

JOHAN SANDERS, 'PROFESSOR BIOBASED'

'The chemical industry is the driving force'

Our prosperity is increasingly fueled by farmland. By making more efficient use of plants, we can break free of fossil fuels, says departing professor Johan Sanders. The biobased economy is within our reach, he believes. 'And that will contribute to better food supplies as well.'

TEXT RENÉ DIDDE PHOTOGRAPHY TESSA POSTHUMA DE BOER



'**P**rofessor Biobased' has reached retirement age. 'I am past my use-by date, but I am going to re-invent myself,' jokes Johan Sanders. He said goodbye to Wageningen University at the end of January, but he is not stopping work. 'I am going to work 20 metres down the road at the Food & Biobased Research institute, which is part of Wageningen UR too.'

So the change is not as big as it seems. Throughout his career, the last 12 years of which were spent at Wageningen University, Sanders has been committed to the idea of a biobased economy: an economy no longer dependent on oil but largely based on plant

products. Bioplastics that provide packaging, for example, and agricultural waste that is converted into refined chemicals for the chemical industry. The raw material for these things grows in the fields, a product of sunlight, says Sanders.

'The biobased economy produces materials which do not emit any greenhouse gases such as CO₂ during their lifetimes, and therefore do not contribute to the climate problem,' explains Sanders. 'The CO₂ that is generated during production or after the biomass products are discarded has already been fixed from the atmosphere by the plant, so the balance is more or less zero.'



‘The biobased economy is coming, slowly but surely’

Johan Sanders, retiring professor of the Valorization of Plant Production Chains, on the Wageningen UR campus.

People in the Netherlands have been spoiled for a long time because of the country's reserves of natural gas. Has this led to a failure to pursue innovations?

‘Through our wealth, due to the natural gas among other things, we are well on the way to exhausting the basis of our economy. There are loads of valuable substances of which we do not make optimal use. Take the problem of manure: we haven't managed to solve that in 30 years. We have calculated that it would be possible to earn 450 million euros a year instead of spending 150 million euros on spreading 6 million cubic metres of muck on the land. If you fail to solve 10 of these sorts of problems optimally, it can easily mean the sort

of budget shortfall of 6 billion which the government had last year.’

How can you make money from manure?

‘By making better animal feeds! Animal feeds are a brilliant driver for the Dutch economy. Currently we import huge quantities of soya and maize through Rotterdam harbour, to be used as feed for pigs and other livestock. The proteins and fibres they contain are valuable, and the imported overdose of nitrogen, potassium and phosphate is just excreted unused by the animals. This is the source of the manure problem. Not only that, but these minerals are often a burden to the animals, which >

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JOHAN SANDERS

Johan Sanders (b. 1948, Eindhoven) studied biochemistry at the University of Amsterdam, where he also obtained his PhD for molecular biological research. From 1977 Sanders led the research group at biotechnology company Gist-brocades which achieved the genetic engineering of enzyme production. In the 1990s he moved to innovative potato starch company AVEBE, as director of research. Since 2004 Sanders has been professor of the Valorization of Plant Production Chains, which became a full chair of Biobased Commodity Chemicals in 2011.



have to get all that urea out of their systems. ‘If we start using biorefinery to separate the substances in feed ingredients that are useful for the animals, such as proteins, from the components that are of no use to them, such as minerals, we will get better quality feed mixes plus large quantities of substances that can be used in chemical processes. ‘What is more, we could make many of the food proteins for our pigs and cows ourselves, without importing all those undesirable minerals from other countries. Proteins from Dutch grass have an amino acid composition which is highly suited to a monogastric animal like the pig, while maize protein is of less value to pigs. Yet pigs eat maize and cows eat grass,

which actually contains proteins that are too high quality for the cow. We should do it exactly the other way round, producing suitable grass proteins for pigs and feeding maize protein to cows. While we are at it, we can extract the overdose of minerals and make those sugars, organic acids and amino acids available to the chemical industry. This would create 30,000 new jobs and all these organic components would double the efficiency of one hectare of grass or maize. ‘The costs of this biorefinery would be covered by the profits from animal feed proteins, coming from the other components. What is more, the manure problem would be solved and soya imports would be slashed.’

So why isn't this happening?

'Refining grass costs about 180 euros per tonne of dry material. The protein sells for 120 euros. That is not enough to cover the total costs of the biorefinery. As long as fossil fuels were cheap the byproducts were of very little value. That is changing now. And the Chinese are very interested in these substances, so the byproducts, such as fibres and grass juice, with all its components, have gained in market value. The process can now raise about 205 euros in all. So I do expect biorefinery to get off the ground soon.'

Will the third world benefit too?

'Production in the third world is lower, making it particularly attractive to make more efficient use of the harvest in those parts of the world. Most biorefinery technology can be applied on a small scale, so that minerals can be returned to the fields at relatively little expense. 'The tragedy was the way we used to dump European agricultural surpluses on the Third World – the butter mountain and the milk lake, for instance. This has prevented farmers in Africa, for instance, from developing their businesses. European farmers are now getting into a similarly dependent position in relation to countries like Brazil. We shall have to make up for our higher cost price by being smart, and by getting more added value out of biomass.'

Sounds nice but the Dutch government has mainly focused on biofuels up to now.

'Fuels are on the lowest rung of my F ladder: Food, feed, functional chemicals and materials like fibres definitely take priority over biofuels or electricity, given their added value. Fuels are the last F you should extract from biomass.

'Politicians, including the last three ministers of Economic Affairs, are not aware enough of the chemical industry. That sector can help us meet our obligations to reduce CO₂ emissions much more effectively than the transport sector and at less expense. The Dutch chemical industry accounts for more than 10 percent of the gross national product. And this sector is going to appreciate the tremendous value of biomass more and more. 'What works against us is that the national gas company NAM, with its annual turnover from natural gas of 12 billion euros, has nothing to gain from a biobased economy.

And as a shareholder, the government shares its interests. Instead of forming a nice trio of arable farming, livestock and chemical production, the Dutch government makes an energy agreement which prioritizes wind turbines and electric cars that can go for a maximum of 50 kilometres on electricity from coal-fired power stations. And then only thanks to heavy subsidies in the form of tax advantages for the car buyer. This is putting the cart before the horse.'

This is not really a very good moment to be leaving.

'Luckily my successor, Harry Bitter, has a sound chemical background. And I will remain active myself as well. I will be working half the time for the Food & Biobased research institute. There is a lot more research to be done, a lot to explain and a lot of knowledge to pass on to a new generation so that biobased becomes a shared vision. It's coming, you know, slowly but surely. And the chemical industry is the driving force.

'I'll be spending the other half of my time on small start-up companies. Byosis is one example, which is working on products from maize and optimizing a biogas process from maize waste products. And a consortium called Grassa! is working on making better use of grass.

NGOs think there is too little agricultural land in the world, and that a biobased economy will cause hunger.

'That is sheer populism, and based on panic. Luckily that is calming down. People exploited the fear that replacing 30 percent of fossil fuels, the target set at the time, would require three times as much biomass, leading to the use of three times as much farmland and three times less food. That fear was unfounded. There is still so much space in the west, so much land lying fallow. With the exception of the Netherlands, almost every country in the world – in Africa to start with – could raise productivity enormously.

'If we do more biorefining, we will also make much more efficient use of biomass. A biobased economy does not have to pose any problem at all for food production. On the contrary, it could contribute to better food production in the third world because minerals would be re-used there and plant materials would be used more efficiently. Increasingly, NGOs are starting to see this.' ■

www.wageningenur.nl/biorefinery