Plant communication and mixed cultivation as a future opportunity for food production?

In an interview with Prof Dr Corina Vlot-Schuster from the University of Bayreuth, the focus is on plant communication and the opportunities for our nutrition. Plants communicate with each other via odours, for example. These are recognised by other plants as messenger substances and trigger a reaction, e.g. an immune response. Prof. Vlot-Schuster is investigating how crops such as barley, wheat and tomatoes use messenger substances to protect themselves against infections. The findings should then be used to develop natural plant protection products. As a future opportunity, it is being discussed whether staple foods such as wheat could theoretically be grown in mixed cultivation instead of monoculture in order to enable natural plant protection. However, the realisation of mixed cultivation is difficult and requires further research.

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Recommended literature on the topic

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Rosenkranz M, Chen Y, Zhu P, Vlot AC (2021). Volatile terpenes: mediators of plant-to-plant communication. The Plant Journal. https://doi.org/10.1111/tpj.15453

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English translation of the German interview transcript

Helen Regina: Dear audience, can plants talk to each other? And if so, how do they do it? And what does it have to do with food production and nutrition? That's what we want to talk about today in another interview from the Ernährungsradar series. I'm Helen Regina, a Master's student at the University of Bayreuth.

Matthias Will: And I'm Matthias Will from the Akademie für Neue Medien. Welcome to today's edition. We are guests today at the Spice Museum here in Kulmbach Mönchshof and our interview partner is Professor Corina Vlot-Schuster. She teaches plant genetics at the University of Bayreuth, crop genetics to be precise. We are delighted that you are our interview partner today. Professor, you have been studying plant communication for many years. Can plants communicate with each other? Is there such a thing as a language of plants?

Prof Vlot-Schuster: Plants can actually communicate with each other. Sure, plants can't talk, but plants have other ways of communicating with each other and one of these ways is through odours. Plants can release scents into the air, which are recognised by other neighbouring plants as messenger substances and trigger a reaction, for example an immune response. If a plant is sick, it will start to release certain scents into the air, which are recognised by the neighbouring plant as a warning signal. This neighbouring plant then brings its immunity, its disease defence system, into readiness so that it can react better to the coming disease.

Helen Regina: Do plants only communicate within the same species or also between different species?

Prof Vlot-Schuster: As far as we have observed, it is indeed possible for plants to communicate between different species. There are herbs, for example. We are now in the spice museum, which fits quite well. Many herbs release these scents into the air even without disease, which are then recognised by other crops as a defence signal. Rosemary, for example, releases these defence messengers very strongly, which are then recognised as a defence signal by a tomato, for example.

Helen Regina: And across what distances can plants communicate?

Prof Vlot-Schuster: That's a good question, it hasn't been conclusively clarified yet. We tried to find out in a greenhouse, in collaboration with colleagues at the Helmholtz Centre in Munich, how distances influence this communication. We then took a small tree, a poplar tree, which releases certain defence messengers into the air and placed another plant next to it to react to this signal. And we were able to go up to 20 cm and still recognise the signal. At 50 cm, i.e. half a metre, we were no longer able to detect an increased defence response in the recipient plant.

Matthias Will: The Frankenpost recently wrote that you are searching for the super plant. That sounds very exciting, why not explain to us exactly what you are researching?

Prof Vlot-Schuster: Well, "super plant" is a nice way of putting it, but I wouldn't say we're doing the super plant, of course, but we're investigating how plants, crops, especially barley, wheat and tomatoes protect themselves against infections. Plants, like humans, have a natural immune defence against diseases that does not consist of antibodies, but of other substances, so-called secondary metabolites. And we want to find these in the plants so that we can then use them as plant protection products. So we are looking for metabolic substances, chemical compounds from the plants, in order to use them for plant protection with the plant's own defence mechanisms.

Helen Regina: Where do you see the potential benefits of your research?

Prof Vlot-Schuster: The benefit of the research really lies in plant protection. We are looking for ways to improve biological plant protection. Either with these plant secondary metabolites, which protect the plant itself, or by using microorganisms with which we treat the plants and thus trigger a certain defence. Or this plant communication, which we want to use by growing different plant species together - known as "intercropping" - in order to better protect the crops.

Helen Regina: Many people in Germany are sceptical about genetically modified plants. Can you understand that? And how would you like to take away their fear?

Prof Vlot-Schuster: I can definitely understand it, because it's something foreign that you might not necessarily understand. And of course it has to do with food, something that you take into your body and digest. In the laboratory, we are currently using genetic engineering to achieve our goal more quickly, to know more quickly which substances the plant releases when an immune reaction takes place. So we first look at the genetic level to see which genes are switched on or off and can we predict the function of a gene and see what substances and compounds are produced for the immune reaction. It is also possible to induce changes in the genetic information of plants with the help of so-called "genome editing". Genome editing is like this: if you look at DNA, there are millions of very small building blocks. With genome editing, you "only" take one or two of these millions, billions of building blocks out of the plant's genome. I think it's important to realise that what you eat always contains DNA. If we make a change using this genome editing, where we only take away one or two of the millions of building blocks, we only have those two building blocks less, but the other millions are still there. We always eat DNA and digest it and even use the molecules released in the process for our own cell metabolism. I think that's important. You can perhaps take away some of your own fear if you know that it's actually something quite normal that you eat. At the same time, I think that we definitely need research to be able to understand the ecological consequences of a change in a plant. That we make sure that if we change something in the genetics of the plant, that this has no negative impact on the environment.

Matthias Will: Important staple foods such as wheat and maize are grown as monocultures in large fields around the world so that they can be harvested more easily. Wouldn't mixed crops be better, because then the plants could communicate and protect themselves against pathogens or pests, for example?

Prof Vlot-Schuster: I think you're right, that could be better. It's difficult to realise at the moment because we also need the land to produce certain quantities of food. If we then do mixed cultivation, the area that can be cultivated with wheat is reduced. So it would be important to find combinations with another crop that you can then possibly harvest. And then I think that might be applicable in the long term, even on a large scale. We are currently using it for horticultural applications, and it is already being used a lot in the organic sector. For wheat, i.e. large agricultural crops, I think we are still further away from this, precisely because of the large area and the harvesting requirements that exist.

Helen Regina: Your husband runs a small organic farm. Aren't organic and genetic engineering contradictory?

Prof Vlot-Schuster: Not from my point of view, and I really like this question because it ties in nicely with my answer earlier about genetic engineering and how we could deal with it. I think that this genome editing, this very small change, strictly speaking, especially in the biological field, could mean a great deal of progress, because you can use such changes to protect plants by making a crop resistant to certain diseases that are common in fields or regions. And then you can grow these plants, which have this minimal change in them, organically, without pesticides, because they are already naturally resistant, even if we have introduced this resistance through genome editing. So if we define "organic" as "without pesticides", "without chemical agents", then that would be progress that could be applied well in the organic sector in my view.

Helen Regina: And at the end of our interview, what do you grow in your garden? Do you both take care of the garden together?

Prof Vlot-Schuster: Well, I don't have that much time at the moment. We used to do it together for longer. My husband now does it mainly on his own. We used to have a small horticultural business where we also grew vegetables. And we also plan to grow spelt and rye here in the region - although we still have to move our farm - and sell it directly.

Matthias Will: Professor, thank you very much for the interview. It was nice to have you as our guest today.

Prof Vlot-Schuster: With pleasure.