Comments on CFIA's July 2018 proposal

Maximum Nutrient Values in Horse Feeds

Submitted by the Animal Nutrition Association of Canada

August 24, 2018

The following comments are submitted by the Animal Nutrition Association of Canada (ANAC) and were developed with a team of Canadian equine nutrition experts from ANAC's nutrition committee. As we considered the recommendations on proposed maximum nutrient levels, we were mindful of the scope as outlined by CFIA in the proposal:

- to determine those nutrient levels that may impact the health and safety of livestock, humans, and environment;
- to determine those nutrient levels that support a nutritional purpose as opposed to a therapeutic purpose; and,
- to determine those nutrient levels that may produce residues in the resulting food that could be harmful to those consuming the products.

ANAC is the national trade association of the livestock and poultry feed industry in Canada. Our 160 members include feed and ingredient manufacturers and distributors, as well as suppliers of a wide range of good and services to the feed industry. Taken together, ANAC's membership represents 90 percent of commercial feed manufactured in Canada.

ANAC and our industry team of equine nutrition experts look forward to discussing our comments with CFIA.

GENERAL COMMENTS

ANAC supports the replacement of Table 4 values with scientifically-supported maximum nutrient values based on the impact to the health and safety of livestock, humans, and the environment.

ANAC and its members recognize that the limits being proposed are intended as maximum levels and do not represent target levels for an optimal diet. The elimination of customer formula feeds in the modernized regulations increases the importance of having levels which accommodate the numerous factors considered during the formulation and manufacture of feed. With that in mind, maximum nutrient levels should be flexible enough to accommodate new developments in the science of animal nutrition that may impact feeding strategies as well as the seasonal and regional variability in nutrient values of agricultural commodities available for use in feed. This flexibility is especially important for horses due to the wide range in nutritional needs between breeds.

For most horses, forages comprise >95% of the total diet; thus, forages can pose a challenge to meeting some of the maximum levels proposed, especially where there is limited data (e.g. selenium) or where nutrient levels are inherently high or variable (e.g. potassium). Because manufactured feed only represents a very minor component of the diet, for some nutrients, typical feeding practices even in the absence of manufactured feed in the regime, would result in maximum nutrient levels in total diet being regularly surpassed; thus, making the levels not practically achievable. As such, enforcing total dietary limits will be difficult, particularly with regards to nutrients such as cobalt, iodine and selenium where data is not readily available and analytical testing would place an impractical and undue burden on industry because of the costs and time delays of such tests. To enable industry to comply with the new regulations, transparency will be imperative with regards to the forage values being used by CFIA inspectors. To this end, ANAC has convened a committee of animal nutrition experts from across the country to develop reference values for forages that account for regional variability in Canada.

Additionally, ANAC urges CFIA to consider bioavailability of different forms of nutrients when setting the final limits. In the case of iron for example, residual iron oxide is commonly found in soil and other minerals and is not readily absorbed by animals; while iron sulfate is the form with greater impact on animal nutrition. Typical lab analyses would not distinguish between the two forms; however, this could have a significant impact on the formulated diet. In cases such as these, ANAC is recommending higher proposed maximum levels.

Below please find our comments on specific nutrient levels proposed as well as our rationale for the levels we recommend.

For horses, ANAC supports the proposed levels of phosphorus, magnesium, sodium, sulfur, copper, and vitamins A, D, and E.

CALCIUM (Ca)

CFIA is proposing a maximum of 2% calcium in the total diets for all horses. Due to the considerations below, ANAC proposes a maximum of 3% calcium for all horses.

Calcium has been fed in excess of requirements without negative effects, provided adequate phosphorus is available (Jordan et al. 1975). A ratio of calcium to phosphorous between 1:1 and 8:1 (NRC 2005, Lewis 1995) is considered safe for horses. Due to different absorption sites, excess calcium has negligible effect on phosphorus absorption (Schryver et al. 1974). When it comes to calcium absorption, horses are unique compared to other mammals in that they exhibit “increased serum Ca2+ concentrations, low mean serum calcidiol and vitamin D concentrations and high intestinal Ca2+ absorption and urinary extrusions” (Sprekeler et al. 2001). Because calcium is not absorbed from the large intestine (Perez et al. 2008, Schryver et al. 1970), adequate levels need to be fed to facilitate adequate absorption in the small intestine (Stadermann et al. 1992).

In the case of the insulin sensitive equine, feeding recommendations typically suggest alfalfa-based forage to reduce the starch and sugar content of the diet. Alfalfa forages can contain over 3% calcium; Equi-analytical reported the upper range of Ca in legume hays as 3.936% (accumulated Crop Years:

5/1/2000 - 4/30/2016). High calcium legume forages have not been demonstrated to be the cause of excess calcium related issues in the horse (Lewis 1995).

NRC 2007 reported more instances of antagonistic factors to calcium absorption than scenarios of calcinosis. The presence of dietary oxalates will greatly reduce the efficiency of calcium absorption (up to 66%, Swartzmann et al. 1978). Additionally, other factors such as dietary phosphorus, magnesium, and phytates reduce calcium absorption in horses (NRC 2007). Plants that have been documented to increase calcium absorption are rare and found in Florida and Australia (NRC 2007). Non- dietary factors, such as activity level, can influence calcium deposition into bone, thus affect calcium requirements (Stephens et al. 2001).

Based on samples submitted to the Cumberland Forage Lab, calcium levels in forage in Canada can reach as high as 2.19%. As forage makes up the bulk of the equine diet, a higher calcium maximum level is needed to ensure sufficient flexibility to meet the regulation during normal feeding practices.

<u>POTASSIUM (K)</u>

CFIA is proposing a maximum of 3% in the total diets for all horses. ANAC proposes that the maximum for potassium in horses be set at 5% due to elevated levels found in common forages combined with the high improbability of potassium toxicity.

Forage is one of the most important ingredients in the equine diet and, in some cases, can make up to 100 percent of a horse's diet. Many forage values reported by Cumberland Forage Lab have tested as high as 4.53%, which is significantly more than the 3% maximum proposed by CFIA. Sourcing good quality hay is often an issue depending on the season and harvest. It simply may not be possible to source forage below the 3% maximum proposed, which would require either not feeding hay (generally not feasible and inadvisable) or reducing the amount fed and providing supplementation. Either case may not be practical depending on the breed of horse, body condition and workload. It is also not in the best interest of horses from a health, welfare and management perspective.

<u>TRACE MINERAL COMMENTS</u>

There are concerns that the proposed levels of trace minerals are too restrictive. Kavazis et al (2002) concluded that a "… horse's homeostatic system maintains the serum concentration of trace minerals within very narrow levels. Because no adverse effects were observed, supplementation may serve as insurance against deficiencies, especially during periods when the forage intake might be low in these nutrients." Additionally, studies have found evidence that trace mineral supplementation in mares and foals can play a role in skeletal development. Mare's milk is relatively low in copper and zinc and does not meet the requirements of developing nursing foals. Trace mineral supplementation is critical in the last few months of pregnancy as fetal stores of iron, zinc, copper and manganese in the liver are used in the first few months after the foal is born (Meyer and Ahlswede, 1976). Van Weeren et al (2003) examined the copper status of foals at birth through radiographic signs of OCD (osteochondritis dissecans) in warmblood foals genetically prone to OCD and reviewed again at 5 and 11 months of age and found high liver copper was associated with improvements in the severity of OCD changes. Copper and zinc supplementation of mares has been associated with a significant reduction in the radiographic physitis scores of foals at 150 days of age. Pearce at al (1998) suggested that oral supplementation of the mare was more important than either supplementation of the foal or copper administration by injection to the mare in late pregnancy, which did not influence foal copper status.

Further, there should be consideration for the bioavailability of trace minerals. While some trace minerals may appear to be high in the diet, their bioavailability is low, impacting the horses' ability to meet their nutrient requirements.

<u>COBALT (Co)</u>

CFIA is proposing a reduction of maximum cobalt levels to 1 mg/kg of diet dry matter, which is too restrictive. ANAC requests that the limit remains at 10 mg/kg of complete feed (added), which is the current level in Table 4 and well within the maximum tolerable level (MTL) for cattle, sheep, chicks, and rats of 25 mg/kg DM and the swine MTL of 100 mg/kg DM (NRC, 2005). As no robust dataset for the cobalt content of feedstuffs (i.e. forages and grains) exists, it is difficult to regulate on a total diet basis. Since the proposed maximum nutrient levels are to be incorporated by reference, ANAC suggests regulating Co on an added basis until sufficient data is collected. At that time, the maximum levels can be changed to total diet Co levels.

The maximum value proposed appears to be consistent with the European Food Safety Authority (EFSA) decision regarding the possibility of cobalt II ion posing a health concern for feed mill personnel. However, there is no data to show reducing cobalt levels in feed to such a restricted level improves human health considerations. Furthermore, Workplace Hazardous Materials Information System (WHMIS) regulations address the handling, training and communication of chemical hazards in relation to worker safety. The WHMIS regulations also control other more concentrated and more hazardous chemicals used in the feed industry.

Although cobalt is restricted in horse racing due to possible performance-enhancing effects (not feed safety), this argument would not be relevant for horses destined for human consumption.

Finally, in the US there is no upper limit on the amount of cobalt that can be used in feed. Certain chelated mineral packs containing high cobalt levels and showing beneficial effects are currently used in Canada and the US; however, Canadian usage would be restricted or potentially eliminated with CFIA's proposed levels.

<u>IODINE (I)</u>

CFIA is proposing maximum iodine levels of 3 mg/kg of total diet DM for pregnant and lactating mares and 4 mg/kg of total diet DM for all other classes of horses. The lower maximum level for pregnant and lactating mares is not warranted. While levels of 48-423 mg of iodine per day fed to pregnant mares can cause increased incidence of goiter and leg weakness in their foals (NRC 2005), practical instances of iodine toxicity are typically limited to excessive seaweed supplementation; seaweed can be 30–4921 mg/kg (Yeh et al 2014). Reduced iodine levels for lactating dairy cattle, sheep, and goats are due to human consumption of those milk products. Since the consumption of mare's milk is not typically practised in North America, there is no reason for a more restrictive iodine level for lactating mares. As such, we request that the maximum iodine level remain at 10 mg/kg of total diet DM on an "added" basis for all classes of horses.

As analytical quantification of iodine is prohibitively expensive, finding typical values in databases is very difficult if even available, which makes compliance to a “total” basis challenging, especially considering that horses have such a high forage diet as well as variable access to iodine-containing salt blocks. ANAC thus recommends that the values proposed by CFIA be considered on an “as added” basis.

With the removal of the current Table 4, maximum levels should be based on evidence of a risk to the environment, food safety or animal safety. To date, we are not aware of any issues involving safety with the current levels of iodine that have been fed. There must be flexibility built in for diets that contain ingredients high in goitrogens that interfere with iodine and the synthesis of thyroid hormones (NRC, 2001). Dietary iodine levels need to be increased when goitrogens are present.

<u>IRON (Fe)</u>

CFIA is proposing a shift from a maximum level of 500 mg/kg of complete feed to 500 mg/kg of total diet DM for all classes of horses. ANAC proposes that CFIA match the EU level of 750 mg/kg of total diet DM.

As previously mentioned, different forms of iron such as iron oxide and iron sulfate have different rates of absorption which nutritionists account for in the formulation phase. Flexibility is needed in the final numbers to account for differences in bioavailability and residual iron found in raw materials such as minerals and water.

Forages in Canada can meet or exceed CFIA’s proposed level, with Cumberland Forage Lab reporting iron maximums of 1385 mg/kg in certain forages.

<u>MANGANESE (Mn)</u>

CFIA proposes to lower the maximum level of manganese for all levels of horses to 150 mg/kg of total diet DM from the current 400 mg/kg in complete feed. ANAC proposes a lesser reduction, to 300 mg/kg of total diet DM which allows flexibility but is still well within the MTL of 1000 mg/kg (Lewis 1995). There is very little potential for Mn toxicity in livestock; animals have been fed twice the MTL with no ill effects (NRC 2005, Watson et al. 1973, Wong-Valle et al. 1989). There are no known instances of Mn toxicity in horses (Schryver 1990).

Human health risk is mainly by inhalation (Levy and Nassetta 2003), although excessive amounts in drinking water can also lead to negative health affects (Kondakis et al. 1988). Manganese consumed in excess of animal requirement is excreted almost exclusively in the feces (NRC 2007), which has not been documented to be a source of environmental contamination. Citing worker, rather than consumer, safety as a reason for this decrease is a duplication of efforts under the Workplace Hazardous Materials Information System (WHMIS), that cover the Canadian workplace. WHMIS regulations address the handling, training and communication of chemical hazards in relation to worker safety. The WHMIS regulations also control other more concentrated and more hazardous chemicals used in the feed industry.

<u>SELENIUM (Se)</u>

CFIA is proposing a maximum of 1.0 (total) mg/kg of total diet DM. ANAC finds the proposed level too restrictive and proposes a maximum of 1.0 (added) mg/kg of total diet DM, which is well below the MTL of 5.0 mg/kg of diet dry matter (NRC 2005).

As analytical quantification of selenium is prohibitively expensive, finding typical values in databases is very difficult if even available, which makes compliance to a “total” basis challenging, especially considering that horses have such a high forage diet. ANAC thus recommends that the values proposed by CFIA be considered on an “as added” basis. As there is insufficient data on selenium levels in forages and given the work currently being undertaken on typical nutrient levels in Canadian forages across different regions, it would be premature to set a maximum on a total basis.

Levels of selenium in forage are highly variable and a level of 1.0 (total) mg/kg of total diet DM would not provide the necessary flexibility for producers, given the high proportion of forage in the equine diet. Data by Cumberland reports maximums as high as 4.51 mg/kg in certain forages.

CFIA cites a Health Canada report on selenium transfer to meat/eggs as justification for the more restrictive level. The percentage of horses in Canada whose meat will be consumed by humans is extremely small and does not warrant the negative impact to producers and owners of horses for other uses which will result from an inability to secure adequate forage that meets the regulations.

ZINC (Zn)

CFIA proposes reducing the maximum for zinc for all classes of horses to 150 mg/kg of total diet DM. For the reasons below, ANAC proposes a maximum of 500 mg/kg of total diet DM, which is equal to the current level and the MTL for horses (NRC, 2005). At a minimum, a separate class of pregnant and lactating mares should be created and given a maximum level of 500 mg/kg of total diet DM.

Studies have found evidence that trace mineral supplementation in mares and foals can play a role in skeletal development. Mare’s milk is relatively low in copper and zinc and does not meet the requirement of developing nursing foals. Trace mineral supplementation is critical in the last few months of pregnancy because of fetal stores of iron, zinc, copper and manganese in the liver can be used in the first few months after the foal is born (Meyer and Ahlswede, 1976). Van Weeren et al (2003) examined the copper status of foals at birth through radiographic signs of OCD (osteochondritis dissecans) in warm blood foals genetically prone to OCD and reviewed again at 5 and 11 months of age and found high liver copper was associated with improvements in the severity of OCD changes. Copper and zinc supplementation of mares has been associated with a significant reduction in the radiographic physitis scores of foals at 150 days of age. Pearce at al (1998) suggested that oral supplementation of the mare was more important than either supplementation of the foal or copper administration by injection to the mare in late pregnancy, which did not influence foal copper status.

Kavazis et al (2002) concluded that a “…horses homeostatic system maintains the serum concentration of trace minerals within very narrow levels. Because no adverse effects were observed, supplementation may serve as insurance against deficiencies, especially during periods when the forage intake might be low in these nutrients.”

Samples summarized in the Equi-analytical data base of forage analysis for legume and grass hays for about 15 years is copied below and is summarized in this table. The table on the next page illustrates how highly variable these values can be.

Legume Hay zinc	Samples	49,380
	Average	26.979 mg/kg
	Range	0-885.204 mg/kg
	Standard deviation	858.225
Grass Hay zinc	Samples	42,937
	Average	31.214 mg/kg
	Range	0-1159.588 mg/kg
	Standard deviation	1128.374 mg/kg

The NRC recommends at least 40 mg/kg diet dry matter. Based on the average forage zinc levels in the Equi-analytical North American data base, legume and grass hays will not meet the NRC minimum while the range of sample analysis is far in excess of the proposed 150 mg/kg diet zinc limit. Concern about excess zinc could limit supplementation of trace minerals required to meet levels know to reduce the incidence of DOD (developmental orthopedic disease) in growing foals where mare supplementation is the effective means of raising foal liver trace mineral status. A proposed diet maximum needs to take normal diet ingredients into account particularly in the case of zinc where forage concentrations are extremely variable.

Beyond nutritional considerations, the EU on July 20, 2016 lowered the zinc maximum to 180 mg/kg for calves (from 200 mg/kg) and 120 mg/kg (from 150 mg/kg) for all other classes in an effort to reduce zinc excretion in the environment. This reduction is expected to reduce zinc excretion by 20% (EFSA, 2014). However, there is no supporting data at this time to substantiate the effectiveness of this decision.