

Biological Dynamic Farming – An Occult Form of Alternative Agriculture?

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Abstract *An analysis of the theory of biodynamic farming is presented. The founder of biological dynamic agriculture, the Austrian Rudolf Steiner, Ph.D., (1861–1925), introduced methods of preparation and use of eight compounds forming the nucleus of his agricultural theory. His instructions were based on insights and inner visions from spiritualistic exercises and not on agricultural experiments. His purpose was to show mankind a form of agriculture that enables not only the production of healthy foods but also the achievement of harmonious interactions in agriculture and a spiritual development of mankind through “cosmic forces” captured in the foods. However, many of his statements are not provable simply because scientifically clear hypotheses cannot be made as his descriptions were unclear and not stringent. Those predictions that can be tested scientifically have been found to be incorrect. It was concluded that Steiner’s instructions are occult and dogmatic and cannot contribute to the development of alternative or sustainable agriculture.*

Keywords: *biodynamic compounds, alternative agriculture, food test, spiritualistic purpose*

Introduction

Biological dynamic (bio-dynamic) agriculture is part of a comprehensive philosophy called anthroposophy. Anthroposophy means knowledge of mankind (from the Greek: antropos = mankind, sofia = knowledge). The founder of the anthroposophic philosophy was the Austrian Rudolf Steiner, Ph.D, (1861–1925). At Whitsun in 1924, June 7–16, Steiner held an agricultural course for about 60 persons in Koberwitz near Breslau (today the Polish Wroclaw) that included eight lectures and four lessons with questions. These lectures, published in a book entitled “An Agricultural Course”, may be regarded as the birth of biodynamic farming and constitute the first alternative form of agriculture in

Europe (Steiner, 1975). The name “biological dynamic farming” was not used by Steiner but was later introduced by some of the participants in the course.

Steiner’s justification for wanting to introduce a change in agriculture is also mentioned in the agricultural course: “agricultural products have become degenerated and, in the long run, cannot be used as food for humans”. The use of chemical fertilizers, especially the use of inorganic N, was regarded as the main reason (first lecture). He was convinced that the quality of foods was continuously deteriorating, with negative consequences for mankind (introduction). By omitting the use of chemical fertilizers and pesticides and by giving recommendations on how “cosmic forces” could be harnessed and used to control biological processes, the degeneration of quality could be stopped and a direction shown for new agricultural production. Nature’s own material from the mineral, plant and animal kingdoms would be used for this purpose. A harmonious interaction could be created between agriculture, forestry, horticulture and the natural ecosystem. Mankind would be blessed as a result of a biological dynamic agriculture.

Brief History of the Biological Dynamic Farming

The agricultural course held by Steiner was initiated by a small group of agriculturalists, members of the anthroposophical society, who had put questions to Steiner about their observations on the decreasing quality of food and plant seeds and the increase in diseases among farm animals and plants (Koepef et al., 1976). They wished to know how these observations could be explained and what one could do about them. When Steiner presented the agricultural course, the participants were rather surprised and initially decided to treat the information as confidential. Steiner mentioned to Pfeiffer (1970) that it was now important to apply his ideas to practical agriculture. A number of the participants in his lectures immediately took up these ideas and established a group to test the methods given in cooperation with the anthroposophical centre (Goetheanum) in Dornach, Switzerland. The application of Steiner’s agricultural ideas became the most important task in their lives. By and by, Steiner’s agricultural course was translated into other languages. The further expansion of biological dynamic farming can be traced back to the work of convinced, anthroposophical agriculturalists. In the 70 years that have passed, many people in many different countries around the world have worked with biological dynamic agriculture but bio-dynamic farming does not represent more than 1% of the total farmed area in Europe (Lampkin, 1993).

As biological dynamic farming excludes the use of inorganic fertilizers and pesticides, it is today placed side by side with other forms of alternative agriculture and has a good reputation. Like other forms of alternative agriculture, it is regarded as an environmentally correct form of agriculture producing healthy foodstuffs. Today, representatives of biological dynamic farming often stress that Steiner’s concept of farm management was based on a picture of a farm as a largely self-contained integral whole with the aim of utilizing the farm’s own

resources to achieve sustained fertility and sound production systems (Sattler and von Wistinghausen, 1992). They also claim that their method is probably the oldest environmentally conscious farming practice in existence (Sattler and von Wistinghausen, 1992). However, Steiner did not initially intend his agricultural course to introduce an environmentally adapted farming method. He did not talk about how to reduce ammonia losses from animal manures on a farm, how to reduce nitrate leaching from agricultural soils into groundwater after manuring, or how to use township waste to recirculate plant nutrients. Steiner introduced a form of farming in which biodynamic preparations are given the central role. The aim was to influence organic life on earth through “cosmic and terrestrial forces” in the right way, which he regarded as lacking in agriculture.

Intention of this Article

Information on bio-dynamic agriculture is mainly presented by anthroposophical agriculturalists whose interpretation of experimental results related to the use of bio-dynamic preparations is invariably positive and uncritical (Koeppf et al., 1980; Sattler and von Wistinghausen, 1992). Others who have commented on Steiner’s approach to agriculture have been unsympathetic to the underlying perspectives regarding allegedly cosmic and terrestrial forces in food production (Jansson, 1948; Finck, 1982). In this article, an effort is made to give a sympathetic presentation of Steiner’s ideas concerning alternative farming methods but to evaluate his ideas according to rigorous scientific criteria. The community of agricultural scientists is morally obliged to undertake such an investigation.

Production and Use of Eight Compounds Form the Nucleus of Biological Dynamic Agriculture (Lectures 4 and 5)

Steiner introduced methods of manufacturing compounds, preparing organic compost using these compounds, and recommendations on control of weeds and pests. By means of these compounds, it would be possible to supply soil and plants with “cosmic forces” and the influence of both “terrestrial and cosmic forces” could be controlled. There are eight compounds, two field compounds and six compost compounds, that are the nucleus of biodynamic farming. The compounds are made from quartz, cow manure and six different plants together with animal organs. Steiner thought the principle of manuring to be as follows: “The purpose of manuring must be to vitalize the soil. Added to manure in the right way, these will stimulate vitalizing and harmonizing processes in soil” (Lecture 4).

Field Compounds

Humus compound (designation 500) is prepared by putting cow manure into cow horns, burying them in the ground (40-60 cm) and allowing them to decay during the winter. Silica compound (designation 501) is made by filling cow horns with finely-ground quartz powder, burying them in the ground during the

summer, and taking them up in the late autumn. The humus or silica compounds are stirred in 40–60 liters of warm water for one hour under turbulence whereby the direction of the circulation is changed about every second minute. About four cow horn fillings of the compounds are used per hectare of arable land. The humus compound is used at sowing and on grass and grazing land, whereas the silica compound is used on other crops.

Compost Compounds

Flowers of yarrow (*Achillea millefolium*) (*designation 502*) are pressed into the urine bladder of a red deer stag placed in the sun during the summer, in the soil during the winter, and dug up in the spring. *Flowers of scented mayweed* (*Matricaria chamomilla*) (*designation 503*) are put into the small intestine of a cow, buried in humus-rich soil in the autumn and taken up in the spring. *Whole plants of stinging nettles* (*Urtica dioica*) (*designation 504*) are embedded in peat and placed in the soil for an entire year. *Oak bark* (*Quercus robur*) *chopped into small pieces* (*designation 505*) is placed in the skull of a domestic animal, embedded in peat and buried in the soil in the autumn at a place where large amounts of rain water run past. *Dandelion flowers* (*Taraxacum officinale*) (*designation 506*) are pressed together, placed in the peritoneum of a cow, buried in the soil in the winter and taken up in the spring. *Flowers of valerian* (*Valerian officinalis*) (*designation 507*) are extracted in water. One to three grams of each compost compound is added to organic manure by placing it in the manure pile in holes about 50 cm deep spaced at 2 m. The valerian extract is diluted with 5 L of water and sprayed over the entire surface of the compost.

Cow horns used for preparation of the humus and silica compound are regarded as antennas for receiving and concentrating “forces” into the materials put inside. According to Steiner, the specific powers of concentration that lie in the cow horn, are utilized through the field compounds (humus and silica compounds). The humus compound provides an immensely concentrated fertilizing power for the soil with vigorous vegetation as a result. It is designed to enhance the “powers that come from the earth”. The silica compound enhances “forces that come from the cosmos” because, according to Steiner, the function of silica in the soil is to mediate cosmic activities connected with light and heat.

The six compost compounds fulfil different functions both individually and in combination. The yarrow compound contributes to control the reactions of sulphur and potassium in order to enable the soil to take up cosmic radiation. The camomile compound has a relationship to potassium and calcium and mediates health-giving powers to the soil to keep the crop healthy; it stabilizes the nitrogen in manure. The stinging nettle compound takes away the “iron effect” in the topsoil and makes the soil “reasonable.” The oak bark compound supplies calcium in an ideal form and the effects of calcium shock are avoided. The dandelion compound allows vegetation to make use of silicic acid from the atmosphere in correct amounts, which makes the vegetation sensitive to the surroundings and the plant itself can absorb what it requires. Valerian extract

will create conditions in composts and manures “for the right way of the manure to react with what we call the ‘phosphoric’ substance”. It also regulates temperature processes and surrounds the heaps with protective warmth.

Three compounds interacting together, yarrow, camomile and stinging nettle, provide the right conditions for a secret alchemy in compost heaps, whereby potassium and calcium are converted into nitrogen.

Weeds and Pests are Controlled by Changing the Effects of “Cosmic and Terrestrial Forces” on Soil, Plants and Animals (Lecture 6)

Steiner considered that planets radiate forces that influence plants and animals. A full moon emits an organized cosmic force that affects the formation of fruit on plants. Steiner considered that lunar power was required for plant reproduction but also forces from Venus and Mercury were needed for some plants. Forces from Venus were required for reproduction of animals. In order to remove weeds from a field, it is considered necessary to ensure that the soil is unwilling to receive “the cosmic force” of the full moon so that it is difficult for the weed to thrive. According to Steiner, there is a 4-year cycle in nature, which means that processes have to be repeated over 4 years. The reproduction of pests should be prevented by stopping the influence of the force emitted from Venus.

On a purely practical basis, weed control is done by ashing collected weed seeds over a wood fire. The ashes, which Steiner considered to contain negative lunar forces, prevent the effect of the full moon where they are spread. The moon’s effect on growing weeds is stopped by small quantities of weed ashes and the weeds become decimated. The method of controlling pests is similar to that for controlling weeds. Fieldmice, for example, are driven away by spreading fieldmice ashes, produced from the skin of mice when Venus is in Scorpio. As regards attacks of sugarbeet nematodes, entire nematodes must be burnt when the sun goes through Aquarius, Pisces, etc., until it is in Cancer. The reason for nematode attacks is explained by Steiner to be a result of certain cosmic forces having sunk too deeply into the sugarbeet plant from the leaves to the roots. The presence of nematodes becomes possible as a result of this incorrect orientation of cosmic forces.

Steiner Sees “Terrestrial and Cosmic Forces” as the Reason for Biological Processes and his Recommendations Have a Spiritualistic Purpose

Steiner introduced the term “cosmic and terrestrial forces”, which is unknown to the natural sciences and does not imply gravitational forces. He considered that forces emitted from earth and cosmos to be the reason for development and growth of agricultural crops, humus formation, the occurrence of parasites, or weeds, etc. Lime and nitrogen are carriers of the “terrestrial forces” and silica,

sulfur, phosphorus and trace elements are carriers of “cosmic forces” (Steiner 1948). In order to achieve a change in the above-mentioned processes, he taught ways in which terrestrial and cosmic forces may be captured, stopped or delayed. The control of cosmic and terrestrial forces by the use of compounds, composts and by considering the constellation of planets when tilling the soil are measures that characterize biodynamic farming. Thus, astrological principles of putting courses of events on earth in relation to the constellation of planets and stars are the basis of biological dynamic farming.

The justification for using biodynamic compounds remains unclear unless the spiritual background is explained. This is not a question of simply producing healthy agricultural products containing sufficient minerals, vitamins, proteins and other vital constituents. Steiner intended to produce food rich in “cosmic or ethereal forces” (Lecture 4), which he looked upon as being the main quality criteria for agricultural products. According to Steiner, the production of crops containing “cosmic forces” enables the spiritual development of humans.

Like all anthroposophists, Steiner believed in reincarnation, i.e., that with time the human soul is reborn in another living creature. Reincarnation is an eastern conception of how mankind can be redeemed of sin, with enlightened awareness, and overcome the evil in the world by repeated rebirth. The fall of man can be solved by the “purification process”, rebirth. In order to enable the “essential purification” of each person, and the attainment of “higher awareness” by mankind, foods rich in “cosmic forces” harnessed and channelled through the use of compounds, are an important factor. Convinced anthroposophists consider that the use of compounds is one of the ways to achieve the development and salvation of mankind. Meditation, the training of thought, feelings and will, are further measures within anthroposophic teaching.

Biodynamic Agriculture has a Mystical Origin

The thoughts, ideas and recommendations presented by Steiner are results of what he called spiritualistic research. His working method differed from research in natural sciences in that he studied a wide range of mystical literature, used meditation and was clairvoyant. The methods discussed by Steiner in his agricultural course are based on “inner visions” and his personal mental experience. His specific recommendations were not based on scientifically tested results. In the sixth lecture of the course, Steiner asserted that spiritualistic predictions are true in themselves. “We do not need any confirmation by circumstances or by external methods. Spiritualism is an extension of scientific thought broadening the prevailing one-sided scientific view, being true and correct”.

Steiner asserted that he did not question science but that he enriched restricted scientific thought by means of a spiritualistic opinion. He wanted to find explanations that extend further than those possible by pure science. The type of information presented by Steiner is regarded in the natural sciences as subjective. This information consists of unproven assumptions and may be

found to be incorrect. However, all questioning of Steiner's material is rejected by the anthroposophists. Steiner's directions are unassailable in the opinion of his supporters and are regarded as the truth. For a non-anthroposophist, such recommendations are difficult to understand. The very central question is whether Steiner's farming recommendations really are true and thus could have a heuristic value, or whether they are assumptions based on false insights and visions.

Steiner's Predictions that Can Be Scientifically Tested Have Been Found to be Incorrect

It is impossible to prepare a scientific hypothesis to confirm or reject Steiner's processes because of his imprecisely descriptions, despite certain accurate details, and the fact that the agricultural course is a reproduction of an oral presentation.

An example is his statement that stinging nettle compound takes away the "iron effect" in the topsoil and makes the soil "reasonable" (Lecture 5). What is an "iron effect"? Iron stress and toxicity (bronzing) has only been observed in wetland rice where an excessive uptake of iron (II) can take place under very specific conditions (Marschner, 1986).

How can one measure the degree to which the soil is "reasonable"? Is it the delivery of nutrients to the plant, is it the microbial activity, or the nitrogen fixation? If an effect of stinging nettles can be found on a soil-biological process or on a chemical reaction involving iron compounds, then it is perhaps not the one intended. Without a stringent and precise formulation of a process or context, its veracity cannot be tested and thereby accepted or rejected.

Steiner's descriptions of processes and occurrences in nature that permit a testable hypothesis -- for example the formation of nitrogen from calcium or potassium using hydrogen (Lecture 5), or the formation of silica in plants by means of a basic element (which had still not been discovered) (Lecture 5) -- have been proved by physics and biology to be incorrect. Quite simply, conversion of basic elements has not been observed by biological processes, but only by high-energy radiation such as in nuclear reactions. If we assume that transformations of basic elements in biological systems are possible, then sciences based on the fact that the mass of elements is constant must be completely revised. Similarly, the above-mentioned effects of weed seed ash, mouse ash, or insect ash (Lecture 6) have not been demonstrated as being viable.

Review of the Literature on the Effect of Biological Dynamic Farming Principles

The effect of bio-dynamic principles have been tested on soil properties, quality of crops, and decomposition of organic materials. The review given below is not a complete examination of the investigations made, and only literature reporting scientific methodologies has been considered.

Soil Properties

Maidl et al. (1988) compared neighbouring bio-dynamic and conventional farms in order to selected parameters of soil fertility. The more frequent cultivation of leys in the crop rotation of bio-dynamic farms resulted in denser earthworm populations, slightly better aggregate stability, and a higher soil density due to the absence of soil tillage and repeated tractor traffic when harvesting leys. No differences in plant-available phosphorus and potassium or in the activity of dehydrogenases and nitrification were found in the study by Maidl et al. (1988), and it was concluded that alternative farming did not increase soil fertility. Bauchhenss and Herr (1986) also found, on average, denser earthworm populations in bio-dynamically farmed soils than in conventionally farmed soils due to different crop rotations. Diez and Weigelt (1986) found significantly lower contents of plant available potassium and phosphorus in soils cultivated according to bio-dynamic principles for more than 10 years. Beck (1986) determined the activity of several enzymes in soils sampled in the spring after fertilization and found 10–15% higher values in bio-dynamically treated soils compared with other agricultural soils. The difference was explained as being an effect of the sampling time, as inorganic N fertilizers temporarily depress enzyme activities but stimulate enzyme activities during the later period of the year.

Crop Quality

Graf and Keller (1978) studied the effect of sowing at different cosmic constellations on yield and quality of potatoes grown in field experiments. Sowing at different constellations had no effect on the nitrogen and mineral contents of tubers, either in conventionally cropped or in bio-dynamically cropped soils, but tuber yields were affected by the time of sowing in one out of two experimental years. The question is whether the variation in yields was caused by different cosmic constellations or simply by different soil water conditions and nutrient availability at sowing, which are not constant over time. The study cannot be considered as conclusive evidence for the effect of planets on crop growth. Dlouhy (1981) and Pettersson (1982) compared the quality of plant products from conventional and bio-dynamic production. Dlouhy (1981) concluded that bio-dynamically grown potatoes had higher dry matter content, a higher essential amino acid index, higher vitamin C content, lower storage losses and better cooking quality than those grown conventionally. He points out that this was the result of the limited nutrient supply in the soil, especially of nitrogen, when using bio-dynamically prepared manure compared with inorganic fertilizer. In a parallel study by Pettersson (1982), an increase in the crude protein content and a slight decrease of essential amino acids was found in crops when fertilized with inorganic fertilizer compared with bio-dynamically prepared manure. However, both studies were performed with only two treatments, bio-dynamic and inorganic fertilization and it was therefore not possible for the authors to draw any conclusions about the effect of the bio-

dynamic preparation. A comparable treatment using manures without bio-dynamic preparations was not performed. Further, Dlouhy (1981) stressed that the increase in crude protein and decrease of other physiological quality parameters at greater nutrient availability in soil is a well established fact observed in fertilizer intensity studies (Mulder and Bakema, 1956; Eppendorfer, 1978) and not specific for bio-dynamically prepared manure. Salomonsson and Larsson-Raznikiewicz (1985), using wheat samples harvested by Dlouhy (1981) and Pettersson (1982), showed that the protein composition of wheat fertilized with inorganic and bio-dynamic manure differed only in that the inorganic fertilizer treatment showed greater residual proteins, insoluble in acetic acid. This was explained as an effect of nitrogen shortage in soil during the early period of growth in the bio-dynamic treatment (Salomonsson and Larsson-Raznikiewicz, 1985).

The root development of seedlings in nutrient solutions to which some of the compost compounds were added was studied by Goldstein and Koepf (1982), who showed that valerian (compound 507) induced the vertical type of root growth and oak bark (compound 505) the horizontal type of root growth, while camomile (compound 503) improves root length. The observations were related to the assumed content of nutrients in the compost compounds. A chemical analysis of the compost compounds was, however, not given.

Decomposition of Organic Materials

Heinze and Breda (1962) found statistically significant increases in the cation exchange capacity of organic matter in mature manure composts treated with bio-dynamic compounds compared with initial values. However, an increase in the cation exchange capacity of organic matter in manures is the result of aerobic decomposition (Levi-Minzi et al., 1986; Kirchmann and Witter, 1992) and not a specific effect of bio-dynamic preparations. Abele (1978) applied compost compounds to both anaerobically stored and aerated slurry and found no significant effects of the bio-dynamic compounds on the chemical composition of the slurries compared with the controls. However, yields of some crops seem to increase slightly when using aerated slurry prepared with compost compounds. Bockemühl (1981) studied the composting of animal manures in small heaps both with and without bio-dynamic compounds, measuring compost temperature, carbon dioxide evolution, ammonia volatilization, nitrogen forms and the presence of soil animals. Besides a slightly lower initial temperature (5–10°C) in two of four experiments using bio-dynamic compounds compared with the control, no clear differences between bio-dynamically prepared and unprepared composts were established. A statistical analysis to prove whether the differences were significant was not performed. Hagel (1981a,b, 1984) studied the “radiation effect” of bio-dynamic compounds by putting the compounds into both open and closed test-tubes, and placing the tubes into soil. Respiration rates and enzyme activity (dehydrogenases) in soil was measured in several experiments over a period of 1 month. Significant differences in respira-

tion rate between controls and prepared soils were measured on several occasions. Hagel (1981b, 1984) interpreted his data as obvious evidence of the "radiation effect" of the compounds. However, different respiration rates are often observed among replicates if sieved and mixed soil samples taken from the field into the laboratory are used. Although soil samples may have been preincubated for 2–3 weeks before the start of the experiment in order to eliminate possible fluctuations, different respiration rates between replicate samples are often measured. Despite the occasionally different respiration rates, the cumulative amounts of carbon dioxide evolved are often very similar. However, Hagel (1981a,b, 1984) did not calculate the cumulative values of carbon dioxide evolution and thus his conclusions do not seem to hold from a strictly scientific point of view. In a decomposition study with wheat straw, Ahrens (1984) found a significantly larger amount of carbon dioxide mineralized if bio-dynamic compounds were added at concentrations of 1.5–3.0% (dry matter basis). At lower concentrations, no effect was measured. As a result of a larger C mineralization, lower C/N ratios and higher total N concentrations were determined in the straw amended with compost compounds after 1 year. Ahrens (1984) discussed and excluded the possibility that this could be due to an effect of microbial inoculation through the bio-dynamic compounds. Dewes (1985) performed a similar study, testing the addition of compost compounds of different ages to wheat straw following the decomposition process. No significant differences in total amounts of carbon dioxide evolved between the straw prepared with bio-dynamic compounds (0.33% added) and unprepared control were found. However, biodynamic compost compounds 3–4 years old, but not 1–2 years old influenced respiration rates between days 17 and 38, being higher and thereafter being somewhat lower than the control. Dewes (1985) concluded that the bio-dynamic compost compounds affect the course of decomposition of organic materials. However, no possible mechanistic explanation was tested or discussed. Free-living nitrogen-fixing bacteria could have been added to the straw through the compost compounds in one study but not in the other. As straw decomposition is generally characterized by a lack of nitrogen, any addition of N has a significant influence on the course of decomposition. This would have been an important question to address. Further, no analysis of the nitrogen content of the bio-dynamic compounds was presented and thus the possibility of a significant N addition through the compost compounds cannot be excluded either.

The review of some relevant scientific literature indicates that a significant effect of the biodynamic compounds has been found in some studies. However, no further attempt at mechanistic understanding has been made. Surely, the results on decomposition of organic materials could have been caused by bacterial inoculation or addition of nutrients through the biodynamic preparations. Why did the authors not test these hypotheses? It is obvious that several authors believed that Steiner's ideas about "cosmic and terrestrial forces" offer a valid, satisfactory explanation for any significant effect they happened to

measure with bio-dynamic preparations. Such reasoning shows a lack of critical scientific thinking and does not help to find an understanding of mechanisms. It reminds this author of Steiner's attitude that spiritualistic research is true in itself and need not be verified.

Anthroposophic Quality Tests of Agricultural Products are Pseudo-scientific

Three methods have been developed from Steiners' recommendations for quality assessments for foods illustrating the "cosmic" or "ethereal forces" present in crops: the crystallization method (Engqvist 1970), the capillary method (Kolisko and Kolisko, 1978) and the chromatography method (Pfeiffer, 1960), the latter being a modification of the capillary method. The crystallization test is performed by adding a given amount of freshly pressed plant juice to a copper chloride solution of given concentration. The mixture is dropped onto a glass plate and evaporated under controlled temperature and moisture conditions. During evaporation, a crystallization pattern is formed that reflects the quality of the plants. The pattern is considered to reflect the "plant's organized and formative forces". The more regular the pattern the better the quality, whereas increased irregularity is interpreted as deficiencies and indicate "less organized plant forces" and poorer quality.

The crystallization process is the result of a number of different factors such as temperature, moisture, rate of addition, surface properties of material on which the crystallization takes place, concentration of the plant solution and possible formation of chemical compounds between the copper solution and the plant juice. The assumption that plant juice should contain formative forces that would cause different crystallization patterns is not demonstrated by the method. The method is unscientific.

For the capillary method and the chromatogram, freshly pressed plant juice is also used, which is allowed to migrate up a filter paper (in the capillary method) or to spread out horizontally on a filter paper (chromatogram). Before or after this is done, the filter papers are supplied with different salts of heavy metals. The shapes and colours formed together with the plant extract are considered to be a measure of quality. Shapes and colours that may be formed depend on even more factors than in crystallization. There are both physical and chemical reactions and it is quite simply presumptuous to consider that "formative forces" behind the results can be identified. The tests are unreproducible.

Comparison of Biodynamic Farming with Other Alternative Forms of Farming

Several other alternative forms of farming have been developed after Steiner, e.g., biological organic farming and natural farming. Both of these are characterized by the absence of chemical fertilizers and pesticides since it is believed that they have a quality-deteriorating effect, but no there is no reliance on spiri-

tuality. The common philosophy is to wish to design a diversified agriculture that maximally utilizes existing resources, produces high-quality foods, and is environmentally sound. In contrast to other alternative forms of farming, bio-dynamic agriculture is based on unscientific methods, misleading measures and unprovable assumptions about natural processes. The form of agriculture is dogmatic, which implies that it cannot be developed. Steiner's recommendations are followed by anthroposophists in the belief that everything he said was true. Due to the anthroposophical belief that bio-dynamic food quality is an important tool for receiving "higher awareness", bio-dynamic farming must be considered as an occult-religious movement.

Who was Rudolf Steiner?

Steiner was born on 27 February 1861 in Kraljevec in what was then Hungary, but is today part of Slovenia. His father was a telegraphist on the South-Austrian railway. When Steiner was two years old, the family moved to Pottschach; when he was eight they moved to Neudörfel, about 45 km to the south of Vienna, and later to Inzersdorf, also near Vienna. In his autobiography, Steiner (1932) writes that as a young child he had been sitting in the railway station's waiting-room when the door opened and a woman came in. Steiner noticed that she looked like someone in his family. The woman stood in the middle of the room and said to the small boy: "Try to help me as much as you can, both now and in your future life." She then walked into the open fireplace and disappeared. Later it emerged that a female relative had committed suicide not far away, dying at the same time as Steiner saw the woman in the waiting-room. Steiner writes in his biography:

From that moment the boy started to develop a spiritual life that made him fully aware of worlds from which not only visible trees and mountains speak to the soul of mankind but also the Beings that live behind them. From that moment, the boy lived together with the natural beings that can be observed in such an area ... and he submitted to their influence in the same way as he submitted himself to the influence from the spiritual world.

When he was eighteen, Steiner started to read scientific subjects at the University in Vienna. On his daily journeys between his home and Vienna, he became acquainted with a factory worker who collected herbs in his leisure time and sold them in Vienna. Steiner was able to speak openly with him about his spiritual experiences without being ridiculed. Steiner wrote that this man gave him an insight into spiritual worlds since he had a "permanent footing there".

Steiner loved science and philosophy and his hunger for the supernatural brought him into contact with many people with different philosophical ideas and thoughts about philosophy. He read, discussed and searched for advance-

ment. He fought against scientific materialism and Goethe's non-materialistic natural philosophy made a great impression upon him. In 1886, when he was twenty-five, Steiner published his first book "Goethe's Theory of Knowledge". In 1888, Steiner came in contact with theosophy, the system of esoteric wisdom spread by the Russian spiritualist H. P. Blavatsky. In 1889, he read the book *The Initiated's Doctrine* by A.P. Sinnett, some of which attracted him, for example the belief that the human soul is developed as the result of several incarnations and that "salvation" is in fact a process of self-realization. In 1891, Steiner presented his Doctor's thesis *Die Grundfrage der Erkenntnistheorie mit besonderer Rücksicht auf Fichtes Wissenschaftslehre* (The fundamental question of the theory of knowledge with special consideration to the scientific doctrine of Fichte). In 1894, he published the book *The Philosophy of Freedom* which he considered to be the logical basis for his future work.

Steiner became converted from being a liberal intellectual with an intensive hunger for supernatural, spiritual knowledge, to a lecturer and spiritual leader who taught mysticism, theosophy and esoteric wisdom. When Marie von Sievers, later his second wife, asked him after one of his lectures (1901) whether it was not time to start a new spiritual awakening in Europe with him as leader, he realized that it was time for him to start with his vision in life – to be the spiritual leader of mankind.

From the beginning of the twentieth century until his death, Steiner presented more than 6000 lectures. For example, just before his death, he gave 70 lectures in two and a half weeks. When Steiner spoke, he was carried forward on a flood of intuition and he "saw" what he described.

Steiner died in 1925 of a stomach disease when he was 64 years old. The publication of all his lectures has left a comprehensive work consisting of hundreds of books on almost all aspects of life. Anthroposophic art and handicraft, architecture, alternative medicine, Waldorf pedagogics, etc., are activities that have evolved from Steiner's recommendations.

Steiner's work is based on three fundamental concepts:

- Behind the material, physical world, as it is interpreted by our senses, there is a supernatural, spiritual world.
- By means of exercises, humans can develop the ability to see and communicate with this spiritual world.
- The aim of developing a spiritual ability to see is not to communicate with spirits in the same way as spiritualists, but to obtain insight, knowledge and wisdom of that hidden behind physical reality.

Conclusions

An analysis of bio-dynamic agriculture shows that no alternative products in the common sense are produced but agricultural products that are enriched with different "cosmic forces" based on astrological principles. As Steiner gave few clear and stringent descriptions, his suggestions and predictions can never entirely be tested scientifically. If clearly formulated directives were given, they

are scientifically incorrect. Steiner's knowledge was based on subjective insights and visions based on a spiritualistic point of view. A scientific understanding and a development of this form of agriculture is not possible.

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