

*Vitamin Panel Supplementary Comments:*  
**Aftermath: Global Vitamin Shortage: What did we learn in ruminants?**

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**Introduction**

In late 2017, several factors resulted in an unprecedented drop in global vitamin supply and subsequent rise in prices. This was coupled with outages in some specialty markets, such as certain vitamin forms for liquid feeds. In the case of vitamin A (retinyl acetate) and vitamin D3, prices reached 3 to 10 times greater than previous typical levels and local availabilities were widely affected. These price increases and shortages resulted in many discussions and strategies at all levels of the ruminant feeds supply chain.

Nutritionists and producers re-evaluated vitamin supplementation strategies, based on actual or perceived shortages and as an attempt to control input costs. Commonly asked questions included:

1. Why and how did this happen?
2. Are there alternatives to vitamins?
3. How low can we go, for how long, and which segments are most sensitive to vitamin levels?
4. If we reduce vitamin levels, what will happen?

Producers and nutritionists demonstrated notable creativity, resourcefulness, and strategic thinking, utilizing input from university researchers, re-interpretation of “old” data, and simply managing on the belief that green grass would grow quickly in early 2018.

**What Happened?**

Within weeks of one another, there were two major events that dramatically affected the vitamin supply and pricing (Figure 1). It is important to keep in mind that there are actually very few vitamin plants in the world and each plant only makes a handful of different vitamins.

- Beautiful China Policy: China is a major vitamin producer, and most industries have been affected by strict environmental quality policies. These policies came to a head in late 2017, resulting in total plant shutdowns of some major vitamins A and E producers in China, which affected global supply very quickly.
- BASF Declares Force Majeure: October 31, 2017 fire shuts down citral plant. Citral is an intermediate in both A and E manufacture, and BASF is a major player.

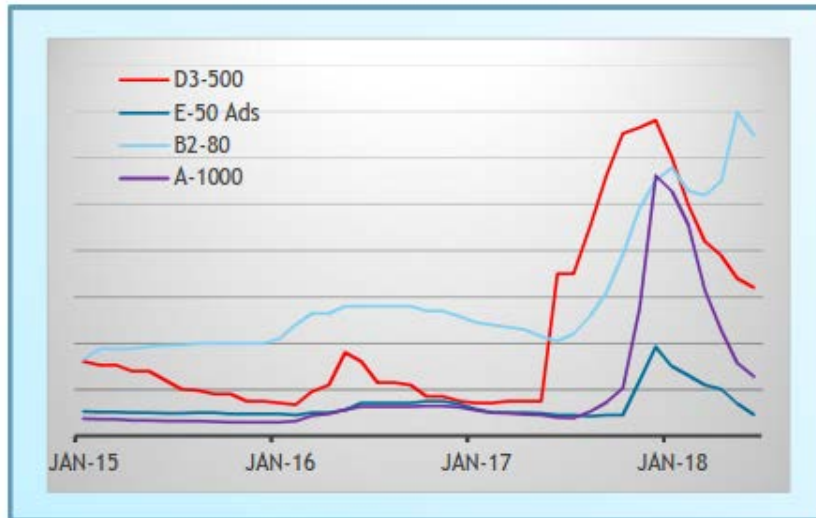


Figure 1 Source: Mark Engstrom

## Alternative strategies employed

Additional antioxidants and vitamin sparing. Because vitamins are understood by all to be essential micronutrients, the vast majority of our customers and producers expected that there would be no suitable alternatives for vitamins. That said, many nutritionists and producers looked for ways to stretch or “spare” vitamin resources, especially those vitamins with antioxidant roles. Strategies included improved trace mineral nutrition, inclusion of additional antioxidants, or substituting pro-vitamins compounds, such as beta-carotene. In ruminants the best alternative to supplemental vitamins is the forage supply.

Fresh forages. Forages can supply up to 40,000 IU of vitamin A activity per kg of dry matter in fresh pasture; unfortunately, that drops to near-zero levels following harvest, storage, ensiling, or winter stockpiling. Sunshine converts plant 7-dehydrocholesterol to D3 in the skin of unconfined animals. Fresh plant material can contribute to vitamin E supply but falls far short of being a major contributor.

Injectable vitamins. Injectable micronutrients have become more widespread for a variety of reasons, including shortages and greater promotion by suppliers. A popular injectable trace mineral source provides Zn, Mn, Se, and Cu in a 1 ml/200 lb dose. A 6-ml injection for a beef or dairy cow would provide 360 mg Zn and 30 mg Se, for example, at a cost to the producer of \$3 per head. Strategic use would be pre-fresh or at breeding time and, although the product provides no additional vitamins, producer perception is that antioxidant status and improved plane of nutrition are enough to prove beneficial. At \$3 per head, MU-Se provides 30 mg Se and 408 IU of vitamin E in an adult cow dose and is in widespread in pre-fresh animals. Although the costs of the additional micronutrients are quite high when compared with in-feed vitamin E and Se,

the perceived and psychological benefits of injecting needed micronutrients at the appropriate time, outweigh the expense in many producers' minds, especially during the last 6 months.

## **Anecdotal experience and recommendations with reduced vitamin levels**

### **Dairy**

With such an extreme supply event, when looking at supplementation strategies anecdotally, the motivation of the consultant or feed company is not always clear. In some cases, clear lack of supply or the threat of running out may have been the prime motivation for cutting levels. In other cases, reducing vitamin levels was purely economic. Unfortunately, dairy economics could not have had poorer timing relative to the vitamin cost run-up. For example, some producers simply directed consultants to keep mineral (base mix) costs the same as before (the run-up). In such cases, vitamins had to be radically reduced in the mineral supplements to comply.

Vitamin nutritional strategies varied somewhat by region. In the Southwest US (marginal milk economics), several dairy consultants greatly reduced vitamin A supplementation, eliminated or radically lowered D3 depending on sun exposure and maintained E levels as high as possible through the close-up phase. Several consultants recommended no supplemental micronutrients in dry cows for 40 days before the closeup period, or depended upon hay supply for whatever vitamins the cow received. As perhaps reported from the depth of the vitamin supply crisis (and just afterward), the most common behavior reported by feed manufacturers and consultants may have been that supplementation levels were generally cut in half with production classes and time coming into play here. We might argue that this was not particularly aggressive, considering the severity of the shortage and how that affected ration cost. Perhaps this is also the reason that there were few reports of health problems that could clearly be tied to vitamin deficiency.

In the Midwest, Dr. Bill Weiss, the leading university dairy vitamin expert related several strategies used by feed distributors:

1. "Greatly reduced" vitamin A supplementation from 2X NRC to 1X NRC levels: to 75,000 IU/hd/d for both lactating and dry cows. This would be near the bottom of an optimum vitamin nutrition (OVN) range.
2. No change in D3; usually fed within OVN optimum vitamin nutrition range
3. Vitamin E—strategic reductions in dry cows to 1000 IU/hd/d; 500 IU/hd/d for lactating cows. These correspond to the minimally acceptable OVN range.
4. Consultants and feed manufacturers were most reluctant to reduce E levels. This suggests the industry has a good understanding of key vitamin issues including research supporting health parameters and limited capacity for body storage.

## **Beef**

Not surprisingly, there was probably more evidence possible vitamin problems in the field with beef cattle. For example, a veterinarian in Montana cow/calf country contacted DSM, asking about weak/dying calves and vitamin A deficiency. Liver samples were sent to the diagnostic laboratory, and assays showed essentially zero vitamin A (retinol): liver levels were < 1 ppm (normally 1.5 to 4.5 ppm for that age). Forage base was poor, and vitamin supplementation came from “unimpressive” molasses block intake—a perfect storm for calf deficiencies in an early calving season where colostrum is the first/best source of vitamins for newborns, followed by (nonexistent) green pasture. The winter of 2017-2018 was exceptionally bitter in Alberta. Cow condition was very poor and calf losses were very high in some instances. In Western Canada, university extension personnel, in concert with DSM, provided vitamin education for beef cow/calf producers, and recommended strategically dividing their herds into less and more susceptible segments. A number of feed manufacturers did reduce vitamin levels in mineral supplements and other beef products. The Canadian Feed Inspection Agency relaxed requirements for levels of vitamin A and E in registered feeds until at least September of this year. Even with this latitude, most manufacturers apparently did not reduce these vitamins down to the permissible 50% reduction compared with their registered formula.

In the U.S., a few companies substantially reduced A and E levels in some product lines. Interestingly, economics of reducing vitamin levels did not appear to be effective in increasing sales, that is, when products were clearly marked as having sub-optimal levels of vitamins.

## **What do we do now?**

As prices and supply return to levels before the fourth quarter of last year, most consultants and manufacturers in the ruminant segments have already begun to re-evaluate any temporary reductions in vitamin levels; vitamin A in particular. Were there widespread deficiencies? Clinical symptoms could include: poor calf health, higher abortion rates, higher retained placenta incidence, increased infectious disease—these are non-specific and tough to evaluate in a short-term market disruption, and ruminants have unique resources (forage supply and several month’s liver storage of retinol) to manage short term deficiencies., except in beef calves born on poor-quality pasture. Our experience was that consultants/producers were most afraid of E deficiencies (changed these levels the least) and least afraid of reducing/removing biotin (not associated with a deficiency; seen as discretionary).