Dietary Cation Anion Balance (DCAB)

$DCAB = ([Na^+] + [K^+]) - ([Cl^-] + [S^=])$

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Important guidelines for successful supplementation with anionic minerals (salts) to closeup dry cows (2-3 weeks before calving):

Do **NOT** feed alfalfa hay free-choice. Limit alfalfa hay and/or haylage to 10 lbs. of dry matter (DM) due to the high potassium (K) level. Consider testing the hay/haylage for K and avoid feeding high K forages (>2.5% K, 100% DM) to the closeup dry cows. (Note: Oat hay K level is around 1.25%, 100% DM—about half that of alfalfa. This, probably, is the reason oat hay, at times has been successful in reducing milk fevers and not because of the lower calcium (Ca) level that many have touted. In fact, with the feeding of anionic minerals, the Ca level needs to be raised by adding either limestone or Ca containing anionic minerals.)

Do **NOT** add sodium (Na), potassium (K) or phosphorus (P) to the closeup ration. Sodium and K contribute to the positive side of the cation-anion equation. Excess P (>50 gms/cow/day) may have varying degrees of inhibition on enzymes in the kidneys that convert inactive vitamin D into active vitamin D. Vitamin D is important for gut uptake of Ca and with lowered vitamin D levels (due to excess P) proper blood levels of Ca may not be maintained at freshening leading to milk fever.

Do **NOT** feed concentrate products that are seeds, meals or brans (i.e. whole cottonseed, cottonseed meal, peanut meal, rice bran, wheat mill run, etc.). These feeds tend to be high in both K and P and will have a cancelling effect on the anionic minerals. The best combination of concentrates for the close up ration is a blend of rolled corn, rolled barley and beet pulp. Feeding a 50:50 blend of rolled corn and rolled barley works quite well, also.

The benefits of a balanced closeup ration and supplementation with anionic minerals are: (1) a marked reduction in both clinical milk fever cases and subclinical hypocalcemia; (2) an increase of 700 to 1,000 pounds more milk in that lactation; (3) reduced reproductive problems resulting in a decrease in average days open and lower services per conception; and (4) reduced incidence of ketosis and displaced abomasums.

The economic advantage of using anionic minerals for milk production alone has been shown to be a 7:1 to 10:1 benefit:cost ration. At current milk prices that means an additional income of $35 per cow (700 lbs. extra milk X $.10/lb of milk) x 0.5 (if 50% of the value of extra milk was expended in feed cost). The additional cost of the anionic minerals for one cow for three weeks before calving is about $5. (the $35 additional income and $5 spent on anionic minerals to get that additional milk income is a return of $7 for each $1 invested. The return on investment would be greater with either higher milk prices and/or higher additional milk production as a result of feeding the anionic minerals). This does not include any estimate of potential economic gain because of reduced incidence of milk fever and other health problems, and improved reproductive performance. The probability is strong for potential economic gains in those areas as well.

A typical close up dry cow ration:

Corn silage	40-45 lbs
Alfalfa hay	7-9 lbs
Alfalfa haylage	4-5 lbs
Corn grain or grain mix	7-9 lbs
*Anionic Minerals with TM and Vitamins	1 lb

*Do **NOT** feed any additional minerals or buffers. Do **NOT** feed salt (NaCl) in any form to the closeup dry cows. Do **NOT** add dicalcium or monoammonium phosphate. Do **NOT** feed any type of liquid mineral supplement to the closeup dry cows.

Specific mineral guidelines and recommendations:

Ca: Want Ca intake at 160 to 180 grams per cow per day.
Keep Ca% at or slightly higher than K%.
Sources: Limestone, $CaCl_2$ and/or $CaSO_4$.

P: Limit P to 50 grams or less. This, almost always, is achieved through the naturally occurring P in the feeds being fed. Advise NOT adding additional P.

K: Want K level less than 1.25%. If higher, then difficult to maintain proper DCAB at - 100 to -150 meq/kg DM.

Mg: Want Mg as close to 0.4% as possible.

Na: Maximum Na of 0.18%, preferably less than 0.1%.

S: Want S as close to 0.4% as possible - maximum of 0.5%.

Cl: Want Cl range of 0.6 - 1.25%, preferably 0.75 - 1.0%.

DCAB: Minimum of -75 meq/kg DM, preferably -100 -150 meq/kg DM.

Anionic Mineral Package (1 lb./head/day ~ $30/cow/day):

Calcium Chloride	160.0 gm (0.35 lb)	=	2.82 eqv.
Calcium sulfate	90.0 gm (0.20 lb)	=	1.05 eqv.
Magnesium sulfate	90.0 gm (0.20 lb)	=	0.73 eqv.
Totals====>	340.0 gm (0.75 lb)	=	4.60 eqv.

Vitamin A	60,000 IU/lb
Vitamin D	30,000 IU/lb
Vitamin E	1,000 IU/lb
Selenium	6.0 mg/lb (13.2 PPM)

Dietary Cation-Anion Balance (DCAB)

DCAB (Meq/Kg DM)	=	$[Na^+]$ +	$(K^+)]$ -	$[Cl^-)$ +	$(S^=)]$
Molecular Wt. (g)	=	23.0	39.1	35.5	32.1
Valence (charge)	=	$^+1$	$^+1$	$^-1$	$^=2$
Equivalent Wt. (g)	=	23.0	39.1	35.5	16.0
Conversion Factors from Percentages to Meq/kg DM	=	435	256	282	625

NRC Recommendations for Dry Cows, 1989, 6th Edition Revised =

0.10%0.65% 0.20%0.16%
(44 + 166) - (56 + 100)
210 - 156
DCAB = +54 Meq/Kg DM

Typical Closeup Ration Without Anionic Salts =

0.10%1.2% 0.14%0.2%
(44 + 307) - (40 + 125)
351 - 165
DCAB = +186 Meq/Kg DM

Closeup Ration with Added Anionic Salts =

0.10%1.2% 0.85%0.41%
(44 + 307) - (240 + 256)
351 - 496
DCAB = -145 Meq/Kg DM

Using urine pH to monitor the effectiveness of anionionic minerals in the closeup dry cow ration:

Even though anionic minerals are being fed to the closeup dry cows, they may not be at the correct levels or if at the correct levels, the beneficial effects of the anionic minerals may be overridden due to other mineral imbalances and/or excesses such as excess K particularly from forages high in K like alfalfa hay. Recent research and field trials have shown that measuring the cow's urine pH to be a simple and accurate monitoring method. If the closeup cows are consuming a ration correctly formulated with a negative DCAB (i.e. -100 to -150 meq/kg DM), then the cow's urine should test acidic—pH 7.0 or less. Cows only need about 5 to 7 days on an anionic ration in order for their urine to become acidic. (Remember that the cow's urine acid-base status is a reflection of her blood acid-base status and when anionic salts are fed properly, the cow's blood becomes slightly acidic allowing better Ca absorption from the gut and mobilization from the bone thereby greatly reducing her risk of getting milk fever.) On the other hand if the cow's urine is alkaline (basic), pH 7.5 or greater, when consuming a supposed correctly formulated anionic mineral ration, then something has gone wrong with the ration's DCAB and further investigation of the feedstuffs and the minerals used needs to be pursued to correct the problem. Cows with alkaline urine in the closeup group are at much greater risk of developing both clinical milk fever and subclinical hypocalcemia than are cows with acidic urine. Using inexpensive pH paper with a range of 6.0 to 8.5 (which can be purchased from Fisher Scientific for about $5.00 a roll) to test a cow's urine now allows for a fast, simple and relatively accurate monitoring method. A random sample of 4 to 6 cows that have been on the closeup ration for at least 5 days is all that is needed. Cows recently moved into the closeup pen (less than 5 days) will probably test alkaline (pH greater than 7.0)—so knowing how long cows have been on the closeup ration is important for proper interpretation.

References

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