

The little difference

The quality of biodynamic and organically produced products in comparison orsc

from Uwe Vultureand Tabea Meischner

Dr. Uwe Geier,
B. sc. oec.troph. Tabea Meischner,
Quality development department at
the Research Ring for Biological-
Dynamic Economy eV,
Brandschneise
5, 64295
Darmstadt, www.forschung.organic

Not all organic is the same. Numerous organizations set standards for cultivation or processing that go further than the EU regulations for organic farming (EU 2007, 2008).

The guidelines of Demeter eV (for biodynamic farming) are particularly strict, e.g. B. through the obligation to keep animals in agriculture or the ban on the homogenization of milk.

Demeter eV also formulates very high food quality goals in its mission statement (see Demeter 2008).

Guidelines regulate process quality. The question arises as to whether differences can also be detected at the level of product quality between ecologically/biologically (Bio) and biodynamically (BD) produced foods.

The following will provide an overview and a commentary on the corresponding published research work.

About the method

Entries from 2005 onwards were searched in various databases (end of July/beginning of August 2011) using frequently combined keywords.

A list of the databases, homepages and keywords used can be found in the research directory at the end of the article. Older works were mostly published in www.biodynamic-research.net or the overview by König (1999).

In individual cases, articles that were being prepared were also addressed or experts were interviewed.

Only publications about the BD / Bio comparison are cited. Comparisons of BD and conventional economics, some of which exist (see

Karin HUBER et al. 2005 or BAARS et al. 2011), are not the subject of this compilation. The overview is limited to food quality in the narrower sense. Effects on soil parameters (see MÄDER et al 2002, RAUPP et al. 1996), induced resistance (see SCHNEIDER

1992) or assimilation performance (cf. KÖNIG 1988) are also not discussed.

discussion

Anyone who follows the work on the Quality of biodynamic

When you turn to food, you cannot ignore two phenomena: the image-creating methods and the biodynamic preparations. Several examinations were carried out using image-creating methods, certain imaging procedures. Pfeiffer's copper chloride crystallization and the WALA gradient method, with which most of the investigations were carried out, are not yet fully scientifically recognized.

Image production and visual differentiation have already been validated in-house (cf. KAHL 2006, ZALECKA 2007). The first scientific presentation of image interpretation is currently the subject of a research project (see BUSSCHER et al. 2010).

In some experiments, the biodynamic variant is defined as organic plus biodynamic preparations. This is understandable because the use of preparations is mandatory in biodynamic farming and represents the clearest distinguishing feature in crop production from other forms of organic farming. Since biodynamic farming represents a holistic operating concept, scientific field or vessel tests always lead to a restriction compared to reality.

Short and sweet:

- The article provides an overview of studies that compare the quality of food from biodynamic or organic production.
- Given that there are only a few studies on this question, only tendencies can be found.
- Based on the results, the authors advocate further research Differentiation of the two cultivation systems.

result Grain

The publications about biodynamic and ecological grown grain mostly come from studies on wheat from the very well documented DOK long-term trial (see MÄDER et al. 2002). In 2007, MÄDER et al. (2007) present the results of the wheat quality tests from the DOK trial, including the comparison of BD, organic and conventional. Mineral content, mycotoxins, amino acids, baking quality, food choice behavior of rats and the image-creating effect were examined. There were only significant differences between the BD and organic variants in the food choice tests and the image-creating methods.

edge differences. In only one of the two food choice tests examined was organic wheat significantly preferred over BD wheat by the rats. Using the image-creating methods, Bio and BD were rated better than the conventional variants in a blind test. When comparing organic and BD, there have been different results over the years.

STRUBE and STOLZ (2004) examined wheat samples from the DOK experiment using fluorescence excitation spectroscopy (FAS). Seed dormancy, which is indirectly measured with the FAS, is viewed by the authors as a criterion for quality. The Bio and BD variants differed significantly from two conventional variants. BD wheat tended to exhibit deeper seed dormancy than organic wheat.



FRITZ et al. (2007) examined DOK wheat from 2000 and 2005 as encoded duplicate samples. From 2000, the organic samples were rated higher than the BD samples. The samples from 2005 showed the opposite result.

ARNCKEN et al. (2007) examined the possibility of using smell and taste as methods to distinguish the development dynamics of plants from different cultivation methods. When tasting porridge samples, the BD variant was significantly preferred over the organic and conventional ones.

In a Swedish trial, the sensory quality of bread made from conventionally and organically grown wheat from six farms each was examined (KIHLBERG et al. 2006). Among the 6 organic farms there were also two biodynamic farms.

The sensory quality of the breads of the four organic and two

biodynamic farms did not differ.

Fruit results

As part of a multi-year cultivation trial at the State Training and Experimental Institute for Fruit and Viticulture in Weinsberg, the influence of biodynamic preparations was examined, among other things. The variants unfertilized, fertilized with compost (organic) and fertilized with prepared compost were tested in blind tests using the image-creating methods of rising pattern, copper chloride crystallization and round filter chromatogram according to Pfeiffer (BALZER-GRAF et al. 1998) . . The sample groups were grouped correctly. The apples of the biodynamic variant were characterized as being more typical of apples, riper and more vital than the organic variant.

Several experiments have already been carried out on biodynamic wine. This is certainly on the rise

Are Demeter foods better than others? What does the research say?

The popularity and spread of biodynamic viticulture can be attributed to this. REEVE et al. (2005) investigated organic and biodynamic farming methods in a field trial lasting several years at a winery in California, with the only difference being the use of the preparations. Nutrient analyzes of the leaf tissue, the number of grapes per vine, yield of the vine, grape and berry weight show



More secondary ingredients in biodynamic lettuce: Experiment by the University of Florence on areas of the research ring

there were no differences. However, in the years 2001 to 2003, the relationship between leaf growth and vine differed significantly, and the BD variant showed a more favorable ratio with regard to the production of high-quality wine. In one year (2003) the BD grapes had a significantly higher Brix value and tended to have higher phenol and anthocyanin contents. The authors conclude that the biodynamic preparations change the vine growth and the chemistry of the vine.

Using image-creating methods, FRITZ et al. (2009) Grapes from a long-term experiment at the Geisenheim University of Applied Sciences. Five cultivation methods were

those who came for examination with two encrypted samples each. FRITZ et al. were able to group and assign the ten samples 100 percent correctly. The two BD variants with the use of both spray preparations (horn manure and horn pebbles) led to a higher substance effect and better ripeness compared to the biological variant.

Since 2003, the effectiveness of biodynamic spray preparations has been investigated in a scientifically supervised trial on wine farms in Switzerland. Preliminary results after three years are an increase in the plant's own defense substances, an improved nitrogen balance in the plant and a generally better taste due to the use of the preparations (VAN DER M 2009).

Results for vegetables

Most of the work on biodynamic quality is on vegetables. ABELE (1978) examined the effect of manure treatment on the yield and quality of various plants in several container and field experiments. The effect of the biodynamic compost preparations was also measured in comparison with untreated manure. In the case of beetroot, the biodynamically prepared manure reduced the content of free amino acids, which are considered an indicator of immaturity. In the case of mustard, the preparation treatment resulted in an increase in the proportion of desired and one

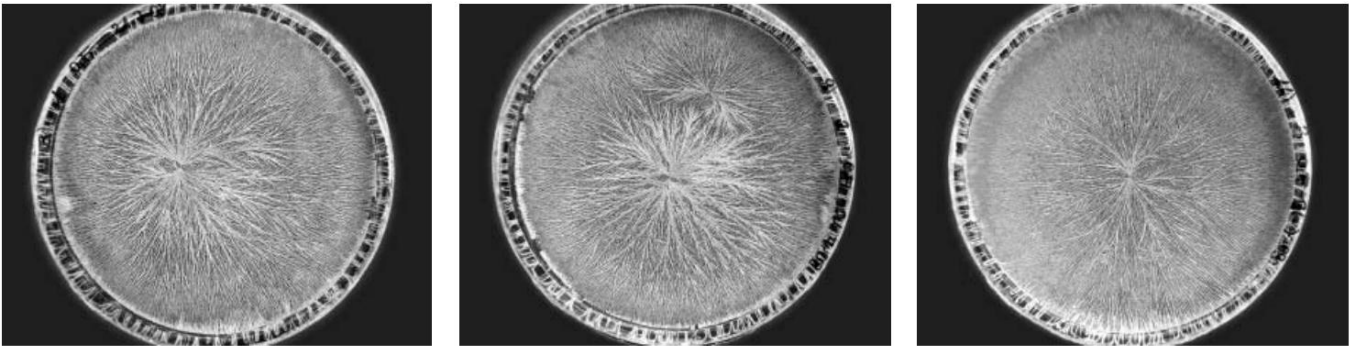
Reduction in the proportion of undesirable fatty acids.

In his dissertation, EL-SAIDY (1982) examined the effect of high levels of manure fertilization on the quality of spinach, in particular the nitrate, nitrite and vitamin C content, smell and appearance. However, with stable manure compost fertilization and the use of all seven biodynamic preparations, 24% of the vitamin C was still detectable after the spinach had been stored for eight days at 12°C, and the nitrate enrichment was only 0.5 mg/100 g The values without preparations were 3% and 7. When the compost or spray preparations were used individually, the values were in between. The use of the preparations also led to more favorable ratings for taste and appearance.

MÄDER et al. (1993) examined the quality of beetroot in five cultivation systems over three years as part of the DOK trial. The mineral, sucrose and vitamin C content, the storage life, the preference in the food choice experiment with rats and the quality using the imaging methods were examined. The variants only differed in a few criteria. The organic variant showed higher potassium contents in one year. Using the image-creating methods, the mineral fertilized (conventional) and the BD variants were rated as extremes.

The organic version was in between in the two years examined.

In recent years, some work has already been done on the effects of biodynamic



mixing preparations carried out on potatoes. SCHULZ (2000) examined, among other things, the ingredients, the technological quality, the shelf life and the taste.

The combined use of compost and spray preparations did not lead to any significant effects compared to organic farming. SCHULZ also separately examined the effects of compost and spray preparations and found, for example: T. opposite effects. Only through the spray preparations was the tuber strength significantly improved and storage loss reduced.

Through the combined use of compost and spray preparations, VON WIS-TINGHAUSEN (1973) found lower storage losses compared to a biological and mineral fertilization variant. In the storage experiments by KOTSCHI (1980), GAP

(1982), VON WISTINGHAUSEN (1984) and ABELE (1987) (cited in Schulz 2000), however, no corresponding effects were detectable.

BALZER -GRAF examined several samples from the above-mentioned DOK trial in Switzerland in 1988 using imaging methods in a blind test (BALZER-GRAF 1997), including the biodynamic variants

and organic (-biological). The biodynamic potatoes were characterized as more potato-typical, livelier, riper and less aged compared to the organic ones.

In the summer of 2008, a field trial with lettuce (red Bata-via) was carried out at the Research Ring for Biodynamic Economies in Darmstadt as part of a diploma thesis at the University of Florence. The treatments corresponded to those of the long-term fertilization experiment at the same location (see RAUPP et al. 1996), namely mineral fertilization, compost fertilization, compost fertilization with biodynamic spray preparations and biodynamic spray preparations. The polyphenol content, antioxidant potential and structure of copper chloride crystallization were tested.

In the copper chloride crystallization, the biodynamic lettuce showed a more pronounced ripeness than the organic and conventional lettuce (GEIER et al. 2011). The results of the secondary ingredients were recently published scientifically (HEIMLER et al. 2011). The anti-oxidative potential of the three variants did not differ. The content of individual polyphenols (flavanoids, geraniol, p-coumaric, p-cinnamic

Acid and anthocyanins), however, were always higher in biodynamic farming than in organic farming, and were significant for the latter two substances. The yields did not differ.

Honey

Demeter beekeeping differs noticeably from organic beekeeping, e.g. B. through natural honeycomb construction. A preliminary study examined whether differences could also be found in the product (GEIER & BUCHMANN 2010). The comparison of organic, conventional and Demeter honey from five locations showed advantages for Demeter honey using image-creating methods and image force research.

Animal products

Our literature search did not find any results about dairy and meat products. For this reason, Prof. Ton Baars and Daniel Kusche were interviewed as experts on the topic. The literature research largely confirms your assessment. A yet unpublished study by BAARS et al. (2011) about the fatty acid quality of commercial milk in Germany and

Qualitatively differentiated: Crystallization images for Salad trial in Darmstadt in 2008; from left to right: conventional, organic, biodynamic

Some European countries tend to have advantages over

biodynamic and organic farming. These may be due to different feeding intensities. A recently published paper on conjugated linoleic acid (CLA) in breast milk depending on the milk consumed (SIMOES-WÜST.) points to the consequences of these results

et al. 2011). Consuming biodynamic milk led to increased levels of the main CLA components compared to consuming organic and conventional milk.

Another preliminary study indicates certain differences in milk origins (GEIER et al. 2011; TTZ BREMERHAVEN 2010): In attempts to develop a test for food-induced emotions, Demeter and organic milk from the same dairy was also tested.

The Demeter milk showed tendential benefits in all six criteria for physical and mental well-being.

Conclusion

At the first scientific conference on "Organic Food Quality and Health Research" in Prague in May 2011, a scientist summed up organic quality research by saying that there were thousands of studies on value-adding and value-reducing substances a few dozen about biomarkers (e.g. animal experiments) and almost none about health effects. Another researcher noted at the conference that of the 140 conference papers, hardly any discussed processed foods. These statements can also be applied analogously to research into the quality of biodynamic food.

There are also some special features of research into biodynamic quality:

- There are only a few peer-reviewed publications. Only these lead to greater awareness of a topic. The situation can probably be partly traced back to the magazines. Several authors (oral communications) report on

Difficulties in accommodating studies on the topic of "biodynamics" in peer-reviewed journals.

- A series of investigations were carried out using image-creating methods. Until the methods are scientifically accepted, the results obtained with the methods can only be used to a limited extent. It is possible that some of the effects of biodynamic farming can only be seen with appropriate holistic methods.

Our research included around twenty publications, including reviews, that allow statements to be made about the quality of biodynamically produced products. This is a small number spread across different foods and over the observation period of 33 years.

Can general statements about the quality of biodynamic products be derived from this basis? With regard to differences to ecological / biological products, the results can

SOURCES

ABELE U 1978: Increased yield through liquid manure treatment. KTBL font 224, Müns-ter-Hiltrup Agrarverlag GmbH.
 ARNCKEN-KARUTZ, C (2008) Shape, smell and taste of wheat in the DOK experiment. Living Earth (3/2008), pp. 42 – 45.
 BAARS T, KUSCHE D, WOHLERS J, MOSLER S 2011: Milk quality biodynamically. Living Earth 1/2011, pp. 42-45.
 BAARS et al. (2011) Comparison of retail milk of different origins within middle and northern European countries. In preparation.
 BALZER-GRAF U (1997): Quality – an experience! Research Institute for Vital Quality, Frick/Switzerland.
 BALZER-GRAF U, HOPPE H, STRAUB M. (1998): Apples – organic and biodynamic. Harvest quantities and vital quality in

LE 5/1998, pp. 387-397.

BUSSCHER et al. 2011: Project Gestalt evalua-henheim. 453-456, Verlag Dr.Köster, Berlin.
 FRITZ J, MEISSNER G, ATHMANN M, KÖPKE U DEMETER 2008: [http://www.demeter.de/intern/Downloads/Leitbild_De-the three image-creating methods Kup-meter.pdf](http://www.demeter.de/intern/Downloads/Leitbild_De-the%20three%20image-creating%20methods%20Kup-meter.pdf)
 pattern method 1982: Post-harvest behavior and especially spinach (Spinatia et al.: Contributions to the 10th Scientific Conference on Organic consideration of nitrate enrichment in dependent Berlin.
 bility of the storage conditions and of GEIER U, BUCHMANN M 2010: Quality under fertilization. Diss. Casting.
 Regulation (EEC) No. 834/2007.
 EU 2008: Regulation No. 889/2008.
 FRITZ J., ATHMANN M., KÖPKE U. 2007: Difference and application of the holistic rentiation and identification of wheat from process biocrystallization for the sub-organic and conventional production system- Separation of wheat, carrot and ap-tems by combined application of three pic-field samples from different cultivation ture forming methods. Proc. 9th knowledge and processing steps. Habilitation.

Conference on organic farming. Ho comparison.

FRITZ J, MEISSNER G, ATHMANN M, KÖPKE U 2009: Examination of grape juice with fi leadmin/ Ferric chloride crystallization, EL-SAIDY SM rising round filter chromatography. In Mayer about vegetables, Farming. Cf. Dr. Kös-Oleratea L.) with special search for Demeter honey. Vibrant EU 2007: Earth 6/2010.
 KAHL J 2006: Development, in-house validation-

University of Kassel, Department of Organic Food Quality and Nutritional Culture.

KIHLBERG I, ÖSTRÖM A, JOHANSSON L, RISVIK E 2006: Sensory qualities of plain white bread: Infl uence of farming system, year of harvest and baking technique. J. of Cereal Science 43, 15-30.
 KÖNIG, UJ 1988: Investigation of daily rhythm and developmental dynamics phenomena on selected cultivated plants when using biodynamic spray preparations (Göttingen) dissertation.

KÖNIG UJ 1999: Results from drug research. Series of publications Volume 12. Institute for Biodynamic Research. Darmstadt.

MÄDER P., PFIFFNER L., NIGGLI U., BALZER U., BALZER F., PLOCHBERGER, VELIMIROV A., BESSON

Depending on the method, the information can be summarized as follows.

- Favorable changes in ingredients through biodynamic farming have been reported by Abele (1978), El-Saidy (1982) and Heimler et al. (2011) found.
- Tendential or partially favorable changes in the ingredients were reported by Ree-ve et al. (2005), van der Meer (2009), (Simoes-Wüst et al. 2011) and Baars et al. (2011) found.
- In several studies, no

improvement in the ingredients through

- biodynamic preparations was found (Schulz 2000, Mäder et al. 1993, Mäder et al. 2007).
- The results regarding the effect of preparations on the storage life of potatoes are contradictory. The image-creating methods were used for apple (Bal-zer-Graf 1998), wine (Fritz et al. 2009), lettuce (Geier et al. 2011), beetroot (Mäder et al. 1993) and honey (Geier et al. 2010) Advantages of biodynamic variants identified.
 - However, the results with the image-creating methods are not clear

Wheat (cf. Mäder et al. 2007 and Fritz et al. 2007).

- Fluorescence excitation spectroscopy tends to rate biodynamically produced wheat better than organic wheat.
- When evaluating smell, taste or condition, the biodynamic versus the organic variant was used by Arncken et al. (2007) better and by Geier et al. (2011) tended to rate better, while Kihlberg (with a small sample size) was unable to determine any differences.

If you combine the results into one picture, many gaps remain. However, where something becomes visible, the results usually speak, significantly or tendentially, in favor of biodynamic farming. This result appears regardless of the examination method chosen.

With a view to closing the gaps, we recommend that future comparative studies also aim for scientific publication. Further recommend

RESEARCH DIRECTORY:

THE research was carried out using the keywords mentioned below in all possible combinations for the years 2005-2011:

FOOD QUALITY – food quality; biodynamic – biodynamic; ecological agriculture – organic agriculture; Food – food, ecological – orga-nic, Demeter – Demeter, test methods – test, methods, experiment – trial,

Databases & web pages USED :
 PUBLISHING PLATFORM of Springer Science + Business Media: Springer Link <http://www.springerlink.com>
 GOOGLE Scholar <http://scholar.google.de/>
 SCIEDIRECT <http://www.sciencedirect.com>
 WILEY online library <http://onlinelibrary.wiley.com/>

ORGANIC Eprints: <http://www.orgprints.org/>
 BIODYNAMIC Research: <http://www.biodynamic-research.net/>
 LOUIS Bolk Institute: <http://www.louisbolk.org/>
 BRITISH Journal of Nutrition: <http://journals.cambridge.org/action/displayJournal?jid=BJN>
 NJAS wageningen journal of life sciences: <http://library.wur.nl/ojs/index.php/njas>
 ECOLOGICAL AGRICULTURAL SCIENCE, Department of Biological Dynamic Agriculture, publications by Ton Baars and Daniel Kusche and Jenifer Wohlers: <http://www.agrar.uni-kassel.de/bdl/?c=26&language=de>
[HTTP://WWW.AGRAR.UNI-KASSEL.DE/BDL/?C=60&LANGUAGE=DE](http://WWW.AGRAR.UNI-KASSEL.DE/BDL/?C=60&LANGUAGE=DE)
[HTTP://WWW.AGRAR.UNI-KASSEL.DE/BDL/?LANGUAGE=DE&C=61](http://WWW.AGRAR.UNI-KASSEL.DE/BDL/?LANGUAGE=DE&C=61)

We use methods that record effects on people. The greatest response is to be expected from corresponding results.

J.-M. (1993): Effect of three farming systems - GEIER U, HERMANN I, MITTAG K, BUCHECKER K (bio-dyn., bio-organic, conventional) 2011: First steps in the development of a on yield and quality of beetroot (Beta Vul-psycho-logical test on the effects of food on garis L. Var. Sculentia L.) in a seven year crop the mental well-being. (submitted to J Sci rotation. Acta Horticulturea 339: 10-31. Agric)

MÄDER P., FLEISSBACH A., DUBOIS D., GUNST L., HEIMLER D., VIGNOLINI P., ARFAIOLI, ISOLANI L, RO- FRIED P., NIGGLI U. (2002): Soil Fertility and MANI A 2011: Conventional, organic and Biodiversity in Organic Farming. Science biodynamic farming: differences in poly-phenol content and antioxidant activity of Batavia lettuce. J Sci Agric 296: 1694-1697. 2011; 91:0.

MÄDER P, HAHN D, DUBOIS D, GUNST L, ALFÖLDI T, BERGMANN H, OEHME M, AMADÓ R, SCHNEIDER H, GRAF U, VELIMIROV A, FLEISSBACH A, NIGGLI U 2007: Wheat quality in organic and conventional farming: results of a 21 year field experiment. J Sci Agric 87: 1826-1835

GEIER U, BORNHÜTTER R, POSTH E 2011: Investigations of lettuce with different types of fertilization using copper chloride crystallization (in preparation).

HUBER K & FUCHS N 2005: Nutrition quality study. Research ring materials no. 13. Darmstadt.

RAUPP, J, KÖNIG UJ 1996: Biodynamic preparations cause opposite yield effects depending upon yoiled levels. Biologist Agric. & Hort., Vol 13, pp. 175-188.

REEVE JR, CARPENTER-BOGGS L, REGANOLD JP, YORK AL, MCGOURTY G, MCGLOSKY LP 2005:

Soil and winegrape in biodynamically and organically managed vineyards. At the. J. Enol. Vitic. 56:4.

SCHULZ, D 2000: Yield and quality of potatoes in organic farming. Diss. agr. Verlag Dr. Köster Berlin.

SCHNEIDER S & ULLRICH WR 1992: Induced resistance to plant diseases. Living Earth, Vol. 43, No. 1, pp. 19-24.

STRUBE J & STOLZE P 2004: Food conveys life. Ed.: tegut... good food. Fulda.

SIMOES-WÜST AP, RIST L, MUELLER A, HUBER M, STEINHART H, THUIS C 2011: Consumption of dairy products of biodynamic origin is cor-related with increased contents of ruminic and trans-vaccenic acid in the breast milk of lactating women. Org. Agr. DOI 10.1007/s13165-011-0013-4.

TTZ BREMERHAVEN 2010: Health test for food effects: dairy products. September 2010. Unpublished commissioned study for the research ring

e.V

VAN DER MEER M, LÉVITE D, WEIBEL F, KÜFFER HEER S, HURTER U 2009: Biodynamic spray preparations in viticulture. Living Earth 5/2009.

V. WISTINGHAUSEN E., 1979: What is quality? Experiments to determine quality in field vegetable production. Living Earth series of publications.

ZALECKA A 2006: Development and validation of the gradient method for differentiating selected foods from different cultivation systems and processing processes. Diss. Agr. University of Kassel, Department of Organic Food Quality and Nutrition Culture.