al. (2004) showed that multiparous cows with an extended four to eight weeks of lactation (approximately 30 days dry) resulted in a greater cumulative net margin of $40 to $60 per cow. Research also has shown that a reduced dry period may increase fertility in cows. Gümen et al. (2005) reported a decrease in the length of time from parturition to first ovulation in cows that had a dry period of 28 days or less.

Dairy operators also have disadvantages to consider when reducing the length of the dry period. The manager needs to consider the herd's treatment program and the potential for drug residues in milk. Cows in this type of program may not have enough withdrawal time during the dry period, and thus the manager may be forced to withhold milk for a longer period during lactation.

Perhaps the greatest disadvantage may be the costs associated with increased labor demands to manage cows in a reduced dry-period program. A shortened dry period requires a greater emphasis on cow health and accuracy of breeding records so that cows are allowed a full 28-day dry period and transition to a successful subsequent lactation. Careful analysis must be conducted before investing in this management technique.

Summary

With an understanding of dry-cow management, producers can determine the type of dry-cow system that will work for their farm. Each farm manager should be able to find his or her comfort zone when gradually implementing the changes necessary to the dry-cow program of his or her choice. No one program works for every farm. Before changing the entire dry-cow program, take time to determine if changes would be economically feasible for the herd. Remember, cow health and productivity depend on a successful lactation, and lactation starts with the dry period. Managed correctly, appropriate dry periods will yield rewards that help extend cow longevity.

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