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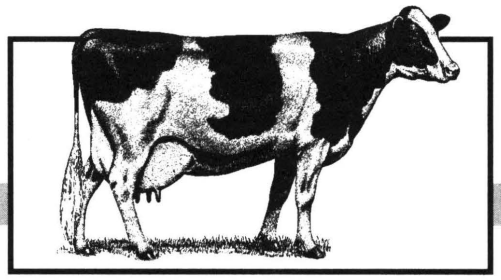

Dairy Science

PUBLICATION 404-212

Proper Dry Cow Management Critical for Mastitis Control

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Summary According to the National Mastitis Council, using FDA-approved intramammary antibiotics at drying off can decrease the number of existing mastitis infections and prevent new infections during the early weeks of the dry period. Dry cow therapy has the following advantages over lactation therapy: a) The cure rate is higher than that achieved by treatment during lactation, b) A much higher dose of antibiotic can be used safely, c) Retention time of the antibiotic in the udder is longer, d) The incidence of new infections during the dry period is reduced, e) Tissue damaged by mastitis may be regenerated before freshening, f) Clinical mastitis at freshening may be reduced, and g) The risk of contaminating milk with drug residue is reduced. Other components of an effective mastitis control program include: proper milking procedures using properly functioning milking equipment, dipping teats immediately after milking with a product known to be safe and effective, good udder hygiene between milkings, culling cows with chronic mastitis, and keeping accurate records of clinical mastitis and somatic cell counts on individual cows to assist in making management decisions.

A cow's lactation begins at the time she's dried off rather than when she calves. Proper management of dry cows often is neglected on many dairy farms. Dry cows often are placed in a back pasture and ignored, and subsequently are underfed. On other farms they remain with the milking herd and may be overfed, especially if they enter the milking parlor and consume left-over grain, or if corn silage is available free-choice. Proper dry cow management is important in preparing cows for the next lactation. Many disorders (e.g., milk fever, abomasal displacements, retained placenta, uterine infections), lowered milk production, and clinical mastitis can be avoided. How the dry cow is managed also may affect the health and performance of the newborn calf.

Dry cow management includes attention to proper procedures for drying-off cows, feeding a special ration, and concern about the cow's environment. Breeding and mastitis problems can result from infections developed during this time. Cows are most susceptible to new mastitis infections during the first two weeks of the dry period, the two weeks before calving, and the two weeks after calving. Bred heifers are prone to new mastitis infections throughout pregnancy, but especially during the last 2 weeks before calving. **Separate dry cows from the milking herd.** When left with the milking herd, dry cows have access to corn silage or high quality legume silage and may become over conditioned or prone to other metabolic disorders, including increased "downer" cows or milk fever, ketosis or acetonemia, displaced abomasum, retained placenta and metritis, and coliform mastitis. During the next lactation, fat cows lose very little body weight, and milk yield peaks at only 60-70 lb. daily for Holsteins rather than over 100 lb. Excessive energy consumption results in a buildup of fatty tissue in the liver which interferes with normal metabolic processes. The damage may be permanent.

During the early part of the lactation, high-producing cows do not consume sufficient feed to meet their nutrient requirements. Milk production peaks at 4-6 weeks after calving; maximal feed intake occurs at 9-10 weeks. The extra energy needed for milk production is supplied by breakdown of body fat.

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Drying-off

The cow's udder needs time to rest and then regenerate new milk secreting cells. The cow's body needs time to restore body energy and nutrient reserves. A summary of DHI records shows that the dry period should be at least 40 days long, preferably 50-70 days, with greatest milk yields during the next lactation occurring after 60 days dry. It's been suggested that first lactation cows should have a 65-day dry period. Cows dry less than 40 days produce lower milk yields during the next lactation. Dairy farms should set aside one day a week for drying-off cows. They should check their breeding records to determine which cows will calve within 50-70 days. They should not skip a week or cows will end up with short dry periods. In addition, when cows are treated with an antibiotic for mastitis at drying-off, a minimum dry period of 50 days is recommended to avoid antibiotic residues in milk after the cow freshens. Any Holstein cow producing less than 20 lb per day should be dried off; the chance of infection increases as production level declines. Dry cows up abruptly by discontinuing milking, dry treating, and feeding only hay and water. Cows should not be milked once-a-day or every-other-day over a short time period. Cows should be watched for several days. If they show signs of mastitis (swelling) or leaking milk, milk out and treat a second time after one week.

Dry Cow Therapy. On the average, 40-50% of the cows in the herd may have subclinical bacterial infections present in the udder. Milk appears normal but after culturing, mastitis-causing pathogens can be isolated from the milk. In a few herds, somatic cell counts may be low. **Administer an effective dry cow mastitis product on the day of drying-off into every quarter of every cow. Before treatment, pre-dip with germicidal teat dip and dry after 30-45 seconds with paper or cloth towels. Then cleanse teat ends with alcohol.** Carefully remove the protective tip from the treatment tube cannula. Do not use tubes if the unprotected cannula has become contaminated in any way, e.g., dropped on the floor, swatted by the cow's tail, etc. Insert the cannula only partially up into the teat canal. Do not insert the cannula fully. **Immediately after treatment, teats should be dipped in an effective teat dip**. Dry cow therapy and teat dipping effectively reduce udder infections, unless damage to the udder by bacteria is too severe or if scar tissue has barricaded the infection. **New infections develop in 10-15% of cows not treated at drying off.** Dry cow therapy effectively prevents new infections from developing during the early dry period. Dry cow therapy is 90-93% effective against subclinical *Streptococcus agalactiae* infections, 70-80% effective against *Staphylococcus aureus*, and 70-90% effective against environmental streptococci. Treatment of staph infections during lactation may be only 50% effective or less.

Examine the individual cow DHI somatic cell count (SCC) records at first test after calving and compare to last test in the previous lactation. A low SCC suggests that either the dry cow treatment effectively reduced any infection or prevented new infections during the dry period. An elevated SCC indicates that a new infection has developed during the dry period. If this trend continues among other cows, re-examine the entire dry cow management program, including drug resistance or sensitivity, treatment procedures, housing, and environment. If the SCC remains high from the last SCC in lactation through the first test in the next lactation, either the dry cow treatment was ineffective or the infection has walled itself off with scar tissue and become resistant to the treatment, which may occur with *S. aureus* infections.

Culture aseptic milk samples from individual cows and review sensitivities to antibiotics. At least 10-20% of the herd should be sampled and cultured during the year to determine which organisms are predominant. Samples should be collected from cows with new mastitis infections (sample CMT positive quarters of cows whose DHI somatic cell count score was 5 or above, quarters with clinical mastitis). Drug sensitivity tests on these samples indicate whether or not microorganisms have become resistant to any antibiotics. Resistant drugs should not be used for treating dry or lactating cows.

Immunization with E. coli vaccine. Research conducted in California and Ohio showed that vaccination with *E. coli* J5 bacterin at drying off, 30 days after drying off, and within 24 hours of calving reduced the incidence by 80% and severity of clinical coliform mastitis during the first 90 days of lactation by four-fold because dry matter intake and milk yield were depressed in unvaccinated control cows who were challenged with *E. coli* infusions into the udder. Although protection was greatest in older cows, positive effects were found in second and third lactation. Heifers were not vaccinated; however, a Utah Extension publication has recommended that heifers can be vaccinated with J5 at the 7th and 8th months of gestation and at calving. Consult your veterinarian for his/her professional opinion.

Early Drying Off. Drying cows off early allows one to administer dry cow antibiotic therapy sooner, which may increase the chance of eliminating the infection. The dry period can be extended by 30 to 60 days. Any cow

whose SCC has increased to DHI SCC score of 5 and above (actual SCC 300,000) during the lactation can be dried off and dry treated earlier than would be expected, especially for cows producing only 30-40 lb. milk.

No dry period. Cows with elevated SCC in early lactation should be cultured. If *S. aureus* is found, the cow should not be bred and she should be culled from the herd whenever she is no longer profitable or the farm is not able to isolate infected cows. These cows remain a source of infection as long as they remain in the herd.

Dry Cow Therapy to Bred Heifers. New infections can be found in many heifers, either at calving or in early lactation. Often *S. aureus* infections, if untreated, become clinical and recur throughout the first lactation and into the second lactation. Louisiana studies have examined the feasibility of giving antibiotic therapy to heifers (Nickerson et al., 1995). A dry cow product containing penicillin and dihydrostreptomycin was administered at the first, second, or third trimester of pregnancy in 35 bred heifers from four herds. Although prevalence of infection and SCC was reduced by treatment in all three groups of heifers, heifers dry-treated during the second trimester of pregnancy demonstrated greater reduction in mastitis and SCC at calving. Consult with your veterinarian for treatment options and choice of antibiotics. To avoid causing an infection during treatment, it is important that teat ends be properly cleaned and disinfected before and after treatment, especially since treatment penetrates the seal in the teat end. Refer to the earlier section on Dry Cow Therapy. Turn heifers into clean and dry environment. Check milk for presence of antibiotic residue at 3 to 5 days after calving and before milk is put into milk tank.

Housing and Environment

Provide an environment that will minimize exposure to dirty conditions. Dry cows need to exercise and to get off concrete. The dry lot should provide numerous shade trees and be well drained. Dry lot location is an important factor in providing an environment with reduced bacterial populations. Filthy, damp, or muddy pens or stalls, lots, or pastures continually expose the teat end to a barrage of bacteria. Often the dry lot on many farms is located down hill or on the lower side of the housing and milking operation. The best solution to this problem is to locate the dry lot up hill from the milking operation and fence off all ponds, streams, swampy areas, and ditches. Cattle crossings should be built to keep cows out of water and prevent erosion of streambanks. Many cases of coliform mastitis and/or reproductive infections have developed from such conditions. If only one or two shade trees are present, cows congregate under these trees on hot days. Considerable manure build up occurs over a short time. Because manure is a good source of coliform bacteria and other destructive organisms, manure buildup resulting from too little shade can result in serious udder infections.

Pasture has reduced the risk of environmental mastitis, but exposure is increased when cows have access to lots with limited shade trees, or pastures that are overgrazed, or grazed during periods of heavy rain. If cows are turned out into pastures or loafing lots, well-drained paddocks are preferred. Loafing lots or pastures should be managed to prevent muddy areas where heifers or older cows would lie down (see Virginia Cooperative Extension Publication 404-252, Dairy loafing lot rotational management system, 1994).

Fly control. Flies carry a number of mastitis-causing organisms that can colonize teat lesions. Incidence of environmental mastitis is higher during summer and fall as is fly infestation. Flies may cause mastitis by biting teats and causing damage that provides an excellent site for colonization. This has not yet been proven, but many feel this may be a convincing cause. Elimination of fly breeding sites is one aspect of fly control. Flies breed in decaying feed or manure that has accumulated, including exercise yards, calf pens, and box stalls. Other options include backrubbers, feed additives and ear or tail tags. The possible role of flies in the transmission of mastitis from infected to uninfected cows is one reason to separate dry cows from bred heifers. First lactation cows have a surprisingly large proportion of mastitis infections, often caused by environmental pathogens.

Feeding Dry Cows

A cow's body condition at drying-off should be close to that desired at calving. Adequate body energy and nutrient reserves are required to attain and hold top production during early lactation. Cows in poor body condition will drop off in milk production and are difficult to get bred. The late lactation is more efficient in restoring reserves than the dry period. The desired body condition in dry cows (3+ to 4 score) is where the chine and loin areas are rounded and continue into the rump. The back should begin to show some fat deposition. The hips and pins are round. Some fat should be deposited around the tailhead and pin bones. For more information, see VCE Publication 404-104, Body condition scores for evaluation of nutritional status, 1990.

Dry cows should be fed a specific ration balanced to meet nutrient requirements of dry cows (see VCE Publication 404-105, Updated Nutrient Specifications For The Dairy Herd, 1996). The ration dry matter should contain 10-12% crude protein, 60% TDN, at least 33% acid detergent fiber, 2.6-3.2 g calcium per lb. (60-80 g per day total), and 1.4 g phosphorus per lb. (30-40 g per day total). Corn silage should be limited to 30 lb. per day for 1500 lb. cows. Feed at least 10 lb. hay, preferably grass hay or grass-legume mix. Do not feed legume alone, as it contains excessive protein and calcium. Examples of dry cow rations are shown in Table 1. Amounts are expressed per 100 lb. body weight. Take the average body weight and divide by 100. Multiply this factor by the suggested amount of feed. For example, the factor would be 15 for dry cows averaging 1500 lb. (factor = 1500/100 = 15). Ration C would provide 30 lb. silage, 10 lb. hay, 1 lb. corn, and 2.25 oz of each mineral per cow daily.

A good quality bluegrass-clover pasture is excellent for dry cows. Such a pasture probably needs no supplementation. Clover and bluegrass contain considerable amounts of vitamins A and E. Stored forages lose vitamin levels with time. The dry cow ration should provide 40,000 I.U. vitamin A, 20,000 I.U. vitamin D, and 1,000 I.U. vitamin E daily if cows are not injected at drying off or if fresh forage is not provided. **Rotational grazing** of such pasture would provide excellent feed to both dry cows and bred heifers, especially since both groups often need additional attention. Rotational grazing would have an advantage over continuous permanent pasture which is usually low quality. Groups of animals would need to be rotated every 3 to 7 days, depending upon pasture quality, growing conditions, and numbers of animals. Several types of pastures could be included in the rotation, such as cool season grasses, legume-grass mix, and sorghum-sudan for summer months. Small amounts of hay (3-4 lb.) should be available to prevent bloating.

Table 1. Feeding Guidelines for Dry Cows at Different Body Weights

	Example Feeding Programs		
Feedstuffs	A	B	C
	lb. per 100 lb. body wt		
Grass Hay	2.0	.67	—
Alfalfa Hay	—	—	.67
Corn Silage	—	2.0	2.0
Shelled Corn	—	0.13	0.06
Soybean Meal	—	0.067	—
Dicalcium Phosphate	—	.1 oz	.15 oz
Limestone	.1 oz	.2 oz	.15 oz

Two Weeks Before Calving (Transition period)

Isolate cows due to calve from other dry cows and the milking herd. A small pasture beside the barn or near the center of activity is ideal. Feed provides nutrients to the cow, the calf, and to the microbial population within the cow's rumen. Rumen microorganisms require adaptation to changes in the ration. A dramatic change after calving from a high forage, high fiber ration to a high concentrate, low fiber ration can throw cows off-feed or result in ketosis or acidosis. The cow must be conditioned so that she can consume large amounts of carbohydrates and proteins after calving. Starches in concentrates are rapidly converted to short-chain acids. Microbes that utilize these acids are slow to develop. The cow spends less time chewing her cud, and therefore reduces the amount of saliva that is added to the rumen to buffer the increase in acid production. A similar phenomenon occurs when finely ground or chopped feeds are consumed.

The energy density necessary in a dry cow ration increases from .57 Mcal/lb. at 21 days to .66 Mcal/lb. at 7-10 days before calving to .88 Mcal/lb. during the last three days[1]. During this period, it is important to feed sufficient fiber or bulk to maintain a healthy rumen and keep it distended, while boosting energy intake or nonfiber carbohydrates (NFC or starch) to increase production of propionic acid. This acid would stimulate growth and development of rumen papillae so that acidosis is unlikely and send a signal so that the cow mobilizes less body fat which may reduce fatty liver or ketosis. Too little fiber may lead to acidosis. The diet should be more energy dense than the typical dry cow ration containing .57 Mcal/lb. A diet containing .88 Mcal/lb. is not practical. A transition diet of .70-.72 Mcal/lb. was recommended, with NFC between 35-40% of dry matter and neutral detergent fiber (NDF) at 32% or above. The amount of concentrate should be limited to 7-8 lb. per cow daily, preferably fed in a total mixed ration. If transition cows

[1] *Grummer, R. 1998. Feeding close-up cows is a balancing act. Page 185 in March 10 issue of Hoard's Dairyman*

cannot be grouped separately from other dry cows and fed this ration, the transition diet should be fed to all dry cows.

At 2-3 weeks before expected calving, offer limited amounts of corn (35-40 lb.) or hay crop silage (30-35 lb.) and provide at least 10 lb. hay. Introduce the milking herd concentrate but restrict the amount to 4-8 lb. per day. Hold the amount constant until after calving. This ration would approximate 25-29% acid detergent fiber, 42% NDF, and 35-40% NFC. Avoid free-choice salt or protein supplement, forages with over 3% potassium, and buffers. Very little is known regarding the cause of udder edema, but excessive salt, energy, or protein intakes may contribute.

After calving, keep milk from fresh cows out of the bulk tank for at least three days. Remove calves from cows and feed colostrum by hand to insure adequate intake. "Hand walk" cows through parlor for milking. After 3-5 days, feed the milking herd ration. If milking cows are grouped, do not put fresh cows into the high group for two weeks after calving. When concentrate is offered at milking, increase the amounts gradually (2 lb. increments). If cows do not receive corn silage until after calving, consider adding sodium bicarbonate to the ration to buffer the dramatic change in feeds. Microorganisms in the cow's rumen are slow to adjust to ration changes, thus drastic changes in the feeding program result in detrimental effects on this microbial population.

Vitamin E and Selenium. Supplementation of the diet with vitamin E and selenium has reduced mastitis. Selenium injections (4.5 mg/100 lb. body weight) may be given at 21 days before expected calving and the ration of bred heifers supplemented with vitamin E. Together these practices have reduced mastitis in early lactation more than either practice alone (Hogan et al., 1993). The effect of vitamin E on clinical mastitis was more pronounced for first lactation than older cows (Weiss et al., 1997). Vitamin E levels of at least 1,000 IU/day during the dry period and 500 IU/d during lactation were more beneficial than National Research Council's recommended 100 IU/d. Selenium was added to the ration to provide 0.1 ppm, which resulted in plasma selenium levels lower than accepted as adequate. Selenium also may be added to dry cow and milking herd rations (3 and 6 mg/head daily, respectively). Vitamin E and selenium also reduced retained placenta, metritis, and cystic ovaries.

Calving areas must be clean and dry. They should be cleaned and sanitized after 1-2 calvings, with one box stall per 15-20 cows and bedded with straw, shavings or sand. Organic materials, e.g., straw, sawdust, and shavings, as bedding have been associated with an increase in environmental mastitis. Sand does not support bacterial growth but could be a problem with liquid manure systems. When cows are confined to freestall barns, adequate dry bedding should be provided to keep freestalls and pens clean, dry, and comfortable. Freestalls should be properly designed and maintained. Daily removal of wet and soiled bedding is recommended.

For herds with a high incidence of mastitis at calving, or high average SCC at first DHI test among first lactation cows, either prepartum milking or prepartum antibiotic therapy may have considerable merit.

Lactating Cow Treatment to Bred Heifers. In Tennessee, several studies administered a lactating cow antibiotic treatment containing either cloxacillin or cephapirin at 7 days before expected calving in heifers (Oliver et al., 1992). In a subsequent study, cephapirin was given at 14 days before calving. Treatment of pregnant heifers at 14 days prior to expected parturition with cephapirin lactation therapy gave greatest reduction in intramammary infections, with greater milk production and little risk of antibiotic residue in milk at 3 days after calving unless heifers calved shortly after treatment. Use treatment precautions indicated under Dry Cow Therapy. If antibiotic treatment is used, remember to follow label withholding recommendations for discarding milk. It is recommended that treated animals should be tested with an antibiotic residue test at 3-5 days after calving and milk discarded until it tests negative.

Prepartum Milking. Incidence of mastitis infections after calving was reduced in seven New York dairy herds when heifers were first milked 14 days before calving. Milk yield was unaffected. Two years later, four herds had continued prepartum milking of heifers because of easier adaptation to milking. The April 25, 1997, issue of Hoard's Dairyman described a New York dairy farm where 2-year-old heifers were milked a minimum of 2 weeks prior to calving, preferably 4-6 weeks (Wilson, 1997). The practice acclimated heifers to the milking environment and cut down on congestion and soreness. Heifers were put in the holding area for 1-2 days before being brought through the parlor. After several days of coming through the parlor, teats are wiped. After a couple more days, milking machines were attached. This practice may be considered for herds with mastitis problems at calving; however, heifers will secrete no colostrum at calving. Thus, newborn calves will need frozen colos-

trum, preferably first colostrum from older cows, to acquire needed immunoglobulins against disease.

In Michigan dairy herds, 30% of drug residue violations during 1996 were related to dry cow therapy. The causes included: (1) Dry cows housed with lactating cows and milked accidentally, 15; (2) Milk from fresh cows not withheld sufficient time, 11; (3) Dry cows in separate lot but escaped to milking lot, 8; and (4) Lactating cows accidentally dry treated but milked, 6. To reduce the risk of antibiotic residues because of treatment during the dry period: dry cows and fresh cows should be separated from the milking herd; dry treated cows should be marked differently from treated lactating cows; milkers should understand different markings and have access to treatment records: milkers should be trained to detect cows with udder edema and the potential risk; and cows receiving any extra-label treatment should be tested with a screening test before their milk is added to the bulk tank.

Conclusions

The management of dry cows needs as much planning and attention as that of milking cows. Certain precautions are necessary at drying off and around calving. Neglecting facilities, environment, and feeding can dramatically influence the long-term success in a herd.

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