

Strategic Nutritional Management of Dry Period in Dairy Cows

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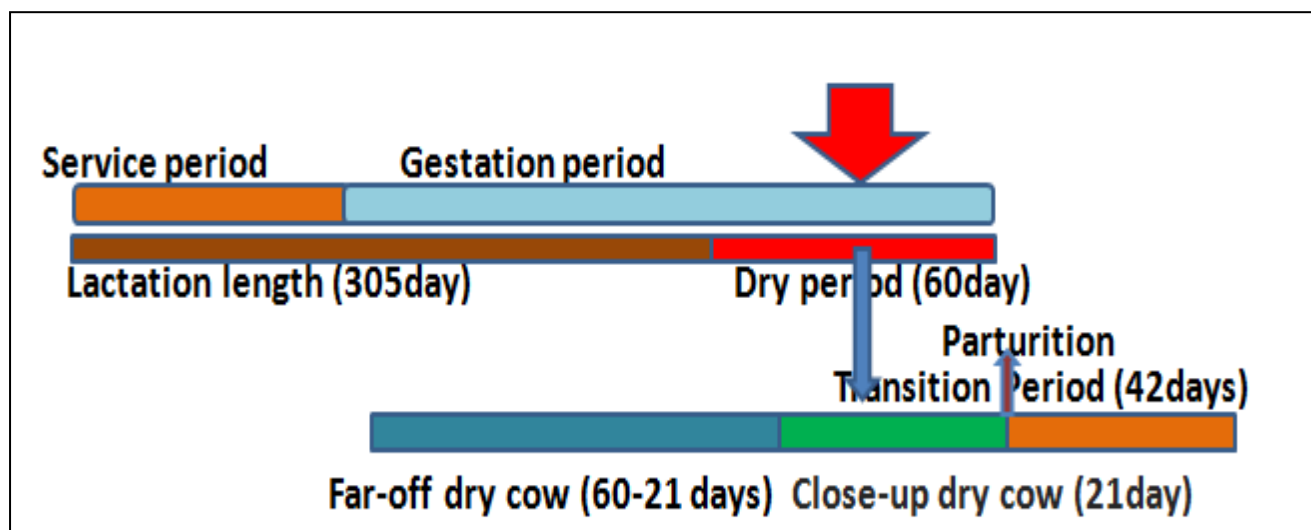
Introduction:

India has been the leading producer and consumer of dairy products worldwide since 1998 with a sustained growth in the availability of milk and milk products. Dairy activities form an essential part of the rural Indian economy, serving as an important source of employment and income. India also has the largest bovine population in the world. Total Bovine population (Cattle, Buffalo, Mithun and Yak) is 302.79 Million in 2019 which shows an increase of 1.0% over the previous census 2012. However, the milk production per animal is significantly low as compared to the other major dairy producers. Moreover, nearly all of the dairy produce in India is consumed domestically, with the majority of it being sold as fluid milk. On account of this, the Indian dairy industry holds tremendous potential for value-addition and overall development.

The dry period of dairy animal should be considered an important phase of her lactation cycle. The dry period in dairy cows is critical for maximal milk production in the subsequent lactation, as its absence is associated with a significant decrease in milk yield (Bachman and Schairer, 2003; Grummer and Rastani, 2004). During the dry period, mammary tissue undergoes extensive growth and cell turnover. This process is necessary to compensate for mammary cell loss during the previous lactation and to replace senescent secretory epithelial cells because the lactation curve is a function of mammary cell number and secretory capacity per cell. Any manipulation during the dry period that enhances mammary growth may be a promising approach to improve lactation performance in dairy cows.

Dry Animals:

A cow that is not lactating or secreting milk after it has completed a lactation period following calving.



- Reduce feed intake by 50-70% for 2-3 days to reduce nutrient supply and reduce milk synthesis.
- Feed to maintain body condition through the dry period after milk synthesis has reduced.

1. Involution of Udder: Secret tissue of the udder involute during this period and secretory cell of the udder breakdown and new new cells are formed. The main aim of the dry period is to prepare the mammary gland for the next lactation.

2. Replenishment of Body Reserves: The high-producing cow will have severely depleted her body reserves of minerals, especially calcium and phosphorus during her lactation. These reserves can only be completely replenished when the cow is dry. So, adequate mineral nutrition is important during dry period.

3. Foetal Development: Fetal development mostly occurs in last trimester of pregnancy. Almost 60% of its birth weight is gain in last 6 to 8 weeks before calving.

4. To Maintain Optimum Body Condition: Dry cows off in good condition with a body condition score (BCS) of 5 to 5.5 out of 8, and maintain this condition score until calving.

5. To Minimize Digestive, Metabolic and Infectious Diseases: Dry cows should not gain or lose more than 0.50 of a condition score during this period. Fattening cows in the dry period can lead to health problems, including displaced abomasums, udder oedema and ketosis at calving. However, if cows are already over fat at drying off, they should not lose weight during the dry period or they may be subject to fatty liver and ketosis. Feed far-of dry cows

(60 to 21 days prior to calving) and close-up Springer's (21 to 0 days prior to calving) separately, as they require a different ration formulation.

Dry Period Length:

The cow should be dry for 45-60 days. The date to begin the dry period is calculated back from the projected date of calving. Dry period length of cow is less than 40 day, the cow produce less milk in the next lactation compared to cow given a 45-60- days dry period. Dry period length of cow 70-days or longer dry period may have a slightly higher milk production, but it cannot be economically justified. Dry period depends on the parity status: cow, 45-60 days and first calf heifer-60-70 days. If a cow is not dry off at all, the next lactation may be lower production by as much as 25-30%.

Body Condition Score:

Body condition score is an indication of the amount of stored energy reserves held by the cow. It changes with stage of lactation. Body condition is a method of evaluating fatness or thinness in cows according to a five-point scale, a scale of 0 denotes a very thin cow while 5 denotes an excessively fat cow. Condition score 3, is the most desirable for the cow at drying off and calving. Over conditioning or fatness, (BCS > 3.5), may cause the dry cow to have difficulty at calving, be more susceptible to metabolic disorders and infections. When milk production decreased and prolonged dry period. In contrast, under condition, or thinness (BCS < 2.5), in the dry cow can frequently lower milk production; reduce the persistency of the cow's lactation. Thin cows often do not show heat or conceive until they start to regain or maintain bodyweight.

Challenges to Current Dry Cow Feeding and Management Concepts:

Practical decisions made regarding feeding cows during the dry period are simple.

1. The cow is not lactating; therefore she does not need a nutrient dense ration as when she is lactating. However, during the last 6-8 weeks prior to calving the fetus is growing at its most rapid rate and has a tremendous demand for glucogenic precursors. It is also the time period that the cow is manufacturing immunoglobulins necessary for the calf at birth. It has been demonstrated that poor nutrition impacts the composition and quantity of immunoglobulins synthesized. The mammary gland also requires nutrients in preparation for lactogenesis.
2. Since the cow has reduced nutrient demands can feed her cheaper feed sources. It has not been demonstrated that all physiological aspects of the cow's nutrient demands are

reduced during this time period. The cow is most immune compromised at this time and exposure to mycotoxins and inconsistent nutrients as found in poor quality forages is least desired during this time period.

3. The dry cow can be brought to another facility, needs less oversight and therefore less labor. This is the time period when observation is critical especially regarding the body condition of the animal and her appetite. Physical facilities and cow comfort during this time period is critical.
4. Use of a steam up ration 2-3 weeks prior to calving. Many times the lactating cow ration is used without attention to differences in mineral requirements between pre- and postpartum animals. In addition, 2 to 3 weeks is not adequate time for liver and intestinal enzymes to adjust to the prepartum and postpartum rations.

Nutritional Management of Dry Period:

Dry Matter Intake (DMI):

Dry matter intake tends to decrease during the latter part of the dry period due to increase in the calf size on reduction in rumen size. Due to this change in DMI, the diet nutrient density must be adjusted in the last 2 weeks to maintain nutrient intake. If this is not done, then actual quantities of nutrient intake will be decrease. Dry matter intake is the most critical factor in evaluating nutritional adequacy of a diet. Dietary nutrient densities for dry cows, based on NRC requirements, are determined on an assumed average dry matter intake of 1.6 to 2.0% of body weight (i.e., 9.6 - 12.0 kg/d for a 600-kg cow). If a cow consumes less dry matter than expected of diets containing these suggested nutrient densities, she will ingest inadequate nutrient amounts to meet her defined requirements. Overconsumption of dry matter produces the opposite result excess nutrient intake which can be just as problematic. Dietary nutrient densities need to be tailored to determine dry matter intake to ensure adequate consumption of nutrients. Feed intake is affected by a wide array of physiologic, metabolic, and environmental factors, suggesting a need for continued monitoring. Much of this variation can be accounted for by animal parity and dietary forage: concentrate ratio. Cows entering their first lactation consume less dry matter (mean, 7 to 12 kg/d) than older cows (mean, 10 to 15 kg/d). Low forage diets are consumed in lesser amounts than high forage diets

Feed Ingredients:

Forages:

Forages should constitute a major portion of the dry cow ration. High forage rations (> 85%) have been thought to maintain maximal rumen fill and volume, stimulate rumen motility, and allow healing of rumen wall lesions resulting from high-grain lactation rations. Maintaining maximal rumen fill and tone may be beneficial in promoting dry matter intake postpartum. A wide variety of forage and roughage ingredients can be fed to the dry cow when rations are appropriately formulated for energy, protein, fiber, and mineral concentrations. Legume forages typically contain excessive amounts of Ca for dry cows and should be limited to 30 to 50% of diet dry matter, depending upon Ca content. Corn silage intake should be limited to 30 to 40% of diet dry matter, otherwise the diet will contain excess energy as well as being deficient in protein. These forages can be combined with alternative roughages like stover, straw, or lower quality forages to dilute the excess nutrients. Quality grass forage is ideally suited for the dry cow. Dry cows require long coarse fibrous material to stimulate rumination and saliva flow to promote maximal fiber fermentation. If the ensiled forages being fed are finely chopped, some long coarse dry hay should be incorporated into the ration.

Concentrates:

In most instances, energy requirements of the dry cow can be met exclusively by a quality forage program. Providing additional concentrates above the energy requirement is unnecessary and detrimental to animal performance. Situations where concentrate feeding would be appropriate would include poor quality forages, cows in thin body condition, adverse environmental conditions or any combination of these factors. The close-up dry cow ration may also require some concentrates to increase energy density, compensating for reduced intake and increased energy requirement. This brings up the practice of "lead feeding," which is daily increasing concentrate intake in the immediate prepartum period up to 1.0 to 1.5% of body weight. Conceptually, this allows time for the rumen microorganisms to adapt to higher levels of nonstructural carbohydrates in preparation of the typical high-grain lactation rations. Incorporating some concentrate or increasing the amount of corn silage in the close-up ration will essentially accomplish the same goals, providing additional rapidly fermentable nonstructural carbohydrate and increasing available dietary energy.

A dry cow feeding program which relies on average quality forages and limited energy intake will minimize incidence of "fat cow syndrome".

Controlling Energy Intake during Dry Period:

Controlling energy intake during dry period might lead to better transition success. Controlling energy intake during the dry period is desirable. Dry matter intakes remain more constant as cows approach calving when fed the high-straw, low energy diets than in cow fed high-energy close-up diets. Common practices to feed ration of higher energy and nutrient density during the close-up period. This approach was designed in an effort to adopt the rumen microbial population and rumen papillae to higher nutrient diets fed after calving.

To Maintain A Balanced Diet For A Cow, Aim For:

- Neutral detergent fibre (NDF) content of about 40% (80% of the NDF should come from forage)
- Starch content of 2-3%, Sugar content of 3-4%
- The optimum crude protein requirement for early dry period should be 12-13 CP%. Protein excess must be avoided which is associated with downer cow syndrome (Rick, 2008). Incidence of metabolic disorders in cows fed different level of CP during dry period.

Mineral/Vitamin	Adequate level (as % of diet DM)
Calcium	0.44
Phosphorus	0.22*
Magnesium	0.11
Potassium	0.51
Sodium	0.10**

* Low phosphorus intake can increase the risk of milk fever, downer cow syndrome, retained placentas and anoestrus after calving.

** Alternatively, limit salt intake to 30 g/cow/day to minimize oedema (build-up of fluid) in the naval and udder area.

Other important daily minerals:

- **Selenium:** 0.30 ppm in the total diet to reduce the incidence of retained placenta.

- **Vitamin E:** 1200 IU/day; deficiency can lead to reduced disease resistance, increased calving disorder, and potential vitamin deficiency for the newborn calf in the colostrums.
- **Niacin:** feeding 3-12 grams daily.

Recommended Feeds In The Dry Ration:

- ❖ Base the dry cow ration on forages, including good quality, long-stemmed hay. This will maintain rumen function, rumen muscle tone and aid in healing the rumen wall lining.
- ❖ Ensure the diet is balanced. Keep an eye on excess protein (high nitrogen forages), calcium (lucerne) and potassium (molasses) in the dry cow diet.
- ❖ Minimize concentrate level in the total ration, but use sufficient amounts for adequate energy and protein levels.
- ❖ Do not feed rumen buffers such as sodium bicarbonate as this will increase the sodium content of the diet and increase the risk of retained placenta.

National Research Council (1989)

NUTRIENT	UNITS	EARLY DRY*	CLOSE-UP DR
Net energy (NE _i)	Mcal/kg	1.10–1.20	1.45–1.55
	Mcal/lb	0.50–0.55	0.65–0.70
Crude Protein (CP)	% DM	12–13	13–14
Soluble CP	% CP	40–50	35–45
Degradable CP	% CP	65–70	62–67
Undegradable CP	% CP	30–35	33–38
Acid Detergent Fiber	% DM	35–40 (27)‡	30–35 (2
Neutral Detergent Fiber	% DM	50–65 (35)‡	40–55 (30
Calcium	% DM	0.31–0.35	0.36–0.41
Phosphorus	% DM	0.19–0.21	0.22–0.25
Magnesium§	% DM	0.18–0.20	0.22–0.25
Potassium	% DM	0.65–0.75	0.70–0.80
Sodium	% DM	0.10–0.13	0.12–0.15
Chloride	% DM	0.20–0.22	0.24–0.26
Sulfur	% DM	0.16–0.18	0.19–0.21
Cobalt	ppm	0.10	0.12
Copper	ppm	10–15	12–18
Iron	ppm	50	60
Iodine	ppm	0.60	0.70
Manganese	ppm	40	50
Zinc	ppm	40	50
Selenium	ppm	0.3	0.3

*Early dry period is defined as 4-6 weeks after dry off with suggested nutrient densities based on a dry matter intake of 1.9-2.1% of body weight.



†Close-up dry period is defined as 2-4 weeks prior to calving with suggested nutrient densities based on a dry matter intake of 1.6-1.8% of body weight.

‡Minimum recommended dietary fiber levels.

§Increases dietary concentrations to 0.3-0.35% when potassium levels exceed 1.2-1.5%, respectively.

Maximum intake allowed by the Food and Drug Administration.

Adapted from National Research Council: Nutrient Requirements of Dairy Cattle, ed 6. Washington DC, National Academy Press, 1989, assuming a thermoneutral environment and 10% activity allowance.

Factors Influencing Nutrient Requirements:

Variable factors can influence an animal's requirement for a particular nutrient.

- **Intrinsic factors:** defining the animal, such as breed, age, sex, body weight and condition, productive function, and rate of production, comprise the basis by which nutrient requirements are determined.
- **Extrinsic factors:** such as animal activity and environment, can dramatically modify nutrient needs. Under typical dry cow management practices, activity allowances and environmental stresses should be considered if nutrient needs are to be appropriately addressed. Current dairy cattle NRC maintenance energy requirements incorporate a 10% activity allowance. This should be a sufficient energy allotment to account for animal activity when housed in stanchions with limited exercise or free-stall facilities. Many dry cow programs, however, include extensive pasture usage. Additional increases in maintenance energy requirement of 10 to 20% for grazing quality or sparse pastures, respectively, are recommended.

Conclusion:

Nutrition and management during the dry period are essential in determining the profitability of the cow for the rest of her lactation. Proper formulation of rations for protein, energy density, fiber and non fiber carbohydrates will help to increase intake along with management of body condition, cow comfort and excellent quality forages will assure an excellent dry period program for the dairy cows.

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