Studies for use in organic viticulture

# POTENZIERTE BIODYNAMIC PREPARATIONS

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*“The aim was to investigate whether*
*“With potentized biodynamic preparations, phenomena can also be observed as with classic biodynamic preparations.”*

Developed at the pioneering times of organic farming Rudolf Steiner introduced new methods and perspectives for agriculture in the early 1920s, which later became known as biodynamic farming. It differs from organic-biological agriculture, among other things, in the targeted use of ferments, the “biodynamic preparations”. Back in the early days of biodynamics, Rudolf Steiner and Lily Kolisko carried out basic research together on the effects of these preparations in the form of homeopathic potentization. Lily Kolisko continued these experiments and repeatedly demonstrated their effectiveness over 30 years (The Agriculture of the Future, 1953).

Although they have been known for almost 100 years, the potentized preparations and their possible uses have not yet been taken into account. Compared to the classic form of preparations, potentized preparations offer several advantages in agricultural practice. After completion, they can be stored for months and therefore do not need to be stirred for another hour before being used. They can be applied as required by the crop and in combination with other field work. Compared to the classic, one-hour dynamization (30-60 l / ha), only 2 l / ha of the potentized preparation are added to a comparable amount of water. The set-up times, which are often a capacity bottleneck in larger areas or in vegetable cultivation, are significantly shorter due to the elimination of stirring.

The aim of the project presented here was to investigate whether phenomena can also be observed with potentized biodynamic preparations as with treatment with classic biodynamic preparations. From long-term experiments at Geisenheim University in the INBIODYN project, it is known that the grape vine responded significantly to treatment with biodynamic preparations with reduced vigor and a looser grape structure. Copper crystallization images of the wine could be clearly assigned to the corresponding form of cultivation, biodynamic or integrated-conventional (Meißner, G. 2015).

The minimum requirement of a hypothesis for this project is: Both biodynamic processes must differ significantly from a 0 control in terms of the parameters of vigor and loose grape structure. Since the test areas were on farms that were already managed biodynamically, the possibility of a comparison with an untreated, zero-organic variant was only possible to a limited extent. A zero-organic variant could only be implemented at the Geisenheim locations and in the conversion companies Philine Isabelle Dienger and Pranzegg. Differences could be found here. However, the small number of samples makes statistical evaluation difficult.

On the assumption that the biodynamic preparations, both in their classic and in their potentized form, have an influence on the vigor and grape structure of the vine, a “+ variant” was developed instead of the zero=organic variant. The “+ variant” pursues the second hypothesis that an intensified use of biodynamic preparations in potentized form would lead to measurable differences compared to the classic biodynamic (common company) and the equivalent variant with potentized preparations. The + variant follows an extended treatment plan that is tailored specifically to the stage of development of the grapevine based on biodynamic principles.

## Methods

To assess the experimental question, the biodynamic preparations in their classic form (variant commonly used in the company) were replaced with their equivalent in potentized form in an on-farm interlaboratory trial in 2020 at eight different biodynamic wine-growing operations and at the Geisenheim University and by the companies at the same time like the classic preparations (variant equivalent), each in the same amount of water. In 2021 and 2022, the focus of the trials on the question of vine health was continued with the + variant (report to follow). The parameters growth and bending index were recorded in all years.

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The partner companies selected the test plots on their farms in advance with a view to ensuring homogeneous vine development as a strip system without repetitions.

- Variant 0: BIO (biological-organic), where possible.
- Variant 1: BB (biodynamic standard): preparations, Fertilization and plant protection according to normal company standards.
- Variant 2: BPÄ (Biodynamic Potentiated Equivalent): The biodynamic preparations in their classic form are replaced with their equivalent in potentized form at the same time of use. Fertilization and plant protection according to normal company standards.

- Variant 3: BP+ (Biodynamically Potentiated +): Application potentized biodynamic preparations according to an extended treatment plan tailored specifically to the stage of development of the vine according to biodynamic aspects.

Fertilization and plant protection were carried out according to the usual company standards. To determine growth, 4 representative shoots were measured on 12 vines for each test variant (from 2021 on 3 shoots on 16 vines). The first and last shoots on a rod were excluded from the outset. The following values were recorded: shoot length, leaves on the main shoot, stingy shoots and leaves on the stinger shoot. The vigor index was calculated from this data as follows:

- The internode length is a measure of the dominance of the shoot - growth and results from: shoot length/leaves. The larger the quotient, the higher the vigor. Stinginess shoot activity is an indicator of high vegetative growth and results from: GA = stinginess shoots/shoot length. The larger the quotient, the greater the vigor. The stinginess shoot dominance (GD) describes the intensity of the vegetative growth over the length of the stinginess shoots: = leaves-stinginess shoots/stinginess shoots. The larger the quotient, the higher the vigor. The vigor index is the product of these three quotients. This reduces the number of shoots and the length of the shoots.

  Vigor (W) = number of leaves on the stinger shoot/number of leaves on the main shoot.

- With the help of rows of leaves, the assessment of the vigor of the vine is visually supported (Meißner, G. Geisenheimer reports 2015). A shoot is selected for the photo that corresponds to the average (length, number of leaves, secondary shoots and leaves of the secondary shoots) of the respective experimental variant.

To determine the bending index, the grape structure of 100 grapes per variant is recorded shortly before the harvest. The classification is made into 5 rating levels (Meißner, 2015). Determining the bending index is a simple method for assessing the grape structure. This is an important indicator of grape development from flowering to ripeness. In addition, the grape structure has a major influence on the health of the berries. Compact grapes tend to suffer berry injuries due to pressure from neighboring berries; they are also less ventilated and therefore more susceptible to pathogens. To determine the bending index, the grapes are bent in on themselves without causing any injuries to the grape.

The bending ability is recorded in angle degrees in 5 categories. The spectrum ranges from category 1, bendability 0° (the berries are deformed by pressure from neighboring berries) to category 5 (bendability with an angle over 90°).

Qualitative investigation using copper crystallization analysis:
For the crystallization images of the grape must, a mixed sample of the berries for each variant was harvested shortly before the harvest. In order to achieve meaningful results with this method, reference samples and many years of experience are required. The investigations were therefore carried out by the Oenocristal Institute in France, which has several decades of experience in copper crystallization analysis of grape must.

## Results and discussion

From a statistical perspective, four repetitions are usually used to record measurement errors that can arise randomly from the test location. However, since on-farm tests are intended to reflect real operational practice, repetitions on site cannot be carried out. Since no random

Tab. 1: VARIANTS WITH biodynamic PREPARATIONS IN TRIAL

| Substances used BB | | BPÄ | BP+ |
|---|---|---|---|
| **Hornmist** | 2x | 2x D6 | 2x D6 |
| **Hornkiesel** | 2-3x 2-3x D6 + Apis C6 2-3x D6 + Apis C6 | | |
| **Flatbread preparation** | 0-1x | 0-1x D6 | 2x D6 |
| **Hornmist** | | | 1x D6 + Lime D10 |
| **Hornturmalin** | | | 1x D7 |

*Use of preparations: BB = biodynamically standard,*
*BPÄ = biodynamically potentiated equivalent,*
*BP+ = biodynamically potentiated with a special treatment plan;*
*Zero = organic version without preparations.*

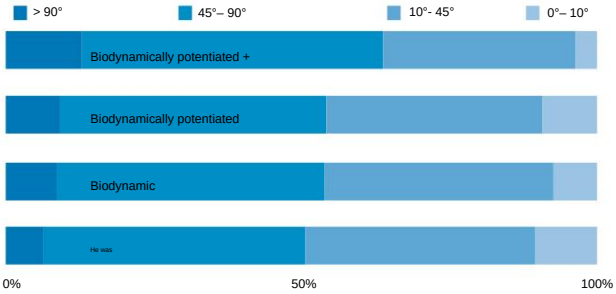
Table 2: WINERY, VARIETIES, REGIONS INVOLVED

| grape variety | Region | winery |
|---|---|---|
| **Zweigelt** | Burgenland | Feiler-Artinger |
| **Chardonnay** | South Tyrol | Alois Lageder |
| **Chardonnay** | Piedmont | Ph. I. Dienger |
| **Gewürztraminer** | South Tyrol | Pranzegg |
| **Riesling** | Palatinate | Ö. Rebholz |
| **Dornfelder** | Palatinate | Sven Leiner |
| **Riesling** | Rheingau | Geisenheim |
| **Pinot Blanc** | Alsace | Patrick Meyer |
| **Pinot Blanc** | Breisgau | Zähringer |
| **Pinot Noir** | Breisgau | Zähringer |

Fig. 1: Rows of leaves for the vigor of the vines


*A lower rate is typical for biodynamically treated vines Miserly instinct activity. The miserliness is more towards the middle part of the shoot, the grape zone is better ventilated (location: Pranzegg, South Tyrol 2020).*

Fig. 2: BENDING ABILITY OF THE GRAPES

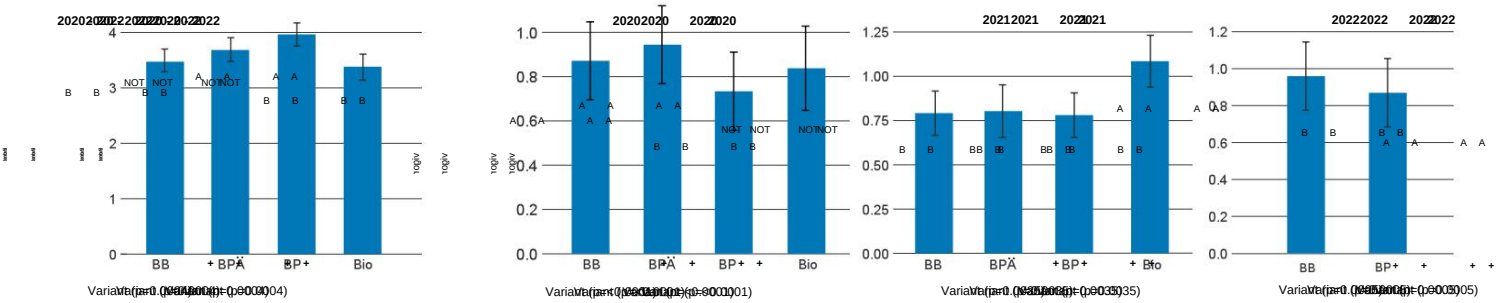



*Bendable grapes have a loose berry structure and good ventilation (location: Geisenheim University 2020, no statistical analysis is available for the individual location).*

Although repeated repetitions within the location could be carried out, the interaction between location and variant cannot be estimated individually. Furthermore, the evaluations for the respective year cannot be guaranteed to be transferable to further test years. However, if several locations are examined within one year, the locations can be counted as a true repetition in the statistics; statistically, the treatment effect can be estimated separately from the location effect. For this project we therefore worked with 8 repetitions.
To further confirm the results, the experiments were repeated over 3 years with the same treatment on the same vine. Ideally, new rows of vines or locations would be selected for each experimental year. However, from a biological background it is important to carry out the same treatments on the same vine over the years. It is assumed that

The respective treatment results in different adjustments to the vine's metabolism. The data were evaluated using mixed linear models. The effect of the treatment, the place and the year, as well as the interactions were taken into account. Repeated measurements on the same row of vines and variance heterogeneity of the data were taken into account. A significance test for the treatment effect was performed using ANOVA. If a significant effect was observed, an LSD test followed to further observe which treatments differed. When comparing the bending indices, differences can be seen between the variants, both in the comparison of individual years and over the period of 3 years.
According to the hypothesis, the + variants (BP+) show the significantly highest value for a loose grape structure in all years and an overall index of 3.57. Between the other variants

Fig. 3: Bending index over all three years of testing shows differences to normal operational use




*Bending index over all 3 years of testing, depending on the respective treatment variant. Results with unequal letters are significantly (p = 0.0004) different in the LSD test.*

*Index of vigor for the experimental years 2020-2022 with the respective significance level in the LSD test. Results with unequal letters are significantly different (p = different, see respective diagram) Reference: mean of all variants of the respective year. In 2022, the organic and BDÄ variants were discontinued.*

Fig. 4: Must in the CuCl crystallization image from the variants

***Variant BB*** *(biodynamic standard)*

*This variant has in its development and the continuity of their growth always backlog storage. Overall, however, she has succeeded in developing strong and powerful vital energies. The berries themselves remain vulnerable, but the actual The actual damage turns out to be extensive lower than expected considering the scars and sluggishness of the vines.*

***Variant BPÄ*** *(Biodynamic Potentiated Equivalent)*

*Very similar to usual but more homogeneous in maturity, it offers more potential and requires less care in winemaking. The existing balances are active (not yet fully developed at the time of the study, but able to achieve this development without wear or loss). When tasting, the grape is certainly a little more complex than usual. With the same attacks, she performed better, which shows that her metabolic process was more successful.*

***Variant BP+*** *(Biodynamically Potentiated +)*

*It is the most powerful Variant, what the quality of the elements-Signature and thus also the homogeneity in ripeness. The mass exchange processes in the phloem-xylem stream were better and the perception of biodynamic cultivation practices was more visible than in the other two. The more powerful immune system allows for optimized playback in the end result.*

The differences were not significant in any of the years. With an index of 3.41, the equivalent variants (BPÄ) occupy a middle position compared to the standard variants (BB) with an index of 3.24. The most compact grapes were found in the organic varieties with an index of 3.22.

The following picture emerges for the growth parameters over an observation period of the individual reporting years: Compared to the equivalent variants, the +variants show the lowest growth in all test years. The standard operational variants occupy a middle position. In 2021, the organic version shows the significantly highest vigor. No differences were found between the biodynamic variants.

In this experiment, the analysis using copper crystallization images serves to compare the ability of the vine to react appropriately to environmental factors such as heat, water stress, pathogens, and to assess the quality of the must.

The standard variants show the uniformity and differentiation in the crystal image, as well as organ-typical characteristics, which are typical for the biodynamic farming method. These treatment-related features were more evident in the + variants. In particular for the criteria of connection to the terroir and functionality of the immune system, as well as in the quality aspects of the must. The equivalent variants occupy a middle position. The differences were somewhat smaller and more similar to the standard variants.

All in all, at the end of this project with the potentized preparations there is an innovative approach that, when used appropriately, could have a positive effect on the health of the vine and the quality of the wine, the mode of action and general effectiveness of which should be further investigated.

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