VITAMIN B2 IN ORGANIC POULTRY NUTRITION

an update…

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Vitamin B2 (Riboflavin) is an essential molecule needed in endogenous processes of all vertebrates including all livestock and poultry species. Deficiency of this vitamin may lead to reduced feed intake, low performance, dermatitis and skin lesions, retarded embryonic development, retarded growth and nervous disorders like leg paralysis and curled toes in poultry (FEFANA, 2014).

Chicks for the riboflavin experiment

These symptoms can be observed in practice, for example, when no riboflavin is added to poultry diets. Riboflavin originates from microorganisms such as bacteria and yeasts. Therefore, ruminants are less challenged by riboflavin deficiency, because it is usually produced in their forestomach by rumen microbes.

MONOGASTRICS AND RIBOFLAVIN

For poultry and pigs, riboflavin is usually added to their diets along with other vitamins and minerals, also in organic feed productions. The source for riboflavin additives is industrial fermentation with bacteria or yeasts, and these are nowadays commonly genetically modified. The use of GMO, however, is prohibited in organic livestock production at any level of the food chain (EC, 2007). Thus, special non-GMO fermentations are needed to produce riboflavin for organic livestock. For years, such products were imported to Europe from one producer in China. In summer 2018, with short notice, the Chinese producer stopped delivery, and since then we have witnessed a shortage of adequate riboflavin for animal feeds in European organic agriculture.

In this situation, two issues required urgent attention. First, a new source for GMO-free riboflavin has to be developed as quickly as possible. Second, assuming that a European GMO-free riboflavin product would be more expensive than the previous one from China, the requirement definitions for various animal categories have to be reassessed under organic conditions in order to discover where reductions of riboflavin supplements are possible without risk for animal health and productivity.
Anticipating the upcoming shortage, a cooperation project including an organic yeast producer, the Research Institute of Organic Agriculture (FiBL) and the German Ministry of Agriculture was already established with the aim of producing a GMO-free yeast, overproducing riboflavin, that could be scaled up to commercial production within a year. First proof of equivalence of this product has been recently published (Lambertz et al., 2020). Now, a granulate of this product is on the market (Ecovit R, Agrano, Riegel, Germany), and for sale in Switzerland, where it is regularly added to organic feeds, with success. A running experiment with the granulate at FiBL Switzerland did not reveal any problems with parent hens, breeding eggs and hatchling, when supplemented at 4.0 mg/kg feed (preliminary evaluation; data not yet published).

For the European Union, the Standing Committee on Plants, Animals, Food and Feed of the European Commission is currently discussing the approval of Ecovit R as a feed (which would imply immediate availability in the market) or as a feed additive, requiring a longer approval process. Until a decision is taken, the responsibility remains with each individual member state, to provide temporary approval. In countries, which do not approve this product, the only legal way is prescription of GMO-based riboflavin by the veterinarian in order to maintain animal health.

RELACS IMPROVING INPUTS FOR ORGANIC FARMING

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Within the EU-Horizon 2020-project RELACS (www.relacs-project.eu), the development of a second GMO-free riboflavin product is one of the targets. This shall avoid further shortages in future and allow an open market situation for riboflavin. However, such a development from the scratch may take more than a couple of years to succeed.

The aim to reassess the riboflavin requirement definitions for organic poultry is also envisaged by the RELACS project. In a series of experiments, we are trying to define lower critical thresholds of supplementation, above which animal health, welfare and productivity should be safe without any impairment. The rationale, why we consider such an assessment is necessary, is the general lack of recent experimental data. As an example: the experimental evidence for riboflavin requirements in poultry in the tables of the National Research Council of the US (NRC, 1994) dates from 1938 and 1947. Meanwhile, genotypes, feeding concepts and performance levels have dramatically changed, which is reflected by the feed producers in high safety margins for the supply calculations. Moreover, organic poultry production has developed its own path in ways with respect to genotypes, husbandry and feeding.

The currently recommended (FEFANA, 2014) and usually applied levels of riboflavin addition to feeds are roughly 6 mg/kg feed for layers, 8 mg/kg for chicken broilers, 15 mg/kg for parent hens, and 10 mg/kg for swine. Detailed recommendations can be found in FEFANA (2014, pp. 98-99, freely available, see below). The same levels are used for animals in organic systems, in Germany and the UK, as indicated by interviews with industries. By contrast, in Swiss organic regulations (Biosuisse, 2020), riboflavin supplementation is restricted at a rather low 4 mg/kg feed.

We conducted an experiment with layers (Lohmann Brown Classic) where we tested feeds supplied with different levels of vitamin B2 (RELACS, 2019). This resulted in a measured total concentration (including the native riboflavin from the feed components) of 5.0, 4.5, and 3.0 mg/kg. With these concentrations, all hens performed well during the whole course of the experiment, which lasted until their 43rd week of life. Performance was on a very high level (above 95% laying performance), and the animals grew even too fast. The only sign of vitamin B2 deficiency we found, was reduced riboflavin concentrations in egg yolk and livers (some animals were

Parent hens from the experiment that were supplied the new riboflavin product

slaughtered for analysis) of the lowest treatment. From our experiment, we conclude a supplementation level of above 3.0 mg/kg to be safe for laying hens. Based on preliminary data evaluation of a running experiment, we expect that the supplementation level of 4 mg/kg is safe for parent hens. For broilers (Lambertz et al., 2020), even a diet without any supplementation did not cause a difference to the supplementation level 9.6 mg/kg. However, we would not recommend to omit riboflavin additives for growing chicken. At the current moment, we conclude that adding 40% less than the FEFANA recommendations is safe for organic poultry, and this could make an economic difference. An important aspect are the native riboflavin contents in feedstuff. They can be increased with silages (Witten and Aulrich, 2019), due to the fermentation process, but also germinated grains may contain more vitamin B2. Last but not least, the intake of roughages triggers fermentative digestion, also in the caecum of birds, and this will contribute to all B-vitamins as well. Diversity in feeding and outdoor pasturing is thus a practice with multiple benefits, starting from animal wellbeing and ending in additional riboflavin supply, which may make the difference between organic and conventional systems.

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