On the effect of preparations in vit

Results from the first four years of the INBIODYN trial

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Interest in biodynamic viticulture has increased significantly. Based on reports and practical experience about the positive influence of biodynamic farming on soil structure, plant growth, plant health and, according to producers, especially on wine quality, Many wine-growing businesses have switched to biodynamic viticulture or are in the process of converting, often directly from previously conventional cultivation. Biodynamic wineries have very different structures. There are small cooperative winegrowers and small independent businesses as well as wineries.

Characteristics of the “Geisenheimer Mäuerchen” experimental plot	
Geisenheim district	
	Wall (M4)
Location Size 0.795 ha (7948 m2)	
Planting date March 15, 1991	
grape variety	Riesling
clone	168-30
document	Even line number: Börner, Odd line number: SO4-60
Changeover year	2006
Line direction	North South
pitch	6%
Plant form	Espalier training
Line width	2 m
Stick spacing	1.2m
Standing room/floor	2.4 m2
type of education	Flat bow
Bleed	1 fruit rod (10 eyes/rod)
Soil type	Topsoil: sandy-clay loam; Subsoil: gravelly-sandy loam

Table 1. Characteristics of the test plot “Geisenheimer Mäuerchen” (M4).

ter with several hundred hectares. The trend can be observed all over the world, whether in the built-in regions of France, Burgundy, Alsace, Champagne, the Rhône Valley, Bordeaux, or in other European countries such as Germany, Austria, Italy, Spain and Portugal and Switzerland and also overseas such as in North and South America, South Africa, New Zealand and Australia (Meissner 2010).

The following reasons are often considered Reason given for switching to biodynamic viticulture (Masson 2009, Meissner 2010):

1. Many winemakers have found a method in biodynamic farming that gives people more space. By expanding the horizon of observation with regard to soil and plant life, including the cosmos, and generally placing these observations into a larger overall picture, her work is now given an artistic and creative character.

Some of them, inspired by the experiences and observations they were able to make on their farms, are also dealing with the humanities background, anthroposophy.

2. Other winemakers whose primary aim is to constantly improve the quality of their wines were convinced by tasting biodynamic wines. The description that the wines become more finessed and that the respective “terroir” or typicality comes to the fore is heard again and again.

3. There are also some wineries that increasingly want to forgo oenological aids in wine production (pure yeasts, enzymes, fining agents, etc.). These winemakers want to produce wines that fully express the influence of the respective “terroir” and should therefore be influenced as little as possible in the cellar.

4. Still others specifically mention an improvement in good agricultural practice through the use of biodynamic preparations

- an improvement in soil structure, more intensive rooting and higher microbiological activity;
- an influence on the growth of the plants. A more balanced growth was observed here, which is reflected in a less dense foliage wall and a looser grape structure;
- the possibility of reducing the use of pesticides (copper reduction) through the use of biodynamic preparations as well

For many people, the use of different teas and plant extracts is crucial for the future of their soil.

5. Finally, there is a group that hopes to gain an advantage in the market by switching to biodynamic viticulture.

test field and
Experimental setup

The field trial to compare the management forms INtegrated (good professional practice), BIO-organic (ECOVIN guidelines) and bio-DYNnamic management (DEMETER guidelines) was repeated four times and is located in the Geisenheimer location “Mäuerchen”. . (see Table 1)

At the beginning of the experiment, an international advisory group was founded that will accompany the experiment over the years. This is made up of practitioners, researchers, lecturers and consultants from integrated, biological-organic and biodynamic cultivation.

The aim of the system comparison experimental program is to examine and optimize the cultivation practices of integrated viticulture, biological-organic viticulture and, in particular, biodynamic viticulture. The aim of the project is to examine the different effects of the management forms “integrated viticulture”, “biological-organic viticulture” and “biological-dynamic viticulture” on soil life, biodiversity in the vineyard, vegetative and generative growth vine and to examine grape and wine quality.

The biodynamic farming method and the effects of the biodynamic preparations on the vine and the wine are given special consideration in this experimental program. According to practical observations from winegrowers, horn silica applications have a visible influence on the growth of the vines. There is a wide variety of information, especially regarding the timing and frequency of application of the horn silica preparation. In addition to the variants of the system comparison, the effect of the biodynamic management variant is the logical-dynamic horn silica preparation (501) was examined in five four-fold repeated variants with different application intensities and application times (see Table 2)

Table 3 shows the different management measures within the variants.

Do biodynamically maintained vines grow differently?

Results of the test years 2006 to 2009*

*see. Meissner 2015

The results from the experimental years 2006-2009 showed that the different forms of management have an impact on the vegetative and generative

1. System comparison

- = a1 Integrated viticulture (IW)
- = a2 organic-biological viticulture (OBW)
- = a3 biodynamic viticulture (BDW)

2. Influence of the horn silica preparation depending on the treatment timing and frequency

- = b1 without 501
- = b2 3 x 501 shoots + emerging flowers + beginning of ripening
- = b3 3 x 501 emerging flowers + beginning of ripening + post-harvest
- = b4 3 x 501 pre-flowering + beginning of ripening + readiness
- = b5 4 x 501 shoots + emerging flowers + beginning of ripening + readiness to read

Table 2: Management methods of the Geisenheimer Mäuerchen experimental facility (M4)

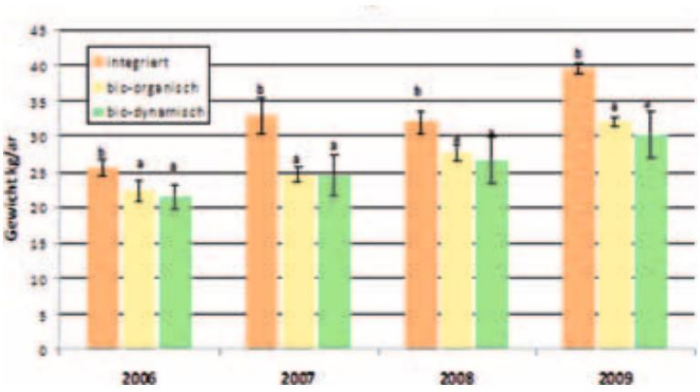

Figure 1: Less cutting required:
Lumber weights (wet weight) from 2006 to 2009 in kg/ar in the various management systems of the Geisenheimer Mäuerchen experimental facility (M4). Values with different letters differ significantly (Tukey test, ÿ = 0.05).

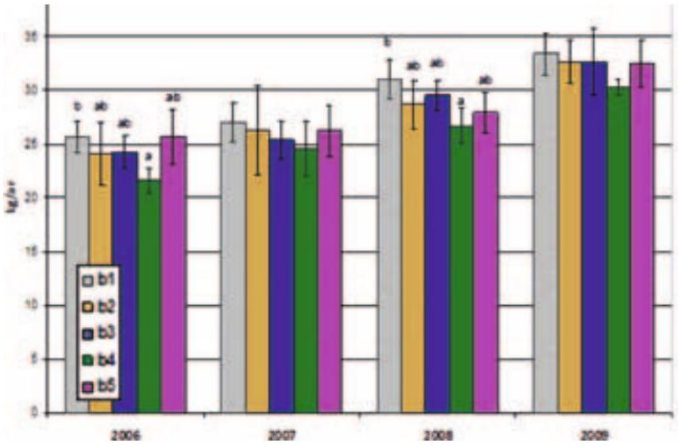

Figure 2: Without horn pebbles it grows a little differently:
Lumber weights (wet weight) from 2006 to 2009 in kg/ar in the variants of the horn pebble comparison of the Geisenheimer Mäuerchen test facility (M4). Values with different letters differ significantly (Tukey test, ÿ = 0.05).

growth of the vine. Differences in vigor in the vegetative and generative development of the vines were already observed in the first year of the study. The vigor was significantly reduced in the organic variants. This was particularly evident in the wood yield measurements (see Figure 1).

The lumber weight of the horn pebble variants was also measured in all test years.

The variant b1 (without horn pebbles) always tended to have the highest lumber weights, the lumber of the variant b4 (3 x horn pebbles), which is also the comparison variant a3 in the system comparison, always weighed the least (see illustration 2).

One reason for the reduced wood weight in the organic variants can be seen as the reduction in growth. This could be shown using the rows of leaves (cf.

Figure 3)
A looser grape structure could also be observed (cf.
Figure 4)
Smaller berries and a lower degree of compactness resulted in a reduction in susceptibility to rot (botrytis, vinegar rot) (see Figure 5).

The yield and quality recording in the years 2006-2009 showed a grape yield of up to 20% lower in the organic variants compared to integrated management. This difference in yield is coupled with a tendency to slightly increase must weighted and slightly lower total acid values.

The experimental wines of the different variants were able to be distinguished from each other during tastings. Due to the high infestation with Botrytis cinerea in the experimental years 2006 and 2008, it is difficult to evaluate the wines of these vintages, as the influence of Botrytis cinerea on the later wine may have been stronger than that of the various viticultural management systems. However, healthy grapes were harvested in 2007 and the results from this year can provide initial indications of the impact of farming systems on subsequent wine quality. The wines in the system comparison of this vintage were rated overall

	Integrated	Biological-Organic	Biodynamic
Greening	Lean grass mixture	versatile Wolff mixture	
Plant protection	organ.synth. Fungicides	Copper preparations, wetting sulfur, plant strengtheners	
Understock processing	herbicide use	mechanical understock processing	
fertilization	green waste compost, Mineral fertilization	Manure compost	with the biodyn. Manure compost treated with compost preparations
Use of bio-dyn. preparations			Horn manure and horn pebbles Compost preparations

Table 3: Management measures within the system comparison

Figure 3: Comparison of the leaf rows from the 2008 test year of the variants integrated viticulture (left), biological-organic viticulture (middle) and biodynamic viticulture (right) in the Geisenheimer Mäuerchen test facility.

eight dates with different taster groups (consisting of: students, journalists, sommeliers, winemakers), two of which were in an aged state (2 years after bottling). The wine of the biodynamic variant came first in the ranking test at 6 of the 8 tasting dates. This was significantly secured on three dates. The integrated and the organic wine each took first place once.

With the help of image-creating methods, it was possible to group and differentiate the samples from the system comparison in all test years. About the A quality ranking was created every year for image-creating methods. The vine seems to react very sensitively to the use of biodynamic preparations, which was expressed in the images (slope images, round filter chromatography, copper chloride crystallization) (see Table 3)

Further information on the effects of biodynamic Preparations on biodiversity and Plant growth can be reflected in the results of earthworm abundance, the vegetative parameters (less shoot growth, airier foliage) and the generative parameters (individual berry growth). weight and, above all, compactness). Based on the results regarding the effects of biodynamic preparations, investigations in the biodynamic context should be intensified in the next few years.

Conclusion and outlook

In the experimental years 2006-2009, consistent differences in the vegetative and generative development of the vine were found, which had an impact on grape quality and wine quality.

To characterize vegetative and generative development, a wide range of methods were used with a focus on characterizing plant morphology. A clear differentiation of the variants was possible. Significant differences were found, especially in the growth parameters. However, the investigations can still be expanded in both areas. In particular, the leaf row method with regard to growth and quality parameters should be further developed specifically for viticulture.

A development of this method and its application that meets scientific criteria would therefore be very desirable in the future.

The successful use of image-creating methods in previous experiments to differentiate samples from different cultivation systems was confirmed. These results are very promising. The method has a high potential for characterizing grape quality and for accurately differentiating test variants. The results were comparable to the results of plant morphological studies and tasting results. So that this method can be used more in viticulture, the method needs to be further deepened and developed. In particular, the application of this method for

Cultivation-related quality of grape juice
Year grape juice of the cultivation systems
2006 **b5 + b5 > a3 + a3 > a2 + a2 > b1 + b1 > a1 + a1**
2007 **a3 + a3 > a2 + a2 > a1 + a1**
2008 **a3 + a3 + a3 > a2 + a2 + a2 > a1 + a1 + a1**
2009 **a3 + a3 + a2 > a3 + a2 + a2 > a1 + a1 + a1**

Table 4: Grouping of coded grape samples from the different management systems of the Geisenheimer Mäuerchen experimental facility (M4) using the image-creating methods. "+" samples were grouped according to similar image elements; ">" Samples were judged to be qualitatively different. From left to right, first, the samples required more juice per image for similar shape formation, and second, the images of the samples showed more evidence of advanced aging.
a1: integrated viticulture
a2: biological-organic viticulture
a3: biodynamic viticulture with 3 x horn pebbles
b1: biodynamic viticulture with 0 x horn pebbles
b5: biodynamic viticulture with 4 x horn pebbles

Figure 4: Looser grapes in the biodynamic version:
Comparison of the grape structure of the average shoots of the variants integrated viticulture (A), biological-organic viticulture (B) and biodynamic viticulture (C) in the Geisenheimer Mäuerchen experimental facility (M4).

the analysis of wine could be promising.

Open questions within the system comparison are certainly the long-term effects of the different cultivation systems on soil quality and soil development. This raises the question of clearer differences in terms of microbiology, for example whether clearer differences in enzyme activities and other parameters not recorded in this work can be observed in the long term. Further, the strong influence on vegetative and generative growth of the various management systems will be continued and clarified.

Explanatory studies, such as the examination of various phytohormones, but also in-depth investigations into the ingredients, recording the water potential, the field capacity and the effects on soil structure and soil ingredients must be carried out in the future for a clear interpretation. This could then also provide clues for an explanation of the influence on the health of the vines and the health of the grapes. It remains to be seen whether the trend towards lower botrytis and vinegar rot infestations of the biological variants will be confirmed.

It would be interesting to investigate whether the different systems have an influence on the occurrence of antagonists of *Botrytis cinerea* and secondary fungi.

The investigation of grape ingredients not recorded in this work and their effects on grape quality and vine disease development could lead to further findings and these could then serve as a basis for an explanation of the influence of management systems on wine quality. In experimental years in which healthy grapes can be harvested

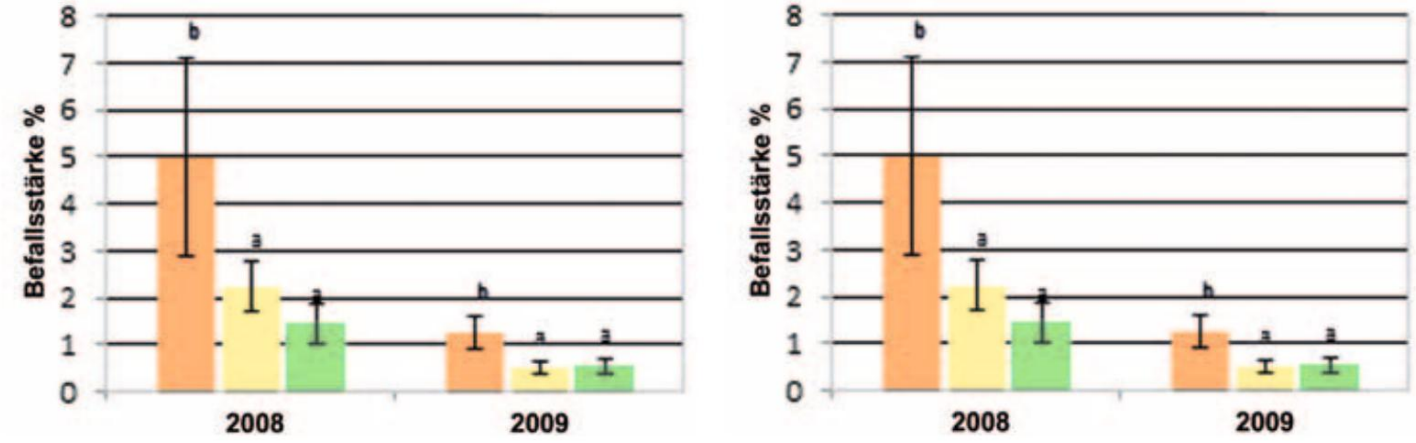

Figure 5: Less vinegar rot in organic variants:
Infestation severity and frequency of infection of the grapes with vinegar rot in % of the experimental years 2008–2009 in the various management systems of the Geisenheimer Mäuerchen experimental facility (M4). Values with different letters differ significantly (Tukey test, ÿ = 0.05).
integrated, bio-organic, biodynamic

to check whether a consistency can be determined in the differences that occurred in this work in the experimental year 2007, such as the tendency of the wines of the integrated variant to have primary aromas and those of the biodynamic variant to have secondary aromas.

The horn silica comparison test was a first tactile test to examine the influence of the horn silica preparation at different phenological stages. The trends observed here showed that foregoing the application of the horn silica preparation when using the other biodynamic preparations reduced quality from both a plant morphological point of view and the quality of the grapes and wine. The results of the imaging methods suggest that the use of the horn silica preparation at an early stage of development probably depends on the health, water and nutrient supply status of the plants.

However, these results still require further investigation be supported. The spray schedule used in the system comparison with 3 application dates of the horn silica preparation at the stages "pre-flowering", "beginning of ripening" and "readiness" showed the most favorable influence in the context of the Geisenheim location.

When the biodynamic preparations were optimally combined, the special importance of the biodynamic preparations was shown in relation to the following parameters: higher number of earthworms, more reduced and more balanced vegetative and generative growth, wine quality (in the test year 2007 in Tastings more often rated better than the organic-logical-organic variant). The analyzes of the image-creating methods showed a positive influence of the biodynamic variant compared to the integrated and biological-organic variant in all years of the experiment.

The use of biodynamic preparations promises great potential. However, a lot of research is still needed in this regard, especially regarding the optimal The time when the preparations are used in viticulture is concerned. Despite many years of use and research, little is still known about how the preparations work. Compared to other cultivated plants, the grape vine seems to be a very good model plant for more intensive preparation research, as it reacts comparatively clearly to the use of biodynamic preparations.

The switch from integrated farming to organic-organic or biodynamic viticulture seems to be a promising option.

Positive effects on soil life, biodiversity in the vineyard, the vegetative and generative growth of the vine and on the quality of the grapes and wine were found. Some of the observed effects could be enhanced through the use of biodynamic preparations.

literature

Masson, P. (2009): De l'agrobiologie à la viticulture biodynamique. In: Lamine, C. and Bellon, S. (2009) L'agriculture biodynamique. Transitions vers l'agriculture biologique. Pratiques and accompaniments for innovative systems. Éditions Quæ / éducagri éditions.

Meissner, G. (2010): Biodynamic viticulture, dynamic development for special wines. In: Ecology and Agriculture 154 (38th year), issue 2/2010, pp. 28-29.

Meissner, G. (2015): Studies on various management systems in viticulture with particular attention to biodynamic farming and the use of biodynamic preparations. Dissertation, Justus Liebig University Giessen.