Gene expression reveals how potatoes are cultivated

May 3 2012

Organically grown potatoes have a higher gene expression of starch production than conventional ones. This statement is put forward by RIKILT, part of Wageningen UR, researcher Jeroen van Dijk, who can tell organically grown potatoes from conventional ones by measuring the RNA in the plant cells. But he cannot say if organic potatoes are any healthier for this.

Unlike in traditional potato cultivation, no fertilizers or chemical pesticides are used in the cultivation of organic potatoes. Van Dijk discovered that the different cultivation conditions can influence gene expression in the potato plant when he was establishing the gene expression - or the RNA - of both types of potatoes. 'We started to do some measuring: which genes are switched on and to what extent. And so we found significant differences between conventional and organically grown Santé potatoes.'
It wasn't that simple really, because Van Dijk had to examine about 40,000 genes. 'Of these, half of the genes are switched on in certain cases; very many variables are involved. Although it's possible to measure the gene expression for each gene, that won't tell you much. Fortunately, we know the types of proteins and ingredients produced by some of the genes. That enabled us to cluster these genes and assign properties to them.' In so doing, Van Dijk succeeded in measuring the differences between organic and conventional potatoes.

He found that some of the RNA are related to proteins responsible for the production of starch in the potatoes. Organic potatoes have more of

such RNA than conventional potatoes, Van Dijk says. But he cannot tell if the organic potato is more nutritious as a result, because he did not examine the starch composition.

He also measured the production of lipoxygenases, genes involved in the plant's defence mechanism, and a group of genes which protect the plant from harmful bugs. Both groups of genes are expressed better under organic fertilization, while pesticides have either no effect or stimulate in fact the gene expression. Based on these results, it would not be right to say that organic potatoes can cope better with diseases, says Van Dijk.

In any case, that was not the aim of his study, published last month in the *Journal of Agricultural and Food Chemistry*. Van Dijk wanted to find out if differences in cultivation methods are measurable in the potato. The answer is: yes. Therefore, a test like this can be used in safety assessments of GMOs because small differences in gene expression can be traced in this way. 'Currently, a 90-day test using mice is often used to gauge the safety of transgenic plants, but nothing ever comes out of that,' says Van Dijk. 'It's better to analyze the gene expression in the lab. You'll achieve two objectives in this way: have more information and do away with the need for test animals to assess the safety of new crops.'

Provided by Wageningen University