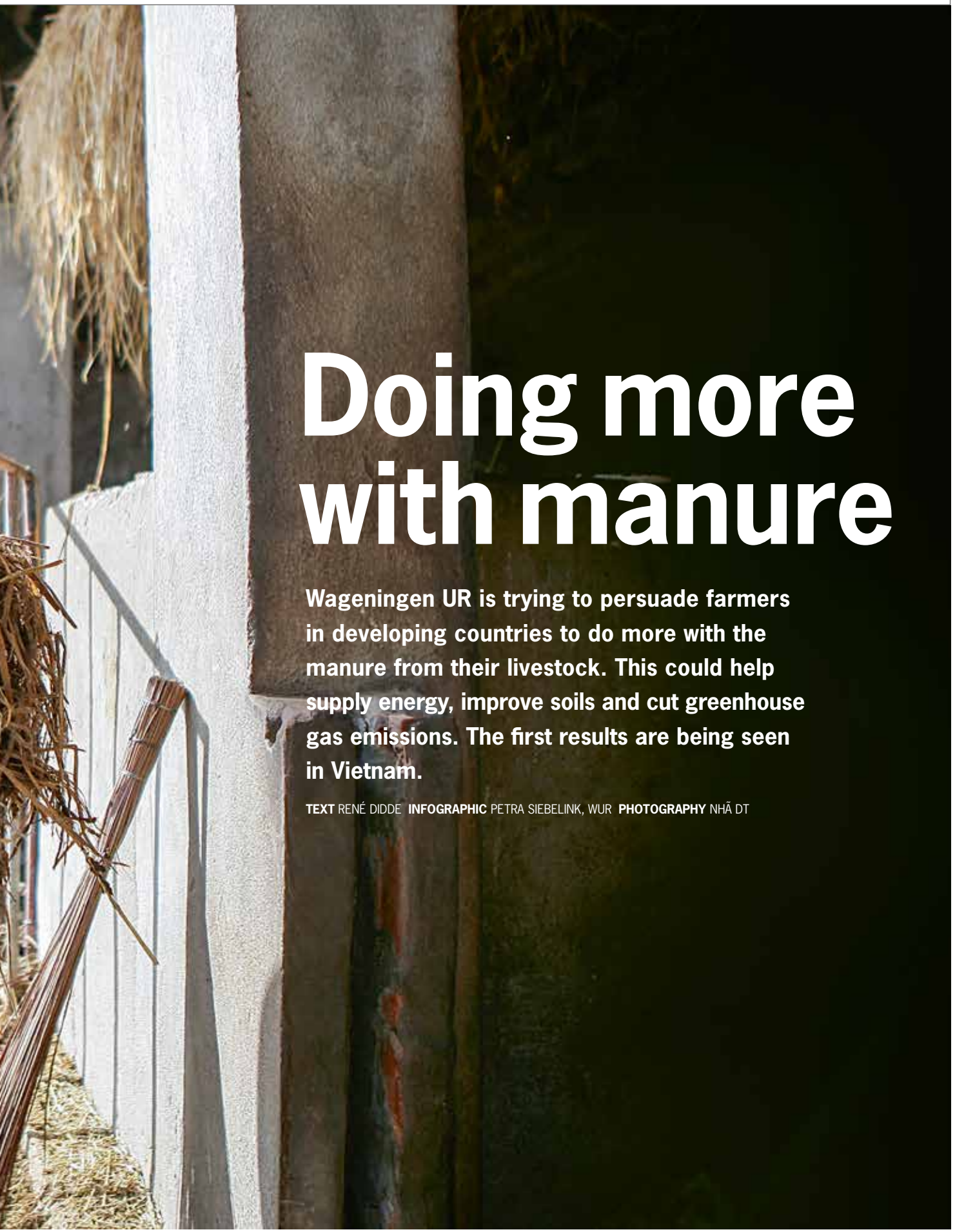


Doing more with manure

Wageningen UR is trying to persuade farmers in developing countries to do more with the manure from their livestock. This could help supply energy, improve soils and cut greenhouse gas emissions. The first results are being seen in Vietnam.

TEXT RENÉ DIDDE **INFOGRAPHIC** PETRA SIEBELINK, WUR **PHOTOGRAPHY** NHÃ DT

There are 150,000 biogas installations in Vietnam. Not in large factories or businesses but on ordinary people's farms. 'This means 750,000 people are already cooking on gas they generate themselves using the manure from their livestock,' says Steven von Eije, sustainable energy advisor in Dutch development organization SNV World.

There are many advantages to biogas. For Vietnamese women it is a much safer and healthier cooking fuel than wood, and saves them a lot of time spent collecting firewood. This leaves the local vegetation more intact as well. And biogas installations are by no means complicated high-tech stoves, Von Eije assures me.

'The anaerobic digestion takes place in an almost completely underground, airtight stone dome connected to the barn by a wide plastic pipe. Farmers rinse the manure into the pipe with water.' The gas gets to the cooking stove through a small PVC pipe, or through a hosepipe if it has further to go. Behind the digester is a tank in which the digested manure is collected. Fresh supplies of manure push the slurry effluent out of the tank. And that slurry, also known as digestate, is full of nutrients such as nitrogen, phosphate and even potassium. The composition is not always optimal but for many crops on many different soils the bio-slurry makes an excellent fertilizer. And that is precisely the point SNV World wants to make, with the help of knowledge and expertise from Wageningen UR Livestock Research. 'We want to contribute to the development of a circular economy in which there are hardly any waste products and all the resources are kept in circulation,' says Von Eije.


PHOTO KARIN ANDEWEG


PHOTO SNV

Vietnamese farmers spread wet manure from the biodigester on their fields in various ways.

THIRTY MILLION FARMERS

There is still some way to go, however. Only 40 percent of the farmers in Vietnam who have a biogas installation are currently using this organic manure on their land, shows a study by Wageningen UR. 'And if you consider that only 2.5 of the 30 million farmers in Vietnam have a digester, there is still a long way to go,' says Theun Vellinga, a researcher at Wageningen UR Livestock Research. 'We get the impression that the farmers who do not have a digester make slightly better use of their farmyard manure: 60 percent of them put it on their fields. Apparently the farmers with a digester think the material left in the digester is exhausted.'

Vellinga and researcher Karin Andeweg are following the development of this Livestock and Manure Management project (LMM) closely. 'By showing what you can do with the digestate, you can bring about a change of mindset among the farmers,' says Andeweg.

SNV World and Wageningen UR Livestock aim to achieve this by offering a lot of training in the coming years. In a four-day 'training-of trainers' course this autumn, 100 trainers are being equipped to teach Vietnamese farmers about the valuable contents of the digested matter. 'The idea is that each of these trainers will demonstrate the advantages of this organic fertilizer to two groups of 20 farmers on an appealing model farm in their region,' says Steven von Eije. 'Preferably with examples of bigger, healthier vegetables as solid evidence of its value as fertilizer.' The training of these 4000 farmers will take place in five different provinces in Vietnam, three in the north and two in the south.

Through this project Wageningen UR transfers knowledge about anaerobic >

SAVING ON ARTIFICIAL FERTILIZER

In Vietnam this autumn, 100 SNV and Wageningen UR trainers are being trained so they can show farmers how valuable this spent manure from the biodigester can be on the farm. Nguyen Thi Thao is one of the Vietnamese farmers who followed the practical course at the beginning of November. Nguyen and her family, from Hai Phuc in Thanh Hoa province, 150 kilometres south of the capital Hanoi, have been putting the dung from their livestock into a digester for five years. 'At the training course I learned that the bio-slurry left after digestion can be used as fertilizer,' she says. Until recently Nguyen Thi Thao got low yields. 'Now I know I can spread the slurry on my maize and other crops. That way I save 30 to 50 percent on fertilizer.'

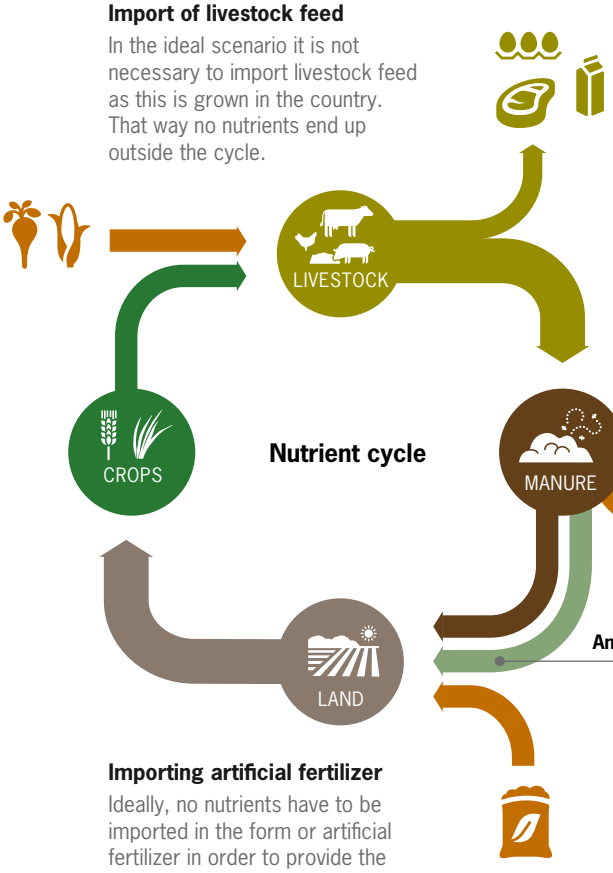
THE PERFECT MANURE CYCLE

In practice the nutrient cycle is not often closed. About three quarters of the nutrients consumed by livestock end up in the manure. If that manure is not made good use of, valuable nutrients are lost and artificial fertilizer has to be used to grow crops.

Spreading the manure on the land and in the biodigester also increases the energy supply and the condition of the soil, as well as reducing greenhouse gas emissions.

Import of livestock feed

In the ideal scenario it is not necessary to import livestock feed as this is grown in the country. That way no nutrients end up outside the cycle.



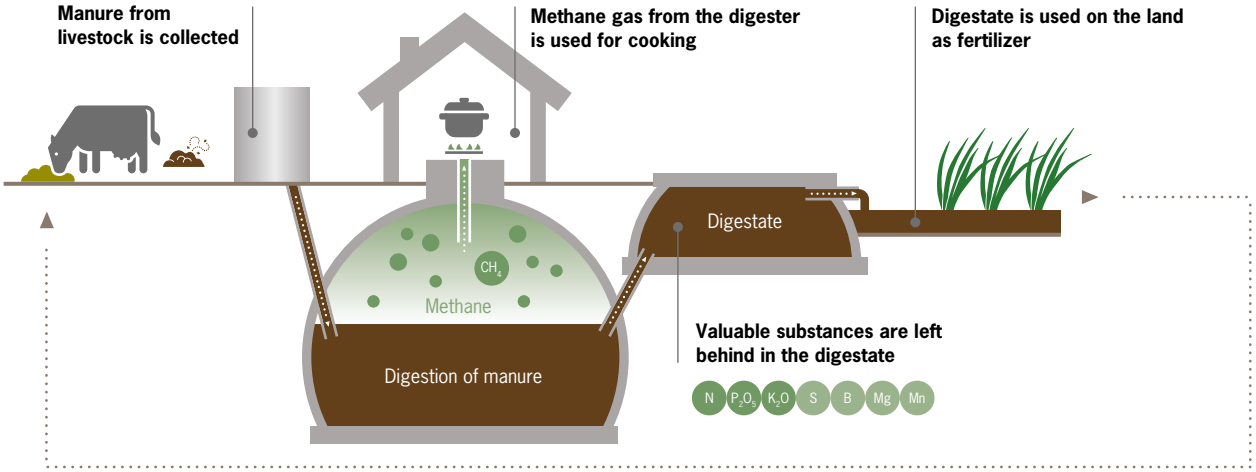
Emissions

Ideally, all the manure is used and no minerals go to waste.

In many developing countries, about 50% of the manure goes unused. This lead to greenhouse gas emissions, groundwater pollution, offensive odours and health risks.

Importing artificial fertilizer

Ideally, no nutrients have to be imported in the form or artificial fertilizer in order to provide the crops with sufficient nutrients.



digestion in general and the use of manure in the soil. 'For knowledge in the field we collaborate with organizations such as SNV, which have good contacts with local government bodies and the like,' says Vellinga. 'It is not just that by making better use of the manure, farmers in Vietnam contribute to improving the rural energy supply and the condition of the soil. They are also helping the country get on track for tempering emissions of strong greenhouse gases such as methane,' says Vellinga. 'Making and using biogas also makes for much better air quality in their homes than when they cook on wood or dung cakes – dried cow dung,' adds Andeweg.

These efforts towards climate change mitigation and clean air are therefore financed by the Climate and Clean Air Coalition (CCAC), a programme implemented by UNEP, the United Nations' environmental organization. Vellinga and Andeweg's group is responsible for project management. The CCAC programme, which aims at both cutting greenhouse gas emissions and improving manure management, is being rolled out not just in Vietnam but also in Argentina, Costa Rica, Malawi, Ethiopia and Bangladesh. The work of improving manure management is carried out either by NGOs such as SNV or livestock institutes and semi-government institutions.

Andeweg: 'The approach and the topics vary from country to country. In Argentina the programme addresses large-scale storage of manure; in Ethiopia, like in Vietnam, the core activity is providing training in manure digestion.'

Vellinga and Andeweg monitor progress in a GIS model. 'In that geo-information system we can keep track per region of the reduction in methane emissions due to digesters in the six countries,' explains Vellinga. 'We hope that the behavioural change will be visible in falling emissions in a few years' time.'

> **'Not using manure goes against common sense'**

BOOSTING HARVESTS

Combining anaerobic digestion with the application of the leftover digestate in the fields effectively kills two birds with one stone. Not only does the biogas extracted from the manure supplement the often inadequate energy supply in many developing countries, but the leftover digestate can also help improve the poor soils and often marginal harvests of field crops. 'The digestate contains the crucial nutrients nitrogen, phosphate and potassium,' explains Andeweg. 'And that is not all. The slurry is also rich in trace elements such as sulphur, boron, manganese and magnesium.'

Spreading this product on the fields leads to bigger rice harvests and benefits key cash crops such as tea, coffee and sugar cane as well, says Andeweg. 'If livestock feed is produced on the farm as well, the cycle is closed too.'

And that is not all. Besides this wealth of inorganic matter, which is undisturbed by micro-organisms, the manure also contains highly valuable organic matter, adds Vellinga. 'During the digestion process only some of the carbon in the manure gets converted into energy. Seventy percent of the organic matter is still there afterwards. That can be used to help increase the humus level in the soil, and then the soil retains more water and plants grow better.'

The lack of awareness of the advantages of manure goes hand in hand with the strong belief that artificial fertilizer is the only answer for raising agricultural productivity.

EXPORT MANURE FROM THE NETHERLANDS?

An imbalance in the manure cycle is an issue not just for Vietnam but worldwide. The import of livestock feed, mainly from South American countries to countries in Europe and Asia, leads in a country such as the Netherlands to a surplus of nutrients in the form of manure, and in South America to a shortage. A simple solution is available: restore the disturbed balance by returning the surplus of manure in dried form.

'The trade in transportable manure could be valuable for farmers both here and there,' says Theun Vellinga of Wageningen UR Livestock Research. Especially now that the milk quotas have been abandoned, Dutch dairy farmers will increasingly come up against the limits for emissions of nitrogen and phosphate.'

The Netherlands could turn the 'manure crisis' – a surplus of 700 million tonnes per year – to its advantage by making manure fertilizer pellets with it. That is not very difficult technically, but so far all attempts have ended in a financial flop – like Promest in Helmond in the 1990s. 'There are projects in the pipeline for studying what has to happen to make processed manure marketable and create a market for it,' says Vellinga. 'We have submitted a research proposal to the European Commission. We want to involve all the stakeholders in the manure chain in order to create a fertilizer that will sell well.'

PHOTOS SNV

A new anaerobic digester is ready in Vietnam. The methane gas released will be used for cooking.

In Vietnam, China and India artificial fertilizer is used in large quantities. 'That happens less in Africa and South America but in Asia the productivity of crops is definitely kept up by using artificial fertilizer. A number of Asian countries subsidize its use,' says Vellinga.

In the long term, however, the farmers in these countries are worse off, believe the Wageningen researchers. 'If you use artificial fertilizer you don't do anything about the amount of organic matter in the soil,' says Andeweg. Moreover, the production of nitrogen for artificial fertilizer is energy-intensive and phosphate is a finite resource, with phosphate mines around the world becoming exhausted. 'Mind you, we are not against artificial fertilizer.

Sometimes the nutrient needs of a crop can be met perfectly like that,' says Vellinga. 'But we would like to reverse the order,' adds Andeweg. 'First use the mineral and organic value from the digested manure and then supplement it with artificial fertilizer if necessary.'

If all manure, whether digested or not, was used in the fields, the Wageningen researchers reckon the use of artificial fertilizer in Vietnam could be halved, while harvests of rice, tea, coffee and sugar cane would stay the same or even increase.

COMPOSTING

There is another explanation for the negligible use of digestate, thinks Theun Vellinga. 'The slurry is liquid and therefore difficult to store. We should do research on how you can dry the manure and convert it into a product that's easy to transport and to process. People often don't have tanks so the manure needs to be solid enough to stay on a cart.'

To achieve this, the researchers are thinking in terms of composting the manure leftovers to make a more solid product, using for example leaves, livestock feed waste, soil or ash from stoves. Farmers could then cover it and store it until it is ready for spreading on the fields. 'We need to find out what the most feasible methods are for each country and each region,' says Vellinga.

COMMON SENSE

'Knowledge about using manure efficiently has been pushed into the background by the large-scale use of artificial fertilizer,' agrees Eddy Teenstra. He has been seconded to the Manure Kiosk web portal by Wageningen UR. The Kiosk, based at the World Food Organization (FAO) in Rome, is a joint initiative by Wageningen UR and the FAO, and consists of a database of 23,000 publications on manure. As well as an outlet for scientific and policy publications, the website also provides factsheets and best practices from the field, edited by Teenstra, as a source of inspiration for users. The website is free and accessible to anyone. Together with institutes in Asia, Africa and South America, Teenstra carried out a survey in 34 countries last year of the obstacles for improving manure use. 'The lack of awareness and knowledge is the biggest bottleneck. Not using farmyard manure goes against common sense.'

Common sense tells us that livestock only uses a maximum of 30 percent of the nutrients in the feed for the production of milk, meat and eggs. Teenstra: 'The rest comes out the back end. Isn't it a pity that you first 'invest' money and effort in livestock feed and then just let 70 percent of it go to waste? That's just throwing money down the drain.' ■

www.manurekiosk.org
www.ccacoalition.org