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# A New Generation Anion Supplement for Transition Cows

By Jill Faser and Maura Keller

**F**or dairy cows, the transition from the dry period to lactation is a stressful part of an animal's life and a critical period of the cow's production cycle. Physiological and hormonal changes accelerate as the cow prepares for birth. The last three weeks of the dry period set the stage for a successful future lactation (Goff, Horst 1997). During this time, the transition diet is critical in preventing a number of nutritional diseases and can help yield a healthy, productive and profitable cow.

It is widely accepted that a diet with a negative dietary cation anion difference (DCAD) is beneficial to the health and performance of prepartum cows because it improves calcium mobilization. Research and experience have demonstrated that lowering the ration DCAD three weeks prior to calving helps prevent serious health challenges, such as milk fever, displaced abomasum, mastitis and ketosis, while increasing immune function, reproductive performance, dry matter intake and milk production postpartum. The onset of lactation results in a rapid and significant demand for calcium and imposes serious challenges to calcium homeostasis. The addition of anionic salts to prepartal rations of dairy cows is a proven means of reducing DCAD and results in higher blood calcium at calving. (Oetzel et al., 1988).

MegAnion is a new generation anion supplement manufactured as an extruded organic complex that has

significantly greater nutritional value and chloride content than other anion supplements. Recent research conducted at the University of Minnesota assessed the impact of MegAnion on mineral and electrolyte status in periparturient multiparous cows. The study compared a MegAnion treatment to a control treatment with traditional anionic salts. Both treatments had equivalent DCAD levels and nutrient content, except a difference in chloride and sulfur content between treatments. The study found that both treatments decreased urine pH and maintained blood ionized calcium levels well above the required calcium threshold for a healthy and productive cow. In other field studies, MegAnion fed as a top dressing or in a total mixed ration (TMR) was readily consumed and dry matter intake maintained. Research shows MegAnion is an effective DCAD supplement and DCAD supplementation that can be used to increase feed efficiency to help dairy producers sustain dairy cow health and performance during transition and improve profitability.

Negative anions will acidify a cow's system via blood and urine pH reduction required for calcium mobilization by reduction of blood buffers and hydrogen accumulation. Positively charged calcium ions need negatively charged anions to pull calcium from the bones into the blood stream. Reducing ration DCAD induces a metabolic acidosis in which calcium is reabsorbed from bone into the blood stream to compensate for calcium secreted in colostrum and milk (Charbonneau et al, 1997). Negative DCAD diets, ranging from -10 mEq to -15



mEq/100g diet DM with proper management and nutrition, are crucial for the prepartum period.

MegAnion is a high-quality, economical DCAD solution that meets the dietary requirements of dry transitioning dairy cows. Collaborating with nutritionists, research scientists and consultants in the dairy industry, MegAnion was developed with a unique process of combining the most potent anion salts with high levels of chloride in a stable organic complex.

Two duplicate pilot studies were conducted at the University of Minnesota to determine the effectiveness of MegAnion supplementation on blood acidosis and improvement of calcium status at the transition in dairy cattle. Both studies used six multiparous cows 21 days before their expected calving to postpartum. Treatments included diets with MegAnion versus a control diet with typical anionic salts added. Both treatments had a final DCAD value of -12 mEq/100 g. Formulations of the mineral mix and the final diets fed are listed in Table 1 and Table 2. The nutrient content of both treatments was equivalent with the exception of a difference in chloride and sulfur content between treatments listed in Table 3. Fresh whole blood was collected throughout the duration of the studies and analyzed for ionized calcium, pH, and other acid-base indicators as partial pressure of CO<sub>2</sub> (PCO<sub>2</sub>), partial pressure of oxygen (PO<sub>2</sub>), bicarbonate (HCO<sub>3</sub>), total concentration (TCO<sub>2</sub>), base excess of the extracellular



**TABLE 1: SALT MIXES (% AS FED)**

	Control	Treatment
Soy Hulls	38.33	44.74
Canola Meal	20.10	14.20
Soybean Meal, 47%	19.88	14.04
Corn, Ground Shell	11.44	11.04
Blood Meal	1.07	1.09
Dicalcium Phosphate, 21%	0.43	0.44
Magnesium Oxide	0.41	0.63
Magnesium Sulfate	2.25	
Calcium Sulfate	2.40	
Calcium Chloride, 94%	1.36	
Calcium Carbonate	2.75	
MegAnion		8.71
Bio-Sel Dry Cow 1000-Rum	1.50	1.53
Fat	0.82	0.83
Rumensin 90	0.01	0.01

**TABLE 2: GRAIN MIXES**

	Control		Treatment	
	As Fed	DM	As Fed	DM
Corn Silage	13.00	33.33	13.00	33.33
Grass Hay	8.00	8.90	8.00	8.90
Water	0.001	10.00	0.001	10.00
Control Salt Mix	11.00	12.30		
Treatment Salt Mix		11.00	12.11	

**TABLE 3: RATION NUTRIENT ANALYSIS (DM BASIS)**

	Control	Treatment
Dry Matter, %	49.60	49.70
Crude Protein, %	14.50	14.50
Soluble Crude Protein, %	32.60	33.00
Net Energy Lactation, Mcal/lb	0.69	0.68
ADF, %	28.30	29.00
Crude Fat, %	2.70	2.70
Na, %	0.07	0.07
K, %	1.26	1.22
P, %	0.40	0.39
Cl, %	0.64	1.05
S, %	0.47	0.27
DCAD, mEq/100g	-12.00	-12.00





fluid (BEecf), hemoglobin (HGB), saturated oxygen (SO<sub>2</sub>) and hematocrit (HCT) to compare metabolic acidosis and calcium status. Urine was collected by manual vulva stimulation throughout the duration of the studies and was used to determine urine pH.

The results of the study are listed in Table 4. MegAnion was as effective as the control treatment with anionic salts and was observed to lower urine pH from biological dairy cow levels of pH 8.0 to 8.5 and maintain blood ionized calcium well above critical calcium levels of 4.0 mg per dL, where the prevalence of subclinical hypocalcemia, is typically characterized by ionized calcium less than 4.0 mg/dL (or less than 1 mM). There was no statistical difference between the control treatment and the MegAnion treatment other than PCO<sub>2</sub> where MegAnion exhibited a statistical difference in decreasing PCO<sub>2</sub> representing a metabolic acidosis. Urine pH was lower in the MegAnion treatment than the control diet. This was not statistically different between the two diets, however, the urine pH may represent a trend towards greater acidosis (P=0.07). Metabolic acidosis is represented by a lower pH, a lower BEecf or HCO<sub>3</sub> concentration and a compensatory decrease in the PCO<sub>2</sub> signifying an attempt to blow off excess acid load. The following studies illustrate that the treatments with MegAnion were effective in controlling

**TABLE 4: EFFECT OF MEGANION SUPPLEMENT ON ACID-BASE AND CALCIUM STATUS**

	Control	Treatment	SEM	P-Value
Blood pH	7.45	7.43	0.01	0.12
Urine pH	7.82	7.28	0.14	0.07
Blood Ionized Calcium, (mg/dL)	4.74	4.76	0.08	0.34
PCO <sub>2</sub> , (mmol/L)	40.72	38.17	0.91	0.07
PO <sub>2</sub> , (mmol/L)	49.99	51.49	5.60	0.86
HCO <sub>3</sub> , (mmol/L)	26.89	27.33	0.54	0.57
BEecf, (mmol/L)	2.65	3.44	0.55	0.32
SO <sub>2</sub> , (mmol/L)	72.01	71.26	4.80	0.92
TCO <sub>2</sub> , (mmol/L)	28.14	28.62	0.56	0.56
HCT, (mmol/L)	26.56	27.73	0.61	0.21
HGB, (mmol/L)	9.01	9.39	0.20	0.21

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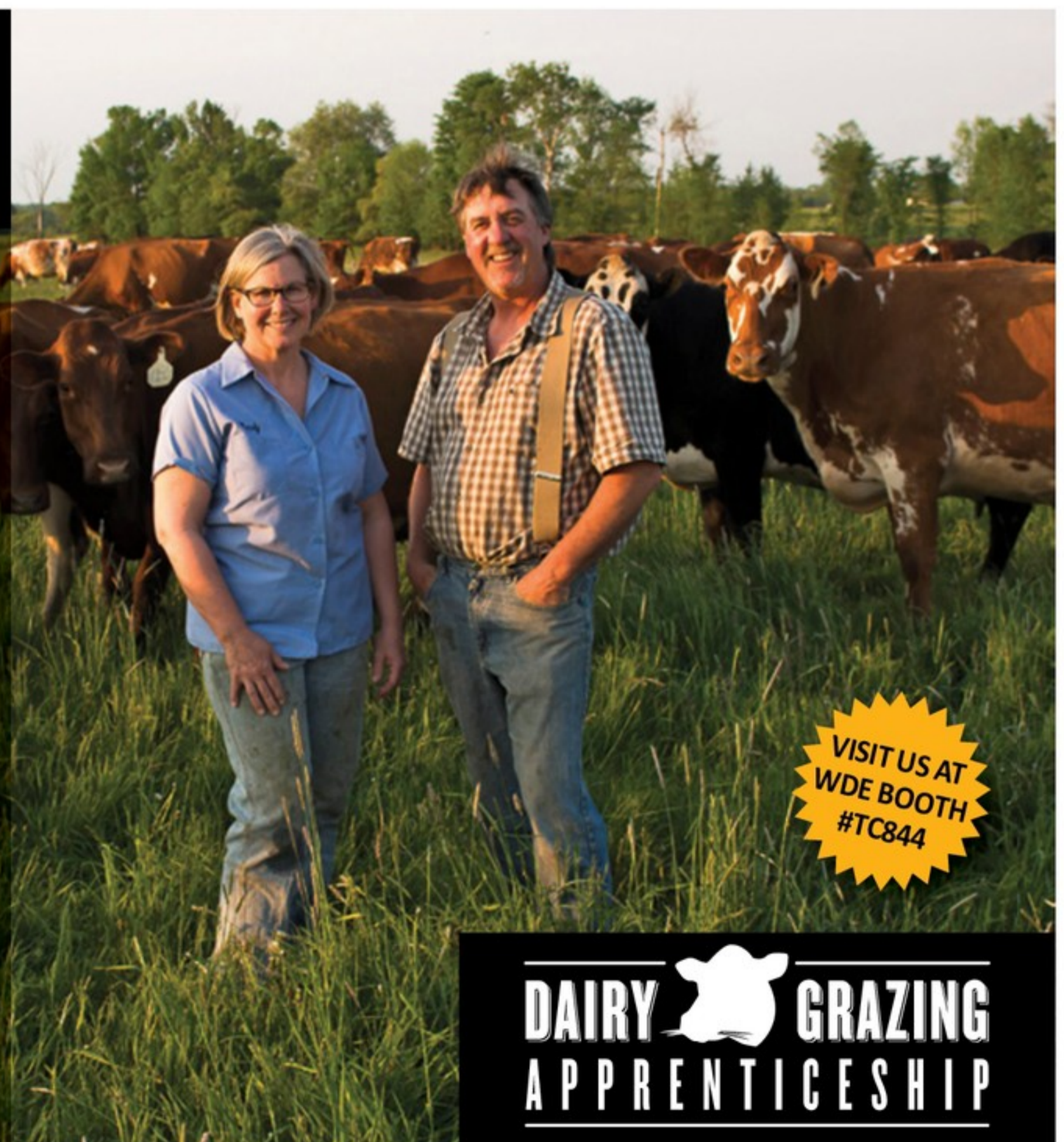
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the cation-anion balance and as efficient as the control diet with anionic salts designed to lower DCAD, cause blood acidosis and preserve ionized blood calcium after calving.

Depending on the severity, hypocalcemia may manifest as clinical milk fever, which occurs in 5 percent to 10 percent of dairy cows with incidences of hypocalcemia or subclinical milk fever ranging from 23 to 39 percent in multiparous cows and 50 percent of all adult dairy cows. The problem gets worst when cows age into their milk production years, with hypocalcemia as high as 66 percent for second lactation and higher (Oetzel et al., 1988; Beede et al., 1992).

Studies on lactation performance have shown that sub-clinical hypocalcemia dairy cows produce approximately 850 lb. less milk annually or 14 percent less milk than cows with normal blood calcium (Block, 1984, Beede et al. 1992). Savings are significant for the prevention of milk fever and subclinical milk fever.

Analyzing for plasma calcium or blood ionized calcium are both reliable measurements of changes in calcium levels in the blood. The prevalence of subclinical hypocalcemia is typically characterized by blood calcium levels with a lower threshold of less than 8.0 mg/dL or blood ionized calcium less than 4.0 mg/dL. Blood levels above 8.0 mg/dL or blood ionized calcium above 4.0 mg/dL are considered normal. The above research found that the control and MegAnion treatment blood ionized

calcium measured at 4.74 and 4.76 mg/dL respectively, well above the required calcium threshold for a healthy and productive lactation.

Balancing prepartum rations with anionic salts for negative DCAD levels has been shown by many researchers to have a significant effect on blood calcium and postpartum milk production, substantially reducing hypocalcemia and milk fever. In one study, milk fever was prevented 92 percent of the time by feeding typical anionic minerals prepartum (Dishington, 1975). Block, 1984 showed feeding typical anionic minerals also increased subsequent lactation by 7 percent.

However, it is often difficult to apply typical anionic salts to dairy cow diets because of poor palatability and the potential for reduced dry matter and feed intake. Anionic salts often have a pungent odor. Ammonium salts pre-mixed into a concentrate mixture during warm weather may result in release of ammonia gas and feed refusal. An effective, palatable and concentrated anion source, MegAnion delivers a negative DCAD and maintains DMI during transition. MegAnion is specially formulated with processed flavor enhancers for toasty granules with a touch of sweet cool taste for good palatability. Field studies using MegAnion as a top dressing and in TMR have shown MegAnion is readily consumed and maintains dry matter.

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In addition, anionic salts are very difficult to handle, store and blend. Anionic salts are highly hygroscopic in nature and attract moisture leading to caking and bricking. MegAnion is easy to use and is composed of uniform small prills for greater ease of handling and storage.

It is manufactured using a unique homogeneous chemical and nutrient-blending process, which solubilizes the anion salts with organic protein complexes, allowing for precise and consistent nutrient levels across all particles. MegAnion is a safe and stable organic complex, which can be fed as mixed rations or as a top-dressing.

In addition, different anion minerals have varying acidifying effects required for calcium mobilization. Goff et al. found that chlorides provide the greatest acidifying effect to maintain calcium homeostasis. Chlorides were demonstrated to be 1.6 times as potent as sulfates for acidification of the cow's blood and urine. MegAnion contains a considerably high level of chloride delivering the lowest DCAD offered in a palatable and stable organic complex.

Supplements with less acidic anion sources and higher DCAD require more feed inclusion to lower DCAD and can cause the ration to become unpalatable, hard to handle and more expensive. MegAnion offers a low inclusion rate and flexibility in feed formulation with high economical advantage.

A successful feed management program for transition cows maximizes dry matter intake and promotes ideal blood calcium levels to prevent milk fever, improve cow performance, health and maximize profitability. Lowering DCAD helps allow the cow to increase dry matter intake (DMI) postpartum and maximize milk production.

The University of Minnesota research showed that MegAnion is an effective anion supplement that successfully acidifies blood pH and promotes ideal blood calcium concentrations in transition cows. Use anion supplements, like MegAnion, as an opportunity to increase cow productivity rather than just a tool to prevent losses. ■

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Recent research conducted at the University of Minnesota assessed the impact of MegAnion on mineral and electrolyte status in periparturient multiparous cows.



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