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Feeding nitrate on De Marke

Not only is nitrate a valuable fertilizer, it can also be used as a feed additive to reduce methane emission from ruminants. For a climate neutral dairy sector, it can be an important means to attain this objective. That is why De Marke has investigated in a pilot study whether feeding nitrate fits in the management of the dairy farm and whether there are risks as to animal health. It has also been investigated what the effect of this extra nitrogen source is on the N-cycle of the farm. If reduction in methane emission involves more losses from the N-cycle (nitrate leaching, emission of ammonia and nitrous oxide), then the remedy may be worse than the disease.

Reducing greenhouse gas emission

Reducing greenhouse gas emission on the dairy farm is important. Many parties in the dairy sector recognize this factor and have therefore signed the covenant 'Clean and economical agro-sectors'. The covenant includes a greenhouse gas reduction of 30% compared to the reference year 1990. But it is more than the agreed emission reduction; it also touches the image of the dairy sector. Society asks for ever-continuing efforts from producers to reduce the environmental impact, also from dairy producers. Recent results of the project Cows & Opportunities show that the Dutch dairy sector must be able to realize a 20-30% reduction of the greenhouse gas emissions through efficient management, which means that the intended 30% is not obtained. Therefore, additional measures are necessary, which comes down to manure management. Examples are airtight storage of fresh manure, cooling manure storage, manure fermention or use of nitrification inhibitors on the land. An additional measure as to feed management is the use of feed additives.

Feed additives and greenhouse gas emissions

Many additives are known to reduce methane emission from the intestines of ruminants. One well-known product is Monensin, which is not allowed any longer for use in animal feed. A worldwide study into allowed methane reducing additives in animal feed showed that in a little more than a hundred additives, only three are capable of reducing methane emission permanently. These were nitrate, sulphate and possibly linseed oil. The other products had a temporary effect, because the rumen flora was able to adapt within 2 to 3 weeks. These products are only interesting when the additives are constantly changed, so that the rumen flora has no chance of adapting itself. This requires precise management and is only interesting when, for example, the feed supplier can provide a solution.

Form of nitrate

Of course, artificial fertilizers cannot be added to the ration just like that, due to the great risks of undesirable other substances. Fertilizer producer Yara from Norway has set up a special animal feed line for the production of nitrate that is suitable as feed additive for ruminants. The firm is currently trying to get this production line under GMP. As soon as this has been arranged, the product can be marketed under the name Bolifar CNF (Calcium Nitrate Feed). De Marke has been allowed to test the product by courtesy of Cargill.

Animal health risks

Feeding nitrate can cause problems with the oxygen-binding capacity of blood. One measure for this is the amount of methemoglobin in the blood. With methamoglobin values higher than approximately 40%, acute health problems may occur (seriously ill). Values higher than approximately 20% can lead to clinical symptoms (discoloured mucous membranes) and reduced production. Contents higher than 20% are for that matter a reason for stopping feeding nitrate. Older dairy farmers know the risks of high nitrate contents in the feed due to large fertilizer N doses on grassland from the 1980s.

The experiment in a nutshell

The pilot study of De Marke was not aimed at the efficacy of nitrate as methane reducing additive. That efficacy has conclusively been proven in scientific research (*Dietary strategies to reduce methane emissions from ruminants*, S. van Zijderveld, 2011, PhD-thesis Wageningen UR). This research has shown that, for example, for an approximately 10% reduction in methane emission from the rumen, approximately 200 grams of nitrate/animal/day is necessary. This is approximately 1% in the dry matter of the ration for an average dairy cow. The experiment on De Marke aimed at the practical applicability of adding 1% of nitrate to the dry matter of the dairy cattle ration. The focus was on the effect on animal health, milk production and the effect of the extra N supply through nitrate on the N balance of the farm, including the effect on the nitrous oxide emission, ammonia emission, nitrate leaching to groundwater and on the obligatory manure removal.
For an adequate effect of the product and to be able to feed it safely, a steady administering is necessary. Mixed feeding (with the roughage) and administering at the feeding rack is the most obvious method. This proved to be well feasible; the distribution in the mix was adequate and did not lead to higher blood values for methemoglobin in the animals. Other ways of administering nitrate to dairy cattle have not been investigated, but are likely to be feasible as well.

Practical usability

Nitrate is a nitrogen-rich additive. Extra nitrogen in the feed eventually means undesired extra N losses (for example ammonia emission) or extra manure removal due to higher N contents in the manure. The practical challenge is therefore to decrease methane emission by means of nitrate and yet realize an adequate BEX/BEA. In other words, if nitrate is fed, also some protein should be taken out of the ration. The roughage package is not a source of N supply, but feed purchases are. That is why De Marke has looked for protein limitation in the (concentrate) feed addition. The concentrates for dairy cattle contained technical urea; in the experimental period this has been kept out. Because of insufficiently cutting down on N, also less soya was fed. This made it possible to keep the nitrogen intake at the same low level as before the experiment. This adjustment did not result in a different milk production. Price-wise, feeding nitrate did not seem to have advantages or disadvantages. For a wide application in practice the form in which nitrate is administered is still a point of attention. Blending it with, for example, a protein kernel, which is then fed in a mixed ration seems to be a good possibility. The conclusion is that 10% less methane emission from the livestock through feeding 1% of nitrate in the dry matter of the ration is well feasible under De Marke's conditions. Feeding 1% of nitrate does not have any influence on milk production and animal health.

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Please read more on KTC De Marke: www.projectdemarke.nl and the project 'Cows & Opportunities': www.koeienenkansen.nl