

Mineral Nutrition on Commercial Dairy Farms in the United States

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As I have visited farms and reviewed diets in the Ukraine, two critical areas come to the surface. The first is a lack of protein nutrition. The second is a lack of mineral and vitamin nutrition. We have heard a rumor about United States dairy farms not supplementing any minerals and vitamins. Regardless of level of production, all cattle from calves through heifers, dry cows, and lactating cows are fed minerals and supplements. In many cases, our level of supplementation exceeds published requirement guidelines providing safety factor levels. If someone were to walk onto an American farm, they may see no bags of minerals. This is because most of our minerals are added to protein blends or complete feeds at feed mills. We may have bags of minerals for specific groups that get added to the diet on-farm. However, we try to avoid that as much as possible because any feed added to a TMR mixer must be added at a certain minimum level to ensure adequate mixing (typically at least 250 g per cow).

In the United States (and what we are doing in Ukraine), we are using the 2001 Nutrient Requirements of Dairy Cattle published by the National Academy Press in the United States. These requirements are based upon years of research from Europe, Canada, and the United States. Based upon these requirements, a cow producing 25 liters of milk would require the following:

Nutrient	Absorbed Requirement	Units
Calcium	53.3	g/d
Phosphorus	44.3	g/d
Magnesium	5.9	g/d
Potassium	175.0	g/d
Sulfur	36.5	g/d
Sodium	40.3	g/d
Chloride	44.8	g/d
Iron	458.0	mg/d
Zinc	138.0	mg/d
Copper	9.0	mg/d
Manganese	2.0	mg/d
Selenium	5.5	mg/d
Cobalt	2.0	mg/d
Iodine	9.2	mg/d
Vitamin A	67.4	KIU/d
Vitamin D	18.4	KIU/d
Vitamin E	490.0	IU/d

These values are for a specific level of production and stage of lactation. Additionally, these are the animals Net Requirements. When we formulate, the software we utilize includes absorption coeffi-

cients for each mineral within a feed. Thus, we can select ingredients that are the most cost effective for meeting requirements.

From a feeding standpoint, we start with the minerals that are available in the forages (maize silage, lucerne hay and silage, wheat straw, hays, etc.) coupled with those in concentrates (maize, barley, wheat, sunflower, etc.). Then we select mineral and vitamin supplements to finish balancing to meet requirements. Ingredients we will typically use include: limestone (calcium carbonate), calcium sulfate, magnesium sulfate, magnesium oxide, salt, sodium bicarbonate, and a trace mineral pack that includes zinc, manganese, copper, iodine, selenium and vitamins A, D, and E. Many farms will also include yeast products and other additives (e.g. biotin, niacin) in these mineral mixes depending upon farm needs and farm requests.

The question must become why do we add all these ingredients. All animals have basic requirements for minerals and vitamins. Minerals such as calcium are required for normal bone development and maintenance, energy metabolism, milk production, and other uses. Micro-minerals such as selenium are used for energy metabolism, muscle integrity, and improve the immune function of the animal. It has been clearly shown that selenium and vitamin E work together to prevent white muscle disease in young cattle as well as aid in preventing retained placenta, metritis, and reducing milk somatic cell counts. The following table lists some of the uses of each mineral and vitamin.

Nutrient	Some uses within the animal
Calcium	skeletal tissues, transmission of nerve impulses, muscle contractions, milk
Phosphorus	bones, energy metabolism, blood buffering, cell walls
Magnesium	co-factor for enzymes, nerve conduction, muscle function
Potassium	osmotic pressure, acid-base regulation, water balance, nerve impulse
Sulfur	primarily fed for rumen microbes--produce methionine, thiamin, biotin
Sodium	energy metabolism, acid-base balance, nerve impulses
Chloride	body anionic balance, carbon dioxide transport, protein digestion
Iron	red blood cells, enzymes
Zinc	enzymes for metabolism, prostaglandins, immunity
Copper	enzymes, red blood cells, connective tissue
Manganese	growth, bone formation, reproduction, anti-oxidants
Selenium	enzyme (anti-oxidants); primarily smooth muscles.
Cobalt	production of vit. B12 by rumen microbes. B12 used for energy metabolism
Iodine	thyroid hormone production for energy metabolism
Vitamin A	vision, growth, skeletal tissue, immunity
Vitamin D	calcium metabolism
Vitamin E	anti-oxidant, immunity, reproduction

Research has shown that overall animal performance and health can be improved via proper mineral and vitamin nutrition. Allow DNCS LLC specialists to review your current program and then follow our recommendations to take full advantage of advanced nutrition for dairy cattle.