



2nd International Conference on Biodynamic Research

Growing beyond resilience

August 30th to September 2nd 2021 / Dornach, Switzerland (online)

Conference Contributions

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Growing beyond resilience

Opening up Biodynamic Research

Contributions to the
2nd International Conference on Biodynamic Research

August 30th to September 2nd 2021 / Dornach, Switzerland

Editors: Lin Bautze, Jean-Michel Florin

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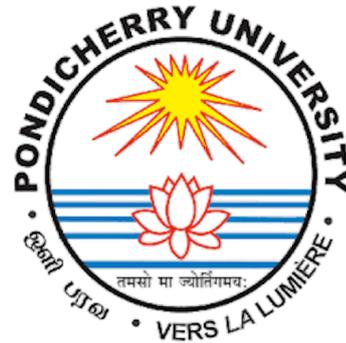
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WELCOME AND THANK YOU

Since the lectures on biodynamic agriculture given by Rudolf Steiner in Koberwitz in 1924, research and practice have developed in partnership. Biodynamic research is carried out in every field of agriculture and in many places around the world. It makes use of a broad range of methods and links to various other research areas such as agroecology.

In 2018, the first International Conference on Biodynamic Research (BDRC) took place. The conference aimed to provide a networking opportunity and to present cross-disciplinary and international biodynamic research projects for researchers, advisors, trainers and farmers.

Due to the success of the first conference, a second conference was organised with a larger group of partners, these being the Royal Agriculture University (UK), Coventry University (UK), Stellenbosch University (SA), Pondicherry University (IN), the Biodynamic Associations of the UK and US, the University of Kassel (DE), the Research Circle (DE), the Research Institute of Organic Agriculture (CH), the Natural Science Section at the Goetheanum and the Biodynamic Federation Demeter International.

The 2nd International Conference on Biodynamic Research (BDRC21) took place from 30th August to 2nd September 2021. There were over 60 contributions in the form of presentations, working groups, posters etc. A total of over 170 delegates from 34 countries from all the continents took part.

In line with the conference theme of “Growing beyond Resilience”, this topic was discussed from different angles. What are the current resilience concepts? How are they being put into practice? Are they fostering or hindering further development? What forces are needed to move beyond the present situation?

This booklet contains the abstracts of the papers, posters and workshops presented at the conference. Some of them deal more with scientific research, while others are more observational papers. We believe that bringing these different sources of knowledge together is the best way to further explore and understand agricultural systems.

Our warm thanks go to all the authors and reviewers, the programme committee, and the organisation team and partners, as well as the conference participants and sponsors. The conference would not have been possible without the cooperation of all these people.

Dornach, March 2022

Lin Bautze, Christopher Brock, Jonathan Code, Petra Derkzen, Jürgen Fritz, André Hach, Jasmin Peschke, Neil Ravenscroft, Regina Sharmila Dass, Anet Spengler-Neff, Richard Swann, Saskia von Diest, Verena Wahl, Johannes Wirz, Julia Wright and Jean-Michel Florin

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PARALLEL SESSIONS

VITICULTURE

Effects of biodynamic management of vineyard soils in Burgundy on aggregate stability and visual evaluation of soil structure.

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An on-vineyard approach was used to investigate the effects of biodynamic preparations horn manure and horn silica (BD) on soil structure in five vineyards on different bedrocks that had been under organic management for different time periods (Fritz et al. 2021).

The underlying hypothesis was that the effects of biodynamic preparation increase aggregate stability and improves soil structure assessed by visual evaluation (VESS). The aggregate stability during wet sieving was not changed with biodynamic preparations (BD+) compared to without (BD-). An improvement in soil structure based on VESS with BD+ compared to BD- was not significant for macropores/biopores; drop test topsoil and subsoil colour. In contrast, significant changes were observed in the drop test subsoil ($p = 0.009$), topsoil colour ($p < 0.001$), root penetration ($p = 0.017$), structure surface (stable aggregates and little encrustation, $p = 0.006$), structure topsoil ($p = 0.030$), structure subsoil ($p < 0.001$) and colour change from topsoil to subsoil was in a deeper soil layer ($p = 0.049$). Based on previously reported results showing that significant changes in the microbial activity of BD+ compared with BD- of same soil samples were found, it was thought possible that the differences in the activity of the microbial community in the soils was the cause of the structural differences the soil with BD+ compared to

BD-. It was recommended that further investigations it should be examined whether the joint occurrence of altered microbial activity and soil structure improvement in VESS of BD+ compared to BD- can be observed at other sites.

References

Fritz J., Lauer F., Wilkening A., Masson P., Peth S. (2021): Aggregate stability and visual evaluation of soil structure in biodynamic cultivation of Burgundy vineyard soils. *Biological Agriculture & Horticulture* (submitted).

Keywords

Aggregate stability; horn manure, horn silica; VESS; viticulture.

Ringversuch 2020 - Crop management with potentised preparations in viticulture

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Research question

The research project is centered around the application of potentialized biodynamic preparations in viticulture. Main goal was to determine whether or not potentialized preparations would show equivalent effects on the morphological structure of grapevines, as the common application of the biodynamical preparations does, during one growing season. Adding to that, we tried to reduce the use of copper, by linking application times and techniques to specific physiological stages of the vine.

Research method

Eight different wineries and one university (listed below), in seven different viticultural regions of Europe took part in this project. All project partners selected the vineyard site on which this experiment takes place by themselves. To keep track of all applications, the growth stadium on the vines, plant health and additional factors like the weather we scheduled once a week by phone calls. During the season of 2020 there were two timeframes in which we physically collected data on site. The first one was an assessment of the vegetative growth, where we assessed length of main shoots, amount of watershoots and we counted the leaves on both. Also we took a picture of the order of leaves along the shoot. Later we used the collected data to calculate the length of internodes. The second assessment focused on generative growth. We documented the amount of clusters per vine and shoot, the amount of berries per cluster, the weight of clusters and berries and the cluster

compactness. Through calculation we estimated the potential yield. To get an idea of the quality of the grapes we send samples to France, where Madame Chapelle performed copper chloride crystallization with grape juice samples.

Results

For most of the indicated parameters there was no difference shown between common biodynamical treatment, using potentialized preparations and the application of potentialized preparations linked to specific physiological stages. The only factors that showed major differences were cluster compactness and the copper chloride crystallizations. Through the application of potentialized preparations linked to the physiology we found a higher percentage of loose clusters. The crystallization pictures indicated a better inclusion of terroir, more balance in flavours and in general a better ripeness of the grapes when treated with potentialized preparations.

Conclusions

So far our study has shown, that applications of potentialized biodynamic preparations have an equivalent effect on plant growth in viticulture.

Keywords

Potentialized preparations, plant health, terroir

CULTURE AND INTEGRITY

The Agricultural Course as a Milestone in Fertilization

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With the advent of modern agriculture, organic inputs were replaced by inputs from the chemical industry, permanently changing the landscape and the way in which human beings relate to nature. During the second half of the 19th century and the beginning of the 20th century, the chemical industry had a great technological rise, partly subsidized by interests of the war industry that reflected the desire for territorial expansion and nationalism that the great economic powers at the time.

The present work seeks to understand how Biodynamic agriculture engendered in 1924 is characterized as a break from the synthetic fertilization paradigm and its historical weight for the way human beings fertilize the soil. In this way, the present article has an explanatory character, as it pursues to understand the historical significance of Biodynamic agriculture in its conjuncture.

Thus, with a bibliographic search developed based on material already prepared, consisting mainly of books and scientific articles. (GIL, 2008, p. 44). We understand that, although biodynamic agriculture was consolidated in 1924, it was structured around a rescue of the holistic view of life already contemplated by other ancient cultures. According to Jovchelevich (2012, p. 292), Biodynamic agriculture values this

knowledge and expands it, incorporating the other rhythms of the moon and the movement of the planets related to agricultural activities in general. Therefore, for Steiner, the development of a landscape that is harmonious with nature, once established, will guarantee a permanent fertility of the soil, plants and the human being itself. Surprisingly contrary to this force of rationalization of biological processes initiated more forcefully by Justus Von Liebig and later materialized in the Haber-Bosch process of synthesizing ammonia, Biodynamic agriculture, with its landmark in the Koberwitz convection in 1924, represented a milestone for humanity as a resistance to the dissociation of human beings with nature when striving for living processes, in an effort, always continuous, to cultivate food and products respecting the idiosyncrasy of plants and the rhythms of nature. The agricultural course was a new impetus to combat the current thinking of the time that masked cosmic processes with dead science.

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JOVCHELEVICH, P. Ensino de Astronomia no Meio Rural Através de um Calendário Astronômico Agrícola. In: II Simpósio Nacional de Educação em Astronomia –

Keywords

Biodynamics; synthetic fertilization; Koberwitz

Biodynamic farming: an exception to the whitewashing of indigenous agriculture?

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Biodynamic farming, along with organic farming, permaculture, agroecology, regenerative agriculture and more, are all modernist approaches to food production that arose over the last century as rational alternatives to industrial farming. Whilst the latter is typically characterised by a reductionist focus on maximising yields and profits through technologies aimed at suppressing and controlling nature, those modernist, western, alternative farming approaches deliberately strive to take a systems view of farming, optimising a more considered range of outputs through a collaborative relationship with nature (Ponisio & Erlich, 2016).

In doing so, almost all alternative agricultural approaches claim to draw from, or be based on, indigenous knowledge and farming systems from Southern countries, and to combine these knowledges with scientific advances (see for example Altieri & Toledo, 2011).

It is this claim that has led to a recent critique by a consortium of sixteen indigenous leaders and organisations which states that regenerative agriculture and permaculture offer only narrow solutions to the climate crisis. Called "Whitewashed Hope" (2020), the critique encourages these western farming movements to go deeper than simply taking indigenous practices out of context, but rather to encompass the

worldviews they represent and in doing so to enable the cultural and relational changes needed for humanity's collective healing.

The critique identifies six key areas of divergence between modernist western and indigenous worldviews around: dualism versus monism, dead matter versus the consciousness of all life, the notion of good and bad versus a relational striving for balance, the limitations of modernist languages, the need to consider the historical relationship of people to land, and the interconnectedness of human-Earth healing cycles.

This paper takes a critical analysis perspective to evaluate the argument made by this critique against the worldview of the biodynamic farming approach. Drawing from Steiner's agricultural lectures as well as other materials (Steiner, 1993), it posits that, to some degree, biodynamic agriculture stems from a worldview that is relatively more similar to those of indigenous cultures. The paper goes on to attempt to qualitatively identify the extent of this similarity and concludes with a discussion around the application of the term 'indigenous' in relation to modernist western farming regions.

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food sovereignty and empowering peasants. *The Journal of Peasant Studies*, 38(3): 587-612

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East Troy: Bio-Dynamic Farming & Gardening. *Whitewashed Hope: a message from 10+ indigenous leaders and organisations*. (2020) Open source document bit.ly/IndigenousWorldViews 24h November 2020

Keywords

Indigenous, worldviews, biodynamic, whitewashing

Opportunistic agroecological adaptation by farm women under semi-arid conditions of Rajasthan, India

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Climatic vulnerability and exposure to multiple stressors have compelled small-holder farmers world over to develop location specific knowledge and adaptation strategies to sustain their livelihoods in risk-prone ecosystems.

Under these conditions Madhu Devi a local female farmer of Pali district utilized agroecological knowledge to convert stress into opportunity with autonomous adaptation. The major stress in this area are high temperature, hot and dry winds, low and delayed monsoon, high salinity in ground water, erratic rainfall and early recession of rains. The farmer is having her land at scattered sites in Hemawas dam which is used to store runoff water in catchment area of around 260 hectares of land. The farmer very effectively utilizes the conserved soil moisture in Hemawas dam catchments area for crop diversification under varying moisture regimes. The stress of climate variability and salinity in varying landscape traditionally used for cultivation of wheat, barley, chickpea and mustard with low yield, has now been substituted with muskmelon as opportunistic adaptation (Wang et al., 2008). The terminal heat and aberration of temperature during February-March

negatively impact yield of winter season crops.

This variability is now adapted with introduction of muskmelon a fruit vegetable relished for its taste and sweetness. This is a three months short duration cash crop, cultivated with very minimum external inputs and moderate farmers' vulnerability (Jackson et al., 2004). In the land, freed from water, she grows muskmelon in the conserved moisture during last week of February. Sowing is done by simply ploughing the land to open up the soil in the open spaces using local seeds specially treated with luke warm water and kept in moist jute bags overnight for easy germination. This adaptation is continued when there is very minimal competition with other agricultural enterprises and related. The farmer plank the field when the seeds germinate and attain 2-3 weeks age to trap the moisture and level the field (Patil et al., 2014). This also controls the insects attacking the crop by burying the eggs deep and sealing the soil. The seeds germinate and utilize the runoff organic matter and conserved moisture for luxurious growth and high yield. Easy market through organized muskmelon's contractors at field itself makes this adaptation further robust for the farmers' livelihoods.

This location specific agroecological adaptation further empowers other rural women, who are landless and relatively more marginalized. They are the main actors in the entire operations of the muskmelon's cultivation where either they contribute as family labour or as daily paid laborer earning cash from land owners. This adaptation provides an insight for the formal science about how formal and informal knowledge can be hybridized to co-produce more robust adaptation to convert stressors into opportunity.

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Wang G., Ngouajio M., McGiffen M.E. Jr and Hutchinson C.M. 2008. Summer cover crop and in-season management system affect growth and yield of lettuce and cantaloupe *HortScience* 4313981403

Keywords

Semi-arid climate, conserved moisture, agroecological knowledge, opportunistic autonomous adaptation, muskmelon

VINEYARD SOILS

Response to biodynamic management in Burgundian vineyard soils on functional microbial diversity

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An on-vineyard approach was used to investigate the effects of biodynamic (BD) preparations on soil microbial biomass and microbial functional diversity in five vineyards on calcareous bedrocks under organic management (Fritz et al. 2020).

The vineyards formed two groups according to soil type; Cambic Leptosols (A1, A2, and B) and Calcaric Leptosols (C1, C2) as well as two groups according to duration of BD application; 16 years (A1 and A2) and 1–3 years (B, C1, and C2). The two Calcaric Leptosols contained on average 65% more microbial biomass C, 110% more microbial biomass N, 70% more ergosterol and exhibited a 45% higher basal respiration rate than the three Cambic Leptosols. The vineyards had, on average, 11% lower MB-C:N ratios in the treatments with the BD addition (BD+) than in those without (BD). Most substrates induced the highest respiratory responses at vineyards A1 and A2 and the lowest at vineyard C2. Averaging the 17 substrates of the multi-substrate-induced respiration (MSIR) approach, the mean respiratory response was approximately 20% lower in the BD+ treatment at vineyard A1 in comparison with the BD- treatment, but 33% higher at vineyard C2.

The differences between the BD treatments in the induced respiration rate for individual

substrates were significant for 12 substrates at vineyard A1 and for 5 substrates at vineyard C2. The lower the respiratory response, the higher the anabolic demand for a specific MSIR substrate, indicating C limitation of the soil microbial community.

The current results suggested that BD preparations have balancing contrary effects on the microbial functional diversity under different soil conditions and that these effects may increase with the number of years of application. More vineyards should be analysed to differentiate between the effects of soil type and duration of BD application.

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Keywords

Microbial biomass; ergosterol; multi substrate induced respiration; limestone; viticulture; horn manure

Investigations of vineyard soils in France with and without the application of biodynamic spray preparations

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The research project aims to study the effect of biodynamic preparations horn manure and horn silica (BP) on physical, biological soil properties, as well as visual assessment from 18 vineyards located in Bourgogne, Baux de Provence, and Avignon, France.

To understand possible transformation processes, soil sampling will take place every six months during three years. All vineyards are organically managed, but considering two plots for treatment with BD (BD+) and without BP as a control (BD-). Six replicates were collected (0-10 cm) in each plot through the slope. Soil samples were sieved (<2 mm) and stored at 4°C prior to analysis. For the first soil sampling (Autumn 2020) following laboratory analyses were considered: General soil analyses: Dry mass, pH, carbonate, total C and N, soil organic carbon. Soil biology: Basal respiration, microbial biomass C and N, ergosterol, multi substrate-induced respiration. Soil physics: Water holding capacity, aggregate stability as mean weight diameter (MWD), bulk density, contact angle, texture, water-retention process.

Preliminary results of four vineyards were already obtained (48 samples): During the air-drying process soil samples began with a similar water content (22-26%). After eight days (until a constant weight was reached) the moisture averages were higher in treatments without BP. The water was probably retained in the fine pores, making it less available to the plants ($pF > 5$).

In such sense, the experimental results could mean that the availability of water was increased by the BD application. Aggregate stability results were not statistically different between BP- (4.51 MWD) and BP+ (4.54 MWD), but between different locations.

pH had significantly higher values in BP+ (7.85) compared to BP- (7.69) and increased significantly along the slope (7.56 and 7.99 in the bottom and top position, respectively). Contact angles (CA) were significantly lower in treatments with BD+ (105.4°) in contrast to BD- (108.7°). BD affected positively CA (lowest values), turning the soil more hydrophilic. CA significative difference was found between the bottom (111°) and top position (101°) of the slope. Basal respiration was significantly higher in BD- (14.9 $\mu\text{g g}^{-1}$ soil d^{-1}), in comparison with BD+ (13.6 $\mu\text{g g}^{-1}$ soil d^{-1}).

Lower microbial basal respiration rates may indicate higher carbon storage in soils. BP application showed a positive effect on some physical soil properties, which need to be studied over different seasons and linked to microbial activity.

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management. *European Journal of Soil Science*, 56(2), 239-251.

Keywords

Biodynamic agriculture; viticulture; microbial activity; contact angle; aggregate stability

ANIMAL WELFARE

Selection concept based on Vitality and Resilience for extensive organic Beekeeping of the Dark Bee Colonies

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According to breeders in Switzerland, dark bees can only be successfully conserved today if the beekeeper observes the characteristics of pure breeding and buys the queens from recognized breeders. However, this leads to a narrow genetic breeding selection, which can also cause some one-sidedness, such as the loss of vitality.

In this project we developed a selection concept for bee-related, extensive organic beekeeping based on vitality traits to get a locally adapted and healthy dark bee. We would be interested to know if an adapted selection concept for extensive organic beekeeping management meets or contradicts standard breeding criteria and whether main criteria can be observed during the year that can help the beekeeper make an assessment.

In 2018, three apiaries were located at 3 locations at different altitudes (400-1000-1500m above sea level) around Lake Lucerne. Each apiary was of 12 bee colonies per location and kept for 4 years. The bees were kept according the biodynamic guidelines, which includes the building of natural honeycomb and reproduction based on the swarming process. Just short to the swarming, the mother colony was divided in three sub-colonies. All sub-colonies were maintained at the same apiary. This with the aim that young queens resulted mated with the populations of drones from the apiary as much as possible. However, wild crosses with

other drones, depending the altitude might be possible.

An extensive data collection was carried out four times a year, which included, depending on season, the following standard selection criteria: natural colonies losses, bee health, bee colony size, varroa infestation, aggressiveness, calmness, cleaning behavior, weight of the hive. Additionally, locally adapted criteria as vitality (building activity, brood nest quality, behavior, swarming) and resilience (adaptation to environment, feed storage in brood chamber) were included. The sub-colonies for continuing breeding were selected in spring 2020 and 2021, based only on survival characteristics as health, vitality and resilience.

At this time point it seems that progenies of more aggressive colonies show better vitality and resilience. Further interesting observations: small hives may have some advantage to spend wintertime, may to less food consumption. In summer some colonies stop the brood at poor feeding condition, as it is known of african bees. Large differences were also found in the amount of storage of nectar and pollen. As expected, it was not possible to keep a purebred dark bee, but more coloured bees were observed in the hives. It remains unclear whether crossbreeding has a positive or negative impact on resilience and vitality.

According to the results obtained, we would be interested to know whether a selection concept according to vitality and resilience would positively influence the health of dark bee colonies and whether it would be possible to define clear characteristics of a hive in order to define a resilient, locally adapted bee during the bee year.

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Keywords

Dark bee, extensive beekeeping, vitality, resilience, breeding

VEGETABLE GROWING

Agronomic performances of organic rocket cultivation in greenhouse: a comparison among intensive (Business as Usual), biodynamic and agroecological systems of production

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Organic greenhouse production can be very intensive (Voogt et al., 2011) and is object of strong debate among actors within the same country and among different countries in the framework of the European Union (Blom, 2011). After almost a decade of discussions, the recently published Regulation on organic production Reg (EU) 2018/848 has introduced, for the first time, new rules regarding organic production in protected conditions.

“Organic and biodynamic vegetable production in low-energy GREENhouses – sustainable, RESILIENT and innovative food production systems”, is the multidisciplinary project which has been funded in the framework of CORE Organic Co-fund (Tittarelli et al., 2020).

In the Italian experimental site, three main production systems were compared to a Control not fertilized (CNT: i) Business as Usual (BAU), an intensive organic system of production based on the use of organic fertilisers and pesticides allowed by organic regulation (according to the input-substitution approach) and on the regular use of soil solarization to control weeds and to protect crops from soil-borne pathogens; ii) Biodynamic (Biodyn), a system of production based on the biodynamic method, with the introduction in the crop rotation of mixed

green manure species during summer, the use of biodynamic compost and biodynamic preparations (500 and 501); iii) Agroecological (Agroecol), an organic system of production based on the introduction in the crop rotation of green manure species during summer, the use of biowaste compost and of pesticides allowed by organic regulation, when needed.

Compared systems were assessed according to a multidisciplinary approach taking into account commercial yields, nutrients availability, potential risk of nitrate leaching, weed diversity, soil arthropods, nematodes and microbial biodiversity, and soil suppressiveness.

In this paper, we focus our attention on the agronomic performances of the biennial cultivation of rocket (*Eruca sativa* Mill) in compared systems. Yields of rocket in compared systems did not differ from the CNT in the 2018-2019 cycle; they ranged from 23.6 Mg ha⁻¹ in Biodyn to 29.1 in CNT. In the 2020-2021 cycle, yields generally lowered and the compared systems did not differ again from the CNT. However, yields decreased 14.1 Mg ha⁻¹ in CNT, 6.9 in Biodyn, 6.2 in Agroec, 7.3 in BAU. Due to soil solarization, the potential risk of nitrate leaching was by far higher for BAU than for Biodynamic and Agroecological method.

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Keywords

System comparison, nutrient availability, agroecology, input substitution

PREPARATIONS

Assessment of 501 influences on vegetative growth and berry metabolism of the grapevine variety *Verdicchio*

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The application of biodynamic preparations in the vineyards has raised scientific interest in the last years. The preparations are claimed to stimulate soil nutrient cycle, photosynthesis in plants and optimal evolution of compost, enhancing both soil and crop quality (Reeve et al., 2005). In particular, preparation 501 is believed to act on the aerial part of plants stimulating their ability to catch light and to adjust a series of internal mechanisms, including the defence against pathogens, the response to biotic stress, the vegetative growth and the maturation of the fruits (Brock et al., 2019). Positive effects on soil characteristics, plant growth, yield and biodiversity were evidenced in vineyards cultivated with biodynamic system (Döring et al., 2019). Picone et al. (2016) found changes in grape berry metabolome, likely related to physiological response of the plants treated with preparations. The application of 501 was noticed to positively affect the quality of grapes and wines (Fritz et al., 2017).

The present study aimed at investigating the effects of 501 on the grapevine variety *Verdicchio*.

The research was set in two vineyards in Marche region (Italy), with the application of four 501-treatments during the grapevine growing season: from pre-flowering until near the maturation. During this period of time a series of morphological observations (shoot length, number of leaves, number of

clusters) and analytical measurements (foliar pigments content; soluble solids, acidity and polyphenols in berry juice, thickness of berry skin) were performed in plants exposed and not exposed (control) to 501. This to assess and better understand any possible influence of the 501 applications. Particularly, grapevine plants of *Verdicchio* cultivar were selected in two vineyards, one with grafted plants and the other with un-grafted plants.

Overall the results revealed significant responses of the plant to the 501 treatment. The content of chlorophylls increased by 13% in the 501-treated leaves and the carotenoids accumulated 22% more than in control leaves. The concentration of soluble solids in mature berries resulted significantly higher (+7%) in grape exposed to 501 than in control, concurrently with the weight of the berry skins. No variations were detected in the polyphenol content of the berries.

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Keywords

501, grapevine, growth, berry composition

Casting light on the reason by which manure is stuffed into horns in Biodynamic Agriculture preparation 500: the keratin catabolism evidence

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Research question

The main practice in Biodynamic agriculture is the use of a preparation (Horn manure) obtained by the underground overwinter maturation of cow manure stuffed into cow horns. Such protocol has always been the object of skepticism by supporters of strictly conventional agriculture due to its apparently ungrounded basis and seemingly casual rationale. The question was whether there would be any biochemical meaning in having chosen horns as incubator shells for manure.

Research method(s)

Using a DNA sequencing-based taxonomical analysis and rescuing buried horns at different time intervals we followed the successional composition of bacteria and fungi throughout the process, from initial cow manure, throughout a series of intermediate stages, up to the mature Preparation 500.

Results

Marked shifts in the microbial community were seen involving a general decrease from a Firmicutes-dominated material to a product transiently enriched in Proteobacteria and later in Actinobacteria,

mostly within the Nocardioideae family. But the most striking finding was that the dominant fungus in the initial manure results a member of the Onygenales, an order specialized in keratin degradation. Its presence in faeces is explained by the fact that keratin, in the form of a thin cytoskeleton net, is present in all mammals epithelial cells including the gut mucosae. The fact that horns get thinner at every use suggests a catalytic connection between the main representative of the manure fungal community and the horn's composition. The dominance of a fungus with a tight ecological attitude, i.e. the capability of digesting keratin, suggests that horns, qualify as substrates for a specific proteolytic decomposition process which is bound to drive the series of bacterial and fungal succession which is observed to occur across the whole process.

Conclusion

Being keratin also the polymer by which horns are totally made of, a rational ground is suggested to the hitherto unexplained practice of placing manure into horns.

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Keywords

Biodynamics, hornmanure, onygenales, keratinolysis

FARM INDIVIDUALITY AND COMPOST

Biodynamic compost effect on soil parameters in a long-term field experiment

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Composted farmyard manure (FYM) is mainly used in organic agriculture for soil quality enhancement. The aim of the present work was to point out the role of traditionally and biodynamically composted FYM on soil parameters in a long-term field experiment, where different FYM has been applied during 27 years.

The initial soil had low potassium contents. Field experiment is located on the Wiesengut certified organic research farm of the Institute of Organic Agriculture, University of Bonn. Experiment was carried out under a completely randomized block design considering four treatments: T1 (without FYM), T2 (FYM), T3 (FYM+ biodynamic Achillea preparation), and T4 (FYM+ all biodynamic compost preparations) with six replications and applying 30 ton fresh mass ha⁻¹ year⁻¹. Rotation of six main crops was identical among all 24 plots.

Laboratory analyses were: General soil analyses: Dry mass, pH, carbonate, total C and N, soil organic carbon. Soil biology: Basal respiration, microbial biomass C (MBC) and N (MBN), ergosterol, multi substrate-induced respiration (MSIR). Soil physics: Water retention curves, infiltration, air-water conductivity, water holding capacity, aggregate stability, bulk density, contact angle, texture. Spade Analysis (SPA): Scoring categories for aggregates, roots development, pores, color and drop shatter test for top- (0-15 cm) and bottom layer (15-30). The highest values of total soil C and N were found in T2 and T3.

However, significantly more MBC and MBN were found in T3 (FYM+ biodynamic Achillea preparation). Through MSIR, after applying

18 different substrates to soil samples, respiratory responses from 14 substrates showed the significantly highest values in treatments with all BP or with 502. The highest multi-substrate-induced respiration rates in T3 and T4 are an indication of high soil microbial activity. T1 showed a low respiration rate. Regarding SPA, the highest significant mean was found in T4 for -roots development- of the top layer, whereas means for most quality visual parameters showed the following order: T4>T3>T2>T1.

The use of FYM and also biodynamic compost preparations in FYM promoted soil microbial activity, improvement of soil physical properties, and water retention.

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Keywords

Biodynamic agriculture; achillea preparation; multi substrate-induced respiration; spade analysis; microbial biomass

Grasping the Whole – Biodynamic Tacit Knowledge

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How do biodynamic farmers experience, conceptualise and develop their farm's individuality?

From a Goethean perspective, the whole is more than the sum of the parts. It is something in its own, but since the whole is not a thing, it is often difficult to grasp and express.

From a reductionist scientific perspective, the holistic aspects are often overseen. This has also been the case in much of the research on biodynamic practices.

My research investigates how biodynamic farmers in Sweden relate to the farm individuality in their daily work. Through semi-structured interviews, participant observations of daily work (shadowing) and walk-and-talk conversations, I examine the tacit knowledge developed by the farmer in relation to his/her farm. In working with the living, the biodynamic farmer is in a process of coming into being. This process takes place on different levels at the same time, including the observation of a single plant while harvesting it, reflecting on how it was planted and if it should be done differently and constant adjustment of compost and biodynamic preparations practices.

This leads to farmer self-reflection on her/his own knowledge in relation to the development of their farm. In their daily work, the farmers move upstream and downstream in time, e.g. when holding a small lettuce seed and in the moment of seeding it seeing themselves selling that luscious lettuce head to a customer at the summer market. This kind of imagination is not only abstract but is developed through practical work throughout the years. The

experiences from earlier seasons nourish the imaginative forces. Biodynamic farming is a hermeneutic process in which the farmer moves between parts, from the bigger picture of grazing and crop rotation down to details of routine daily work.

These observations lead to adjustments in understanding the whole, which in turn put the details in a new perspective. But, unlike a hermeneutic text analysis where the analysed object is at hand, the farmer is co-creating the wholeness – the farm individuality – that he/she relates to. In that sense, farming practice contains both reflexive and imaginative aspects, even though these are often tacit and not explicitly articulated.

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Keywords

Biodynamic farming, farm individuality, tacit knowledge, Goethean science, hermeneutic circle

RESEARCH METHODOLOGY

A single case study into research methodology: Opportunities and limitations of a long-term randomized field experiment to investigate the possibility of replacing animal manure with plant manure in biodynamic farming

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A wide variety of research methods are used in research on BD agriculture, in order to investigate the productivity, self-regulation and sustainability on a farm as well as product quality. Additionally, BD agriculture aims at more comprehensive effects on various levels like sustainability for the environment, climate and humans; health of plants and animals; development of a farm organism as self-contained as possible; nourishment of humans for body, life, soul and spirit; care and promotion of natural beings; enlivening of the earth/the soil ; permeating the manure / the the soil with reason and intelligence; empowerment and development of the farm's individuality; ...

So far, there are hardly any publications on which research methods are suitable under which circumstances to answer the different questions arising from BD agriculture.

Based on the detailed experimental design of the long-term experiment "BoDyn", which was initiated on the farm Oberfeld near Darmstadt, DE in 2018, the methodological approach, the possible conclusions as well as the emerging questions are described.

Thereby, a cyclical process of viewpoints is run through, which can be called "research logic":

1. Questions and hypotheses
2. Data collection, parameters
3. Data analysis, statistics
4. Possible results
5. Achievable statements
6. Discussion of results and statements
7. Emerging questions

On this basis, the strengths and limitations of the methods applied at the long-term randomized field experiment are identified for answering questions on the different levels at which BD agriculture aims; methods like measurements of soil organic matter, nutrient availability and losses, soil structure and moisture, biological activity, microbial diversity, plant health, crop yields and product quality as well as statistical analysis of the data.

This case study can also be used to elucidate, via the statements for the individual case, that applying such a research logic for developing an experimental design can lead to a clearer awareness of the possibilities and limitations in relation to the questions asked. This can contribute to more refined research outcomes and better use of human

and financial resources, as well as promote a focus on the core questions of BD agriculture. As an outlook, the perspective is presented that an overview may emerge from a larger number of such methodological single case studies on BD research projects, which could become the basis for the participatory development of a research strategy on BD agriculture.

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- (2) Steiner, Rudolf, Agriculture Course 2004 tr. G. Adams, p. 96

Keywords

Research logic; longterm field experiment; methodology; single case study

Influence of different cultivation methods on the bacterial diversity in vegetables and the influence of consuming these vegetables on the GI-tract

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Background

A low gut microbial (GM) diversity is associated with various diseases, including metabolic and inflammatory disorders. To maintain a high GM diversity, diet is of crucial importance: a complex and varied diet rich in fibers is associated with a relatively higher GM diversity.

The reduced use of herbicides and pesticides is associated with a higher microbial diversity in soil.

A study on apples has shown that cultivation in a highly diverse microbial environment results in an increased diversity of microorganisms within this fruit.

Research question

Does consuming vegetables with a high microbial diversity (obtained by cultivation in soil with a high microbial diversity) or with a low microbial diversity (obtained by cultivation in microbial soil with a low diversity) result in differences in microbiota diversity in a model system of the small intestine of humans?

Research methods

To study this, the diversity of the microbiota within cucumbers, lettuce, bell pepper and tomatoes cultivated in a greenhouse will be compared to the counterparts cultivated outside in soil with no use of synthetic pesticides and herbicides. This will be investigated in a sophisticated, validated model of the upper GI-tract: the TNO in-vitro Model of the stomach and small intestine (TIM-1) using a parallel group design. A puree will be made from 200 grams of product. Fifty grams will be sampled for bacterial microbiota profiling by 16S-rRNA gene amplicon sequencing. The other 150 g of product will be added to TIM-1. At the end of TIM-1 the total efflux will be collected and sequenced using 16S-rRNA gene profiling to evaluate composition and diversity of the bacterial GM. Alpha diversity of the samples, based on Shannon and other diversity indices, will be measured. The beta-diversity will be determined by the use of QIIME2. The non-parametric Kruskal-Wallis test (with FDR correction) will be used to determine the significant differences on taxa abundance at genus level and in some cases, species level.

Results

The results of this study will be obtained at the end of June 2021. The results will include microbial diversity of four different vegetables cultivated in an environment high or low in microbial diversity, including the difference within product groups. The second part of this study will show the diversity of the bacterial population in the small intestine, simulated by a TIM-1, after digestion of the vegetables.

Conclusion

Based on findings in the relevant literature we expect a higher diversity of microorganisms in the vegetables cultivated in a high microbial divers environment compared to vegetables cultivated in a low microbial divers environment. In addition,

differences will be evaluated between these products when digested in TIM-1 in order to conclude about the influence of the digestion from mouth to ileum, on the composition and diversity of bacterial GM and the implications for human health.

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Keywords

Human, health, gut, microorganisms, diversity

Kinesthetic engagement in the visual evaluation of copper chloride crystallization images

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There is an increasing interest in a systemic approach to food quality. From this perspective, the copper chloride crystallization method is an interesting asset as it enables an estimation of a sample's 'resilience' in response to controlled degradation.

In previous studies, we showed that an ISO-standardized visual evaluation panel could correctly rank crystallization images of diverse agricultural products according to their degree of induced degradation.

In the current study, we examined the role of contextual sensitivity herein, with the aim to further improve the visual evaluation. To this end, we compared subjects' performance in ranking tests, while primed according to two perceptual strategies (levels: analytical vs. kinaesthetic engagement), according to a within-subject design.

Kinaesthetic engagement in crystallization image evaluation involves an embodied simulation of the growth, curvature and tension of the tree-like branches of the

crystallization images. The ranking test consisted out of wheat and rocket lettuce crystallization images, exhibiting four levels of induced degradation.

The perceptual strategy imbuing kinaesthetic engagement significantly improved the performance of the ranking test in both samples tested. The outcome demonstrates the significance of an empathetic engagement in the visual evaluation of crystallisation images. This forms a conceptual basis for a qualitative discrimination of crystallisation images of

products derived from different farming systems.

References

Huber et al., 2010
Doesburg et al., 2014
Frtiz et al., 2018
Busscher et al., 2014
Doesburg et al., 2021

Keywords

Copper chloride crystallisation, visual evaluation, kinesthetic engagement, panel training

MILK PRODUCTION AND PROCESSING

Innovation culture in biodynamic practice on the example of mother bound calf rearing systems in Germany

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In Germany, organic farmers with innovative and forward-looking ideas can apply for the federal organic farming competition. Individual concepts that have proven themselves in practice are sought. These concepts can encompass the entire farm or cover individual areas. All farms that have been certified organic for at least two years in accordance with EU legislation on organic farming are eligible to participate. The prerequisite is that the entire farm is managed organically (oekolandbau.de, 2021). Jury board member of the federal organic farming competition Prof. J. Heß (2020) had the assumption that particularly many biodynamic farms were among the prizewinners of the competition in the last 20 years until 2020. This assumption could be verified based on the data on prizewinners of the competition. As a result, it turned out that out of 60 organically operating prize-winning farms, 19 farms belong to the Demeter association and this, although the share of Demeter farms of all organically operating farms in Germany is nowadays only approx. 5 %.

This factual situation gave rise to the following questions: What conditions prevail on biodynamic farms that make them so innovative in comparison to other certified organic farms? If and why the Demeter association seems to be instrumental in establishing and developing such an

innovation phenomenon? What moves biodynamic farms to the topic and how did this innovation development come about on the farms?

In order to find indications for the innovativeness of biodynamic farms, the 19 Demeter awardees of the competition were examined with the help of a more detailed categorization by means of given information in the form of text and film on the website of the competition. It was noticed that 5 of the 8 Demeter dairy farms in the competition practice mother bound calf rearing in one or the other form. Mother bound calf rearing systems can be described as an innovation phenomenon. Farms using this system are not officially counted. Only an estimated share below 0.5 % of all dairy farms in Germany practice it today, but it has become well known in recent years. Biodynamic farms were among the first to establish and develop this new system and are still leading the introduction in broader agricultural practice. In October 2019, we additionally observed the introduction of a first label of biodynamic hay milk farmers on the market that included mother bound calf rearing systems.

2 of the 5 prize-winning biodynamic farms in the competition that practice mother bound calf rearing were interviewed about their specific background and the introduction of their new calf rearing system. Due to the

Covid restrictions to that time, the planned farm visits could not take place and telephone interviews were conducted using the guided interview method.

After addressing both farms own individual systems of mother bound calf rearing, the findings were that farm-specific implementation determines the success of the system. A look on other farms practicing other variations of mother bound calf rearing systems showed that there is no such thing as the one standard system. Rather, the interviews showed that those systems are still being further developed and that real pioneering work is being done on the farms. This new form of calf rearing on both farms convinced the farmers with more advantages than disadvantages. Neither of the farms would like to imagine returning to the old calf bucket feeding.

An allocation of 8 factors according to Augsten et al. (2017) attributed special innovation potential to both farms. After qualitative content analysis according to Mayring (2010) of the interviews and an evaluation of the personalities of the innovators, it can be concluded that the Demeter association with its mission statement and guidelines did not provide the impetus for innovation in the case of the mother bound calf rearing on both of the prize winning farms. The idea of feeding calves by their mothers at the time of the first practical introduction on the farms was

just as new and unconventional to biodynamic advisors. However, the Demeter association seems to attract people and personalities who are inclined to self-critical questioning, have high demands on agriculture, which are always compared with the real practice/situation on the farm. The practitioners needed courage as well as willpower, even against resistance or concerns from the outside, to introduce the new system. Severe calf diarrhea as well as critical questions from customers why calves are separated from their mothers were additional impulses in the two selected case studies to enter into the change process and the beginning of giving back the cow and her calf the relationship appropriate to their nature.

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Keywords

Innovation, mother bound calf rearing

Can milk consumption impact resilience, how and what milk?

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Introduction

Food processing, - quality, and - origin impact our health. What is known about Hippocrates' statement '*led food be thy medicine and medicine be thy food*' with the focus on milk? Goal of this article is to

discuss, how milk can be part of a healthy diet; what kind of milk quality is found in relation to health support and how this insight impacts organic and biodynamic milk production.

Milk and health

Milk has become a food commodity and there is a constant pressure on the price of milk. Price competition led to an ongoing intensification of production per cow, per hectare land, per farm and per farmer. Farm milk nowadays is chilled in bulk tanks for 2–3 days, transported over large distances to be processed in large scale plants. Milk has become raw material for processed foods. The obliged pasteurization of farm milk in European countries is prompted by food safety issues and the increase of the shelf life of heated milk.

At start of the millennium the negative health impact of the heat processing of milk was recognized. In the last two decades a wide range of studies showed, that:

- The protection was found in farm children as well as in urban children, if they consumed raw cow milk since the first year of life (Braun-Fahrländer et al., 2011; Brick et al., 2020).
- Whey proteins, and especially unchanged beta-lactoglobulin excreted in the cow's environment (urine) and in raw milk play an essential role in the immunology (Roth-Walter et al., 2020).
- Cow milk tested in mice models confirmed the impact of heating: only after heating of either raw milk, skim milk or whey a negative immune response was found (Abbring et al., 2019; 2020).
- In mice, there was already a cut-off in the allergy outcomes, when milk was heated above 60°C (Abbring et al., 2020).
- The incidence of asthma in pre-school children was reduced, if children consumed pasteurized milk products, full fat milk or butter, but not skimmed milk and margarine (Wijga et al., 2003).
- A reduced incidence of allergies and asthma was found in relation to specific fatty acids in milk, omega-3 fatty acids and/or CLA_{9t11} and its precursors (Kummeling et al., 2008; Brick et al., 2016).

Resilient farming and robust human health

The two ways to impact immunity (through raw milk or the fat plus fatty acids) have different impact on milk quality. To get high levels of long-chain poly-unsaturated fatty acid in milk fat, the cows need to produce milk from grass, avoid maize silage and concentrates (Baars et al., 2019-A). Most milk should be produced in summer, and surpluses in summer will be preserved in terms of cheese and butter.

The other route of protection lies in safely produced raw milk or raw fermented drinking milk, like kefir (Baars et al., 2019-B; Baars, unpublished data). To reduce the zoonotic risks, the industrial challenge is based on high-tech milk processing based on ultra-filtration, high pressure and UV-light to eliminate bacteria, so-called less-processed milk (Zhang et al., 2021). The farmer's task to reach a resilient raw milk production is through knowledge about the safe on-farm production of raw milk, germ ecology and grass-based systems (Berge et al., 2020).

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Keywords

Raw milk, milk quality, immunity, prevention strategy

CHROMATOGRAPHY

Correlations between Pfeiffer's circular chromatography test and physical, chemical, biological compost parameters in compost and vermicompost

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The objective of the present work was to evaluate the quality of compost (Exp 1) and vermicompost (Exp 2) by chemical (electrical conductivity -EC-, pH, ash content -AC-, organic matter -OM-, N, C, H), physical (temperature, moisture, volume, color) and biological analyses (CFU of fungi, bacteria), and looking for correlations between them and data obtained from visual inspections of chromatograms (VIC) of both experiments. Experiments were carried out at the Faculty of Agronomy (UANL, Mexico).

Exp 1 was established under a completely randomized design with factorial arrangement: two turning frequencies (once every 7 and 14 days) and five substrate mixtures (moringa crop wastes -MW-; cow manure -CM-).

Exp 2 was carried out with the same statistical design considering two earthworm species (*Eisenia foetida* and *E. andrei*) and four substrate mixtures (MW; CM; chicken manure -CHM-; cafeteria wastes -CW-). Three replications were considered for each treatment.

Data collected from VIC were: zones (dist), concentric rings, color, channels, and spikes. VIC and chemical-, physical-, biological -parameters (CPBP) were subjected to ANOVA or by non-parametric tests (according to assumptions). Pearson correlation coefficient (*r*) was considered in order to determine the correlation degree between all parameters obtained from VIC and CPBP.

Highlights of experiments: (1) Turning compost every 14 days had the significant highest N retention, but the lowest significant OM. Increasing CM amounts in compost mixtures attained a significantly lower C:N ratio at the end of the experiment, which may promote a better substrates decomposition. (2) CFU of bacteria were significantly highest in treatments with *E. foetida*. The same specie in MW:CM:CW mixture (1:1:0.5 ratio) showed the highest significant values of AC, OM, and moisture. pH values were significantly higher in treatments without CHM.

Significant correlations were found between VIC and CPBP. However, variables correlated differently in each experiment.

In Exp 1, OM and EC correlated negatively with the middle and outer zone, as well as channels and spikes with CFU of bacteria and fungi. Moisture created positive correlations with the outer zone, as well as pH with the middle zone.

In Exp 2, OM and moisture correlated positively with the inner zone, channels, and spikes, as well as EC with the inner zone. Significantly negative correlations were found between CFU of fungi and middle zone, as well as pH with channels and spikes.

Further studies on correlations between picture elements in PCC and CPBP are necessary for further development of PCC as a method for assessing compost.

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Keywords

Organic agriculture, *Eisenia foetida*, *Eisenia andrei*, substrate mixtures, pearson correlation

Farmers ability to perceive soil health using circular chromatography

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Global food production depends on soil health (SH). The search for an all-inclusive indicator for SH is challenging deductive scientific research, as SH should derive from the interrelation of physical, chemical, and biological components. This complexity of SH indicators is a barrier for farmers with practice orientation. Lack of coherent understanding of overall soil conditions is tampering with practitioners' choice of best practices promoting SH.

The Pfeiffer's circular chromatography (PCC) has been reported to generate a qualitative SH assessment. PCC Visual representation of SH is suggested to be accessible for the nonscientific community via a non-numeric reading. To date, PCC research work investigated its ability to report on SH or specific soil conditions. When reviewing the original design of PCC, it is evident that its full potential should lay in the meeting point between the farmer and their ability to perceive the soil condition.

This pilot research aims to map the relationship between agricultural practices and PCC results. Furthermore, to shed light on farmer's reaction to the qualitative indications derived from PCC.

As part of farm consultation work, 10 farms in Israel were monitored in the Mediterranean, semi-arid, and hipper desert zones. Their cultivation includes vegetables, olive groves, vineyards, and almonds. Farming practices observed: with\without cover crops, changes in soil cultivation, and biological amendments of biodynamic preparation, compost tea, and effective micro-organism (EM).

Using an Archetypal Mapping method, the research was able to identify key visual changes in the chromatography correlating between the different agricultural practices. Thus, it is possible to indicate how PCC represents soil care practices. Farmer's perspective of the PCC results were decoded using ground-based theory methodology.

Four levels of soil health understanding were identified. Motivation for choosing practices promoting soil health were noted.

The interim conclusion of this ongoing action research reveals the possibilities laying in a non-numeric understanding of SH. When done with farmers' direct reporting on their understanding of SH, the PCC could be an important tool for promoting best practices.

Further investigation is needed to develop archetypal mapping of chromatography results. Long-term monitoring and farmer reporting on their understanding of SH will continue to improve the processes leading to SH adoption.

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Keywords

Soil health, chromatography, Soil assessment, Qualitative assessment

SYSTEM COMPARISON

Do biodynamic preparations influence yields, product and soil quality? Evidence from 15 years of research in the Frick long-term trial, Switzerland

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Research question

Do biodynamic preparations (500-507) influence yields, product and soil quality in a Swiss arable rotation in the long-term?

Research method(s)

The Frick trial (47°30'N, 8°01'E, 350 m a.s.l.) was started in 2002 and has a factorial strip split-plot design representing the bioorganic and biodynamic farming systems separated for fertilisation (slurry vs. manure compost/slurry, one livestock unit nitrogen per ha) and biodynamic preparations (with BD500-507 vs. without) in split-plots.

The crop rotation includes winter wheat, silage maize, spelt and two years of grass-clover. The rotation was adapted to the heavy clay soil (45% clay) and moist cool climate conditions (1044 mm, 10.3°C). See Krauss et al. (2020) for more details.

In each year, yields and nutrient contents of plants and manures were measured. Soil quality analyses were conducted in three-year intervals in 0-10 and 10-20 cm soil layers. They included chemical (pH, soil organic carbon, nutrients) and biological (microbial biomass and activity) parameters.

In addition, product quality of wheat was assessed in 2003, 2009 and 2019 by biocrystallisation (CuCl₂) with the focus on samples with and without biodynamic preparations.

Results

Over the course of 15 years, the application of biodynamic preparations did not impact yields in comparison with non-treated plots (Krauss et al. 2020). We detected some effects on soil quality in some years, which however did not lead into an overall trend over time.

In 2015, plots with biodynamic preparations induced a lower soil pH. In the last sampling in 2018, ca. 5% lower microbial biomass and 6% lower P contents were recorded. The assessment of wheat grain quality with CuCl₂ biocrystallisation revealed a correct separation of blinded samples treated with and without biodynamic preparations in 2003, but not anymore in 2009 and 2019. In an extended assay in 2019, the fertilization treatment were discerned. The addition of manure compost also increased soil quality over time while yields were slightly lower than in the slurry only fertilization treatment.

Conclusion

In the arable farming setting of the long-term trial in Frick where the bioorganic and biodynamic farming system was compared in a factorial design, only minor impacts of biodynamic preparations were recorded.

Fertilization on the other hand had a consistent impact and may indicate that it is more the addition of manure compost that improves soil quality and impacts yield and yield quality than biodynamic preparations.

There is also the question, if the influence of biodynamic preparations can be assessed in field trials with plot replicates following natural science based standards as we have seen effects in the beginning diminishing with time.

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Keywords

Arable farming, long-term trial, biodynamic preparations, fertilization

South African farming systems research comparing organic and conventional: The Mandela Trials.

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The Mandela Organic Farming Systems Research Trials compared organic and conventional farming with cabbages, sweet potatoes and cowpeas in rotation and also with mono-cropped cabbages.

In the first two years, soil life improved and soil acidity decreased in the organic treatments; however, the yield gap was larger after the second year (organic 31% lower yields) than the first (20%). Low available soil phosphate was then addressed using rock phosphate before planting the third cycle of crops. The yield gap was closed after the third year, with organic crops outyielding conventional.

A wide range of soil improvements was measured, including soil micro-organisms (diversity and quantity), soil organic carbon, soil water content and soil chemistry. Soil water content was consistently better in the

organic farming system, as was soil organic matter and soil acidity.

In the fourth year, crop rotation yields were significantly better than mono-cropped cabbage yields. Sensitive chromatography showed improved soil structural patterns and a more alive picture for organic soils than conventional.

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Keywords

Soil biodiversity; farming systems comparison; soil organic matter.

CERTIFICATION

Alternative certification paving the way to social innovation

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The organic sector is looking back on a story of success. Starting in small alternative circles, the last decade has proven how professionalized alternative food systems can be. Alongside this professionalization, a complex certification system has evolved in order to guarantee an agreed minimum of organic practice.

In the European Union, the process started with the development of an organic regulation in the beginning of the 1990s. A farmer's compliance to these standards is ensured by private certification bodies, which compete with other certification bodies. Until today, the organic quality of a certain farm's products is determined by a regular farm audit through a trained inspector.

The biodynamic association in Germany has developed the concept of development-oriented certification, which aims at centering the certification process on the individual development of the biodynamic farm. The participatory mode of the certification procedure aims to go beyond regulatory compliance and encourages innovation and individual value orientation.

The concept is both referring back to the beginnings of organic agriculture, preserving original ideals and values and it is going forward in the way that every farm is supported in its individual path of development towards sustainable organic farming.

In the ongoing pilot project approximately 40 farms are trialling the development-oriented concept. Central to the development of this pilot project was the idea to both strengthen

value orientation and the opportunity for individual development within the certification process, acknowledging that the idea of biodynamic farming consists of more than complying with standards.

Hence, the research question is: Does the new concept of development-oriented farming allow for more value orientation, cooperation, and innovation in the certification process?

The group certification process has been documented as a case study of participatory certification in Germany. Three German biodynamic farms have been accompanied in their development-oriented certification process in the year of 2019. Additionally, two expert interviews with a certification expert and an agricultural advisor illustrate the debate on the necessity for progression within the organic certification sector. The certification process observation and the interviews were conducted by one researcher. The interviews were based on a partly structured interview guideline and held via telephone; the process observation was conducted on the respective farms. Data was recorded and transcribed for later analysis.

The interviews show a broad spectrum of perspectives on organic certification. Third-Party Certification (TPC) has become a complex and technical process, that allows full confidence of consumers in the organic quality of the produce. For organic producers, the certification process is part of yet another requirement of red tape.

The concept of development-oriented certification has been developed by a working

group within the Demeter Germany association. With approval of the Demeter International board, up to 100 farms are eligible to take part in a pilot project which lasts for 5 years (2018-2022). For the time of the project, the regular Demeter audit by a certification body is suspended. The certification procedure is described in a corresponding handbook. Facilitators have been trained accordingly by the project team. The participating farms are allocated in so-called credit groups of three to five farms each. Central to the procedure is a farm development dialogue which consists of a facilitated group discussion on the respective farm. Farmers of the credit group as well as the group's own facilitator are part of the dialogue. The facilitator moderates the process for the whole group. The structured group discussion lasts about four hours. The farm development dialogue takes place once a year at each farm. This means the development-oriented certification process is not necessarily more time efficient than the regular third-party certification. It is, however, more personalized adapted to the individual farm and its key issues. Each year, every farm defines two to three development measurable goals. These goals can refer to economic achievements, social changes, ecological ideals, or milestones for the development of a new branch of the farm. At the end of the dialogue, the facilitator and other farmers discuss whether the respective farm will be granted the Demeter certification. If there are serious doubts, individual action plans are to be designed by the group and checked back with the respective regional office. The sovereignty over the development-oriented certification process lies mainly within the group and can be adapted according to individual needs. The space that is provided by a new understanding of certification – a type of peer-to-peer-certification – can create a common grounding among the respective farmers.

In response to the research questions, the following developments could be observed: the participatory certification stimulates the group members' reflection on their value

orientation. This not only bears the potential for holistic farm development and innovation, but also brings members of biodynamic farming to tell their personal biodynamic story. However, as this is an official certification process, all members have economic and social interests in a successful certification process and are, at the same time, designers of that very process. Theories of commoning and collective action confirm that these are preconditions for effective social innovation.

Additionally, the group members strengthen the relationships themselves through involving each other in the individual farm development. There are, however, risks of principal-agent-problems as well as potential loss of consumers' trust.

The risks and chances need to be investigated further during the course of the pilot project, since the development-oriented concept is equally remarkable and ambitious. Demeter is going down a courageous path with the trial of bottom-up participatory certification, aiming to connect the dots of the movement's beginnings and its future.

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Keywords

Development-oriented certification; organic and biodynamic agriculture

BioFarming and BioHotels Perspectives in Georgia

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Nowadays the BIO farming is the best method for healthy and organic food which takes an important role in sustainable and environmentally friendly agricultural and food production in Georgia.

The paper analyzes the development and issues of future perspectives of Bio (organic) farming and BioHotels Businesses in Georgia.

Some findings of organic agriculture development are given, estimating the primary information on organic farming in Georgia regarding the trends of the organic farms' number, utilized organic agricultural, and share of organic land in the total agricultural land.

The influence of Georgia's Bio Farmers will be increased in coming years and some issues

of further perspectives of the development of Georgian BioHotesl Facilities will be integrated with BioFarmers and organic Food Producers.

Because bio-certification is quite expensive for Georgian farmers, our association helps local bio-farmers to learn more about bio-hotels philosophy and Business Models to be able to feed their own guests with their own bioproducts, and this is the best way for them to earn extra income.

Keywords

Climate change, biodiversity, biofarming, Georgia, BioHotels, income

BREEDING AND SELECTION

Breeding for nutritional quality in open pollinated vegetable crops

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After decades of focusing on increasing crop yield, improving nutritional quality of food crops is gradually becoming more important in plant breeding. In particular organic consumers value the nutritional quality and taste of food. However, it is not yet clearly understood how breeding can improve the nutritional quality of food crops. There is evidence that in general breeding can result in lower mineral contents (Murphy et al. 2008; Davis, 2011). It is also suggested that it is possible to aim for a balance in yield and nutrient quality in wheat (Moreira-Ascarrunz et al. 2016). In that respect, not much scientific evidence exists in the case of vegetable crops, although there are interesting studies. For example, Renaud et al. (2014) studied the complex relationships between specific secondary metabolites of broccoli cultivars under organic and conventional conditions.

However, in biodynamic breeding the aim is to breed for nutritional quality from a holistic perspective. An important question is how plant breeding with a focus on traits to improve aspects such as storability and increased harvesting efficiency may have impacted nutritional quality and taste. Another important question is how to select

for improved nutritional quality and taste by looking at plant growth and more specific traits like leaf formation, shape and size. A better understanding of such relationships will allow indirect selection in the field.

An overview has been made on various crops using different methods (field observations, taste tests, and various laboratory analysis (see Table 1). For example, in the case of cauliflower and Chinese cabbage, negative relationships were found between leaf formation and taste. For red cabbage, relationships between leaf development and picture forming methods were observed. Comparisons on onion and pumpkin showed that soil fertility and soil type can have large effects on nutritional quality and are often interacting with different cultivars of these crops.

Nevertheless, these comparisons suggest that there are relationships between plant growth and nutritional quality. This means that farmer breeders can select for nutritional quality by selecting on specific plant growths. The data show that for each of the studied crops different approaches are needed to address nutritional quality in the breeding process.

Table 1: Data collection on various crops was conducted in the following projects in the following locations and years. Per crop a brief description of the focus of the main results is provided.

Project	Location*	Year	Crop	Main results
Divers en Dichtbij	GAOS	2014/15	Red Cabbage	Relationships between leaf development, nutritional quality and picture forming methods were observed
Breeding for quality	GAOS, DBH	2017-2018	Carrot, Red Cabbage, Pumpkin	Relationships between yield, storability, taste and nutritional quality
LIVESEED	DBH	2019	Cauliflower	Leaf formation and taste
Zaadvast en Zeker	DBH	2020	Chinese Cabbage	Leaf formation and taste
Zaadvast en Zeker	GAOS	2020	Onion	Yield, storability and nutritional quality
Zaadvast en Zeker	DBH	2020	Pumpkin	Relationships between yield, storability, taste and nutritional quality
Zaadvast en Zeker	DBH	2020	Rucola	Yield, leaf development, taste and nutritional quality
Zaadvast en Zeker	DBH	2020	Spinach	Yield, leaf development, and nutritional quality
Zaadvast en Zeker	DBH	2020	Red Beet	Yield, leaf development, and betacyanin levels

* the farm GAOS has clayey soil, the farm DBH (De Beersche Hoeve) has sandy soil.

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Keywords

Plant breeding, vegetables, nutritional quality, indirect selection

Partnership breeding of maize for nitrogen efficiency/fixation, weed control, and nutritional value.

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Question

How to evolve maize to increase sustainability and resilience for farming and thereby to marry it with a future that is healthier for humans and the planet?

Methods

The program uses pedigree breeding and yield testing, but its philosophy is to dialogue with maize as a biologically creative partner. Aside from orchestrating genetic recombinations, our breeding process also involves observing and utilizing shifts in regulatory patterns that may be epigenetically engendered or caused by genomic shifts ('emergence-breeding'). To increase its resiliency, and induce shifts, maize was grown and selected under biodynamic/organic environments that featured stress from limitations of nitrogen (N) and weeds.

Results

Spontaneous mutations and heritable changes were employed to increase essential amino acids and micronutrients in the grain of our corn and nitrogen (N) efficiency. N efficient inbreds were shown to bear bacterial endophytes in their seed, transfer them to their roots, and excrete them through root hairs into their rhizospheres. This process, called rhizophagy, entails the culturing of bacteria and their partial consumption in root cells, and the stimulation by these bacteria of root hair formation. Conventionally bred inbreds, grown under the same conditions, did not foster these bacteria in their seeds and roots. Under N-limited conditions, the putative N₂

fixing, rhizophagic inbreds from the Mandaamin program show robust growth as if they have been fertilized with N. Strip trial and small plot trial results showed negative effects of manure applications on grain yields for the putative N₂ fixing hybrids but similar or even higher yields to fertilized commercial hybrids if no manure is applied. Some of the putative N₂ fixing hybrids seem to better tolerate weed competition. In 2020 hybrid trials took place in a uniform patch of thistle (*Cirsium arvense*). Yields of the highest yielding putative N₂ fixing hybrids in this trial reached up to double the average yield attained with three commercial hybrids from a cooperating organic company.

Conclusion

This partnership breeding is in sync with maize's native cultural roots. The 'partnership' includes positive relationships with microorganisms in plant seeds and roots (rhizophagy). These plant:microbial partnerships enhance sustainability and resilience, including N efficiency and tolerance to weeds, that are not available in conventional maize.

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Keywords

Rhizophagy nitrogen fixation methionine weeds

AGRICULTURE IN BRAZIL

Biodynamic Certification in Brazil

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The certification process was a legal framework for Biodynamic agriculture, because through this standardization process, the principles first proposed by Steiner for agriculture were legitimized. Through this aegis of legality, the associations and institutes of the biodynamic movement managed to establish themselves and grow in the 20th century, especially after the second world war.

Due to the importance of this recognition, this article pursues to understand the trajectory of Biodynamic certification in Brazil, as well as the institutions linked to the certification process.

A descriptive study was carried out on the certification process, which according to Almeida (1989, p. 71) is characterized by a study that focuses on precise and explicit objectives on the observed facts describing the characteristics of a phenomenon or group of individuals, in the research in question, the agents involved in the certification process, as well as the certifying institutions located in Brazil.

A bibliographic research was also carried out on the subject and semi-structured interviews with agents of the Biodynamic movement in Brazil.

The history of Biodynamics in Brazil is in no way dissociated from the history of the movement started in 1924 by Steiner's agricultural course. The first immigrants to practice Biodynamic agriculture on Brazilian soil were German farmers who left their country of origin in 1939, a time of expansion of the Experimental Circle and full dissemination of Steiner's principles throughout the world, with the creation of associations in several countries.

In Brazil, the audited certification process is 29 years old and is currently carried out by the Biodynamic Certification Institute (IBD), initially created within the Biodynamic movement. Today, the institute moves away from the Biodynamic movement, embracing the different seals that meet the new food trends, acquiring a more entrepreneurial character, and abandoning the principles by which it was founded. The Participatory Guarantee System (PGS), originating from the organic movement, has as diffusers the Association of Biodynamic Agriculture and the Association of Biodynamic Farmers of the South. This system is promising when it merges the legitimacy of the norm with more personal relationships allowing the exchange of knowledge between members, this capacity for exchange of knowledge brings it closer to the roots of the Biodynamic movement.

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Keywords

Biodynamic Certification; Audited System; PGS

Biodynamic Agriculture in Brazil and the relationship with trees and forests

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Brazil is a country that, on the one hand, is marked by its wide diversity and forest extensions, on the other, it ends up standing out as a country of large estates, monocultures, forest deforestation and environmental imbalances, these characteristics being the historical results of occupation and land use, driven in the 20th century by a series of unsustainable developmental policies, in various spheres, mainly in the environmental one.

However, observing the biodynamic agricultural organisms in Brazil, the opposite reality is found, in such a way that it was questioned about the contributions that biodynamic farmers in Brazil can offer to the construction of a co-evolution relation between human beings and nature, understood as a necessary aspect for the promotion of sustainable development.

Thus, the object of study of this research were the set of interpretations that biodynamic farmers in Brazil bring in their narratives of the world, with a focus on the meanings and senses that these agents attribute to trees and forests, as well as practices related to.

To this end, a qualitative explanatory research was carried out in 2019, in which,

through a phenomenological approach, data was collected from 16 farmers, using tools such as interviews, visits and observations, whose the objective was to apprehend the perception of these farmers in order to demonstrate the importance of the cosmovision of biodynamic agriculture in sustaining an agricultural activity that is harmoniously integrated with nature.

As a result, it was learned that the gaze of the agents in evidence did not allow them to look at the individual tree without thinking about the soil, weather conditions, animal life, etc., demonstrating a thought structure that communicates with Steiner's holistic perception. In this sense, the importance of the arboreal organism lies in its socialization, not necessarily material, with other organisms and factors, making trees important beings in the composition of dynamics and landscapes, making it possible to understand that their presence influences the energy conditions of agricultural organisms, contributing to their individuality, astrality and quality of life.

It is concluded that the theoretical and empirical reality of biodynamic agriculture in Brazil supports a cosmovision about trees and forests that has much to contribute to the improvement of understanding about

development, presenting important experiences as references for the theme and future rural development projects sustainable.

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Keywords

Coevolution; sustainability; rural development; tropical forests

SOIL

Soil life quality; gaining first-hand experiences through observational exercises.

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Questions are how the life dynamic of the soil can be experienced and characterized and how it is affected by management, monthly rhythms, and regions.

Methods

The potential for having life experience with the soil is assumed as being universally nascent in humans. Participants are recruited from amongst biodynamic practitioners and others. Assistance and outreach are co-sponsored and web information is on the North American Biodynamic Association website. Monthly internet meetings occur to accompany participants.

Participants are asked to individually participate in observing soil from a field or garden that they know the history of and will have access to through the growing season into the next year. The samples should be taken from the same site on a monthly basis, starting in the spring, taking a pause in the winter for frozen ground, and ending with sampling early the next spring. Ideally a heavy feeding crop should be grown. Notes are taken on dates, types of soil, weather conditions, and previous history of the soil in terms of management. Two soil monoliths (approximately 30x30x20 cm deep) are extracted with a shovel and smeared edges are removed to expose native soil structure. The soil profile should be photographed. A short description of experiences should be recorded each month. These include: 1) Outer appearances (including structure, smell, organisms, etc.). 2) Inner life qualities of the soil. 3) A comparison of how the soil has changed between examinations. Ideally, site

findings will be gathered in a short PowerPoint presentation with photographs and impressions for consecutive months.

Inner life quality experiences and capacities should develop in the participants by magnifying the genuine life experiences that arise in association with the soil, and participants should find the language to express them. While forming these impressions, observers should abstain from speculation or mixing in information from soil tests.

Guiding preliminary results are that the production of a heavy feeding crop causes a progressive devitalization and degeneration of soil structure until August but that these qualities are replenished in November.

Conclusion

The project is in its second year. The exercise is meant to help participants gain an experiential basis for understanding the second lecture of the Agriculture Course. Reports will enable assessing commonalities in experience and regional differences across the continent.

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Keywords

Human experience life quality soil

Agroecology Value chains and sustainable life cycles

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Preamble

The oral presentation will be an opensource platform to initiate a dialogue towards the creation of innovative cognitive processes and system engineering for "Growing beyond Resilience"

Context

Our study field is spread over the last two decades after the emergence of a "new" democracy in South Africa, observing the concept of property and ownership over land, water, biodiversity, culture and minerals. This originates in the destruction of the paradigm of the "commons" and "cooperation" conducted by traders, soldiers, missionaries and politicians who came in waves to "colonise" and "civilise" the indigenous people. the dominance of the Property over land has become a central issue when it comes to apply associative economics, in local EcoEco Systems and circular ways to consider all inclusive relationships.

Relevance to bio-dynamics and beyond

The field of bio-dynamics offers the opportunity to enter a journey bridging spirit and science and a relevant, modern, necessary, fundamental to communities that are presented with situations such as land reform, redistribution, traditional wisdom, and the responsibility to develop skills, knowledge, competencies, technology to live in osmosis and symbiosis with the land.

Research Question

How to apply holistic notions of our human agrarian presence in the macrocosm-microcosm reality ?

Research Method

Discovery of the visible and invisible aspects and energies of the connection between the Universe and the Earth.

Results

How to handle ethically the complexity of our daily life on the land where we live. conclusion: the emerging of the Next Opensource World (NOW) and our collective and individual contribution to the evolution of consciousness.

References

Challenge of our times (Rudolf Steiner)
Hymn to the Universe (Pierre Teilhard de Chardin)
Holism and evolution (Jan Christiaan Smuts)
la Commune (Joseph Proudhon)
Ubuntu - (Lovemore Mbigi)

Keywords

Coherence, resonance, convergence, abundance

FUTURE FARMING

Food for the future scenarios with regard to climate and environment based on ecological recycling agriculture farms in Sweden

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The food's climate impact in Sweden is calculated at 18.8 million tonnes CO₂ eq. (approximately 2 tonnes CO₂ eq. per capita and year - about 20 % total per capita climate footprint) including imported food and production resources from other countries (Cederberg, 2019). This includes the use of chemicals in agriculture, imported feed and emissions from deforestation to produce more agricultural land for meat consumption. Processing and distribution account for about 20%, while the main burden (more than 1,5 tonnes per capita) comes from food production in agriculture

Biodynamic and other ecological (organic) recycling farms selected all over Sweden, covering the main types of soil and climatic conditions in the country, from south with an annual mean air temperature (1961-1990) of +7 °C (Skania) to +2 °C in the North. The selected 22 good-example farms fulfill the definition for ecological recycling agriculture defined in the EU part funded project BERAS (Granstedt et al, 2008; Larsson, Granstedt & Thomsson 2011; Granstedt & Seuri, 2013). They are ecological farms, more or less self-sustained, use diverse crop rotation and symbiotic nitrogen-fixing legumes in interaction with site appropriate human-food crops. In most cases they have animal production based on own fodder production for mainly coarse fodder fed ruminants.

The results show that the example farms' climate impact per hectare of agricultural area on average was 82 to 88% lower, considering the carbon sequestration in the

soil in each cultivation system and the nitrogen surplus 43 to 49 % lower than today's average conventional agriculture in Sweden. Two scenarios, based on two different diets, showed that national self-sufficiency (estimated for 11 million inhabitants by 2030) based on the example farms, using mainly local and renewable resources, could be produced on a total of 2.7 – 3.1 million ha (available today 3 million ha but historically 3.5 million ha). It requires, however, a radical dietary change with a 44% reduction from today's average consumption of meat from ruminants (27, 1 kg per capita and year) and at least 90% less meat from monogastric animals (mainly chicken and pigs, 55.4 kg per capita and year) and 0- 30% less milk consumption from the current level (357 kg milk). These reduction in food from animals is in our scenarios compensated by a higher consumption (and thus production) of vegetables and root crops while the current level of cereal products is maintained.

The scenarios reduce the food's climate impact from agriculture to between 80 and 100 kg CO₂ eq. per capita, considering the carbon sequestration of organic grassland farming (Granstedt and Kjellenberg 2017) and traction based on renewable energy.

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Keywords

Biodynamic, Ecological Recycling Agriculture, global warming, carbon sequestration

Biodynamics in an agroforestry system: principles for the cultivation of medicinal herbs and strategies for health promotion.

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The high cost of the health field affects measures and reduces the adherence and effectiveness of actions in the care of people. There is never so much knowledge, resources and information available for care, however never have people felt so insecure and poorly cared for. For this reason, different integrative practices have been implemented to expand the capacity for care and autonomy of people with the available resources.

The objective of this work is to discuss the use of biodynamics in an agroforestry system for the cultivation of medicinal herb as a strategy for health promotion in the Brazilian Unified Health System. In 2018, in the face of an arbovirus epidemic, it was created for the biodynamic cultivation project of medicinal plants in a basic health unit, with the principles of agroforestry, participatory management founded on the Pedagogy of

Doing and Anthroposophical. Regular task forces were carried out for soil preparation, cultivation, management and phenomenological observation of plant development, cosmic rhythms and the application of biodynamic preparations. All these actions were added to the principles of diversity, cooperation, strata and succession adopted by Ernest Götsch in the development of syntropy.

This set of actions resulted in the creation of a regular health education agenda with community participation for the development of an integral approach to health. In the agroforestry planting spaces, the permanent presence of users and health professionals enabled the development of healthy practices, welcoming and psychosocial care in a network for mental health patients, combating zoonosis vectors, improving the ambience of the basic health unit and

consequent prevention absenteeism of servers and greater therapeutic adherence of chronic patients. Through debates on the proper use of the land and the tragedy of common goods, cooperation strategies between managers, health professionals and users of the health system were promoted, as well as introductions such as notions of the culture of peace, autonomy, health surveillance, cultural competence, allocation of genetic resources and sustainable use of biodiversity for the health of communities.

Conclude if the experience of using biodynamics in agroforestry systems worked very well for the cultivation of medicinal plants and enabled the development of a set of health-promoting actions in a basic unit of the Brazilian Unified Health System.

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Keywords

Biodynamic agriculture, agroforestry, anthroposophical medicine, medicinal herb, public health

WORKSHOPS

How I found the farm organism by researching on the fatty acid contents of cow-milk.

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This contribution to the biodynamic conference is developing further on the results of my study on milkfat quality of five finish Dairy breeds with special view on omega-3 and CLA fatty acids.

In the workshop we look at the results of the study and discuss how an interpretation of the statistic results from the viewpoint of

individual farms can help interested farms and consultants to make relevant breeding and feeding decisions.

The workshop is for farmers, consultants and scientists.

Keywords

Farm organism, milk fatty acids, milk breed, old breeds

Arboreal Apiculture - a Phase Shift

Michael Thiele¹

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The field of arboreal apiculture - or a better term may be arboreal apiology - completely embraces the life forces and life gestures of honeybees, and mimics their natural, indigenous nesting environments.

It opens the way into a holistic apian cosmology and re-conceptualizes stewardship and apian nest design. It is pregnant with new possibilities, and novel ways of seeing. It has radically transformed our views and understanding of the apian being and introduced a fundamental challenge to default beekeeping practices.

It also initiated a new era of apian conservation and preservation. Arboreal apiology has brought into our awareness notions of agency and sentience of honeybees and advocates for the rehabilitation of their basic birthrights.

In this workshop, we will look at the implications for biodynamic beekeeping and

conservation in general in the time of the Anthropocene. Michael is the executive director of Apis Arborea, a US-based nonprofit, and will illustrate this pioneering new field by sharing current research and conservation and re-Wilding programs.

Keywords

Arboreal apiculture; rehabilitation of birth rights; ecology of selves; rewilding

Integrating Valerian into Tropical Agricultural Landscapes

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The workshop intends to show and exchange experiences with the participants on the growing of Valerian in the tropical and subtropical regions using a study case from Brazil. The importance of the personal relationship, dedication and comprehension

to the plant and the environment. As well the observation on the native similar plants. Building such a condition for valerian development in several surroundings evidenced the progress of a more resilient landscape.

Keywords

Biodynamic preparation, tropics, cultivations core, farmer, valerian

Twenty years' research experience on biodynamic farming research on horticultural crops

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Biodynamic package of practice was applied in field for growing of subtropical fruits (mango, guava and aonla (Indian Gooseberry) and vegetables (tomato, cauliflower, cabbage etc.) in randomized block design with 3 replications. Insect pest management in all experimental trees was done with spraying of biodynamic liquid pesticides and lime sulphur.

Initial soil sample was drawn before the application of biodynamic package of practice and initial soil properties revealed that the organic carbon, available P and K and population of mould and bacteria were 0.53 %, 8.66 and 140 ppm and 1.3×10^4 and 3.7×10^6 cfu/g, respectively. After three years of interventions significant improvement in physical, chemical and biological properties of the soil was noticed as organic carbon, available P and K and population of mould

and bacteria were improved to 1.16 %, 56.27 and 1062.25 ppm and 8.5×10^4 and 3.1×10^8 cfu/g, respectively.

Four types of composts, i.e., Biodynamic, NADEP, Vermi and Micro Mediated (MM) were prepared with locally available materials with minimum use of cow dung. Nutrients level of these composts along with Cow Pat Pit (CPP) was almost 2-3 times more than normal compost. Biodynamic compost contained N (1.68%), P (0.17%), K (1.23%), Zn (96 ppm), Cu (45 ppm), Mn (357 ppm) and Fe (3352 ppm) compared to 0.70%, 0.10%, 0.37%, 75 ppm, 34 ppm, 222 ppm and 3134 ppm, respectively in farm yard manure.

Initial nutrients level of common farm yard manure N (0.70%), P (0.19%), K (1.37%), Zn (75 ppm), Cu (34 ppm) were improved after fortification with cow pat pit to N (1.02%), P

(0.38%), K (0.32%), Zn (80 ppm), Cu (45 ppm) which indicates that application of compost quantity can be reduced per unit area to minimize the cost of production.

Microbial population improved in soil after the application of different organic treatments viz., total bacterial count was recorded maximum (8.1×10^6 cfu/g soil) with application of BD-500 + FYM 10 kg/tree.

Application of biodynamic compost (30 kg tree⁻¹) + bio-enhancers cow pat pit (CPP) 100 g, BD- 500 and BD- 501 as soil and foliar spray) was applied 35 years mango trees. After two years of experimentation, maximum increase in total bacterial population (69.14×10^8), actinomycetes (38.94×10^6), microbial biomass (750.27 mg/kg), microbial biomass phosphorus (4.58 mg/kg), microbial biomass nitrogen (181.42 mg/kg), alkaline phosphate activity (136.37 μ g pnp/g/h) and acid phosphate activity (80.26 μ g pnp/g/h) was recorded.

In another experiment, application of BD-500, vermiwash, vermi compost and CPP in papaya improved soil bacterial and mould population (5.3×10^6 & 3.3×10^4 cfu/g soil).

Application of biodynamic package of practice in guava, improved the fruits/yield (319/33.20kg/tree) and fruit quality TSS, ascorbic acid (12.66°Brix and 231.38mg 100/fruit) and reducing sugars in fruit (4.70%).

In organic production of mango, maximum fruit number (403.83/tree) and fruit yield (108.98 kg/tree) was recorded with biodynamic package of practice. It improved the fruit weight (0.261kg). Application of biodynamic package of practice in Indian goose berry improved the fruit yield and quality parameters of Indian gooseberry.

Cauliflower and cabbage were successfully grown with application of composts, BD preparations and BD liquid manure and yield was recorded up to 42.58 t/ha in cauliflower and 56.16 t/ha in cabbage.

Application of biodynamic package of practice was done in cauliflower, cabbage, Okra and cowpea production following the randomized block design. Observations revealed that maximum yield (95.95 q/ha.

(Cauliflower), 178.73 q/ha (cabbage) and 89.27 q/ha. (ladies finger/okra) was recorded highest.

Sowing of seeds of Okra was done as per biodynamic calendar and without following the calendar in randomized block design. Result showed that highest yield (125.00 q/ha) was recorded when seeds were sown on Moon opposite to Saturn and on fruit day.

Neem and *Pongamia* based biodynamic liquid pesticides (50%), used against first instar nymphs of mealy bug and it caused the mortality ranged from 76.67 to 100 % on 7th day.

In an experiment, mango hopper management was done with spraying of neem based biodynamic liquid pesticide. Spray was carried out twice (11th and 14th SMW) after panicle emergence stage. The observation on mango hopper population was recorded during the flowering and fruiting period at weekly intervals. Before spray, the hopper population was 3.07/panicle and after the spray the reduction in the insect population was found up to 15th SMW with 0.95. Second spray was taken up at 14th SMW, as result insect population reduced to 0.4 hoppers /panicle up to 19th SMW. Powdery mildew was managed with spraying of BD - 501 and 0.2 % lime sulphur.

A typical phenomenon in mango, i.e., setting of fruits at the tip of the floral panicles in 'cluster' has been observed since a number of years in mango. The phenomenon is locally called as jhumka (clustering). Setting of fruit in cluster occurs in a number of mango varieties with varying degree of intensity and in Dashehari variety of mango about 80 % of the trees were found affected. An estimated loss of crop due to clustering disorder during the year 1993 was in the range of 60.00 to 80.00 %. Its occurrence was not noticed at biodynamic research farm, which was managed with biodynamic package of practice for 4 years.

On farm production of biodynamic inputs production and use were also demonstrated to the farmers. Biodynamic inputs are rich source of microbial consortia, macro,

micronutrients and plant growth promoting substances. These were used for seed/seedlings treatments and spraying crops and soil. On farm production of bio-pesticides with herbal, medicinal plants and animal products were also demonstrated to the farmers for management of insect pests.

Several off farm and on farm training programmes and field demonstrations were organized for on farm production of quality organic inputs and their use in various crop productions continuously for 11 years. 212 farmers were trained and 125 demonstrations were organized in 450 ha of land in Sikkim, Assam, Nagaland, Arunachal Pradesh, Manipur, Tripura and Mizoram of India. This impacted that Sikkim has become first organic state of India. In Bundelkhand region of Uttar Pradesh, India 125 farmers were also trained and 125 field demonstrations were organized for popularization of the practice.

Thirty seven farmers of Azamgarh district of U.P., India adopted biodynamic farming for production of medicinal crops and earned profit from INR 3, 45, 00.00 to INR 4, 36,000.00/ha and in Lucknow districts of U.P., India 31 farmers adopted package for vegetables crops and earned net profit from INR 20, 000.00 to INR 36, 000.00/ha over conventional cultivation.

Yield of mango cv. Mallika was taken for economic analysis showed that the minimum cost of production (INR 5.41/kg), maximum production (10898.67kg/ha), total production value was recorded maximum (INR 163480/ha) and maximum benefit cost ratio (5.10) was obtained with application of biodynamic package of practice.

Comparative assessment of pollinators was made on their populations in mango in different environments viz., organic farm of the institute and conventional farmers' orchards. Assessment of insect pollinator populations at different locations and environments revealed that the pollinator populations were adequate at organic farm of the institute. At farmer's fields where

orchardists regularly used synthetic pyrethroids in addition to other chemical pesticides, insect pollinator's numbers were very low. In such orchards average pollinator population was very low 0.50-0.80 and the fruit set 0.60-1.60 per panicle.

Conclusion

Biodynamic preparations are cheap source of agriculturally important microbes having miscellaneous PGPR and biochemical activities. The present study reveals that biodynamic preparation viz., cow pat pit, BD-500, BD-501, BD (502-507) and biodynamic liquid pesticide are potent source of nutrients, microbes have PGPR potential antagonistic properties against *C. gloeosporioides*, *C. fimbriata*, *P. aphanidermatum* and *F. oxysporum*. Therefore, these formulations can be effectively used for nutrient and pest management in organic production system.

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Keywords

Cow Pat Pit, BD-500, Actinomycetes, Azotobacter, Azospirillum and Plant Growth Promoting Activities

Individuality, Intuition and Health in Agriculture: A Landscape Perspective

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The concept of a farm as an individuality, proposed by Steiner in the Agriculture Course, is one of his most powerful contributions to agriculture today. The human being plays a key role in integrating all the natural kingdoms in the farm, thus shaping and determining its identity, biography and health.

The farmer's intuition, self-observation and self-reflection abilities are now increasingly recognized as indispensable tools to keep a farm in good health (1). "An organism can only be apprehended through an intuitive approach" says Steiner (2). Working with farmers on observing the farm landscape and its environment contributes to the development of their intuitive skills. It opens up a new perspective on the farm they're responsible for, and on the landscape of which their farm becomes an integral part as an organ of it.

This regard, the work of Jochen Bockemühl (3) and those inspired by him (4 & 5) has made available to farmers a working methodology on the subject with a landscape approach, to work out on a farm level and beyond it.

In this sense, the Spanish Agro Cultura Con Respeto Association is carrying out this exercise in the advisory and training work of an organic pistachios' cooperative in Ciudad

Real, Spain. After the exercise, farmers realise that their connection to the landscape is fairly close. However, they only see the things that are most closely related to their agricultural activity, f.e. the white storks walking behind the tractor while ploughing; the bee-eaters, spring migrants, as a threat to beekeepers; the appearance of ladybirds when aphids emerge, or emblematic species such as the great bustard or the common trumpeter crane, an autumn migrant.

This shows they don't have yet a view of their landscape as a whole and many details of relevant connections between farm management and the environment are lacking. Through the methodological work quoted above, it's possible to enhance the farmer's intuitive abilities, which are key to healthy landscape and farm management. However, it requires lifelong training, so more attention should be paid in the training programs for biodynamic farmers. Furthermore, in a community work with several farmers in an area, that feel committed to offering to consumers a product of highest quality, the practiced exercises become richer and strengthen the internal bonding for that common endeavour. Therefore, we strongly recommend the use of this methodology elsewhere.

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Keywords

Individuality, intuition, health, biodynamic training, Central Spain

Focus on Farmers: Certification as a Tool for Farm Development

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Demeter e.V.'s alternative certification project has allowed us to introduce something big, even radical, to our members and partners, and pilot a new approach to biodynamic certification by adding a new dimension to the participatory certification approach. We are creating something our members have been requesting for years: an approach that puts the focus on farms and farmers, not checklists and inspections.

Thus, we open ourselves up to a development that has the potential to bring vitality to the way we recognize our farmers' accomplishments; foster the creation of high quality products, and build vibrant knowledge-sharing networks.

During the project, our participating farms receive their Demeter certification following a rigorous, moderated farm development talk. Each year, for five years, we add farms to the participant group until up to 100 farms are partaking in 2022. In 2020 we added an initiative for small-scale processors which will run along the same lines as the alternative certification scheme for farmers,

but adapted to the special challenges faced by Demeter-certified processors.

We are working together with the University of Hohenheim in Stuttgart, Germany to develop our methods, accompany us in the process and scientifically evaluate the results to help us decide how this model can best be implemented on a broader scale. Our focus is on giving farmers and processors the tools they need to build stable networks of peers and stakeholders, such as customers, and maintain or improve the quality of their products and the standard of their work.

The future of our farms is reliant on the people who operate those farms: without a strong social foundation, sustainable agriculture is just a buzzword. This project gives us the opportunity to test a radical hypothesis: when farmers feel supported in their work and have access to information and networks and regularly receive structured input, they will be less likely to breach the certification standard. In fact, the overall quality of their work will improve and

the attractiveness of their farms for future generations will increase.

As our project is currently under way, we will not be able to present final results at this year's conference. Nevertheless, we feel that our preliminary results and insights may be of interest. We would be happy to share these with the conference attendees as a

workshop, giving insight into the project and our approach to farm development talks.

Keywords

Alternative certification, trust, peer-to-peer, knowledge sharing, life-long learning, farm talks

Plant growth promoting, biochemical and antimicrobial properties of microbes isolated from various Biodynamic preparations

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Biodynamic farming refers to "working with the energies which create and maintain life. It's a process of healing earth with vital forces through human efforts. Using biodynamic preparations regularly opens the soil to cosmic activities and allows these to work through soil into the plants. The aim of biodynamic concept is to establish a system that brings balance into all factors, which maintain life. In biodynamic farming energy harnessed from cosmos, plant earth and cow. Biodynamic compost, BD-500, 501, cow pat pit, biodynamic preparations (502-507) and biodynamic liquid manure/pesticides are produced at the farm for nutrient and insect pest management. To find out scientific explanations to prove the efficacy of biodynamic inputs extensive research was done and connected to modern science.

1. Cow pat pit

Cow pat pit contained maximum number of microbial colony (96×10^6 CFU/ml) observed on the Actinomycetes agar and Kings B agar medium (specific for actinomycetes and pseudomonas, respectively) as compare to bacterial colony observed in nutrient agar medium (80×10^6 CFU/ml), Pikovskayas agar (76×10^6 CFU/ml) and other media. It is also recorded that significant number of

microorganisms appeared in CRYEMA (32×10^6 CFU/ml), N-free malate medium (64×10^6 CFU/ml) and azotobacter specific Jenson's agar medium (56×10^6 CFU/ml). Total number of fungi (20×10^6 CFU/ml) observed on Rose Bengal agar medium.

Fifty five microbial isolates (52 bacteria, 3 actinomycetes) were isolated and evaluated for different plant growth promoting attributes viz. ammonia, indole acetic acid, siderophore and HCN production. Among them 9 bacterial isolates and 3 actinomycetes isolates were from CPP and rest 43 bacterial isolates were from other biodynamic preparations. Actinomycetes isolated from CPP showed siderophore and HCN producing activity (CISH-PGPA 13). Similarly, CISH-PGPA 15, an actinomycetes isolated from CPP also produced both ammonia and IAA in the test medium conducted in the laboratory.

Cow pat pit enriched in mineral salt medium (MSM) with chlorpyrifos (1%) as sole carbon source for isolation of potential microorganisms and their application for chlorpyrifos (@2.5%) biodegradation. The strains *Pseudomonas aeruginosa*-CPP14 (MT043911), was identified from Cow Pat Pit.

This strain was tested positive for plant growth promotory properties like P, Zn, K solubilization, IAA & siderophore production and also inhibit the growth of potential plant pathogens (biocontrol activity) like *Ceratocystis fimbriata* (MTCC-2281), *Pythium aphanidermatum* (MTCC-284), *Colletotrichum gloeosporioides* (MTCC-2190) & *Fusarium oxysporum* (MTCC-10247). Based on enrichment, PGPR and biocontrol activity consortium (C1 and CPP14) was developed and tested for chlorpyrifos biodegradation (@2.5%) in pot trial (SS-sterile and NSS-nonsterile soil) in comparison with single strain. Consortium C1 degrades 94.96% of chlorpyrifos in non-sterile soil as compared to control (23.55%) after 9 days of interval. The identified strains of this study have huge potential to degrade chlorpyrifos that can further use for soil reclamation from pesticide contamination and plant growth promotion.

Based on biochemical tests, most potent isolates were selected for antimicrobial properties against some selected pathogens. Microbial isolate from cow pat pit i.e. CPP-14 inhibited the growth of *F. oxysporum* and *P. aphanidermatum* by 60.34 and 17.67 % but failed to affect the growth of *C. fimbriata* and *C. gloeosporioides*. CPP-2 inhibited the growth of all fungus i.e. *C. fimbriata*, *C. gloeosporioides*, *F. oxysporum* and *P. aphanidermatum* by 49.83, 51.49, 28.98 and 14.39%, respectively. CPP-7 and CPP-8 has also inhibited the growth of all four pathogens.

2. BD-500

The microscopic characterization and PGP properties of microbes were observed. Test strains BD-1, BD-3, BD-5, BD-7, BD-9, BD-11, BD-13, BD-15, BD-17 and BD-19 were tested positive for Zn solubilization, P solubilization and siderophore production. This indicates that application of BD-500 in soil improves soil fertility through Zn solubilization, P solubilization and siderophore production microbes.

3. Cow horn silica (BD-501)

The maximum number bacterial colony (30×10^5 CFU/ ml) was observed in the

Pikovskaya's agar medium (specific for *Azotobacter*) as compare to *Azospirillum* (30×10^6 CFU/ ml), G⁺ bacteria (20×10^5 CFU/ ml), Actinomycetes (8.0×10^5 CFU/ ml), Rhizobium (13.0×10^5 CFU/ ml), G⁻ bacteria (18×10^5 CFU/ ml), Pseudomonas (6×10^5 CFU/ ml), P-solubilizing bacteria (30×10^5 CFU/ ml) and other bacteria. Total number of fungi (1×10^5 CFU/ ml) observed on Rose Bengal agar medium.

Based on morphological (microscopy) characterization, total 15 efficient bacteria (501-1 to 501-14) were screened and observed. All the isolated bacteria were tested PGP properties viz; P-solubilization, siderophore production, IAA, amylase, K and Zn solubilization and HCN production. 501-1 and 501-2 tested positive for P-solubilization and Zn solubilization. Test strains 501-7, 501-11 and 501-14 were tested positive for Zn solubilization. Test strains 501-7, 501-11 and 501-15 were also tested positive for IAA production. None of test strain was tested positive for amylase, potassium and HCN production.

4. Biodynamic preparations (502-507)

Microbial characterization, biochemical and plant growth promoting activities of microbes isolated from these preparations.

BD- 502

Biochemical characterization of isolated cultures BD-502-16 showed positive activities for urease and H₂S production while BD-502-10 showed positive for malonate utilization lysine utilization, urease, H₂S production, citrate utilization, malonate utilization, esculin hydrolysis, saccharose, ONPG and catalase.

5. BD- 504

Biochemical characterization of isolated cultures BD-504-1, 4, 6, 7, 16, 18, 19, 20, 27 showed positive activity for urease and H₂S production while BD-502-10 showed positive for Malonate utilization Lysine utilization, urease, H₂S production, citrate utilization, Malonate utilization, Esculin hydrolysis, Saccharose, ONPG and Catalase.

6. BD- 505

Biochemical characterization of isolated cultures BD-505-4,12,20,21, 22, 22, 23 and 24 showed positive activity for urease and H₂S production while BD-502-10 showed positive for Malonate utilization Lysine utilization, Urease, H₂S production, Citrate utilization, Malonate utilization, Esculin hydrolysis, Saccharose, ONPG and Catalase. Seven potential microbes isolated from BD-505 and tested for various plant growth promoting activity. BD-24 and BD-4 were tested for Zn solubilization, BD-4, BD-20, BD21, Bd-22, BD-23 and BD-24 were tested positive for phosphate solubilization, BD-24 and BD-21 were found positive for HCN production and BD-12 and BD-24 were tested positive for siderophore production.

7. BD- 506

Biochemical characterization of isolated cultures BD-506-2,4,5,7,8,13,14,16,17,20,25 and 28 all potential microbes were tested for various plant growth promoting activities. BD-4,7,8, 11 and 22 were tested positive for siderophore production, BD-506- 5, 14, 15 and 16 were tested positive for Zn solubilization, BD-506- 25 was tested highly positive for Zn, P solubilization and siderophore production. None of microbe tested positive for HCN production.

8. BD- 507

After biochemical characterization of isolated cultures BD-507-10, 11, 17 and 26 all microbes were tested for various plant growth promoting activities. BD-507-17, 26 and 6 were tested positive for P solubilization and all the isolates were tested positive for siderophore production and all the isolates were tested positive for IAA, siderophore production and Zn solubilization. None of microbe tested positive for HCN production.

9. Biodynamic liquid pesticide

Biodynamic liquid pesticide (BL) was prepared with materials i.e. cow dung, urine and leaves of neem, castor leaves and other medicinal plant parts. Besides cow dung, cow urine and one set of BD-preparations

(502-507) were incorporated. After 14 days microbial analysis of preparation was done. Maximum number bacterial colony (225×10^6 CFU ml⁻¹) observed on the Methyl Red agar medium (specific for gram positive bacteria) as compare to Azospirillum (200×10^6 CFU ml⁻¹), G⁻ bacteria (5×10^6 CFU ml⁻¹), Actinomycetes (110×10^5 CFU ml⁻¹), P solubilizing bacteria (160×10^6 CFU ml⁻¹), and other significant bacteria. No fungus colony was detected in the preparation.

Biochemical characterization of isolated strains i.e. BL-8 and BL-2 showed positive activity for lysine utilization, ornithine utilization, urease, nitrate reduction, H₂S production, citrate utilization, voges Proskauer's, malonate utilization, esculin hydrolysis, saccharose, raffinose, trehalose, nitrate reduction, glucose, lactose, Catalase. IMViC test also performed for identification of proteobacteria group of species. Test isolates BL-5 and BL-2 showed positive test for citrate utilization while BL-11 showed positive test for ONPG and Adonitol. For sugar utilization test isolates BL-8 and BL-2 showed positive results for Saccharose utilization.

Based on morphological and biochemical characterization total 5 efficient bacteria (BL2, BL 5, BL 8, BL 11) were screened from biodynamic liquid pesticide formulation and observed that all bacteria were gram positive. All isolated bacteria were tested for PGP properties, and BL 8 showed maximum PGPR properties including Phosphorus, Zinc solubilization, siderophore production as compare to other test isolates.

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Keywords

BD-500, HCN production, anti microbial property, F. oxysporum, citrate utilization

Tropical Regenerative Agriculture (ART) methodology and weed inhibition

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ART is an evolving methodology born from anthroposophy adapted to the tropical climate and to the current situation of climate change. It is based on the development of trees in the vegetable garden which are suppliers of RCW (ramial chipped wood).

It also uses dense green manure as a source of soil fertility. Both practices seem to be good allies not only in soil fertility but also in weed inhibition, especially grasses.

We invite you to talk about the principles of ART and the results we achieved during the first cycle of investigation.

Keywords

ART (Tropical Regenerative Agriculture), weeds inhibition, CRW

Influence, Inspiration and Improvisation as Tools in a Garden Maintenance Plan

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My focus is on understanding place as a source of inspiration; that is, a place's identity, genius loci, or the essence of the place. By working for a long time with a place and studying it, a gardener acquires a unique knowledge of its essence. This site knowledge is part of a kind of knowledge that is experience-based, also called the practical or tacit knowledge. A gardener acquires practical knowledge during a long period of

work in combination with basic theoretical and technical knowledge. Site knowledge plays a major role in, for example, design, function and choice of activities. However, experience-based knowledge is difficult to convey and create a common understanding around.

For professional gardeners a dilemma often arises towards both employees and clients when this knowledge is communicated. One

way to communicate park management is to compile a garden maintenance plan. But an ordinary maintenance plan does not take into account the practical knowledge but is formulated so that basically anyone can do the tasks. Consequently aspects of in-depth understanding may eventually disappear, which undermines the possibility for the essence of a place to come to its proper expression.

This in turn means that in-depth interactions between nature and people are overshadowed and that ambitions for holistic thinking remain theories. A maintenance plan for green spaces need to be supplemented with a dynamic working method that can be described and valued.

I therefore want to investigate whether it is possible to find a method for this that includes the practical knowledge. A dynamic method involves elements of uncertainty, reflection, and constant re-evaluation as these create experience-based knowledge. In this workshop, I will lead a discussion about tools for an in-depth study of experience-based knowledge in a garden context.

In the workshop, the conversation will be about: - What influences a gardener? - What inspires a gardener? - What does improvisation mean for a gardener? - Can these three concepts (Influence, inspiration, improvisation: see Marcia sá Cavalcante Schuback) function as tools for a development and deepening of a maintenance plan? - How to raise awareness of practical knowledge and how can it be given weight in an organization?

About: The workshop leader has many years experience developing the biodynamic park and garden that was founded by Arne Klingborg in Järna. She now works as a teacher and gardener at Skillebyholm Gardening Educations in Järna. She uses her practical knowledge as a basis for phenomenological studies of tacit knowledge.

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Keywords

Garden maintenance plan, genius loci, essence of the place, experience-based knowledge, practical knowledge

POSTER CONTRIBUTIONS

Beyond standard Valerian use

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I wanted to see if I could grow salad greens in my un-heated Greenhouse using the Valerian seed treatment that Enzo Nastati gave in his first USA seminar in Paonia Colorado in September of 2013. The purpose or result of this treatment was to have plants that would withstand extreme cold, continue to live and bear produce. Prior to 2013 I could not grow any cash crops in this Greenhouse from November through February.

Methods; using Biodynamic Valerian potentized to 100x, details of this method are explained at the end of this paper. I spritzed a tbsp. of this preparation onto a cup of lettuce seeds. I closed these seeds up in a plastic tupperware box for 24 hours. I also treated Arugula and Spinach seeds in the same way. Seeds were treated on October 10, 2013.

On October 17th 2013 I planted the treated seeds. 1 bed of spinach, 1 bed of Arugula and 2 beds of Lettuce. Each bed is approx. 3 feet x 80 feet.

I sprayed many additional treatments of Valerian into the air in the Greenhouse above

the plants, dates and temperatures as follows;

November 25th Greenhouse 7 degrees

November 26th Greenhouse 10 degrees

November 27th Greenhouse 7 degrees

November 28th Greenhouse 10 degrees

December 6th no temperature recorded

December 8th – 15 degrees outside, 21 degrees under row cover on Arugula bed

All results or yields of any and all crops are an increase in previous production because I could not prior to using this Valerian treatment grow crops in my unheated greenhouse in Taos New Mexico at 7800 ft from November through March. Prior to 2013 and the use and experimentation with this method I could only seed crops starting in late February and ending in October or early November

Keywords

Valerian, sub-zero temperatures, production,

A handbook on the Bio-Dynamic Preparations

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Question

97 years after Rudolf Steiner's Agriculture Course we still are missing a comprehensive basic formation for instructors and researchers for the Bio-Dynamic Preparations. Rudolf Steiner's instructions are often overseen and forgotten. Many valuable experiences which are reported in

the Bio-Dynamic literature are not easy to find.

Methods

- Trying to learn do all the works around the Preparations by myself.
- Inquiring into every question which appeared.

- Studying Rudolf Steiner's Agriculture Course and other works of Steiner.
- Collecting everything about the making and application of these Preparations.
- Consulting many libraries and archives.
- Consulting also literature about important themes as the anatomy of the organs we need for the making of these Preparations.
- Corresponding and working with pioneers: Hugh Courtney, Hugh Lovel, Peter Proctor, Alex Podolinsky, Pierre and Vincent Masson etc.
- Checking methods for their feasibility and developing new methods.

N.B.: The effectiveness of the methods is not part of this research although it puts many questions.

Result

A book with 748 pages full of practical information and accurate descriptions, with a bibliography with much more than 4'000 citations.

A manual and encyclopedia for practice and research.

It raises a lot of questions. Some have to be answered in a concrete situation, but some are of general interest:

- The consistence of the Preparations (dry, humid, colloidal?).
 - The importance of warming water for stirring Preparation Horn manure 500 (and Horn Silica 501).
 - The importance of the intensity of stirring Horn Manure and Horn Silica Preparations.
- For the stirring of the Preparations exists a more actual publication. (Stappung 2018)

The complement: The Preparation Study of Sedlmayr et al.: That is a in-depth sociological study on some few persons, has

no historic dimension and deals only about the making of these Preparations.

Conclusion

Although this book is not perfect, we have a basis now. This overview raises many questions. Some may give rise to further research. Others should not be answered in general. In practice, we need many possibilities because we have not everywhere the same prerequisites.

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Keywords

The Handbook for the Bio-Dynamic Preparations

Influence of homeopathic preparations substances and phase of the moon on the growth pattern of rice seedlings

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Kolisko and Kolisko were the pioneers in testing the biological effects of highly diluted (smallest entities) and agitated (a kind of potentization) substances in plants. Since 1923 they carried out a series of experiments, mainly with wheat seedling germination and growth assay, to determine the potency curve – a graphical representation of the effects measured as a function of potency levels – specific for each substance.

The aim of the research described in this paper was to determine the potency curve of homeopathic preparations of *Silicea terra* (Sil.) and *Calcarea carbonica* (Calc.) on rice seedlings and assess its interaction with the moon phase. The trials were carried out at the Centre for Agroecology, Water and Resilience, Coventry University, United Kingdom, between April and September 2020.

The experiment was composed by 8 repetitions, 4 beginning on the new moon and 4 on the full moon. They were conducted in a growth chamber with a controlled environment for 13 days. The treatments were randomized and a double blind approach to the preparation identity was used. Sil. and Calc. were applied, each from 5 to 30CH (CH= hahnemannian centesimal dilution order) using deionised water and dynamized deionised water as the controls.

Each treatment comprised 15 seeds in a pot and the controls comprised 45 seeds in 3 pots. The length of the first and second leaf were measured.

The results showed that each homeopathic preparation presented a distinct potency curve and they were influenced by the moon phase. For the first leaf growth in the full moon, Sil. presented the maxima at the 18, 19, and 21CH and the minimum at 9, 10 and 26CH while the maxima for Calc. were at 5, 6, 12CH and the minimum was at 7, 18, and 26CH. However, at the new moon, the maxima for Sil. were at 16, 17, and 27CH and the minimum were at 12, 20, and 25CH while for Calc. the maximum were at 9, 16, and 18CH and the minimum were at 15, 19, and 26CH. For the second leaf growth at the full moon with Sil. the maxima were at 7, 23, and 24CH and the minimum at 12, 25, and 28CH while with Calc. the maxima were at 5, 10, and 29CH and the minimum at 17, 20 and 28CH. However, at the new moon Sil. maximum were at 5, 7, and 28CH and minimum at 6, 12, and 25CH while Calc. has the maximum at 24, 26, and 28CH and the minimum at 12, 13, and 17CH.

This experiment shows that with increasing potencies (CH) the influence on plant grow may something be favourably or unfavourably. The kind of influence depends on the homeopathic preparation and its potency used as well as the moon phase when the treatment is applied.

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Keywords

Silicea terra, calcarea carbonica, potency curve

Goethean morphological test

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Based upon Jochen Bockemühl's leaf "morphic movements," mature leaves of arugula (a "leaf" plant) were studied after sowing, according to Maria Thun's sowing calendar, when the moon was in a fruit sign, root sign, leaf sign or flower sign.

Eight replicates were laid out in a four by eight garden plot in a random block design. Stem length, leaf blade length, leaf width, and the number of points (or lobes) were measured.

There were no appreciable differences in measurements among plants sown during the four zodiacal signs, except that the plants

sown during the ROOT sign showed more sectioning (points/lobes). Something apparently may be going on with the position of the moon. However, this does not readily fit with Thun's four-fold plant/zodiacal scheme for a "leaf" plant.

Replication and more detailed analyses of concurrent lunar rhythms are in order.

Keywords

Goethean, Bockemühl, Thun calendar, morphology, lunar-zodiacal

Biodynamic pepper as a promising method in the control of *Atta sexdens*

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Biodynamic Agriculture was renowned by Rudolf Steiner in 1924, and consists of being a model of sustainable agriculture that acts mainly in the relationship between plant growth and cosmic rhythms together with

the maintenance of soil fertility. Another important premise is the least possible dependence on external inputs, prioritizing the self-regulation of the system. The Earth must be nourished so that cosmic influences

can flow freely, and for this to occur, beneficial forces must work through animals and plants.

For Steiner (1924), insects that are considered "pests" within agriculture can be controlled by burning them, transforming them into ashes or into a kind of "pepper". Thus, it is possible that animal pests are distant from agricultural production fields, since the impact of the "pepper" fire will destroy the fertility of the target insect, in this case, of leaf-cutting ants.

Knowing that the region of Botucatu –SP has an abundance of *Atta* nests, the objective of this study was to test the efficiency of biodynamic ash / pepper as a possible control method in *Atta sexdens*, evaluating its activity of foraging before and after the application of the ashes for three consecutive months in the constellation of Taurus.

The methodology used in the present study was adapted from Rudolf Steiner (1924), Giesel (2007) and Forti et al., (2017). Firstly, it is extremely important to know which *Atta* scouts belong to the same nest, for this, the straw methodology was used (Forti et al., 2017), which consisted of cutting small pieces of plastic straws (0, 5 cm), soak them in orange juice and cover them with soybean meal, allowing them to rest for 24 hours at room temperature. After that, the four most active scouts and closest to the heap of land were selected, they were marked with a stake by color and number and the straws of a single color were placed in the respective demarcated scouts. As ants do not digest plastic, within a few days, straws were discarded outside the murundu or scouts, demonstrating which scouts correspond to the same nest, according to the colors.

With the confirmation of the trails, the second part of the experiment followed: the dynamisations and applications. The ashes / peppers used in this study came from the flock of Queens of 2019, which were stored in glasses containing hydro alcoholic solution for their conservation. Following the precepts of Biodynamic Agriculture, the application of

dynamized ashes must be carried out when the Moon and the Sun are in the constellation of Taurus. However, as the experiment was carried out in the months of July, August and September 2020, only the Moon was in the constellation of Taurus. During the three consecutive months, it was established to dynamize 400 mL of D7 in 4 L of water in the costal spray, daily for the days of Taurus. To facilitate the process, in July, 10 L of D7 was stored in one gallon, which was used in the three months of application. The validity of the dynamizations is up to 2 (two) years.

The evaluations were made before each application, in order to count the number of ants in movement with and without load during one minute in their respective selected scouts, according to the methodology of Giesel(2007).

After counting, the application was made both in the selected scouts and in the nest, using a 5 L backpack sprayer. Temperatures and RH were measured before each application using a hygrometer.

In this experiment there was no complex experimental design, only the selection of a single nest and its four most active trails / scouts. Through observations and counting of ants in the three consecutive months of the experiment, it can be said that the results obtained were apparently promising, since the foraging activity of the saúvas decreased at the end of the tests, which makes biodynamic ash / pepper viable as a possible alternative method in the control of saúvas. It is suggested to deepen this study extending it for a period of 1 (one) year, so that other parameters such as seasons, constellations, phases of the Moon, knots, conjunctions, oppositions, eclipses, trines, perigee and apogee are evaluated and correlated, in order to identify whether there is any direct or indirect influence of these factors on the activity of ants.

In addition, it is extremely important that research in this area be promoted, enriching the scientific database in order to contribute to the accessibility of knowledge to all. It is concluded that the dynamized ash / pepper may be an economically viable and

sustainable option in the control of healthy ants in Brazil.

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Giesel, 2007

Miklós, 2008
Forti et al., 2017
Kumar et al., 2019

Keywords

Ashes; *atta sexdens*; biodynamic agriculture; pepper;

Pilot project to assess perennial vegetables for commercial production in Sweden

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Which perennial vegetables are best integrated into small-scale mixed vegetable market gardens?

Interest in growing and eating perennial vegetables has increased markedly in recent years. Perennial vegetables are an essential part of regenerative cultivation systems which are characterized by diversity with minimized tillage and inputs. Perennial vegetables often have deep roots which allows them to seek nourishment deeper, and need less irrigation and fertilization, compared to annual crops. They contribute to biodiversity and carbon sequestration. Many are nutritious.

Despite many advantages of perennial vegetables, research is lacking in areas that are crucial from a commercial production perspective.

Four organic and biodynamic market growers in Sweden participate in the pilot study. The study was initiated and carried out in close collaboration with the growers and advisors.

Approximately 40 species and varieties are evaluated in field trials. We examine questions regarding demand, productivity, harvest period, hardiness, taste, weeds, resistance to pests and disease and storage qualities. These qualities are weighed against each other, with growers evaluating which qualities are most important to them and their customers. Thereafter growers can

decide which crops they prefer and are most appropriate for them.

Preliminary results have identified several perennial vegetables that are of interest as commercial crops. Other vegetables which have some good qualities are rejected due to one or more poor qualities.

Key questions concerning demand and harvest remain and will be answered in the final year of the study. Results from this pilot study can be used to indicate species and varieties that are worth cultivating and for future studies.

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Keywords

Perennial vegetables, field trials, farmer-led research, biodynamic/organic market gardens

What do we feed when we feed? CSA, biodiversity and social web

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Research question

What do we feed when we feed? (question emerged by a co-producer during meetings)

Research method(s)

This is a report of a Community supported agriculture, CSA São Lucas, of those members (producers and co-producers), food in agricultural life cycles, biodiversity and food health. This CSA aim was share principles, foods and learning collectively. For building a community of people that seek a balanced and harmonious life with nature resources and agroecosystems.

It was started in November/2017 by family of São Lucas Farm, a farm as biodynamic organism, Nova Venécia city - ES/Brazil. The farm is characterized by a biodiversity of crops in agroforestry system. From reports, observations and learnings, administrative notes and many harvests, the historical report was presented from Nov/2017 to Jan/2020. In 2020 the CSA was finalized to develop a new phase (here is another timely report).

Results

The community involved 20 co-producers families, initially only São Lucas Farm (two families), then there was the inclusion of four family farm, and made up this collective

(figure 1). All the people's farms were members of the Veneciana Agroecology Association, an association of organic small farmers. Among the families of co-producers, initially were all from Nova Venécia City, after involved family of 2 more neighboring cities.

According to food offer and agricultural produce, vegetable predominated, mainly fruits, horticulture, grains (e.g. beans, corn and rice) and agro-industrialized foods (e.g. jellies, breads and dehydrated fruits). Animal food only honey and chicken eggs. During the year, the total food diversity was 83 types (figure 2). Weekly have 10 to 12 types of food, throughout the year could feed on a wide variety, each season its harvests (figure 3). In the spring (sep. to dec.), fruits mainly, fruit and agro-industrialized vegetables, in the summer (dec to mar) higher offerings of fruit and horticulture fruit, in autumn (Mar to jun) greater supply of leafy horticultures and grains, at the end of autumn added the harvests the citrus fruits and beginning of horticulture roots, in winter (June to September), mainly horticulture roots and leafy, and agro-industrialized.

Conclusion

The CSA São Lucas provided a participatory and systemic social structure with successfully and replicable, each region with

its social individuality. Non-existent until then in the Espirito Santo/Brazil, as new possibilities with farmers & consumers (co-producers).

Keywords

Socio-economic system, farming systems, food systems, seasonal food

Influence of different feeding systems to quality of beef

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This research has confirmed that grass-fed beef contained 7.3 times more conjugated linolenic acid as compared to the grain-fed beef. The same could be said about omega-3 fatty acid. Even though beef is not the best source of omega-3, grass-fed beef might contain 2-4 times more of this acid than

grain-fed beef. This has also been confirmed by Lithuanian research. Hence, the ratio between omega-6 and omega-3 is better in grass-fed cattle. The better this ratio, the more beneficial effect to the health. Grazing cattle move a lot and feel less stress. Their meat has less fat and is more healthy.

Keywords

Meat quality, animal husbandry, grassland

Milk processing and allergy in mice models

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Introduction

Both in epidemiological studies in rural children (Brick et al., 2020) and a small clinical trial in multiple allergic children differences (Abbring/ Kusche et al., 2019-A) are found in allergy outcomes between shop milk and raw farm milk. Raw milk showed protection against allergic outcomes. In two studies in mice, it was investigated, which part of the milk fraction is responsible for the allergy protective effects and at which temperature of heating, the allergy protective effect is lost.

Methods

To investigate the impact of the fat-fraction and heating, mice were pre-treated by oral gavage with different milk types: whole raw milk, skimmed raw milk, heated whole milk (78°C, 15 sec) prior to oral sensitisation with

ovalbumin using cholera toxin as an adjuvant. To get a better view on the impact of heating, in experiment 2, mice were fed different types of milk, based on small steps of heat treatment of raw whole milk (raw, 50, 60, 65, 70, 75 or 80°C) prior to oral sensitization with ovalbumin.

To compare the heat steps a fixed time of heating of 30 minutes was chosen for research purpose. In both trials the clinical reaction was measured upon ovalbumin challenge (anaphylactic shock, drop in body temperature and ear swelling) plus immunity parameters in serum and organs. Additionally, in experiment 2, also the concentration of the different milk protein composition was measured.

Results

The outcomes of experiment 1 were that similar to raw milk, skimmed raw milk suppressed food allergic symptoms, demonstrated by a reduced acute allergic skin response and low levels of OVA-specific IgE and Th2-related cytokines. Not the fat content, but the heat-sensitive components are responsible for the allergy-protective effects of raw cow's milk (Abbring et al., 2019-B). The outcomes of experiment 2 were, that a substantial loss of native whey proteins, as well as extensive protein aggregation, was observed from 75°C. However, whey proteins with immune-related functionalities already started to denature from 65°C, which coincided with the temperature at which a loss of allergy protection was observed in the murine model (Abbring et al., 2020).

Conclusions

No effects could be found between whole milk, skimmed milk and the whey fraction of milk, and therefore changes due to the allergy response are located in the whey fraction. Immunologically active whey proteins, that denature around 65°C, are of importance for the allergy-protective capacity of raw cow's milk.

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The potential of biodynamic farming to respond to the current crises in UK food and farming systems

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The UK's self-reliance in food production and supply has been slowly decreasing since 1980 (Lang, 2020) and is being further affected by Covid-19 and Brexit (Moran et al., 2020).

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Keywords

Raw milk, heating, allergy

the second highest level of food insecurity within Europe (WHO, 2018).

As a result of Covid-19, it is estimated that there was a quadrupling in levels of food insecurity as a result of panic buying and economic impacts (Loopstra, 2020). Biodynamic farmers can form partnerships with local communities who are at higher risk from food insecurity in the form of community supported agriculture to allow individuals to benefit from the production, rewards and responsibilities associated with the production of food (Biodynamic Association UK (BA), n.d.) and try to reduce the current disparities within the UK food system. With food insecurity comes dietary related illnesses (Lang et al., 2018).

Biodynamic farmed produce have been proven to provide a range of health benefits including a reduction in allergic reactions (BA, n.d.) and the supply of greater quantities of nutrients including vitamin C (Crinnion, 2020), iron and magnesium (Larion, 2009).

By improving the health of individuals, wider benefits may be seen when looking at the strain currently experienced by the health services. Biodynamic farming techniques can enhance the fertility of soil (Fließbach et al., 2000), therefore by implementing such techniques, the UK can continue to produce

food for an extended period of time, increasing its resilience.

Biodynamic farming focusses on each farm being self-sustaining, consequently, adopting these methods can reduce the reliance on imports of food from different countries, which has the potential to be affected by Brexit and border challenges (Lang et al., 2018).

The UK has a 20-year vision on antimicrobial resilience which can be achieved using biodynamic farming due to their view of using antibiotics only in cases of preventing suffering of livestock (BA, n.d.).

Furthermore, this enhances the health of the animals which can ensure their efficacy for future generations, thus providing a steady supply of food. Biodynamic farming techniques can be adopted as a response to the many challenges currently facing the UK food and farming systems whilst providing wider economic and environmental benefits.

Keywords

Biodynamic farming, Covid-19, UK food resilience, food insecurity, Brexit, Environmental Land Management schemes, food insecurity, antibiotic resistance.

Autonomy in biodynamic and agroecological practices: a crop path for quality of agroforestry robusta coffee

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Research question

What are the strategies and practices provide soil life, biodiversity and food quality in a robusta coffee crop?

Research method(s)

This is a report of a year planning for a coffee crop, developed and applied in 2020. With the aim to advance in biodynamic agriculture of robusta coffee (*Coffea canephora* Pierre ex

A.Froehner) under agroforestry system, to improve healthy quality for coffee bean.

This research was developed on São Lucas Farm, a family farm in Nova Venécia City, ES/ Brazil. The farm is a biodynamic organism since 2014, initially using the fladen, 500 and 501 biodynamic preparations, then compost with biodynamic preparations, thus far Hugo Erbe preparations (HE#8 Three Kings and HE#9 Harmonizing). The preparations were self-produced, exception are compost preparations (502 to 507).

The farm has the characteristic of biodiversity crops in alley agroforestry system, the robusta coffee is the main crop.

At the beginning of the plan (August/2019) after harvest, is characterized by dormancy period, in this time the agroforestry trees were pruned and the plan was started. Thus the practices were systematized:

- Pruning and canopy opening of agroforestry trees (biomass production for soil cover);
- Hoemopathy for coffee leaf rust (*Hemileia vastratix* Berk. and Broome) and plant health: two applications of Kali Carbonicum and Rust Nosod, through drip irrigation;
- Conservation of green cover of the soil with native grasses and perennial peanut: cut the cover crop on "flower" days and ascending moon, three times in the year (image 2);
- 500 and Fladen preparation - three applications each, respectively 100 and 150 gr./ha: in the september/post-flowering, december/filling of grains and february/green grains;
- 501 preparation - 3 applications of 4 grams/ha, the last 9 days before the harvest start (March/2020). The latter practice suggested by Masson, 2009.
- coffee harvested predominantly on "fruit" days. The post-harvest of coffee fruits consists washing (separation of ripe, green and dry grains), and drying in farmyard with sunlight. After coffee processing, samples were taken for sensory analysis of the SCA scale (Speciality Coffee Association).

Results

In coffee leaf rust management, controlled plant's disease, and the leaves recovered. The main difference observed in fruits was less affected by diseases and less bean defects. The sensory classification of coffee SCA, 2019 sample the score was 75 points and the 2020 harvest was 82 points, increase quality. The comparison of this report is based on the 2019 observations in farm.

Conclusion

The set of practices promoted the balance in the farm organism as a whole, bring increase results in each practice carried out.

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Keywords

Biodynamic preparations, biodiversity, biodynamic agriculture, coffea canephora.

Multifunctionality of small farms in arid zone for food security and sustainability: Case study from Pali, India

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The paper describes the case study of Mr Mangilal living in hot arid zone of Thar desert of India who with his hard determination and organic principles turned his deserted farm in a green economy. As his land was barren, soil was saline and low in organic matter, weeds were major problem he decided to go for multifunctional agriculture and convert his farm into an organic farm. He started with levelling of land and preparing his field in summer by deep ploughing and making deep ridges so that he can trap maximum rain water in his field for the upcoming crops.

He followed crop rotation as the basis of his farming system as crops are grown naturally without external inorganic inputs (Singh and Singh., 2017). The crops are grown in a 3-crop rotation and a very unique crop rotation devised is Wheat, Mustard, Cumin, Greengram system in which mustard residue acts as disease controller for the wilt and blight in cumin crop along with good yield of major crop and nitrogen requirement is covered by legume.

Besides field crops incorporation of spice crops mainly cumin, fenugreek, fennel and ajwain plays a very important role in farm sustainability as spices are disease resistant, hardy, requires less water and nutrients and play a major role by providing food and shelter to variety of insects and pollinators. Mr Mangilal also reared cows and goats of local breed which are the most important component of Crop-animal integrated farming.

The farmer practice composting for organic waste management and uses a variety of organic materials in composting process such as straw, crop residues, fallen leaf litter and kitchen waste. Under rainfed conditions he practice intercropping of green gram with

sorghum and sesame which reduces the climate-driven crop failure as variety of crops have different climatic adaptability.

Intercrops efficiently utilize the natural resources and nutrient and increase biodiversity, productivity, resilience and stability of agroecosystem (Ning et al., 2017). The main crops are pulses, spices, barley, oats and wheat. The farm fields are bordered by safflower margins. These margins prevent run-off of minerals from the field into bordering ditches. These practices have built soil organic matter and the soils are now self-enriched. In general, the crops give 20-32 percent higher yields without any chemical fertilizers.

Acacia trees planted on farm boundary acts as biological fence and as sink for carbon dioxide and store excess carbon as biomass. The integration of trees with crops is an age-old practice to exploit the ecological and economic interactions of the different components (Coulibaly et al., 2017).

The farmer is satisfied to cultivate organic crops at his self-sustainable farm which are economically beneficial too. Alternative agriculture integrating different components with farming seems to be capable of producing sufficient yields by maintaining crop-fodder-livestock -forest plant diversities (Wolfe, 2011).

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Keywords

Deep ploughing, crop rotation, soil organic matter, organic, sustainability

Accessing the Peripheral Forces

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A central tenet of biodynamic agriculture is that various stages of plant development are influenced by environmental energies from deep space, aka the cosmic periphery. This concept presents a challenge to growers because the so-called peripheral forces and their formative qualities are not widely known.

To address this challenge, additional emphasis must be placed on education. An experimental means to demonstrate the reality of peripheral forces would be ideal. Is it possible to collect peripheral forces using a selective antenna, and demonstrate a beneficial effect on plant development?

Research Methods

A collector of environmental energy was devised based on a dielectric cavity resonator. This type of antenna is typically used to receive microwave energy and was selected because the earth is bathed in such energy from distant stars. Resonators were coated with selective materials to create an emissive surface. It was hypothesized that specific peripheral forces would be derived from environmental energy and emitted from these surfaces.

Experiments were conducted indoors under a humidity dome in which light, temperature, and moisture were carefully controlled. Cat grass seedlings were cultivated in glass columns allowing root development to be observed and photographed. Treated plants were exposed to the dielectric resonators. Control plants were shielded from the resonators by a sheet of dense plastic. The shield was positioned directly beneath the grow lamp, effectively dividing the light source, and ensuring that both sides received the same amount.

Results

In multiple trials treated plants exhibited a significant increase in root development, as shown in photographs. When green shoots were trimmed and weighed, treated plants showed an increase in biomass of 15%.

Conclusion

The data suggest that peripheral forces related to root development were derived from environmental energy using resonators with a copper coating. It was assumed that forces related to upward growth were derived using resonators with a chromium coating. Treated plants exposed to these forces sequentially, or in combination, exhibited a corresponding.

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Keywords

Education, peripheral forces, cosmic radiation

Pfeiffer Circular Chromatography: contributions to the analysis of soil health in biodynamic agriculture areas

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Soil degradation is a process resulting from the management adopted by industrial agriculture, which configures an environmental and social crisis, in the countryside and in the city. In the midst of such a context, agroecology as a movement, science and practice, values the diversification of food production while respecting the ecological and social conditions of a territory.

In order to implement this agriculture proposal, it is essential to have methods to assess the impacts on soils resulted of agroecological and biodynamic practices adopted in agricultural organisms.

Pfeiffer Chromatography is a comprehensive diagnostic tool for the soil quality, the method of which is simple and inexpensive.

The present paper aimed to understand the state of soil health in four land uses in a biodynamic site certified by the Participatory

Guarantee System (PGS) of the Brazilian Biodynamic Agriculture Association.

The areas evaluated were: an agroforestry system with vegetables, an area of planted banana in which green manure were cultivated, a fallow area and a remaining forest, in a family farmers area in the Iperó municipality, São Paulo state.

For this, the Pfeiffer chromatography method was used and the physical-chemical attributes of the soils were examined.

The qualitative and quantitative outcomes obtained are enough to state that the soils of the forest area and the agroforestry system are the healthiest and are similar in several aspects. The agroforestry area, due to the presence of a great diversity of tree species, which provides diverse ecosystem services, and the use of biodynamic preparations in vegetables and plants associated, promoted improvements in the physical, chemical and

biological soil qualities, captured by chromatography.

Chromatography was an efficient method for analyzing the health of tropical soils, with potential for use by family farmers, in the process transition to biodynamic management, and especially those organized in participatory guarantee systems. In this way, it is possible to follow the evolution and improvement of the soils managed by biodynamic agriculture, in its greatest objective, which is the Earth healing and the wellness for all beings.

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Keywords

Agroforestry system; agroecology; family farmers; quantitative method; tropical soils.

Evaluation of Populations of squash (*Cucurbita moshata* L.), under biodynamic management and participatory genetic breeding, in Botucatu-SP, Brazil.

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The squash (*Cucurbita moshata*), plant of American origin, is part of the tradition of old civilizations that colonized America and it is cultivated in many states in Brazil, mainly by familiar farmers. There are a great biodiversity of genetic material. This plant is used for human and animal feeding.

According to FAOSTAT 2009 the distribution of squash and pumpkin in the world is:

China- 353.000 ha, Cameroon -110.000, Cuba – 66.000, Russia – 54.000, Egypt – 40.000, total amount in the world – 1.556.000 há. While in Europe the legislation for organic and Demeter products prohibits the use of conventional agriculture seeds, here in Brazil, when we talk about vegetable seeds there are few options at the market. It is very important to research, develop and

produce new seeds adapted to the organic cultivation.

The aim of the present work is to evaluate the income and the quality of fruits of one kind of squash, with the participatory approach and through the mass selection of four populations in three generations, in a biodynamic familiar farm in the Botucatu city, in São Paulo state, Brazil.

The experiment was lead by the local farmer Edmilson Veríssimo at Botucatu city/SP. He was a biodynamic horticulturist whose fields were certified as Demeter. The area lies at south latitude 22°44'00", longitude 48°34'00" west of Greenwich, altitude of around 900 meters above the sea level. The climate is classified as Mesotérmico Cwa, which means, subtropical humid with dry winter period. The ground is classified as latossolo red-yellow, sandy texture, distrofic. The farmer's area is surrounded by diverse tree rows, in a riparian forest area and with extensive pasture in the neighborhood, with more than 1 km of geographic isolation from other vegetable crop areas. For the initial culture there were used seeds of four distinct populations from the research material of PhD Antonio I. Cardoso (FCA-UNESP University).

There were two experiments comparing the original seed and three cycles of selection, one in September (2009) and another in November (2009). For such, this assay was conducted through an experimental design of randomized blocks, with seven repetitions.

We evaluated the following items: Average number of fruits per plant; average weight of the fruits; total length of the neck and the bulge, and diameter of the neck and the bulge.

The results of the three cycles of selection indicate an increase in the frequency of plants with longer and fine fruits. It is observed a lesser frequency of plants with undesirable format of fruits. The results of weight of the fruits is not significant. Thus, application of simple breeding methods, such

as mass selection, show a real improvement. The experience of participatory improving brings a rich knowledge for both involved - researcher and farmer

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Keywords

Agrobiodiversity, cucurbitaceae, mass selection, biodynamic agriculture, participatory breeding

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