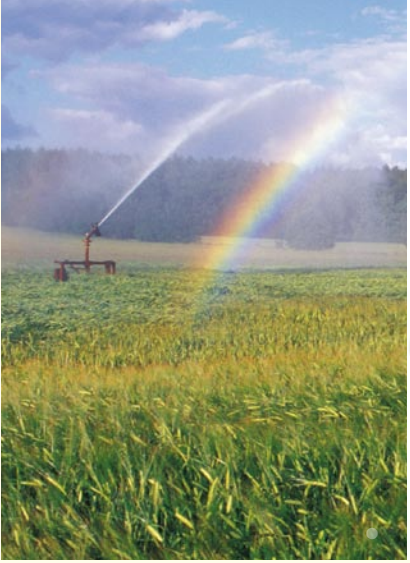

10 Years of Organic Monitoring

2002 – 2011

Special Anniversary Edition

Baden-Württemberg

MINISTRY OF RURAL AFFAIRS AND
CONSUMER PROTECTION

Where is What?

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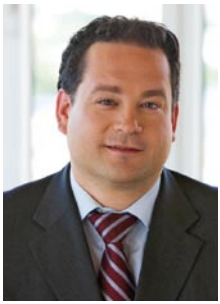


Dear readers,

Over the past 10 years the State of Baden Württemberg has conducted a federal-wide, unique monitoring program of organically produced foods. I am pleased to be able to present the summary of the findings from the years 2002 to 2011. In retrospect, we can see that the food control program with the addition of the organic monitoring program was very successful. Each year the employees were able to identify and correct weaknesses, bringing about a lasting improvement in the quality of organic foods. All in all, the results are promising. The available organic products largely fulfill the strict requirements of the European regulations for organic products, thereby assuring the trust of the consumer.

From niche product to trendsetter: nowadays there are more and more organic foods landing in the shopping carts of consumers. Approximately 80 percent of consumers in Baden-Württemberg say they would like to buy organic products from the region. The state government has reacted by strengthening local organic farms. What finally determines the quality of organic food is the care taken during the whole production process: not only the production and selection of raw materials, but also the processing, the packaging, and the storage. With this in mind, it was important for us in Baden-Württemberg to conduct this investigative program in order to continually monitor the status of organically produced foods, to prevent consumer fraud, and to discover areas for improvement.

Over the last 10 years about 8,000 organically-labeled food products were analyzed in a vast array of parameters. While at the beginning unprocessed foods were the main focus, with the ever growing selection of organic products, processed products such as wine and bread were increasingly included. Inspections conducted at different stages as well as pilot projects carried out with producers and processors of organic foods at such locations as a mill and a wine-growing institute have helped to clarify the paths of contamination and determine ways of preventing them in the future.

The balance of the past ten years shows: organic products have a good reputation, and rightly so.

I wish to thank all those who, with their many years of active engagement, have contributed to the success of this organic monitoring program.

Alexander Bonde
Minister of Rural Affairs and
Consumer Protection Baden-Württemberg
Stuttgart, June 2012

Chronology

1993	Council Regulation (ECC) No 2092/91 for organic farming comes into effect
1999	Establishment of standards for organic livestock production
2001	Introduction of a national organic logo
2002	Start of the organic monitoring program in Baden Württemberg Organic teas proven to be treated with ionizing radiation
2003	23 % of organic honey found with antibiotics
2004	Pilot project in a mill regarding cross contamination with pesticides
2005	Chlormequat (growth regulator) from straw found in cultured mushrooms
2006	Chlorpropham found in organic potatoes: contamination determined to be result of processing
2007	Organic food of animal origin - 4th consecutive year without medicinal residues
2008	Unauthorized use of mineral-based nitrogenous fertilizer detected Acrylamide: worse rating for organic chips! No further complaints of pesticides in organic carrots from Italy
2009	The new EU organic farming regulation comes into effect Natural cosmetics in sight: only one sample with high pathogen content Organic linseed spared from genetic engineering!
2010	Introduction of the EU organic logo All 24 organic confectionaries free of artificial food coloring
2011	Organic scalded sausages, also without nitrite pickling salts, found microbiologically stable Filtration experiment at the State Institute for Viticulture and Enology in Freiburg reveals contamination pathway in organic wines

1 Introduction

The Launching and Accomplishments of the Organic Monitoring Program

As a result of the total concept formulated by the Council of Ministers on 16 October, 2001 to establish regulations and provide consultative support for organic farms in Baden-Württemberg, a special investigative program for organic products was established. This project was conducted under the framework of the official food control program. This unique, federal-wide program was to serve as an instrument for uncovering possible consumer fraud, thus strengthening the consumers' trust in the quality of organically produced foods. Meanwhile, this investigative program, conducted jointly by the four CVUAs in Baden-Württemberg in close cooperation with the authority in charge of organic foods in Karlsruhe, and supported by the State of Baden-Württemberg over the last 10 years, has garnered much response from the media and numerous experts and consumer protection organizations.

While the analyses in the first year of 2002 were limited to pesticide residues, genetically modified organisms and radiation of untreated plant-based foods, the spectrum was continually broadened in the years up to 2011. Increasingly, animal feed and processed foods as well as non-food products such as natural cosmetics were included. In all, over the last 10 years approximately 8,000 organic food products and natural cosmetics were analyzed and compared with conventionally produced products. In addition to assessing the status of organic products in terms of, for example, pesticide residues and contaminants such as dioxins and PCBs, the organic monitoring program has also succeeded in pinpointing possible causes of contamination in cultivation (drift, culture media) and in the processing (cross-contamination) of organic foods. Finally, the program has uncovered consumer fraud based on falsely labeled organic products.

How are Organic Products Recognizable?

Organic products are recognizable via the information on labels such as the EU organic logo, the words "bio" or Öko" (organic) or the control body found on the label, the packaging or on a sign near the product. The terms "ökologisch" (ecological), „biologisch" (organic) as well as derivatives such as "öko", "bio", and "aus ökologischer/biologischer Erzeugung" (from ecological/organic production) are legally protected in the EU. That means only products produced, processed and monitored according to the EU organic farming regulations can be labeled as organic. Products with labels stating "unbehandelt" (untreated), "ungespritzt" (not sprayed), "naturnah" (close to nature), "rückstandskontrolliert" (monitored for residues) and similar phrases have nothing to do with officially recognized organic foods produced in accordance with the EU organic farming regulations.

EU Organic Logo

Since July, 2010 all packaged organic products that were produced in an EU country and that fulfill the requirements stipulated by the EU organic farming regulations must be accompanied by the EU organic logo. Organic products imported into the EU can also carry the logo, albeit voluntarily, as long as they were produced according to equivalent standards. In the same area as the EU organic logo, the code number for the control body and the origin of the product (e.g. "EU-Landwirtschaft" ("farm")) must also be provided. The code number (e.g. "DE-Öko-001" ("Germany, organic, 001")) starts with the abbreviation of the EU member state; then comes the word "organic", written in the language of the originating country; and finally the reference number for the control body assigned by the Federal Office for Agriculture and Food (BLE). Since the transitional regulations for the labeling of organic products with the EU organic logo are valid until July, 2012, it can be expected that comprehensive compliance for all packaged organic products will only be in effect from this date onward.

National Organic Logo and Organic Farming Association Logos

Many organic food products also carry the hexagonal national organic logo or a label from one of the organic farming associations in Germany. A prerequisite for using the national organic logo is that the producer complies with the EU organic farming regulation and its implementing rules. On several points the requirements stipulated in the guidelines of such farming associations as Demeter and Bioland go significantly beyond those of the EU organic product regulation. The national organic logo and the various organic logos of the agriculture organizations are authorized to be used in addition to the EU organic logo.

The 95% Rule for Processed Foods

Only when at least 95 weight % of the ingredients in processed food stem from organic production is the producer permitted to use the EU organic logo and to advertise with the terms "bio" or "öko" as part of the product's name. If the proportion of organic ingredients is less than 95 weight % an indication of organic production is only permissible within the ingredients list, normally designated with an asterisk or a footnote. At the same time, the list of ingredients shall include an indication of the total percentage of organic ingredients in proportion to the total quantity of ingredients of agricultural origin.

What is Organic?

On 1 January, 2009 the regulation that had previously been established for organic farming (Council Regulation (ECC) No 2092/91) was replaced with the EU organic farming regulations (Council Regulation (EC) No 834/2007, Commission Regulation (EC) No 889/2008, and Commission Regulation (EC) Nr. 1235/2008). According to these regulations, which are also valid for imported organic products, the following requirements are especially significant:

- Ban on use of genetically modified organisms (GMO) and products made from GMO
- Ban on use of mineral-based nitrogenous fertilizer
- Ban on use of chemical-synthetic pesticides
- Animal health: avoidance of chemical-synthetic medications, as much as possible
- Ban on treating products or ingredients with ionizing radiation
- Limited use of additives such as artificial colors and preservatives in comparison to conventional products
- Spatial and temporal separation of organic and conventional foods during processing (due to cross-contamination)

▶ *For more information regarding organic farming, please refer to the website www.landwirtschaft-bw.info*

2 Organic Foods: How Does the Monitoring System Work?

In the EU only products that are produced and inspected according to the guidelines of the EU organic farming regulation are permitted to be called and labeled as organic food. The control system includes manufacturers at every level: the farmer that grows the grain, the miller that mills the grain, and the baker that bakes the bread from the grain.

Control Bodies and Authorities in Germany and in the EU

The EU organic farming regulation defines the standards for organic produce and processing of foods in the European Union. The member states are thereby obliged to hold to these standards by establishing a national monitoring system with specially designated inspection officers. In Germany, as with the majority of European states, the inspections are carried out by private, state-authorized control bodies who are themselves monitored by the responsible regional authorities (a multi-level control system). In Baden-Württemberg the Regional Council in Karlsruhe is responsible.

Inspection Procedures

Every company (farming, processing, storage, trading) involved in the marketing of products with even a hint of organic processing, whether in agricultural production, seeds, food or feed, must register with the responsible regional authorities and sign a contract with an authorized control body. The controller will then conduct regular inspections (at least once a year) at the company as well as at the site of its subcontractors. The controller must grade all the companies annually on the basis of a risk analysis and, depending on the outcome, adjust the frequency of inspections. Of 100 inspection visits, at least 20 must be unannounced.

The first item on the agenda for an inspection is a description of the company, which also includes the measures taken for adherence to the EU organic farming regulation (e.g. separation of organic from non-organic products within the confines of the company's facilities). The inspector will check if the production conditions on the farmland, in the stalls, storage facilities and processing plants are in accordance with the regulations. Documentation and recording of operations as well as organic labeling on the products, in the shipping documents or in the advertisements will also be checked. In addition to these measures, the controller may also take samples to be analyzed for substances banned in organic production. When a concrete suspicion exists, these analyses are compulsory. If the farmer or processor is a member of an organic farming association , the controller will also check for adherence to the association's guidelines.

Within the scope of Baden-Württemberg's official food control program, hundreds of organic samples have been systematically inspected for residues, GM impurities, unauthorized additives and much more, since 2002.

What Happens in Cases of Irregularities?

If the controllers find minor deviations from the regulations stipulated in the EU organic farming regulation, the company will usually only be given written notification because the organic integrity of the product is not seriously endangered. Significant irregularities will be addressed with a warning and, when necessary, instructions and subsequent inspections by the controller at the company's cost. In extreme cases the company will be prohibited from marketing the product as organic. The threat of a total ban on marketing products with organic labeling by the Regional Council in Karlsruhe can be avoided when the company itself ceases to take part in inspection proceedings, thereby giving up their right to market organic products in the future. When products are proven to have been falsely marketed with organic labeling, the company will be fined for counter-regulation activities by the Regional Council. In individual cases, suspicion of a criminal offense will be reported to the state attorney's office.

3 Organic vs. Conventional: Overview of Results

Residues and Environmental Contaminants

Pesticide residues in plant-based foods: organic fruits and vegetables showed, on average, a lower amount of pesticides than conventional goods by a factor of 180; only 5 % of the organic samples were rejected as a result of their pesticide content.

Pharmacologically active substances were not detected in any organic products.

Antibiotics in honey: in the year 2003 there were still 6 out of 26 (23 %) organic honey samples found with residues of antibiotics. Since 2005, however, all organic honey samples have been free of such residues.

Mycotoxins: there was no or only minimal difference between organic and conventional goods ascertainable; the organic products tended to be slightly less contaminated.

Organic contaminants and pesticides in food of animal origin: : on average there was no significant ascertainable difference between organic and conventional products; organic eggs tend to have slightly higher levels of contamination due to being kept outside (free-range).

Dioxins and dl-PCBs in food of animal origin: on average there was no significant ascertainable difference between organic and conventional products; organic eggs and organic beef tend to have higher levels of contamination due to being kept outside (free-range).

Contaminants Derived from Manufacturing Process

Furan in roasted coffee: the amount of furan in organic coffee was slightly less than that in conventional coffee, as a result of roasting.

Acrylamide in crackers and potato chips: in organic and conventional crackers there was no significant difference found regarding the presence of acrylamide. For potato chips (crisps), there was, on average, a higher amount of acrylamide detected in organic chips than in conventional; the number of samples with acrylamide levels over the signal value of 1,000 µg/kg was also higher for organic chips.

***Trans*-fatty acids in ready-to-eat meals:** there was no significant difference found between organic and conventional products.

Additives

Preservatives in refreshment drinks: no preservatives were detected in organic refreshment drinks.

Artificial food colors in confectionery: no artificial food coloring was found in organic confectionery.

Taste-enhancer glutamate in scalded sausages and ready-to-eat meals: only one of 23 organic scalded sausages was noticeable for its glutamic acid content. Organic ready-to-eat meals, due to their usage of yeast extract, tomato and soy products as substitutes for the "chemical" taste-enhancer, also contained glutamic acid.

Others

Genetic Modifications: the proportion of samples revealing genetic modification, as well as the extent of contamination from genetically-modified plants, was lower for organic foods; in comparison to conventional products, the proportion of organic products with genetic modification was never over 0.1 %.

Irradiation: In only 4 out of 193 organic samples (ayurvedic teas) was unauthorized irradiation detected.

Nitrogen-stable isotope ratio: the results of only a few organic products pointed to unauthorized use of mineral-based nitrogenous fertilizer.

Microbiological quality of scalded sausages: despite the common avoidance of nitrite pickling salts as an effective preservative in organic products, there was no difference observed in view of the microbiological stability between the two types of production.

Natural cosmetics containing synthetic preservatives were only seldom detected, and most were microbiologically inconspicuous. Natural cosmetics are not covered by the EU organic farming regulation. In our view, for the protection of consumers from health risks and deception, however, there are certain basic requirements to be established for the composition of these products and the quality of their raw materials.

In the following sections the individual analytical results will be summarized and presented. Detailed information on all results can be found in the annual reports from 2002 until 2011 (available on the Internet website **http://oeko-monitoring.cvuas.de**). To download all organic monitoring reports, please scan here!

4 Genetic Engineering in Organic Food

Organic Food and Genetic Engineering – A Little is Permitted

For organic food products there is a general ban on the use of genetically modified plants and products manufactured thereof. However, as with conventionally produced food, contamination stemming from authorized GM plants up to 0.9 % is allowed, as long as the contamination is "technically unavoidable" or "coincidental". In the analyses of organic products over the last 10 years, however, there were never any cases with genetic modification over 0.1 % found. Any higher levels of GM found would be seen as "technically avoidable".

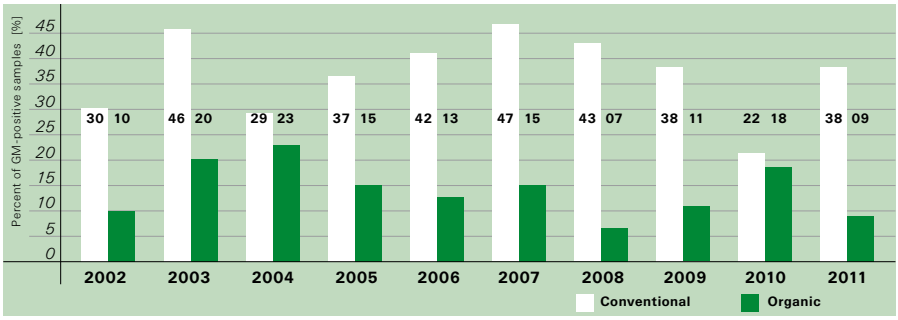
Soy – It's the Origin That Counts

Soy is considered to be a highly nutritious plant-based food. Products such as tofu or soy drinks are not only popular among vegetarians. In industrial food manufacturing, soy is extracted for plant oils and emulsifiers (soy lecithin). The quantity of raw materials grown locally, however, is not sufficient to meet the large demand for these ingredients alone. Additional imports (mostly from Brazil) are necessary. While genetic engineering has steered clear of Europe, it has a firm grip on the American continent with its huge soy plantations. Thus, despite a separate flow of goods, beginning with the harvest, traces of genetically modified soy among imported soy cannot always be completely avoided.

The need for organic soy can, on the other hand, be extensively met by local cultivation. As the results from the organic monitoring program show, one can fairly guarantee that, up to the end product, no contamination from genetically modified soy will be detected.

Organic and conventional soy products are contaminated from genetically modified ingredients with varying frequency. While, on average, approximately 15 % of the organic samples were positive over the last 10 years, in the case of conventional goods, it was over 35 %. Also, the amount of genetic modification among the organic samples was never more than 0.1 %, whereas this limit was regularly breached in the conventional soy products.

Genetic Modification in Soy and Soy Products



Conventional soy products such as soy, soy drinks and "meat substitutes" made from soy are sometimes advertised as being "non-GMO." For such products only traces of GM soy (less than approx. 0.1 %) are tolerated. Over the course of the last five years these products showed a rate of GM-contamination similar to that of organic soy; there were no soy samples with GM levels over 0.1 % found. Nevertheless, the percentage of soy samples that were GM-positive was significantly higher than that for organic soy (27 % vs. 11 %).

The Case of Linseed: Organic Goods not Affected

Evidence of genetically-modified linseed was first reported in Baden-Württemberg in autumn, 2009. By the end of 2009, corresponding results were reported in over 30 countries. Soon it was apparent that practically all businesses that used linseed (e.g., baked goods & breakfast cereals) were affected. In the EU, GM linseed is not authorized in general. There is zero tolerance for unauthorized GM plants, not even for the smallest of traces.

All of the affected linseeds came from Canada, the most important linseed cultivating country in the world; the EU is the biggest importer of the seeds. The authorization to cultivate GM linseeds in Canada was revoked as long as 10 years ago.

In organic products, however, there was no genetic modification found. This can be explained by the different regional origins as well as the different flow of goods, in comparison to those of conventional products. Importers, manufacturers and traders reacted quickly. As early as 2010 there were no GM-positive results found in conventional linseed.

5 Mycotoxins – from **A**flatoxin to **Z**earalenone

According to the EU organic farming regulation, no chemical-synthetic fungicide applications are permitted. Whether this has an effect on the incidence of mycotoxins in organic products is unclear.

From 2003 to 2011, 845 samples of organic foods were analyzed for the presence of mycotoxins and compared with conventional products. The analyses covered a broad spectrum of foods as well as mycotoxins, from Aflatoxins to Zearalenon and from grains to corn-based snacks to roasted coffee. The main focus, however, was on food staples such as cereals and products made thereof (flour, breakfast cereals and bread), as well as imported goods (dried figs, roasted coffee, and cocoa).

The analyses showed that, in terms of contamination from mycotoxins, there was no or only negligible difference found between conventional and organically produced goods. Organic goods tended to be less contaminated than conventional. As with conventional products, positive findings were only associated with particular food-mycotoxin combinations.

Fusarium Toxins – A Fungus in the Cornfield

The incidence of fusarium toxins is mostly influenced by the weather during the blossoming of the grain. It is often claimed that organically grown cereals and their products are more heavily contaminated with mycotoxins than their conventional counterparts because of the avoidance of chemical/synthetic fungicides. However, the analyses carried out within the framework of the organic product monitoring program did not bear this out. By using a variety of good farming techniques for organic fields (appropriate choice of crop variety, healthy seeds, multiple crop rotation, etc.), contamination can be minimized without the use of fungicides.

There were some conspicuous cases of contamination from fumonisins (fusarium toxins), found in organic corn products, including cornmeal and corn semolina, as well as in corn-based, processed foods such as cornflakes, cornbread and other baked goods.

Despite descriptions of the damage caused to one's health by the toxins trichothecene T-2 and HT-2, the maximum residue limits (MRL) of these substances, already prescribed and promoted for several years, have not yet been put into force. The T-2 and HT-2 toxins occur in cereal products, especially in oat products. Analyses in the past years have shown that oat products are more often and more heavily contaminated with T-2 and HT-2 toxins than other cereal products. The average and maximum content level of toxins in organic samples tend to be lower than in conventional products.

Organic Roasted Coffee: Only Expensive or Really Better?

About 50 samples of roasted coffee from organic and conventional cultivation were analyzed for ochratoxin A, a toxin that forms during storage, from 2006 to 2008. In the organic coffee samples both the frequency and quantity of ochratoxin A contamination was less than that detected in the conventional goods. The highest amount found in organic coffee was 0.47 µg/kg (max. residue limit: 5 µg/kg).

Ergot in Rye Flour and Rye Bread: Only a Question of Manufacturing Practice

Among the various types of cereals, rye is often infested with ergot. Therefore, rye flours and rye breads with varying percentages of rye content were analyzed for the presence of ergot alkaloids. Since the percentage of rye in the bread samples differed, a comparison between the two types of production was limited. In general, however, ergot alkaloids made a regular appearance in these products: their presence was detected in 12 of 25 loaves of bread made with rye flour. The highest amount detected was 250 µg/kg. Due to these findings, it is recommended that observations regarding the contamination of bread and flour with ergot alkaloids continue. Farmers as well as millers can make an important contribution vis-à-vis the minimizing of contamination from these toxins.

6 Antibiotics in Organic Honey Still an Issue?

In Germany the use of antibiotics for the treatment of bees is not approved; as a result, no antibiotics should be detected in either conventional or in organic honey products. Under this regulation, substances used in veterinary drugs as well as in pesticides, such as Streptomycin, are exempted.

Over the last 10 years a wide spectrum of antibiotics was analyzed in honey, within the framework of the organic monitoring program. Fortunately, it was found that the percentage of honey samples with residues of antibiotics had significantly decreased, for conventional as well as organic. In 2003 residues from antibiotics were still detected in 6 out of 26 (23 %) organic honey samples; however, since 2005 all organic honey samples have been shown to be free of these residues.

Semicarbazide in Organic Honey – Unauthorized Use of a Veterinary Drug?

In previous years, especially in 2007 and 2008, the substance semicarbazide (SEM) was detected in individual samples of honey, also in those stemming from organic production. This substance can be produced as a result of the degradation of the EU-wide forbidden veterinary drug nitrofurazone. SEM can, however, also be present in the lid gasket of honey jars, from where it can migrate into the honey. Azodicarbonamide, from which SEM is formed, has been forbidden for use as a foaming agent in the process of manufacturing the gasket since 2005. The honey jars in which the SEM-contaminated honey was found were closed with metal lids and plastic gaskets. A test of these lids revealed a very high level of SEM. Thus, it can be assumed that the honey jars were closed with lids that had already been banned for several years.

What Makes Honey Organic?

For honey to be marketed as organic, the following requirements established by the EU organic farming regulation and guidelines set by the organic farming associations must be adhered to:

- Ban on use of chemical-synthetic drugs
- Ban on use of chemical-synthetic repellents during honey harvest
- Ban on use of chemical products for the cleaning and disinfection of the honeycomb
- Use of only natural materials such as wood, clay or straw for the beehives; plastic is taboo
- Choice of location: preferably ecologically managed area or place where wildflowers grow within 3 km of the beehives
- Wax for the honeycomb/inner walls must be organically produced and free of residues.

7 Furan in Coffee: Pleasure without Regret?

Furan has been classified by the World Health Organization (WHO) as a possible carcinogenic substance for humans. However, it is not considered to be an acute health risk. Furan occurs in foods when heated at high temperatures (e.g. roasting), from carbohydrates, amino acids, ascorbic acids, unsaturated fatty acids or so-called precursor substances such as 2-furan carbonic acids.

In May, 2004 the US Food and Drug Administration (FDA) informed the public about furan in foods including, among others, brewed coffee, with a quantity of up to 84 µg/liter. Given that coffee-infused drinks are also top-sellers in Europe and that, for the average adult, the most exposure to furan comes from such drinks, more exact knowledge regarding consumer consumption is vital.

In order to determine whether the type of production (organic vs. conventional) has an effect on the amount of precursor substances (and thus furan) found in roasted coffee, a total of 176 samples of ground coffee were analyzed for furan content. A portion of the samples included "coffee pads", and 115 of the samples were from organic cultivation. All coffees were caffeinated. In comparison to the conventional coffees, the roasted and ground organic coffees contained somewhat less furan. Moreover, when comparing the median values, which represent the middle value of the distribution, the organic coffees had a value slightly lower than that of conventionally grown coffee (2,127 µg/kg vs. 2,340 µg/kg). There was practically no difference found between the maximum values. The lowest quantity found was in an organic coffee sample, at 684 µg/kg. All in all, only marginal differences in the amount of furan between organic and conventionally grown coffee were found. The occurrence of furan is apparently dependent to a large degree on production, packaging and storage.

Content of Furan in Ground Coffee

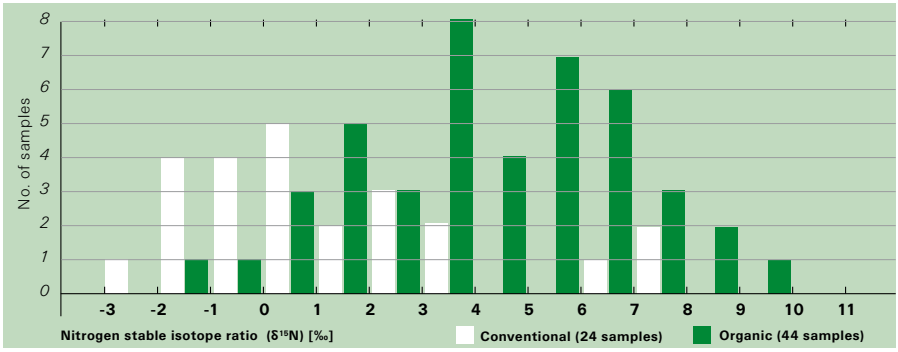
Parameters	Source	2008	2009	2010	2008-2010
No. of samples	Organic	48	39	28	115
	Conventional	17	19	25	61
Minimum [µg/kg]	Organic	1209	684	1536	684
	Conventional	1807	1146	1129	1129
Average [µg/kg]	Organic	2079	2163	3060	2346
	Conventional	2893	2248	3083	2769
Median [µg/kg]	Organic	2033	2074	2744	2127
	Conventional	2827	2240	2810	2340
Maximum [µg/kg]	Organic	3776	4783	6218	6218
	Conventional	5537	3892	6254	6254

8 Nitrogen Stable Isotope Ratio: Plant Memory

Fertilizer is used in agriculture to give plants an optimal amount of nutrients, thereby achieving a higher yield or better quality crop. As a matter of principal, there is a distinction between organic and mineral-based fertilizers.

According to the EU's legal directives for organic farming, only fertilizers from organic sources are authorized for plant production; mineral-based nitrogen fertilizers are not permitted. The testing for adherence to this requirement normally takes place within the framework of the company inspections. With the determination of the nitrogen stable isotope ratio in plant-based foods, however, an analytical parameter can also provide valuable information regarding the type of fertilizer used. This is because the nitrogen stable isotope ratio is different in organic and conventional fertilizers, and this difference can be detected in both the fertilized plant and in the food product. As part of the organic monitoring project, data relating to the nitrogen stable isotope ratio in tomatoes, bell peppers, and leaf lettuce was collected from 2008 to 2011. Differences between organic and conventional cultivation was recognizable due to the frequency distribution in all three products, although there were also some areas of overlap. These overlaps resulted only partially from the variation limit for the specific type of fertilizer. Samples that are falsely declared or conventional goods that are permissively treated with organic fertilizer result in a broader distribution of values. However, in all three product groups, including the organic products, nitrogen stable isotope ratios were observed, that can only be explained by the unauthorized use of mineral-based fertilizers. These results illustrate the necessity for a statistical approach based on a large databank with reliable, comparative data as well as the continuation of the investigative program.

Frequency Distribution of Nitrogen Stable Isotope Ratios for Tomatoes, 2008 to 2011



9 Dioxins and Dioxin-like PCBs in Eggs – an Overview of the Last Years

Eggs, Eggs, Eggs, Whose Pecking There…?

Chickens that are kept outside can pick up traces of dioxins and dioxin-like polychlorinated biphenyls (dl-PCBs) by pecking in the dirt. Because chickens, in comparison to other animals with regard to their body weight, take in more particles from the soil, they are especially sensitive bio-indicators in reference to the accumulation of dioxins and dl-PCBs. Increased levels of dioxins can be detected in the eggs of such laying hens, even when the level of dioxin contamination in the soil is only slight. Therefore, the analyses of chicken eggs for dioxins and dl-PCBs, especially those from free-range chickens, have been intensified in the last several years.

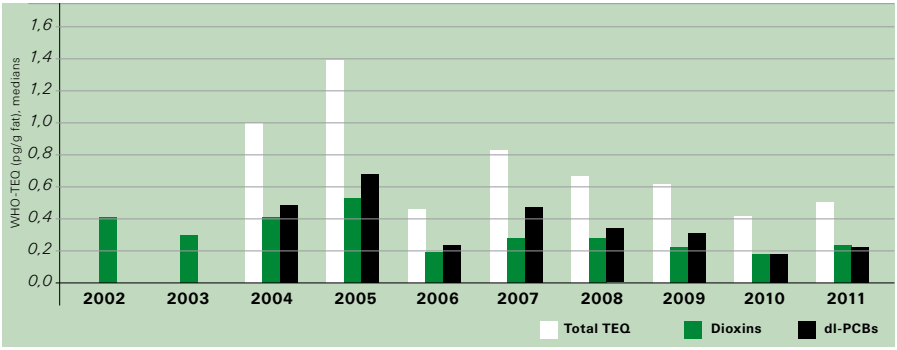
Legal Regulations

The Commission Regulation (EC) No 1881/2006 set a maximum residue limit for chicken eggs of 3.0 pg WHO-PCDD/F-TEQ/g fat for dioxins and a maximum limit of 6.0 pg WHO-PCDD/F-PCB-TEQ/g fat for the sum of dioxins and dl-PCBs (total TEQ). In addition to the established MRLs, the commission recommended on 6 February, 2006 (2006/88/EG) an alert level of 2.0 pg WHO-PCDD/F-TEQ/g fat for dioxins and 2.0 pg WHO-PCB-TEQ/g fat for dl-PCBs in chicken eggs, with the purpose of reducing the levels of dioxins, furans, and PCBs in feed and food. In cases of limit exceedance, the source of contamination is established and measures are taken to contain or eliminate the contamination. The MRLs and alert levels apply to both organic and conventionally produced foods alike.

Dioxin and dl-PCB Levels in Eggs Predominantly Low

From 2002 to 2011 a total of 1,209 samples of chicken eggs (211 from organic production) were analyzed for the presence of dioxins and, since 2004, also dl-PCBs. The average amount (medians) of dioxins and dl-PCBs detected in the eggs was predominantly low, much lower than the maximum residue limit (MRL) and the alert value; moreover, the values tended to decrease over the years. The low levels held across all types of chicken housing conditions. The detected values ranged from 0.03 to 98 pg WHO-PCDD/F-TEQ/g fat for dioxins, from 0.01 to 161 pg WHO-PCB-TEQ/g fat for dl-PCBs and from 0.05 to 167 pg WHO-PCDD/F-PCB-TEQ/g fat for the sum of dioxins and dl-PCBs. Over the past 10 years, a total number of 95 chicken egg samples (8%) exceeded the MRL established in 2006 for dioxins and dl-PCBs; 59 samples (5 %) exceeded the MRL for dioxins, which has also been valid for eggs from free-range hens since 2005. In the cases of higher levels, production-specific parameters played a significant roll. In order to identify a possible internal source of the problem, the Ministry for Rural Affairs and Consumer Protection Baden-Württemberg published written informa-tion regarding the keeping of laying hens (Dioxin in eggs from free-range hens: **www.landwirtschaft-bw.de**, keyword "Dioxinbelastung in Eiern" (dioxin contamination in eggs)).

Dioxins and dl-PCBs in Organic and Conventional Chicken Eggs (1,209 samples)



Housing System and Size of Production Influence Dioxin Content

In order to find the root cause for the occasional higher levels of contamination, various special programs were conducted in 2004 and 2005, from which differences between eggs were ascertained according to the conditions under which they were housed and the size of the operation.

- The amount of dioxins and dl-PCBs detected in the eggs of free-range hens from the 20 largest operations in Baden-Württemberg confirmed the previous assumption that free-range eggs from large operations differ only slightly from eggs of caged hens and, as a rule, are clearly under the maximum limit established in 2006.

- In a second special program chicken eggs from small operations (< 200 animals) with plenty of space to move around were targeted for analyses. Differentiation according to operation size presented a clear picture regarding dioxin and dl-PCB content: approx. 35 % of the eggs from operations with 30 – 200 hens and approx. 80 % from those with fewer than 30 hens contained levels over the allowable limits for the total sum of dioxins and dl-PCBs.

Organic Eggs Contaminated with Higher Levels of Dioxins and dl-PCBs

As part of the organic monitoring project, chicken eggs, especially from organic production, were examined for dioxin and dl-PCB content and compared with eggs from conventional production. As expected, there was little difference found, which points to general environmental pollution as the source of contamination. The average level of dioxins and dl-PCBs in the organic eggs tended to be somewhat higher than that in conventional egg samples, but was nevertheless significantly under the established MRLs and alert levels.

10 Organic Contaminants and Pesticides in Organic Eggs

From 2003 to 2011 a total of 435 samples of chicken eggs, 190 from organic and 245 from conventional production, were analyzed for liposoluble pesticides and contaminants. Indicator substances for the overall contamination of eggs with obsolete pesticides and organic contaminants include hexaclorobenzene (HCB), lindane, sum-DDT, PCB 153, dieldrin, endosulfan (sum), musk xylene, as well as the sum of polybrominated diphenyl ethers (PBDEs).

Organic Eggs More Often and Highly Contaminated

Contamination of animal-based foods with organochlorine and organobromine contaminants and pesticides as well as nitromusk compounds Has greatly decreased in the last 20 years, whereby DDT and PCB and, to some extent, HCB still present the highest concentrations. The average background level for these persistent contaminants and pesticides in the product category of eggs is under 10 µg/kg fat. Only 13 % of the eggs from organic and 8 % of those from conventional production had higher levels.

The highest single findings as well as the highest average levels were measured for total DDT and PCB 153. Among the organic samples, 13 eggs were found to have levels of DDT over 10 µg/kg fat (13 to 788 µg/kg fat); among the conventionally produced eggs, 11 cases were found (13 to 92 µg/kg fat). The situation regarding PCB 153 was similar: 11 egg samples

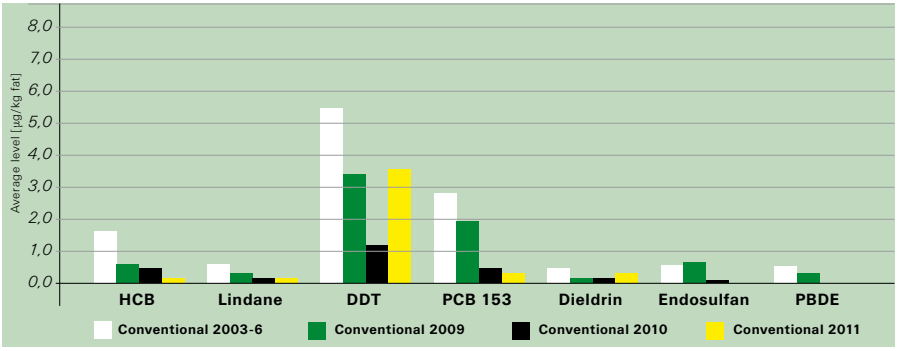
Environmental Contamination in Organic Eggs – What Can Consumers Expect?

The EU organic farming regulation dictates the requirements for produce marketed with organic labeling. It exclusively regulates the methods of production and makes no "harsher" demands regarding freedom from environmental contaminants for organic products than that demanded for conventional products. Because liposoluble, persistent organic compounds accumulate via the food chain in the fatty tissue of animals, foods of animal origin are the main source of exposure to such substances by consumers. Since they aren't substances employed in the production of food, but rather environmental pollutants from air, water, soil or animal feed, organic products aren't fundamentally less affected than conventional products. In individual cases the amount of environmental contaminants in organic products can even be higher than the prevailing average background level for the current combination of substance and food matrix. For these reasons, the amount of environmental contaminants in an organically produced product cannot serve as a criterion for measuring the quality of ecological production methods. The consumer can certainly expect otherwise.

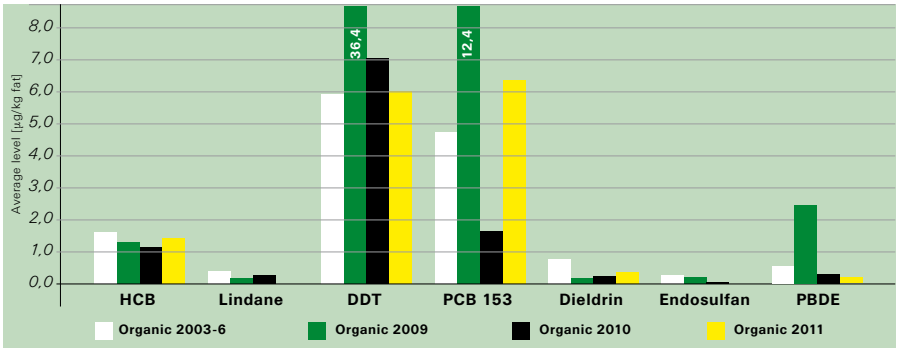
from organic production contained over 10 µg/kg fat (15 to 100µg/kg fat) and 7 samples from conventionally produced eggs contained 13 to 37 µg/kg fat. In addition, more than 10 µg/kg fat of pyrethroid was detected in 3 eggs from conventional production. When comparisons were made between eggs from ecological and conventional production, aside from the annual fluctuations in the total picture, the average residue content of DDT and PCB was somewhat higher in eggs from ecological production (DDT: 6.0 - 36.4 µg/kg fat, PCB: 1.6 – 12.4 µg/kg fat) than in conventionally produced eggs (DDT: 1.3 – 5.5 µg/kg fat, PCB: 0.2 – 2.8 µg/kg fat). In only two samples, one organic and one conventional, were the maximum limits for DDT exceeded. The average levels for all other detected substances were under 5µg/kg fat for both organically and conventionally produced eggs.

A chronological look at organic egg analyses shows no trends. In a comparison made over several years, average levels over 3 µg/kg were only detected for DDT and PCB, with a sudden spike in the year 2009 of both substances (12.4 µg PCB 153/kg fat and 36.4 µg DDT/kg fat), the highest amount so far. The residues detected in conventionally produced eggs, at least those of DDT and PCB, show a trend of significant decline, while the average DDT levels fluctuate.

Chronological Comparison of Conventional Eggs



Chronological Comparison of Conventional Eggs



Housing Systems of Chickens Compared

While the keeping of hens outdoors (free-range) is obligatory for organic production, chickens raised conventionally can also be kept inside, albeit on the floor; the caging of hens has been forbidden in Germany since 2010. Instead of cages, keeping the hens in small groups has been established as the minimum standard. To demonstrate differences according to housing systems among the conventionally produced eggs, additional analyses were conducted on free-range, floor and caged hen eggs, from 2003 to 2006. The highest average level was detected for DDT, followed by PCB, the contamination from which decreased significantly from free-range to floor to caged keeping. The other substances showed a very low average level, less than 2 µg/kg fat.

11 Pesticides in Plant-Based Foods

From 2002 to 2011 a total of 4,481 plant-based foods from organic cultivation were analyzed for pesticide residues. These included agricultural products such as fruit and vegetables as well as products processed from fruit, vegetables and cereals, baby food, wine, etc.

Pesticide Residues in Plant-based Foods from Organic Production, 2002 to 2011

No. of samples	Samples with residues	Samples with residues > 0,01 mg/kg[1)]	Irregular samples[2)]	Samples with multiple residues
4481	1308 (29 %)	375 (8 %)	218 (5 %)	473 (11 %)

[1)] not including substances authorized for organic production, bromide < 5 mg/kg and gibberellic acid
[2)] due to deception or exceedance of the MRL

Good Marks for Organic Producers!

Approximately 95 % of the samples from the market were correctly labeled with the organic logo. In 5 % of the organic food samples pesticide residues were detected that indicated, due to their type and amount, unauthorized treatment or mixing with conventional goods. In these cases the labeling of the products as organic or ecological was determine to be consumer deception. A further 133 samples (3 %) suggested the possibility that the goods were not produced in accordance with the EU organic farming regulation. The organic inspection authorities were informed of these findings. Post investigations are hereby necessary to determine if, in fact, unauthorized pesticides were applied.

Over these investigatory years it has been confirmed that plant-based foods from organic cultivation are overwhelmingly free of pesticide residues (71 %), despite the ever-broadening spectrum of substances analyzed for (200 substances in 2002, up to 600 pesticide agents today). When residues in organic products were found, they were usually single substances whose content level was under 0.01 mg/kg, thus under the concentration normally detected after application of a pesticide to crops. On average, conventionally produced fruit and vegetables contained a factor of about 180 times more pesticides than organic goods.

0.01 mg/kg – Orientation Value not Same as Limit Value

The EU organic farming regulation allows practically no application of chemical-synthetic pesticides. Nevertheless, there is no special limit value in the EU organic farming regulation that regulates the marketing of organic foods. The limit values stipulated by the regulation for conventional products (Regulation (EC) No 396/2005) are also valid for organic food. In view of the high measurement sensitivity of testing methods, it is not inevitable that an organic product with evidence of pesticide residues has been treated with an unauthorized substance or exchanged/mixed with a conventional product. However, considering the potential sources of contamination from drifting and environmental pollution, products from organic cultivation should not contain identifiable residues over the "orientation value" of 0.01 mg/kg, determined by the Baden-Württemberg organic monitoring program. What is important here is that the 0.01 mg/kg is not a limit value by which an exceedance of this level is proof that a product was not produced in accordance with the regulations of the organic farming regulation. Rather, it is much more a threshold, over which the source of the residual contamination must be determined.

Overview of the Numbers

Fruit

A total of 1,308 samples of organic fruit were analyzed, most of which were berries, citrus and pome fruit. Residues over the orientation value of 0.01 mg/kg were detected in 83 samples. A further 46 samples (3.5 %) were found with misleading irregularities, due to their high content of pesticide residues, and 11 samples (0.8 %) contained levels of authorized pesticides over the MRL stipulated by Regulation (EC) No 396/2005. The organic control authorities were informed of 15 cases of high residue levels.

Organic fruit	No. of samples	Irregular samples[1)] [%]	Samples with residues [%]	Samples with residues > 0,01 mg/kg [%]	Samples with multiple residues [%]
Beeries	181	1.7	19.3	1.7	4.4
Grapes	223	4.0	30.9	7.2	13.0
Pome fruit	242	3.7	19.0	5.0	3.7
Stone fruit	120	5.0	22.5	5.8	5.0
Citrus fruit	368	6.8	30.2	10.6	10.9
Exotic fruit	174	2.9	20.7	3.4	3.4
Total	**1308**	**4.4**	**24.8**	**6.3**	**7.5**

[1)] Due to deception or exceedance of the MRL

Vegetables

A total of 1,732 samples of organically grown vegetables were analyzed. Residues over the orientation value of 0.01 mg/kg were detected in 7 % of the samples; 57 samples (3 %) were found with misleading irregularities due to their high residue content, and 20 samples (1 %) exceeded the MRL stipulated by Regulation (EC) No 396/2005. A further 67 samples suggested the possibility that the organic farming regulations were not adhered to.

Organic vegetables	No. of samples	Irregular samples[1] [%]	Samples with residues [%]	Samples with residues > 0,01 mg/kg [%]	Samples with multiple residues [%]
Leavy veg.	416	2.6	26.4	4.8	9.4
Fruit veg.	644	4.3	27.5	5.1	7.8
Sprouts	138	7.2	26.1	9.4	3.6
Root veg.	289	3.1	19.4	5.5	9.3
Mushrooms	105	11.4	61.0	22.9	14.3
Potatoes	140	5.0	35.7	13.6	10.0
Total	**1732**	**4.4**	**28.5**	**7.2**	**8.7**

[1] Due to deception or exceedance of the MRL

Processed Organic Products

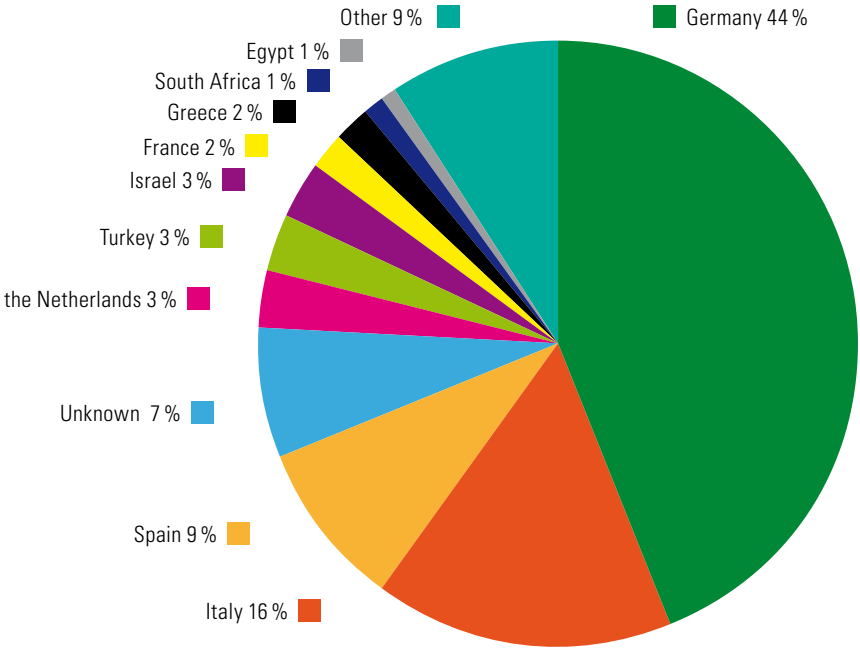
A total of 1,384 samples of processed organic products were analyzed: especially in focus were cereals and cereal products, wine grapes, wines, mash and must, as well as baby food and dried fruit. The spectrum of samples also included products such as frozen foods, canned fruit, and alcohol-free drinks. 82 samples (5.9 %) were found faulty and 51 were reported to the authorities.

Processed organic products	No. of samples	Irregular samples[1] [%]	Samples with residues [%]	Samples with residues > 0,01 mg/kg [%]	Samples with multiple residues [%]
Plant-based oils, oil seeds	91	1.1	59.3	12.1	23.1
Cereals, cereal products, baked goods, pasta	310	6.5	21.6	8.1	9.4
Dried fruit	178	9.0	63.5	19.1	37.1
Tea, tea-similar drinks, lupine coffee	49	6.1	44.9	26.5	20,4
Wine grapes, mash, must, wine	220	8.6	38.2	11.8	21.8
Baby food	185	2.7	17.3	9.7	0.0
Other processed products	351	5.1[2]	32.2	10.5	13.4
Total	**1384**	**5.9**	**35.0**	**11.8**	**16.0**

[1] Due to deception or exceedance of the MRL

[2] Among others, deep-frozen berries, canned fruit, lentils, peanuts and food supplements

Origins of Organic Foods



The Origin Matters!

Organic goods are imported to Germany from many different countries. All in all, the samples came from 55 different countries, mainly, however from Germany (44 %), Italy (16 %), and Spain (9 %). The comparison of irregularities found, differentiated by country of origin, gives Germany good marks for her organic fruit and vegetables: only 2 % of the samples hinted at application of unauthorized pesticides. In contrast, the quota of irregularities was, in part, significantly higher for imported fruit and vegetables.

Irregularities in Unprocessed Organic Foods, Differentiated by Country of Origin

Country of origin	No. of samples	Samples with irregularities[1] [%]
Germany	1115	2.0 %
Italy	672	9.2 %
Spain	383	4.2 %
Israel	133	2.3 %
the Netherlands	130	3.8 %
France	92	-
South Africa	59	3.4 %
Greece	56	8.9 %
Egypt	44	9.1 %
Argentina	36	5.6 %
Morocco	28	3.6 %
Other [2]	349	4.0 %
Total	**3097**	**4.4 %**

[1] Due to deception or exceedance of the MRL

[2] Other countries and unknown origin

On the Trail to Finding Causes of Organic Product Contamination!

Aside from the risk-oriented investigations geared toward analyzing "truth in packaging" vis-à-vis organic products, the organic monitoring program also has the important task of identifying possible causes of contamination through, for example, investigations into drifting, when conventionally grown crops are in neighboring fields, and through monitoring at different stages in a grain mill and at a winery. As a rule, drifting from conventional crop fields, environmental contamination, illegal application, or mixing with conventional goods can lead to pesticide residues in organic agricultural products. However, among processed organic products found to contain unauthorized pesticide residues, the main culprit is so-called cross-contamination. This occurs when organic and conventional goods are processed at the same time. Through our investigations, manufacturers and food processors were able to receive important information regarding the prevention of contamination. That these cases were usually successful was seen in the following years.

Time Travel Through Organic Food

In individual years of testing there were always cases of different cultures and products that caught our attention. However, in almost all cases the residue situation improved in the following years.

Pome Fruit, Stone Fruit and Berries (Except Table Wine Grapes) Minimally Contaminated

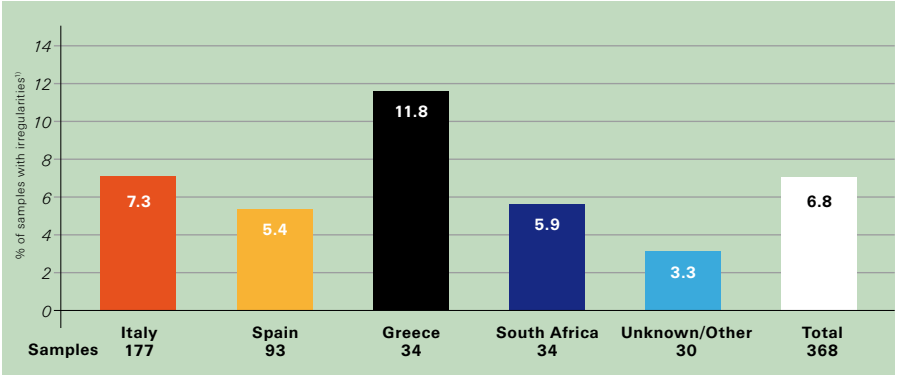
A very positive residue situation for pome and stone fruits as well as berries was observed. Residues were seldom detected, and were almost solely in minute concentrations.

Positive Trend for Table Wine Grapes and Citrus Fruits

In the early years of the monitoring program table wine grapes and citrus fruits were often found with residues and irregularities. Happily, however, the residue situation in table grapes has significantly improved. In the last four years only one sample was found with residue levels over 0.01 mg/kg.

Citrus fruits have also progressed. While from 2005 to 2008 an average of one in 10 samples were found objectionable, mostly due to very high levels of insecticides, fungicides, and acaricides, in the following two years all citrus fruits were found to be in line with the organic regulation. In 2011 only one of 38 samples was rejected for having residue levels that were too high. In the early monitoring years, several citrus fruits were conspicuous for their trace amounts of surface treatment agents. It is assumed, due to the extremely low levels (less than 0.01 mg/kg), that the organic goods were contaminated in the packaging location, where relatively high concentrations of the same types of surface treatment agents are applied to conventionally produced goods.

Irregularities in Organic Citrus Fruits, Differentiated by Country of Origin



[1] *Due to deception or exceedance of the MRL*

In Sight:
Cucumbers, Bell Peppers, Carrots & Co.

In 2008 organic cucumbers from Spain, Italy and Morocco were rejected on the grounds of containing high levels of the fungicide fosetyl. Irregularities were also often found in bell peppers from Italy and Spain. In numerous samples of broccoli from Italy residues of the herbicides fluazifop, haloxyfop, and 2,4-D were detected. In 6 out of 26 samples of Italian broccoli, coming mostly from the same region in southern Italy, herbicide residues over the legal maximum limit were found; 3 of the samples were rejected as being deceptive, due to their herbicide content above the 0.01 mg/kg allowable limit. All 5 broccoli samples from Germany and all 21 from Spain were on board vis-à-vis labeling the products with the organic seal, and none had any irregularities.

A striking media response came with the results of the analyses of organic carrots in 2006. The high number of irregularities (15 %) were noticed, as well as the many cases of herbicides, fungicides and insecticides found. Many of the effected goods came from Italy where, apparently, conventional goods were being sold as organic.

Nevertheless, the results of our analyses of the above-mentioned cultures in the last few years are very encouraging: in 2010 and 2011 only 2 % of the samples of fruit vegetables contained pesticide residues above 0.01 mg/kg (in 2009 and 2008 they were 3 % and 10 % respectively), and just 1.4 % of the samples (2 Spanish tomatoes) were not in accordance with the EU organic farming regulation. The herbicide fluazitop was no longer detected in Italian broccoli and in 2011 only one sample from Italy was judged as being deceptive. Since 2008 no carrots have been rejected for irregularities, and no residue levels above 0.01 mg/kg have been detected.

Sprout Inhibitor in Organic Potatoes – Unauthorized Post-Harvest Treatment?

In the investigatory years of 2006 and 2007 a large number of organic potatoes from Egypt and Germany were rejected mainly due to the presence of chlorpropham residues, a substance that is authorized for conventional products. A further investigation revealed that, during the washing, sorting and packaging of the potatoes, organic potatoes can become contaminated from conventional potatoes treated with the sprout inhibitor chlorpropham when they were previously processed in the same area. In the following years there were no more incidences of such irregularities. In the year 2011, with one exception, all of the analyzed samples were virtually pesticide free. This shows that being extra diligent paid off in the prevention of contamination.

Growth Regulator in Cultured Mushrooms – Situation not yet Satisfactory

In individual years the number of organic cultured mushrooms found with irregularities was very high (over 20 %). Most of the problems lie with oyster mushrooms and cultured button mushrooms from either Germany or the Netherlands, resulting from high levels of residues from chlormequat and mepiquat. These two substances are applied as growth regulators in conventional cereal cultivation and are assumed to reach the organic mushrooms via the substratum (straw) where the mushrooms are bred.

According to the guidelines of the EU organic farming regulation, the substratum must also come from organic grain; the application of growth regulators is not permitted in organic farming. Although the residue situation has significantly improved, last year there were, again, 3 out of 11 samples with over 0.01 mg/kg of chlormequat/mepiquat residues detected. Despite intensive investigations, the causes for these findings have not yet been conclusively identified and rectified.

Baby Food – Only the Best for the Little Ones

Infants and young children are especially sensitive, thus requiring extra care regarding their nutrition. As a precautionary measure to protect their health, their food should be as pesticide-free as possible. Only in 2002 were samples from five different companies rejected on the basis of irregularities; evidence of chlormequat above 0.01 mg/kg was detected. At that time the improper use of growth regulators in conventional pear and carrot cultivation was discovered. In the years thereafter baby foods always fulfilled the strict legal requirements and were virtually residue free.

Organic Wine – Probable Contamination via Processing

Wine grapes, mash, grape must and wines have always been targets of investigations in Baden-Württemberg because organic wines play an important role here. Moreover, many organic vineyards are on small parcels of land, directly neighboring conventional cultivation surfaces; this raises concern regarding the possibility of contamination via drifting.

Our analyses of pesticide drifting showed, nevertheless, that with the proper usage of pesticides and equipment in conventional cultivation, the small neighboring grove of organic

grapes will be only minimally affected. Organic wines made by vintners that produce wines exclusively from organically grown grapes were almost completely pesticide free.

In 2010 there were conspicuous findings regarding wine from vintners and wine cooperatives that produce both conventionally and organically: 61 % of the wine samples contained residues and 8 out of 67 were judged to be misleading to the public. In 2011 the State Institute for Viticulture and Enology in Freiburg conducted initial investigations in conjunction with CVUA Stuttgart, with whose assistance they were able to identify the source of the detected pesticides. It was shown that organic wine that is originally residue free can become contaminated when the filtration process is carried out with a filtering system that was previously used for conventional wines. In a future series of investigations it should be examined whether there are other sources of contamination from pesticide residues that occur during the process of wine preparation.

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