

THE AGRICULTURAL ORGANISM AS A SUBJECT OF RESEARCH

LONG-TERM TRIALS ON BIOLOGICAL-DYNAMIC CULTIVATION IN SCANDINAVIA 1958–1990



RESEARCH

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(Translation Jürgen Vater)



ABB: Basic description of the nutrient cycle in the farm organism with crop rotation (clover grass and crops), animals, farmyard manure, the soil worked by the farmer

(Drawing: Alexander Westerlund, Demeterbund, Järna)

In 1949, a research ring for biodynamic farming, the Nordisk forskningsring för biodynamisk odling, was founded in the Nordic countries of Sweden, Finland, Denmark and Norway. Biodynamic farmers, consultants and researchers had annual meetings within this framework. Based on Rudolf Steiner's agricultural impulse and the experience and experiments they subsequently gained, they wanted to work together to develop biodynamic cultivation under Scandinavian conditions. A corresponding research institute was set up in Järna, Sweden. The first long-term comparative field trial was established here in 1958. He included eight fertilization regimes in a four-year crop rotation, with annual clover sown in spring wheat. Each fruit was grown every year, without repetition. Four fertilizer regimes were fertilized differently organically (biologically dynamic, composted stable manure and field spray preparations, biodynamically composted stable manure without field spray preparations, organic with fresh stable manure, and the combination of organic and mineral fertilization), according to the calculated manure production operating system. Three fertilizer regimes were only mineral fertilized in three different stages, and one regime was without fertilization. This so-called K trial was carried out for 33 years, the second longest comparative trial with biodynamic and organic cultivation. A laboratory was set up to examine the quality of the products from the experiment, but also those from biodynamic cultivation. Various methods were developed there to show the quality of products, such as shelf life tests, decomposition tests and copper chloride crystallization, which was introduced into Nordic work by Magda Engqvist. The results of product studies from various

Between 1971 and 1979, comparative experiments between biodynamic and conventional cultivation were started and carried out. They were designed in such a way that they also included repetitions and enabled statistical evaluation. Several scientific papers were published on this subject: Bo Petterson 1970, 1982, Josef Dlouhý 1981, Lennart Salomonsson 1986. According to the studies, the differences in crop yields were less than ten percent, and statistically reliable results showed a higher quality of the biodynamic products in terms of properties.

Tens such as the composition of the protein (proportion of essential amino acids in bread cereals and potatoes) showed higher nutritional values, lower nitrate levels and better storage behavior. Using multivariate statistics, it was later confirmed that biodynamically cultivated plots had better quality in all years than the corresponding conventionally cultivated plots (published internationally by Kjellenberg and Granstedt 2015). However, the annual, clover-rich pasture in the crop rotation had a negative effect on the nutritional quality of the following crop.

From plot experiments to farm studies: an important one method

With regard to the environmental debate of the 1970s, it was important to study entire farms and their impact on the environment. The question was how an entire agricultural operation can manage its nitrogen supply without the nitrogen from commercial fertilizers. From 1981 to 1987, two biodynamic farms in Järna in central Sweden and one such farm in southern Sweden were compared with conventional, specialized arable farming and animal husbandry farms. On all farms, nitrogen processes in soil and seeds, consumption through animal husbandry, fertilization and the balance between supply and removal were tracked and presented at farm level (Granstedt 1990). Here the basic principles of agriculture based on cycles were shown, in which the losses of plant food are minimized by adapting animal husbandry to one's own feed production as well as balanced crop rotations with nitrogen-fixing legumes.

These investigations were followed by further farm studies and finally the Baltic Sea project BERAS. On the basis of farm studies in the Baltic Sea region, a guide for biodynamic cultivation in this region was shown in order to reduce the discharge of fertilizer salts into the sea.

Exact experiments in biodynamic farm organisms

In the agricultural course, Rudolf Steiner asks the question: Does it make a difference whether we take the manure from the neighboring farm or from our own farm? Steiner presents the farm not just as an ecosystem, but as an individuality that should be self-sufficient as much as possible. If funds are allocated from outside

leads, they can be viewed as remedies. The agricultural organism is described as an individuality that is upside down and has a spiritual dimension. The plants on the farm grow in the part that can be compared to the belly. This is where the farm's metabolism with animals and manure takes place. If you take this picture seriously and carry out experiments with manure, it is important to use manure from your own animals, whose feed comes from the agricultural organism's own resources. This is likely to be particularly important when carrying out experiments in which biodynamic preparations are to be tested.

In 1991, a comparative study began on the Skilleby farm, which after five years covered all crop rotations on the farm. The question concerned the effect of composting or non-composting as well as the influence of the use of biodynamic preparations on crop yield and the quality of the products. The adaptation to the farm made the experiments different from other experiments in the field of biodynamic farming.

Composting and biodynamic preparations: their effect on yield and soil organic matter

A general difference when using uncomposted manure compared to composted manure could not be shown during the first test period. However, the results indicated that composted manure with and without biodynamic preparations can produce a slightly more plentiful harvest in dry conditions in spring.

The experiments show that the main nitrogen supply comes from the soil and can be attributed partly to the previous year's fruit and partly to the mineralization of the humus layer of the soil. It is clear that the majority - in this experiment 80 to 90 percent - of the manure nitrogen in organically decomposed manure is used to maintain the humus reserve and thus the longer-term mineralization capacity of the soil. These long-term effects were studied under the conditions of the experiment.

Effect of biodynamic preparations in cultivation

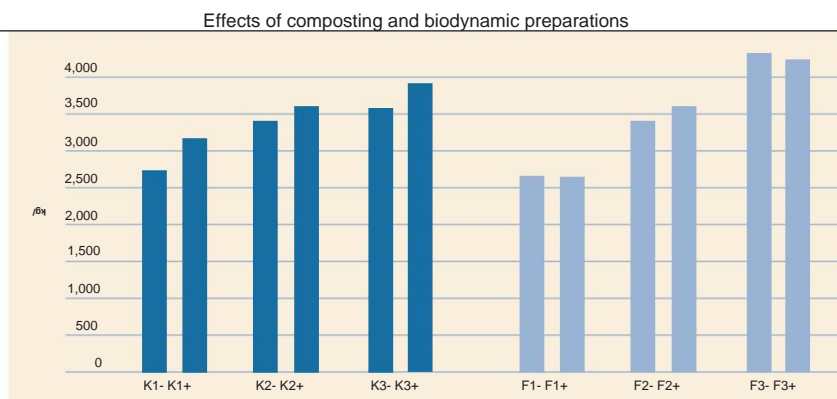
In five out of six years, the yield of winter wheat was higher with the use of biodynamic preparations in the plots and with biodynamically prepared and composted manure, on average 5% for the entire period. In particularly poor growing conditions - in 1993 - it was significantly higher. Previous studies have also shown that the effect of the preparation is systemic: the biodynamic spray preparations have a particularly yield-increasing effect when conditions for lower yields prevail. This is also evident from the crop yield with different fertilization levels of uncomposted and composted manure (Fig. 1).

It seems to be the case that the effect of the preparations in the form of higher yields can mainly be demonstrated in combination with the use of manure composted with the biodynamic compost preparations. The effect continued even after treatment with manure, which increased yields and total protein. The test results also indicate that it is not the use of nitrogen in the manure that produces the more beneficial effect, but rather the use of the accessible amount of nitrogen in the soil. The existing archive samples from these tests could enable further tracking of the quality properties.

The long-term effect on soil fertility

Trials at Skilleby continued for twenty years until 2010. The organic matter in the soil, measured as organic carbon, increased in all experiments. In two fields with crop rotation, significant increases were found when using composted manure as well as biodynamic preparations. In field 1, where the experiment began, the increase was an average of 400 kg C per hectare per year from 1991 to 2005 (Fig. 2). Composted manure with the application of biodynamic field and compost preparations each year increased the organic matter in the growing soil by 10 percent, compared to the application of uncomposted manure without preparations, where the increase was seven percent (Fig. 3).

Fig. 1: THE USE OF BIODYNAMIC PREPARATIONS APPARATUS FOR MANURE COMPOSTING AND ON DEM FIELD resulted in significantly higher yields (+10%) in composted manure treatments. Mean yield of winter wheat in 1996 and 1997 with composted manure in three fertilizer levels (12.5 or 25 or 50 t) (left: K1, K2, K3) or uncomposted manure in three fertilizer levels (right: F1, F2, F3) • treated without (-) and with (+) biodynamic preparations.



The application of the preparations resulted in the clearest effect at the beginning of the experiment: significantly higher organic matter content in the rows with uncomposted and composted manure. In contrast to other experiments, this effect of different fertilizations and the importance of the preparations could be documented individually and in combination.

Summary: Composting and preparation increase humus content

Long-term trials with fertilization variants to compare biodynamic, organic and conventional cultivation began in Järna in 1958. Since 1990, farm trials have been carried out with studies of entire cultivation systems, supplemented by detailed trials within the farm organism itself. This made it possible to understand the importance of the application of fertilizer from your own farm. The tests showed that biodynamic preparations can increase crop yields, especially at low harvest levels. Composting and the use of both biodynamic compost and spray preparations each individually improved the organic matter of the soil. Both treatments together had the greatest effect: 10% more humus in 14 years. Here, when combined with clover cultivation and manure from our own farm, there are means of increasing the fertility of the soil. At the same time, this contributes to reducing the climate crisis by binding carbon dioxide from the atmosphere. Future reports will also address the question of what could be demonstrated as a consequence of the different treatments in terms of the quality of the products. Further experiments are currently aimed at liquid fertilizer in comparison to composted, solid fertilizer within the biodynamic farm organism. •

SKILLEBY FARM IN JÄRNA: biodynamically operated since 1967 • 20 to 35 m above sea level • annual rainfall Ø 655 mm • annual average temperature 6.2° Ø • arable land 57 ha

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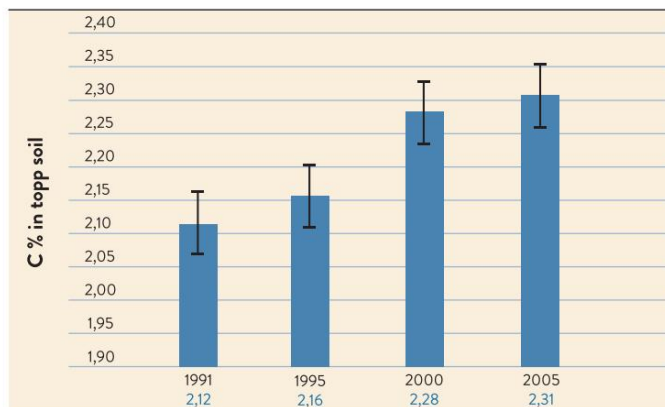


FIG. 2: AVERAGE ORGANIC CONTENT

CARBON IN THE TOP SOIL, 0 to 20 cm, in 1991, 1995, 2000 and 2005 across the 12 variants as part of the farm trials at Skilleby. The small dashes indicate standard deviations.

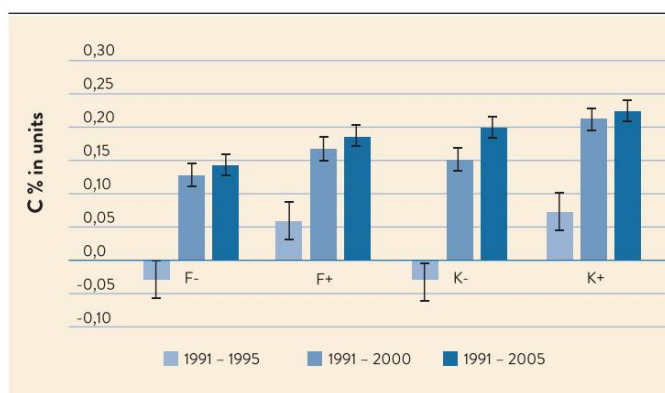


FIG. 3: MANURE COMPOST PLUS BIODYNAMIC PREPARATIONS

MAKE A DIFFERENCE. Average increase in organic carbon content in the topsoil in treatments with uncomposted manure without biodynamic preparations (F-) or with preparations (F+) as well as with composted manure without (K-) and with (K+) preparations for the years 1991 to 1995, 1991 to 2000 and 1991 to 2005. The small lines show the standard deviations: if the difference between the columns is larger, the variants differ.

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