

## Pesticide Residues in Organic Seed

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### Abstract

In autumn 2009 a big German retail store chain reported on pesticide residues found in organic vegetable and herbal seed. This is a fraud for the consumer. In special cases, if seed is identical to food (e.g. coriander, anise, caraway) it can also possibly endanger food safety. Consequently the state of Baden-Wuerttemberg (Germany) started a monitoring on pesticide residues in organic seed in spring 2010. In this report the analytical method and the result of the survey will be presented.

**Keywords:** Organic seed, pesticide, contamination, monitoring, GC-MS, LC-MS/MS

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### 1. Introduction

Organic food is monitored for pesticides residues by retail store chains on a regular base due to their quality assurance policy. In autumn 2009, a big German store chain extended their monitoring for other organic products such as organic seed. The determinations showed soon that different lots were contaminated with pesticide residues.

Council Regulation (EC) No 834/2007 [1] gives a legal framework of organic production rules. It describes both basic principles and details of organic farming. It points out that “in the case of an established threat to a crop plant protection products may only be used if they have been authorised for use in organic production” Only very few plant protecting agents from “natural origin” are authorized e.g. azadirachtine (neem), spinosad, bee wax, mineral and vegetable oils, pyrethrines, iron and copper salts, calcium hydroxide. The use of chemically synthesized compounds is not allowed. Consumers expect an organic (labeled) product to be free of pesticides and other contaminants.

In some cases the contamination with very small amounts (“traces”) of pesticides can not be avoided due to drift from nearby conventionally cultivated fields during farming or not avoidable cross-contamination during processing. If there are contaminations on a higher level in organic seed indicating a direct application during its production, the sale of this seed is fraud for the consumer and not acceptable. If seed is identical to food (e.g. coriander, anise, caraway) pesticide residues can also possibly endanger food safety. Council Regulation (EC) No 834/2007 [2] gives maximum residues for this kind of seeds as criteria for safe food.

### 2. Biological Material and Method

As a reason of the findings of pesticide residues in organic seed the state of Baden-Wuerttemberg (Germany) started a survey in spring 2010. The chemical analyses of this survey were done by the Center for Agricultural Technology Augustenberg using VDLUFA (German Association of Agricultural Analysis and Research Institutes) method no. 3.3.7.1 [3] (modules Ex1, GPC, D1, D2 and D5) which is described briefly below:

For the extraction 5 g seed sample are homogenised with 100 mL of water and 200 mL of acetone for 2 minutes using a homogeniser system. 35 g of sodium chloride and 100 mL of the GPC elution mixture (cyclohexane/ethyl acetate 1:1) is added and the mixture homogenised again for 1 minute.

After phase separation 200 mL of the organic layer are filtered through a funnel containing a layer of sodium sulphate. The solvent is rotary-evaporated and replaced by 10 mL GPC elution mixture. Afterwards a clean-up by gel permeation chromatography and the analysis by GC-MS and LC-MS/MS takes place.

The following 46 pesticides were analysed: azoxystrobin, alpha-cypermethrin, bifenthrin, boscalid, chlorpyrifos-ethyl, cyfluthrin, lambda-cyhalothrin, cyprodinil, o,p-DDD, p,p-DDD, o,p-DDE, p,p-DDE, o,p-DDT, p,p-DDT, diazinon, dichlorvos, dieldrin, dimethoate, dimethomorph, alpha-endosulfan, beta-endosulfan, endosulfan-sulphate, epoxiconazole, fenpropimorph, fludioxonil, flusilazole, gamma-HCH (lindane), heptachlor, cis-heptachlorepoxyde, trans-heptachlorepoxyde, hexachlorobenzene, imazalil, imidacloprid, iprodion, metalaxyl, methidation, permethrin, phoxim, pirimiphos-methyl, procymidon, propamocarb, pyraclostrobin, tau-fluvalinate, tebuconazole, thiacloprid, tolclofos-methyl.

**Table 1.** Analysis results of the seed samples

<i>Seed</i>	<i>Pesticide 1</i>	<i>Content [mg/kg]</i>	<i>Pesticide 2</i>	<i>Content [mg/kg]</i>
Basil	Phoxim	0,027	-	-
Beetroot	Iprodion	0,055	Pyraclostrobin	0,029
Beetroot	Lindane	0,012	-	-
Carrot	Bifenthrin	0,026	Iprodion	<b>0,84</b>
Dill	Dimethomorph	0,024	-	-
Lamb's lettuce	Azoxystrobin	<b>0,52</b>	Boscalid	<b>5,17</b>
Lamb's lettuce	Boscalid	<b>2,84</b>	Iprodion	<b>1,33</b>
Pumpkin	Pyraclostrobin	0,016	-	-
Red cabbage	Chlorpyrifos-ethyl	0,041	-	-
Savoy cabbage	Matalaxyl	0,016	-	-
White cabbage	Boscalid	0,021	Procymidon	<b>0,373</b>

### 3. Results and Discussions

In 2010 32 organic vegetable and herbal seed samples (spinach (2), dill (2), carrot (4), beetroot (2), leek (3), kohlrabi, lamb's lettuce (2), pea, onion, butterhead lettuce, radish (3), pumpkin, cress, coriander, chervil, basil, savoy cabbage, white cabbage, red cabbage, endive, bean) were analysed. 11 samples were containing pesticide residues.

Table 1 shows the results in detail. Residues of maximum 2 pesticides were found per sample. Higher contents indicating probably a direct application during its production are bold.

### 4. Conclusions

On the market there are seed lots labeled organic which originate from conventional farming. High contents of azoxystrobin, boscalid, iprodion and procymidon were found in different samples. All these pesticides are fungicides. Their use does make sense in seed production especially in agricultural cultures (e.g. cabbage) which need a long time to develop the seed and which are endangered by fungus infection during this time. But this is considered fraud for the consumer and cannot be accepted in organic production. The topic should be monitored carefully by the authorities. In the state of Baden-Wuerttemberg the monitoring will be continued in 2011.

## References

1. *Regulation (EC) No 834/2007 of the European Parliament and of the Council of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91*
2. *Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EEC with EEA relevance*
3. VDLUFA, *Methods book VII, 3rd Edition*, VDLUFA Verlag, Darmstadt (Germany), 2008