

Ecological knowledge offers perspectives for sustainable agriculture

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A smart combination of different crops, such as beans and maize, can significantly cut the use of crop protection agents and at the same time reduce the need for fertilizers. Integrating ecological knowledge from nature with knowledge of crops opens up the prospect of a sustainable strategy that will increase yield per hectare at reduced environmental costs. This was the assertion of Prof Niels Anten in his inaugural speech

upon accepting the post of Professor of Crop and Weed Ecology at Wageningen University, part of Wageningen UR, on Monday 22 April.

Prof Anten sees great similarities between nature and a field full of crops. In both cases, plants are surrounded by numerous organisms such as [weeds](#), [pollinating insects](#), fungi, blights and diseases and their [natural enemies](#), all engaged in the struggle for existence.

In order to meet the food demand of nine billion people in 2050 and at the same time reduce our impact on the environment, such as the use of crop protection agents and developments leading to deforestation or desertification, we can no longer rely on [synthetic pesticides](#) and [fertilizers](#) alone. 'We need to conduct much more research to better understand how to utilize the potential provided by natural [ecological processes](#),' said Professor Anten.

He points to recent research data showing that mixed crops require 20-40% less land to obtain the same total yields as mono-crops. There are several reasons for this. Different plant varieties make use of different growing times and different nutrients in the soil. They can also facilitate each other, for example by providing shade or making the soil more acidic, so that more [phosphate](#) is released. Also striking is the fact that mixed cultures are on average 40% less affected by diseases on average than single crops. In China there are even examples of a 90% reduction in diseases caused by fungi, leading to increased overall production.

'Mixed crops like these have a range of benefits. This makes it all the more surprising that so little research has been done into them,' observes Professor Anten. 'Our knowledge of plant breeding and crop physiology has resulted in crops which deliver maximum yield in monocultures. But there has been virtually no equivalent research conducted in mixed crops.'

In his inaugural address entitled 'Crop ecosystems as diverse playing fields,' Professor Niels Anten discusses the parallel development of two fields, the ecology of natural systems such as forests and the ecology of agriculture. Within his teaching and research remit of Crop and Weed Ecology, he will be looking at the connections between these areas of study for the benefit of sustainable crops with high yields.

Neighbours

In his speech, Anten talked at length about the way in which plants can detect each other's presence. Plants responses to neighbour plants can differ depending in whether these neighbours are: friends or a foes, a plant of the same species, a family member or a genetically identical clone, as in many monocultures in the West. A plant uses shade and filtering of sunlight by a neighbouring plant to detect its vicinity and size. It may respond with a growth spurt, towards the light. But the plant also differentiates between species. Maize growing beside wheat will produce deep roots to avoid those of the wheat, whereas if there are roots of beans close by, the maize roots will grow towards them. Plants from the same mother can also react differently to each other than plants from different mothers. So it appears that they recognise each other at the family level too.

Alien neighbouring plants include weeds, which pose an important threat to crop production. The use of herbicides is an important element of weed control, but also harmful to the environment, while more and more weeds are becoming resistant to these agents. 'We will therefore also need to look at other, more ecological solutions,' says Professor Anten. 'In short, in order to achieve a sustainable increase in food production, we will need to deploy all the weapons in our arsenal; among these, the opportunities produced by ecological interactions have to date been largely neglected.'

Provided by Wageningen University

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