Cation-Anion Differences and Milk Production

In a recent article by Delaquis and Block (JDS 1995,78:2259-2284) the relationship of dietary cation / anion difference (DCAD) and milk production was discussed. The authors utilized a switchback design with early, midlactation, and late lactation cows to evaluate several levels of DCAD. A positive DCAD was maintained for all treatments. DCAD was calculated by the following equation.

DCAD = (Na + K - Cl -S)

The DCAD was increased with potassium carbonate, or decreased with magnesium sulfate. Magnesium levels of all of the rations was maintained constant. The DCAD of each ration and the mineral levels of each ration are shown in the following table:

	Early		Mid		Late	
	high	low	high	low	high	low
Ration Balance						
DCAD meq/kg	258.1	55.5	327.7	140.2	402.6	199.8
Na %	0.39	0.42	0.38	0.41	0.44	0.46
K %	1.15	1.09	1.50	1.40	1.64	1.50
Cl %	0.30	0.35	0.21	0.22	0.35	0.36
S %	0.20	0.49	0.18	0.53	0.23	0.50
Performance						
DMI lbs	35.71	33.5	37.5	34.4	39.2	37.0
Water Intake L/day	83.7	76.7	86.4	76.3	90.7	86.7
Milk lbs	43.0	40.3	41.6	40.1	33.7	32.8
Fat %	3.88	3.94	4.0	4.16	4.38	4.41
Protein %	2.89	2.84	3.04	3.05	3.50	3.49

Measurements of plasma bicarbonate were also made at feeding and 2 and 4 hours post feeding. These results showed that the higher DCAD rations, in the early lactation cows was associated with a significantly higher plasma bicarbonate. A higher plasma bicarbonate is associated with a higher capability of managing excess acid from stress or feeding. The high DCAD cows maintained a higher plasma bicarbonate at 2 and 4 hours post feeding as well. This infers that these cows handled the acid load from feeding and early digestion better than cows fed lower DCAD rations. This agrees with other data from dairy trials as well as data from feedlot cattle.

The results show that dry matter intake, water intake, and milk production was increased with higher DCAD. The greatest improvements with higher DCAD was shown in the early lactation cows. In general, these results agree with data showing improved production with higher DCAD in poultry, swine and beef cattle. The authors concluded; "*Milk production and dry matter intake were significantly increased by a higher DCAD in early and mid-lactation but remained unaffected in late lactation.*"

This research paper has practical implications when balancing milking cow rations. It has been shown that it is advantageous to increase the DCAD in early and mid-lactation rations. DCAD can be increased by either increasing sodium or potassium. As potassium is naturally high in some areas of the country, care should be taken prior to increasing ration potassium levels. The addition of potassium as potassium chloride will not increase DCAD, as the chloride increases proportionally with the potassium having the net effect of 0 meq/kg. Potassium carbonate is a possibility, however, the cost may be prohibitive. Increasing sodium is commonly done by the addition of sodium bicarbonate or sodium sesquicarbonate. Common mineral additions and their effect on DCAD are shown in the following table.

Source	% Na	Addition % DMI	meq /kg change
Sodium Bicarbonate	27.0 %	0.75 %	+ 88 meq/kg
Sodium Bicarbonate		1.0 %	+ 117 meq/kg
S-Carb®	30.4 %	0.75 %	+ 99 meq/kg
S-Carb®		1.0 %	+ 132 meq/kg
trona ore	27.0 %	0.75 %	+ 88 meq/kg
salt	60 % Na 30 % Cl	0.25 %	no change

S-Carb® is GENESIS's purified sodium sesquicarbonate.

As shown in the table, S-Carb® is the most efficient buffer for use in raising the ration sodium, and hence the ration DCAD.