Vitamins

Although present in varying levels in natural feedstuffs, the fat soluble vitamins (vitamins A, D, and E) are routinely supplemented in dairy diets.

Vitamin A

- Functions in the processes of the eye, epithelium lining of the reparatory, digestive and reproductive tracts and the bone matrix.
- Vitamin A does not exist in plants, but green forages have a very high content of carotene.
- Carotene is converted in vitamin A by enzymatic action in the small intestine of cattle.
- Approximately 1 mg of beta-carotene is converted to 400 International Units of vitamin A.
- Large doses of vitamin A may deplete vitamin E reserves and vice versa.
- Vitamin A is essential for optimum reproduction.
- Vitamin A deficiencies may increase the severity of mastitis in milking cows via immune dysfunction.
- Toxic doses in milking cows appear to be in the range of 1 million International Units per head daily.
- Lower doses may also be toxic if fed for extended periods of time.

Vitamin D

- Essential for normal calcium and phosphorus metabolism by promoting the absorption of this mineral from the intestine, regulates calcium excretion by the kidney and bone calcification.
- Usually supplemented as Vitamin D_3; the plan form is Vitamin D_2.
- Beware of a potential toxicity if high levels are fed on a continuous basis (>100,000 I.U. / day); may cause calcium deposits in soft tissues (heart muscle)

Vitamin E

- Plays a key role in normal immune function and antioxidation.
- Large doses of vitamin E may deplete vitamin A reserves and vice versa.
- High doses (>1,000 I.U.) prior to calving may reduce the incidence of retained placenta and mammary infections post-calving; the optimum dose is not well defined.
- Vitamin E and Selerium metabolism are interactive.
- Almost impossible to feed a toxic level.

Vitamin K (Menadione)

- Essential for normal blood clotting.
- Widely distributed in forages.
- Generally not supplemented in mature dairy cattle diets.
- Synthesized by the rumen and intestinal bacteria.
- Certain molds produce dicumarols which are antagonistic to vitamin K (sweet clover disease), and may require Vitamin K be supplemented.

Water-soluble vitamins (B-vitamins) are required by all animals, but are generally not supplemented on a routine basis for mature cattle. Rather B-vitamins are fed on a special need bases that typically includes calves, early lactation and stressed cattle. A contribution from feedstuffs and microbial synthesis is generally expected to meet the B-vitamin needs of cattle. There are exceptions however when supplementation of stressed or high production cows may be beneficial. For the purpose of this text only mature cattle will be discussed further.

Thiamine

- Thiaminase found in some plants, fish, etc. is an enzyme that can reduce the biological activity of thiamine.
- Clinical symptoms PEM (polio), a severe nervous disorder caused by a thiamine deficiency can occur in ruminants fed diets high in readily fermentable carbohydrates, or sulfur. This is most common when feeding significant amounts of corn gluten feed.

Riboflavin

- Generally not considered deficient in cattle diets.

Pantothenic Acid

- Generally not considered deficient in cattle diets.

Niacin (Vitamin B_3)

- Commonly supplemented in early lactation and prefresh cows at a rate of 6-12grams per head daily as an aid in reducing the incidence and severity of ketosis; several studies have shown an increase in milk production in cows supplemented with 6 grams niacin during early lactation.
- Recent evidence suggests that niacin may not be effective on cows fed supplemental fat in excess of 2-3 percent of the dry matter.

Pyridoxine (Vitamin B_6)

- Generally not considered deficient in cattle diets.

Folic Acid

- Rarely added to cattle rations.

Vitamin B_{12}

- Rumen synthesis of vitamin B_{12} cobalamin depends on an adequate level of cobalt in the diet.
- At times used as an injection or paste (high doses) to stimulate appetite in cows off-feed.

Biotin

- Used in Dairy diets for hoof health. Recent data suggests a milk production for response to the inclusion of biotin (20mg/ head/ day) in the diet of lactating cows.
- Important in controlling the rate of production and deposition of "hard" proteins such as keratin, a component of skin, hair, and horn.

Ascorbic Acid (Vitamin C)

- Rarely added to cattle rations.

Choline

- Usually classified as a B-vitamin, but does not truly fit the classification.
- Involved in the metabolism of fat and prevention of Ketosis.
- When used in dairy cattle diets, must be fed in the rumen-protected form.

Table 1. Suggested Levels of Fat Soluble Vitamin Fortification

	Vitamin A	Vitamin D	Vitamin E
Calves			
3-6 mo.	15,000 – 25,000	3,000 – 7,500	75-160
6-12 mo.	20,000 – 45,000	7,500 – 10,500	160-280
>12 mo.	45,000 – 55,000	10,500 – 15,000	280-400
Lactating Cows			
1st 1/3 of lact.	150,000 – 200,000	40,000 – 60,000	600-800
2nd 1/3 of lact.	125,000 – 155, 000	30,000 – 50,000	400 – 600
last 1/3 of lact.	100,000 – 125,000	25,000 – 35,000	400 – 600
Dry Cows			
Dry	75,000 – 100,000	25,000 – 30,000	600 – 1,000

Note: These levels are intended as guidelines.