THE NITROGEN PROBLEM IS NOT AS BLACK AND WHITE AS IT SEEMS

Less nitrogen is very doable

This autumn, Dutch farmers protested en masse against their government's nitrogen policy. But they are also collaborating on research aimed at cutting nitrogen emissions. That is no easy task for pig farmers, but on dairy farms a reduction of 'at least 20 per cent' seems very doable.

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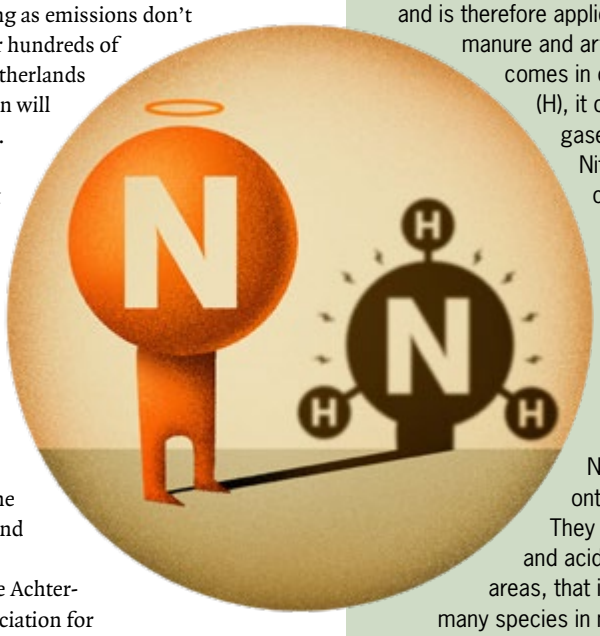
On several occasions over the past few months, hundreds of Dutch farmers drove their tractors to the seat of government in The Hague and those of Provincial Councils around the country to protest against the government's nitrogen policy. Measures had been announced for protecting nature areas better against damaging nitrogen deposition (see inset). As the biggest producer of nitrogen in the country, the agriculture sector needed to change the most. And something had to be done fast, because as long as emissions don't go down, planning permission for hundreds of barns, houses and roads in the Netherlands is on hold because the construction will generate extra nitrogen emissions.

At the same time, many hundreds of dairy farmers in the Achterhoek region in the east of the country, the Groene Hart in the west and the province of Overijssel have been testing measures for reducing nitrogen loss on their farms. The farmers' organization LTO supports the protesting farmers as well as the research into lowering nitrogen emissions around nature areas. The nitrogen problem is not as black and white as it seems.

More than 300 dairy farmers in the Achterhoek have joined forces in an association for promoting circular agriculture, *Vruchtbaar Kringloop Achterhoek* (Fertile Cycle Achterhoek). They have been working for years on a voluntary basis to limit nitrogen loss on their farms using the *Kringloopwijzer*, a system for measuring the mineral cycle on a farm that was developed with input from the Wageningen research farm De Marke. Farmers can use the *Kringloopwijzer* to register how much nitrogen comes onto the farm in the form of artificial fertilizer and livestock feed, how much they use on the farm, and what quantity of minerals disappears into surface water and the atmosphere. De Marke, where the mineral cycle has been the subject of study since 1990, then makes recommendations on the measures with which the farmer can reduce nitrogen loss.



SURPRISINGLY POSITIVE

Dairy farmers in the Groene Hart are working on reducing their nitrogen losses too. For the past year, in

WHY IS NITROGEN A PROBLEM?

There is nothing problematic about the element nitrogen (N). It is in the air we breathe all the time, in the form of N_2. It is nitrogen compounds such as NH_3 and NO_x that cause problems, and that we refer to in common parlance when we talk about 'nitrogen'.

Nitrogen is the main nutrient for plant growth, and is therefore applied to farmland in manure and artificial fertilizer. When it comes in contact with hydrogen (H), it can be converted into gaseous ammonia (NH_3). Nitrogen (N) can also be converted into nitrogen oxides (NO_x) during combustion with oxygen. Traffic and industry are largely responsible for this process.

The nitrogen compounds NH_3 and NO_x fall out of the air onto the soil (deposition). They increase nutrient density and acidify the soil. In nature areas, that is problematic because many species in nature need low nutrient densities or an alkaline soil. As a result, species disappear and that has an impact on populations of birds and other fauna. European member states are obliged by the Birds and Habitats Directives to conserve and improve nature in certain areas.

Farmers succeeded in cutting ammonia emissions by 20 per cent'

the Veenweiden Innovation Centre in Zegveld, 10 dairy farmers have been working with researchers on measures for cutting nitrogen losses. Hundreds more farmers are following the results with interest. 'They are surprisingly positive,' says researcher Gerard Migchels of Wageningen Livestock Research. 'With simple measures such as spreading manure that has first been watered down – preferably choosing times when there is little wind and low temperatures – the farmers succeeded in cutting ammonia emissions by at least 20 per cent.'
'They could cut the emissions by another 10 to 15 per cent by using less protein-rich feed and putting cows out to pasture more,' says Migchels. Less protein-rich feed lowers the amount of nitrogen the cows ingest, and therefore also the amount they excrete. Moreover, the harmful ammonia is only formed when the cattle's faeces and urine get mixed, as they do in old barns and slurry pits. There is much less mingling out in the field. Migchels thinks a combination of measures can deliver a reduction in ammonia emissions of 35 to 40 per cent. Comparable results came out of Wageningen applied research done between 2011 and 2015 among farmers close to nature areas in Overijssel.

COLLECTIVE AGREEMENTS

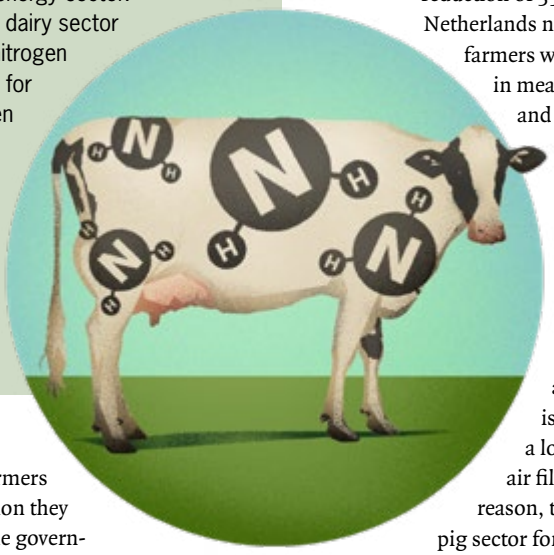
While ammonia emissions went down on the research farms, not much changed at other dairy farms in the Netherlands. True enough, the government had drawn up collective agreements on ammonia reduction with the agriculture sector, but these had not been converted into objectives for individual farms. One consequence of this was that when the European milk quotas ended in 2015, dairy farmers started building new cowsheds without incorporating the available innovations for cutting ammonia emissions.
'The Wageningen tests were not used as the basis for directives for the dairy industry,' notes Migchels, 'but it's not too late to do so.' He expects that farmers will use the *Kringloopwijzer* to improve how they close the mineral cycle on their farms. Affordable ammonia sensors, currently under development, keep the farmer informed about where nitrogen losses are taking place.
With the *Kringloopwijzer* and these sensors, farmers can show the government how they are performing in terms of nitrogen. Livestock farms that emit little nitrogen or that reduce their emissions fast should be rewarded, Migchels suggests, with exemptions from regulations or financial compensation. He talks of 'yellow services', echoing the 'green services' recognized for nature conservation. >

WHY HAS THE NITROGEN PROBLEM SUDDENLY COME OUT OF NOWHERE IN THE NETHERLANDS?

There has been a nitrogen problem in the Netherlands since about 1980, when the country was affected by what was called 'acid rain'. Besides sulphur dioxide (SO_2), that rain consisted of nitrogen oxides (NO_x) and ammonia (NH_3). Government policy since then has focused on trying to reduce these emissions. Emissions of NO_x and NH_3 have been halved since that time, but emissions of ammonia have gone down by little or nothing since 2010. In spite of the reduction in nitrogen, too much nitrogen still gets deposited on about 75 per cent of nature areas in the Netherlands.
The Integrated Approach to Nitrogen (PAS) of 2015 was intended to further reduce nitrogen emissions so as not to endanger the building of roads, industrial infrastructure and new livestock sheds. But in May this year, the Council of State ruled that the PAS was not adequate. This was because the government was allowing new nitrogen emissions from construction, for example, on the strength of some of the planned (but not yet actually realized) reduction in emissions. The European Court, and following in its footsteps the Dutch Council of State, did not accept this approach.

WHERE DOES ALL THAT NITROGEN COME FROM?

Agriculture produces about 45 per cent of the nitrogen that is deposited on nature areas in the Netherlands, while about 35 per cent of the nitrogen comes in on the wind from neighbouring countries. Dutch road traffic accounts for about 6 per cent, as do Dutch households. The rest comes from air traffic, shipping, industry, construction and the energy sector. Within agriculture, the dairy sector is by far the biggest nitrogen producer, responsible for twice as much nitrogen as the pig sector. And the Netherlands produces more nitrogen than is deposited in the country; most of it blows on the wind to other countries.



Such an approach puts farmers at the helm. Which direction they should steer in, is up to the government to decide. It is impossible to achieve the 'critical deposition values' (see inset) in all the nature areas in the country, says the Wageningen nitrogen professor Wim de Vries. Even just the nitrogen that blows in on the wind from neighbouring countries (one third of the nitrogen deposition in the Netherlands) is too much for some kinds of nature. But by halving domestic nitrogen emissions, the deposition in the majority of the nature areas will be reduced to below the critical values. De Vries thinks it would be sensible for all the sources of the nitrogen problem in the Netherlands – including industry, traffic and shipping – to halve their emissions so that they all make a proportional contribution. 'If you want to achieve that halving by, say, 2030, you are talking about an emissions reduction of five per cent per year.'

The dairy sector could achieve a lot in the first few years with Migchels' fast, cheap solutions, but they will not suffice in the long run. Migchels' farmers achieve a reduction of 35 to 40 per cent at most, while the Netherlands needs a reduction of 50 per cent. Dairy farmers will therefore still ultimately have to invest in measures such as separate storage of manure and urine or improved barn floors, from which manure can be removed fast and separately from the urine. If that is not possible or does not make enough difference, the livestock population might have to be reduced.

> 'The tests were not used as the basis for directives'

SERIOUS INVESTMENTS

The dairy industry currently emits twice as much ammonia as the pig sector. That is because pig farmers have already invested a lot in emissions-cutting measures such as air filters and manure management. 'For that reason, there are now fewer possibilities in the pig sector for cutting ammonia emissions fast and cheaply,' says researcher André Aarnink of Wageningen Livestock Research.

'Half the pigs in the Netherlands are in sheds fitted withan air filter,' says Aarnink. Most of these sheds were built since 2007. The chemical air filters capture as much as 90 to 95 per cent of the ammonia, more than the 85 per cent stipulated by the provincial government in its nature conservation legislation.

Most of the older pigsheds don't have air filters, because those sheds lack a central outlet for the air in the ventilation system. These pig farmers have two options: closing this shed, and perhaps building a new one, or taking steps to prevent ammonia emissions in the first place.

SLATTED FLOORS

methane and odour emissions at source. 'By using a combination of measures, farmers can just about manage a reduction of 85 per cent,' estimates Aarnink. The pig farmers would have to invest in slatted floors

that allow the manure through better and create a smaller manure surface from which ammonia can be released. 'That way they can reduce the barn floor emissions by about two thirds.' But most of the emissions by far come from the slurry pit. These can be reduced by watering down the manure, acidifying it or separating it into faeces and urine in the shed using manure belts and scrapers. The faster the manure is then brought to a closed container or a digester, the better.

'These measures cost money. At the most, 30 per cent of the pigsheds without air filters can be adapted at an acceptable price with measures targeting the source,' thinks Aarnink. 'For the rest of the sheds, it is probably cheaper to build a new one. There are no free options for pig farmers,' says the researcher. In the dairy industry, farmers can water down their manure – a cheap measure – and spread it on the land. Most pig farmers don't have any land. So watering down the manure would be a cost in pig farming, because the farmer then has to sell more manure on the already saturated manure market.

INCENTIVES

So one quarter of the pigsheds in the country – all older sheds – emit too much ammonia, and these farmers cannot afford the measures to reduce their emissions significantly. These farms may qualify for financial incentives to close down. The ministry of Agriculture, Nature and Food Quality has already allocated 200 million euros to this in order to protect the health of people living near the pig farms.

Closing these farms would also mean less livestock in the country. According to researcher Edo Gies of Wageningen Economic Research, that reduction could best be achieved in buffer zones around nature areas designated by the government. Intensive farms in these zones would be closed down, and only extensive farming would be allowed there.

It remains to be seen whether this becomes policy. Next year, the Remkes Commission will submit its 'structural measures' for cutting back nitrogen emissions in the long term. ■

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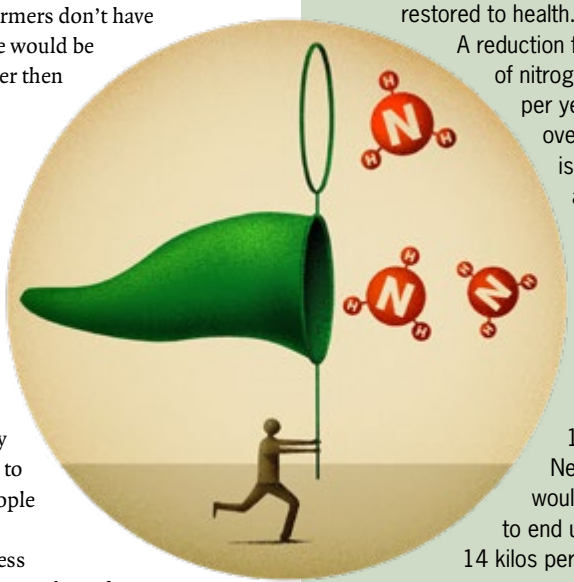
'There are no free options for pig farmers'



HOW MUCH DOES NITROGEN DEPOSITION NEED TO GO DOWN?

According to the Integrated Approach to Nitrogen (PAS), nitrogen deposition on nature areas needs to go down to what it has defined as the critical load for nitrogen deposition. This load varies with the type of nature concerned. A peat bog can cope with less nitrogen than a forest on sandy soil. For most types of nature, the critical load is between 10 and 20 kilos of annual nitrogen deposition per hectare. The average deposition of nitrogen per hectare in the Netherlands is 21 kilos. If this was cut to an average deposition of 14 kilos of nitrogen, most of the nature in the country would be restored to health.

A reduction from 21 to 14 kilos of nitrogen per hectare per year does not seem overambitious. But it is in fact extremely ambitious, because more than one third of the deposition is caused abroad. The Netherlands cannot do anything about those eight kilos. The remaining 13 kilos which the Netherlands causes itself would have to be halved to end up with a deposition of 14 kilos per hectare.