

Circular agriculture has already started

Around 150 Dutch farmers are already trying to close cycles on their farms, despite the strict manure rules standing in their way. Minister Carola Schouten wants to remove those obstacles. She believes the Netherlands should lead the way in circular agriculture. Wageningen is itching to get started.

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A modern poultry barn covered with solar panels stands near Castenray, a town in northern Limburg. It houses over 20,000 chickens that roam around and lay an egg a day. Welcome to Kipster, 'the most animal-friendly, people-friendly and environmentally friendly poultry farm in the world' according to the website.

Wageningen alumnus Ruud Zanders, co-owner of Kipster, explains the basis for the claim. The chickens are fed with waste from the food industry, including cookie remains. The young cockerels, which are normally gassed, are raised here for meat; the egg production is climate neutral and the concentrations of fine particulates are low. The most important thing: the chickens don't eat any products that we could have eaten. 'It is >





unethical and inefficient to feed our chickens perfectly decent grain when millions of people are starving,' says Zanders. 'The pigs and chickens have to eat up the leftovers, just as they did in our grandparents' day.'

He got the scientific evidence supporting this approach from Wageningen researcher Hannah van Zanten, who obtained her PhD in 2016, with Imke de Boer as her supervisor, on the role of animals in a sustainable food system. 'Kipster has been going for over a year now and we work closely with the Animal Production Systems chair group. A while ago we had a discussion about rice bran layers: is that a waste product from producing white rice or human food that you shouldn't use as animal feed? That's something we ask Hannah.'

LEADING THE WAY

Kipster fits perfectly with the minister Carola Schouten's new vision for farming's future: *Agriculture, Nature and Food: Valuable and Connected* (see inset). She wants the Netherlands to lead the way in circular agriculture. 'In a circular agricultural system, in principle arable farming, livestock farming and horticulture make use of raw materials from each other's sectors and waste products from the food industry and food supply chains,' she writes in her vision. 'In principle, livestock should be fed on grass, feed crops or crop remains from the farm itself or the local area.'

Schouten's intention with this vision is also to use circular agriculture to resolve various modern-day problems in agriculture, which is currently geared to the global market and low costs. The idea is that circular agriculture will lead to less environmental harm, greater biodiversity, higher incomes for farmers, less wastage of raw materials and food, and lower greenhouse gas emissions. These points will serve as a kind of checklist for testing the effect of the new circular policy. Schouten presented her vision in September at an organic dairy farm near Delft. Wageningen University & Research was a key adviser to the minister. Martin Scholten

in particular, the director of the Animal Sciences Group in Wageningen, has turned out to be an important ambassador for circular farming in the past two years. He prepared the ground in January 2017 during a debate with politicians, businesses and civil society organizations in The Hague, where he made the case for a radical transformation to circular agriculture in which the feed for livestock farming comes entirely from grass and food remains.

Six months later, Scholten and two Wageningen colleagues got the Parliamentary Committee on Agriculture up to speed on circular agriculture. At present, the farming sector is very efficient from the perspective of the products — butter, cheese and eggs — but it is also causing climate change and reducing biodiversity. Scholten argued that circular agriculture should tackle the issues of food, the climate and biodiversity as an integral whole. In the past few months, he has attended countless meetings of farmers, civil society organizations and researchers to

explain his viewpoint.

Scholten bases much of his vision on the work of the Animal Production Systems group in Wageningen. Professor Imke de Boer and her group have developed a food system approach in which high-grade feed such as maize and cereal that is also suitable for human consumption is no longer fed to pigs and chickens as this is not an effective way of utilizing raw materials. It is more sustainable if we only use arable land for producing plant crops for humans, say De Boer and Van Zanten. Livestock farming should only use low-grade feed: grassland — as humans can't eat grass — and waste products from the food supply chains.

23 GRAMS OF PROTEIN

Circular agriculture using grassland and waste products would be able to produce about 23 grams of animal protein per head of the world population per day, thinks De Boer. That is around half of what Europeans currently consume daily in

'The pigs and chickens have to eat up the leftovers'





PHOTO ANP

CHARACTERISTICS OF CIRCULAR AGRICULTURE

According to minister of Agriculture Carola Schouten's vision paper, the farming sector should aim to reduce its consumption of raw materials through more efficient utilization in closed cycles.

- Arable farming, livestock farming and horticulture should use raw materials that come from each other's sectors and from the food industry (crop remains, food remains, processing waste, manure, compost).
- Livestock should be fed with grass, feed crops or crop remains from the farm itself or the local area, and waste products from the food industry.
- Processed animal manure should be used on the land, and as little synthetic fertilizer as possible.
- Circular businesses should use renewable energy wherever possible.

closed cycles? That still has to be worked out in specific policies.

Take animal feed. At present it is cheaper for livestock farmers to buy imported soya meal from Brazil than animal feed from a local arable farm, says Oene Oenema, professor by special appointment in Nutrient Management. If we replace those imports with Dutch soya, and maize and cereals from north-west Europe, feed prices will increase. The cultivation of Dutch soya will also have consequences for arable farming. 'Maize and soya are useful feed crops but you don't want them taking up half of the Netherlands,' says Oenema.

There is another complicating factor too, says the professor. Dutch animal feed imports don't just consist of rainforest-destroying soya, as is often thought. 'Our feed manufacturers are very smart and scour the global market to produce good, cheap animal feed,' says Oenema. 'They use over 20 different waste products such as orange peel and palm kernels, which they turn into high-quality animal feed. That is a circular economy but on a global scale. What do we plan to do with that?'

SURPLUS MANURE

Then there is the manure, currently a real pain in the neck for Dutch livestock farming. In circular agriculture, all manure has to be turned into high-grade raw material for pastures and arable farming — but how? At the moment, a quarter of all manure produced in the Netherlands is exported to surrounding countries, says Oenema. 'If the Netherlands stops exporting manure, we would have to reduce the livestock population by a quarter in order to avoid having a manure surplus.' But this story is somewhat more complicated too. Dutch farmers currently use synthetic fertilizers as well. The new circular vision requires a reduction in the use of synthetic fertilizers so that farming uses fewer raw materials. That would lead to an increase in the demand for animal manure in the next few years, which could create room for more livestock after all, predicts Oenema. These positive and negative factors determine >

animal protein. This diet is actually more sustainable than a vegetarian diet, she claims, because vegetarians do not use the waste products and grass for food production. The professor argues that you need livestock farming for effective circular agriculture.

A major bottleneck for circular agriculture is that many waste products from the food supply chain are currently banned from being incorporated in animal feed. A ban was introduced in 2003 on feeding kitchen waste and food leftovers to cows, pigs and chickens. What is known as 'animal meal' — finely ground carcasses and other animal remains — is also not allowed in animal feed, in part because of the risk of BSE (mad cow disease). De Boer says those rules need to be reviewed. She points to Japan, where 35 per cent of food waste is processed in feed for pigs. 'If you heat that waste proper-

ly, it's safe and a very nutritious alternative to maize and soya beans.'

The minister, Schouten, wants an end to the legislation that is holding back circular agriculture, but her vision for livestock farming is less radical than De Boer's. Whereas De Boer is aiming to minimize the use of animal feed that is also suitable for human consumption, the minister mainly wants livestock farmers and arable farmers to collaborate in closing the cycle. Livestock farmers should supply manure to the arable farmers, who in turn provide animal feed to the livestock farmers. That animal feed should be grown nearby and replace imports of soya from Brazil, is the idea. The manure should also be supplied to nearby farms. A point for discussion is the geographical extent of the closed-cycle chains: are we talking about local, regional or international

the eventual 'room for manure'. The rule here is that all the manure should end up in the place where the animal feed is produced — in order to close the cycle. But do arable farmers want that manure? Oenema says livestock farmers should separate their manure out into a solid fraction — with phosphate and fibres — and a liquid fraction — with nitrogen and potassium. The professor expects this will let them deliver nutrients tailored to meet arable farmers' needs, which will make the manure valuable.

PRODUCING ANIMAL FEED

Wageningen's experimental farm De Marke is trying out a number of these circular principles. De Marke is a dairy farm that produces its own animal feed. Manure and minerals are used as efficiently as possible so that the requirements for raw materials and energy are as low as possible. The farm stopped using synthetic phosphate fertilizer in 1993 and barely uses synthetic nitrogen fertilizer anymore. The cows eat a lot of silage and little concentrate, so the farm's ammonia emissions are low. De Marke offers one form of circular agriculture for dairy farming but the circular approach has to apply to arable farming too. Good soil is fundamental for circular agriculture, states the minister in her vision. Soil quality affects not just crop production but the climate too. Good soil contains a lot of organic matter, explains Lijbert Brussaard, emeritus professor of Soil Biology at Wageningen. After all, soil with a lot of organic matter is able to absorb water and cope much better with drought. He quotes approvingly from the minister's circular vision: 'Such a soil can also hold more nitrogen and minerals; it sustains a richer soil life and helps produce healthy crops'. Farmers can help reduce CO₂ emissions by fixing carbon in the soil

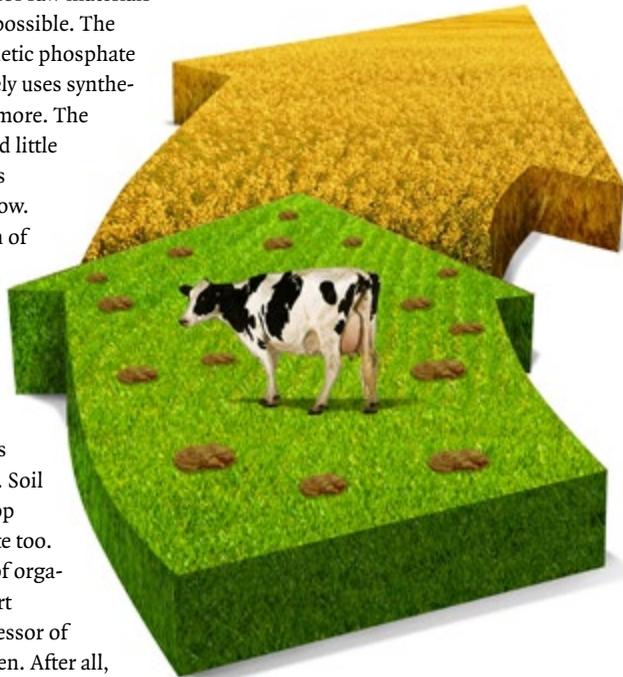
in the form of organic matter, he explains. Ploughing less is an important measure because ploughing causes carbon compounds in the soil to come into contact with oxygen, resulting in the creation of CO₂. The more climate-friendly alternative is called non-inversion tillage. Furthermore, carbon is fixed by growing crops with deep roots, such as cereals, rather than crops that put out shallow roots, such as potatoes, so farmers have to take that into account in their cultivation plans. Brussaard also sets requirements for the quality of the manure. 'Slurry is not good enough; aged manure with straw is much better for the soil.'

At the Agroecology and Technology Test Location in Lelystad, WUR is working on the

arable farming approach sketched by Brussaard. The experimental farm stopped ploughing nine years ago and aims to 'use ecology's regulating capacity in agriculture,' as researcher Wijnand Sukkel puts it. By practicing shallow tillage or not ploughing at all, they have increased the organic matter content of the soil considerably. This year, the farm started strip cultivation with potatoes, sugar beets, a mix of grass and clover, carrots, wheat, flowers and onions. In principle, the application of strip-cropping should result in fewer diseases and pests because there are more natural enemies of the pests on the plot than in a monoculture. Biodiversity and soil quality are the points of departure for this nature-inclusive experimental farm that was officially opened as a test location in September. It can provide the building blocks for the new circular policy.

OBSTACLES

Circular agriculture has actually been practiced for a long time on individual farms. Frank Verhoeven, who advises farmers through his company Boerenverstand, knows of around 150 Dutch farmers who apply circular principles on their farm. Those farmers have a hard time, says Verhoeven, because current agricultural policy stands in the way of circular farmers. Like Scholten, Verhoeven also talked last summer to the coalition parties and the minister about both the obstacles to circular farming and the opportunities. The dominant course of producing as much as possible as cheaply as possible for the global market has left its mark on policy, says the alumnus, who graduated in Animal Sciences in Wageningen 20 years ago. 'What is more, regulations primarily focus on parts of the system,' he says, quoting from the



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circular vision document. For example, in the policy on the environment, sustainability is interpreted as minimizing the environmental damage per kilo of meat, litre of milk or kilo of potatoes, which makes intensive production appear the best solution. Circular farmers on the other hand aim to minimize the use of raw materials for their farm. They interpret sustainability as low environmental damage per hectare. These are low-input dairy farmers, says Verhoeven, who use little or no synthetic fertilizer and concentrates, and mainly use their own grass as animal feed. They produce as much milk as intensive farmers, but with one more cow. However, the ammonia and phosphate laws put limits on the number of cows. Under that legislation, farmers who produce as much milk per cow as possible have an advantage. What is more, policy rules form an obstacle to ageing manure and using it to improve soil fertility. The Use of Fertilizer Decree states that farmers have to inject slurry into

the soil whereas circular farmers prefer to spread manure on top of the soil. The Low Ammonia Emission Animal Housing Systems Decree says cows should be kept in closed barns to minimize emissions of ammonia and greenhouse gases, whereas circular farmers want to compost their manure.

PIONEERS

Bieslandhoeve in Delfgauw, where the minister presented her circular vision, is an open straw barn where the manure is composted. ‘That is the ideal barn for both soil and cows, but the ministry assigns this barn system the highest emissions factor, so no farmer will want to build one,’ explains Verhoeven. The minister wants to remove obstacles but she does not yet have any concrete legislation. She does promise in her vision that she will give ‘the pioneers strong support from now on for the innovations, experiments and investments in a closed cycle that they have already made in the past

few years.’

But policy alone is not enough; circular farmers also need a business model. If the current economic system does not change, food production looks set to remain a race to the bottom, with low prices and food wastage. We therefore need to encourage the circular approach through higher prices, thinks Wageningen economist Krijn Poppe.

‘Current prices are not a good indicator for what we are doing. At present, nobody pays the bill for depleting global phosphate stocks or for producing waste and greenhouse gases. If you let businesses and consumers pay the real costs, you will automatically end up with optimum closed cycles. That debate about local or global closed cycles will be resolved automatically.’

You could for example increase the value of manure with new rules, says Poppe. He suggests that livestock farms could introduce a money-back system for the minerals in the animal feed. Farmers who buy this feed should be able to deliver the manure from the cows that ate the feed to the animal feed factory and get money back. The economist thinks that would close the mineral cycle between animal feed producers and farmers. Kipster founder and agricultural economist Ruud Zanders thinks people overly complicate the business model for circular farming. ‘It’s very simple. You calculate the unit cost, add a margin and you get the sale price. Then you go to a potential customer with your story and ask them whether they want to buy at this price. Our first step was to arrange the contract with Lidl; without that sale contract, we wouldn’t have started.’

Kipster will be taking the same approach for a planned second location in the Netherlands and one in Belgium for the production of eggs — first sort out the sales, then the licences, then build the farms. He will be sticking to the circular concept. ‘The European food industry produces around 115 million tons of waste annually. At the moment, only 4 to 5 million tons are used for animal feed. There is still lots of potential there.’ ■

www.wur.eu/circularfood