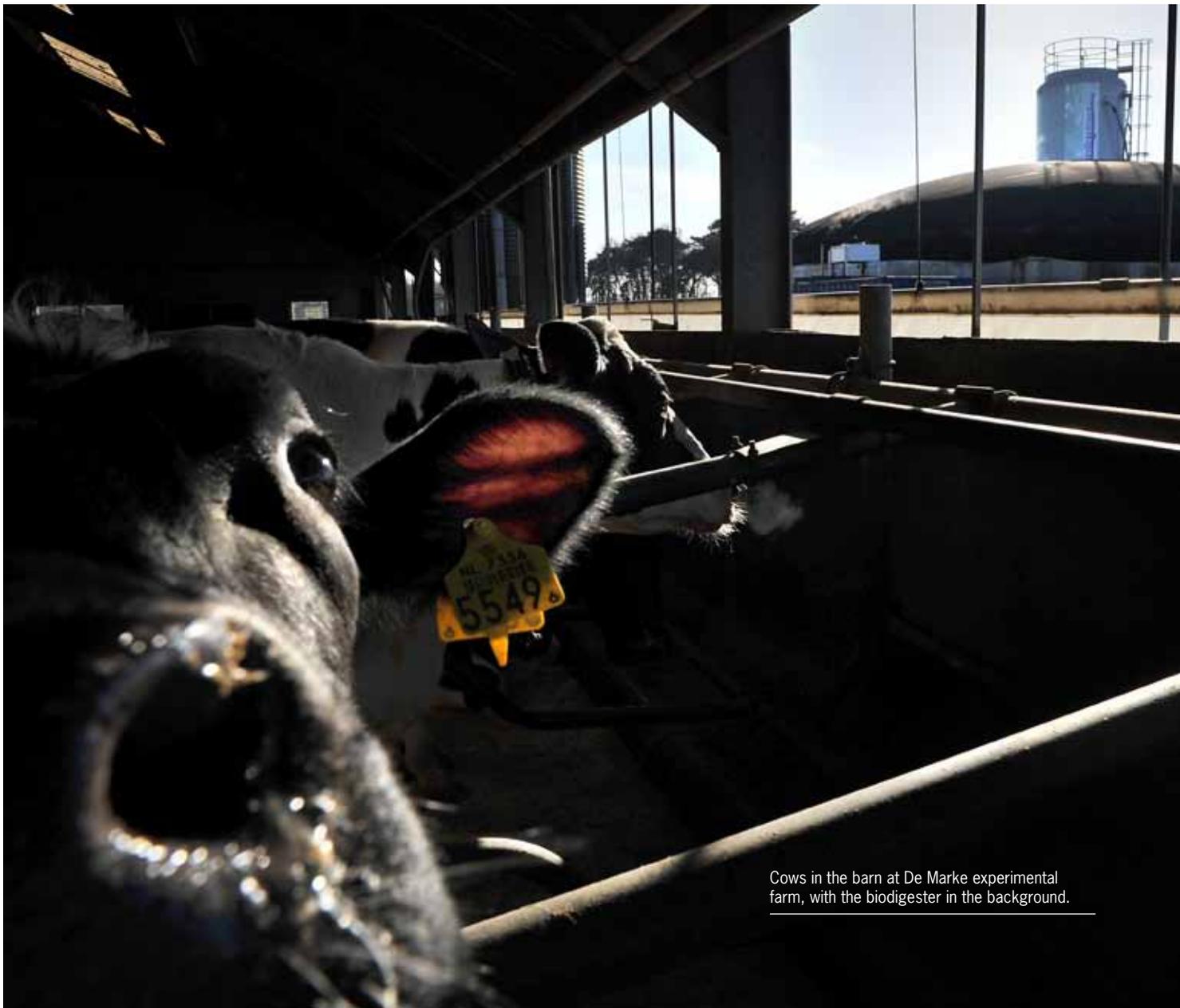


# Hold on to those

**Research results from De Marke experimental farm show that dairy farms could reduce surpluses of nitrogen and phosphate in manure and the environment considerably. That is good for the environment and for the farmer's wallet. 'The key is to get more feed from your own land.'**

TEXT MARION DE BOO PHOTOGRAPHY MARCEL VAN DEN BERGH ILLUSTRATION JENNY VAN DRIEL



Cows in the barn at De Marke experimental farm, with the biodigester in the background.

# minerals

**T**hey raise their black and brown-and-white heads in curiosity as the visitors approach. The cows at De Marke, the experimental farm in the small Gelderland town of Hengelo, are lined up along the feed fences eating the roughage. Some of them have wandered to the back to chew the cud calmly on the two rows of beds. One cow gets a back massage from a rotating brush. Three more of the animals are waiting hopefully at the automatic concentrates dispenser. 'The feed computer recognizes them from their collars,' explains researcher Koos Verloop from Wageningen UR. 'The dosage system knows exactly how much milk each cow is producing and how much concentrate it needs.' He inspects the gleaming cows with a look of approval. 'They are in good condition. Not too fat and not too thin. It was only when we had children ourselves and my wife was breastfeeding that I realized what huge amounts of energy it takes to produce milk. The cows have to perform well, but they must not become overfed, because that's a waste of money and results in surpluses of nitrogen and phosphate in manure and the environment.'

## MILK QUOTA

The milk quota system will end in 2015, which will lead to more intensive milk production. That will make proper mineral management even more important. 'Every kilo of nitrogen that disappears into the environment is lost grass,' argues Zwiervan der Vegte, the farm manager at De Marke. 'The trick is to create a closed mineral cycle. We are getting better at this thanks to a whole range of extra measures.'

Making optimum use of manure and minerals reduces dairy farming's ecological footprint. The newest acquisition in this effort is the biorefinery plant. It converts raw manure into a 'digestate', from which pure minerals are extracted that can then be used as fertilizer on the same farm. The advantage of using biorefining to process the manure on your own farm is that it avoids the need for expensive, energy-guzzling transportation on public roads in trucks full of watery manure where the dry matter content is only about nine or ten percent.

De Marke has also taken many other measures to avoid mineral losses, such as the use of low-emission stall floors that cause less ammonia to evaporate, good quality manure storage, fewer calves on the farm and the optimization of milk production. In addition, more concentrates are grown on the experimental farm itself—

such as maize cob silage in which the entire cob and stalk are processed, not just the kernels. Italian ryegrass is grown between the rows of maize as a 'catch crop' to prevent the leaching of minerals after the maize harvest. After the winter, the ryegrass is ploughed in to help increase the organic content of the soil.

Furthermore, the cows are regularly moved from one field to another to make sure they keep the grass short and do not trample very long grass, and to prevent too many urine spots accumulating. 'Frequent rotation in grazing is easiest to arrange on farms with conveniently positioned plots,' says Verloop. He bends over to pick up a handful of roughage, rubs it between his fingers and sniffs at it. 'They find this really tasty: tender and not too tough.'

## PUTTING IT INTO PRACTICE

In the Cows & Opportunities (Koeien & Kansen) project, De Marke is collaborating with 16 innovative dairy farms spread across the Netherlands, to put the research results into practice. A closed cycle tool (KringloopWijzer) for good mineral management was developed as part of the project and is now already being used by five to six hundred farmers. The closed cycle tool shows a farmer the mineral balance sheet for his own farm.

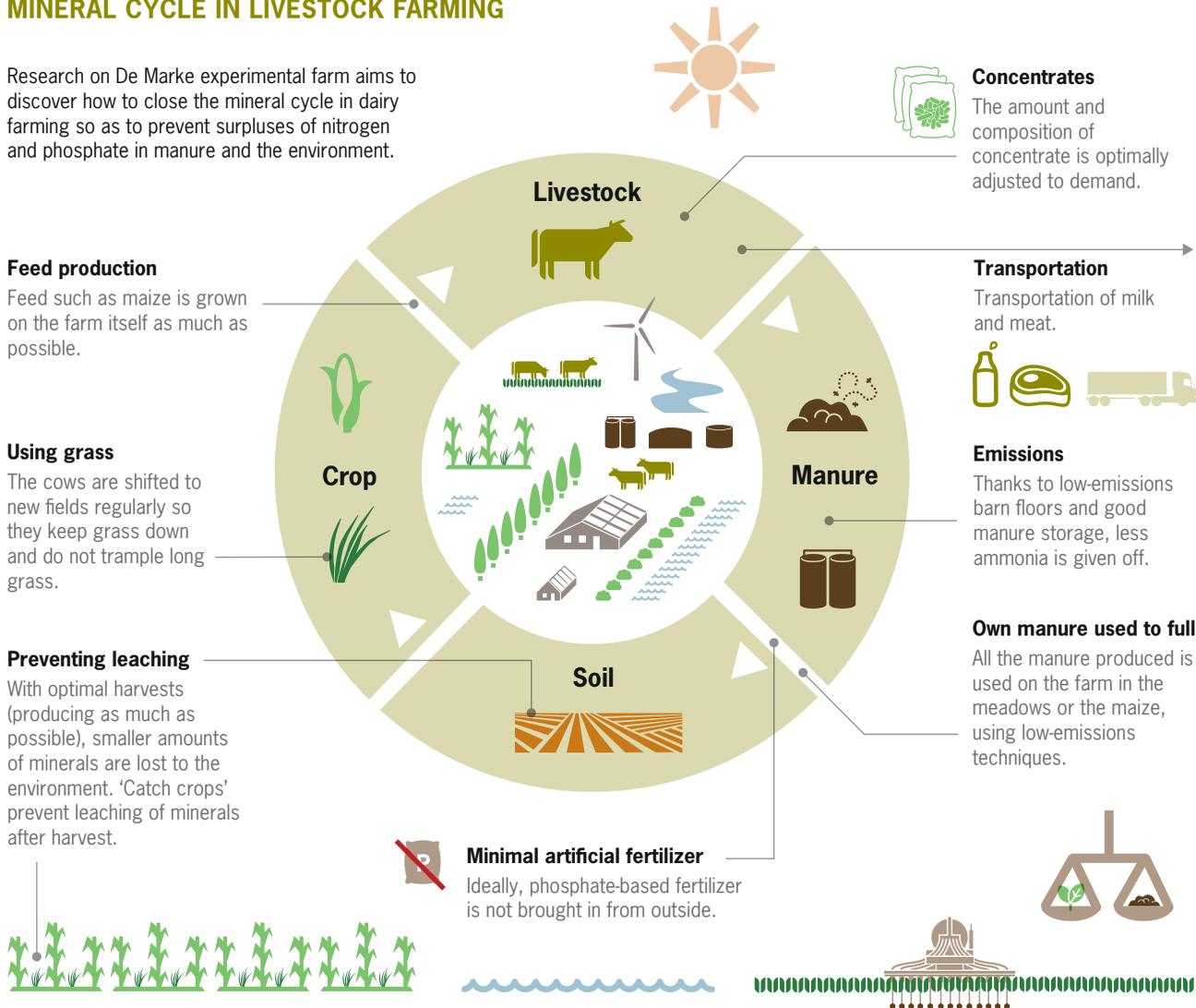
The research results are also communicated to dairy farmers through open days and study groups. Van der Vegte: 'Once the milk quota is abolished, dairy farmers who are able to achieve high production levels per hectare on their land will also be allowed to use more fertilizer. That encourages entrepreneurship. Someone who is able to produce more feed with the same minerals rather than buying in extra feed will be able to produce milk at a much lower cost. That business model has real potential.' 'We know from experience that ordinary farmers rapidly adopt three-quarters of the measures we take here and implement them on their own farms,' says Jouke Oenema of Wageningen UR. 'As far as environmentally friendly farming is concerned, there is less and less of a gap between the experimental farm and actual practice.' The closed cycle tool will probably be introduced nationwide in 2015 for all dairy farmers with a phosphate surplus on their farm.

In November 2013, Verloop and Oenema got PhDs for their research results in the Cows & Opportunities project. Verloop examined where exactly the leaks are in the closed cycle for nutrients and how you can prevent those leaks. In the 1980s and 1990s, only about 14 per cent >



## MINERAL CYCLE IN LIVESTOCK FARMING

Research on De Marke experimental farm aims to discover how to close the mineral cycle in dairy farming so as to prevent surpluses of nitrogen and phosphate in manure and the environment.



## NITROGEN AND PHOSPHORUS EFFICIENCY

On livestock farms about 15 years ago, only 20% of the nitrogen (N) in manure and feed was used on the land, and 45% of the phosphorus (P). The rest disappeared into the environment. Meanwhile,

efficiency levels have risen across the country. Innovative farmers get better results with extra measures and supervision, and come close to the results obtained at De Marke experimental farm.



		Nitrogen (N)		Phosphorus (P)	
		Leached into environment	use on land	Leached into environment	use on land
<b>1998</b>	Average Netherlands	80%	20%	55%	45%
<b>2014</b>	Average Netherlands	70%	30%	40%	60%
	Innovation in companies	62%	38%	15%	85%
	De Marke	55%	45%	0%	100%

## ‘The trick is to create a closed mineral cycle’

### DE MARKE

De Marke was established in 1992 as an Experimental Farm for Dairy Farming and the Environment. These days, it calls itself Knowledge Transfer Centre (KTC) De Marke. It has 81 dairy cows plus 6 to 10 calves. The farm has 55 hectares of light sandy soil: 11 hectares is permanent grassland and 44 hectares is for crop rotation, alternating between the cultivation of maize and of grass and clover. Little to no artificial fertilizer is used and all the slurry produced is used on the farm by applying it to the sods on grassland or using band application for maize. The farm is in the heart of the Achterhoek region, in a sparsely populated area of woodland, fields, hedge banks and ponds. The farm also has 1.2 hectares of nature boundaries with a path running alongside.

of the nitrogen from manure and animal feed was being used. The rest disappeared into the environment in the form of nitrate and ammonia — about 484 kilos per hectare every year. That affects the water quality and makes nature areas wilder due to the excess fertilizer in the environment.

Oenema analysed the results for the 16 innovative dairy farms and concludes that the model farms achieved some very good results, in part thanks to the intensive assistance they were given. ‘They are making much better use of the animal manure on their own farm. They are hardly buying in any phosphate fertilizer anymore. On top of that, they are making much better use of the animal feed and they are more critical in their purchases, paying close attention to the composition.’

### LONG DISCUSSIONS

That is good for the environment and for the farmer’s wallet. Between 1998 and 2011, the efficiency of nitrogen utilization on the 16 model farms rose from about 30 per cent to 38 per cent. De Marke itself achieves 45 per cent. Nationally, nitrogen utilization efficiency on an average dairy farm increased from 20 to 30 per cent in the same period. The utilization rate for phosphorus on the Cows & Opportunities farms went up from 45 per cent in 1998 to 85 per cent in 2011. De Marke even achieves a rate of 100 per cent in good years. Phosphorus utilization efficiency increased nationally too in that period, from 45 to 60 per cent.

Oenema: ‘If you tell farmers they won’t need phosphate fertilizer any more, they sometimes give you a really strange look because they’ve been doing that all their lives. But you convince them when you show them the figures. And that includes the older farmers. Some remember the days when their own father didn’t use much phosphate fertilizer either. They’ve also often had long discussions with a son or daughter about the benefits of being economical with minerals. The key is that you need to get more feed from your own land. There is still

plenty of room for improvement here. And if you can cut down the loss of minerals in your farming practices, you can use up more of the manure on your own land, which saves you lots of money.’

Van der Vegte: ‘The interesting thing is that everything is interrelated. Changes in the fertilization of grass or maize have an immediate effect on the feed quality. Farmers can still make big improvements here. You want to get the feed just right, without scrimping at the expense of the cows and their milk production. The grass still needs to be tasty and nutritious. The cow needs to be able to digest the feed quickly and get enough energy out of it.’

The role of the experimental farm is to test the limits. Van der Vegte: ‘Twenty years ago, farmers were giving their grassland such an excess of manure that the grass had pretty much turned toxic for the cows: it contained far too much protein. If the cows were allowed to eat unlimited amounts, it made them sick.’ Partly thanks to the Cows & Chances project, farmers now have a pretty good idea of what cows need and what the best approach to feeding them is. But according to Van der Vegte, there is still a lot of room for improvement in terms of soil fertility and the application of fertilizer. ‘All farmers basically give their grassland the same fertilizer treatment, based on the rules in current manure legislation. But the same dosage of fertilizer could give one farmer six tons of dry matter in grass per hectare while another could achieve a yield of fourteen tons or more.’ It depends partly on the soil type, but management certainly also plays a role, says Van der Vegte. ‘It’s a question of carrying out measurements to get information: what’s the quality of my soil, what crop do I want to grow, what’s the composition of the manure from my cows, how much artificial fertilizer do I need to add? A farmer who gets a low yield is polluting the environment unnecessarily while a farmer who gets a really high yield is impoverishing the soil and therefore not in fact getting the most out of his valuable land either.’ ■

[www.wageningenur.nl/en/demarke](http://www.wageningenur.nl/en/demarke)