Contaminants and micro-organisms in organic food products
Comparison with conventional products

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Summary
The report describes the results of two projects sponsored by the Ministry of Agriculture, Nature and Food Quality and the Food and Consumer Product Safety Authority (VWA), and carried out by the RIKILT (coordinator) in cooperation with the CIDC, the Louis Bolk Institute and Biologica. The study focussed on a limited number of contaminants and micro-organisms in organic products and production ways. Selection was based on a report of the Expertise Centre for Agriculture, and information on other ongoing projects in this area. Results were subsequently compared with those from conventional agriculture, partly derived from this project and partly from other monitoring programmes. We also took into account the results from other studies. The sampling was in most cases carries out at the farm, allowing a comparison of the results with the specific conditions on the farms. Results will be described for each type of contaminant or micro-organism.

Mycotoxins in wheat

The amounts of the 7 mycotoxins examined were below detection limits in most of the conventional and organic wheat samples. Levels of the Fusarium toxin deoxynivalenol (DON) were below the action limit of 0.5 mg/kg in almost all samples collected in 2003 and 2004, with the exception of 4 conventional products showing levels between 0.5 and 1 mg/kg. However, after a period with heavy rain fall by the end of August 2004, DON levels of up to 11 mg/kg were measured (Table 1). In these samples also zearalenone (ZON) was increased with levels up to 5.2 mg/kg. There was however no difference between organic and conventional wheat.

Table 1. DON levels (median and range) in organic and conventional wheat sampled in 2004.

Production type	Until 24th of August			After 24th of August		
	DON (mg/kg)	ZON (mg/kg)	Number of samples	DON (mg/kg)	ZON (mg/kg)	Number of samples
Organic	<0.5 (<0.50-1.8)	<0.05 (<0.05-0.12)	7	2.0 (0.59-11)	2.7 (0.12-5.7)	14
Conventional	<0.5 (<0.50-1.5)	<0.05 (<0.05-0.13)	11	2.0 (<0.50-6.3)	0.7 (<0.05-5.2)	6

Heavy metals and arsenic in wheat, lettuce, carrots and potatoes, and in pork and eggs
Levels of arsenic and the heavy metals cadmium, lead and mercury in organic and conventional wheat and lettuce, and in organic carrots and potatoes were all below the legal limits. There were no differences between organic and conventional wheat and lettuce. Conventional carrots and potatoes were not analyzed and there were no recent data from other studies.
Levels of lead, mercury and arsenic in kidneys and meat from organic pigs were below the detection limits and far below the legal limits. Cadmium could be detected but was also below the EU-limit of 0.05 mg/kg product. No heavy metals were detected in eggs of organic laying hens.

Nitrate in lettuce, carrots and potatoes
In both organic and conventional iceberg lettuce produced outdoors, nitrate levels were below the limits, with a range of 373 to 1759 mg/kg for organic and 652 to 1367 mg/kg for conventional products (Table 2). In the case of organic head lettuce produced outside (19 samples) and the greenhouse (10 samples) one sample for each exceeded the limit. In the case of conventional head lettuce, this frequency was much higher. Levels above the limit were detected in 18 out of 19 samples grown outside and 4 out of 14 samples from the greenhouse. In comparison with conventional head lettuce, nitrate levels were much lower for organic products. In the case of iceberg lettuce, no differences were observed.
Nitrate levels in organic carrots showed a large variation, with a range of 11 to 864 mg/kg and an average of 230 mg/kg (Table 3). This was 3 times higher than in conventional carrots, showing a range from 70 to 180 mg/kg. The nitrate level in organic potatoes was low with an average of 87 mg/kg. There were no Dutch data on conventional potatoes for comparing the data.

Table 2. Nitrate levels (median and range) in organic (O) and conventional (C) iceberg and head lettuce produced outdoors and in the greenhouse.

Type	Production		Nitrate (mg/kg)	number
Iceberg	outdoors	O	939 (370-1759)	13
Iceberg	outdoors	C	966 (652-1367)	13
Head lettuce	outdoors	O	1275 (139-3212)	19
Head lettuce	outdoors	C	3280 (1818-4357)	19
Head lettuce	greenhouse	O	3223 (946-4129)	10
Head lettuce	greenhouse	C	3515 (2439-5197)	14

Residues of pesticides in wheat, lettuce, carrost and potatoes
Using a multimethod for pesticides, no residues were observed in any of the organic products and in the conventional wheat, carrots and potatoes. An exception were two pooled samples of conventional head lettuce, but this concerned legally allowed substances and levels below the tolerance limits.

Table 3. Nitrate levels in organic and conventional carrots (mg NO_3/kg)

Production	year	number	median	range
Organic	2003	20	192	34-449
Organic	2004	15	244	11-864
Conventional	2004	15	58	16-180

Microbial contamination of lettuce, pigs, lactating cows, broilers and laying hens
None of the samples organically produced head and iceberg lettuce was contaminated with *Salmonella* or *E. coli O157*. The incidence of *Salmonella* in feces collected at the 31 organic pig farms was around 30% and comparable to data known from conventional farms. However about half of the farms that switched to organic production recently were contaminated whereas at the 14 more experienced farms, *Salmonella* was only observed in one case, being a stable with young pigs that were recently purchased elsewhere. *Campylobacter* was detected in feces at 55% of the farms, similar to conventional farms. As in the case of conventional farms, *E. coli O157* was not detected. The latter micro-organism was however detected in feces at one of the ten farms with dairy cows, the incidence again being similar to conventional.
Salmonella was not detected at any of the nine organic broiler farms, whereas one of the ten farms with laying hen was contaminated. At conventional farms the incidence is around 10% for both types of chickens. *Campylobacter* was detected at al nine organic broiler farms which is clearly higher than at conventional farms. This can partly be explained by the larger number of samples collected at the organic farms.

Residues of antibiotics and coccidiostats in pigs, cows and eggs
No antibiotics were detected in kidneys and meat of organic pigs. Similar was the case for kidneys of cows. In the organically produced eggs no antibiotics or coccidiostats were found.

Antibiotic-resistant bacteria
The incidence of antibiotic-resistant bacteria in organically raised broilers and pigs was clearly lower than known from conventional farms (Figure 1). An exception was observed for *Campylobacters* in broilers, which showed a similar incidence for organic and conventional animals.

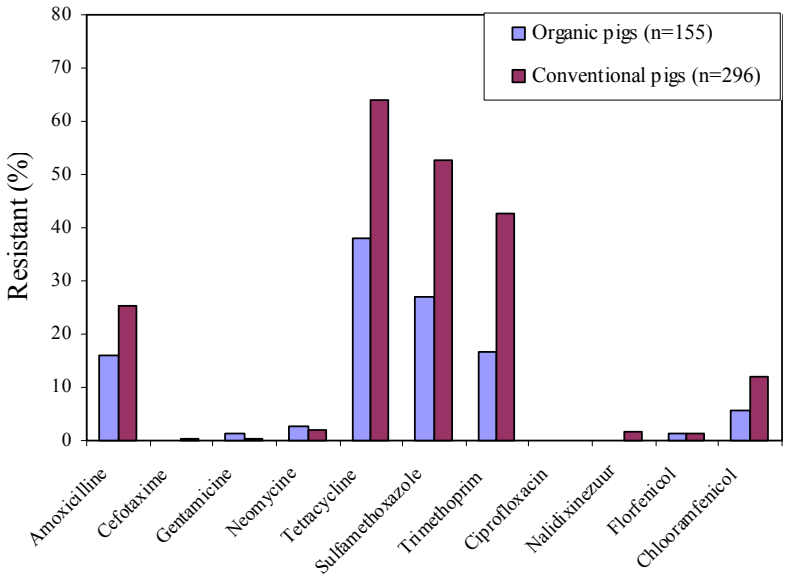

Figure 1. Incidence of antibiotic resistant E. coli's in feces of organic and conventional pigs.

Conclusions

Some of the present data suggest a clear difference between products from organic and conventional agriculture. However, it should be stressed that the present study was only a survey focussing on one set of samples and one or two production years. Nevertheless, in a number of cases the results are similar to those from other Dutch or European studies, like the lower nitrate levels in head lettuce, the lack of increased mycotoxin levels in organically produced grains, less *Salmonella* but more *Campylobacter* in broilers, and less antibiotic-resistant bacteria in broilers. In the case of nitrate in organic carrots, there are indications for increasing levels and further studies are required to confirm this. Also the lower incidence of antibiotic resistant bacteria in pigs and the lower incidence of *Salmonella* at the more experienced pig farms are positive developments which deserve further attention.

Note: data will be presented to a peer-reviewed journal