3RD INTERNATIONAL **BIODYNAMIC RESEARCH CONFERENCE**

THE WHOLE AND ITS PARTS

Conference Proceedings

Royal Agricultural University
biodynamic uk association
BIODYNAMIC FEDERATION demeter
FORSCHUNGSRING
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Preface to Conference Proceedings

Thresholds

Agriculture stands today at a threshold.

A narrow and even obsessive focus on maximizing crop yields and food retail profits - characteristic aims of the last century - has resulted in a worldwide crisis of compromised soil health, biodiversity loss, and multi-facetted fissures in food culture. Although some regions of the globe have, since the Green Revolution, managed to maintain more agroecological and socially coherent food ecosystems, most countries today must contend with food industries whose production methods are costing us the Earth.

A wide range of responses to the un-intended consequences of agricultural 'improvements' have given rise to land stewardship approaches that regenerate soil, re-vitalise food, and restore richness to our agri-cultural contexts. Biodynamic agriculture is one of these and is the central focus for this publication.

Agricultural research, crucial to informing the future of food production, also stands at a threshold in these tumultuous times.

This threshold is one that concerns ways of knowing, what might more commonly fall under the catch term 'science'. However, the threshold that we find ourselves facing in research today is that the term 'science' has become something of an empty signifier, particularly in its everyday use. An empty signifier is spoken about with a vague and inadequate understanding of its full meaning and at the same time, is received with a habitual, uncritical interpretation.

When political will and influence is actioned based on the assurance that 'we have the science' to validate such efforts, what 'science' is meant here? When the judgement is made – in any context – that a fact or finding is either 'scientific' or 'unscientific' – by what measure is this determined? These are considerations of immense importance, as 'science' has for several centuries adopted, claimed, or been granted an authority that was hitherto the purview of the church or priesthood. It is essential, therefore, that 'science' is not called in as an authority, particularly if it is empty or cast as a monolithic social/cultural endeavour with one agreed set of methods and masters. There is, in short, not one kind or way of doing 'science' and it is essential that we are clear about what we mean when we use terms such as 'science' and 'scientific'. Doing this will, in turn, clarify what we mean by 'research'.

The thresholds briefly touched upon above are, of course, not new problems. They are, nonetheless, very pressing to consider anew as we pass the first quarter of the twenty-first century. Attempts at addressing these thresholds and the troublesome currents they create have given rise to a broadening of the inadequate catchall 'science' with qualifiers such as holistic science, Indigenous science, noetic science and – perhaps most relevant to this publication – spiritual science. What these deliberations about the cultural activities we call 'science' and 'research' lead to for agricultural concerns are sketched out further as follows.

Knowing and growing

Knowing as we do from the philosophy of science that 'what is seen depends on the way it is seen', if our science/seeing posits a lifeless, mechanistic, and materialistic root to all of the features of our farms,
fields and forests, then we will treat these as such. We will see the needs of the farm as requiring so much input of mineral fertilisers, the plants and animals as means of production, the whole 'enterprise' as being controllable, predictable, and made to be ever more efficient for ever greater profit.

If ways of growing are expressions and manifestations of ways of knowing, the reductive, abstract and mechanistic modes of enquiry that informed industrial agriculture have proved to be effective in developing factory-like 'efficiency' in food systems. They have, however, also resulted in a paucity of farmland diversity and lifeless uniformity in many of our agricultural products. There should be no surprises here, as the 'sciences' that led to these ways of growing honed their methods and means in the study of the inorganic – the lifeless, the inert, effectively the realm of the dead.

The myths of reason that informed the Green Revolution are, however, losing their monopoly at the same rate that many industrial farming contexts continue to lose their soil.

The recent formal recognition of Mount Taranaki and the Whanganui river in New Zealand with the legal status of personhood heralds a move closer to what indigenous peoples from around the globe have always known and advocated: that we live on an animate Earth, that we are people dwelling amongst other People, and that we therefore require ways of knowing and growing that honour them, us, and this common dwelling place of ours.

Animate beings are contextual beings; their lives unfold in time and place. Relationships and dynamic interactions are of greater import in understanding an animate Earth than are position, number, weight, and measure. The Enlightenment objective of identifying laws and truths that are immutable and applicable for all people in all places and all times is therefore – for animate experience – not so much a worthy goal as a straightjacket for what is in essence a complex, living Earth.

Attending to animacy is therefore to acknowledge that life, sentience, and the spiritual realities which inform the Earth and her People require ways of knowing – 'sciences' - adequate to these. In turn - where agriculture is concerned - the preceding considerations lead us to conclude that ways of growing that are aligned with a living Earth must caretake life, sentience, and consciousness.

Biological dynamic agriculture

An area of research and innovation that has engaged with these objectives for over a hundred years is that of Biodynamic agriculture. Since its inception in 1924 in middle Europe, biodynamics has sought to cultivate approaches and methods that care for the vitality and integrity of soil, plant, animal and human. Many biodynamic practitioners also extend their activities beyond these to include the more-than or greater-than-human domains that have

been spoken of, and attended to, by Indigenous peoples of all continents for millennia and by the spiritual guardians of all cultures.

Biodynamics does not, however, aim to either adopt or co-opt wisdom traditions or holistic practices uncritically. Following the acknowledged aims of scientific enquiry – transparency of methods, rigorous observation and recording, and an open and critical sharing of findings – research in biodynamics builds on the foundations established in the natural sciences while also expanding on these in numerous ways. Biodynamic research is curious about quality as much as it is about quantity (in, for instance, soil characteristics, plant nutrients, animal welfare). Biodynamic research is as attentive to compost as it is to the consciousness that guides the transformative processes unfolding in the heap. Biodynamic researchers question the contribution that the researcher makes to the research, what it means to be participants in research processes, and seeks to understand the social/cultural dimensions of science as well as the phenomena they research.

The Whole and its Parts

The breadth of topics and approaches that are currently the focus of biodynamic research came prominently and proudly to the fore in September 2025 when the 3rd International Biodynamic Research conference convened at the Royal Agricultural University, Cirencester, England. This was a momentous event, held in the oldest agricultural college (now university) in the English-speaking world and attended in-person by over one-hundred and eighty delegates from 28 countries around the globe.

It was evident to all who attended the conference that biodynamic researchers have developed a global community of practice that befits an agri-culture seeking to comprehend the multiplicity and complexity of the lifeworld. The contents of this publication attest to these efforts and provides concrete examples of biodynamic research in practice.

The topics addressed at the conference – many of which are reproduced in these proceedings - were wide ranging. They considered themes that are clearly of concern in all agricultural contexts: the ecosystem and the environment, food and nutrition, soil, the economy, seeds, plants and animals. They also delved into topics unique to biodynamics or from a uniquely biodynamic perspective: agriculture and social life, the biodynamic preparations, rhythms in nature and agriculture, and the Farm organism.

Throughout the conference the central themes of ‘studying the living’ and the importance of different perspectives was everywhere evident.

Good research can flourish where there is curiosity, respectful critical enquiry, and honest reflection. Sharings that were both given and received in a spirit of respect led to a good and trustful gathering; respect for the dedication it takes to ask good questions and to follow them through often for years or even decades. Respect for the fact that biodynamic practice and biodynamic research are engaged with the challenges of re-enlivening soil, restoring relational, systemic approaches to plant and animal care, and for re-establishing healthy and harmonious food culture.

It is out of this spirit that the proceedings from the Conference are gathered herein and offered to readers and researchers interested in a future for agriculture that is part of a wider communion of life.

Dr. Jonathan Code – on behalf of the conference committee (Dr. Christopher Brock, Paz Bernaschina, Berni Courts, Prof. Dr. Regina S. Dass, Dr. Jürgen Fritz, Prof. Dr. Christian Herzig, Kalle Hübner, Gabriel Kaye, Dr. Jasmin Peschke, Eduardo Rincón, Dr. Anet Spengler Neff, Richard Swann, Prof. Dr. Julia Wright).

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1. Keynotes

1.1 Vignettes of Indian Traditional Knowledge in Biodynamics

Keynote presentation 01st September 2025 at the 3rd International Biodynamic Research Conference 'The whole and its parts' The Royal Agriculture University, Cirencester, United Kingdom

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The last decades have been about working with large number of small farmers and promoting Biodynamic Agriculture as a low cost agriculture system hence support in their livelihoods. The high point of Biodynamic agriculture with SARG India has been introduction of composting and other simple on farm inputs made in the farm leading to positive impact on soils, quality of crop production and increased productivity in general.

The construct of the theory of Biodynamics has always been an underlying contemplation in my work inspiring towards a deeper study of this approach.

I am fortunate to be born in a country where traditional knowledge expands like endless oceans of knowledge and I was able to find some links of the principals of Biodynamic agriculture to the ancient scriptures of India.

Rudolf Steiner

Rudolf Steiner is the clairvoyant initiate we are following. Steiner had the capacity to look at life and its processes in a way no one could. From among his contemporaries' and in the time of his life he took the different points of view and existing knowledge like an innocent student and contemplated with the theories and ideas. There is no doubt that his own thought process took inspiration from the eastern philosophies particularly from the 'Vedas' and the 'Gita' which he has eloquently interpreted for the European audience of the early twentieth century in the book 'The Gita and the West'.

Whether it is taking the reader to space in his book '*At home in the universe*' or the book 'Bees' where he says 'The bee makes six sided cells from wax and the earth makes six sided silicic acid crystals'. Steiner says 'I have always explained this to you that in human's beings reside all the forces that are in the earth, in turn receives this force from the cosmos.

In the book 'Agriculture' Steiner 's opening statement is 'Look at relationship of earth & soil to the formative forces of the etheric, astral and ego of nature. how the health of soil, plants & animals depends on nature connecting with cosmic creative, shaping forces'.

The Indian Knowledge System (IKS) is rooted in a holistic worldview that emphasizes the interconnectedness of all things and the importance of harmonizing the physical, mental, and 'spiritual' aspects of life. It promotes a comprehensive understanding of the world by integrating traditional wisdom with contemporary knowledge, fostering personal and societal well-being.

Rhythms of the cosmos

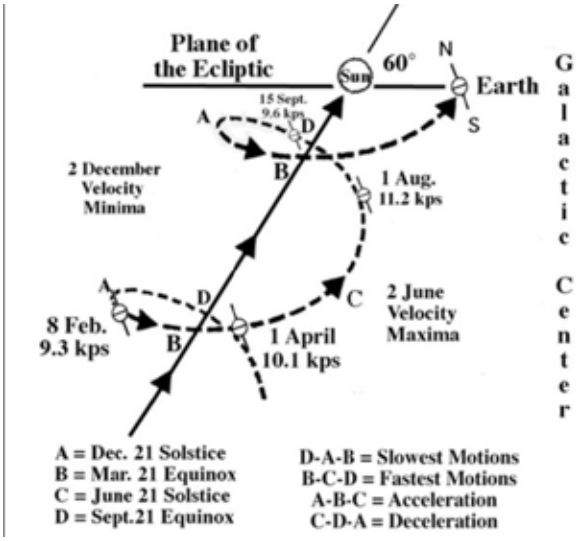
Biodynamic Preparations are at the heart of Biodynamic agriculture. There is a specific time recommended for making the Biodynamic preparations 500 to the 507. They are prepared and buried in the soil after the autumn equinox that is after 21 Sept each year and up to the winter months and retrieved after the spring equinox. What happens just after the 21 September each year.

A single calculation shows that the speed of earths spiral trajectory reaches a maximum in March and a minimum in September, at approximately the time the cow horns and the preparations related to growth gestures are buried. (reference Millers Ether Drift)

Particularly the equinoxes are significant points of change in astronomy and particular esoteric energies are being produced. We find that soon after the autumn equinox on 21 September the earth starts to make the loop in a descend and at the same time the speed is decelerated (short length) movement, the period during this as per astronomical events is the slowest rhythm. Where as the spiral (long length) from Spring equinox 21 March (April to Aug) is the fastest and longest length.

During this period the earth is breathing in and the forces of nature are active in the womb of the earth and inactive above the earth. Therefore all preparations 500, 502 – 508 (9 preps) which are to do with the production (earthly activities) processes are buried during this time where as after spring equinox the earth is breathing out hence more active above the earths surface and prep 501 which is to do with the light forces (air activities) is buried after the spring equinox with the rhythm being the fastest.

From the lens of the ancient ITK, autumn or '*sharadritu'*, and in the month of (November,'*Ashwin'* during the waxing period of the month (14 days) fall the nine days of fasting or '*navratri' (*nine nights) is a very auspicious time among '*Hindus'* , this is done primarily for the attainment of spiritual growth. Similarly in the '*basant ritu'*, the month of '*Chaitra*' (April) when the spiral of earth is the fastest the nine days '*Navratri'* start from the first day of the waxing moon.



Trajectory of Earth around the Sun

Among the Cow I am the wish full filling cow

This cosmic event is taken into consideration for preparation making. The Autumn nine nights signify, spiritual growth, during fasting the entire body is left undisturbed by externalities like food and other material indulgence. The mind and body must go in a meditative state and connect with the world spirit. The spiritual being (consciousness or awareness) which is present in every human being, will connect itself with the world spirit. This period, however, signifies longevity and the occult.

In spring the nine nights signify yet again spiritual growth but this time the mind and body aspires to seek 'nirvana' or freedom from the cycle of rebirth. Meditation and abstinence will connect the spirit with the world spirit and re string itself with the cosmic whole.

The ancient text explains it the following ways:

Bhrama Puran, repeated and explained in the 'Gita' chapter 8'

'*agnir jyotir ahah shuklah shan amasa uttarayanam*

Tatra prayata gachchanti brahma brahma vido janah'

Fire, light, day time, the bright half of the moon and the six months of the northward passage of the sun taking this path the knowers of the 'brahma' go to to the 'brahman'

'*Dhumo ratris tatha krishnah, shan masa dakshinayanam*

Tatra chandramasam jyotir yogi prapya nivaraate'

Smoke, night the dark side of the moon and the six months of the southward passage of the sun taking this path, the yogi reaches the lunar path and thence returns

As mentioned earlier Rudolf Steiner has been deeply inspired by the **Sankhya Philosophy (*Darshan*),** the fundamental concepts of the Gita and the Vedas.

In a Lecture on December 29th, 1912 in Finland, Steiner refers to the Gita as 'the spiritual horizon surrounding the great 'Buddha'. He considers it significant that Buddha was born in Kapilavastu, the birthplace of Kapila Muni the creator of the Sankhya philosophy.

According to Samkhya a multiplicity of individual souls '*purusha'* plunged into *'prakrati',* reality in its plural forms, and developed downward from the highest differentiated form of the primal flood to course bodies. Having arrived at this physical stage, the souls evolve back upward again to the primal flood.

Samkhya Philosophy

Samkhya philosophy teaches us that the universe was born from the union of '*Prakriti* 'and '*Purusha'*. '*Prakriti'* here refers to the basic cosmic material that is the root of all beings, and '*Purusha*' to the spirit or conscious energy that governs life and reality. The cosmic entity, '*Purusha'*, exists beyond the realms of time and space and combines with '*Prakriti'* to form this world of creation. Both these eternal indestructible realities join to form the matter we perceive.' '*Prakriti'* evolves in response to '*Purusha',* and its internal elements change further, leading to the formation of the '*Pancha Maha Bhutas'*, or the Five Great Elements. The physical universe we are familiar with comprises primarily the '*Pancha MahaBhutas'*, or the five elements namely, '*Akasha' (space)* '*Vayu'* (Air), *'Agni'* (Fire), '*Jala'* (Water) and '*Prithvi '*(Earth).

Similarly, the preparations made with very specific herbs representing the cosmic primordial elements through the representation of the planets is the '*purusha*' and the specific visceral parts of specific animals (being with specific constitution) is the '*prakrati*' and when brought together in specific time of the year are able to bring about a creation, which carry and nurture life forces.

Manfred Klett in his book 'The Preparations' says on Prep 500 that' in breaking down the material substances of the plant the 'cow' is able to taste the cosmic forces they contain' 'the cow experiences the unique qualities oft the place where the fodder was grown, the soil and the climate conditions '

'She perceives these as a mighty network of forces and through her internally focused condition of wakeful concentration and outwardly dreamy state, her soul or astral body is able to connect fully with the etheric body'. The physical – chemical processes which bring about the metabolism are reflected back into her body, she is unable to hold the streaming energy and throws out the cud now in form of dung in excretion.

The Cow being central to Biodynamic preparations as well as the agriculture landscape is the 'Holy Cow' of India. An entire *veda* has been written dedicated to the cow. There are a number of verses written quoting the horns and the hoofs are the symbolic dwellings of the trinity '*Brahm ,Vishnu and Mahesh*' which in interpretations means life energies. In the Gita Lord Krishna says:

"Dhenunam asmi kamadhuk," meaning "Among cows, I am the wish-fulfilling cow".

Association of Planets with Plants

A lot has been said and discussed on the different planets and their associations with corresponding plants. The plants are then used in the preparation making work where planets, plant and the associated sheath of the animal is all put together representing the streaming in of the specific planets. In Biodynamics the plants used and their association with specific planets is well known. In Traditional Indian Knowledge too there are designated plants which represent specific planets. The association is used for therapy in Ayurveda, to balance negative planetary influences as well as in religious rituals.

The Nine planets (*Navagraha)* and plants

1.	*Surya* (Sun): **CalatropisGigantea 'Arka', symbolizing vitality and power**
2.	*Chandra* (Moon): **Butea monosperma, '*Palash*' tree, promoting emotional stability**
3.	*Mangala* (Mars): **Accacia Catachue, 'katha' fostering strength and courage**
4.	*Budha* (Mercury): **Achyranthus Aspera '*Apamarga*' plant, supporting intelligence and communication**
5.	*Brihaspati* (Jupiter): **Ficus Religiosa, '*Peepul*' tree, enhancing wisdom and prosperity**
6.	*Shukra* (Venus): **Ficus Glomerata, '*Medi*', signifying love and abundance**
7.	*Shan*i (Saturn): **Prosopis Cenararia, '*Shami*' tree, offering resilience and endurance**
8.	*Rahu (ascending node):* ***Cynodon Dactylon, 'Doob' known for its purifying effects***
9.	*Ketu (descending node) Imperata Cylindrica, 'Baljamu'* ***provide spiritual awakening***

Similarly, the *Nakshatras,* also known as lunar mansions, are constellations or star patterns that the Moon occupies during its journey through the zodiac. There are 27 *Nakshatra*s, each spanning 13 degrees and 20 minutes of the zodiac. Each *nakshatra* symbolizes a specific personality trait, an animal character and also a plant / tree.

One of the important elements of Biodynamic agriculture is the planting calendar. The use of the Planting Calendar is a way of incorporating the planetary rhythms of the cosmos into our agriculture practices on earth.

Thus elements from the Indian Traditional Knowledge are visible like vignettes in the founding Philosophy of Biodynamic Agriculture.

1.2 Advancing Biodynamic Agriculture through Postmodern Science, Research and Knowledge Systems

Based on the keynote presentation of 1st September 2025

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Introduction: welcome to the British Isles and modern farming

This keynote address sets the scene for the 3rd International Biodynamic Research Conference by exploring the types of science, research and knowledge systems appropriate for such a holistic farming approach. To do so, I would first like us to consider how we arrived at modern, industrial farming through the particular lens of its emergence and development in Britain – the host country of this conference. I will then broaden this exploration to highlight the relevance of international developments in agricultural knowledge systems worldwide, before circling back in to reflect on the implications for biodynamic research going forward.

A welcome to Britain, in this context, must give thought to the ancestry of these Isles, an ancestry that still strongly lingers in our landscapes and mythologies. As far back as Neolithic times (4500-2500 BC), if not earlier, were constructed large megalithic monuments and sacred spaces such as Stonehenge, Avebury and Silbury Hill. This period has been described as a time "*when elaborate ceremonial practices emerged among some communities of subsistence agriculturalists*" (Barrett, 1994), and these places and practices were carried forward by the Celts – and their priestly class of Druids – into the subsequent Bronze Age (2500-600 BC). By piecing together fragments of narrative from historical chronicles, poems, legends and ecclesiastical references, visionary scholars and antiquarians paint a picture of the innate, landscaped power and significance of the British Isles:

"To the peoples of antiquity the isle of Britain was the very home and environment of mystery, a sacred territory, to enter which was to encroach upon a region of enchantment, the dwelling of gods, the shrine and habitation of a cult of peculiar sanctity and mystical power. Britain was, indeed, the insula sacra of the West, an island veiled and esoteric" (Spence, 1928).

"These people [of ancient Britain] knew where the source of power existed, they understood, they realized the stars as being worlds of greater power and force and that they were all inter-related. They were, in fact, the great generating stations of celestial energy and that in the measure to which man could in himself rise to appreciate this power, so in like measure, was this power distributed and appropriated. " (Forbes, 1938)

"….the more one reads Blake's prophesies, the more strongly grows the conviction that he was inspired by a notion so sublime that it can scarcely be conceived; nothing less than the

recreation of the old system of spiritual engineering whose ruins are still visible in every corner of the country. From the rocks, mountains and headlands a mysterious current once flowed down avenues of standing stones over mounds and earthworks." (Michel, 1983)

In short, these lands were, in mythical terms, the place where initiates came from far and wide, for short periods of time, to learn the esoteric and occult traditions. If this were the case, the rather poignant question inevitably arises as to what happened between then - and now? A rather less mythical response is that a series of invasions and appropriations is what happened. The enforced separation of peoples from the land commenced about 2000 years ago with wave upon wave of somewhat violent colonisation. This started with the Roman influxes from 55BC (and the introduction of Christianity), superseded by the Anglo-Saxons in about 410AD, then the Vikings (793AD) and finally the Normans in 1066. As well as massacres and inter-marriages, lands were taken, most notably by the Norman elite (whose descendants, according to Cahill (2001) comprise approximately 0.3% of the current British population and still own the majority (66%) of the land). Even after this period and over the last thousand years, further death, destruction, displacement and disassociation from the land has continued, with significant occurrences including widespread plagues (for example the Black Death of 1348 which killed 40% of the population), the English Civil War of 1642-1651, and the persecution of nature-connected healers – mainly women – from the 15-17 centuries. As if handing over the baton in a relay, the Scientific and Industrial Revolutions of the C17-19 exacerbated the disconnection and displacement, firstly through the development of a particular scientific worldview whereby humans are understood as being separate from, and holding dominion over, nature, and secondly through the mass rural-to-urban migration throughout the 1800s. In parallel with these Revolutions was of course the outward spread of empire orchestrated by the ruling and mercantile classes of Britain (a spread so vast, compared to the size of the Isles, that one might also surmise – to continue the creative narrative – that it was fuelled by the mis-appropriation of those ancient sources of power?).

Out of these Scientific and Technological Revolutions and their underlying worldview emerges modern agriculture, characterised by monocultures, mechanisation, intensive chemical input use, animal confinement, long food supply chains and goals of yield and profit maximisation (Pretty, 1995). For decades now, ever since Rachel Carson's Silent Spring (1962 - with Carson drawing heavily on extensive evidence gathered by two biodynamic farmers (Paull, 2013)), the negative consequences of modern agriculture have been clearly in the public domain, yet insufficient remedial action has been taken. US environmental philosopher J Baird Callicot has this to say: "*Modern agriculture is embedded in and informed by the prevailing modern worldview, Newtonian Mechanics. Notoriously it is not working, at least not sustainably and it is based on a bankrupt metaphysics, a scientific worldview that has not sustained critical scrutiny and that is in fact, dead in pure science… …. A future post-modern ecological agriculture will help to solve the ethical problems engendered by modern mechanical agriculture.*" (Callicot, 1990).

International developments and challenges in agricultural science and knowledge systems

It should be apparent by now that I am a researcher of the agricultural social sciences, and straying further into the humanities. Working first in the agricultural development sector in the Central and South America, I then undertook doctoral studies at Wageningen Agricultural University in the Netherlands on the transition to more sustainable farming and food systems. Here in the social science department I learned the importance of social constructivism and of declaring one's positionality – one's worldview, identity, experiences, and social context that influence and shape one's approach to research (something that is not commonly taught in the natural sciences). Perhaps the most significant of my research findings was that we are being hindered in this transition to sustainable food systems not so much by a lack of technological innovation nor even so much by the corporate sector's prioritisation of yield and profit, but – underlying it all – by our belief systems, our fears and our insecurities (Wright, 2009). To go further in this enquiry would require knowledge of psychology and cognitive studies, subjects that do not feature in agricultural curricular.

The profession of development-oriented agriculture had emerged in earnest as a post-war endeavour of colonial administrations in the Global South, and has over the decades been arguably more progressive and adaptive than has the agricultural sector in the Global North. What started in the 1950s as a drive for increased crop and livestock productivity underpinned by plant breeding, genetics and agrochemical use, has over the decades shifted to the realisation of the need for institutional and political reform of national and international farming sectors through transformational approaches based on social learning and complexity science (Rhoades, 1990). In particular the perspective on the role of the farming community has changed, from one of being passive recipients of technology to that of being participators and co-designers of collective action research. This shift was helped by the introduction of concepts such as rural livelihoods, learning cycles, complex systems, and agricultural knowledge systems (AKS). For sustainable agriculture, knowledge and information was posited as being a more important resource than material inputs, with farmers taking the central role in exchanging and producing knowledge in conjunction with a number of other sources and actors, including research, agricultural advisors, and education/training and support services (Roling & Wagemakers, 1998). A knowledge exchange platform put farmers on equal footing with these other stakeholders in the farming system, thus alleviating power imbalances. The concept of AKS continues to be routinely used in European and international research and development projects and programmes, and from here it was an easy step to then conceptualise other forms of knowledge system - Traditional, Ecological and Indigenous, each with their own worldviews, ways of knowing, and stakeholder networks.

Indigenous Knowledge Systems in particular have been studied in some depth over the last 2 to 3 decades, and one of the earliest comprehensive works was undertaken from 2000 to 2012 by a network of stakeholders from 16 countries in the Global South (Haverkort et al, 2003). This network discussed and conceptualised an agreed framework for Indigenous science based on their shared, tripartite worldview: comprising the spiritual, the human and the natural (see Figure 1). This worldview was defined as the way the people see themselves and their relation with the rest of the cosmos.

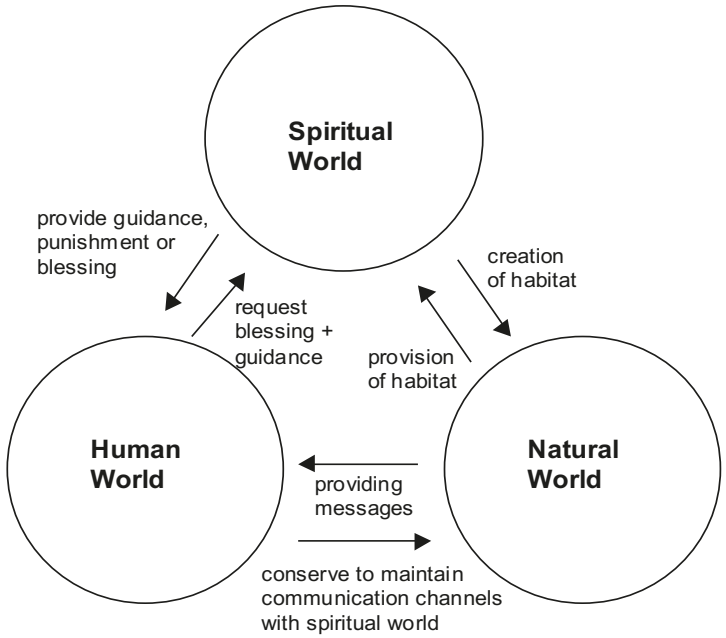

Figure 1. The Three Worlds of Indigenous Science and Their Interactions. (Haverkort, 2021: 26)

Knowledge was recognised as deriving in part from the scientific method, but also and just as importantly from "Pre-Enlightenment views, new scientific insights from quantum mechanics and transdisciplinarity, systems thinking, chaos theory, social learning and a diversity of ways of knowing and ways of learning from non-Western cultures." (Haverkort 2021: 25)

This initiative also defined a knowledge community in its broadest sense as comprising the experts, leaders, healers, guides and the way they carry out peer reviews, have debates and discourses on worldviews, methods, theories and values and agree on accepting or rejecting them. In this sense, they were democratising research. Critically, they also defined science as: "a body of knowledge formulated within a specific worldview. It emerges from specific methods of learning and producing knowledge and uses a consistent theoretical framework that includes assumptions, general principles, and theories. It involves an active role of a specific knowledge community that has reached consensus on the validity of knowledge. The knowledge acquired and the resulting science is a product of a social process and is always limited and subject to modification in the light of new data, information and insights." (Haverkort, 2021: 32).

This work, and others, helps to contextualise modern science alongside other ways of knowing, and to avoid the pitfall of 'scientism', the belief that science and the scientific method are the best or only way to determine truth about the world and reality. Rather, the right of different forms of knowledge to coexist and be actively respected has been conceptualised as 'cognitive justice' (Visvanathan, 1997). These developments in understanding Indigenous Knowledge Systems are hugely significant for the biodynamic movement because they have enabled the establishment of, and broad agreement around, a rationale for the rightful existence of other worldviews, ways of knowing and of undertaking research in transdisciplinary knowledge communities. As we know, Rudolf Steiner – the developer of the biodynamic approach to agriculture - was openly influenced by mystic and

spiritual traditions of the world, but primarily he directly explored the spiritual worlds and his lectures were based on his insights and inner visions from these spiritual exercises (McKanan, 2018). Recently I undertook a study to compare the worldview characteristics of Rudolf Steiner with those of Indigenous authors and – unsurprisingly - found significant synergies in key areas of importance (Wright, 2022) including shared ideas around the consciousness of all life, monism, a moving toward balance and harmony, the need for healing, and the interconnectedness of human-Earth cycles.

Nevertheless, as many of us experience, undertaking research into biodynamic farming is challenging, not so much because of the paucity of appropriate methods through which to explore the underlying metaphysics at play, but, moreso because of politics of differing scientific ontologies and the aspersions cast on biodynamic research by certain factions of the mainstream scientific community. I have also experienced such aspersions in relation to my own research programme on Subtle Agroecologies, a programme that explores the supersensible and metaphysical dimensions of sustainable agriculture from a multidisciplinary and transdisciplinary perspective, and that includes some biodynamic farming techniques. Whenever introducing Subtle Agroecologies, I am careful to stress that it is grounded not in science but in the lived experiences of humans working on, and with, the land over several thousand years to the present. Research may enable us to build a body of scientific knowledge and understanding that contributes to the already-existing Indigenous, traditional, intuitive and other knowledge systems, ways of knowing and worldviews of practitioners in this field. Nevertheless, such explanations do not deter detractors, and earlier this year an extra-curricular short course on this subject, organised in Wageningen by retired university staff, was forced to cancel amidst social media accusations of 'pseudoscience' and 'esotericism'. (There were, to be fair, an equal number of positive commentaries.) See Figure 2 flyer for the course. Of course we need to undertake robust science and to avoid making baseless inferences, but I find these accusations curious. Pseudoscience is, according to the Oxford Languages Dictionary: "*a collection of beliefs or practices mistakenly regarded as being based on scientific method*", yet I am under no illusion that the beliefs and practices exemplified in Subtle Agroecologies are based on the scientific method, far from it. This leads me to develop a different definition of pseudoscience, being: "*the scientific method is performed based on a collection of erroneous beliefs*". Using this alternative definition, almost all science may be classified as pseudoscience as almost all scientists (as well as everyone else) hold inaccurate or incomplete beliefs about life.

Figure 2. Flyer for the (cancelled) course on 'Farming with the Hidden Half of Nature' at Wageningen University

Similarly curious is the accusation of esotericism. The formal definition of esoteric is "*intended for or likely to be understood by only a small number of people with a specialised knowledge or interest* ". This definition could apply to much academic output across the board, and there are areas of biodynamic theory and practice that are unashamedly esoteric, and why not so? Some time ago I had been a member of the Board of Trustees of the UK Biodynamic Association, during which time I had spent many hours strategising, rather unrealistically, about ways to massively increase both biodynamic acreage and farm numbers across the country. It was only when I properly acknowledged the spiritual nature of biodynamics and the implications of this for its role in community that I relievedly let go of my global domination plan. During my previous work in development research, I had lived amongst the Mayan communities of Yucatan, Mexico where I had learned of the high priests in their astronomical observatories, providing wise counsel to the political rulers. If biodynamics were to take the stand as the spiritual 'high priestess' of agriculture, its most important and pragmatic present-day role might be to advise and influence decision-makers in the agricultural knowledge system?

Now to briefly turn back to the political challenge of researching biodynamic farming, explanations as to the underlying causes of the criticism that it receives, as well as to possible solutions - lie not in the agricultural sciences but, I would suggest, in the social sciences and humanities. Eminent psychiatrist, neuroscientist and philosopher Iain McGilchrist (2019), for example, sets out a treatise concerning the biohemispheric structure of the brain, and explains how the increasingly over-dominant left hemisphere, with its belief in secular-materialism and propensity for intellectualisation, struggles with its own inherent insecurity and has given rise to society's disassociation from nature and a normalisation of an emergency footing in the everyday. McGilchrist suggests that this hemispheric imbalance became more prevalent over

time as a result of the declines of Greek, Roman and post-Enlightenment civilisations and the struggle for survival. This treatise is mirrored by that of feminist psychologist Anne Baring, who traces this insecurity back to the loss of respect for nature and the feminine that was instilled by the Abrahamic religions over the last four millennia. Baring explains that "*we no longer have access to other levels or modes of consciousness because our 'rational' mind has, over the last four centuries, increasingly ridiculed, disparaged and repressed what it has been unable, so far, to accept, prove or comprehend*" (Baring, 2013:491). To move beyond this impasse, both scholars suggest that we embrace a cosmology that unites life, consciousness and the cosmos. Such a cosmology resounds with the indications of both Rudolf Steiner and Indigenous scholars.

In fact, biodynamic farming has always been ahead of the game. I have already described the progressive direction of international development in the 1980s-90s that recognised farmers as active participants in the research process rather than passive end-users. Yet Steiner was advocating for farmer-to-farmer and farmer-researcher collaboration almost one hundred years earlier. Other 'firsts' of biodynamic agriculture were to question the use of agrochemicals, to take localised and appropriate scale approaches that incorporated considerations for mental health, alternative economics, and justice, to offer the highest animal and plant compassion and welfare standards, as well as to provide an alternative, holistic cosmovision and a spiritual dimension to guide concepts and practices. Frustratingly, these 'firsts' are not much recognised outside of the biodynamic movement, even in alternative farming spaces, and I would put this down to both poor outward-facing communications by said movement as well as to the poor receptivity by - even - agroecological and organic farming networks which largely remain grounded in the same secular-materialist worldview as that of their nemesis.

Emergent trends of significance for biodynamic research and development

The good news is that this situation is changing, if not in the mainstream then at least at the periphery, and I will present a few examples of the surge in interest in what we could call post-modern, post-material, nature-based ontologies, methodologies and farming practice that align with biodynamics. At an international level we have the Conscious Food Systems Alliance (Co-FSA) of the United Nations Development Programme, which aims to 'Reconnect with ourselves, each other and nature' (Legrand et al, 2022). This global alliance –free to join – was itself inspired by the emergence of the Inner Development Goals (IDGs) as an endogenous counterpart to the more widely known Sustainable Development Goals. Other high level initiatives include the recent thematic report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), which examined the underlying causes of biodiversity loss and determinants for transformative change. This comprehensive scientific report identified 5 core themes evident in over 800 visions of a sustainable world, one of which was that of spiritual reconnection and behavioural change. The report states "*New eco-social imaginaries can inform visioning processes with the transformative potential to change mindsets and ultimately behaviours... That includes revisiting much Indigenous and local knowledge to see humans as part of nature. Diverse ideas include… transformative ways of human and non-human nature relating through intuitive communication*" (Villasante et al, 2024:88). If we look within the international scientific community we can now find a whole

raft of disciplines and subdisciplines for exploring post-material phenomena in agriculture. These include, for example, Intuitive Inter-Species Communication (IISC), Transpersonal Agroecology, Plant Neurobiology, ParaAnthropology, Quantum Biology and More-than-Human Participatory Research (MtH-PR). Within the alternative farming movements we find a heightened interest in subtle and spiritual phenomena and concepts. For example, the co-author of one of the seminal articles on agroecology (Altieri and Toledo, 2011), has more recently stated: "*So far, agroecology has… neglected the ontological dimension. The ontological perspective leads to spirituality. Recognizing and integrating spirituality into agroecological practice would reinforce agroecology as a socially and environmentally liberating activity*." (Toledo, 2022). Back on the British Isles, this revival of interest in postmaterial ontologies and practice is also apparent. Our annual alternative farming conference – the Oxford Real Farming Conference (with 1,800 in-person and 3,000 online attendees) now includes both a pre-confernce day and a thematic strand running through the conference called 'Listening to the Land'. Most recently, last July 2025, our main regenerative farming event, Groundswell (with 10.000 attendees), for the first time offered a session on 'Subtle Energies of the Land'. With all these developents, it wouldn't take much now to conceptualise a Biodynamic Agricultural Knowledge System, one that not only identifies and strengthens the communicative relationships with the alternative and mainstream human actors and organisations, but that also acknowledges knowledge sources and relationships with the other-than-human realms, including farms and gardens as living organisms, the preparations, the elementals and the cosmos. There is much to be positive about.

I would like to close with three concluding points to consider for advancing biodynamic research.

1) Biodynamic agriculture is unique but not alone in its worldview – there is an increasing number of aligned, like-minded research disciplines, organisations and practitioners who could be allies - especially in the arts and humanities, and social sciences.
2) In terms of knowledge, nature-connected and metaphysically-literate knowledge systems are being reclaimed in industrialised regions – the Biodynamic Agricultural Knowledge System (BAKS) approach could lead the way and form a bridge between these and Indigenous Knowledge Systems.
3) In terms of research, to what extent do we wish to comply with a bankrupt, outdated scientific establishment, at the expense of integrity and authenticity?
    - Following this, we need to be clear, confident and united about dismantling claims of pseudoscience and (possibly) accepting esotericism.
    - Could biodynamic research then more openly explore more appropriate inter- and trans- disciplinary concepts and methodologies?

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1.3 Embracing the different dimensions of biodynamics

Full narrative summary of the keynote presentation of 02nd September 2025

David Martin, Physician and Professor

University of Witten/ Herdecke (Germany)

With reference to the biodynamic course and its relating plant life to cosmic events, Prof. Dr. David Martin opened his lecture by taking a look at our solar system and how according to present day calculations it is hurling through the galaxy at speed of 800,000 km/h. From the Sun's point of view, the planets move in nearly flat, elliptical orbits in the ecliptic plane, but because the Sun itself is racing around the galaxy, each planet actually traces out a corkscrew-like or helical path through space. The ecliptic plane is tilted by about 60 degrees relative to the Sun's galactic orbital plane, so over each year a planet spends part of its orbit slightly "ahead" of the Sun along the galactic path and part slightly "behind." The sun takes about 200-250 million years to complete one spiraling circle around the centre of the galaxy – one galactic year. One Galactic year ago is the time warm-bloodedness is supposed to have developed on earth. Two galactic years ago is the time when Earth underwent the Cambrian explosion, a period of rapid diversification where most major animal groups appeared in the fossil record. This era also saw the emergence of complex traits like skeletons and limbs in organisms.

He then began is lecture by introducing the University of Witten/Herdecke, describing its founding vision inspired by anthroposophy. The university now enrolls approximately 3,500 students and regularly scores amongst the top 10 universities in Germany in Medicine, Psychology and Business. He then discussed Anthroposophic Medicine as a developing form of integrative medicine rooted in evidence-based conventional practice and extended through additional therapeutic modalities, specific medications, and biographical approaches to patient care. To date, 1,082 peer-reviewed publications on Anthroposophic Medicine are indexed in PubMed, the database of the U.S. National Library of Medicine (NIH). There is still a long way to go, he said, until Anthropoposophic Medicine is making substantial contributions to the global health burden, but its potential may be substantial.

Prof. Martin then presented his *FeverApp*, a digital tool providing parents with evidence-based guidance on fever management and allowing them to document their own approaches. The *FeverApp* received the award for "Most Innovative Registry in Germany" in 2023. This presentation was in view of the progressive web app projects he describes at the end of his lecture.

He subsequently outlined two national clinical guidelines for which he is responsible: the *National Guideline on Prevention of Regulated Use of Screen Media in Children and Youth*, and the *National Guideline on Fever Management in Children and Youth*. In the context of

the latter, he addressed the issue of antimicrobial resistance, emphasizing how appropriate fever management can help reduce antibiotic use in both humans and animals.

Discussing the topic of screen time and child development, Prof. Martin referred to their 2025 study published in “Developmental Science”. The study demonstrated that parental use of mobile phones in the presence of their children was associated with adverse developmental outcomes, whereas time spent outdoors had beneficial developmental effects. He also introduced their most recent publication on “Ecotherapy (Nature Therapy)”.

Another focus of the lecture was children’s environmental health in agricultural settings. Prof. Martin presented findings showing neurodevelopmental impairments linked to early-life exposure to organophosphate pesticides. He also discussed emerging but limited evidence for respiratory effects associated with air contaminants from confined animal feeding operations (CAFOs). Additional research needs were identified, particularly regarding diesel exhaust, biomass smoke, solvents, veterinary antibiotics, and silica-containing particulate matter.

He further reported on studies examining pesticide exposure in relation to cognitive and motor functions, including overall development, visual memory, visuospatial performance, motor speed, motor coordination, and total neurobehavioral scores.

Prof. Martin addressed the intersection of European agricultural policy and public health, drawing on the comprehensive 2020 analysis by the European Parliamentary Research Service. He illustrated trends showing increases in obesity rates across several EU countries since 1996 and summarized the chronology of key events and research linking agricultural practice with public health outcomes.

Looking forward, he proposed the development of a *Biodynamic School Study* that could potentially be supported by public research funding.

He also referred to the *Annual Training on the Philosophy of Freedom* (http://www.philosophie-der-freiheit.de), describing it as an international platform for dialogue and deepened reflection on essential questions of freedom and consciousness.

To conclude, Prof. Martin presented a real-time science communication tool designed for biodynamic agriculture and related fields. He illustrated how progressive web applications can enable real-time data collection, visualization, adaptive farm management, and open scientific collaboration. The overarching vision is to:

- Democratize access to scientific data in agriculture and nutrition.

- Provide real-time feedback loops for farmers, consumers, and researchers.

- Visualize complex constructs such as vitality in intuitive, interactive formats.

- Integrate open science, reproducibility, and user-centered design.

This approach aims to empower farmers through data-driven insights and to position biodynamic agriculture as transparent, participatory, and scientifically grounded. It further seeks to connect consumer perception with economic and ecological parameters, advancing a modern form of open, participatory biodynamic science.

1.4 Embracing the different dimensions of biodynamics

Summary of the keynote presentation of 02nd September 2025

Eduardo Rincón

Section for agriculture at the Goetheanum, Switzerland

The keynote began by highlighting the importance of holding the International Biodynamic Research Conference in the UK, specifically at the Royal Agricultural University in Cirencester, Gloucestershire. Founded in the mid-19th century, it was the world's first English-speaking agricultural college. We were honored to be guests at this prestigious university and to present our vision of agriculture there. It was particularly relevant for us to be at the UK for several reasons but also because it is the land of Newton, Shakespeare and Darwin, just a few of the many individuals who contributed to this country's rich cultural and scientific heritage. It was also there that Karl König founded the Camphill Community movement, and where Lilly Kolisko lived the last part of her life and published the famous book Agriculture of Tomorrow, based on the research that she and her husband, Eugen Kolisko, had conducted in Switzerland and Germany.

Then I went on to share an image that had stayed with me for a while relating to Isaac Newton. He was born on a prosperous farm in Woolsthorpe Manor, Lincolnshire, this allowed him to attend Cambridge University. After completing his undergraduate degree as a natural philosopher, he returned home due to the Great Plague, during which he developed key ideas in optics, motion, gravity, mechanics, and calculus.

Newton was also deeply interested in theology. When he described his cosmological theory, he defined the key concept of force as an active principle instilled in matter by God. He was also dedicated to the study of alchemy, viewing it as secret knowledge that could reveal the principles of matter. He conducted alchemical experiments to understand the relationship between force and matter. These studies eventually led him to believe that a single guiding force ruled the universe; for him, that force was gravity. Although Newtonian physics marked a shift away from natural philosophy, Newton himself remained convinced that gravity was linked to a divine principle. Ultimately, his work contributed to the separation of science from religion, fostering a materialistic perspective. This duality reflects the contemporary tension between the rational, materialistic nature of science and the pursuit of spiritual science, a tension that is evident even among researchers and practitioners in our field. Newton's dedication to understanding matter, alongside his alchemical research, can be seen as a sacrifice for the advancement of humanity. Today, the challenge lies in moving beyond a materialistic worldview in order to explore spiritual science. This path has its roots in Goethe's transcendental worldview, which inspired the birth of anthroposophy.

For those of us working in research and BD agriculture, rational science is not enough, it doesn’t encompass the totality of existence, but how, then, can we work today and into the future? This does not mean that we should neglect or avoid contemporary science, Rudolf Steiner provides a way forward to resolve this dilemma “The occult scientist has no desire to

undervalue natural science; on the contrary, he desires to acknowledge it even more than the natural scientist himself. He knows that, without the exactness of the mode of thinking of natural science, he cannot establish a science. Yet he knows also that after this exactness has been acquired through genuine penetration into the spirit of natural scientific thinking, it can be retained through the force of the soul for other fields"[1].

When a researcher first notices something in nature that provokes a profound question, a mood arises unquestionably. This mood is the basis of the scientific method and the starting point of what we do in spiritual science. As Rudolf Steiner wrote in his Outline of Occult Science: "It is possible, however, to rise above this arbitrary self-limitation and, apart from special application, consider the characteristics of scientific activity. This is the basis for our designating as "scientific" the knowledge of a non-sensory world-content"[1].

Lilly Kolisko followed this path, conducting research throughout her life to reveal the forces at work in nature. After Rudolf Steiner invited her to present her work publicly, he made a short comment that remains relevant to our work. He said, "You have seen that in inner quietude, work is being done by us on scientific problems, and it is already possible to stimulate science through anthroposophical research in the way that science really needs to be stimulated today, Dr. Kolisko has conducted this research." If the work proceeds as it has in our research institute until now, then perhaps in 50 or 75 years we will achieve what must be accomplished: uniting many details in the whole[2] this was very similar to the title of our research conference at the Royal Agricultural University.

Continuing with my presentation I went on to briefly describe some of my own research work which brings together, Science Art and Biodynamic agriculture After finishing my degree in Biology I conducted a research in the most northern tropical forest in Mexico, studying the distribution of ferns on the forest floor at a biosphere reserve. By incorporating art into my research, I explored the forest beyond conventional scientific measurements, revealing to me its deeper aspects. This approach combined science, and art to seek answers that could not be found through traditional methods.

I went on to describe a project carried out with the Amate tree, which is series of species native to Mexico and the Americas. Historically, its bark had been used to make paper. Research revealed seven species, and an art installation was created in a 16th century former convent to raise awareness of the fact that they are near extinction due to extensive deforestation. The project involved biological and historical research, resulting in thousands of seeds being germinated with the help of various institutions. Over three months, approximately 35,000 trees germinated, leading to a reforestation initiative undertaken in partnership with local schools and the municipality.

[1] Rudolf Steiner An Outline of Occult Science,

[2] Peter Selg, Rudolf Steiner in public life. 2025. Verlag des Ita Wegman Instituts

Another project I presented focused on oaks in Mexico, which has the greatest oak diversity in the world. These trees are crucial to Mexico's ecosystem and culture, yet they have almost disappeared from areas that were once flourishing oak forests. In collaboration with different Initiatives, I researched the biological, historical and cultural significance of oaks, including rituals performed by local indigenous cultures at a mountain known as the Orphan Oak. The results of the research identified seven species of oaks in the local area, inspiring experiments with biodynamic preparation 505. I held art exhibitions and facilitated discussions among diverse communities, integrating perspectives from biodynamic agriculture, science and art to promote awareness of, and research into, the role of different oak species in the production of Biodynamic preparation 505 in Mexico.

Finally, I presented a study conducted by a group of researchers in Mexico on the dynamics of the mycorrhizosphere and its interactions for the efficient nutrient uptake of the medicinal plant chamomile. Conducted on a biodynamic farm in Mexico, the study revealed an increase in plant and root biomass, which was attributed to enhanced soil fertility and the use of compost.

1.5 Unlocking the Aromatic Potential of Yeasts in Foods

Key Note Address, 3rd September 2025 at the Royal Agricultural University, Cirencester, United Kingdom

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The key note address blended well through the theme of the third International Biodynamic Research Conference held at Royal Agricultural University, Cirencester, United Kingdom. The emphasis was on traditional knowledge in agriculture systems, soil quality, fertility, role of animals as integral parts of a food-farming system and a wide range of specific factors which affect the quality, safety of food and human well-being. Indian Agriculture was distraught with several challenges after the Green Revolution failed to maintain soil fertility. The scenario in Indian agriculture started to witness several changes to adopt alternative agricultural systems like organic, regenerative and Biodynamic agriculture. In the year 2020 the number of countries practicing biodynamic agriculture rose from 55 to 65 countries in the world. In the year 2020 India achieved a significant milestone by certifying 9303 hectares of Biodynamic land, positioning India to occupy the fifth position in the world after Germany (84,426 hectares) and Australia (49,797 hectares). This data highlights the importance of biodynamic agriculture in India, showcasing how Indian farmers are embracing biodynamic and regenerative agriculture practices to effectively address critical challenges such as soil quality, fertility, and the health of the soil microbiome.

In addition, an experiment conducted over two consecutive years to unlock the aromatic potential of yeasts isolated from coffee plantations under organic and regenerative agricultural management. Adequate training was provided and dispensed to farmers for upkeep of eco-regenerative agricultural practices in their respective coffee plantations. An experiment to map the series of experimental activities from isolation to cupping were presented to the audience at the conference. The research protocols followed were microbiological, analytical, fermentation assays, controlled fermentation parameters, coffee processing, product development, cupping and determination of cupping scores and specific notes for unique coffee lots.

Tracing this back to the roots, Rudolf Steiner, mentioned that the food we grow, nourishes the whole human being, and communities, in body, soul, and spirit. It is less important to view food as a substance to our body and more reasonable to view food as fuel for our will.

Key Words: Biodynamic agriculture, research, India, microbiology, food quality, food safety, Demeter, certification, soil quality and soil fertility

1.6 Transdisciplinary approaches to sustainability transformations: New Horizons for Biodynamic Research

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Abstract

Transdisciplinarity (TD) has emerged a few decades ago as an alternative research paradigm, based on the integration of different ways of knowing, and the ambition to foster practical sustainable changes on the ground. In the last years, a “transformative turn” in TD explicitly insists on the need for the scientific academy itself to transform its core principles, structures and assumptions. This evolution creates new opportunities for Biodynamic Research, which can play a highly strategic role in the sustainability transformations of both agriculture and agricultural sciences institutions. This strategic role is illustrated with the transformative journey of the author, which began with a modest explorative academic research project on biodynamic animal farming in France, and ended up (to be continued) with a deliberate active personal engagement in co-creating sustainable pathways with the biodynamic farming community (and everyone interested!). Along the way, transformative TD explorers have to be prepared to face voices of judgment, cynicism and fear. Community-building and care for each other are essential to be resilient in the face of turbulences.

Transdisciplinarity (TD) as the emerging Master research paradigm

Emergence of transdisciplinarity (TD)

The concept of transdisciplinarity emerged in the 1970s in response to the inability of scientific institutions to solve major problems facing humanity (poverty, pollution, etc.) (Klein, 2014). TD is often characterized by the inclusion of non-academic stakeholders in the process of knowledge production, and/or by the integration of multiple disciplines and ways of knowing (art, science, spirituality…) (Max-Neef, 2005). A common characteristic in the major problems facing humanity is that they most often correspond to "wicked problems": without a clear solution, characterized by multiple and contrasting opinions and incomplete and contradictory knowledge. According to Funtowicz and Ravetz (1993), wicked problems fall within the domain of "postnormal science," where both the uncertainties of knowledge and the stakes of decision-making are considerable. This postnormal science requires transdisciplinary approaches for several reasons: a single discipline or expert cannot address the complex issues; the sciences concerned with the origins of the problems are not necessarily the same as the sciences supposed to solve them (ecology, etc.); and the

integration of stakeholders in the field is essential, not only because they possess knowledge (experiential, professional, tacit, etc.), but also because of their fundamental right to be involved in research that concerns them. Finally, many authors have highlighted the notion of "implementation gap", that is, the existence of the gap between the production of knowledge in research institutions and its practical application (Lux et al., 2019).

The transformative turn

Over the last twenty years, transdisciplinarity has been increasingly promoted as a promising avenue for knowledge production and decision-making (Fischer et al., 2023). A major recent evolution corresponds to a "transformative turn", as more and more scholars explicitly aim not only to observe and describe, but also to actively initiate and catalyze them, including in the scientific academy itself (Schneidewind et al., 2016). Along this line, a key question becomes how to move from the WHAT to the HOW of transformations (Vogel and O'Brien, 2022). New corresponding keywords are "Inner Transformations", "Knowledge co-creation", "Empowerment of marginalized communities", as exemplified in the last cutting-edge IPBES report on transformative change (IPBES, 2024). A promising approach from the what to the how is the identification of "Leverage Points" to transform a system (Meadows, 1997). This approach has been applied by a group of researchers to the uptake of organic food production and consumption in the United Kingdom, with a contribution from the UK Biodynamic association (Staton et al., 2024). This high-level study confirms that most powerful Leverage Points are most often ignored, indicating a key area for future research (Abson et al., 2017). These deeper Leverage Points correspond to changing or transcending rules, structures, goals and paradigms in the system (Meadow, 1997). To tap into these deeper Leverage Points, Theory U (Scharmer, 2018) appear among the most promising methodologies. Based on cutting-edge system science, it has shown to be efficient to genuinely transform organizations in many contexts and economic sectors (Scharmer, 2018). Interestingly, the creator of Theory U Otto Scharmer grew up in a biodynamic farm, and was deeply inspired by his experiences in his childhood. It is no surprise then that Theory U is particularly popular and practiced in the biodynamic research community. Theory U takes its name from the representation of transformative processes with a U shape, corresponding to different steps or "gestures" (i.e. Observing, Sensing, Presencing, Prototyping, Embodying) (Scharmer, 2018). During the U process, people engaged in transformation have to face voices of judgement, cynicism and fear, which I will illustrate in the second part of this paper. In the context of academic research especially, the principles of Theory U resonate deeply with the idea of TD as a "way of being" that I have developed a few years ago (Rigolot, 2020). TD as a "way of being" is indeed characterized by a deep commitment to participate in sustainability transformations ("epistemological activism"), and the ability to "let go" one's deepest assumptions behind her/his discipline and professional researcher roles (Rigolot, 2022).

According to Theory U, a genuine transformative process always starts with suspending our current ways of thinking. Within agricultural sciences, biodynamic farming research offers a unique opportunity to do so, because of its specificities and underlying post-materialist paradigm (Rigolot and Quantin, 2022). However, engaging in biodynamic research also requires from the start to face "voices of judgement" in the academy, as many established researchers prefer to see it as "pseudoscience" (Wright, 2025). For biodynamic researchers

who willingly chose to move beyond, the next question becomes: How can we then express our full transformative potential? In the next section, I will present insights from a transformative journey, which might seem quite personal at the beginning (as I recall from my own experience), but whose collective nature will become increasingly apparent.

Insights from a transformative journey

A research project to explore biodynamic animal farming

Before I started to work on Biodynamic Farming about four years ago, I had already some experiences as a transformative transdisciplinary researcher, complementarily to my educational background in Livestock Farming System sciences (Rigolot, 2020). In 2020, I started a two-year mobility in Japan, where I discovered a strong form of transdisciplinarity, in particular with indigenous communities (Gasparatos et al., 2023). At the same time, I was still in touch with researcher colleagues in animal science and socio-anthropology in France, working closely with an association of alternative livestock farmers to identify pathways for the agroecological transitions (Crémilleux et al., 2023). These experiences set the foundations for an exploratory project on biodynamic animal farming (2022-2024). As we were mostly Livestock Farming System researchers and sociologists in the project, with our Master students, our main research approach was typically to perform surveys on farms, from quantitative questionnaires to open qualitative interviews. In Theory U language, farm surveys are great for observing the system. For example, we found that biodynamic farmers have a unique perspective on the integration of crops and livestock in a same area, which is known to have multiple benefits for sustainability (nutrient cycling, biodiversity, economic and climatic resilience…) (Lebrun et al., 2024). Particularly, what was striking in the interviews was how animals are valued for themselves, and for the atmosphere they bring to the farm and quality of life. However, for biodynamic farmers, keeping animals make sense only if you can respect them until their death. From their perspectives, developing more respectful animal slaughter systems and value chains for males is paramount, and this has general implications for the development of mixed crop-livestock systems (Lebrun et al., 2024). Moreover, farm surveys helped us to identify promising alternative herd management practices (for example, feeding the animals with the different parts of the plant, controlled inbreeding, osteopathy…) (Elvira, 2024). A stimulating perspective would be to develop researchers-practitioners' collaborative teams to collectively investigate such alternative practices, as in the inspiring work of Spengler Neff et al. (2024) in Switzerland. Furthermore, our research project team also made a lot of participant observation, which is a relevant methodology for sensing the system, at a deeper level. Particularly, participating in farm activities was essential for us to understand how biodynamic farmers develop relationships of care with their animals, and a generic process for farmers to connect with their animals has been characterized: 1) Letting go the mental, connecting to the body, allowing emotions to flow; 2) Attentively observing the animal, developing empathy; 3) Learning a new language, recognizing the animal as a subject; 4) Reintegrating the rhythm of Life and taking care for the common good (Perrin, 2024). The implications are very deep, at a paradigmatic level: Our findings challenge not only the most basic textbooks for agricultural education, but also the very way textbooks are generally used, given the importance we saw in experiential learnings (Perrin, 2024).

Deeper learnings

Our project started to ripple beyond its initial boundaries, as we started to imagine new projects and new orientations in our institutions. Personally, I started to question the foundations of my own discipline (i.e. Livestock Farming System science) which I realized has still a very mechanical view, compared to what I felt biodynamic farmers were doing with their "farm organism" (Sattler and Wistinghausen, 1992). Most notably, I was stroke by the use of the metaphor of a "conductor of an orchestra" by biodynamic farmers to describe their activity, by contrast with the image of the "pilot" which is common in my discipline. I found this metaphor really inspiring: unlike the "pilot" of an airplane, for example, a conductor is responsible for the harmony between living entities, which will infuse their own unique sensitivities into the overall performance. Complementarily to the "farm organism", another essential idea is that of "farm individuality," according to which each farm is absolutely unique and should cultivate this individuality (Sattler and Wistinghausen, 1992). The "farm individuality" has major implications for development policies, obviously, but also for research methodologies. The work of Ton Baars (2011), who is both an academic researcher and former biodynamic farmer and cheesemaker, is particularly inspiring. In his proposal for a "new experiential transdisciplinary science", Baars (2011) puts a strong emphasis on the subjective/experiential dimension, as a basis for creativity. Like in Theory U (Scharmer, 2018), Baars (2011) identifies a form of "implicit" knowledge, which goes beyond the idea of tacit (unspoken) knowledge commonly used in my discipline. Along this line, Van Diest (2019) suggests a groundbreaking research perspective: Fostering the development of farmers' intuition (defined as the human faculty that allows access to this implicit knowledge), which can be done with or without necessarily seeking to formalize this knowledge. To this aim, "sensory approaches" are particularly promising: they consist in connecting with the world through our senses, and letting the external world permeate our bodies (Javelle, 2025). Again, biodynamic farming appears to be at the forefront, with the "Goethean Method" at its core to develop sensory approaches in a rigorous way in practice (Colquhoun, 1997).

Meeting voices of judgment, cynicism and fear

As our insights in the project went deeper, the initial sarcasms (voices of judgment) let place to stronger criticism (voices of cynicism). For example, the originality of sensory approaches was dismissed ("Many people in the institution already do that, nothing new"…), without trying to really understand all the implications (i.e. an approach opening to inner dimensions (Ives et al., 2020), far beyond mere observations by the five common senses). Or, regarding our future research proposals, for which I suggested to fully integrate the sensitivity of our students for defining research topics: "It's impossible! You can't rely that much on intuition; you need a scientific strategy…". Still, we managed to move some lines… But at some stage come also the voices of fear. From the beginning, our collaboration with the biodynamic farming community generated intense attacks coming from social networks (X/Twitter), as critics were seeing in our project a dangerous "entrism" in public research of what they seem to consider to be a pseudoscientific movement abusing farmers (!). As disconnected from reality as it may seem, such critics are as old as the biodynamic movement itself (McKanan, 2017), and the censorship of inconvenient scientific research to preserve vested interests is a common strategy for those in power (Cummings et al., 2023). In our case, surprisingly enough,

the accusations went viral and spread out to mass medias and to high institutional levels. We then experienced a massive social and institutional pressure to limit or even stop our investigations. Then, something unexpected happened…

At one pick of the controversies, our colleague Sophie Allain, whom I had never met before, took the initiative to contact us and other researchers studying biodynamic farming in France. Together, we started to think and feel as a network, sharing our insights and experiences… According to Theory U (Scharmer, 2018), "fight or flight" is like an automatic response when one encounters voices of fear; but in this case, we managed to stay connected, without firing back the attacks directly, nor accepting to give up under pressure. Collectively, we found resources to really listen to the deep fears, in ourselves and in others, and the underlying systemic patterns: we reached some state of presencing (Scharmer, 2018).

Prototyping and embodying the New

Meeting voices of fear was the best of opportunities in our journey. Particularly, the attacks of our critics led to the merging of our project with another project led by Sophie Allain, which resulted in key realizations around sensory approaches, as described above (Perrin, 2024). A joint seminar was organized, bringing together researchers, artists, and farmers with a common interest in sensory approaches and constructive dialogue to transcend paradigms. Following this seminar, under the leadership of Sophie Allain, a new association was created, building on previous initiatives, and bringing together researchers and practitioners: L'Institut du Vivant et des Communs – Pour une agroécologie paysanne et une alimentation conscientes 3. This association can be seen as a prototype of a transdisciplinary space for agricultural transformations, with four key missions: 1) Advocacy and shifting narratives; 2) Training and education; 3) Support transformative initiatives; 4) Exploratory research. Networking and making alliance are key parts of our strategy, and we already became the first national hub of the COFSA (Conscious Food System Alliance)4, a high-level initiative led by the UNDP (United Nations Development Program). Importantly, at a very deep level, being accused in our research integrity helped us to fully realize one key aspect of transdisciplinarity, i.e. that neutrality and objectivity in science are always situated, embedded in researchers' worldviews and positions (Haider and Reiser, 2025). This realization creates new opportunities to navigate complexity, conflicting values, power struggles and uncertain knowledge, and to develop both "practical wisdom" and "virtue ethics" (Caniglia et al., 2021). Practically, and perhaps even more importantly symbolically, our new association is a living example of a citizen-led initiative to create an innovative space of freedom, where everybody can feel safe and empowered to explore the most stimulating research perspectives.

[3] Institute of Life and the Commons – For a conscious peasant agroecology and food system

4 The Conscious Food Systems Alliance

Conclusion: Community-building and *Care* for each other as keys for transformations

To sum up our story at this point, can we really speak of a transformative journey? Structures are perishable, and one cannot say what the future of our association will be. Yet, more importantly perhaps, something subtle but very significant changed in the landscape. We generated some curiosity in society toward biodynamic farming, and its potential to inspire sustainable livestock systems deeply respectful of farmers and animals. We started to act as a growing network, not limited to biodynamic farming but really transcending paradigms. To such extent, our story illustrates how transdisciplinarity as a research paradigm can create new possibilities for Biodynamic Research, and how Biodynamic Research can humbly but strategically contribute to much broader societal transdisciplinary transformations (Rigolot, 2023).

With these considerations in mind, what if we take our role of change-makers seriously, as a collective? Could we, biodynamic researchers, take a real leadership on (our share of) sustainability transformations? As a powerful metaphor, Care et al. (2021) propose to see leadership collectives as plants, with three conditions for collective flourishing: 1) taking roots (i.e. taking care of ourselves and each other, as transformations can be so painful sometimes); 2) pollinating (i.e. actively exchanging with other communities, in an open manner, as there is so much to learn around); 3) seeding change (i.e. encouraging collective processes and actions to emerge, keeping in mind that their effectiveness will depend on our collective capacity to transcend existing limitations in the way we relate to each other in society, Vogel and O'Brien, 2021). Along this line, to conclude, I have to say I have been deeply impressed and touched by the quality of the exchanges at this Third International Biodynamic Research Conference. This gives me a lot of hope, inspiration and more than ever great expectations for the future of Biodynamic Research and its strategic contribution to sustainability transformations.

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2. Biodynamic Preparations

2.1 The effect of biodynamic preparations on wheat roots associated microbiome

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Abstract

The application of biodynamic preparations (BD) as an organic amendment has been reported to positively affect crop development, health, resilience to environmental stress, and yield. While most studies have focused on the impact of BD applications on plant physiology, few studies have examined the effect of BDs on the soil and plant microbiome. The plant associated microbiome plays a key role for plant growth, health and yield and may be strongly impacted by BD applications which can further explain the effects obtained on plants.

In Milke et al. (2024) it was already shown by a 16S rRNA gene amplicon sequence based approach that the application of BDs significantly increase the relative abundance of bacteria with plant growth promoting functions (e.g. phytohormone production) in bulk soil of treated fields.

Our current research hypotheses are that BDs introduce plant growth promoting bacteria (BGPB) into the agricultural systems and increases the colonization of roots by BGPBs, which may be present in soil or introduced by BD applications.

The initial cultivation depended on analysis of a BD 500 used for spraying of wheat showed that the BD 500 contained a high concentration of bacteria. We cultured several strains of the genera Pseudomonas, Janthinobacterium, Bacillus, and Achromobacter from the BD 500. All genera had plant growth promoting properties are reported. We are currently investigating the effects of the root microbiome of wheat treated with the studied BD 500 and 501. This study will enable us to investigate the effect of the spraying in the diversity and community composition of the wheat root microbiome and to evaluated if the bacteria with were sprayed with the BD500 and 501 were introduced in the wheat root microbiome.

Background and Aims

The application of biodynamic preparations (BD) as an organic amendment has been reported to positively affect crop development, health, resilience to environmental stress, and yield.

While most studies have focused on the impact of BD application on plant physiology, few studies have examined the effect of BDs on the soil and plant microbiome. The plant associated microbiome plays a key role for plant growth, health and yield and may be strongly impacted by BD applications which can further explain the effects obtained on plants.

In Milke et al. (2024) it was already shown by a 16S rRNA gene amplicon sequence based approach that the application of BDs significantly increase the relative abundance of bacteria with plant growth promoting functions (e.g. phytohormone production) in bulk soil of treated fields.

Our current research hypotheses are that BDs introduce plant growth promoting bacteria (BGPB) into the agricultural systems and increases the colonization of roots by BGPBs, which may be present in soil or introduced by BD applications.

Methods

We are currently investigating the effects of the root microbiome of wheat treated with the studied BD 500 and 501. Biodynamic preparation BD 500 and 501, and root associated microbiomes will be studied using cultivation dependent and cultivation independent approaches like 16S rRNA bacterial gene and 18S rRNA fungal genes using amplicon sequencing for microbial community profiling.

Results and Discussion

The initial cultivation depended on analysis of a BD 500 used for spraying of wheat showed that the BD 500 contained a high concentration of bacteria. We cultured several strains of the genera Pseudomonas, Janthinobacterium, Bacillus, and Achromobacter from the BD 500. All genera had plant growth promoting properties are reported.

Conclusions

This study will enable us to investigate the effect of the spraying in the diversity and community composition of the wheat root microbiome and to evaluate if the bacteria with were sprayed with the BD500 and 501 were introduced in the wheat root microbiome.

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2.2 Potentized Biodynamic Preparations in Research and Practice

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Abstract

Potentized biodynamic preparations have existed since 1923. Rudolf Steiner developed initial test designs with Lily Kolisko, who continued this research for over 30 years, publishing results in Agriculture of the Tomorrow. After her death, the preparations were largely forgotten. Since 2010, Benjamin Epler has revisited her work, replicating experiments. From 2017, he investigated their effects in public research institutes, later collaborating with Demeter im Norden (2020) and Forschungsring (2022). Results from both past and recent studies highlight the significant impact of potentized preparations in agriculture, horticulture and vegetable growing.

2.3 Impact of biodynamic preparations on soil microbial community diversity in vineyards of Lafite, France

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Abstract

Globally, vineyards are facing significant challenges due to climate change, and biodynamic practices show potential for alleviating climate-related stressors via impacting on the soil microbiome. However, clear evidence for effects on the level of microbiome physiological response is still outstanding. Here, results from a French on-farm experiment are presented, showing that biodynamic soils exhibit higher respiration rates after adding low molecular weight organic substances (15 of the total 17 substrates). This indicates a lower anabolic demand for the added substrates and therefore a good supply status of soil microorganisms. Furthermore, a stronger catabolic response after sugar addition indicates a higher abundance of carbon to the microbial community in biodynamic soils.

Background and Aims

Climate change is profoundly impacting vineyards worldwide, with changing temperatures, altered precipitation patterns, and increased frequency of extreme weather events affecting grape yields, quality, and wine production (O'Brien et al., 2025).

The biodynamic field preparations (BD) horn manure (BP500) and horn silica (BP501) have been shown to harbor potentially plant growth-promoting microorganisms that may play key roles in alleviating climate-related and other stressors, thus increasing plant resilience to various stresses (Milke et al., 2024). However, other microbial indicators are needed to understand how microbial functional diversity is affected on the level of physiological responses. In this regard, particularly community-level physiological profiling using multi-substrate-induced respiration (MSIR), indicating microbial responses to N and C limitation in terms of catabolic or anabolic use of low molecular weight organic substances by soil microorganisms (Struecker & Joergensen 2015) has repeatedly shown to be affected by BD: Out of nine French vineyards, four showed higher respiration rates (averaging the 17 substrates added) in response to low molecular weight substrates with BD application, while two showed lower respiration (Fritz et al. 2020, Bublitz et al. 2025).

In the current study, for the first time effects of BD on Multi-SIR were studied in a field experiment with randomized complete block design and four field repetitions established in 2017 in Château Lafite Rothschild, France.

Methods

The on-farm experiment (4 ha) was established with a randomized block design with two treatments and four repetitions at Château Lafite Rothschild, France in 2017, to evaluate the effect of BD on soil physical and biological properties, as well as plant physiology and resistance to pathogens.

Treatments include application of biodynamic field preparations BP500 and BP501 (BD+), and Maria Thun Compost applications, while the control received no biodynamic preparations (BD-).

Disturbed soil samples (nine per plot) from two treatments (BD- and BD+) were collected in 2023 to assess the community-level physiological profiles (multi-substrate respiration rate approach, Multi-SIR, Rodas-Gaitán et al., 2022), total C, total N, carbonate, basal respiration, pH, among other parameters that reflect plant and soil "health".

Results and Discussion

Our preliminary results show that biodynamic soils exhibited higher respiration rates after adding 88% of substrates (15 of the total 17 substrates), with significant increases in two of them. The higher the respiration rate, the lower the anabolic demand for specific substrates, indicating abundant supply of suitable substrates from the soil to the soil microbial community.

A stronger catabolic response after the addition of sugars (glucose and fructose) indicates a higher abundance of carbon to the microbial community in biodynamic soils (Rodas-Gaitán et al., 2022).

These results obtained from a 6-year BD application support the similar response of the microbial community profile observed in four out of seven Burgundian vineyards, partially with stronger effects than in the current study, by Fritz et al. (2020) and Bublitz et al (2025). However, as these authors observed contrary results for two out of seven vineyards sampled, there is still a need for more evidence from different sites and seasons.

Conclusions

The current study provides further evidence for BD effects on soil microbial functional diversity. Evidence from more sites and seasons is needed to confirm these results. Furthermore, future studies on BD effects should look into other indicators of soil microbial activity and plant-soil-microbe interactions as well as their potential effects on plant health and food quality.

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2.4 Improving Fruit Shelf Life Using Biodynamic Preparation Extracts

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Abstract

Post-harvest losses in fruits are a significant challenge in agriculture, particularly in organic and biodynamic farming, where synthetic preservatives are avoided. Biodynamic agriculture relies on plant- and mineral-based preparations, such as BD501 (silica) and BD508 (horsetail extract), known for their effects on plant resilience and metabolism (Juknevičienė et al., 2021). However, their potential post-harvest benefits remain largely unexplored. This study aims to investigate whether biodynamic preparation extracts applied as sprays can enhance fruit shelf life by influencing ripening dynamics, antioxidant activity, and microbial resistance. If effective, such an approach could offer a natural, sustainable alternative to conventional post-harvest treatments (Shahbaz et al., 2022).

Background and Aims

Post-harvest losses in fruits are a significant challenge in agriculture, particularly in organic and biodynamic farming, where synthetic preservatives are avoided. Biodynamic agriculture relies on plant- and mineral-based preparations, such as BD501 (silica) and BD508 (horsetail extract), known for their effects on plant resilience and metabolism (Juknevičienė et al., 2021). However, their potential post-harvest benefits remain largely unexplored. This study investigates whether biodynamic preparation extracts applied as sprays can enhance fruit shelf life by influencing ripening dynamics, antioxidant activity, and microbial resistance. If effective, such an approach could offer a natural, sustainable alternative to conventional post-harvest treatments (Shahbaz et al., 2022).

Hypotheses:

1) Extended shelf life due to reduced moisture loss and delayed senescence.

2) Increased antioxidant levels, which may contribute to improved fruit quality.

3) Insights into biodynamic extracts as a potential post-harvest treatment for organic and biodynamic fruit production.

Methods

The experimental design will consist of fruits (e.g., apples, strawberries, grapes) divided into treatment groups sprayed with different biodynamic extracts and a control group (untreated). Afterward, the fruits will be evaluated for their shelf-life quality by measuring weight loss, firmness, color changes, and ethylene production. Additionally, the antioxidant and phenolic content will be measured to study the biochemical effect of the extracts on fruits.

Results

Results are not yet available.

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2.5 Effects of Biodynamic Preparations: A Network Meta-Analysis

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Abstract

Biodynamic (BD) preparations are central elements of biodynamic farming, yet their agronomic efficacy remains debated. To address this, we conducted a meta-analysis of field trials evaluating the yield response to BD preparations. Based on a systematic search strategy, we compiled data from 54 field trials reported in 36 independent studies across nine countries and four continents, spanning from 1977 to 2023. All analyses were conducted on the natural logarithmic scale and followed a random-effects model weighted by the inverse of the squared standard error. Our results indicate a significant yield increase under BD treatment compared to untreated controls (mean effect: +3.7%, 95% CI: 1.6–5.8%, p = 0.0009).

Background and Aims

The biodynamic preparations are a core feature of biodynamic management and distinguish this method from other organic farming approaches. Scientifically spoken, the preparations are intended to support plant health and plant growth on a systemic level. As the rationale of the preparations is rooted in Anthroposophy and contains a lot of hypotheses that lack scientific validation until now, there has been much debate about this practice. Scientific results on preparation effects are heterogenous, leading authors to different conclusions. However, a sophisticated meta study has not been conducted until now. We fill this gap and present results from a meta analysis of published peer-reviewed articles on preparation effects on plant and soil properties.

Methods

The dataset builds on a previous compilation by Alain Morau (unpublished) and includes only peer-reviewed publications and doctoral dissertations. We expanded the literature search to include studies through August 2023 using Web of Science, Google Scholar, and regional databases. To ensure consistency and data reliability, only those trials that fulfilled defined inclusion criteria regarding treatment composition, experimental design, data accessibility, publication status, availability of yield data, and temporal scope were considered eligible for this meta-analysis.

We limited our search to studies published from 1980 onwards 2023 August. This cut-off point was chosen to reflect changes in agricultural practices, the standardisation of BD treatment

protocols, and improvements in experimental design over time. Although this approach ensures relevance to modern conditions, earlier trials that could have provided additional historical context may be excluded.

We examined the data set using a factorial ANOVA framework (Piepho et al. 2012). All analyses were performed on the natural log scale (Hedges et al. 1999), and we applied a random-effects model that weights each observation by the inverse of its squared standard error.

Results and Discussion

A total of 54 trials (from 36 independent studies) were conducted across 3 of the 4 major climatic zones and on 4 of the 7 continents, spanning 9 countries. The experiments ran from 1977 to the present, with individual trial durations ranging from 1 to 28 years (mean = 3.9 years; median = 1.5 years).

At the writing of this article we did only finalize the evaluation of preparation effects on crop yields. However, other effects will be presented in detail at the conference and in the intended publication.

Crop yields were slightly (aprox. 4%) but significantly ($p<0.05$) improved by the application of the biodynamic preparations.

Interpreting the effect, it must be considered that a bias may arise from the fact that we expect the preparations to regulate plant health and growth in a most beneficial way. This regulation must not always result in an increase of yields, but could also decrease yields under certain circumstances, when the environmental conditions or individual properties of the plants rather require a moderation of processes. However, we did not find a valid way to test this hypothesis in our meta study.

Another drawback is that we could not include studies on preparation effects on the microbiome (Milke et al. 2023). Microbiome effects may be a key to the comprehension of the preparations, as they provide a link between the anthroposophical rationale and possible scientific explanations of an impact of the preps. Unfortunately, there are too few studies for a meta analysis of this pathway until now – this must be left to future research.

Conclusions

In our very robust meta analysis we observed a significant positive effect of the biodynamic preparations on crop yields. Even though the effect size was small, it is a clear proof of the existence of a preparation effect according to the expectation. This justifies further research in the biodynamic preparations, which is a very interesting challenge from a scientific point of view.

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2.6 Horn Manure & Horn Silica: Does the Application Method Make a Difference?

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Abstract

Nowadays, biodynamic spray preparations such as horn manure (P500) and horn silica (P501) are applied in Germany using air-blast sprayers. Drone technology, offering reduced soil compaction and greater flexibility, is a promising alternative for difficult terrains. However, its impact on the effectiveness of these preparations and on crop quality remains unclear. This study compared air-blast and drone application on winter spelt at three Demeter-certified farms. To assess the influence of application method, copper chloride crystallisation (CCCryst) was employed to analyse both the preparations and the harvested spelt grain. The resulting image-forming patterns revealed that spelt samples treated with the air-blast sprayer consistently ranked highest across all three sites, displaying clear signs of maturity and structural harmony. In contrast, samples from drone and control treatments were more difficult to distinguish, indicating reduced or inconsistent effects.

Background and Aims

Biodynamic spray preparations such as P500 and P501 are essential components of biodynamic farming, applied using air-blast sprayers to support soil fertility and plant quality. These sprayers are based on a design developed by Forschungsring e.V., the integrated technology was selected and tested using formative forces analysis (Schmidt, 2014), to ensure the quality of the preparations remains intact.

With recent advances in drone technology, interest has grown in alternative application methods that offer increased flexibility and reduced soil compaction, particularly in areas with steep slopes or limited accessibility. However, it remains uncertain whether drone application affects the subtle efficacy of these preparations and the resulting crop quality. This study aims to determine whether the method of application, air-blast sprayer versus drone, has an impact on the preparations themselves and on the quality of the harvested spelt grain. CCCryst (Doesburg, 2021 and Fritz, 2022) was used to assess differences between treatments. The study seeks to contribute to a deeper understanding of how application techniques influence biodynamic outcomes.

Methods

A field trial was established in 2021 at three biodynamic farms in Schwäbisch Hall, Germany, all certified by Demeter. Each farm cultivated winter spelt (varieties: Raisa, Dottenfelder Rotling, and Oberkulmer Rotkorn) under three treatments: air-blast sprayer, drone, and untreated control. P500 was applied once in April and P501 was applied twice in May and June. Preparations were stirred and sprayed in succession, resulting in a 1-hour delay between sites. Preparation samples were collected immediately after stirring and again after passing through the nozzle of the air-blast sprayer or drone. Harvested spelt samples (n=9) were taken on July 23, 2021. All samples were anonymized and analysed using CCCryst.

Results and Discussion

Effect of Application Technique on Preparations

CCCryst images of P500 and P501 demonstrated that the application method significantly affected the structural integrity of the preparations. For P500, the air-blast sprayer sample showed the strongest image structure and central coordination, while the drone sample was weaker but still more vital than the untreated control. For horn silica (501), the drone sample appeared dense and inhibited at the center, in contrast to the more balanced and mineralic image from the air-blast sprayer. Overall, the method of application left distinct imprints in the crystallisation patterns, with drone-treated samples showing reduced image integrity, especially in horn silica.

Effect of Application Technique on Spelt Quality

In the harvested spelt samples, image forming methods consistently ranked the air-blast sprayer treatments highest across all three farm locations, revealing clear visual indicators of ripeness and internal structural harmony. Following this ranking, crystallisation images were assigned to their respective treatment groups. Drawing on previous studies, it was anticipated that preparation-treated samples would exhibit enhanced order and maturity. This expectation was confirmed for the air-blast variant, which was correctly identified in 100% of cases. In contrast, distinguishing between drone and control treatments proved difficult, suggesting that the drone application may attenuate the preparations' effects, resulting in image characteristics that closely resemble those of untreated controls.

Conclusions

The results confirm that the application of P500 and P501 preparations can lead to observable differences in the harvested grain, particularly when analysed using image forming methods. At the same time, the findings highlight that the choice of application technique significantly influences the effectiveness of biodynamic preparations.

These differences were clearly reflected in the spelt samples: treatments applied with air-blast sprayers consistently exhibited higher levels of maturity and internal structural harmony, whereas drone and control variants were more difficult to distinguish. This suggests that

drone application may attenuate the subtle effects typically associated with biodynamic preparations.

Further studies are desirable to evaluate how drone technology could be optimised with respect to preserve the integrity of biodynamic preparations during application.

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2.7 Microbial functional diversity indicators in vineyard soils under biodynamic land management

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Abstract

An on-vineyard research project was conducted to assess the effect of biodynamic preparations (BD) on microbial functional diversity (MSIR) and extracellular polymeric substances (EPS).

The results showed that vineyards with BD improved soil quality, with higher soil organic carbon, nitrogen, and microbial biomass carbon levels. The MSIR approach clearly separated the treatments without and with BD. The study also revealed that the BD increased the production of EPS, which is a key component of soil structure. Particularly, the increase in EPS-carbohydrates production in vineyards with BD was linked to improved soil chemical and biological properties.

Background and Aims

Previous studies explain the essential role of soil microbial functions in nutrient cycling and decomposition (Op De Beeck et al. 2021; Rodas-Gaitan et al. 2022), emphasizing their importance for maintaining soil quality in biodynamic agricultural systems (Fritz et al. 2021; Milke et al. 2024). The quality of organic matter influences the microbial community's ability to produce "binding agents" such as extracellular polymeric substances (EPS) and glomalin-related soil protein (GRSP), which enhance soil structure and water retention, benefiting plant performance, especially under stress (Flemming et al. 2017; Costa et al. 2018; Ilyas et al. 2020; Benard et al. 2023).

The on-farm research project aimed to analyze the effects of biodynamic preparations (BD) on the functional diversity of microorganisms and the production of EPS and GRSP in the soils of four vineyards (Prissé, Fleurie, Lavernette, Prés Culey) in the Burgundian region of France.

Methods

This study was carried out in vineyard soils from the Burgundian region, and four farmers who owned about 0.5 ha were selected randomly. Each vineyard was divided into two halves, spraying annually in one half BD preparations (BD+), whereas the other half received no BD preparations (BD-).

Soil samples from each treatment (BD- and BD+) were collected to measure factors that reflect soil quality, such as soil organic carbon (SOC), total nitrogen (N), microbial biomass carbon (MBC), multi substrate-induced respiration (MSIR), with 17 substrates and H_2O, EPS, and GRSP (Sradnick et al. 2013; Bublitz et al. 2023).

Results and Discussion

Our study demonstrates that the application of BD preparations has a positive impact on soil, leading to significant increases in SOC, total N, MBC, basal respiration, and the MBC/SOC ratio. The discriminant function (DF) analysis revealed that the differences between BD- and BD+ treatments were most pronounced at certain vineyard sites, where DF1 separated the two treatments at Prés Culey and Lavernette, and the DF2 separated them at Prissé, Fleurie, and Prés Culey.

Our research confirms the positive effects of BD preparations on soil respiration (Multi-SIR), which have been observed in previous long-term field experiments (Fritz et al. 2020; Rodas-Gaitan et al. 2022). A possible explanation for these benefits is that BD preparations contain bioactive substances that can trigger strong respiratory responses and promote microbial functions in the soil (Milke et al. 2024). These bioactive substances, present in trace amounts, may be responsible for the observed improvements in soil health.

Conclusions

Our findings indicate that the increase in EPS-carbohydrate content in BD+ is positively correlated with enhanced respiratory activity, suggesting a synergistic interaction between these substances and the improvement of soil chemical and biological properties in vineyards. Conversely, lower ratios of EPS-carbohydrates/MBC and EPS-proteins/MBC after BD application suggest that soil microorganisms are able to allocate more resources towards the production of microbial biomass, rather than diverting them towards the synthesis of these extracellular polymers.

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2.8 Studies on the responses of grapevines on different application times of the horn silica

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Abstract

The global production of organic and biodynamic grown crops has grown exponentially over the last few decades and has also seen huge increases in viticultural area as a result of the remarkable interest of both winegrowers and consumers in vineyard management systems with a presumed reduced environmental impact (Yiridoe et al. 2005, Castellini et al. 2017, Willer et al. 2025). In response to this continuing trend, a long-term replicated field trial was initiated in 2006 at the University of Geisenheim in the Rheingau region in Germany to compare the effects of integrated, organic and biodynamic management systems. Research investigations were carried out on plant development and physiology, pests and diseases, as well as on soil and product quality of grapes and wine of Vitis vinifera cv. Riesling. Compared to the integrated management system, the organic and biodynamic management systems showed higher soil quality, lower grape yield and lower vegetative growth (Döring et al. 2015, Meissner 2015, Hendgen et al. 2018, Döring et al. 2019, Meissner et al. 2019, Di Giacinto et al. 2020, Hendgen et al. 2020). Furthermore, results suggest that organic, and especially biodynamic management practices, promote favourable grape morphology and thereby product quality, even though grape analyses, such as total soluble solids, pH or total acidity did not show pronounced differences among the three production systems (Meissner et al. 2019).

To investigate the role of biodynamic preparations, and particularly the field spray preparation 501 horn silica, a second trial has been running in parallel within the existing management trial since 2006. The preparation 501 is applied as a foliar spray on crops, consists mainly of quartz silica and is described to be actively involved in light-mediated physiological responses of plants and also in grapevines (Pettinelli et al. 2023, Hazarika et al. 2024). The biodynamic horn silica trial was set up as a randomized complete block design, where five different applications of the horn silica preparation were replicated in four plots. Every plot was subdivided into two subplots in which two different rootstocks were used. Also, each plot consisted of four rows of 16 vines and only the inner two rows were used for data collection, while the outer rows were considered as buffer rows. The five different application times of the horn silica field spray preparation were 1) without 501; 2) bud break, post-bloom, veraison; 3) post-bloom, veraison, after harvest; 4) pre-bloom, veraison, harvest and 5) bud

break, post-bloom, veraison, harvest. Besides the application of horn silica all plots received the same amount of the field spray preparation 500 horn manure three times per year. To study the effects of the horn silica preparation on vegetative and generative growth and grape quality over time, pruning weight, yield and juice quality were recorded from 2006 onwards. To assess whether climatic effects contribute to possible differences among the treatments, vintage parameters such as temperature, sunshine hours and precipitation were also considered within the study. Different applications of the horn silica preparation affected growth and juice quality of grapevines. Especially the vines not being subjected to horn silica treatments were distinct from the other variants.

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3. Education

3.1 'Farmer Bee Schools' as a Modified Group Consulting Tool

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Abstract

Farmers and beekeepers are increasingly separated by labor division. An emotional connection between farmers and the insect world is urgently needed to increase biodiversity efforts on farms. We applied the concept of Farmer Field Schools to the training of farmers in 'Farmer Bee Schools' (FBS). In regular meetings over three years on host farms, 12 participants in two regional groups learned about a new field (apiculture) and discussed the integration of insects into the farm organism. Accompanying research analyzed under which conditions active beekeeping is feasible on modern organic farms and if the participation in the FBS influences farm management decisions. Methods included repeated semi- structured interviews with participants and questionnaires for FBS facilitators. Results of this project show that all participants successfully established healthy honeybee colonies despite some particular challenges (social, personal and organizational framework conditions). Through the contact with the bees, supported by laboratory tests of bee products, the farmers realized that even diverse organic farms are currently not providing sufficient resources to support honey bee colonies. The implementation of biodiversity measures and related plans for the future increased. We showed that FBS are successful in establishing farmer- managed honeybee populations on farms on several levels.

Background and Aims

In agriculture, group consulting meetings in the field or on a host-farm are largely accepted as effective methods of extension. We adapted the concept of 'Stable Schools' (Brinkmann & March, 2018; Hansmann et al., 2020; Ivemeyer et al., 2015, 2015) which in turn is based on 'Farmer Field Schools '(FFS) to enable farmers to actively keep healthy honeybee colonies on their farm. In FFSs a group of farmers meets regularly during a production season or throughout the year. In a risk free setting the participants create their own location specific curriculum. Originally, FFS have not been designed to learn about a totally new field, but to optimize processes on the farm. In contrast, we applied the concept to a new field: bringing a

new topic (beekeeping) on the agenda of dairy, cropping or mixed farms. In Farmer Bee Schools (FBS) farmers learned to integrate a new species into their daily work. The main reason for this was the assumption, that the occupation with the new area would necessarily lead to the reflection about already existing aspects of farm life and farm enterprises, especially the biodiversity of the farm. When a new species and new tasks need to be included, the system must adapt and transform. We had the hypothesis that during the process the focus would shift from beekeeping to a broader perception of insect needs and to the adaption of farming methods and/or the integration of biodiversity measures to support pollinator species.
Research questions are: i) Enable and motivate FBS farmers to support a surviving population of healthy honeybee colonies on their farms? ii) Can a shift in the farm-nature relation and a change in management practices be observed during the FBS?

Methods

We designed the FBS based on Stable Schools. Common features included these aspects: The focus lays on the questions and needs of farmers, who took turns in hosting the group meetings. Differences between the concepts were: FBS continued for three consecutive years in a stable group of participants. FBS consisted of online meetings (for both FBS groups together) and farm visits (separate for each regional group). FBS facilitators need practical expertise in beekeeping and agriculture. As both skills are rarely combined in one person, both facilitators collaborated closely and were both present in all online and at least one farm meeting per year. Facilitators actively introduced seasonally relevant topics of beekeeping.

Methods for the accompanying research included repeated hive- records, semi-structured interviews with participants, yearly questionnaires for FBS facilitators. The interviews were structured as follows: 1) general farm description, 2) agricultural questions: biodiversity measures, societal nature relations and 3) beekeeping-related questions. The answers were protocolled verbatim (Vogel & Funck, 2018), and the transcripts were flexibly open-coded to identify frequently emerging themes considered relevant to the study topic. In the final workshop at the end of the project we conducted a collaborative workshop. Our setting was apt for a collaborative group flow as described by (Duncan & West, 2018). We collected the answers, grouped them by content and assigned headings to the underlying concepts. Then, all farmers anonymously classified first in how far each condition domain was met in their life and on their farm when starting the project and secondly, how much space the respective domain took up during the three project years. The self-evaluation was given on an ordinal five-level Likert scale.

All statistical analyses to calculate three success-measurement-indices (self-evaluation, facilitator's evaluation and biological success) were performed using the R environment for statistical computing (R Core Team, 2023). The survival analysis was performed with the R package survival (Therneau & Grambsch, 2001) and survminer (Kassambara et al., 2024).

Results and Discussion

All participants but one were actively increasing the number of colonies to replace losses or increase colony numbers. The total number of hives on the project farms increased from a mean value of 3.41 to 5 per farm within the three years, meaning that most participants increased the number of colonies they kept. All but one farmers are committed to continue beekeeping in the future. The main challenge for the participants was the huge expenditure of time (on average 19 days per year) for the FBS participation and colony care.

For the survival analysis, we calculated the survival time in days from the day of the first colonization until the end of the experiment. The swarms survived on average 2.23 years (SD = 104.95 days). Seeley estimated 2.2. years for the overall survival probability for swarms in the wild (Seeley, 2017).

Six domains of conditions for successful beekeeping resulted from the collaborative workshop: 1) personal conditions, 2) social conditions, 3) content-related conditions, 4) economic conditions, 5) operational/infrastructure conditions and 6) time- related conditions. An active network was formed between farmers and other stakeholders. The beekeeping consultants were amazed how quickly the farmers learned the basics of beekeeping compared to other training groups and how easily they developed a feeling for the animals and their needs.
Our hypothesis was, that with the integration of beekeeping into the farm organism the system would adapt and transform. The experience of the farmers confirms this also for unexpectedly broad topics: This quote from the interviews highlights the social, ecological and operational dimension of farm beekeeping: 'Discussions among us have become much more intense thanks to the bees. We are no longer a purely plant-based company, we also think about other animal species - inspired by the bees. They have created a different level of communication among us, in the sense that we take a more critical look at many things.'
Concerning biodiversity measures, our results show a positive development for 13 out of 35 biodiversity measures when comparing the status before, during and after the project. Farmers stated that they wanted to focus more on biodiversity measures in the future. The integration of honeybees into the farm organism might on the long-term influence management decisions substantially.

Conclusions

An emotional bond between farmers and insects is urgently needed. This research showed that FBS participation motivates and enables farmers to support healthy honeybee colonies on their farms. It leads to a change in the perception of the surrounding landscape and possibly alters the farmers' attitude towards biodiversity measures. However, long-term studies over 5-10 years would be necessary to determine whether the farms successfully maintain beekeeping and implement further biodiversity measures and how these in turn affect the food situation for their bees.

Farm beekeeping as one method of the integration of insects into the farm organism is an effective yet time-consuming way to achieve this goal. To achieve this, a stronger network, cooperation (e.g. with older farming generation, family) and the exchange of skills between farm-beekeepers, (organic) farming associations and their extension agents, agricultural/biodiversity/beekeeper consultants should be stimulated.

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3.1 Biodynamic Ecology as Therapeutic Education: Nurturing Growth and Transformation

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Abstract

Recent research on the history of biodynamic practice in the UK has identified seven key domains where biodynamic practices are currently predominant, including biodynamic ecology in therapeutic education. (Reakes, 2024) At Ruskin Mill Trust, biodynamic farms serve as central learning environments for students with special educational needs (SEN), where trained educators integrate biodynamic principles into their teaching.

Research conducted at Coventry University's Centre for Agroecology, Water and Resilience, and at Ruskin Mill Trust, highlights how SEN learners experience personal growth through engagement with biodynamic ecology. This is reflected in qualitative testimonies and outcome space analysis from both SEN learners and staff. A master's module on biodynamic ecology was developed to train educational leaders, revealing a transformative impact on their understanding of pedagogy and purpose.

Key themes emerging from the research include Transformation Through Nature Connection, Transdisciplinary Integration, Threshold Concepts in Embodied and Situated Learning, and Holistic Nutrition as a Mediator of Culture. All these themes can contribute to behavioural change, improved well-being, advancement of skills, and agency. The study suggests that biodynamic ecology fosters relational ontologies, allowing learners to reimagine their potential beyond societal limitations. This educational model presents a unique approach that integrates cognitive, social, and cultural development through engagement with biodynamic agroecological practices on the land and in the wider cultural life

Background and Aims

Berni Courts has been involved for the past 30 years in developing the field of biodynamic ecology as educational practice within Ruskin Mill Trust, working alongside colleagues. The research aims to offer a critical analysis of this educational method, positioning it as an effective educational practice with biodynamic agroecology at its core.

The study incorporates perspectives from SEN learners who experience biodynamic farms and gardens as part of their education, as well as staff who have completed the "Growing the Land; Growing People" biodynamic training program that enables them to work biodynamically with SEND learners. The final dataset is collected from senior college and school leaders who

implement farms and gardens as learning environments, which are crucial to Practical Skills Therapeutic Education (PSTE).

Methods

This research utilised a mixed-qualitative methodology, primarily using phenomenography and its concept of "outcome spaces" (Marton, 1981; Akerlind, 2022) to capture participants' experiences of self-orientation, engagement, and personal change. Data was gathered via semi-structured interviews designed for SEN learners with communication challenges (Diefenbach, 2008; Mahuri et al., 2022), and a taxonomic filter was employed to identify growth points for both learners and staff who held a diploma in biodynamic ecology.

Acknowledging a 30 -year "insider" position, this study adopts a critical autoethnographic perspective to lend credibility (Castagno, 2012) and uses action research principles to validate internal research (Brannick & Coghlan, 2005; McNiff, 2013). While ensuring anonymity, the research is enriched by narrative case studies (Connelly & Clandinin, 1990; Nasheeda, 2019).

As part of the research, the author developed and taught a Master's module on biodynamic ecology to 16 educational leaders. A Reflexive Thematic Analysis (RTA) of their final submissions confirmed the efficacy of this knowledge for leaders in the field (Braun & Clarke, 2021).

Results and Discussion

The culture of biodynamic ecology enables SEN learners to experience a profound transformation, fostering growth in their physical, cognitive, emotional, and social capacities. This journey serves as a vital developmental stage, comparable to higher education for their “neurotypical” peers and can inspire them to use their newfound competencies in wider society. This transformative potential extends to staff, with training in biodynamic agroecology renewing their sense of purpose as therapeutic educators; notably, a significant percentage of biodynamic practitioners at Ruskin Mill Trust are graduates of this training. A Relational Thematic Analysis of educators' work confirmed a significant evolution in their pedagogical understanding, revealing new ways to predict and change behaviour (Mena-Garcia et al, 2019; Pirchio et al, 2021; Morrigi et al, 2020). This entire framework is supported by a holistic nutritional approach where the sensory-rich farm environment, social interactions, and consumption of homegrown food cultivate a culture of health, belonging, and growth (Franco et al., 2017; Cekici & Sanlier, 2017; Monterossa et al, 2020).

A central theme from the Master’s submissions is the encounter with "relational ontologies": an educational paradigm in biodynamic agriculture with profound potential for wellbeing (Riley et al., 2024).

In biodynamic ecology, different disciplines converge towards a state of holism, informing one another to create a new "onto-epistemology" (Hyde, 2021) one that is fundamentally ethical (Lange, 2018). This method may uniquely free our cognitive processes, actions, and social

outcomes from the constraints of what the world is, and what it expects us to be (Ceder, 2020).

This aligns with the Ruskin Mill Trust's principle of "re-imagining potential." Many of our learners have experienced educational failure. However, biodynamic ecology within PSTE offers them a new worldview, empowering them to envision a self beyond the limited expectations of the wider world.

Conclusions

An interlocution emerges between the three study groups, where staff and leaders are required to understand and meet the needs of SEN learners. In doing so, SEN learners are likely to find an entry point to relationality and can advocate for their own growth, particularly in their wellbeing and social capacities.

The "Growing People" aspect of the "Growing the Land; Growing People" biodynamic training speaks strongly to teacher understanding of dysconscious ableism and challenges this through the design and understanding of land-based activities (Broderick & Lalvani, 2017). The nature of biodynamic agroecology is that it aims to be non-exploitative of the land and its farm inhabitants, including non-human beings, and promotes pro-environmental behaviour. It is labour-intensive and often small-scale, requiring mostly hand tools and physical endeavour.

In an educational context, the land and the learner meet within a meaningful framework for respectful relationships at a very human level.

There is an interlocution that comes into being between the three study groups, where the staff and leaders are required to understand and meet the needs of the SEN learners, and in doing this, the SEN learners are likely to find an entry point to relationality. They can vouch for their own growth points especially in their wellbeing and social capacities. The Growing People aspect of the Growing the Land Growing People biodynamic training speaks strongly to teacher understanding of dysconscious ableism and challenges this in the design and understanding of activities on the land. (Broderick & Lalvani 2017) The nature of biodynamic agriculture is that it aims to be non-exploitative of the land and its farm inhabitants, including the non-human, and promotes pro -environmental behaviour. It is labour intensive, often small scale, so mostly requires hand tools and physical endeavour. In an educational context the land and the learner are meeting a meaningful context for respectful relationships at a very human level.

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3.2 The Biodynamics 'Show and Tell' Initiatives of Marna Pease

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Abstract

Marna Pease (1866–1947) was the leading advocate for biodynamic agriculture in Britain during its first two decades. Although no English speakers attended Rudolf Steiner's Agriculture Course in 1924, Marna took up the cause after hearing about it from Dr. Carl Alexander Mirbt (later Mier) at the 1928 World Conference on Spiritual Science in London. She founded the Anthroposophical Agricultural Foundation (AAF) to promote Steiner's ideas and led the organization for twenty years. With Mirbt, she made the first biodynamic preparations in Britain at her home in Northumberland. Later, the Old Mill House in Bray became the movement's base, featuring a biodynamic display garden and preparation distribution center. Marna typed, bound, and distributed all English copies of the Agriculture Course, helping spread biodynamic agriculture across the English-speaking world. Even after the 1935 rift between the British and Dornach anthroposophists, she continued her efforts through WWII. In 1946, she passed leadership of the AAF to Carl Mier. Her tireless work laid the foundation for the spread of biodynamics to the UK, USA, Canada, Australia, and New Zealand. This presentation will feature newly recovered photographs of Marna Pease's garden and award-winning biodynamic produce.

3.3 Trust, Leadership, and Biodynamics: Exploring Temple Wilton Community Farm's CSA Model

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Abstract

A PhD jointly funded by Ruskin Mill Trust and Coventry University's Centre of Agroecology Water and Resilience examines Temple Wilton Community Farm (TWCF), a pioneering Community-Supported Agriculture (CSA) initiative in New Hampshire, USA. This CSA integrates biodynamic principles, non-market land stewardship, and reflexive leadership structures to uphold ecological viability and maintain a cohesive community. Drawing on four years of qualitative data—including ethnographic fieldwork, interviews, participant observations, and document analysis—the research explores how anthroposophical values, charismatic leadership, and evolving member dynamics coalesce to shape TWCF's trust-based approach to agriculture.

4. Economy

4.1 Exploring "True Trading"

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An introduction to an associative approach to food distribution; the background to and presentation made 3 September 2025 at the 3rd International Biodynamic Research Conference at the Royal Agricultural University, Cirencester, England.

Abstract

Mindful of the relationship between the closed economy of the single farm, on the one hand, and the only other closed economy, that of the world as a whole, on the other, the aim of this research is to focus on the special tasks of distribution. It posits the concept of 'true trading' with a view to identifying implicit, nascent or actual examples of it.

The author has been involved in the farming and distribution of organic and biodynamic food for over 50 years, including serving on the BDAA Council in England and on the Soil Association and BDAA organic standards committees and running wholesale businesses as part of a Europe-wide collaboration, also with Australia. Throughout that time, little direct attention has been paid to the twin problems of fictitious land values and the economics of distribution. Instead, reliance has been placed on premium pricing and 'high-ending' such food. The aim of this proposal is to pay fresh attention to these concerns at a time when conventional distribution and marketing are becoming outmoded and so unfavourable to farmers.

Introduction

This paper is written with some disquiet about how Rudolf Steiner's work, formally known in English as spiritual science, is interfaced with science as generally understood – which for Steiner was often faux science. Just as, to use a central banking image, one cannot be 'half pregnant' when it comes to economic policy, nor, as Augustine had hoped, can one negotiate morality, so one has to proceed very carefully when interfacing Steiner's ideas (in both agriculture and economics) with conventional understandings and standard tropes.

As he remarked, one needs no proof that the sun will rise tomorrow or that an empty stomach will be followed by hunger. The argument of this proposal is not hypothetical, therefore. It is experienced-based and its truth will only be known by stepping onto the path it throws light upon. More concretely stated, the author's ideas are elaborated in two papers written in 2001

and 2017 on the website of the Economics Conference of the Goetheanum under *Current Convenor's Considerations*, where our understanding of scientific research is set out.[5]

From these documents, it is clear that we do not see a difference between 'spiritual scientific' andconventional research processes, at least as regards the social sciences generally and economics especially.

This may be at odds with many colleagues in the anthroposophical movement; even so, one doubts the need, validity and time-spend on proving spiritual science because the definition of evidence that one is trying to appeal to is too narrow, making much of what claims to be scientific today itself either faux or flawed. In our understanding of Steiner, the 'proof' of spiritual science is that no one concept contradicts another. If it seems to do so, one needs to expand one's enquiry. The closest that conventional social science gets to this is what it calls 'triangulating the data'.

That said, the 'true trading' project is framed in normal research terms, except that it is not meant as an academic event, but as a way of ordering one's thoughts and conduct in regards to distribution; not as a 'proof of concept' (i.e. evidencing feasibility) or, indeed, as proof of anything. It is better described as a potential multiple case study,[6] even a call to action. If people want to devise theory out of this proposal or ‘mine’ it for policy insights, that is fine, but that is additional to and not part of our goal. One knows well enough that ‘science’ is not looking to be disproved, so this project is aimed at those who simply want to behave associatively – out of their deeper will, not on a merely theoretical basis.

Antecedent to the research proposal, true trading was outlined in an article under that name in *Associate!*

(September 2023, p.5),[7] stating that in essence true trading relies on distributors facilitating and not controlling producers. That article ended with mention of a proposed seminar called 'Seed Corn – the Economics of Farming', which was subsequently held in Chicago in March 2023 and Brisbane in November 2024. Much of the content of these efforts had been given prior expression in a video’d lecture the author gave in Madrid, Spain in 2005 at the invitation of Triodos Bank,[8] where the case of L'Aubier near Neuchâtel, Switzerland was featured.

In February 2024, the *Associate!* article was enlarged into a 'think piece' (see Appendix 2), which added to its critique the problem of so-called 'world food prices' – a macro-economic concept, policy and practice that few, if any, dare challenge, yet one that makes a mockery of fair price endeavours, reducing them to tilting at windmills, to use a Quixotic expression. This short paper was valuably critiqued by Xavier Andrillon, an agronomist colleague in Brazil with

[5] https://economics.goetheanum.org/research/convenors-considerations.

[6] Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.) Publisher: Sage publications.

[7] https://economics.goetheanum.org/fileadmin/economics/Newsletters/ECN41_September_2023.pdf, but also see Appendix 1.

[8] https://www.youtube.com/watch?v=dh8cgH8vGV8

long and varied experience throughout Latin America especially in regard to sustainability. Albeit inadequately

taken into account, but with a fuller consideration to follow, his comments were influential in the fuller research proposal of January 2025 and are hereby acknowledged.

Overview

As already noted, this proposal is made 'mindful of the relationship between the closed economy of the single farm, on the one hand, and the only other closed economy, that of the world as a whole, on the other. The aim of the research is to focus on the special tasks of distribution. It posits the concept of 'true trading' and aims to identify implicit, nascent or actual examples of it.' It is about getting traction for Rudolf Steiner's contribution to economics[9] in the dual context of conventional economics and market-driven economies, both born of Anglo-Saxon culture, meaning economics as created especially in Cambridge (England) and as fits a constitutional monarchy, where what Steiner calls spiritual life and rights life are seconded to free-willed, and free-wheeling, individualism.

The proposal is about moving from the market and neo-liberalism to association and a single world economy, but free of egotism. It is not about conflating associative economics with economics as generally understood today. Nor is it about 'doing a deal' with market theory. It is about leading that theory onto the ground of Rudolf Steiner's economics course. This means deriving theory out of practice, not the reverse. A true economy grows out of the unfolding human will. The task of economists is to describe what then unfolds, not to prescribe our behaviour or fit it to a theory.

The chosen topic – the role of distribution in the context of a single closed one-world economy – takes no cues from neo-liberalism or the kind of statist or civil society thinking that results in criteria such as the United Nations' ESGs (environmental, social, and governance) or Michael Porter's 'corporate social responsibility', etc. They will never overthrow neo-liberalism; it will just go underground, bide its time, and try again. The only way out of today's vale of economic tears is for those with the will to do so – in this case those undertaking food distribution – to ground their actions on Steiner's insights, fighting whatever fights they have to, in academia, in law, in finance and in trade, to secure their ground, and then writing up their experience. That means its methodology is case study, not hypothesis-proving, descriptive not definitional – witness the discursive illustrated nature of the proposal's presentation.[10]

True trading is linked to two topics that are explicitly central to Rudolf Steiner's contribution to economics and cannot be separated from his conception of a one-world economy which provides the background assumptions to this study:

[9] Steiner, R (2014 [1996/1922]) Economics – The world as one economy. New Economy Publications, Canterbury, England. Search aebookstore.com

[10] Indeed, the presentation was accompanied by several coloured chalk sketches on black paper (PowerPointPlus) – see Appendix 3.

1) mitigating the false conception that land as such has a value, and

2) achieving true prices[11] at the farm gate.

The latter is our direct focus because, as argued here, not only can prices not be true as long as land is fictitiously valued, but they also cannot be achieved except by what is here called 'true trading'.

Apropos England

In preparation for this presentation, the author revisited his long relationship to 'bio-dynamic' agriculture dating back to 1971, when he first sprayed some land with a bucket and brush.[12] He began his engagement with farming economics out of his original sense that agriculture in general, not just seen in terms of what Rudolf Steiner calls 'spiritual science', needs its counterpart in economics, to the elaboration of which he have devoted much of his professional life – a commitment that continues even now. This experience first arose on his initial reading of Steiner's course on agriculture, when he realised it was also a course on economics. Or at least that it contained heavy hints for any economist minded to understand farming economically, as distinct from fitting or forcing farming into the straitjacket approach of industrial production, which is what first gave modern economics its stamp and hence its 'non fit' to farming.

With this in mind, he read the Agriculture Course once more.[13] Interestingly perhaps, his re-reading took an unexpected turn when he captured the red threads of the course in a long poem in iambic tetrameter, the rhythm of the beating heart.[14] Throughout, his aim has not been to pretend he is a farmer, though he is not without farm experience from a tender age thanks to a childhood spent in the country and at a time when horses still ploughed fields and hay-ricking was done by hand. His intention has always been to understand as best he can what it is that the economist has to comprehend and befriend. This is what the epic-like nature of the poem is meant to illustrate.

Finally in this preamble, for an English-speaking readership, for which this paper is primarily intended, especially one linked to the topsoil and all that implies in English culture and society, a reader's advisory is perhaps needed. Per Ehrenreid Pfeiffer, 'the name [bio-dynamics] did not originate with Dr. Steiner, but with the experimental circle [founded in 1924]…'[15] As with

[11] Per Steiner's true price formula: 'A 'true price' is forthcoming when a man receives, as counter-value for the product he has made, sufficient to enable him to satisfy the *whole* of his needs, including of course the needs of his dependants, until he will again have completed a like product.' *Economics*, op. cit., Lecture 6.

[12] See biographical remarks in *Seed Corn – the Economics of Farming.* Search aebookstore.com.

[13] *Agriculture*. BDAA, London 1972.

[14] See Appendix 4: 'A Brief Course in Agriculture' .

[15] Quoting Steiner in his 1956 preface to *Agriculture*. BDAA, London 1972, op. cit., p.61. Also published in *The Golden Blade*, 1958.

the naming of any approach, the label one gives it may render the approach opaque and liable to vulgarisation or compromise. Try, therefore, not saying 'biodynamic' in order, as Pfeiffer suggests, to remove or avoid engendering a bias in one's own mind or other people's that prevents clear thinking, i.e. perceiving and conceiving directly what the label refers to. By way of an anecdote, on one of the writer's first trips importing Beutelsbacher 'bio-dynamic' fruit juice from Germany into England, the customs officer at Dover, on reading the signs on the side of his van, said: 'Ah! Life and Movement!" Less estranging than 'bio-dynamic', this was the spontaneous and unsought translation of a straightforward but educated English mind. Indeed, it describes well an approach to agriculture that endeavours to bring back life and movement to farming where both can be seen to be lacking or waning – entailing, moreover, a discourse and vocabulary that one can use without awkwardness in any agricultural college or local farmers' pub.

Rationale

Agriculture and nutrition belong together; good food begins with good farming. By 'good food' is meant Rudolf Steiner's colloquial or plain English way of saying how, when not compromised by financial distress, land owners' and farmers' innate good will, common sense and concern for human and soil welfare will lead of themselves – not in response to financial imperatives – to the deepened understanding of life that informs the 'bio-dynamic' approach to farming.[16] Of the many financial challenges that today's prevailing economic and financial paradigm gives rise to, farmers directly (but all of us indirectly) are often faced with fictitious or over-stated land values, interest rates not commensurate with farming economics, and off-field prices that are not 'true' in Rudolf Steiner's sense that true prices are in essence those that ensure forward viability.

Traders, too – those 'who have to mediate between farmer and consumer'[17] – and to whom is entrusted the

safeguarding of food vitality during its transfer from field to shop – will be similarly tested when they meet their own financial challenges. However, whether they are processors, transporters, wholesalers or retailers, traders operate in the realm of distribution, not production, and so they are not subject to the constraints of nature on the one hand and end-users' disposable income on the other. Their financial challenges are of a different kind, namely:

(i) to pay farmers true prices,

(ii) to produce a reasonable return to investment, and

[16] Formally and in terms of Steiner's own contribution, this refers to understanding agriculture on the basis of spiritual science, meaning a scientific understanding of supersensible phenomena, in addition to and alongside a senses-based perception of the sense-perceptible world.

[17] *Agriculture*, op. cit., p.61.

(iii) to release the capital that emancipates itself through their activity (see next paragraph), so that it can finance farmers' training and continuing professional development (CPD) as well as ameliorate the effects of fictitious land values. This, rather than treating all their gains as belonging to investors – to whom they are then transferred.

All these considerations are addressed in Steiner's comprehensive approach to the nature and history of economics and finance, generally but variously known as 'associative economics'.[18] We have already mentioned 'true price', for example, but among the many insightful concepts in Steiner's economics course, there are some linked directly to farming, two in particular:

- variable, better put, sectoral interest rates, such that, for example, money borrowed to buy land would be charged at 100% and so render the value of land as zero or at least stable,[19]
- the low price of rye grain when sold externally offset by the avoided cost of fertiliser due to the internal economy of recycling its stalks.[20]

And in the Agriculture Course itself, according to the early pioneer Ehrenreid Pfeiffer, 'one must work in a business-like, profit-making way, or it won't come off.'[21]

As concerns the economics of trading and distribution, however, the key but often overlooked observation on Steiner's part – the focus of this proposal – is his explanation of how the overall processes of capital formation come to a kind of culmination in the realm of distribution. Not, that is, between producers and distributors or between distributors and consumers, but between distributors themselves: i.e. trader-to-trader.[22] Not where money is exchanged for goods (buying from the farmer in this case), or goods are exchanged for money (selling to a shop), but where goods are exchanged for goods and so money for money: the realm of merchants who arrive in the market place with goods and leave with cash, culminating historically in today's footloose merchant banks and footloose capital generally. It is here that capital becomes free of the two poles of economic life, the one characterised by the necessary *selflessness of production* and the other by the equally ineluctable *selfishness of consumption*. (One cannot profitably produce for oneself; one cannot consume for someone else.)

And yet, at the very point where capital becomes emancipated from the overall economic process it can all too easily become abstracted (and even extracted) from socio-economic life as a whole and siphoned off through profit distributions. In economic truth, however, at precisely that point, as well as or in addition to providing a reasonable return to investors, it can also be used to finance the training and CPD of farmers (especially new and especially

[18] See *The Metamorphosis of Capitalism – Realising associative economics*. (2003) Christopher Houghton Budd. Search aebookstore.com.

[19] *Economics – the World as One Economy*, op. cit., lecture 6.

[20] Ibid., lecture 9.

[21] *Agriculture*, op. cit., p.8.

[22] *Economics*, op. cit. Lectures 1 and 3 and elsewhere.

young farmers) and to ameliorate any undue land costs that are such a basic hindrance to viable farming. This possibility is what is here called ‘true trading’. True traders are those who place these considerations at the heart of their work.

Guiding Intuition

The author's seminal sense in the early 1970s of the response economics owes, as it were, to agriculture inhered in two main considerations:

1: The world economy as a whole is the ultimate (and in principle only) optimal currency area: i.e. an area in which all primary resources are found as also all markets for goods; in which, that is, everything that is produced is also consumed. And in which, per Rudolf Steiner, money can alone be sound and true. Moreover, by his lights, there is only one world currency, not the current 180+, and it is represented by money as bookkeeping, not money as a thing, regardless of whether that 'thing' be fiat-based, cash, ‘alternative’ or digital. This is a single integrated economy in global, monetised macrocosmic form, the microcosmic reflection of which, of course, is the concept of a farm as a self-contained individual organism – what one might call an ‘optimal manuring area’.

2: The special role and responsibilities (described later) of distributors, meaning all those ‘who have to mediate between farmer and consumer.’

This two-fold insight is what this research proposes be examined.[23]

Framework

The considerations outlined in the above rationale give rise to several main criteria, which can be used to frame the concept of ‘true trading’ – whereby food distributors can be evaluated to see if they take their economic cue from the heart-and-lung function of distribution and its consequent and inherent ability to reconcile the opposite economic imperatives of production and consumption. These criteria are:

1) Assurance of food vitality at shop shelf:

   i) How conceived?

   ii) How achieved?

   iii) How verified?

2) Off-field pricing policies in terms of ‘true’ pricing:

   i) Per farm, it would assess the financial literacy of the farmer and the financial state of the farm, projected forwards five years minimum to achieve farmer's agency in

[23] Proposes because, approaching 80, it is too late for this writer to do more than outline what, even so, remains in his view an urgent and long overdue task.

terms of adequate profit, appropriate types and amounts of capital and positive cash flow management, via Xavier Andrillon's four indicators.[24]

ii) The prices paid meet the financial needs of each farm:

iii) The trader goes from there.

3) Effecting the release of emancipated capital by profit sharing between:

(i) Shareholders,

(ii) Farmer training and CPD

(iii) Provision of farming capital

(iv) Land cost amelioration

Accounting

Implicit to 2 and 3 above, is the use of accounting as an instrument of perception, in line with Rudolf Steiner's concept of money as bookkeeping.[25] This would result in a modified balance sheet that can be established pro forma and so provide an end-outcome tool of assessment of the degree to which true trading is practiced.

Case Study Methodology

Conceived and structured as a case study (after Yin, etc.[26]), the idea of this research is to elaborate these criteria in conceptual and practical terms and to use them to examine whether any existing traders might meet them and so be examples of 'true trading'. The suggestion is for *n* cases to be examined in three ways:

i) matching them to the chosen criteria

ii) identifying other possible criteria

iii)distinguishing between case specific and generic (globally replicable) aspects.

We have four potential cases in mind:[27]

Santiago Peralta / Pacari, Ecuador

[24] Revenue Independence, Full Cost, Asset Retention and Reinvestment, Debt Sustainability. See Xavier, A (2020) True Price as Condition of Sustainability. Available at SSRN: https://ssrn.com/abstract=3666512

[25] See various texts in the References section.

[26] See footnote 2.

[27] These are known existing examples of what this research has in mind. There are likely to be others when distributors are viewed through the lens of this proposal.

Fabio Brescacin / EcorNaturaSì, Italy

Aender Schank / Biogros, Luxembourg

Robert Pekin / FoodConnect, Australia)

Importantly, all are all entrepreneur-driven independent businesses, suggesting that franchised, managed or merely corporate vehicles are probably unlikely candidates. Like Migros, John Lewis Partnership and other examples of 'ethical' businesses, much depends on the founders' values and whether they become embedded in their businesses and/or adopted by their successors.

Results, Discussion and Conclusion

The intention is not to prove a hypothesis, but to establish a framework that enables distributors to change the purpose and nature of their *modus operandi*. At this time in history, there is little point – to use an Americanism – devising a talk that cannot or will not be walked.

Appendix 1: One Enterprise at a Time / True Trading

In the food world, much is made of 'organic', 'biodynamic', 'wholefoods' and many other identifiers – all in their different ways aiming to raise awareness of today's nutritional and agricultural challenges. They seek ways to do this using Fair Trade, the erstwhile Max Havelaar, and other marks which aim to treat food producers more fairly as regards price. This is often a moot point, however, since the pricing is usually linked to 'high-ending' the product for European and North American markets, creating the false idea that better food is de facto more expensive to produce. In addition, such prices are usually based on so-called 'world' food prices. While for the farmers, especially in small-scale[28] coffee and cocoa production, for all the 'fairness' of these pricing strategies, they often result in micro-managing the farmers' existence, controlling how much they spend on education and so on. This, rather than beginning at the farmers' end, befriending them with capital on terms they can afford and determine, not terms set by the strategies and exigencies of large international NGOs.

It is also the case that, economically, it is the task of distribution (and therefore distributors) to solve a mystery: through the abstract market the true prices of food production are transformed into affordable, not high-ended, prices for consumers. Food prices being basic to economic life as a whole, they ought not to be subject to 'premium price' treatment that pretends good food is a luxury rather than a staple.

To make this situation clear, a new approach is needed that I have outlined here under the tag of 'true trading' – meaning its focus is on how, precisely, those involved in distribution – from the raw, off-field product to the final in-store item – solve this economic riddle.[29]

The 'true trader' approach begins with the farmer and relies on distributor facilitation, not distributor control. It is for distributors (including processors and manufacturers) to support farmers' off-field prices all the way to consumer purchase. For it is in distribution that economies of scale, independence of both production and consumption, and the up-valuing of milk into yoghurt, for example, take place.

The approach focuses on reinforcing or establishing accounting and financial literacy on the part of farmers so that all aspects of their business (adequate profit, appropriate types and amounts of capital) and positive cash flow) are maintained and secured. And by whatever price their raw product is sold for, given that 'fair' prices are neither synonymous with nor a guarantee of this. The effect is also not always benign overall, in that mere pricing solutions can lead to excess capital retention by farmers and the buying up of smaller producers, therefore, pressuring them to sell.

My opening critique is based on a review of the catalogue of a well-known chocolate company in Latin America regarding its various claims concerning farming methods and its economic approach. The purpose of the enquiry is twofold: (1) to examine it as an instance of generic considerations, and (2) to establish a clear approach to the way small-scale farmers are

[28] According to the FAO, a small holding is less than 2 hectares. This, however, is a relative statistic that does not necessarily convey anything about the individual farm or farmer.

[29] See 'Rethinking Distribution', in Seed Corn – The economics of farming. Search aebookstore.com.

supported in their endeavours to develop and maintain economic agency (independently of their chosen farming methods).

With this work in mind, a follow-up to the recent Chicago workshop, Seed Corn – The Economics of Farming, is being considered, for Ecuador in February 2024, but of a larger, more hands-on type. See Note 3 on last page.

Appendix 2: True Trading – A 'think piece'

20 February 2024

In the food world, much is rightly made of 'organic', 'biodynamic', 'wholefoods' and many other identifiers – all in their different ways aiming to raise awareness of today's nutritional and agricultural challenges. While the intrinsic value of such food for everyone is recognised, efforts to make it generally available, meaning affordable, are mainly caught up in 'fair trading' schemes, such as *Fair Trade*, the erstwhile *Max Havelaar*, and other marks which aim to treat food producers more fairly as regards price. This is often a moot point, however, since the pricing is usually linked to 'high-ending' the product for European and North American markets, creating the false idea that such food is *de facto* more expensive to produce.

In addition, for all the intended fairness of these pricing strategies, they often result in micro-managing farmers' existence, controlling how much they spend on education and so on. This, rather than beginning at the farmers' end, providing them with capital on terms they can afford and determine, not terms set by the strategies and exigencies of large international NGOs, government programs, and so on.

There is nothing new here. Throughout my many years involved in farming and food distribution, I have always been concerned about the way farmers are controlled by distribution in its largest economic sense – meaning all those who undertake everything from the purchase of raw product to final sale to the consumer, including transport, processing, end-use packaging and retail operations. By and large, the approach taken is that, in order to provide consumers with the lowest (and, therefore, supposedly most 'social') price raw product, off-field prices must bear the brunt. They will be whatever is left over after all the costs between the 'farm gate' and the consumer's basket have been deducted from the retail price. In social fact, however, the brunt is born by small-scale and tenant farmers,[30] to whose situation these remarks are addressed, rather than large-scale land-owners.

Under various 'fair trade' rubrics, efforts have been made in recent times to ameliorate the lot of small producers by increasing what this 'left over' price is, but the fact remains that the process seldom begins with them. Nor is there much by way of any systemic and substantial attempt to augment their accounting literacy or access to finance on terms born of and tailored to their situation. Instead, prices remain linked to so-called world food prices

[30] According to the FAO, a small holding is less than 2 hectares. This, however, is a relative statistic that does not necessarily convey anything about the individual farm or farmer.

and are calculated on an aggregate basis, while capital is provided on the terms of those who provide it.

How can this situation be turned around 180 degrees?

A New Approach

It is the very task of distribution (and therefore distributors) to solve a mystery – namely, how through the anonymous market the true prices of food production can be transformed into affordable, not high-ended, prices for consumers. Food prices being basic to economic life as a whole, they ought not to be subject to 'premium price' treatment that pretends good food is a luxury rather than a staple. A new 'true trading' approach is needed, therefore, that focuses on how, precisely, those involved in distribution can solve this economic riddle.[31]

The 'true trader' approach begins with the farmer and relies on distributor facilitation, not distributor control. It is for distributors (including processors and manufacturers) to support farmers' off-field prices all the way to consumer purchase. For it is in distribution that economies of scale, independence of both production and consumption, and the up-valuing of milk into yoghurt, for example, take place.

This approach focuses on reinforcing or establishing accounting and financial literacy on the part of farmers so that all aspects of their business (adequate profit, appropriate types and amounts of capital) and positive cash flow) are maintained and secured. Maintained and secured, moreover, by whatever price their raw product is sold for, given that 'fair' pricing is not necessarily synonymous with or a guarantee of this. Its effect is also not always benign overall, since mere pricing solutions can lead to excess capital retention by farmers and the buying up of smaller producers, therefore, pressuring the latter to sell.

The aim of this approach is to develop ways through which small-scale farmers are befriended in their farming endeavours, while at the same time strengthened in their direct economic agency, *a consideration independent of their chosen farming methods*.

True-priced Sustainability

One way to do this is to engage with producers one-on-one on the basis of the novel approach of agronomist and development economist, Xavier Andrillon, as outlined in his PhD, *True Price as Condition of Sustainability*,[32] published in book form as Beyond *Brundtland – True Price and Sustainability*.[33] Using the objective and universal instrument of accounting, Andrillon's four-

[31] For the full background, see 'Rethinking Distribution', in *Seed Corn – The economics of farming*. Search aebookstore.com.

[32] Andrillon, Xavier, True Price as Condition of Sustainability: The Global Coffee Crisis (1999–2003) and the Brazilian Amazon as Case Studies (June 17, 2020). Available at
SSRN: https://ssrn.com/abstract=3666512 or http://dx.doi.org/10.2139/ssrn.3666512

[33] https://aebookstore.com/publications/associative-economics-worldwide/authors/books-by-xavier-andrillon/beyond-brundtland/

indicator approach is designed to ensure the economic viability of producers on a case-by-case, farm-by-farm basis. For no two cases are the same, and one cannot reverse specific details out of aggregated information.

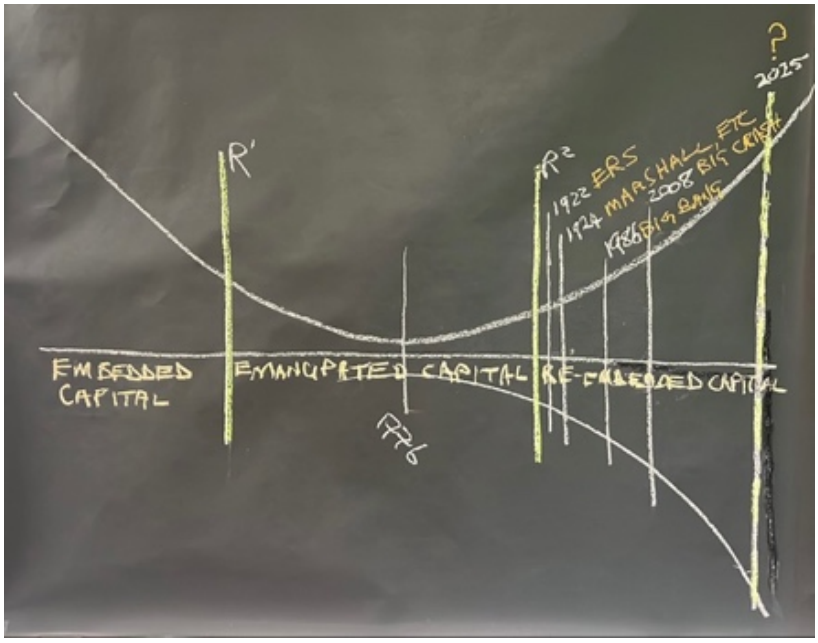
Conversely, in practical terms and seen economically, aggregating the different prices paid to many suppliers is the first role of any distributor, whose overall cost of coffee beans, for example, smooths out the various prices actually paid. Distributors can further overcome the problem of ensuring the profitability of their own 'up-stream' operations by careful choice of and positioning in the many markets they can serve, something no single producer can do. But, again, this will not be possible if the mind-set is that everything that moves has to make a profit; it will work only if the profit is aggregated across all their transactions.

True Traders

Where, though, are the traders who understand such double aggregation? If they cry 'too expensive' or 'too complex', what is the difference between doing that and acting under a normal market price regime, then setting up a foundation to, in effect, pay the higher prices that could have been paid in the first place? Worse, foundations of this kind then become capital pools that further determine the access to and kind of finances available to farmers, when, again, that capital could have stayed with the famers in the first place (for viable pricing entails the ability to service the right amount and kind of farmside credit). Why cannot such end-of-the-line 'largesse' on the part of traders be obviated by ensuring the starting prices are farm-viable in the first place?

Appendix 3: Presentation Sketches[34]

3 September 2025



Sketch 1.

Overall economic historical background showing humanity entering the vale of tears of economic materialism, pausing for thought then deciding to regenerate economic life from within in order not to fall into financialism, etc.

Sketch 2.

Distribution occurs in the heart-and-lung space of economic life, between the farm gate and the shop shelf.

[34] Sketches 1 and 2 from 3 September 2025. 3 and 4 are from a workshop in Quito, Ecuador in March 2025.

Sketch 3.

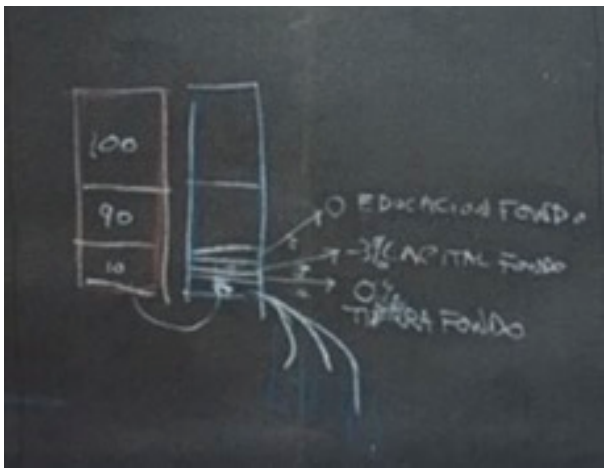
In the food sector, as well as quality of food from field gate to shop shelf, financing has to be provided – by distributors – for:

– the education of (young) farmers

– the provision of capital at farming rates

– the acquisition of land, leased at zero or negative rent.

This is the mark of 'true trading', for which an appropriate balance sheet needs to be constructed.



Sketch 4.

A 'True Traders' balance sheet, as evidenced by the creation of three funds

in addition to shareholders' funds:

– education fund

– capital fund

– land fund

Appendix 4: 'A Brief Course in Agriculture'

The planets from beyond the Sun
Have rayed down light since time began
The nearer planets too have shone
And have done since the Earth was won
Together they have lent their strength
And will so do throughout time's length
The Sun she too has played her part
By giving to all things their heart
Asilica'd is much our globe
And most the rest is limestone old
Between the two the plants unfold
'Cross summers warm and winters cold.
Without them there would be no food
And then of course there'd be no broods
No animals would roam about
With sturdy hinds, ingesting snouts
Both running fast and plodding slow
Manuring everywhere they go
Without them where would we all be
That crowning touch, humanity.
With element'ry company
Of carbon wise and sisters three
With silica and limestone too
And claggy clay between the two
The cosmos weaves into the land
And there it works on ev'r y hand
But not as it was done before
But now by man's own farming lore.

[Yet interluding this grand aim
We must not overstate our claim
And take the world by its neck rough
– that we reserve for our own scruff
Mixt' compositum won't suffice
To make today's poor science right
It's lonely iron persevêrance
That gives us ground to make amends
And tolerance, ironic wit
Are at the very heart of it
If we would with our science blend
The wisdom that is born of land]

Set aside our microscopes
And all of our misguided tropes
Manuring is the thing to know
But rush things not, just take it slow
Then in the great totality
The smallest things we there will see
Allow expansiveness inform

What here on Earth receives its form
It's not down here, we need to know
The cause of how plants come and go
But way out in the starry realm
Is where true farming finds its helm
That lets it wisely find its way
Protecting it from paths astray
By tending life quite forcefully
Refuting so-called mystery

From horny heads to feet with hoofs
In time we'll furnish all with proofs.
But first we need to take brave steps
Then let our karma do the rest
For if we can avoid the traps
Then life itself fills in the gaps
Let yarrow, camomile enough
Inside some innards both be stuffed
Vitality is not without
It starts within – in that don't doubt
And don't forget the nettle's sting
That stimulant to life within
When calcium you need, there's oak
Its bark, that is, its hoary cloak
A-boned, be-mossed in time you'll see
How farming knows economy
Materialism's lion abates
If dandelion we rightly rate
There's one more river left to ford
Do not valerian ignore.

[Pause now all this so far to note
Should not be learned alone by rote
The context is of climates fair
How is it then far flung from here
How is it done in distant lands
And furthermore it's done by hand
So how do machines play their part
In this new agriculture's art.]

Although we're anchored in this Earth

That's not our measure or our worth

We're like those weeds that grow somewhere

That we decry but nature dares

And then of course there shines the Moon

We live within her very loom

Alone on Earth we're surely not

Though science has this long forgot

And though the Moon forgives our lapse

Beware her patience not to tax

But, yes, push back with peppered weed

To rid the fields of unwant seeds

And field mice too will go away

If peppered on a Scorpic day

The Sun you see is not all one

And cycles often four years run

While insects tell another tale

That reason's cyphers can't avail

For what the microscope reveals

To the I makes no appeal

Yet equisetum, clever plant

Knows all this and watches on

There's coarseness here, of course there is

But that's not where we start our tests

For this we need a macroscope

Whose lens will bring to doubters hope

Look up sometimes at flying things

The butterflies and birds a-wing

Then look to roots and study trees

And cambium especially

And don’t forget the earth’s own worm
That golden creature’s not to scorn
And never wingèd creatures slight
– a wrong that’s very hard to right
Be wary of analogy
That’s not the way to nature see
Seek wisdom, not just cleverness
Or just to be the cleverest.
Lone practicality beware
Without clear insights hidden there
The body’s not aburn, e.g.
Though theory soon would have it be
It’s less to substance we should turn
Than forces we so easy spurn
To cosmos more than to the ground
To everything that’s all around
And learn to let our I’s depend
On noble yet excreted brains
And then there is this other fact
To which no farmer turns his back
The farm as such is all-a-piece
This at least is what we preach
To see all this behold the cow
Before whom let your knowledge bow
And so to cooking, use of herbs
There’s nothing here that is absurd
Yet nothing through our lips should slip
That worldly men will take amiss.

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4.1 Developing Calculative Practices for Sustainable Agriculture

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Abstract

The study examines how new calculative practices for sustainable agriculture are actively developed by people. It centers on a research project involving three biodynamic farms. The study clarifies the motivations of the actors involved in the development process and improves our understanding of key factors relevant to the development and implementation of new calculative practices for sustainability.

Background and Aims

The aim of the study is to examine the process by which a new framework for farm accounting is developed in order to monetarily depict the socio-ecological services of farms. From a socio-practical perspective, the study investigates how, in collaboration with three biodynamic farms (mixed farm, vegetable and fruit), new ways of achieving a more holistic balance sheet are identified and tested within a research project.

Methods

Individual interviews (23) and group interviews (6) were carried out using a semi-structured interview guide (with the three pilot farms and other stakeholders in the regional food network). In addition, project and other meetings were recorded and secondary sources such as annual reports and newsletters were analysed. Data were transcribed, coded and evaluated using content analysis along the four dimensions of Nørreklit et al. (2010): facts, possibilities, values and communication.

Results and Discussion

The study provides recommendations for the implementation of an accounting method that better reflects the ecological and social performance of farms and enables integration into the annual balance sheet. The ontological and epistemological structure of the chosen approach (which is richer than realism) captures, for example, questions concerning classifications, social constructions and valuations (all of which realism would consider invalid). The findings indicate that the approach developed ties in with the values of the participants, both instrumental-strategic and normative. Main categories of benefits and properties identified in

the study are: formalisation/ substantiation, learning processes/ comparability, internal use, automation, minimisation of effort, integration and openness.

Conclusions

In contrast to research approaches that are based, for example, on realism, the chosen, problem-oriented design of the study enables a more comprehensive investigation of factors without which the problems, challenges and solutions in 'accounting practice' cannot be sufficiently understood and explained.

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4.2 Price building in associative food value chains

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Abstract

Fair pricing is a crucial issue in agricultural markets, including biodynamic agriculture. Rudolf Steiner emphasized the importance of fair prices in his concept of associative economics. Based on the existing literature, research perspectives on prices in associative agricultural value chains are discussed. Better prices are understood both as motivational factor for participation in associative value chains and as the result of such participation. Moreover, although price is a fundamental element of associative value chains, their role in other aspects of interorganisational fairness is also highlighted.

Background and Aims

"Most of the food- and agriculture-related SDG targets are still far from being achieved" (FAO, 2023). This statement summarizes not only the status of the SDGs in the area of food and agriculture, but is also indicative of the state of our entire agricultural and food system. A radical change in the agricultural and food system is seen as one of the most important challenges of our time, the success of which is of great importance for the development of society as a whole (Fischedick et al., 2024). Rudolf Steiner also sees the special role of the agricultural sector in the process of striving towards social justice (Steiner, 1919, 1924). In his understanding, also known as Steinerian or associative economy, members of the value chain join together in associations to share information and make collective decisions based on the resulting transparency. Since Steiner (1922) described prices as the most important aspect of economic activities and the achievement of fair prices is widely discussed, the aim of this paper is to present the current state of research on prices in associative agricultural value chains. Since Rudolf Steiner gave eight lectures for farmers in 1924, which were the basis for the biodynamic approach (Brock et al., 2019) the research potential in biodynamic agriculture is also discussed.

Methods

In order to select the literature as replicable as possible, a systematic approach was used for selecting the literature (Sauer & Seuring, 2023). The process used is shown in Figure 1.

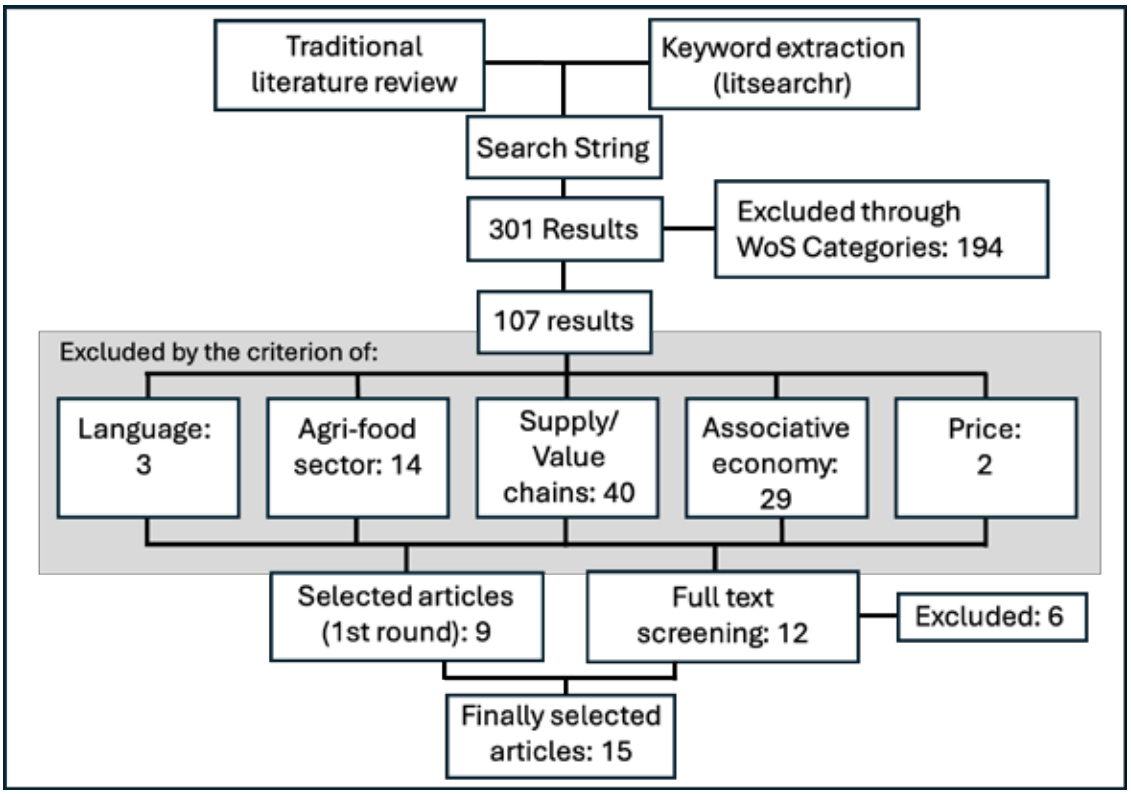

Figure 1: Flow chart of selecting the literature sample (Source: Own data)

The search string (Figure 2) was derived from a literature review and a semi-automatic keyword extraction (Grames et al., 2019) and combined with a search string for agriculture (Luo et al., 2018) and supply/ value chain (Jose & Shanmugam, 2020) as well as the keyword "pric*" using the operator "AND". The publications were found via Web of Science (WoS).

```
(TS=("associative democracy" OR "associative econom*" OR
"associative governance" OR "associative action" OR
"associative sector" OR "associative structures") OR
TS=("association*" OR "community supported agriculture" OR
"CSA" OR "round table*"))
```

Figure 2: Key phrases used for the concept of associative economy (Source: Own data)

Results and Discussion

A description of the articles analysed (Seuring & Gold, 2012) is provided in Table 1.

It is noticeable that higher prices are considered to be a motivation and advantage for farmers in voluntary certification schemes (Furumo et al., 2020, Nupueng et al., 2022, Phranakhone & Nanseki, 2015), multi-stakeholder associations (Guyver & MacCarthy, 2011) and as a factor influencing the choice of the marketing channel (Mensah-Bonsu et al., 2019). Farmers' associations can contribute to higher minimal prices by facilitating access to government funding (Wulandri et al., 2020), while multi-stakeholder initiatives offer lower input prices (Nupueng et al., 2022). Farmers in food consumption cooperatives receive prices that cover

production costs and guarantee fair wages, ensuring affordable consumer prices (Sacchi et al., 2021). Interbranch Organizations can facilitate negotiations on a reference price between producers and processors through economic analysis, market research and statistical evaluations, but they have no direct influence on transactions (Samoggia et al., 2022).

Trust is also seen to be an important factor in alternative food networks, both from the perspective of producers and consumers (Sacchi et al., 2021, Slavuj Borčić, 2020). Interestingly, Nupueng et al. (2020) conclude that trust is more important for non-RSPO-certified farmers than for certified farmers, as formal contracts offer the latter more security.

An asymmetrical distribution of power manifests itself in the ability to unilaterally determine prices vis-à-vis other actors (Javornicky et al., 2021). Cooperatives that negotiate collectively through cooperative associations have greater bargaining power vis-à-vis retailers and thus greater influence over prices than if they negotiate separately (Xi et al., 2025).

Transparency is described as a constitutional principle of alternative agricultural and food networks (Sacchi et al., 2021) and as a strength from the consumer perspective (Doernberg et al., 2016). Access to relevant market-related information is also an important factor for farmers when choosing a marketing channel (Mensah-Bonsu et al., 2019) and governance structure (Sharma et al., 2023).

The aspects – financial outcomes, trust, power and transparency – are all factors that can be found in the interorganisational fairness framework presented by Gudbrandsdottir et al. (2021). In addition, vertical and horizontal supply chain coordination are described here as a strategy for overcoming challenges in food supply chains.

As Brock et al. (2019) and Santoni et al. (2022) note, research on the socioeconomic perspectives of biodynamic agriculture is limited. It is therefore not surprising that only one of the publications (Slavuj Borcic, 2020) mentions farming according to biodynamic principles as a characteristic of the farmers. None of the studies analysed explicitly used a price transmission framework. Further research is needed here, as vertical price relations are particularly suitable for showing the distribution of costs and profits in the value chain (Cramon-Taubadel, 2021, Hillen, 2021).

Conclusions

The necessity of forming associations, as described by Rudolf Steiner (1922), is also discussed and practiced outside of biodynamic agriculture. In particular, forms that involve members of the value chain vertically and horizontally could contribute to greater fairness between organisations within value chains and, in particular, to higher producer prices. As the concept of associative economy is an integral part of biodynamic agriculture, biodynamic value chains could make a special contribution to fairer prices and greater interorganizational fairness.

Table 1: Description of articles analyzed (Source: Own data)

Reference	Journal	Aim/ main topic
Doernberg et al. (2016)	Sustainability	Factors of regional organic food supply chains and implementation of an analytical framework for CSA and organic regional products in retail trade as two examples of alternative food networks in Germany
Furumo et al. (2020)	Journal of Cleaner Production	Effects of voluntary certification schemes on environmental stewardship, socio-economic conditions and financial benefits of palm oil producers in Colombia
Guyver and MacCarthy (2011)	International Journal of Agricultural Sustainability	Reviewing of the Ghana Grains Partnerships
Javornicky et al. (2021)	Sustainability	Media analysis of the reporting on beef protests and Producer Organisations in Ireland
Mensah Bonsu et al. (2019)	International Journal of Value Chain Management	Choice of marketing channels by smallholder beef farmers in Ghana
Navarrete-Cruz and Birkenberg (2024)	World Development Perspectives	Effect of governance mechanisms by Export Companies on the on-farm implementation of Voluntary Sustainability Standards (VSSs) by Colombian coffee farmers
Nupueng et al. (2022)	Sustainability: Science, Practice and Policy	Effect of RSPO certification on governance arrangements between actors of the palm oil sector in Thailand
Phranakhone and Nanseki (2015)	Journal of Faculty of Agriculture, Kyushu University	Profit differences between organic and inorganic rice producers in Laos and participation factors into organic farmer associations
Raharja et al. (2020)	Heliyon	Strengthening and enhancement of farmer institutions as well as of institutional aspects of independent smallholders in the Indonesian oil palm sector
Sacchi et al. (2022)	Sustainable Production and Consumption	Application of the concept of co-production in alternative agri-food networks on the example of "Camilla" in Italy
Samoggia et al. (2022)	Sustainability	Role of Interbranch Organisations in equilibrating power imbalance in the processed tomato value chain in Italy
Sharma et al. (2023)	International Food and Agribusiness Management Review	Intrinsic and extrinsic factors on the choice of governance structure by tomato and cauliflower farmers in Bangladesh and perceptions of traders on their internal and external governance structures
Slavuj Borčić (2020)	Hrvatski Geografski Glasnik	Adaption to alternative food systems by organic farmers in Croatia and their cooperation experiences in groups of solidary exchange
Wulandari et al. (2020)	Sains Malaysiana	Difference of price risk between two farmers' groups using the example of banana and potato farmers in Indonesia
Xie et al. (2025)	Naval Research Logistics	Examines the relationship between bargaining power and cooperative behaviour between agricultural cooperatives

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4.3 Development-oriented recognition procedures as an alternative to infringement-oriented controls?

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Abstract

The applicability of a development-oriented recognition procedure for production according to standards in the agriculture and food sector as an alternative to infringement-oriented controls was examined. A procedure that has been developed and trialed as a pilot project by Demeter Germany was evaluated. In a participatory process evaluation indicators were developed. The analysis of procedure acceptance among consumers was carried out with an online survey of a representative sample (n=1.058).

Testing and evaluation of the procedure show that the tested version of the recognition procedure can be used as an alternative to conventional organic association certification.

Background and Aims

Certification is based on risk-orientated examination of binding guidelines and certifies their compliance. This does not promote further development regarding ecological values or sustainable management.

Development-orientated procedures that consider the individual farm situation may be an alternative. A procedure developed by Demeter Germany was evaluated for its suitability to promote farm development and initiate high-quality quality development.

Methods

Two workshops were held in 2021, each lasting around two hours, with a total of 16 participants. Using the SMART scheme four evaluation indicators were drawn up in the workshops and 7 further indicators were subsequently (further) developed by the project team based on interviews with stakeholders. Additionally, an online survey was conducted with a representative sample (n=1.058).

Results and Discussion

The recognition procedure fulfils its set objectives of ‘initiating or promoting further development on the participating farms’ and creating a space for recognition and appreciation for producers. The farm development goals are partially achieved, but often not within the planned timeframe.

The number of non-conformities identified in 2023 compared to the preliminary inspection before joining the project almost doubled. Considering the type and the low number of serious non-conformities identified, a moderately higher risk can be assumed compared to the current certification procedure.

Acceptance on the part of various stakeholders (participants, consumers) is high, and the feasibility and usefulness of the procedure is given after analysing the indicators. However, there are still open points for discussion in terms of feasibility.

Conclusions

Testing and evaluation show that the tested version of the recognition procedure can be used as an alternative to conventional organic association certification for farms. Existing challenges must be resolved.

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4.4 Sustainability and Economic Viability of Olive Farming Systems: A Comparative Study in Sinai, Egypt

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Abstract

This study conducts a holistic sustainability assessment and evaluates the economic viability of olive production systems in Egypt's Sinai Peninsula by comparing conventional, organic, and biodynamic farming systems. The research employs the SAFA framework, True Cost Accounting (TCA), and Cost-Benefit Analysis (CBA) to identify synergies and trade-offs across environmental, economic, and social dimensions of sustainability. Nine farms representing three farming systems (three farms per system) cultivating Picual olive variety were selected east of the Suez Canal. Each farm covers 20 feddans under uniform pedoclimatic conditions. The study aims to determine which farming system is most suitable for the Egyptian context, providing evidence-based insights for farmers, policymakers, and stakeholders to improve policy interventions in Egypt's olive sector.

Background and Aims

Egypt faces severe economic challenges including foreign currency shortages and heavy import reliance, prompting government strategies to boost exports by 15-20% and achieve $145 billion in export revenue by 2030 (Albazar, 2024; Ben Fishman, 2024). Egypt's olive production has grown significantly, reaching 1.13 million tons from 269 thousand feddans in 2021/22, compared to 1.08 million tons from 214 thousand feddans in 2017/18 (Awad & Nagaty, 2024). While organic farming prioritizes soil health and environmental sustainability, biodynamic systems introduce holistic approaches with unique practices. However, limited research exists comparing economic and environmental trade-offs of conventional, organic, and biodynamic systems under Egypt's economic realities. This study aims to fill this gap by providing evidence-based insights aligning with Egypt's Vision 2030 goals and contributing to SDG 12 (Responsible Consumption and Production).

Methods

This study adopts a mixed-methods approach combining qualitative and quantitative analyses. Nine farms were selected east of the Suez Canal in western Sinai Peninsula, with three farms representing each system (conventional, organic, biodynamic). Each farm covers 20 feddans (8.4 ha) cultivating Picual olive variety under similar pedoclimatic conditions.

To evaluate sustainability and economic feasibility of the farming systems a quantitative and qualitative Analysis was combined. The SAFA framework evaluates sustainability across Environmental Integrity, Economic Resilience, and Social Well-being dimensions. Cost-Benefit Analysis (CBA) assesses direct financial indicators including production costs, revenues, and profitability and also incorporates the value of carbon credits as an additional benefit. True Cost Accounting (TCA) incorporates monetized externalities using the Cool Farm Tool (CFT) for greenhouse gas emissions, biodiversity, and water use assessments. Primary data collection involves surveys and interviews with farm owners and workers, while secondary data includes financial records and government reports. Data analysis employs descriptive statistics, correlation analysis, and sensitivity analysis. The data will be analyzed using sensitivity analysis, descriptive statistics and correlation analysis.

Results and Discussion

Not yet available.

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5. Food and Nutrition

5.1 Biodynamic Farming and Nutritional Quality: Understanding Life Forces in Tomatoes

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Abstract

A century after Rudolf Steiner warned that synthetic fertilizers drain crop vitality, a 2024 ICAR survey now reports nutrient loss and toxin build-up in staple crops. To explore a remedy, we cultivated tomatoes (Solanum lycopersicum) on paired plots: one using Biodynamic (BD) practices with preparations BD500, BD501, and compost preparations 502–507; the other using conventional methods with chemical fertilizers and pesticides. The harvested fruits were analyzed using Gas Chromatography–Mass Spectrometry (GC-MS). BD fruits displayed coherent radial symmetry, absent in the controls, reflecting enhanced secondary metabolism. These findings echo ancient Tamil wisdom, *"giving good food is giving good life"*—and reaffirm Steiner's thesis: phasing out mineral fertilizers and adopting BD principles leads to nutrient-dense, toxin-free food imbued with measurable life forces, offering a credible path toward regenerative nutrition.

Background and Aims

The organic farming community has long advocated that organically grown food is richer in nutrients and lower in toxins compared to conventionally produced food. Numerous academic studies have supported this claim. In recent decades, the rise in chronic illnesses such as diabetes, high blood pressure, cancer, respiratory disorders, and premature births has drawn attention to the nutritional quality of food as a key factor in public health.

Biodynamic (BD) farming, which views the farm as a living organism and works with natural cosmic rhythms, is believed to enhance not only nutrient content but also impart vital "life forces" to food. While this belief is deeply rooted in traditional and holistic farming wisdom, it is essential to validate it through scientific analysis.

This research was undertaken to identify and quantify the nutritional and energetic differences between Biodynamically grown and conventionally grown tomatoes (Solanum lycopersicum). Through field cultivation and laboratory analysis, the study aims to provide

concrete evidence on how BD farming contributes to human health, offering a sustainable alternative to chemically grown food.

Method of the Research Work

This research was designed to compare the nutritional quality and presence of life forces in tomatoes (Solanum lycopersicum) grown using Biodynamic (BD) and conventional methods. Biodynamic farming, rooted in a holistic view of agriculture, emphasizes the health of soil, plants, animals, and humans, aiming to produce nutrient-rich food in harmony with nature.

Field Trial: The cultivation was carried out on a one-acre plot (4000 m^2) in Trichy District, Tamil Nadu, South India. Tomato seeds were sown in September, with transplanting done in October—an ideal season for vegetable cultivation in the region. The land was prepared with five heaps of BD compost (5m x 1.5m x 1.5m), thoroughly incorporated through rotovating process. Plant beds and furrows were laid out with a spacing of one meter between rows, and an inline drip irrigation system (4 LPH, 50 cm spacing) was installed.

Following DEMETER standards, Biodynamic preparations including BD500, BD501, CPP, and compost preparations were applied sequentially. The crops remained healthy, requiring minimal plant protection—only a 5% Neem Kernel Solution, a 3G biopesticide (Ginger–Garlic–Green Chili), and 12 pheromone traps to prevent American Bollworm infestation.

Laboratory Analysis: Harvested fruits from both BD and conventionally grown plots were subjected to [1]**Gas Chromatography–Mass Spectrometry (GC-MS) analysis.** This advanced technique enabled profiling of key metabolites such as organic acids, sugars, amino acids, and lipophilic compounds. The results established the presence of richer secondary metabolites and “life forces” in BD tomatoes, demonstrating their nutritional superiority over conventionally grown counterparts.

Results and Discussion

From the above analysis, 12 different bio-compounds were identified in the biodynamically (BD) grown samples, whereas only 9 bio-compounds were found in the chemically fertilized (CF) samples. Furthermore, the CF samples may contain higher levels of toxins due to the use of chemical fertilizers and harmful agrochemicals. However, no pesticide residue tests were conducted in this study. It is strongly recommended that a comprehensive comparative analysis be carried out, including nutrients, life forces, and pesticide residues.

Table-1: GC-MS ANALYSIS OF BIODYNAMIC (BD) *SOLANUM LYCOPERSICUM* FRUIT EXTRACT-LIST OF COMPOUNDS

S. N0	COMPOUND	RETENTION TIME	AREA %	HEIGHT %
1	1-(3,4-DITRIMETHYLSILOXYPHENYL)-2-ISOPROPYLAMINOETHANOL	9.996	2.65	3.83
2	CYCLOHEXASILOXANE, DODECAMETHYL	13.923	8.16	10.5
3	2-CYCLOBUTEN-1-ONE, 4-[[(1,1-DIMETHYLETHYL) DIMETHYLSILYL] OXY]-2,3-DIMETHOXY-4-(3-PHENYL-1-PROPYNYL)-	17.538	2.13	3.37
4	DIISOOCTYL-PHTHALATE	34.855	69.14	59.97
5	(SS)- OR (RR)-2,3-HEXANEDIOL	35.806	1.31	1.43
6	3,4-DIHYDRO-4-(1,3-DIOXOLAN-2-YL)-5,7-DIMETHOXY-1(2H)-BENZOPYRAN-2-ONE	36.665	0.65	1.26
7	1,2-BIS[1,2,3-TRI(T-BUTYL)-2-CYCLOPROPEN-1-YL] 1,2-ETHANEDIONE	38.17	0.44	0.58
8	NICKEL (II)-BIS[2-(HEPTAFLUOROBUTANOYL) -(+) CHOLEST-4-EN-2-ONATE]- fungicide	38.425	2.33	1.48
9	(+-)-1-(ACETOXY)-2-(1-BROMOETHYL)-3-METHOXYANTHRAQUINONE	38.587	0.73	1.53
10	SILANE, [2-[(1,1-DIMETHYLETHYL) DIPHENYLSILYL] ETHENYL] TRIMETHYL-, (E)	38.67	1.63	1.54
11	TRI-O-TRIMETHYLSILYL, N-PENTAFLUOROPROPIONYL DERIVATIVE OF TERBUTALINE	38.608	2.85	1.43
12	4,5,6,6A,10',11'-HEXAHYDROSPIRO{5'H-DIBENZO[A,D]CYCLOHEPTENE-5',3(3AH) - [4,5,6] METHENOCYCLOPENTAPYRAZOLE}	40.165	1.5	0.51

Among the phytocompounds identified in BD Solanum lycopersicum, the following novel compounds with high pharmacological activity were discovered:

- Tri-o-trimethylsilyl, n-pentafluoro propionyl derivative of terbutaline, identified in the biodynamic sample in large quantities, acts as a bronchodilator and to delay premature labor.
- (+/-)-1-(acetoxy)-2-(1-bromoethyl)-3-methoxyanthraquinone, which exhibits anticancer activity, is present only in biodynamic Solanum lycopersicum fruit extract.
- Ethanedione, bis[4-(1,1-dimethylethyl) phenyl], has shown promising results as a potential drug candidate for the treatment of various diseases, such as cancer and diabetes.

Conclusions

This study concludes that biodynamically grown tomatoes (Solanum lycopersicum) are rich in secondary metabolites known for their beneficial effects on human health, including protection against cancer, diabetes, respiratory disorders, and premature birth. Consuming such nutrient-dense, toxin-free food supports overall well-being. Biodynamic farming also enhances soil health, contributing to sustainable agriculture and environmental resilience. Thus, producing and consuming BD food aligns with the UN Sustainable Development Goals—SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), and SDG 12 (Responsible Consumption and Production). Further research is needed to isolate and explore the economic potential of these bioactive compounds.

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5.2 From food system to food organism – a concept for biodynamics

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Abstract

Food systems are defined as all elements and actions serving the nutrition of the people. There are interconnections between the elements, but in general, the human being, that is nourished and is the subject to be served, is not part of it. In developing the system to an organism, the properties of the living can be detected, and man is the central actor. His skills are essential for the success and welfare of all elements and for the transformation of the food system. A contribution to a sustainable development.

Background and Aims

The multiple crisis we are living in nowadays ask for collective mitigation. As the progress to reach sustainable goals, e.g. the SDGs, up to now is limited, a transformation of the habits of thinking is needed. The food system is an abstract concept that omits the own purpose and goal, the human being. This abstract concept must be adapted to the living to serve it.

Methods

Propose a new concept for food systems that respect properties of the living and develop further the concept of the farm organism to the “post farm area”. Methods of exercising and training the skills needed for the transformation are introduced.

Results and Discussion

The way we are trying to solve the problems of the poly-crisis we are in is not efficient. It needs a spiritual and cultural transformation. A transformation of the attitude towards all living creatures including the earth is the key and starting point. The abstract concept of food systems is adapted to the living to serve it. For this the attitude of the actors must be transformed. Skills should serve the welfare of all elements and the living.

As man is the central actor, the purpose and the goal of the food organism, the success for all elements depends on his decisions, his motifs and his contribution. For this he has to be connected to himself, to the social surrounding and to the earth. On the ground of biodynamics and anthroposophy a path for skills development is proposed.

Conclusions

The food organism as a new concept is introduced. It aligns the concept of a food system with the properties of the living and includes man. A transformation of attitude and thinking is facilitated.

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5.3 Homeopathy in Agriculture: A Systematic Review of Its Potential

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Abstract

Designing good experiments for basic research is a challenge, especially when subtile effects on living organisms are investigated like in biodynamic research. In the field of complementary and integrative medicine, scientific guidelines for preclinical research on potentised substances (PrePoP guidelines) have been published. As an example of how these research guidelines can be applied in BD research, we present our research project which investigates possible influences of BD preparations (500P and 501) administered at a specific cosmic constellation (the opposition of Moon and Mars, MoM) on oak seedlings. The design of our research project was supported by the transdisciplinary application of the recommendations and considerations collected in the scientific PrePoP guidelines especially regarding controls, blinding and randomization.

Background and Aims

Designing good and methodological reliable experiments for basic research is a challenge. This is particularly true for biodynamic (BD) research examining subtle effects on living organisms. Various aspects have to be considered, like controls and the question of outcome parameters. Recently, scientific guidelines have been published for preclinical research on potentised preparations (PrePoP guidelines) in the field of complementary and integrative medicine (Tournier et al. 2024). They cover additional aspects of the design of experiments and aim to provide recommendations for high-quality, statistically sound, and reproducible research. Our contribution will shed light on different aspects of applying the PrePoP guidelines to the design of a specific BD research experiment.

Methods

As an example of how the PrePoP guidelines can be applied in BD research, we present our research project, which investigates possible influences of BD preparations and cosmic constellations. EIn particular, in this project we intend to study possible effects of BD preparations (500P and 501) administered at a specific cosmic constellation (the opposition of Moon and Mars, MoM) on oak seedlings. For the experiment design, we had to determine several parameters (e.g. origin and vitality of acorns as starting plant material, amount of plants in each treatment group, appropriate controls, time and way of applying the BD preparations etc). We also had to take additional influencing factors into account (e.g. season, weather and laboratory conditions during the evaluation phase). In order not to miss important items in designing the experiment, it was useful to check items which are summarized in the checklist published in the PrePoP guidelines. Any items that were not suitable for our research question were discarded.

Results and Discussion

For us it was meaningful to consider some of the recommendations and considerations suggested in the PrePoP guidelines when designing the new research project focussing on possible effects of BD preparations administered at a specific cosmic constellation (MoM). Since the project involved two locations with pots in the garden and a field trial, we had to determine how many replications of each treatment respectively and controls should be included in each setting. The treatment consisted of applying the BD preparations (500P and 501) repeatedly (each 2-3 times/year) to germinating and growing oaks over a time frame of 6 years few hours before and after the selected constellation. During the last 3 years, the evaluation phase took place.

Water was applied as control for applying the BD preparations. We hypothesised that the constellation impulse could be given when exposing the trees to the preparations/water control few hours before the effective constellation time. Therefore, as a control for the constellation impulse we exposed the trees to BD preparations/water control at an equal time after the effective constellation. After 3 years the oaks unfolded sufficient amounts of leaves for two or three samplings per year in order to take the seasonal variations into account. Leaves of each variant were mixed and the samples were randomized and blinded for further assessment in the laboratory. Sample differences were evaluated by juice extraction from leaves of the young oak trees and further analysed by applying capillary dynamolysis and copper chloride crystallization.

Conclusions

The design of our research project, investigating possible effects of BD preparations administered at a specific cosmic constellation (MoM) was supported by applying the recommendations and considerations collected in the scientific PrePoP guidelines especially regarding controls, blinding and randomization. The data analysis of the biodynamic

preparation and constellation experiment, designed by using the PrePoP guidelines, is ongoing.

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5.4 The Significance of Horn-Bearing Cows: Insights into Milk Quality and Holistic Cow Physiology

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6. Knowledge Systems

6.1 Coming to our senses - Measuring food quality using taste

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Abstract

Aims: To learn how to measure food quality in relation to human and planetary health

Approach: Engagement of Food Citizens in UK and India with comparative taste testing panels to identify high- and low-quality crops. Samples of each quality are tested for nutrient composition and soil health indicators. Clinical trials are run to assess impact of both qualities on human and planetary health

Results This is an early-stage project beginning in March 2025

Conclusions This work is testing a hypothesis that, 'Humans have an innate ability to detect healthy, nutritious food, that supports ecosystem health'

Background and Aims

- Develop a Food Quality Standard Database to regenerate ecosystem health.
- Engage Food Citizens in comparative taste testing panels to identify high- and low-quality crops
- Conduct clinical trials to study effects of each quality on people and planet health.

Research Question

- How does food quality, measured through taste testing and nutrient analysis, affect ecosystem and human health?

Background & Rationale

- Exploring food quality through a non-anthropocentric lens can enhance both human and ecosystem health.

Methods

The study follows a three-step approach:

1) Pilot Phase: Engage food citizens in taste testing and Brix measurements to identify high- and low-quality crops.
2) Nutrient Analysis: Scale up pilot, collect crop and soil samples for nutrient and soil health analysis.
3) Clinical Trials: Distribute crops for clinical trials, focusing on health impacts of high- and low-quality foods.

Results

Not yet available.

6.2 Active perception as the basis for free action in agriculture

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Abstract

The current climate and ecological chaos, which is accompanied by various economic and social uncertainties, is making the work of farmers increasingly difficult. It is becoming difficult to rely on supposedly tried-and-tested methods. How can farmers train their perception of the condition of their farms, soil, plants and animals so that they can make the right decisions despite the uncertainties?

This talk will first describe the context of a project we developed to answer this queston. In a second part, we will present the initial lessons learned from a pilot study, and in the third part, we will describe our current results from various workshops on different farms and outline the next step, in which we intend to process all the results in such a way that they provide concrete suggestions for farmers, advisors and trainers, so that current and future farmers can learn how to use their concrete perceptions on the ground to make free and responsible “intuitions” for their important decisions.

6.2 Active perception as the basis for free action in agriculture

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Abstract

Based on Goethean scientific inquiry, my aim is to share a contextualising overview of water and air as mediators of the diversity and unity of our biosphere. A survey of evolutionary as well as daily and yearly timescales across a range of spatial scales opens a vista of environmental and organic inter-reliance and interfluence - mediated and unified through the encircling fluidity of water and air. Animals, notably we mammals and humans, can be seen as microcosms of global fluidity, having inner circulatory systems with hearts that unify the diversity of our own organic diversity while also relying on air, food and water received as we co-shape the places we inhabit.

Background and Aims

For nearly fifty years I've tried to practice applied Goethean scientific inquiry. As a medic, my field was the living human cardiovascular system investigated by MRI. I also have long-standing interests in sculpture and fluid 'morphodynamics', i.e. formed and formative fluidity across scales between sub-cellular and global. My aim here is to share a dynamic, contextualising overview of water and air as mediators between the diversity and unity of our biosphere.

Methods

Goethean scientific inquiry is founded, where possible, on direct observing and practical engaging, supplemented by appropriately discerning inclusion of indirect, technologically accessed information. Together these can engender 'informed imagining' of complex, unfolding realities. In this attempt, direct studies of fluid morphodynamics complement inquiries into very large, very small and physically concealed states of global and organic fluidity.

Results and Discussion

Inquiries spanning evolutionary, daily and yearly timescales across a range of spatial scales open a vista of environmental-organic inter-reliance and interfluence, mediated and unified through the fluidity of water and air. Cyanobacteria, phytoplankton and plants, for example, provided the oxygen we breathe. Tectonic shifts shaped oceanic and continental contours that, through days and years, guide the thermohaline currents of oceans and effect the wind pattens that encircle our globe. In living cells, aqueous fluids intimately associated with membranes are integral to all life forms. Microvascular systems penetrate larger organisms. The seeping of saps up and down through plants open into global fluidity. Animals, notably we mammals and humans, enclose inner circulatory systems with hearts that unify the diversity of our own organic microcosm while also relying on air, food and water received as we co-shape the places we inhabit.

Conclusions

Both on a global and individual bodily scales, fluidity mediates organic inter-reliance and interfluence, maintaining continuity through continual change and unity amid diversity.

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6.4 Representations of Biodynamics in French viticulture: From skepticism to curiosity

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Abstract

At a time of transition in winegrowing methods, Biodynamic viticulture, and its holistic approach, is a choice made by many technicians of the French wine industry. Nevertheless, Biodynamic viticulture is perceived in very different ways by members of the industry. Some of them often debate its foundations and its tangible benefits. Some other practitioners question the value of scientific research carried out on the methods used in this type of agriculture.

The representations motivating the choice of Biodynamic practices remain unclear. In order to try to understand the attraction or rejection of biodynamical practices within the professional world, we conducted the following experience. Thirty members of the industry were interviewed about their opinions and knowledge on Biodynamics through semi-structured interviews. A textual analysis of their answers using Alceste software highlighted 4 representations of this growing method that coexist in the industry.

1-Biodynamic preparations could have a material effect on plant behavior. 2-The effects of Biodynamic viticulture on the final quality of the wine should be studied more closely. 3-The anthroposophical foundations of the method should be set aside in order to reinvent the method on a forward-looking basis. 4- Experimental methods and exchanges with peers are essential to understand the effects of this method of cultivation in a given context and terroir.

These different points of view should be combined to come up with interesting and innovative uses for Biodynamic farming methods.

Background and Aims

Biodynamic agriculture, founded by Rudolf Steiner (1861-1925), emerged as a holistic farming approach addressing agricultural challenges of the early 20th century, particularly those related to chemical fertilizers and synthetic pesticides. Steiner's 1924 lectures emphasized the interconnectedness of soil, plants, and cosmic forces, framing the farm as a living organism where all components must interact harmoniously (Steiner et al., 1999).

In France, two labels certify Biodyamic products, the Demeter label, which was officially recognized by the Ministry of Agriculture in 1982, and a specific label for viticulture, the Biodyvin label, introduced in 1995. Both labels impose strict requirements, including organic practices and the use of biodynamic preparations.

Despite these guidelines, adhering to the requirements of both labels can be challenging, particularly in conditions of high mildew pressure or for estates producing barrel-aged wines. Steiner's intention was to democratize these practices, making them accessible "for everybody, for all farmers" (Steiner et al., 1999). However, for much of the twentieth century, biodynamic methods were largely overlooked. It was not until the early 2000s that a resurgence of interest in biodynamics began to emerge, with only 55 of the 183 countries practicing organic farming in 2020 engaging in biodynamic practices, representing approximately 30% of those countries (Paull & Hennig, 2020).

Scientific research on biodynamic viticulture is limited, with only around fifty articles published on its effects on soil, plants, and wine quality (Paull & Hennig, 2020). Many associations conduct long term trials but are not considered by the scientific community. For instance, the DOK trial in Switzerland compares biodynamic, organo-biological, and integrated farming systems (Agroscope, FIBL, 2019).

Biodynamic agriculture often grapples with its anthroposophical heritage. Research by Alexandre Grandjean indicates that 39 out of 40 Swiss practitioners do not openly identify with the biodynamic movement, which is frequently perceived as spiritual or religious. Many practitioners are familiar with Steiner’s teachings in a fragmented manner and use the biodynamic pharmacopoeia as a foundation for holistic farming practices focused on plant and soil health (Grandjean, A., 2021).

The French wine industry is currently undergoing a significant transition characterized by major commitments to environmental sustainability and social acceptance. Key initiatives include reducing the use of the most toxic pesticides in favor of natural alternatives, increasing biodiversity in a landscape previously dominated by monoculture, and minimizing carbon footprints by 2050.

In this context, a variety of tools are available to farmers, ranging from precision agriculture to regenerative practices, agroforestry, and permaculture. The selection of these tools is not straightforward and depends on the farmer’s perspective, cultural background, and historical context. Rigolot draws parallels between literary worldviews and the visions of farmers facing choices about their future trajectories. He emphasizes the importance of understanding one’s worldview and that of others to facilitate a shared transformation (Rigolot, C., 2017).

The primary aim of this study is to investigate the diverse viewpoints on biodynamic viticulture within the French wine industry. This includes identifying potential obstacles and opportunities for adopting biodynamic practices and highlighting research areas that could yield objective insights into a debate that is often driven by subjective opinions. Key questions guiding this inquiry include: What are the various representations of biodynamics in the wine industry? How are these representations influenced by geographical and practitioner profiles? In what ways could they impact industry practices and the choices made by growers to adopt or reject biodynamic methods?

Methods

To acquire a range of contrasting perspectives, we assembled a varied panel of 30 interviewees representing different wine-growing regions, including Bordeaux (65%), Burgundy (23%), Loire (6%), and Languedoc-Roussillon (6%). The panel consisted of 42% owners, 32% directors, 13% technicians, and 13% advisors. Predominantly male (83%), the interviewees held various educational backgrounds, with 42% agronomists and 39% enologists. Notably, 84% practiced biodynamics, though only 22% were certified (Figure 1).

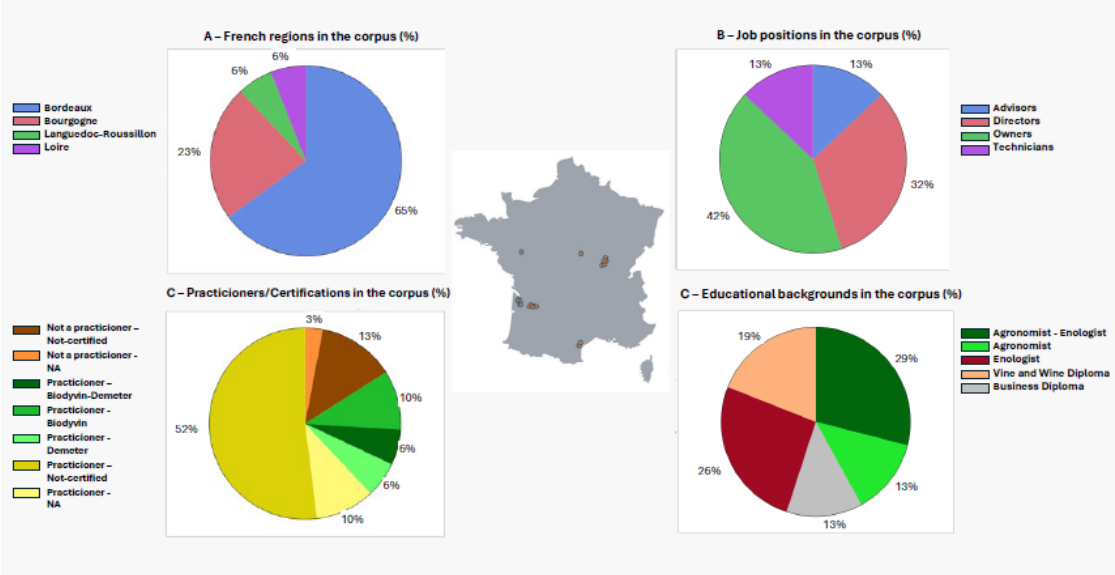

Figure.1– Characterization of the panel interviewed with regard to A-Region, B-Job Position, C-Educational Background, D-Biodynamic practices and certification.

We conducted semi-structured interviews featuring eleven questions related to participants' definitions of biodynamic agriculture, their practices, and their perceptions of the effects of biodynamic preparations on plants, grapes, and wines. Responses were recorded and transcribed in French, allowing for thorough analysis.

Textual analysis was performed using Alceste software, a tool developed by Michel Benzecri, which employs multidimensional statistics to analyze textual data (Benzecri, 1981). The corpus comprised 84,408 characters from the thirty interviews, with each response tagged with nine attributes, including position, education, age, gender, region of work, property size, biodynamic practices, and certification status.

The Alceste method divides the text into elementary context units (UCEs), which are reduced to lexemes—free or bound lexical morphemes. A hierarchical ascending classification is executed based on analyzable terms, allowing for the identification of classes within the corpus. The strength of association between lexemes and classes is measured using χ^2 calculations, providing insight into the prominence of specific terms within various contexts (Vaguet et al., 2022).

Results and Discussion

Results

The analysis focused on 51% of the text units in the corpus, the remaining 49% represent the most infrequent units, appearing only a few times throughout the corpus. The analysis resulted in the identification of four distinct classes, as illustrated in Figure 2. Each class comprises lexemes that show significant associations or exclusions, with significance determined by the chi-square (χ^2) values. A positive χ^2 indicates co-occurrence, while a negative value indicates co-exclusion, allowing for the identification of common terms within each class.

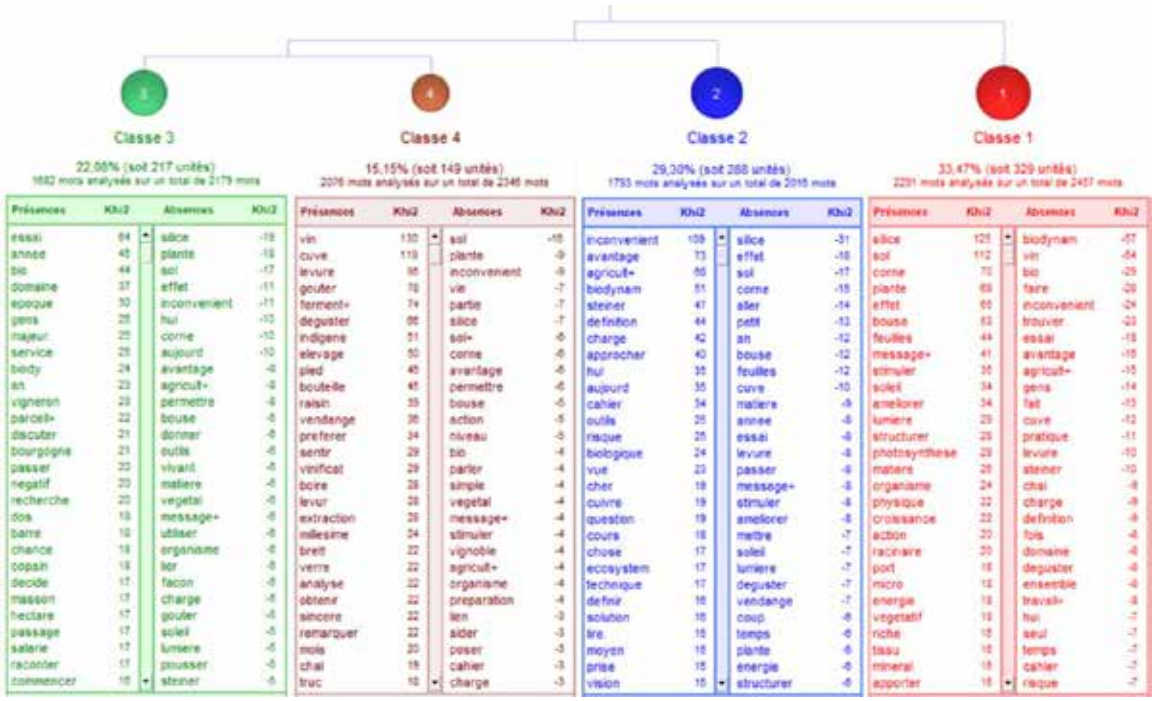

Figure 2– Classes defined according to the corpus by hierarchical ascendant classification using Alceste. Co-occurrences, co-exclusions, percentage of representation in the corpus.

In our findings, Class 1 is notably distinct from Classes 2, 3, and 4, which form a subgroup. Within this subgroup, Class 2 is further separated from Classes 3 and 4. Within the French wine industry, two contrasting states of mind regarding biodynamics emerge. Individuals in Class 1 exhibit certainty regarding the actions and effects of biodynamics, particularly concerning the impact of biodynamic preparations like silica and horn manure on plants and soil. In contrast, individuals in Classes 2, 3, and 4 express curiosity, doubt or skepticism about biodynamic practices.

Class 1: Agronomists, practitioners, and advisors, convinced of the material effects of Biodynamic preparations

The prevalent lexemes in class 1 include "silica," "soil," "horn," "plant," "effect," and "growth," among others. This class primarily comprises nouns and action verbs, focusing on the physical effects of biodynamic preparations. The representation of biodynamics in this context is a materialistic one, suggesting that biodynamic practices yield visible and measurable results in agriculture. This perspective distances itself from Steiner's original spiritual foundations, framing biodynamics more as a method of farming rather than a spiritual practice. The members of Class 1 predominantly include biodynamic practitioners, either certified or not, with a high proportion being agronomists (60%).

Class 2: Non-practitioners or uncertified practitioners, skeptical about the fundamentals of Biodynamics

Class 2 is characterized by lexemes such as "disadvantages," "advantages," "specifications," and "risk." These terms indicate a questioning attitude toward biodynamics, with few references to its practical effects or operational terms. Class 2 embodies skepticism regarding biodynamic practices, questioning their efficacy and the restrictive nature of biodynamic specifications. This skepticism can inhibit the adoption of biodynamics among potential practitioners. A significant majority (90%) of Class 2 consists of non-practitioners or uncertified practitioners.

Class 3: Non-certified practitioners attached to the experimental method to prove the effects of Biodynamics on their terroir without constraints

Class 3 participants utilize words like "trial," "research," and "discuss," indicating a focus on experiential learning and experimentation. Few references are made to the direct effects of biodynamic preparations. Class 3 represents a more experimental mindset, where practitioners seek to understand biodynamic practices through empirical investigation rather than established dogma. A majority of Class 3 participants (73%) are non-certified biodynamic practitioners, primarily from Bordeaux and Burgundy.

Class 4: Hedonist practitioners, certified or not, curious about the effects that Biodynamics can have on wine

Class 4 centers on lexemes related to wine and sensory experiences, such as "grape," "harvest," "taste," and "ageing." This class emphasizes the sensory and qualitative aspects of wine production. In this class, both certified and non-certified practitioners are represented, with a notable curiosity about how biodynamics influences wine quality.

Discussion

The discourse analysis conducted using Alceste software has revealed four distinct representations of biodynamics within the French wine industry. These representations highlight the varying degrees of certainty and skepticism surrounding biodynamic practices. However, there are inherent limitations to this analysis, particularly due to the small sample size of only 30 participants, predominantly from the Bordeaux region. This limited panel may not fully capture the diversity of views present across the entire industry. Moreover, discourse encompasses not only semantic elements but also verbal and non-verbal cues, such as body language and silences. Thus, focusing solely on semantics can lead to a reductive understanding of the complexities involved in practitioners' perspectives (Kalampalikis et al, 2005, Fracciola et al., 2021).

The classes identified in this study demonstrate that opinions about biodynamics are individual yet coexist within the industry. As Jean Foyer (2018) articulates, there is a persistent tension among different epistemic registers—peasant, scientific, and esoteric—within these representations (Foyer, J., 2018). This coexistence raises questions about whether these differing views can lead to a new understanding of biodynamics amid the ongoing transition towards sustainable practices in viticulture.

Biodynamics can be perceived as a synthesis of various agricultural worldviews developed by Cyril Rigolot (Rigolot, C. , 2017). Class 1 aligns with a modern, materialistic perspective, where scientific knowledge and technology are prioritized. In contrast, Classes 3 and 4 reflect a postmodern worldview, emphasizing contextual experimentation and the importance of social exchanges among practitioners. Class 2 critiques the esoteric aspects of biodynamics, which some perceive as overly religious or dogmatic, potentially alienating prospective practitioners.

Finally, the study aimed to identify the supposed effects of biodynamic preparations, focusing on empirical observations from practitioners: they suggest that biodynamic practices may enhance plant growth and improve soil health through microbial activity. This study highlights the need for collaborative, transdisciplinary research to validate biodynamic practices, encouraging winemakers to develop methods based on solid evidence and diverse perspectives within the industry.

Conclusions

This study explores various representations of biodynamics in the French wine industry, identifying four distinct perspectives while acknowledging the existence of many others.

These diverse viewpoints offer valuable insights that can drive the evolution of agricultural practices. However, the foundational principles established by Steiner may hinder the practical application of biodynamics. It is crucial for practitioners to move beyond these principles to develop more personalized and innovative approaches.

Biodynamics fosters a holistic relationship among plants, the environment, and farmers. Increasing experimental studies demonstrate the positive effects of biodynamic preparations

on soil microorganisms and plant resilience. To effectively integrate these findings into biodynamic practices, collaboration between scientists and practitioners is essential, ensuring that both perspectives are considered.

A transdisciplinary approach that encompasses various representations in the wine industry—such as field experiments, biological research, and social studies—is vital for enhancing the understanding, acceptance, and advancement of biodynamics in viticulture.

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6.5 Revisiting Spirit of Place

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Abstract

This paper proposes an expanded understanding of spirit of place by building upon Marilena Vecco's influential tangible/intangible framework for *genius loci* and introducing a third category: the supratangible. Through synthesis with Isis Brook's metaphysical taxonomy of spirit of place and Julia Wright's pioneering work on subtle agroecologies this study demonstrates that while Vecco's dual categorization provides an essential foundational understanding, the metaphysical dimensions central to practices such as biodynamic agriculture require theoretical recognition of transcendent realities that operate beyond both material properties and human cultural constructions. The paper introduces the concept of the supratangible to encompass Brook's metaphysical approaches and Wright's 'invisible dimension' of nature, which represent objective metaphysical realities that transcend the human/material binary. Drawing on Rudolf Steiner's biodynamic agriculture and Wright's systematic study of subtle agroecological practices, this analysis demonstrates that a complete understanding of *genius loci* requires a further step - acknowledgment of the metaphysical realm and an expanded place-consciousness, which operate independently of human perception while manifesting through specific locations. The paper argues that recognising the supratangible as a third dimension of place theory is essential for developing adequate frameworks for understanding the spirit of place in contexts where metaphysical dimensions constitute fundamental aspects of place-based practice.

Background and Aims

Contemporary place theory faces a fundamental epistemological conundrum: its frameworks can accommodate material properties and human cultural meanings, but, when it comes to engaging the metaphysical dimensions that practitioners consistently report as foundational in the domain of agriculture, it lacks an adequate framework. This theoretical inadequacy becomes particularly pronounced when considering biodynamic agriculture and other place-based practices. In such practices, the metaphysical dimensions are not supplementary cultural beliefs, but, moreover, integral realities. The epistemological gap becomes more pronounced with the inability of conventional frameworks to account for the effectiveness of practices that operate beyond purely material (the tangible) or cultural mechanisms (the intangible).

Since Norberg-Schulz's seminal work on *genius loci* (Norberg-Schulz, 1980), the concept of spirit of place has experienced renewed scholarly attention, yet this attention has remained

constrained within epistemological boundaries that systematically exclude the very dimensions that practitioners report as most fundamental to place-based agricultural success.[35] Rudolf Steiner's biodynamic approach exemplifies this challenge, as its principles recognise metaphysical dimensions of place that require theoretical frameworks capable of accommodating transcendent realities alongside material and cultural dimensions. (Steiner, 2012)

More recently, Julia Wright's work on subtle agroecologies has provided contemporary academic legitimacy to the study of what she terms, (Wright, 2021, p. xxx) "the invisible dimension of agriculture." Wright's systematic approach to the "systematic study of the nature of the invisible world as it relates to the practice of agriculture," (Wright, 2021, p. xl) and its attendant methods represents a significant advancement in supporting academic inquiry into metaphysical dimensions of agricultural practice.

Biodynamic agriculture and subtle agroecological practices present strong cases for expanding place theory. Their foundational principles recognize and embrace metaphysical elements such as metaphysical forces, elemental and nature spirits, and a spiritual place-consciousness. Such elements operate independently of human perception while manifesting through specific locations and to the individual practitioner, and these metaphysical dimensions cannot be adequately understood through conventional frameworks.

Marilena Vecco's paper, '*Genius loci* as a meta-concept,' provides an influential and valuable framework for analysing place relationships through its taxonomy of tangible/intangible values (Vecco, 2020). Vecco's tangible/intangible framework offers a tool for understanding the complex and reciprocal interplay between material foundations and cultural meanings in place experience. However, when considering the metaphysical dimensions central to biodynamic agriculture and subtle agroecologies, Vecco's framework reveals taxonomical limitations.

In 'Can 'Spirit of Place' Be a Guide to Ethical Building?', Isis Brook's metaphysical analysis offers definitions of "spirit of place" that extend beyond Vecco's tangible/intangible binary (Brook, 2000). Brook's identification of metaphysical characterizations of place—specifically, *abodes of special beings, energy fields, pantheism,* and *panpsychism*—opens a theoretical space for understanding place significance that transcends both material properties and human cultural constructs.

This paper proposes that synthesizing Vecco's foundational framework with Brook's metaphysical insights and Wright's study of subtle agroecologies creates the theoretical foundation for recognizing what is termed here the "supratangible"—objective metaphysical realities that constitute a third dimension of place significance. Through examination of Steiner's biodynamic principles and Wright's study of subtle agroecological practices, this analysis demonstrates how metaphysical dimensions of place represent potentially fundamental aspects of agricultural practice that require explicit theoretical recognition to

[35] It should be noted, however, that Norberg-Schulz promotes concepts such as the "cosmic landscape," "cosmic order," and "cosmic sphere."

develop adequate frameworks for understanding *genius loci* in contexts where metaphysical dimensions are foundational rather than supplementary.

Methods

This study employs a theoretical synthesis methodology to draw together three complementary frameworks to develop an expanded understanding of *genius loci.* The methodology combines:

1. **Evaluation of Vecco's tangible/intangible framework** - examining both its foundational contributions and theoretical limitations in the context of metaphysical dimensions of place
2. **Integration of Brook's metaphysical taxonomy** - incorporating the identification of metaphysical approaches: abodes of special beings, energy fields, pantheism, and panpsychism
3. **Synthesis with Wright's subtle agroecology research** - drawing on her systematic study of 'the invisible dimension' of nature in relation to agriculture
4. **Case study analysis** - examining Rudolf Steiner's biodynamic agriculture as a practical application demonstrating the metaphysical dimensions as fundamental in place-based agricultural practice

The analysis proceeds to examine how each framework contributes to understanding place significance, identifying theoretical gaps in existing approaches, and demonstrating the necessity for recognizing a third "supratangible" dimension, one that embraces metaphysical dimensions of place constituted beyond both material properties and human cultural constructions.

Results and Discussion

Vecco's *Genius Loci* Framework: Essential Foundations

Vecco's contribution to the discourse on *genius loci* represents a significant theoretical consolidation of the Markevičienė's tangible/intangible framework (2008) employed to explore the connection to and recreation of a heritage site's spirit of place. Vecco's binary framework accounts for both the material foundations of place experience and the rich tapestry of human meanings that develop through sustained engagement with particular places.

The significance of Vecco's developed approach lies in her recognition that *genius loci* cannot be understood exclusively through either the tangible or the intangible. By proposing the idea of '*Genius loci* as a meta-concept' (Vecco, 2020) that synthesises multiple dimensions of place experience, Vecco offers a framework that acknowledges both the irreducible complexity of place significance and the need for systematic analysis. This 'meta' approach proves particularly valuable in heritage studies, urban planning, and cultural geography, where

practitioners require tools that can accommodate diverse concepts of place value without privileging one dimension over others.

Vecco's tangible dimension provides crucial grounding for place analysis by emphasising the physical, material aspects of places—the geology and hydrology, the concrete structures and built environment, and overall landscapes that constitute the observable, measurable, and quantifiable elements of place experience. This 'tangible' foundation prevents place studies from succumbing to purely subjective or culturally relativistic interpretations.

By contrast, the intangible dimension demonstrates Vecco's sensitivity to the experiential and phenomenological aspects of place that cannot be reduced to material properties. By encompassing cultural significance, the unique 'atmosphere' or character of a place, cultural heritage and identity, this category captures the subjective lived-experience of place.

Significantly, and this is linchpin of Vecco's proposal, her framework presents *genius loci* as a meta-concept' emerging from the dynamic interaction between tangible and intangible dimensions rather than privileging one over the other. This dialectical understanding recognizes that place significance cannot be adequately understood through either purely materialist or purely culturalist approaches.

Brook's Metaphysical Insights: Complementary Dimensions

Let us turn now to Brook whose analysis of spirit of place offers valuable complementary insights that can expand our understanding of the metaphysical possibilities inherent in place significance.[36] Brook's taxonomy (2000) can be organised into three broad categories that illuminate the philosophical foundations underlying different conceptualizations of place significance.

Brook's materialist/naturalistic approaches (*Ecosystem, Character*) align closely with Vecco's tangible dimension, grounding spirit of place in observable, accessible phenomena that do not necessitate metaphysical explanations. Her phenomenological/experiential approaches (*Essence, Narrative, Authenticity, Local Distinctiveness*) correspond substantially with Vecco's intangible dimension, focusing ostensibly on human experience and meaning-making. Again, such phenomenological approaches do not necessitate metaphysical explanations.

For our purposes, however, Brook's most significant contribution lies in her identification of metaphysical approaches, which assign the source of spirit of place to supernatural, divine, or transcendent realities. These approaches include: (1) *Abode of Special Beings*, where places are inhabited by gods, goddesses, spirits, or other supernatural entities; (2) *Energy Fields*, where places contain metaphysical energies; (3) *Pantheism*, where the world is infused with divine presence, with some places serving as especially clear manifestations; and (4) *Panpsychism*, where all things possess consciousness, with some places developing coherent "place-minds" through the combination of individual mind-like qualities.

[36] For a detailed account of the historical and cosmological shifts in the experience and conceptualisation of place, see Casey (1997).

When contrasted with Vecco's tangible and intangible, Brook's metaphysical approaches clearly reveal theoretical space for understanding place significance that transcends both material properties and human cultural constructions. This insight suggests opportunities for expanding Vecco's framework to accommodate dimensions of place significance that operate independently of the material/human categorisation implicit in her binary structure.

Wright's Subtle Agroecologies: Academic Studies of Invisible Dimensions

Julia Wright's groundbreaking work on subtle agroecologies (Wright, 2021) offers robust contemporary academic support for investigating the metaphysical dimensions of place within agricultural contexts. Wright conceptualizes subtle agroecologies as "the systematic study of the nature of the invisible world as it relates to the practice of agriculture" through "adapting and innovating with research methods, in particular with those of a more embodied nature" (Wright, 2021, p. xl). Her research methodology encompasses field trials, systematic reviews, and case studies. Together, these methods provide a strong case for the effectiveness of engaging with invisible dimensions of agricultural places.

Wright's systematic study of 'the invisible dimension' of nature in relation to agriculture demonstrates that such realities "superimpose a non-material dimension upon existing, materially-based agroecological farming systems." (Wright, 2021, p. xl). This position strongly resonates with the supratangible concept being proposed here, and suggests that metaphysical dimensions constitute essential aspects of place significance that require both an extended theoretical framework and distinctly different methods of investigation.

The Case for the Supratangible: Synthesis and Expansion

This paper argues that combining three different approaches to understanding place reveals a gap in current theory. Vecco's framework divides place significance into two categories. However, adding Brook's metaphysical insights and Wright's study of subtle agricultural environments necessitates a third category: the "supratangible." This third category is necessary because Brook's and Wright's work addresses aspects of place that cannot be accommodated into Vecco's binary system without losing their essential meaning.

Brook's concept of *Abode of Special Beings*—places inhabited by supernatural entities such as gods, spirits, or other metaphysical beings—reveals a fundamental limitation in Vecco's binary framework. These entities cannot be accommodated within the tangible category because they lack measurable, quantifiable properties. However, categorizing them as intangible would reduce their ontological status to mere cultural constructions, thereby negating their potential objective reality. This same theoretical tension extends across Brook's other metaphysical categories: *Energy Fields*, *Pantheism*, and *Panpsychism*.

Wright's systematic study of subtle agroecological practices provides contemporary validation for this theoretical gap. Her documentation of "the systematic study of the nature of the invisible world as it relates to the practice of agriculture" (Wright, 2021, p. xl) demonstrates that metaphysical dimensions of agricultural places operate according to their own principles and produce measurable effects that cannot be explained through either material properties or human psychology alone.

The supratangible category addresses these theoretical gaps by acknowledging metaphysical realities that:

- Possess ontological status independent of human perception or cultural construction
- Resist reduction to measurable physical properties
- Transcend the human/material binary while potentially manifesting through both dimensions
- Constitute objective aspects of place significance operating according to autonomous principles
- Require expanded consciousness or spiritual practice for access rather than conventional analytical methods
- Permit systematic investigation through embodied methodologies, as Wright's research demonstrates

Steiner's Biodynamic Agriculture: Practical Application of the Supratangible

Rudolf Steiner's biodynamic agriculture provides a compelling practical context for understanding the supratangible dimension of place significance. Biodynamic practice operates within metaphysical assumptions that align remarkably with Brook's approaches, demonstrating how recognition of metaphysical dimensions becomes foundational rather than supplementary to agricultural practice.

Abodes of Special Beings in Biodynamic Practice

Brook's category of 'Abode of Special Beings' finds resonance with Steiner's spiritual scientific understanding of elemental beings and nature spirits that inhabit and actively influence agricultural landscapes. For example, Steiner describes (1923) gnomes working with root formation, undines influencing plant sap circulation, sylphs affecting leaf development, and salamanders governing fruit and seed formation. For Steiner, such beings are not understood as metaphorical constructs or cultural projections but as actual metaphysical entities that dwell in specific places and actively participate in agricultural processes.

Wright's research documents similar experiences among contemporary farmers working with subtle agroecological methods, providing academic support for farmer reports of collaboration with elemental beings and place-spirits that influence agricultural outcomes. It is important that emphasize that without acknowledging these metaphysical inhabitants, whose presence and activity fundamentally shape the farm's productive capacity and 'atmosphere,' the *genius loci* of farms practicing these approaches cannot be comprehensively understood.

Energy Fields and Formative Forces

The 'Energy Fields' category aligns closely with Steiner's concept of formative forces and 'etheric energies' that, from a spiritual scientific perspective, permeate agricultural landscapes. Biodynamic preparations, such as horn manure (BD500) and horn silica (BD501), are understood to work with both cosmic and terrestrial energy patterns that concentrate and

focus metaphysical forces within specific places.[37] From a Steinerian perspective, these energy fields are not mere human constructions but represent objective metaphysical realities that influence plant growth, soil vitality, and the health of the farm organism.

Wright's research includes reports of various energy-based practices in contemporary agriculture. The timing of preparation application according to cosmic rhythms supports the idea that places exist within broader patterns of metaphysical energies that fluctuate according to celestial movements and seasonal cycles.

Farm Individuality and Place-Consciousness

Steiner's understanding of the farm as a living organism directly corresponds to Brook's 'Panpsychism' approach, suggesting that agricultural places possess their own consciousness or life-force that emerges from the integration of all farm components. This 'farm individuality' represents a coherent entity that both integrates and transcends the sum of its physical elements. The farm individuality develops its own character and consciousness through the farmer's spiritual work and the harmonious integration of cosmic and terrestrial forces.

Wright's research documents contemporary farmer experiences with place-consciousness, including practices of listening to the land, receiving guidance from place-spirits, and developing intuitive understanding of farm needs. Significantly, the *genius loci* of such farms is understood as a conscious entity capable of self-regulation, adaptation, and metaphysical development over time.

Implications for Place Theory and Practice

Recognition of the supratangible dimension has significant implications for both the theoretical understanding and practical applications of place significance. The expanded framework of the supratangible acknowledges and embraces that a complete understanding of *genius loci* requires accommodation of metaphysical realities that transcend both tangible, material properties and intangible, human cultural constructions, while potentially manifesting through both dimensions.

Theoretical Implications

The supratangible category completes Vecco's framework by providing theoretical space for understanding place significance that operates independently of the human/material divide. Wright's research studying invisible dimensions provides crucial support for this expansion, demonstrating that metaphysical realities can be investigated systematically while maintaining research credibility.

This expansion acknowledges that place significance operates across multiple levels of reality, from material foundations through cultural meanings to metaphysical dimensions that may constitute fundamental aspects of place identity. Wright's interdisciplinary approach provides

[37] On the efficacy of BD500, BD501 and other biodynamic preparations, see Santoni, M., Ferretti, L., Migliorini, P., Vazzana, C., & Pacini, G. C. (2022). A review of scientific research on biodynamic agriculture. *Organic Agriculture, 12*(3), 373–396. 10.1007/s13165-022-00394-2

more adequate theoretical tools for contexts where metaphysical dimensions are foundational rather than supplementary to place-based practice.

Practical Applications

The expanded framework has particular relevance for agricultural contexts, where recognition of metaphysical dimensions can inform sustainable land management practices that work with rather than against natural and metaphysical forces. Both biodynamic agriculture and Wright's documented subtle agroecologies demonstrate how acknowledging the supratangible dimension can lead to practical methods that enhance both agricultural productivity and ecological health.

The expanded framework also has implications for other contexts where metaphysical dimensions of place are recognized as fundamental, including indigenous land management practices, sacred site preservation, and ecological restoration projects that acknowledge the metaphysical dimensions of landscape healing.

Conclusions

The analysis presented here demonstrates that while Vecco's *genius loci* framework provides essential foundations for understanding place significance, the metaphysical dimensions central to practices like biodynamic agriculture and subtle agroecologies require theoretical recognition of transcendent realities. Such transcendent realities operate beyond both tangible material properties and intangible human cultural constructions. The extension of Vecco's initial research through Brook's metaphysical explorations and Wright's structured investigation of invisible dimensions establishes the conceptual framework for recognizing the "supratangible" as a third dimension of place significance.

The supratangible category acknowledges objective metaphysical realities that transcend the human/material divide while potentially manifesting through both tangible and intangible dimensions. According to the enlarged framework, recognition of the entire range of metaphysical possibilities, including those that locate place meaning in transcendent realities, is necessary for a thorough comprehension of *genius loci*. This recognition has practical implications that extend beyond academic discourse and address how we understand and engage with locations in situations where metaphysical elements are foundational, integral components of place-based practice.

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6.6 Scientific guidelines for preclinical research on potentised preparations: Benefits for Biodynamic Research

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Abstract

Designing good experiments for basic research is a challenge, especially when subtile effects on living organisms are investigated like in biodynamic research. In the field of complementary and integrative medicine, scientific guidelines for preclinical research on potentised substances (PrePoP guidelines) have been published. As an example of how these research guidelines can be applied in BD research, we present our research project which investigates possible influences of BD preparations (500P and 501) administered at a specific cosmic constellation (the opposition of Moon and Mars, MoM) on oak seedlings. The design of our research project was supported by the transdisciplinary application of the recommendations and considerations collected in the scientific PrePoP guidelines especially regarding controls, blinding and randomization.

Background and Aims

Designing good and methodological reliable experiments for basic research is a challenge. This is particularly true for biodynamic (BD) research examining subtle effects on living organisms. Various aspects have to be considered, like controls and the question of outcome parameters. Recently, scientific guidelines have been published for preclinical research on potentised preparations (PrePoP guidelines) in the field of complementary and integrative medicine (Tournier et al. 2024). They cover additional aspects of the design of experiments and aim to provide recommendations for high-quality, statistically sound, and reproducible research. Our contribution will shed light on different aspects of applying the PrePoP guidelines to the design of a specific BD research experiment.

Methods

As an example of how the PrePoP guidelines can be applied in BD research, we present our research project, which investigates possible influences of BD preparations and cosmic constellations. EIn particular, in this project we intend to study possible effects of BD preparations (500P and 501) administered at a specific cosmic constellation (the opposition of Moon and Mars, MoM) on oak seedlings. For the experiment design, we had to determine several parameters (e.g. origin and vitality of acorns as starting plant material, amount of plants in each treatment group, appropriate controls, time and way of applying the BD preparations etc). We also had to take additional influencing factors into account (e.g. season, weather and laboratory conditions during the evaluation phase). In order not to miss important items in designing the experiment, it was useful to check items which are summarized in the checklist published in the PrePoP guidelines. Any items that were not suitable for our research question were discarded.

Results and Discussion

For us it was meaningful to consider some of the recommendations and considerations suggested in the PrePoP guidelines when designing the new research project focussing on possible effects of BD preparations administered at a specific cosmic constellation (MoM). Since the project involved two locations with pots in the garden and a field trial, we had to determine how many replications of each treatment respectively and controls should be included in each setting. The treatment consisted of applying the BD preparations (500P and 501) repeatedly (each 2-3 times/year) to germinating and growing oaks over a time frame of 6 years few hours before and after the selected constellation. During the last 3 years, the evaluation phase took place.

Water was applied as control for applying the BD preparations. We hypothesised that the constellation impulse could be given when exposing the trees to the preparations/water control few hours before the effective constellation time. Therefore, as a control for the constellation impulse we exposed the trees to BD preparations/water control at an equal time after the effective constellation. After 3 years the oaks unfolded sufficient amounts of leaves for two or three samplings per year in order to take the seasonal variations into account. Leaves of each variant were mixed and the samples were randomized and blinded for further assessment in the laboratory. Sample differences were evaluated by juice extraction from leaves of the young oak trees and further analysed by applying capillary dynamolysis and copper chloride crystallization.

Conclusions

The design of our research project, investigating possible effects of BD preparations administered at a specific cosmic constellation (MoM) was supported by applying the recommendations and considerations collected in the scientific PrePoP guidelines especially regarding controls, blinding and randomization. The data analysis of the biodynamic preparation and constellation experiment, designed by using the PrePoP guidelines, is ongoing**.**

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6.7 Qualitative Nature Research: Expanding the Scientific Framework for Organic Agriculture

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Prelude

What does a pig perceive from its environment? How does a chicken and a pig talk to each other? What does the tree perceive? What characters do lime trees have? What social structure do lime trees have? Do they have roles? How do the sheep and the tree talk to each other? What does the grass feel when it is trodden on by the cow? How does the earthworm react to the green cuttings above? What happens when the earthworm encounters a mole? How do mites play?

Need for new research methodology

In the natural sciences (NW) today, nature is primarily analyzed quantitatively and statistically. Theories are used to formulate hypotheses. The input is varied in experiments and the output is measured. The data collected in this way are statistically analyzed. The results are significances, correlations, effects, connections and functions. The view of nature is functional-mechanistic. Nature itself, i.e. living, social nature, is left out and is not considered. This is not a malicious intention, but a consequence of the quantitative methodology.

Starting points for qualitative-empirical nature research (QNF)

Studying nature as a living or social nature is the subject of the QNR (Timmermann 2024). It also takes up the scientific methodology that followed Goethe[2] , but at the same time offers a fundamentally open approach, which makes it possible to establish qualitative-empirical research styles for all natural science and related disciplines as a completely normal research option.

QNR draws on a successful and established model: qualitative-empirical social research (QSR). This recourse is interesting both in terms of the history of science and methodologically. In the 1960s, QSR developed out of research practice and in critical engagement with the dominant paradigm of quantitative social science (SS)3 (Strübing 2018). A wealth of different qualitative research styles emerged under the label "QSR" (Kleemann et al. 2009). Formal acceptance did not take place until 2002, when the German Sociological Association recommended "equal training in qualitative and quantitative methods as a standard for sociological degree programs" (Strübing 2018: 20). Recognition at eye level.

The basic thesis and demand of this article is: Like the QSR in the social science, a QNR in the natural science should become standard.

What is Qualitative Nature Research (QNR)?

Here we understand nature to mean everything living, from ants to walnut trees, to complexes derived from them, such as the soil, the forest, the landscape or the underwater world, and also human beings insofar as they are also nature through their bodies. The terms "living" or "social nature" are used synonymously here, because being alive also means being social and vice versa. At the same time, nature is a construct that has been changed in many ways by us and with us, it is "hybrid" (Latour 2008/1991) or "cyborg" (Haraway 1995). Nature is understood as the place that encompasses us, "where a subject encounters something in its existence as unavailable ("unverfügbar") (Böhme 1997: 13).

QNR is interested in nature itself, its vitality and its dynamics. Because nature acts, it communicates, it interacts, it has strategies and pursues structures of meaning. Three selected dimensions are used to characterize QNR.

Single case and everyday life

Nature also has its everyday life. And this is always different. The individual case or the individual or a specific group is special in each case. The individual case does not disappear in the mass of a sample, as is necessary in hypothesis-testing statistical methods (Strübing 2018). In QNR a theoretical dimension is always worked out more clearly through different or contrasting cases, in the context of everyday life. This is not a question of quantity.

Circular and open research process

The research process is open in qualitative research. The first field visit starts with a question. The question is not theory-free or without prior knowledge, but without fixed hypotheses to be tested. With this conceptual and empirical openness in the field, the object of research is explored. Data are diverse: observation protocols, videos, documentation, diaries, interviews. (Almost) anything is possible. For QNR researchers, creativity and curiosity are required, especially in terms of new methods. The data material is transcribed, i.e. textualized. These transcriptions are interpreted. Categories and dimensions are formed, "coding" takes place. The findings from this research phase are the starting point for the choice of method and the next field situation ("theoretical sampling"). We go back into the field and collect data. It is a circular process of collecting data, analyzing the data and selecting the next data collection situation. This circular process is repeated until "theoretical saturation" sets in and nothing new is discovered. The object of research is described more and more precisely and "thick" (Geertz 1987). A theory emerges from the data, an area-related theory, a grounded theory (Glaser & Strauss 1967; Strauss 1998).

Understanding – reconstructing

The transcripts need to be interpreted and understood. We are interested in the "qualitative moments" in the context of everyday life and a unique environment. Nature also reacts to this environment. It acts, and always somehow uniquely. It interprets its environment and reacts in some way. Like us humans, nature subjects can live modes of perception, judgements, relevance settings, supra-subjective, nature-society patterns of interpretation. And these make up the structures of meaning in their everyday lives (formulated analogously to social sciences: Kleemann & Matuschek 2009: 18). However, as constructions of "common sense"

(Schütz 2004/1953), as first-degree constructions so to speak, these are not accessible for research. They are only accessible to the QNR researcher as "second-degree constructions (Schütz 2004/1953: 159), i.e. only via a "methodologically guided external understanding", through special "conceptual-theoretical explications" (Kleemann & Matuschek 2009: S18f.).

This is because researchers interpret and construct what is not directly accessible to them. What applies to researching humans also applies to researching nature. Analogous to Schütz, we can initially state: Direct access will not be possible, but only the mediated understanding of others. It is not possible to talk to sheep, but to try to understand what sheep mean to say.

Research is language and conceptual work

Scientists are not philosophical theorists. They are practitioners. They use language, concepts and sentences to become active in their reality. The Pragmatism, for example, understands reality as the "result of people's active engagement with their material and social environment" (Strübing 2018: 50). Every action is bound to space, time and perspective, "so that, strictly speaking, no two actors experience exactly the same reality". The usual subject-object dualism dissolves and becomes a "continuum". An object is then "a practical constitutive achievement (Strübing 2018: 50). Reality is therefore not arbitrary, but a complex construction that can only be conceptualized approximately. The self-image of what we generally understand by data, what we expect from the role of researchers or what we understand by theory is shifting (vgl. Strübing 2018: 51 ff.).The meaning of language, practice and constituent environment has been wonderfully elaborated in the QSR and can be transferred to the QNR.

Research is practice

Good research is to be understood as good professional practice. A practice that is associated with many requirements. "Quality criteria of qualitative research" are, for example, the appropriateness of the subject matter, empirical saturation, theoretical penetration, originality and textual performance (Strübing 2018: 204ff.). These are all requirements that can be transferred to a QNR. How can the object of research be justified? Is the empirically obtained data material enough? Is the research question theoretically well understood? Is the field of research new and linguistically well understood? These are aspects that are linked to the competence of theoretical (self-) reflection.

The four requirements that are named for phenomenological research are also practical (Böhme 1994: 242; Timmermann 2007): methodical approach, learnability, contribution to intersubjective epistemic progress, communicability of its results. Practical scientific work aims at intersubjective, reliable findings. Communicability or textual performance are relevant here. How do I have to present my findings so that my readers can understand them? This textual performance is the "didactic part" - as Goethe calls his Theory of Colors in the subtitle (Goethe 1998: HA, Bd.13: 330ff) - of good qualitative research (Timmermann 2007).

The change of perspective alone is appealing: not to ask which functions, which control mechanisms we can still measure, discover and utilize. But rather: What does nature actually mean? From the perspective of nature. Seen through us, as long as we don't know the language. Roughly speaking, there are two perspectives.

On the one hand, we can access nature via the experiential knowledge of human protagonists - then QNR is a social science or ethnographic approach. The researcher looks at a nature professional and their nature expertise4 . The person is questioned, but it is about the nature with which this person is involved. Examples would be the farmer, the breeder, the hunter, the sommelier, the perfumer, the dressage rider.

On the other hand, we can investigate nature directly. What does the robin mean when it sings? How does the pig perceive its environment? What does it mean when lime trees grow differently? Can we learn to understand them better? Their signs, their tracks, their language, their interactions, also with us? A wide field opens.

QNR always has a scientific claim and contributes to an intersubjectively secured progress in knowledge.

Out of the niche - utilising the potential of QNR

Qualitative-empirical research is first and foremost a way of thinking and researching that needs to be learnt. QNR offers existing and future qualitative-empirical research styles a common methodological foundation without getting lost in discourses on scientific theory. QNR is simply another research option, in good co-operation with the quantifying NS. Let us be courageous and curious: QNR as a research loosener. With QNR, we can get closer to the "living" and better understand its meaning structures. Learning to think scientifically in a qualitative way is a fruitful opportunity for ecological and biodynamic agricultural science and can ultimately only be beneficial for any agriculture.

[2] *Examples for phenomenological goetheanistic research see Bockemühl (1997), Holdrege (2015), Vahle (2003), see image-creating methods for visualizing food quality (Fritz et al. 2022), see food induced emotions (Geier et al. 2016), or methodological analyses (Timmermann 2007).*

[3] *This was accompanied by an intensive discourse under buzzwords such as "crisis of representation" or "positivism dispute" (Adorno 1969), a discourse that is still pending in the Natural Science / Agricultural Science.*

[4] *Compare, for example, Timmermann, who has structured and elaborated the empirical knowledge in cereal breeding under the term "breeder's view" (Timmermann 2009).*

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7. Seeds and Plants

7.1 Assessing Cultivation Impact on Cucumber Quality: Insights from the Stress Storage Test

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Abstract

The Stress Storage Test for cucumbers (Cucumis sativus L.) enables analysis of the effect of different cultivation systems on the Antimicrobial (AMP), Colour Retainment (CRP) and Slice Healing Properties (SHP) of cucumbers after harvest.

The aim of this study was to analyse the effectiveness of this test in differentiating between conventionally (Conv), organically (Org) and biodynamically (Dyn) grown cucumbers (Cucumis sativus L.), at three independent European laboratories using fresh samples, obtained from local markets.

The mean values of CRP, AMP and SHP were found to be highest for the Dyn cucumbers (58-71%) and lowest for the Conv cucumbers (4-8%).

In summary, in our study the cucumber Stress Storage Test method showed differences between conventional, organic and dynamic samples, regarding the three stress storage parameters CRP, AMP and SHP. The Dyn cucumber samples demonstrated the most favourable outcomes in the majority of cases.

Background and Aims

The assessment of organic product quality remains a significant challenge. This raises the need for the development of methods that align with the fundamental principles of organic production. This means that in addition to the usual quantitative chemical analysis of individual compounds, quality statements can be made based on complementary methods that relate to the product as a whole, including storage and degradation tests1.

Thus, the Stress Storage Test for cucumbers was applied to examine the effects of different cultivation factors on the Antimicrobial (AMP), Colour Retainment (CRP) and Slice Healing Properties (SHP) of cucumbers after harvest. The SHP reflects the ability of the sample to develop 'healing tissue' after a complete slicing of the cucumber. Higher values of these three stress storage parameters are interpreted as a higher vitality for the product in question as a whole2,3.

The objective of the present study was to examine the ability of this test to discriminate between conventional, organic, and biodynamic cultivated cucumber in three independent labs, using locally sourced market samples from the three cultivation systems, in three different countries.

Methods

In three different European countries, in three laboratories, eight independent intercomparison tests were conducted, with each test utilising fresh samples from three different production systems, generating a total of 24 experiments. The experiments were blinded, using locally obtained cucumbers. The diameter, length, and weight of the cucumber samples were measured, before slicing with a special tool took place. The slices were assembled, reconstructing the original assembly, then foiled and the 36 samples were put away for two weeks at 23.5°C in a heating cabinet, with protective cardboard cylinders.
After 14 days, the samples were scored for AMP, CRP and a SHP was performed by hanging weights at two different slices. In two of the labs, Dry Matter analysis (DM) was performed on 4-5 samples per experiment.

Figure 1 shows the procedure:

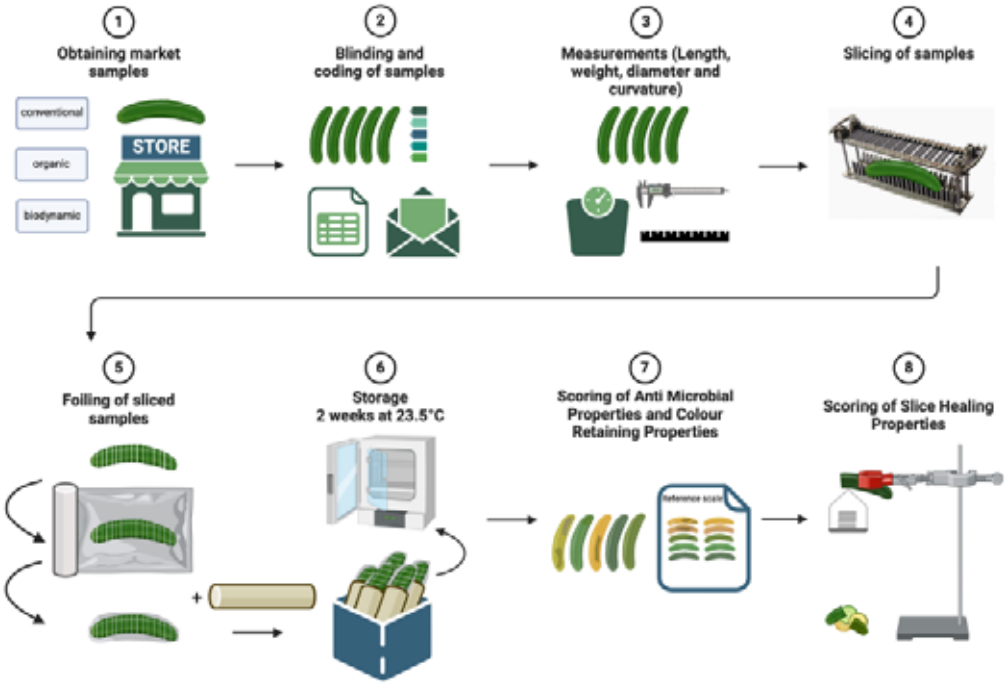

Figure 1. Determination of Antimicrobial, Colour Retainment and Slice Healing Properties of cucumber (*Cucumis sativus L.*), as performed in each of the three laboratories. Created with BioRender. ©Elsevier

Results and Discussion:

For the parameters weight and diameter, the difference between Conv and Dyn was significant ($p < 0.05$). Concerning mean values over the 24 experiments, the values for CRP, AMP and SHP scored highest for the Dyn cucumbers and lowest for the Conv cucumbers. For all three stress storage parameters, the Org and Dyn cucumbers showed highly significantly better stress storage properties than the Conv cucumbers ($p < 0.001$). For the parameters CRP and SHP, Dyn had significantly better values than Org.

When analysing each of the 24 experiments, in 58 to 71% of these experiments, Dyn had the best stress storage properties (figure 2). Org had the best stress storage properties in 25 to 38% of the experiments. In only 4 to 8% of the experiments, Conv had the best stress storage properties.

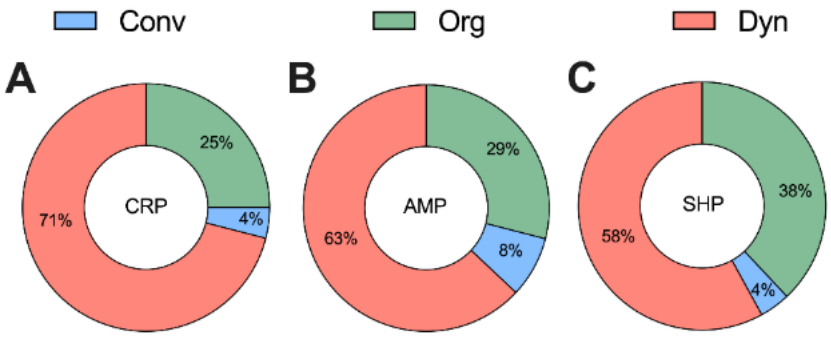

Figure 2: Representation of the percentage of experiments in which the respective cultivation method (Conv, Org or Dyn) yielded the most favourable outcomes, with regard to the stress storage properties CRP, AMP and SHP, the data is derived from the combined results of the 24 experiments conducted by the three laboratories. ©Elsevier

The cause for these significant differences between the three farming methods, appears to be multifactorial. On the one hand, it has been shown that organically produced vegetables contain higher amounts of vitamins and secondary plant compounds such as polyphenols, enabling disease resistance4. However, as Dyn in our experiences scored even better storage properties than Org, the most obvious difference is the use of biodynamic preparations in the former. The understanding of the effectiveness of biodynamic preparations is a point of discussion due to the small amounts of the preparations used. There are studies suggesting a possible stimulating role of these preparations to the so-called soil microbiome, which in turn is thought to have a modulating effect on the plant microbiome5,6. More studies are needed to clarify the observed differences.

Our study also confirms that Dry Matter is a factor of influence, however possibly involving other aspects of stress storage than SHP. For consumers of Org or Dyn products, the demonstrable added value is important, the Stress Storage Test can potentially contribute to this.

Conclusions

We found significant differences between the three farming systems studied, regarding the three Stress Storage parameters CRP, AMP and SHP. For consumers who choose these products because of their perceived greater vitality and sustainability, the fact that the Dyn cucumber samples achieved the best results for stress storage parameters in the majority of experiments could be a confirmation. In order to determine the potential applications of the cucumber stress storage test, further research is required.

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7.2 Experimental approaches to seed treatment in biodynamic vegetable breeding

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Abstract

Individual experience of breeders with different approaches to stimulate developmental processes in crops by seed treatment across several decades led to a joint project in 2021. The effect of various new approaches of seed treatment in biodynamic vegetable breeding with regard to the promotion of ripening ability were investigated and compared over a period of 3 years using a wide range of research investigation methods. All treatments (winter forces, soil shaping, sound, eurythmics or meditation) showed differences to the untreated control. The comparative nature of this experiment allows us to deepen our understanding of treatment effects and enables an initial categorization of the methods used.

Background and Aims

Many years of individual experience of breeders with different approaches to stimulate development processes in crops by seed treatment, e.g. Kirchgaesser (2004) and Henatsch (2012), led to a joint project in 2021. The aim of the project was to promote the ripening ability of plants by targeted seed treatment. In addition, this structured trial enabled common perception of effects and exchange between the project participants.

Methods

Treatments and controls of a spinach and a carrot variety were tested over 3 years together at two locations, as well as at the growers' place, where also seed was obtained (table 1). Leaf and taproot assessments, yield measurements and gustatory testing were carried out. Further investigations using picture-forming methods, empathic food testing and formative forces research were commissioned.

Table 1: Types of seed treatment and spinach cropping locations

category	type of seed treatment	locations						
		CB	UK	CM	JJ	WSi	TH	CHe
nature	winter forces	yes	yes	yes				
	soil shaping (swirl)	yes	yes		yes			
sound	fourth interval	yes	yes					
eurythmics	evolutionary series	yes	yes			yes		
	gesture "Virgo"	yes	yes				yes	

	essence of the plant	yes	yes		
meditation	Stegemann mantra	yes	yes		
	meditation, based on the 17th lesson	yes	yes		yes

Results and Discussion

All treatments showed changes over the years compared to the untreated control. There were hardly any externally visible changes, but slight to moderate modifications in taste and empathic food testing were recognized. Clear differences to the untreated control could be perceived by means of the picture-forming methods and formative forces research. The results of the examination methods corresponded or complemented each other in most cases.

Figure 1: *Copper chloride crystallization of the second generation of spinach treated with „Winter Forces“ (right) and untreated control (left).*

Effects got more evident in the second generation of spinach offsprings than in the first generation of carrot offsprings. Testing of the second generation of carrot offsprings is planned for 2025. Based on the effects observed so far, the treatments can be categorized into a) effects from enhanced natural processes, b) human guidance and c) spiritual influence through meditation.

Conclusions

Options were demonstrated to initiate development in plants using different methods of seed treatment. Their comparison forms the basis for being able to apply them confidently and beneficially.

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7.3 Co-Evolving with Nature: A 37-Year Maize Breeding Journey in Biodynamic Agriculture

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Abstract

Biodynamic breeding can enhance plant capacities for coevolution with microbiomes. This workshop explores a biodynamic maize breeding program that uses a partnership-style, "learning from the plants" approach. Landraces are crossed with commercial varieties, and selected for vigor, nutrient efficiency, and grain quality under nitrogen-limited, biodynamic conditions. Resulting varieties accumulate higher mineral levels and superior grain proteins. They are competitive in yield and with weeds and need less or no fertilizer. These varieties foster bacterial endophytes that multiply in vegetative and reproductive parts, supplying and cycling nutrients through rhizophagy and inducing systemic resistance to stress and disease. Findings parallel Rudolf Steiner's insights on plant genetic stability, elements, and 'living nitrogen'. Applying the Goethean method and biodynamic practices for breeding crops opens up a new path, holobiont breeding, for resolving planetary-wide problems with fertilizer, nutrition, and pollution.

Background and Aims

Maize is the sacred crop of indigenous people in the Americas. It is a remarkably productive and adaptable species which has enabled it to become the most produced cereal crop on the planet. Breeders view it as genetic machinery, farmers view it as a more-or-less profitable commodity or feed. And it is increasingly engineered for conventional farming by a handful of very powerful companies. The results have been greater efficiency of production under high planting density with agrichemicals, decreases in grain protein and mineral contents, smaller tassels, less pollen production, greater uniformity, poorer taste and nutritional value, contamination with transgenes, soil erosion, pollution and greater dependence of agriculture and national economies on maize.

There is a tension between the attitudes of indigenous peoples and the modern industrial mindset and this is reflected in their corn. Native corns are remarkably 'talented' in nutritional traits, their ability to adapt by shifting their genomes with the help of 'jumping gene' transposons, and their ability to interact with microbiomes to gain new services. Conventional varieties are very productive fixed products, that should be reliable wherever they are grown, given the right inputs.

We attempted to combine the best of both perspectives to meet the needs of biodynamic and organic farmers, animals, and consumers, and the Earth.

Methods

I have selected maize under biodynamic conditions for biodynamic and organic farmers, paying close attention to the plants. This work took place at two non-profit organizations, mainly in Wisconsin and on several organic and biodynamic farms and in cooperation with James White's team at Rutgers University, agricultural universities in Illinois, Iowa, Wisconsin, Puerto Rico and with several companies. In response to farmer needs, my breeding efforts shifted from 14 years of open pollinated population development to breeding inbreds, hybrids, and improved synthetic populations mainly from crosses between landraces and conventional inbreds. Plants were grown under biodynamic practices in Wisconsin, USA in the summer, but also under organic conditions, and in a few cases under conventional practices in Hawaii, Puerto Rico, or Chile in the winter to enable two crops per year. Selection in Wisconsin was on sites which were limited in available N, P, and K. Multiple applications of biodynamic preparations (up to 7x) were often utilized. Plants were sequentially inbred for mostly 6 generations. Selection considered vigor, nutrient uptake efficiency, nutritional value, grain yield, and performance in hybrid combinations.

Results and Discussion

The first major results were the mass emergence of soft textured seeds. These mutants contain higher levels of essential amino acids (methionine, lysine, and cysteine) and higher levels of minerals. This significantly shifted the value of the grain. Organic poultry farmers would not need to feed synthetic methionine to their layers and they could reduce the amount of soymeal by 9%.

Then it became apparent that our most efficient inbreds and hybrids are densely colonized with bacteria. These bacteria streamed in and through young tissues of roots, leaves, chloroplasts epidermis, silks, pollen, and embryos. They engendered dynamic movement in the protoplasm of tissues. The bacteria produced nitrate, ammonium, and nitric oxide while being chemically attacked by the plant's superoxide and hydrogen peroxide.

Bacteria are passed from generation to generation through seed. But the plants also take up large quantities of bacteria through their rooting systems, increase them in their hairs and tissues, and assimilate them in specific cells located in the roots, epidermis and glumes. Lipid studies confirmed that the plants were cycling large quantities of microbes and depositing their contents in plant leaves.

The plant/bacterial partnership is reminiscent of R. Steiner's description of 'living nitrogen' and the interactions between Carbon, Nitrogen, and Oxygen in the plant in the Agriculture Course.

These MI inbreds were much more vigorous and stress resistant than conventional inbreds and had very dark green leaves full of chlorophyll. They and their hybrids were also better at

competing with weeds. The MI plants did not respond positively to fresh manure like conventional hybrids, but they responded positively to compost or to soils with a high content of microbial biomass. Isotope studies showed that some of the inbreds and hybrids were probably fixing substantial amounts of nitrogen with the help of their bacteria.

Large-scale, soft seed mutations only occurred when plants were grown under biodynamic conditions. Initial studies with biodynamic herbal seed baths suggest that they can strongly increase microbial colonization in maize leaves and enhance plant growth.

The intense bacterial colonization found in silks, pollen, embryos, and nuclei may be connected with a greater ability of the plants to generate variation in their offspring. It proved difficult if not impossible to breed clonal MI inbreds, even with excessive inbreeding. This makes them difficult to register with governmental authorities.

Conclusions

The application of "learning from the plants" approach, coupled with biodynamic practices, led to shifts in plant biology that are paradigm shifting and potentially of World significance. The results open up a whole new area of work: holobiome breeding, that could help humanity resolve the climate, pollution, and health problems associated with farming. They can reduce the need for fertilizer and enhance weed control, while resulting in higher value products. Under stressful conditions weeds often have these beneficial, adaptive, vitality-engendering partnerships even if our crop plants have lost them.

Biodynamic farmers should have ‘dynamic holobiont’ varieties. But dynamic holobionts can also be a present to the rest of the world. If this development is taken seriously, it could revolutionize biodynamic, organic, and conventional agriculture.

7.4 Effects of Eurythmic Gestures on Plants: An Overview of 25 Years of Research

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Abstract

With the gestures of eurythmy, people can have an effect on the etheric. The effect can be differentiated and focused on plants or substances via the specific gestures and thus transferred.

These effects can be demonstrated in laboratory experiments and in sensory tests. The effects are specific to the treating person, time and eurythmic gestures. Each eurythmy treatment must therefore be viewed and evaluated as an individual case. The aim of the work at the Institut ArteNova is to bring the artistic input into a meaningful overall picture with the results of the tests.

Background and Aims

We have been researching the effect of eurythmic gestures on the growth of plants for 25 years. Our work is based on the hypothesis that the etheric in human beings has an effect on that of plants. With eurythmy, we can shape the etheric in ourselves and bring it into an external effect through the gestures.

In this way we can exert an effect on the growth of plants, which we investigate in corresponding experiments. We have noticed significant changes in the growth and quality of food and water.

Methods

The seeds or plants are treated eurythmically by making the gestures around them over a defined period of time and frequency. The gestures are selected based on the quality of their movement and the desired effect.

Both metric parameters and qualitative characteristics are recorded on the plants. The evaluation is carried out using statistical methods or in shape characterizations.

The aim is to combine the artistic input with the results of the experiments into a meaningful general picture.

Results and Discussion

In this presentation we show the results of a few projects. In the laboratory test with cress, we found clear differences in the length of the plants depending on the eurythmic treatment. Here, the duration of the treatment and the phases of the moon had a measurable influence.

In the treatment of water, 7 out of 8 different test methods showed differences between the treatments.

In the taste test of apples, we found similar differences in various treatments despite different apple varieties.

The results show an influence of eurythmy treatments in each specific case. However, this does not mean that the effects are always identical. The treatment is an artistic act of an individual person at a specific point in time and therefore the quality of the treatment - despite the same gestures - is specific in each case.

Conclusions

People have an influence on their environment on the etheric level. This influence can be differentiated and focused through the movements of eurythmy. This influence can be demonstrated using suitable plants and substances. In this context, each eurythmy treatment must be viewed and evaluated as an individual case.

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7.5 Induced epigenetic influences in plant (vegetable) breeding

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Abstract

Water-soaked seeds of various species have been treated with different vibrations and other environmental stimuli (eurhythmy, intervals, meditation) to find out about their effects on phenotype, taste[38] and nutritional quality.

In lettuce we found effects on the formation of the lettuce-heads.

In green beans we found effects on phenotype and the Brix-contents. These effects are stable through the generations.

In Dandelion we found, after two generations, different phenotypes and tastes of roots, leaves and or flowers.

The forming forces and nutritional quality of tomatoes and potatoes and different cereals could change to better wholesomeness and digestibility.

Moreover, sensitive copper crystallisation [39] was applied, as well as drop-pictures [40] and forming forces methods[41] showing reliable differences between the treatments.

Background

Studies have shown that noise and vibration can influence germination, gene expression, growth and disease resistance in plants[42].

As a breeder of vegetables my research question has been: How can I induce variation in plant species without crossing or genetic engineering (GM). Thus, by fully respecting the species' 'intrinsic value'.

During fifteen years of research, trials have been made on various crops (lettuce, broccoli, spinach,

38 https://thebiologist.rsb.org.uk/biologist/158-biologist/features/2129-safe-and-sound; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3906434/

39 https://science.goetheanum.org/fileadmin/nws/text-downloads/flyerBWeng.pdf

40 http://www.waterresearch.org/about.html

40 D, Schmidt: „Lebenskräfte - Bildekräfte"

40 See note 1.

carrots, red beets and barley) to get find out about effects of various sounds and other signals.

Effects on morphology and taste of the various treatments as well as their combinations have been compared, as well as those of yield mass and size. Based on the results of explorative trials, seed treatments for different crops have been selected and used to strengthen the resilience and nutritional quality of the crops' varieties.

Method

Seeds are soaked in little water to trigger their physiology, where after the various treatments are applied for a few minutes[43]. In some cases, different treatments have been combined (applied one after the other during the same treatment and/or a different treatment added for the next generation).

The seeds have then either been sown directly (SD) or first dried and sown later (SL) (this can be at any time also a year or more later).

The treatments have been compared with untreated crops (controls). The same treatment has been tested on different crops and in different years or planting (SD and SL). Seeds of the treated plants have been harvested and been tested as such again up to seven generations after the particular treatment. There, no more treatments have been applied after the original one.

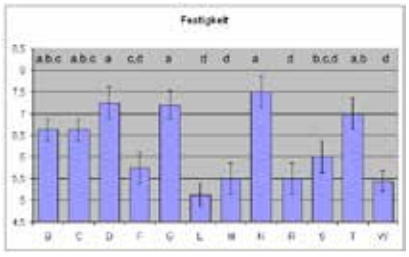
Results and Discussion

1. In Lettuce the goal was, to learn about the effect of the different planets and zodiac signs – and to find the most appropriate gesture to support the typical forming forces of the lettuce. Thus, we applied all zodiac signs, eurhythmic consonants, which belong to a certain zodiac sign, all single tones and intervals and compared them. We found differences in the forms and the different filling/ compactness of the heads and their weights. The differences were statistically relevant.

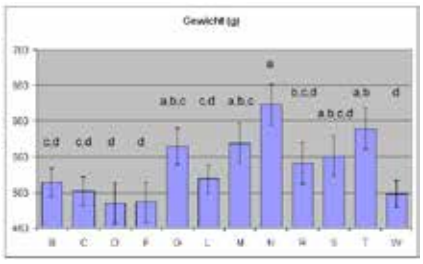
Lettuce treated with eurythmie gestures. L and G

Lettuce treated with different eurythmic consonants:

43 As treatments sounds, gestures and 'focussed attention' were applied.



compactness



weight

2. In Green beans the goal was to improve the forming forces. We applied different eurythmic gestures and meditations throughout 5 generations. We found an improved food quality. This was documented by copper crystallisation and rational forming forces research[44].

   Although green beans are self-pollinators, over the years no selection has been done: they were just harvested and the seeds have been re-sown. We found after eight generations that, compared with the original variety, the morphological changes were so obvious, that the treated plants could be registered as a new variety.

   Drip pictures of beans:

untreated

treated

3. In Dandelion the goal was to develop a crop with 'edible and nutritional' qualities. The focus was in particular on three different 'potential' organs: roots (R), leaves (L) and flowers (F). Seeds from a wild dandelion were separated in three badges (R, L and F) and treated in 3 different combinations of sound, movement and meditation. Subsequently they were cultivated, selected, their seeds harvested and treated again. Differences could be recognised already after two generations. This process went on during the next – now seven – generations.

   In the R treatment we found that the main root was stronger, straighter and thicker. The root- taste is slightly little bitter but good to eat. However, the leaves are not digestible.

44 D. Schmidt in „Lebenskräfte – Bildekräfte 2011.

In the L treatment we found that the leaves are broader and less bitter and very good to digest even if eaten in a high quantity. However, they flowered 1-2 weeks later than F, with much less flowers.

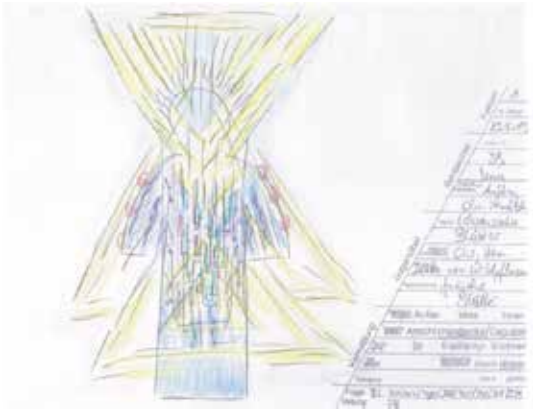
In the F treatment we found much more flowers then both other variations and earlier flowering. The flowers are somewhat sweet and good to digest. However, the leaves are bitter and not to digest.

It was found that even after years the treatment had still the same effect as was found after direct sowing.

The 3 variations showed quite different forms in the picture methods applied, and each very different form the original Dandelion.

In the following forming forces pictures (observation and pictures by D.Schmidt, forming forces society) show the differentiation from

the wild form



into

root

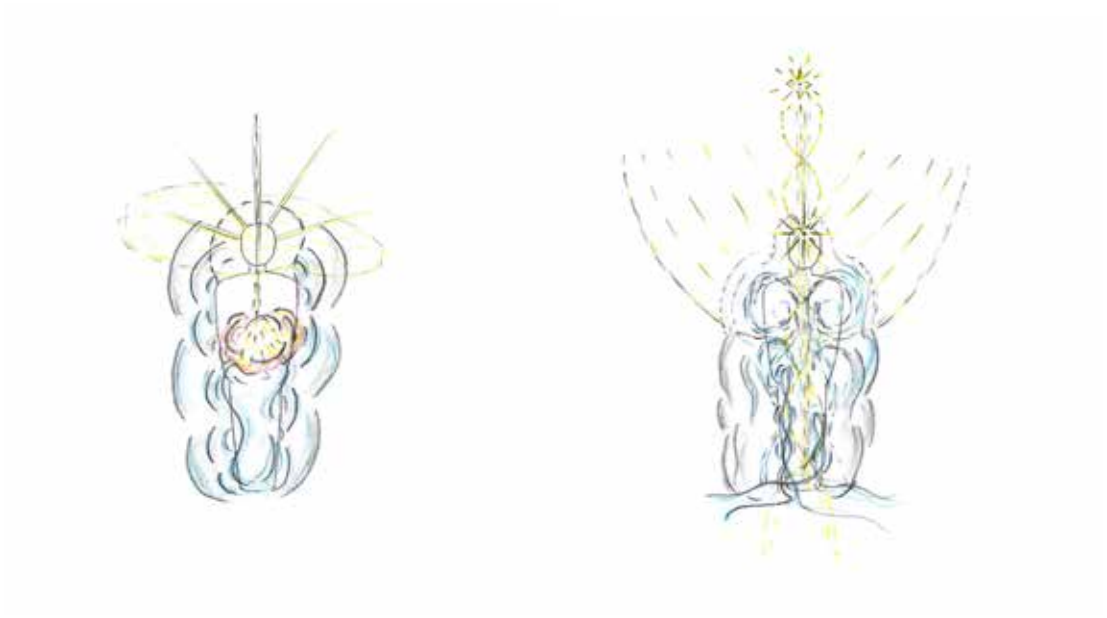
leaf

flower type:

Dandelion treated for Leaves reated for flower, pictures taken at the same day

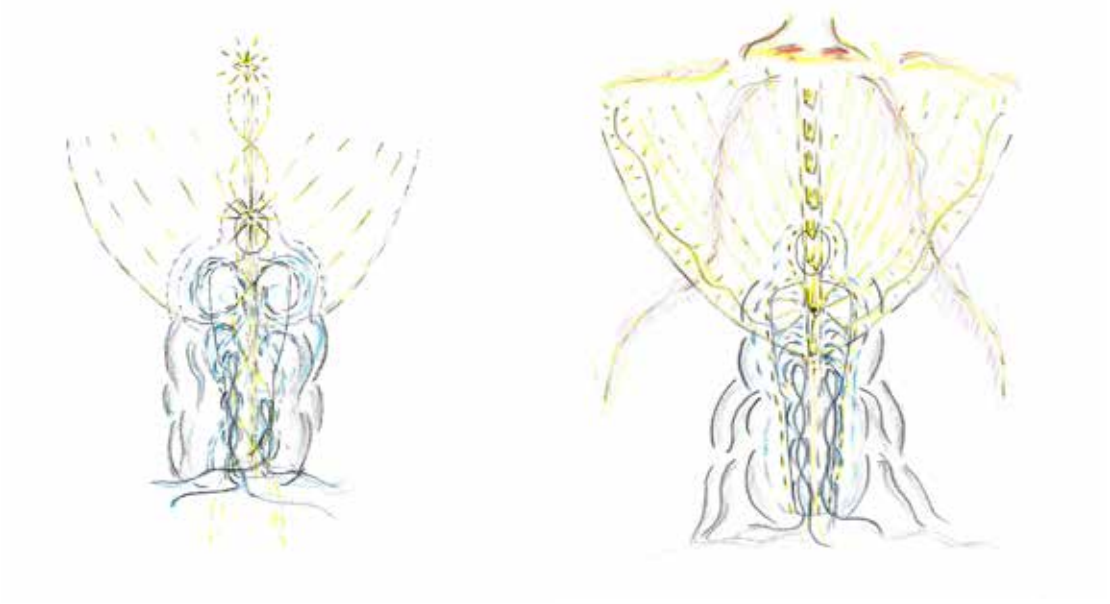
4. In tomatoes and potatoes the aim was to change the nutritional quality (as nightshade plants are considered difficult to digest for human consumption, especially for people whp suffer from cancer and similar deseases.

Two potato varieties were treated: (observation and pictures by M. Buchmann, forming froces society)



Potato untreated
Working of light in the head due to spraying of silica; equisetum – weving, not formed, swelling growth forces.

Potato treated
A connection to the being of the potato is present > an uprightness comes into the gesture, the heaviness of the potato is pressed down, the swelling forces enliven the breast.



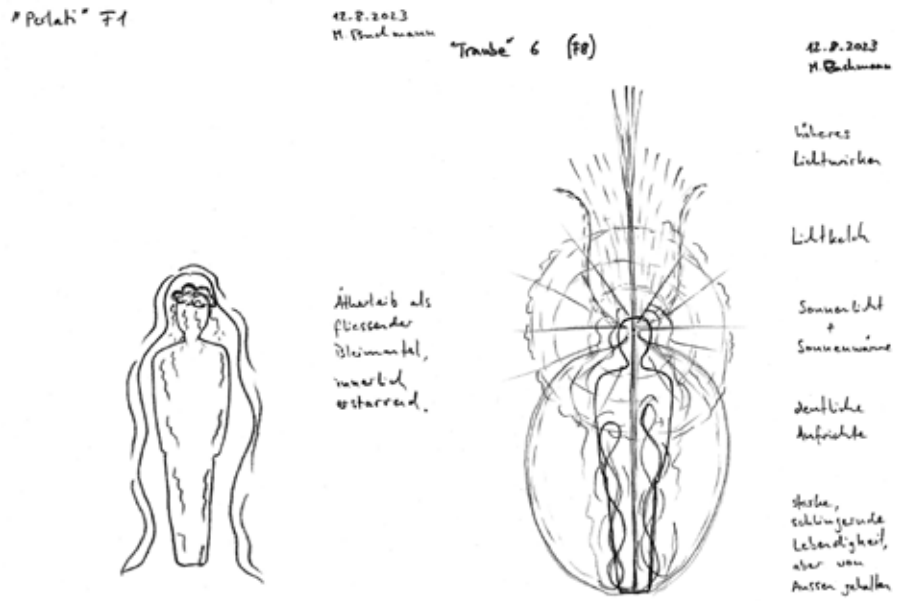
Potato untreated

Working of light in the head due to spraying of silica; equisetum – weving not formed, swelling growth forces.

Potato treated

A connection to the being of the potato is present > an uprightness comes into the gesture, the heaviness of the potato is pressed down, the swelling forces enliven the breast.

A hybrid tomato was treated throghout 8 generations: (observation and pictures by M. Buchmann, forming froces society)



Tomato: Perlati F1

All life-forces follow a strong suction into heaviness as as if you have a coat of lead. Especially in the head the forces remain blunt and dull. All life forces, which would stream up, remain in stiffness.

Traube 6 (now registered as „Tiamarie“)

A strengthening of uprightness which has not been observed at tomatoes before.Swelling ether forces and warmth forces work in the digestion, and animate the liver. In the upper part sunny light and the forces of consciesness can light up clearly. In the middle part, the two forces come together in harmony and lead to an harmonious ether gesture.

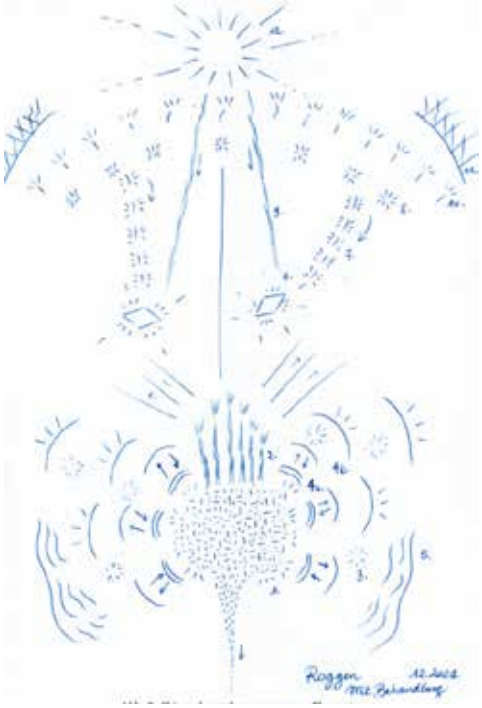
5. Different <u>cereal corps</u> (wheat, rye, millet, oats etc.) were treated through several generations (1-5) with eurythmic and meditation to improve the nutritional quality and digestibility for people with gluten- intolerances. Forming forces pictures show a change of the gestures. People with intolerances report a better digestibility.

A wheat (Observation and picture by Audrey Krebs, forming forces society): left untreated – right treated

Little uprightness and warmth the cosmos.
Dark downwards flowing streams.

Stronger uprightness, opening to the forces of pulsing, covering warmth life ether forces unfold

themselves, active structured.



Overstructuring „Z“ forces, pressure.

Stream of compact blocking substance (gluten).
The being seems barren, little communicatiom
Impression of heaviness

Uprightness, presence, streaming warmth, the gluten is streaming, circulating the gesture is in a wide golden vibrating room.

Conclusions

1. It could be shown that it is possible to influence the way plants grow and develop, as well as their nutritional quality through seed treatments with sounds, gestures and focussed attention.
2. The effect can be repeated and is predictable.
3. The effect of single treatments were found to be intact over generations.
4. The applied treatments might be referred to as ways for ‘dialogue’ with the plant species.

7.6 Climate change adaptation strategies for biodynamic garlic cultivation

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Abstract

Agroforestry and organic mulching promise to increase climate resilience of crop cultivation and simultaneously regulate greenhouse gas emissions. These practices may be particularly suitable for perennial crops highly dependent on a predictable environment and with relatively poor competitive ability. Twenty garlic varieties were grown with and without hay mulch in an agroforestry or open-field cropping system under biodynamic conditions for two years. Soil temperature variation was moderated and the average bulb weight per plant was 30% higher under mulch and 8% higher in the agroforestry system. Biodynamic growing practices and variety diversity offer promising future perspectives.

Background and Aims

Climate change severely impacts biodynamic as well as conventional agriculture. Agroforestry and organic mulching promise to increase climate resilience by improving the microclimate (temperature and moisture) and soil structure (Carr & Congreves 2020, Luís et al. 2020, Haque et al. 2002). Simultaneously, greenhouse gas emissions may be regulated by sequestering (soil organic) carbon (Mayer et al. 2022; Tiefenbacher et al. 2021). These practices are studied in the case of biodynamic garlic cultivation considering variety diversity.

Methods

Twenty garlic varieties were cultivated with and without hay mulch at two locations, in an agroforestry and in an open-field cropping system, both on a biodynamic farm in Germany. Four replications of 10 plants each were used per variety x treatment x location combination. Soil temperature was recorded every hour. The mean bulb weight per plant was measured and statistically analysed.

Results and Discussion

The mean bulb weight per plant was 11% and 50% higher under hay mulch in the first and second year, respectively (averaged over varieties and locations). Moreover, the mean bulb weight was 13% and 1% higher in the agroforestry system in those two years (Table 1).

Table 1 Average bulb weight with and without hay mulch in the 2021/2022 and 2022/2023 growing seasons at two different locations at Dottenfelderhof

Treatment	**Average bulb weight 2021/22 [g]**	**Significant difference ***	**Average bulb weight 2022/23 [g]**	**Significant difference ***
With mulch	49.6	A	57.2	A
Without mulch	44.4	B	38.2	B
Location				
Agroforest system	50.0	A	48.3	A
Open-field cropping system	44.0	B	47.1	A
* Different letters show significant differences p> 0.05 between the two pairwise comparisons with / without mulching and agroforestry / open-field cropping system using t-tests				

These yield advantages are remarkably high given that they can be attributed exclusively to the use of ecologically favourable cultivation practices. Possible explanations for these results include a more even temperature change during the vegetation period extending the assimilation phase. They are in line with the corresponding measurements and findings of Dix (2024) or Portela (2013). Additional effects may include soil improvements, a higher moisture retention, and increase microbial activity. The weight differences between the highest and lowest yielding variety amount to up to 130%, with some variety x practice interactions.

Conclusions

The adoption of agroforestry, hay mulch as well as suitable varieties offer the potential to increase the climate resilience of biodynamic garlic cultivation.

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7.7 Tree Bark Mulch in Black Pepper Crops: Strategies and Perspectives

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Abstract

How to perform weed managment in black pepper crop? How to develop soil cover in perennial crops? Based on black pepper crops using eucalyptus bark, an experiment was developed that provided practical advances on this subject. Two treatments: a) 50 liters of eucalyptus bark crowning the plants with a 300 mm radius from the stem; b) 170 liters of bark covering entire crop line. On a certified organic farm, Linhares-Brazil. The results demonstrate that was efficient in soil coverage, soil protection and weed suppression for around 6 months, with large variations between the two treatments. Entire line cover provides benefits that go beyond soil cover and weed suppression.

Background and Aims

How do weed management in black pepper crops? How to develop soil covers in perennial crops? The challenge of controlling competition between weed and the main crop is a reality present in all crops, especially in the establishment crop phase. With various ways of carrying it out. Based on black pepper crops using eucalyptus bark, an experiment was developed that provided practical advances on the subject.

Methods

The soil was covered as follows: a) 50 liters of dry eucalyptus barkcrowning the plants with a 300 mm radius from the stem (TCover30); b) 170 liters of bark covering entire crop line (TEntireL). Located on a certified organic farm, Linhares-Brazil. The soil was characterized, including Pfeiffer chromatography analysis; farmer's report on the phenomena experienced, and morphological plant evaluations, using a randomized block design.

Results and Discussion

The results demonstrate that the use of eucalyptus bark was efficient in soil coverage, with soil protection and weed suppression for around 6 months, with large variations between the two treatments. The variables stem base diameter (SBD), plant height (H), number of leaves per branch (NL) and quantity (QB) and size of bunches (SB) for TCover30 were 29 mm, 248 mm, 15 and 8 units and 108 mm respectively. While for the TEntireL treatment the same variables measured were 42 mm, 276 mm, 19 and 18 units and 144 mm respectively. A significant result (alpha 0.05) for all variables mentioned, demonstrating a effect of TEntireL. One effect observed was an increase in plant vigor in the area with total line coverage, while in TCover30, there is an incidence of more yellowish plants. This result also counteracts the effect of soil nitrogen immobilization by covering with high carbon contents.

Conclusions

Entire line cover provides benefits that go beyond soil cover and weed suppression, with a long-term residual effect on vigorous plants and nutrition.

7.8 Exploring Novel Plant Defence Stimulators for Reducing Downy Mildew in Grapevines in Brazil

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Abstract

In older vineyards copper concentrations from the use of copper-based fungicides can build up in the soil harming soil life and sometimes can cause a problem to local aquatic life due to run off. European law changed in 2019 to greatly reduce the allowed amount of copper-based fungicides used in viticulture and so it is important to find an alternative strategy for the control of downy mildew (Plasmopara viticola) which can otherwise devastate the grape crop. This research is to evaluate the effect of different homeopathic and biodynamic preparations on the resistance of grapevines to downy mildew by measuring the protein and protective enzyme content of the vine leaves before and after treatment.

Background and Aims

In Brazil levels of copper of over 1800mg/kg of soil have been reported in some vineyards while the copper levels found in Europe are also high with 500mg/kg soil reported in some cases (Poggere, 2023).

As restrictions of the use of copper in viticulture increase (OJEU,2018) the aim of this research is to find an alternative to copper-based fungicides, that induces plant protective enzyme activity when sprayed on grapevines giving them temporary resistance to downy mildew.

Methods

Twelve homeopathic and biodynamic preparations were first screened for their effectiveness in increasing leaf protein levels in grapevines. Four of the best of these were used in a larger scale experiment using 80 plants of Pinot Noir and of Chardonnay vines. All treatments were double blinded and a distilled water control used. The leaves were collected at four leaf harvest times and extracts made and protein and enzyme concentrations measured using spectrometry.

Results and Discussion

This research is at an early stage and results are not yet available.

Conclusions

It is hoped that through the results of these experiments, it will be possible to know if these vines produce increased protective enzymes and proteins when treated with the chosen high dilution preparations.

These experiments will naturally lead to field trials in the UK in 2025 and 2026.

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8.Soils

8.1 Sequestering Soil Organic Matter Faster Than Global Targets

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Abstract

Agriculture can play a key role in mitigating climate change through soil carbon sequestration. This on-farm study, conducted on an organically and biodynamically managed farm in Wiltshire, tested a 2-year diverse ley of 23 species within a 7-year arable rotation, comparing it with permanent ley and bare soil. The diverse ley increased soil organic matter—especially where baseline levels were lower—and boosted labile carbon, indicating improved nutrient cycling. Results show it can exceed the COP21 target of a 0.4% annual increase in soil carbon, providing strong evidence that productive arable farming can aid climate change mitigation.

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8.2 Long-Term Effects of Biodynamic Practices on Soil Fertility and Wheat Quality: Insights from the Frick Trial

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Abstract

In the Frick trial, a long-term experiment (LTE) initiated in 2002 at FiBL, Switzerland, the effects of tillage, fertilization, and biodynamic preparations on soil fertility and crop quality are investigated. A new project (2024-2027) in this LTE focuses on soil microbial functional diversity using high-throughput sequencing and metagenomics. The LTE employs a full factorial design, separating the effects of biodynamic preparations from fertilization and tillage. Previous research has shown improved soil quality in biodynamic systems, with effects on soil microbial communities and nutrient cycling. In addition to the biodynamic compost, the preparations can also have an effect on the microorganisms. Soil samples from 2024 are analyzed for organic carbon, pH, minerals, and microbial biomass and wheat samples for yield and nutrient contents, and quality with image forming methods. DNA sequencing of microbes from soil allows identification of metabolic pathways related to carbon, nitrogen, sulfur, and phosphorus cycles. The study aims to deepen our understanding of how biodynamic management influences long-term soil fertility and wheat quality.

Background and Aims

In FiBL's oldest long-term field experiment (LTE), the DOK experiment, various differences were observed between the biodynamic, bioorganic and conventional systems (e.g. Mäder et al. 2002; Krause et al. 2024). However, these differences cannot be attributed to individual factors such as manure quality or the biodynamic preparations due to the DOK's experimental set-up as a system trial. The comparison of systems is intentionally based on the package of various management practices with regard to fertilizer type and amount, and plant protection. Factorial trials are needed to investigate a preparation effect separately from a fertilizer effect. For this reason, a new LTE was set up at FiBL in 2002, which considers the influence of preparations separately from fertilization. In addition, tillage was integrated as factor with the comparison plow *vs.* reduced tillage. Both measures, compost addition and reduced tillage, are expected to lead to improvements in soil fertility over time through the promotion of an active and functional diverse soil life as a healthy basis for plant production. Reduced tillage has a beneficial effect on the soil's micro-, meso- and macrofauna due to reduced soil disturbance (Krauss et al. 2020; Schmidt et al. 2020; Betancur-Corredor et al. 2022). The

fertilization with composted manure has an important function for soil life, as it nourishes it with organic carbon and nitrogen compounds. Biodynamic preparations may act via non-material forces, but there have recently been indications that they could also exert a material influence on soil microorganisms (Juknevičienė et al. 2019; Fritz et al., 2020, Milke et al. 2024). In a new project started in 2024, the influence of the three experimental factors on the soil metagenome, on soil chemical and biological parameters, as well as on yield and weed development, and crop quality will be investigated. Furthermore, the aim is to investigate whether there are interactions between biodynamic cultivation and the type of tillage or fertilization.

Methods

On 1 March 2024, soil samples were taken on all 32 plots (ploughing or reduced tillage, manure compost or slurry fertilization, with or without preparations, four replicates) of the Frick LTE at depths of 0-10 cm and 10-20 cm, with at least 8 subsamples per plot. These were cooled at <4°C immediately after sampling and then prepared in the soil laboratory for the subsequent analyses, i.e. one subsample was separated with sterile gloves and sieved to 2 mm for DNA extraction, one part was sieved to 2 mm for the analyses of pH, total nitrogen (TN) and soil organic carbon (SOC), and one part was kept cool for the extraction of microbial biomass C and N (C_{mic}, N_{mic}). Wheat samples were taken by hand on 15 June 2024. The influence of management on the quality of the wheat grains of 2024 was investigated using image forming methods of copper chloride crystallization according to Pfeiffer and the WALA rising images (Busscher et al. 2014; Steffen 1983). The statistical analysis of the agronomic data was carried out with IBM SPSS Version 23, in form of an ANOVA with tillage, fertilization, preparation, and depth as fixed factors and block as random factor.

Thanks to the latest developments in high-throughput sequencing technology, the metabolic potential of a soil can be characterized by comparing the entire genetic information of a soil with global databases and subsequent assignment to individual metabolic processes (Huson et al. 2016; Bağcı et al. 2021). The complex bioinformatic analysis requires access to powerful computing capacities, but allows a high-resolution analysis of possible metabolic pathways. In this way, the functional diversity can be characterized independently of the taxonomic structure of a soil microbial community, and the long-term effect of agricultural measures on a variety of soil functions can be compared. For this purpose, the soil samples of spring 2024 were homogenized and DNA extracted from a subsample. In addition, DNA was extracted from slurry and manure as well as the preparations (BD500 - horn manure, BD502 - *Achillea millefolium* L., BD503 - *Matricaria recutita* L., BD504 *Urtica dioica* L., BD505 - *Quercus robur* L., BD506 - *Taraxacum officinale*, Wiggers, BD507 - *Valeriana officinalis* L.). DNA was extracted at the FiBL laboratory and the sequencing was carried out by the Functional Genomics Center Zurich (FGCZ) on the Illumina NovaSeq X platform. An average of 114 Mio paired-end reads per sample was achieved. The analysis includes a comparison with the two general ontologies eggNOG and SEED (Huerta-Cepas et al. 2018, Overbeek et al. 2005), and the two special databases CAZy and NCycDB (Drula et al. 2021; Tu et al. 2018), which classify genetic information according to different criteria. CAZy and NCycDB have a special focus on genes related to the carbon and nitrogen cycle, respectively. Genes related to the sulfur and

phosphorus cycle, SCyc and PCyc, will also be investigated (Yu et al. 2021; Zeng et al. 2022). Through the subsequent statistical analysis, the functional genes of various metabolic processes that have changed due to the influence of cultivation can be identified.

Results and Discussion

Regarding SOC and C_{mic} as indicators for soil fertility, tillage had a significant effect (p=0.000) on SOC in both the 0-10 cm and 10-20 cm layers. The content was higher with reduced tillage than with plowing. The factors fertilization and biodynamic preparations had no significant effects on SOC and C_{mic} in 2024, but there was a significant interaction of tillage*biodynamic preparations (p=0.049). With plowing, i.e. in the treatment with lower SOC content, there was a tendency for a higher SOC content with biodynamic preparations than without, while with reduced tillage, i.e. the treatment with higher SOC content, there was a tendency for a lower SOC content with biodynamic preparations than without. The same was the case for TN (p=0.007). This could possibly show a balancing effect of the biodynamic preparations. Regarding C_{mic}, tillage had a significant effect (p=0.001) with higher values for reduced tillage compared to plowing in both soil layers. A similar trend for the effect of biodynamic preparations like for SOC could be observed for C_{mic}, however, it was not significant.

The investigation of wheat quality using image-forming methods showed only slight differences between the treatments. The classification could not be made correctly.

While the statistical analyses of the metagenome data is currently ongoing, the data processing already revealed a high yield, indicating sufficient sequencing depth and coverage as a solid foundation for the functional profiling. First results of the functional diversity analysis of the soil microbiome will be part of the presentation.

Conclusions

In the Frick LTE, the tillage factor has the strongest effects on most parameters assessed. Interactions with the factor biodynamic preparations occur, which require further attention. Results for the metabolic potential of the soil will follow.

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8.3 Crop Production and Environmental Impact of Organic and Conventional Farming Systems

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Abstract

Agriculture provides food to a still growing population but is a major driver of the acceleration of global nutrient flows, climate change, and biodiversity loss. To assess long-term environmental impact of organic food production we synthesized research on agronomic and environmental performance of the 47 years old DOK experiment, which compares organic (bioorganic and biodynamic) and conventional (integrated and mineral-based) cropping systems. Despite strong reduction of inputs, yields of the organic systems achieved 85% of the conventional systems. Organic cropping systems, especially compost-based biodynamic, showed enhanced soil health, richness of micro- and macrofauna and weed species. We demonstrate at field level that organic cropping systems with reduced external nutrient inputs have less climate impact and a larger in-situ biodiversity, while providing a fertile ground for the future development of sustainable agricultural production systems.

Background and Aims

Agricultural systems put severe pressure on the environment, and management practices balancing the need for agricultural production and environmental health are urgently needed. Key environmental challenges for agricultural systems include the reduction of nutrient losses, the mitigation of greenhouse gas emissions and the preservation of soil biodiversity. Organic cropping systems are proposed as environmentally friendly alternative to conventional systems due to their focus on long-term soil quality but often show lower yields.

Methods

In this study we present the results from a 42-year-old field trial (DOK trial), located in Therwil, Switzerland on key agronomic and environmental parameters. The trial compares two organic (BIODYN, BIOORG) and two conventional (CONFYM, CONMIN) farming systems with an unfertilized control (NOFERT) and follows a system comparison approach. Farming systems mainly differ in plant protection and fertilization strategy but follow the same tillage system and 7-year crop rotation. CONFYM receives the highest external inputs in terms of nutrients

and chemical plant protection followed by CONMIN, BIOORG, and BIODYN. The biodynamic treatment includes composting of manure and the use of biodynamic preparations for plant health treatments and composting.

Results and Discussion

Across the five main crops (grass-clover, wheat, potato, maize, and soybean), organic cropping systems maintained yields at ~85% of conventional systems with distinct differences between legume and non-legume crops (Knapp et al., 2023). Highest yields were achieved in the integrated conventional system, with highest total nitrogen inputs and enhanced soil health compared to pure mineral fertilization. Yet, these benefits come at the cost of lower nitrogen use efficiency and higher N_2O emissions (Krause et al., 2024; Oberson et al., 2024). Organic systems used 92% less pesticides and 76% less mineral nitrogen than conventional systems. Cropping systems receiving organic inputs at a rate of 1.4 livestock units per hectare and year stabilized (BIOORG, CONFYM) or even enhanced (BIODYN) soil organic carbon and nitrogen stocks. Yet, soil organic carbon and nitrogen contents evolved slowly and differences became statistically significant only after 22 years (Krause et al., 2022). All fertilized cropping systems showed a positive nitrogen balance when nitrogen fixation via legumes was included. Still purely mineral fertilized (CONMIN) and unfertilized (NOFERT) systems lost soil organic carbon and nitrogen on the long term (Oberson et al., 2024). Organic cropping systems significantly reduced soil borne climate impacts, which was rather driven by nitrous oxide emissions than by changes in soil organic carbon contents (Krause et al., 2024). Higher richness of soil fauna and weed population was observed in organic cropping systems, next to enhanced biological soil quality indicators, especially in the compost based biodynamic system (Krause et al., 2022). The functional potential of the soil microbiome showed a gradual change from organic (BIODYN, BIOORG) to conventional (CONFYM, CONMIN) systems highlighting the impact of cropping systems on soil functions (Krause et al., 2025).

Conclusions

With the present study, we could show that with moderate yields gaps organic cropping systems can reduce pressure on the environment by enhancing soil biodiversity and reducing soil born climate impacts. Soil health especially benefited from composted manure, as applied in the biodynamic system.

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8.4 Soil Health: Unlocking Potential for Climate-positive Gardening

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Abstract

With climate, nutrition, and biodiversity crises intensifying, gardeners and farmers are united in the desire to manage soils better. Plant growth, carbon storage, and ecological benefits are shared and desirable aims. With each goal scoring another (e.g. plant growth driving ecological functions and carbon storage) it is reassuring to know that nature is 'on our side' when it comes to climate-positive gardening**.**

How this works:

Plants bring products of the sun and air (CO2 → biomolecules) down into the soil, and out through the roots (called 'root exudates' or 'rhizodeposit-C'). However, plant root exudates may only be present in soil for just a few hours as soil microbes rapidly assimilate these nutritious compounds. Microbes convert plant sugars into proteins, and more complex biomaterials, including 2 key components of a healthy soil 1) Microbial Biomass, and 2) Extracellular Polymeric Substances (EPS). This soil biology, and its extracellular framework (EPS), stabilise a complex and functional soil architecture, imparting vital biochemical functions – including carbon storage. Thus, the power of plants and soil biology combine, supporting each-other by generating a healthy soil which stores carbon: *mitigating climate chang*e. Whether we think of ourselves as gardeners or farmers, or proactive in slowing climate change – we all want soils which grow plants better, for longer – without cost to biodiversity.

RHS Wisley's Soil Health Platform is a new long-term experimental site for collaborations investigating the generation of soil health (via plants and the soil microbial biomass). We believe that through informed gardening practices, all of us can contribute to soil health improvements and climate mitigation with greater confidence. This is the essence of "climate-positive gardening". The old ways of habitually digging in large quantities of organic carbon produced elsewhere (e.g. peat) which then mineralises to CO_2 is now recognised as unsustainable. Instead, putting *plants, carbon sources, and gardening practices* to best effect will empower gardeners and farmers alike to grow more sustainably.

RHS Hilltop: Our recently equipped laboratories are poised to measure microbial biomass and activity (ATP); formative microbial exudates (EPS); soil structural generation (WSA); and mineral-associated organic carbon (MAOC). We also aim to account for the different sequestration values for different C-Pools (Fossil fuel-C, Biomass-C, soil MAOC) enabling the

trade-offs between fossil fuel-C, and shorter lived pools of C to be understood and communicated by our scientists and national advisory team. In this way we can identify what practices, on what soils, reap the greatest benefits for growers, the environment, and future biodiversity.

9.Social Aspects of Agriculture

9.1 Community-Supported Agriculture and Resilience: Biodynamic in Patagonia

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Abstract

The article analyzes the contributions of the social organization system Community Supported Agriculture (CSA) in an agroecosystem in Argentine Patagonia, focusing on its capacity to adapt to changes and challenges. To this end, the LUME method, developed by AS-PTA Agricultura Familiar, was used, which consists of the economic-ecological analysis of agroecosystems. In this context, the systemic attribute of responsivity was employed to assess the ability of farmers to adopt preventive and adaptive strategies. The results indicate that CSA not only promotes biodiversity and access to markets but also contributes to the management of input stocks, strengthening the resilience of the agricultural system. The research concludes that trust-based relationships and organization within the CSA are fundamental to its adaptive capacity and to the perpetuation of sustainable agricultural practices, benefiting both nature and regional identity.

Keywords: Biodynamic Agriculture; Sustainability; CSA; Associative Economy; LUME.

Background and Aims

As a consequence of climate change, biodiversity loss, and ecosystem degradation, the landscape of the 21st century reflects the challenges of the Anthropocene, marked by human impact, especially the emission of CO_2 from fossil fuels. In this scenario, short food supply chains (SFSCs) offer sustainable alternatives by directly connecting producers and consumers, reducing distances, emissions, and strengthening community resilience in the face of external crises.

A prominent example is the Community Supported Agriculture (CSA) model, where consumers assume the risks and benefits of agriculture alongside farmers. These initiatives are often

based on agroecological, organic, or biodynamic practices, promoting food security, ecosystem health, and community adaptation. As Dussi & Flores (2018) point out, “resistance to climate disasters is closely related to the biodiversity present in productive systems”.

This research analyzes how CSA contributes to the responsiveness of an agroecosystem in Argentine Patagonia to economic, environmental, and social changes.

Methods

To obtain the data, a bibliographic investigation was carried out on the LUME method, Biodynamic Agriculture, and the local context, in addition to interviews with consumers and farmers and participant observation.

The agroecosystem studied is located in northern Argentine Patagonia, in Contralmirante Cordero (Río Negro), 30 km from Neuquén. It is the JANUS Integrative Rural Project, created in 2009 by Cecilia Ambort and Jorge Aragón, who transformed an abandoned fruit farm into a biodynamic agroecosystem that offers chemical-free food to families in the region through CSA, farmers’ markets and online store.

To measure its capacity to adapt to socioeconomic and environmental changes, the systemic attribute of responsiveness from the LUME method, developed by AS-PTA (1983), was used. This method analyzes the actions of the Social Agroecosystem Management Core (NSGA), which in this case is composed of Cecilia and Jorge. LUME employs tools such as timelines, sketches, flowcharts, and systemic attributes (autonomy, responsiveness, social integration, gender equity, and youth protagonism) (PETERSEN et al., 2021).

This study focused on the attribute of responsiveness, which analyzes the ability of the NSGA to anticipate and adapt to changes, considering parameters such as biodiversity, market and income diversity, and input stock. The parameter “living stocks” was excluded as it showed no significant connection with the CSA.

Results and Discussion

The JANUS CSA was born in 2013 from the convergence of two interests: a worker seeking a space to grow food and the Christian Community, interested in biodynamic food. In the Alto Valle, the interaction between biodynamic farmers, Waldorf schools, and members of this community formed a social and economic network that facilitated its creation.

Since then, the CSA has gone through various changes: products, payment methods, packaging, logistics, and communication. In 2018–2019, it reached 50 families, but after the pandemic and economic difficulties, it was reduced to 20 families with biweekly deliveries.

For these families, the biodynamic practices implemented at JANUS are fundamental, and they therefore value, support, and actively uphold them. In this way, JANUS maintains the integration of animals and plants, sustainable pasture management, Voisin rotation, and the diversity of crops and spontaneous species. This integration promotes biodiversity within the organism. According to Buganem (2017), who compared the level of organic matter in three

agroecosystems—conventional (2.6%), organic (3.21%), and biodynamic at JANUS (4.2%)—the latter showed the highest soil biodiversity.

The parameter of market diversity considers the variety of commercial channels and the adaptive capacity of the NSGA. The CSA strengthens the territorial market through direct relationships and is also supported by fairs, rural tourism, public programs, and online sales. Moreover, relationships of trust enable flexibility in payments, logistics, and responses to operational changes, which reinforces autonomy and economic resilience.

Regarding income diversity, the CSA provides financial stability to the NSGA, guaranteed by the commitment of its members and an active waiting list. Since 2023, a conscious pricing system has been implemented, offering greater flexibility in the face of inflation and market fluctuations. Lastly, the good management of input stocks, with reserves of compost, forage, corn, seeds, and processed products, allows for stable and predictable production.

Conclusions

The analysis of the CSA's contribution to the responsiveness attribute of the LUME method showed certain limitations in addressing all the parameters, but it allowed for the identification of its potential in the resilience of the agroecosystem. The CSA promotes biodiversity, access to markets, income diversity, and stock management, strengthening the response capacity in the face of change. Based on relationships of trust, dialogue, and mutual support, this system provides productive predictability and economic stability, in addition to promoting an agricultural practice that is sustainable and aligned with nature and the sociocultural identity of the territory.

Acknowledgments

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9.2 Vine's beings: An ethnography of biodynamic winegrowing in Anjou, France

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Abstract

This contribution presents the results of a six-year ethnographic study with biodynamic winegrowers in Anjou. It explores how biodynamic practices reshape relationships with nature through political, spiritual, and ecological dimensions. Drawing on over 100 interviews and participant observation, the research reveals how biodynamics engages with cosmo-politics, infra-politics, and diverse cosmologies—from materialist to animist perspectives. These practices offer alternatives to modern views of nature by reconnecting human and non-human actors through vital forces and spiritual presence. In doing so, biodynamics seeks to "reanimate the world" and propose other ways of inhabiting the ecological crisis.

9.3 The Biodynamic Movement and Demeter in the Time of National Socialism. Actors, Connections, Attitudes

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A Summary

Biodynamic agriculture counts among the earliest forms of organic agriculture in Germany. In response to its centenary, Demeter e.V. and the Forschungsring (the German association for biodynamic research) worked together with the General Anthroposophical Society, the Section for Agriculture at the Goetheanum and Demeter International to establish an independent research group to investigate the role of the biodynamic movement in Nazi Germany. The study was supervised by a five-member scientific advisory board. The clients associate the project, on the one hand, with the goal of critically examining the history of their predecessor organizations. On the other hand, the aim is to set a clear signal with which the participating associations distance themselves from totalitarian orientations and groups or attitudes that discriminate against people in the present.

The core of the study concerns the relationship between the biodynamic organisations and the institutions of the National Socialist (NS) state as well as the motivation of those active during the dictatorship. Numerous publications rightly point out that in no other field of anthroposophical work was there such a readiness to cooperate with the national socialist government than in the biodynamic movement. Conversely, no other anthroposophical project engendered such interest among certain circles of the Nazi leadership.1 Some members of the Nazi elite believed they could use biodynamic agriculture for their own ends despite being highly critical of anthroposophical ideas. The biodynamic movement was the only field of anthroposophical practice that was integrated within the complex and overlapping structures of the National Socialist Party (NSDAP) and the state.

By drawing on source material that was previously unknown, the authors describe in just under 500 pages, the chronological development of relations between biodynamic practitioners and the national socialists. Apart from the key period under investigations, the years of national socialist rule, they also consider what led up to the establishment of anthroposophy-inspired agriculture from about 1920 onwards in order to provide a context for the subsequent decisions and procedures. A brief look at the post-war period up to 1950 explores the extent to which 1945 became a turning point for the biodynamic movement. The study is dedicated primarily to the multi-faceted conception of biodynamic agriculture and Demeter during the Third Reich. It highlights ideological overlaps and the various forms of cooperation, including collaboration, as well as the far-reaching ideological differences

between the National Socialist and biodynamic movements, and the attempts at resistance by supporters and functionaries.

The question of how to interpret “Nazi involvement” was itself the subject of the investigation, since the procedures for political and legal judgment or criminal prosecution have changed several times since the Allied denazification proceedings and the German “Spruchkammerverfahren” after 1945. Drawing on comparable projects that have examined the role of associations or institutions during the Nazi era, the study differentiates between three different “categories of guilt”:

1. “Formal guilt,” i.e., the question of membership in the NSDAP and in organizations classified as criminal, such as the SS,

2. “concrete actions”, a potential debt resulting from certain actions that, have been classified as criminal,

3. an ideological or programmatic overlap with the Nazi system: The authors understand this to mean agreement with the central programmatic Nazi ideologemes: racism, anti-Semitism, imperialism, chauvinism, and the extermination of “unworthy” life.

The Results

As part of the study, the NSDAP membership of more than 500 members of the biodynamic associations was reviewed for the first time. According to the study, the figure was just under 10% of the entire membership. By way of comparison, around 20% of all Germans eligible to vote were party members in May 1945. The authors admit that the figure must remain provisional, however, since there is no central biodynamic membership file and it had to be reconstructed from various sources. In addition, for many of the 1067 members of the biodynamic movement identified, the personal data required for a clear assignment to NSDAP membership was missing.

The question of ‘concrete actions’ and ideological crossovers was investigated chronologically by drawing on numerous sources that included more than thirty public, private and organisational archives in Germany, Switzerland and Ukraine as well as professional journals. Many records were unexpectedly discovered about the National Biodynamic Society (Reichsverband für Biologisch-Dynamische Wirtschaftsweise in Landwirtschaft und Gartenbau e. V.) in the national archive. This is quite remarkable considering how small and economically insignificant this society was with its less than 2000 members. There are various reasons for this. In the first place being engaged with anthroposophy meant that biodynamic practitioners were under surveillance by the Gestapo and security forces and monitored as enemies. These records comprise more than 10,000 pages. The correspondence records of ministers and SS officials amongst themselves or in communication with the National Biodynamic Society, is almost as extensive. It can be safely assumed that the presence of the NBS was not welcomed by the national socialist (NS) state but was rather a cause of alarm right through to the party leadership. At no point the “NS chief ideologists” had been in doubt that anthroposophy and its fields of practice were “incompatible” with National Socialism.

Thanks to the comprehensive nature of the sources available, this study has been able to fill many gaps in the history of the biodynamic movement. In some cases, the results diverge from

previous work on this theme.[2] Some of those theses could not be confirmed and this led to a new and more differentiated assessment of certain specific relationships.

The assumption – made for instance by the American historian Peter Staudenmaier – that biodynamic agriculture and national socialism had 'the same roots'[3] and that it was therefore a 'matter of course that they would work together after 1933', has since become widespread. It was stated on German radio for example in the context of the centenary of biodynamic agriculture that the 'soil focus of anthroposophic thought' and the 'esoteric leanings of leading national socialists' had so to speak 'sought out and found one another' in the national socialist state. And furthermore that this close ideological connection led on to collaboration and a blossoming of biodynamics in the dictatorship.[4]

At first glance this assumption appears plausible, when we think of concepts such as 'blood and soil' or the esoteric tendencies among certain leading figures in the party. And it is a fact, that both the biodynamic movement and national socialism, started around the same time in the context of the so-called reform movements. What the various reform movements had in common was a shared analysis of what was wrong with for example capitalism or more generally the rationalisation of life.

Despite these similarities, the two movements differ fundamentally on the question that is the focus of the study. Nowhere in all the documents, statutes, letters or publications, including the period prior to 1933 and the "Agriculture Course" (Steiner's first lecture in 1924 on the later biodynamic agriculture) itself, have the authors found anything that would accord with the ideological policy programme of the national socialists. Racism and antisemitism played no role in the writings of the biodynamic movement. This finding is worth noting since even before the Nazi dictatorship the concept of 'race theory' was not only considered socially acceptable but was widespread. There were sport- and gardening clubs even before 1933 for instance, whose constitution explicitly excluded Jews.

This finding then led to a new set of questions: If biodynamic people were not followers of Nazi ideology when they started – so the argument goes – why were they so ready to immediately engage with the Nazi regime after 1933 – and thereby bring stability to a criminal system?

During the Nazi era, the development of the biodynamic movement can be outlined as a contradictory process between repression and collaboration, of a rise and fall of biodynamics.

1. The Struggle for Recognition and the forced "truce" imposed by Rudolf Hess

Up until the end of 1933 the National Biodynamic Society found itself in a critical situation despite efforts to make a connection during the early stages of national socialism. From the very beginning, the biodynamic movement had been rejected by the entire national socialist agricultural apparatus and was a thorn in the side of the new regime and especially of IG Farben, one of its most important business partners. The conflict between these two unequal organisations had already begun at the end of the 1920s when the young and rebellious biodynamic movement strongly attacked IG Farben in its first publication. They questioned the hegemony of the agrichemical industry and the industrialisation of agriculture and called upon farmers to help themselves.5 Because of the simultaneous criticism of artificial fertilizers

in the media, the agrichemical lobbyists felt vulnerable and responded with a massive campaign against biodynamic agriculture. Were it not for supporters within the dictatorship the National Biodynamic Society would of necessity have soon gone under as a result of the agricultural changes caused by the 'battle of production'. It is clear from the reports that the agricultural ministry, food council and especially the food industry were not prepared to tolerate this tiny 'agent provocateur' despite its productivity being generally perceived as poor.

That the National Biodynamic Society was able to gain traction in the national socialist system at the beginning of 1934 despite this manifest rejection, was solely due to Hitler's deputy, Rudolf Hess. He was the only man in the regime with the authority to counter the powerful agrichemical lobby. And he did so by enforcing a kind of truce. Although agriculture was certainly not one of his competences, Hess demanded that a comprehensive assessment of the biodynamic methods be carried out and overseen by the nutrition council. According to Hess, the Society should continue operating as a potential 'future form of healthy agriculture' and be protected from defamation and attack by the press or other authorities, until the results were available. The records also show that even after provisional protection was granted by Hess, the continued existence of the society was only possible because several of his colleagues – Dr. Griesbeck, Dr. Hörmann, Hanns Georg Müller, Prof. Franz Wirz and to some extent also the leader of the national doctor's council Gerhard Wagner – continually sought exemptions for the National Biodynamic Society.

Why Hess invested so much time and bureaucratic effort in support of biodynamic agriculture is frequently linked in the literature to his interest in esotericism or sympathy for anthroposophy. The research however was unable to confirm this assumption. He was interested in it more from a health perspective and as a means to reform life styles especially in the field of medicine. It is highly likely that along with other early national socialists, he had become familiar with the biodynamic approach in the context of health spa reform in the late 1920s where it was seen as a 'healthy' form of agriculture. Several doctors had at that time made the connection between the appearance of new forms of illness and a disturbed mineral metabolism caused by the use of chemical fertilizers. Since Demeter was the first certifier of artificial fertilizer-free products, its produce was used not only in anthroposophical children's homes but also as a health diet in some health spas.

This is most probably the reason why Hess – and subsequently other leading Nazis who were interested in alternatives to artificial fertilizers – sought out biodynamic and not other forms of ecological agriculture. Apart from biodynamic agriculture there were in fact at least two alternative approaches from Ewald Könemann and Wilhelm Büsselberg, that were ideologically far closer to national socialism.6 It seems from this perspective that ideological considerations were not decisive for Rudolf Hess, Heinrich Himmler or Walther Darré. Their interest was connected far more with the practical experience which biodynamic farmers had of fertilizing the soil without chemicals – also on large farming estates and in new settlements –and especially their well developed concept of agricultural training. In both these areas biodynamic farmers were way ahead of others. Hess helped National Biodynamic Society to survive because he was convinced that chemical-free fertilization was vital for the 'health of the people' and included it within his plans for a national socialist health service.

It is not possible to speak of a general acceptance or of a collaboration of the National Biodynamic Society with the Nazi regime during the first period leading up until the start of 1934. Records of the correspondence between the office of Hess and the Biodynamic Society show how from the middle of 1934 both of its representatives – Erhard Bartsch and Franz Dreidax – were increasingly integrated within the regime's structure, how they were 'built up' by members of Hess' staff and the kind of influence they had on the biodynamic team. From 1934 till 1941 the collaboration with and repression of the Biodynamic Society became increasingly intertwined.

2. The rise of the Biodynamic Society

From 1939 a struggle began to determine who would be responsible for planning what the regime euphemistically called the "colonising of new lands". In the polycratic national socialist state, government departments, SS institutions and the imperial ministry of agriculture were quarrelling over the so-called settlement question. In early 1939 at the latest and with the prospect of war looming, an unexpected turn of events occurred which for the leaders of the biodynamic movement must have felt like a dream come true. Some of NS politicians were no doubt hoping for the support of the Biodynamic Society with their huge settlement project for the occupied territories.

Records of the correspondence between the various party and state authorities show, that for differing reasons, a wider group of functionaries were supportive of biodynamic agriculture and the National Biodynamic Society. These included the home office minister Wilhelm Frick and member of parliament Walter Granzow. One of the earliest and most important mediators between the NS state and the Biodynamic Society who should be mentioned, is the 'national landscape consultant' Alwin Seifert.[7] Seifert was predestined for this task firstly because since the 1920s he had been in contact with those who would later become leading figures in the national socialist regime and secondly because he was not an anthroposophist. He had discovered biodynamic agriculture back then as a landscape architect and was impressed by the approach both practically and as an ecologist. In his capacity as landscape consultant working on the integration of motorways into the landscape, Seifert gathered many landscape advisors around him including some who were members of the Biodynamic Society.

It was Lotar Eickhoff who as ministerial advisor in the home office, made a powerful case for the Biodynamic Society. Increasing interest was also shown by Robert Ley the leader of the German workers forum. Albert Friehe an early member of the NSDAP, writer on racial policy, an activist and from 1935 mayor of Bückeburg, was a director of the Biodynamic Association in Bückeburg and also a member of the Biodynamic Society.

From mid 1939 onwards a number of senior members of Hermann Reischle's team on the imperial food council began to take an interest in biodynamic agriculture in quite a new way. Reischle, as director of the Food Council had strongly supported the advance of Darré's NS agricultural policy career since 1931[8] and had taken part in a farm visit to the model biodynamic farm of Marienhöhe. In the spring of 1940 he initiated a press campaign to make this 'natural farming approach' more widely known[9] and in March 1940 agreed to a publicity drive on the subject with Josef Goebbels, the minister for information and propaganda. In connection with this, a number of scientists within the Food Council were engaged in assessing

and writing papers to re-evaluate and strengthen biodynamic agriculture.[10] Unlike previous assessments of biodynamic agriculture undertaken by the Imperial Food Council this 50 page document by Wilhelm Driehaus came to a very positive conclusion. He wrote about a potentially spectacular 'transformation' of agricultural policy.[11]

Finally in April 1940 Günther Pancke – the head of police and General of the Waffen-SS , director of the SS Race and Settlement Main Office (Rasse- und Siedlungshauptamt der SS) from1938 and from 1939 the coordinating officer between the Führerhauptquartier (Hitlers Headquarter), the SS-Totenkopfverbände and the Sicherheitsdienst SD (Security Service, SD) reported that there was now a broad alliance in support of biodynamic agriculture that included the ministry of agriculture, Rudolf Hess and the SS-Wirtschafts-Verwaltungs-Hauptamt (SS Main Economic and Administrative Office) under Oswald Pohl.[12]

From this moment on, members of the Biodynamic Society were euphoric about the results and hoped for a massive breakthrough. When the war started, its chairman, Erhard Bartsch, regularly sent the various NS authorities new papers extolling the value of biodynamic agriculture for the war economy and especially for the settlements in Poland. This led to numerous visits to the model farm of Marienhöhe during this period by NS functionaries. Joint associations were founded and some NS institutions even gave financial support to the Biodynamic Society so that it could found its own training centre, the so-called Demeter Haus, in Bad Saarow.

The high point came in the summer of 1940 with the visit to Marienhöhe of the minister for agriculture Walther Darré, and especially with his concluding statement, that called for greater recognition of biodynamic agriculture in the future. This statement however must have set the alarm bells ringing in the agrichemical industry for it resulted in a major offensive by IG Farben. It took the form of a comprehensive paper attacking biodynamic agriculture – a position paper on the question of Biodynamic Agriculture' written by Dr. Alfred Steven. It was then sent to all the relevant departments of the party and state. Its argumentation is what laid the groundwork for the prohibition of the Biodynamic Society that followed soon afterwards.

3. The banning of the Biodynamic Society

The Janus-faced nature of the national socialist movement has been frequently referred to. While one section of the party challenged the profiteering of the agrichemical industry and gave space to a traditional farming lifestyle, another recognised that the new 'Lebensraum' concept could only be achieved by employing a high degree of rationalisation in partnership with industrial power. When the National Biodynamic Society was banned on the eve of the invasion of the Soviet Union it was this section of the party that took over and which would then use the most modern means available to drive forward the war of annihilation – including a highly industrialised agrichemical approach to agriculture.

When its most powerful protector Rudolf Hess fled to England in 1941, the opponents of biodynamic agriculture within the NS leadership took control. On 9th June 1941 as part of the nationwide 'campaign against occult teachings and so-called occult sciences', the Biodynamic Society was dissolved and its staff forbidden to engage in any kind of anthroposophical

activity. With this prohibition the whole system of production, distribution and consumption in the German biodynamic network was destroyed. The products could no longer reach their customers. The farms had very little security. Advertising of and information about biodynamic products was banned and agricultural estates and farms producing biodynamic food could only continue doing so as long as it was not promoted publicly.

However, the ban was not enforced with the same radicalism and violence as the bans against communists, social democrats or trade unionists at the time. This explains, for example, why, even two weeks after the ban, the visit of a group to the model estate Marienhöhe was tolerated by the Gestapo, although it was monitored. It is astonishing that even employees of the Nazi security apparatus, in particular, but also of other Nazi institutions, had previously been familiar with the ideas of Biodynamics and had shown sympathy and interest in them. So there were significant “rearguard actions” within the system after the ban.

There were also long running conflicts and power struggles within the NS leadership, between for instance the agriculture minister Walther Darré and his line manager Martin Bormann regarding their differing approaches to biodynamic agriculture. The ambitious Bormann, previously the deputy of Hess as well as a friend of the agrichemical and fertilizer industry, had climbed the ranks and saw the day of reckoning coming for Darré and his sympathy for biodynamic agriculture, especially once his deputy the secretary of state Backe, had been demoted.

In the context of the Gestapo action, the only arrests of members of the Biodynamic Society were isolated and mostly short-term. Only the chairman of the Society, Erhard Bartsch, remained in solitary confinement for almost six months. Bartsch's first Gestapo interrogation was not without a certain absurdity. In line with their conspiracy theory that the Anthroposophical Society had infiltrated the party and manipulated Rudolf Hess in particular, the Gestapo interrogators asked pointed questions about contacts with state and party officials in order to incriminate the accused. Bartsch gave a rapid outline of his many contacts with leading National Socialists. In conclusion, he stated that shortly before his arrest, he had received an order from Himmler that an 11.120 acres (18.000 Morgen = 4500 ha=11.120 acre https://derumrechner.de/flaechen/morgen-in-acre/18000/) estate in the “area of interest of KL Auschwitz” was to be taken over and run as a biodynamic farm.

The summer of 1941 when Bartsch was waiting to visit the Auschwitz site, was in the time before the line had been crossed to industrial-scale mass murder. Auschwitz then meant something different to what became inevitably associated with today. And yet we can sense how close Bartsch and biodynamic agriculture came to these criminal dimensions.

Erhard Bartsch, as can be shown by reading his articles and memoranda, did not have any antisemitic views. Nonetheless until the time of his arrest in 1941 – and despite the repression of anthroposophy – he believed in the national socialist state and respected the ‘personality’ of Adolf Hitler. Bartsch was not a national socialist but believed strongly in the German nation.

The absence of antisemitic and racist arguments in the texts of the biodynamic movement does not alter the fact that Bartsch, despite widespread awareness of the persecution of Jews in Germany, did notdiminish his faith in national identity or the NS state. Of course at the time he shared this trust with the vast majority of the non-Jewish population of the Third Reich. This attitude can be better understood if national socialism is considered not merely as an

imposed tyranny but – as Frank Bajohr saw it – as a consensual dictatorship and social practice in which the majority of people in German society participated in one way or another.[13]

4. The continued practice of biodynamic agriculture by the SS in the concentration camps and occupied territories

The prohibition of biodynamic agriculture under the terms of the so-called 'campaign against occult teachings' was also a specific campaign against the structures left behind by Rudolf Hess. It resulted in the absurd situation of those in the main office of state security being banned from working with biodynamic agriculture while the SS – which was of course part of the office of state security – continued doing so secretly. The ultimate director of both structures was Heinrich Himmler who had gradually accumulated numerous positions in the regime.

Shortly after the disappearance of Rudolf Hess, the most important protector of biodynamic agriculture, Heinrich Himmler stepped in and quietly circumvented the ban. In 1940 he had already established trials to test biodynamic fertilization techniques at his own SS agricultural research institute (DVA). These were set up around concentration camps and were supported by private interests including properties belonging to KZ Ravensbrück. Oswald Pohl and his family lived at Comthurey and Himmler lived with his lover Hedwig Potthast in Brückentin.

It was the prohibition that inspired Himmler to organise a large-scale trial comparing organic and conventional methods on the DVA's own estates.[14] Some trials took place in concentration camps using prisoner labour and with the confirmed participation of three biodynamic pioneers. The leading members of the now defunct National Biodynamic Society saw the DVA trials as a continuation of the biodynamic trials started by Hess and were then stopped as a result of the ban.[15]

Cooperation with the SS extended over two areas:

I. Work in the concentration camps and occupied territories. This primarily involved the 23 biodynamic holdings run by the SS-Research institute DVA that continued operating without restriction after 1941. These were essentially farms and estates that were operating in and around the concentration camps. The first place that should be mentioned here is Dachau. Organic growing trials mainly of herbs had taken place there since 1939 and it was known euphemistically as 'the plantation or herb garden'. Despite its harmless-sounding name, this was a place where the most brutal exploitation of prisoners took place. Working in the

research department for organic agriculture were the biodynamic pioneers Franz Lippert and Martha Künzel, and to certain extent Carl Grund.

II. Himmler was interested not only in trying out biodynamic agriculture but also on expanding its reach. Openly promoting biodynamic agriculture or 'agriculture with a natural lawfulness' as it was referred to in official circles, was no longer possible in the Third Reich after it was banned in 1941. Since Himmler was nonetheless interested in carrying out further trials he felt that it would be safest to choose a place in the occupied territories of the Soviet Union. The choice then fell on Ukraine and the state property of Vertokiyivka near the town of Schytomyr

that had been renamed Wertingen. This estate had been known under the Soviets as a particularly effective agricultural unit for amongst other things, hop growing for which it had received an Order of Lenin award.

The extent to which Himmler came into contradiction with the interests of the various official roles that he had assigned to himself, is revealed by an episode in the hidden Ukrainian research plots in Wertingen. Under the aegis of the SS, biodynamic agriculture continued to be practised by Carl Grund even after it was officially banned. The SS Colonel Henschel was the one responsible in the district of Schytomyr for dividing up the Soviet collective farm and making it available to German settlers. Wertingen lay in that district.

Dividing it up would have made biodynamic management impossible and destroyed for example the already implemented work of planting hedges. The interests of the SS Colonel Theodor Henschel and SS Lieutenant Colonel Carl Grund, a biodynamic pioneer, were in contradiction with one another. Both however received their orders from Himmler. Grund had a better relationship with his boss and made full use of it. Henschel subsequently emphasised in a report that he was well aware that Grund was carrying out banned biodynamic research in Wertingen.[16]

Himmler also made Schytomyr, now called Hegewald, his forward command centre once the Jewish population had been either murdered or deported. It is reported from Schytomyr in particular, that the SS publicly organised the execution of the Jewish staff of the Soviet justice department as popular entertainment.

Hegewald was also one of the SS settlement zones that had been implemented with around 10,000 ethnic Germans who had emigrated to different parts of the Russian empire in the middle of the nineteenth century. In addition ethnic Germans were brought in from the small towns and cities of the Ukrainian uplands. This was an emergency solution since contrary to expectation hardly anyone from Germany volunteered to settle there. At no time were the settlement plans a response to the economic needs of German settlers. This arose solely from the imperialistic and racist fantasies of the SS and NS leadership as is demonstrated amongst other places in the Schytomir city archives.

Carl Grund was particularly active and, together with other biodynamic representatives, travelled extensively through Ukraine and into Crimea in order to identify further sites. Their very unrealistic plans were for up to 50.

5. Membership of organizations classified as criminal, such as the SS

During this study a total of seven members of the National Biodynamic Society were found to have been members of the SS. Even in the latter years of war membership of the SS was a free choice, there was no compulsion for biodynamic people to join. Several biodynamic representatives though, were arrested.

Herbert Beichl, son of the biodynamic farm administrator on the Heynitz estate in Saxony, was recruited as an SS member by the DVA director Heinrich Vogel as SS Colonel ‘F’ in order to manage the biodynamic estates team after the prohibition in 1941.[17] He was not an

anthroposophist and had learnt about biodynamic agriculture at the Heynitz estate. Carl Grund, Martha Künzel and Franz Lippert also continued working for the SS after the 1941 prohibition including in concentration camps where the criminal context of their own actions was clearly visible. After his release by the authorities in 1941, Grund was employed by the central SS office for economic affairs and worked for the DVA as SS Captain in, amongst places, the Dachau 'plantation' in Dachau, Comthurey in Ravensbrück and on the research project at Wertingen in the Ukraine. Between 1941 and 1945 Franz Lippert was director of the DVA biodynamic research department at the 'plantation' in Dachau.[18] Martha Künzel was also a director of the DVA biodynamic research department in Dachau between 1942 and 1943.[19] As a woman she could not be a member of the SS but as an employed civilian she was beholden to the SS. Maria Lohrmann, also a pioneer of biodynamic agriculture who had worked as a biodynamic gardener for the women's settlement in Loheland from 1928 to 1934, joined the NSDAP in 1941. She was recommended by Franz Lippert for a post in the (not biodynamic) plant breeding station in Rajsko by Auschwitz. She worked there from April 1943 as a civil employee of the SS but left of her own volition in October 1943.[20]

The NSDAP party official Walter Granzow joined the Experimental Circle of Anthroposophical Farmers in 1932 but left soon afterwards when he was nominated as state president of Mecklenburg-Schwerin. He joined the SS in 1933 and in 1936 became an SS Brigadier. Walter Ritter, an anthroposophist, biodynamic pioneer and director of the information office in Bayern, worked as a member of staff and as estate manager for the biodynamic estates of Köfering and Gebelkofen from July 1923 until 1937. In 1940 he became a clerk in the Bayreuth administrative offices of the Bavarian Eastern Marches Farmers Union and then joined the SS.[21]

There are unfortunately very few autobiographical texts available that might provide an insight into the motivation of the various individuals. Only for Carl Grund are private letters available that clearly demonstrate his critical reflections on the criminal activities taking place in the occupied territories. In his case 'cooperation' was least of all voluntary but it did mean that he was released from Gestapo internment and could continue with his professional work. As women it was particularly difficult for Martha Künzel and Maria Lohrmann to find any kind of research opportunities in the Third Reich that did not have precarious conditions attached. Franz Lippert was surely fascinated by the enormous resources made available to him by the SS. He was the only one who after 1945 had to submit to a denazification process and like the majority of Germans, be exonerated. This enabled him through the documentation of the prisoners – many of whom were Catholic priests – to show that they were fairly and humanely treated by him at his research

department in Dachau. With all of them, there was certainly the desire to ensure that the ideas and practice of biodynamic agriculture would survive and that the structures created would not fall into incompetent hands.

6. The end of the war and the new start after 1945

In 1945 a large proportion of the biodynamic farming estates in eastern Germany were gone due to the loss of land that was previously German, property takeovers and land reform. A new farmers coalition started that was small and confined to the western

zones. In August 1946 former members of the Experimental Circle of Anthroposophical Farmers and other interested people were called together in order to discuss the constitution of the Research Association (Forschungsring) for Biodynamic Agriculture which was to be founded in Stuttgart in October. The new name, Research Association, showed that the organizers wanted to avoid a straightforward continuation of the former Experimental Circle. According to early statements,the aim was to not centralise and to consciously avoid having an umbrella organisation. This decision was certainly the result of lessons learnt from the Third Reich – it had after all been the National Biodynamic Society which had engaged with the state and the party. It was believed that by having a decentralised structure the focus would be more individually applied on one's own projects. It was notable too, that neither of the two office bearers in the Third Reich – Erhard Bartsch and Franz Dreidax – were given a specific role in the new organisation. Although there were internal debates, a critical discussion of the Nazi past did not take place. A more public engagement with the Nazi past would only begin in the 1980s.

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[2]Cf. among others: Werner Troßbach, Im Zeitalter des Lebendigen? Zum Verhältnis der Nähe zwischen Regimevertretern und Exponenten der biologisch-dynamischen Wirtschaftsweise im Nationalsozialismus, (In the age of the living? Towards an understanding of the close relationship between representatives of the regime and exponents of biodynamic agriculture) in: ZAA 69 (2021) 1, S. 11–47; Jens Ebert, Tanja Kinzel, Meggi Pieschel, Kristin Witte, Die Versuchsanstalt, Landwirtschaftliche Forschung und Praxis der SS in Konzentrationslagern und eroberten Gebieten, (The research institute, SS research for agricultural and practice in concentration camps and occupied territories) Berlin 2021; Peter Staudenmaier, Between Occultism and Nazism. Anthroposophy and the Politics of Race in the Fascist Era, Leiden/Boston 2014; Uwe Werner, Anthroposophen in der Zeit des Nationalsozialismus (1933–1945), (Anthroposophists during the Third Reich) München 1999.

[3] Cf. Peter Staudenmaier, Der deutsche Geist am Scheideweg, in: Uwe Puschner/Clemens Vollnhals (Hrsg.), Die völkisch-religiöse Bewegung im Nationalsozialismus (The ethnic-religious movement in National Socialism), Göttingen 2012, S. 473490.

[4] Cf. Monika Dittrich, 100 Jahre biodynamische Landwirtschaft (100 years of biodynamic agriculture), in: Deutschlandfunk, 24. Mai 2024.

[5] Cf. Erhard Bartsch, Die Not der Landwirtschaft: Ihre Ursachen u. ihre Überwindung (The agricultural emergency –its causes and how to overcome it); Denkschrift zur Gründung der "Verwertungsgenossenschaft Demeter" G.m.b.H (Memorandum – foundation of the Demeter cooperative). Bad Saarow (Mark), Bad Saarow 1927. The memorandum appeared in 1928 and 1932 in an extended form and in 1934 under the title 'Die biologisch-dynamische Wirtschaftsweise' (Biodynamic Agriculture)

[6] Cf. Ebert/zur Nieden/Pieschel, Die biodynamische Bewegung und Demeter (The Biodynamic movement and Demeter), S. 103 ff.

[7]Cf. Ebert/zur Nieden/Pieschel, Die biodynamische Bewegung und Demeter, S. 123ff, S. 160ff and S. 98ff.

[8] Regarding Reischle's journalistic activities see: Hermann Reischle, Reichsbauernführer Darré, der Kämpfer um Blut und Boden, eine Lebensbeschreibung (Leading farmer Darre, fighter for Blood and Soil, a Biography), Berlin 1935 and Reischle, Aufgaben und Aufbau des Reichsnährstandes (the Development and Mission of the State Food Society'), Berlin 1934 (with Wilhelm Saure).

[9] Cf. BArch, N 1094 II/1a, Politisches Büro Reischle an NSDAP, Reichsleitung, Hauptamt für Volksgesundheit (Reischle's political office to the NSDAP leadership, Department of Public Health), 10.12.1940.

[10] These included Dr. Wilhelm Kinkelin, Karl August Rust, Rudi Peuckert, Wilhelm Rauber, Günther Pacyna, Reinhard Ohnesorge and Dr. Wilhelm Driehaus.

[11] Cf. Forschungsring e.V., Darmstadt Archive, Wilhelm Driehaus, Geht das Zeitalter Liebigs zu Ende? (Is the Age of Liebig coming to an end?) 1940, 51 pages (excluding statistical appendix).

[12] BArch, R 9361 III/546720, Pancke to Forschungsgemeinschaft „Das Ahnenerbe" (Ancestral research group), 19. 4. 1940.

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[15] Cf. Staatsarchiv München, Spruchkammerakte Franz Lippert, Spruchkammern Karton 3902.

[16] Cf. BArch, R 49/764, Bl. 48f.

[17] Cf. BArch, R 9361-II/516373.

[18] Cf. Staatsarchiv München, Spruchkammerakte Franz Lippert, Spruchkammern Karton 3902.

[19] Cf. among others: Heide Inhetveen, Biologisch-dynamische Pflanzenforschung im Dienste des Nationalsozialismus? Leben und Werk der Ökopionierin Martha Emma Künzel (Biodynamic research in the service of national socialism? The life and work of biodynamic pioneer Martha Emma Künzel) (1900–1957), in: Ira Spieker/Heide Inhetveen (Hrsg.): BodenKulturen. Interdisziplinäre Perspektiven (Soil cultivation, interdisciplinary perspectives), Leipzig 2021, S. 127–188

[20] Cf. Staatsarchiv Ludwigsburg, Spruchkammer Maria Lohrmann, EL 90218, Bü 4876.

[21] Cf. BArch, R 9361-III-569149.

9.4 Building Capacity in the Biodynamic Wool Supply Network in the UK

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Since the 19th century, industrialisation in fashion and farming has created damaging social, economic, and environmental consequences, relying on exploitative supply chains, fossil fuels, and synthetics. In contrast, biodynamic farmers have long pioneered regenerative practices, restoring biodiversity, nourishing soils, and valuing the farm as a living organism where sheep play a vital role. This project aims to revive biodynamic wool as a precious, sustainable material that honours landscapes, farmers, and diverse sheep breeds.

10. Studying the Living

10.1 Method to assess organic, biodynamic, and conventional practices on wine quality and typicality

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Abstract

This study proposes a methodological approach to evaluate the impact of different production processes on Chianti DOCG wine quality. Wines from the 2016 and 2017 harvests were selected based on the type of production management. A survey collected winemaking data to estimate CO_2 emissions. Wines were chemically characterized for standard parameters, polyphenol, and volatile profiles. Sensory analysis defined intrinsic quality and typicality. Organic and biodynamic wines showed lower CO_2 emissions, but statistical analysis found no management-based differences in quality. Expert scores indicated that estate management could affect typicality differently, but all management types could still produce wines consistent with the typicality reference frame. It can be stated that a lower carbon footprint in winemaking does not, in itself, hinder the production of a typical wine.

Background and Aims

The wine industry is currently shifting toward more sustainable production systems. While the viticultural effects of biodynamic and organic practices on wine grapes have been investigated, there is a lack in literature on the general effect on the final quality of wine. The questions we aimed to answer were: Is it possible to achieve the same level of quality and typicality in wine by adopting more sustainable production processes, such as organic or biodynamic methods? Do fewer interventions in the vineyard and cellar pose an obstacle to achieving this goal?

Methods

Commercial organic, biodynamic and conventional Chianti wines from the 2016 and 2017 harvests were collected. A survey to estimate winemaking CO_2 emissions was submitted to the wineries. The global wine quality was analyzed by i) eligibility profile (standard chemical parameters and polyphenols concentration), ii) peculiarity profile (volatile compounds), iii)

style profile (characteristics that result from winemaking methods) according to Bertuccioli et al. (2011) and Canuti et al. (2017). A group of 45 experts evaluated the sensory differences between wines by the Napping test and rated their typicality (perceived quality).

Results and Discussion

Organic and biodynamic management showed lower estimated carbon dioxide production levels. No systematic differences were found in the eligibility and identity profiles based on the type of production process. However, significant differences were observed in the phenolic composition and volatile compounds. Specifically, it was confirmed that organic and biodynamic wines were more evolved in terms of color stability compared to conventional wines, according to Parpinello et al. (2019) and Picchi et al. (2020). The SIMCA model, based on chemical and sensory profiles, revealed that the conventional wine model had less variability, while the biodynamic model showed more variability in terms of both intrinsic and perceived quality. Sensory expert ratings emphasized that the estate management process could influence wine typicity differently, but also that any type of management could produce a wine consistent with the typicality reference.

Conclusions

The comparison of organic, conventional, and biodynamic production processes for typical wines provides interesting insights for future research. Based on current knowledge of intrinsic wine quality and the survey conducted, this study offers, for the first time, conclusions regarding perceived quality. It is now possible to state that a lower carbon dioxide emission during the winemaking process does not, by itself, hinder the production of a typical wine. This finding, however, underscores that controlling the process is the key factor in producing a typical wine, regardless of the management type.

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10.2 Evaluation of the Vitality of Organic Amendments in Tomato Production

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Abstract

In this study, we evaluated the vitality of six organic amendments applied to an industrial tomato trial in the province of San Juan, Argentina, using Pfeiffer's circular chromatography (PCC). The amendment with the highest vitality led to increased yields and better soil fertility parameters, despite having lower amounts of NPK and organic matter according to chemical analyses. The vitality of an amendment enhances the ability to form soil aggregates, improving its physicochemical and biological quality (Restrepo 2020). Therefore, PCC is an important tool for decision-making regarding its use. Further microbiological analysis of amendments and soils are necessary to deepen these studies.

Background and Aims

The use of 10 t.ha-1 of uncomposted chicken manure has been a common practice among industrial tomato growers, as it increases yield by 15–35%. However, it does not comply with the Argentine GAP regulations in force since 2021 (Rojas 2024). Therefore, identifying alterative amendments that comply with these regulations is essential. The objective of this study was to evaluate the vitality of such amendments and their effect on tomato yield and soil fertility parameters.

Methods

PCC (Pfeiffer, 1984) was performed as an indicator of vitality of six organic amendments and compared with classical laboratory parameters. The effect of the application of the amendments on the yield (total kg/commercial kg) and industrial quality parameters of the tomato (°brix, fruit size, acidity) was evaluated. Quantitative soil analyses were performed at the beginning and end of the crop cycle to determine fertility parameters (NPK and organic matter).

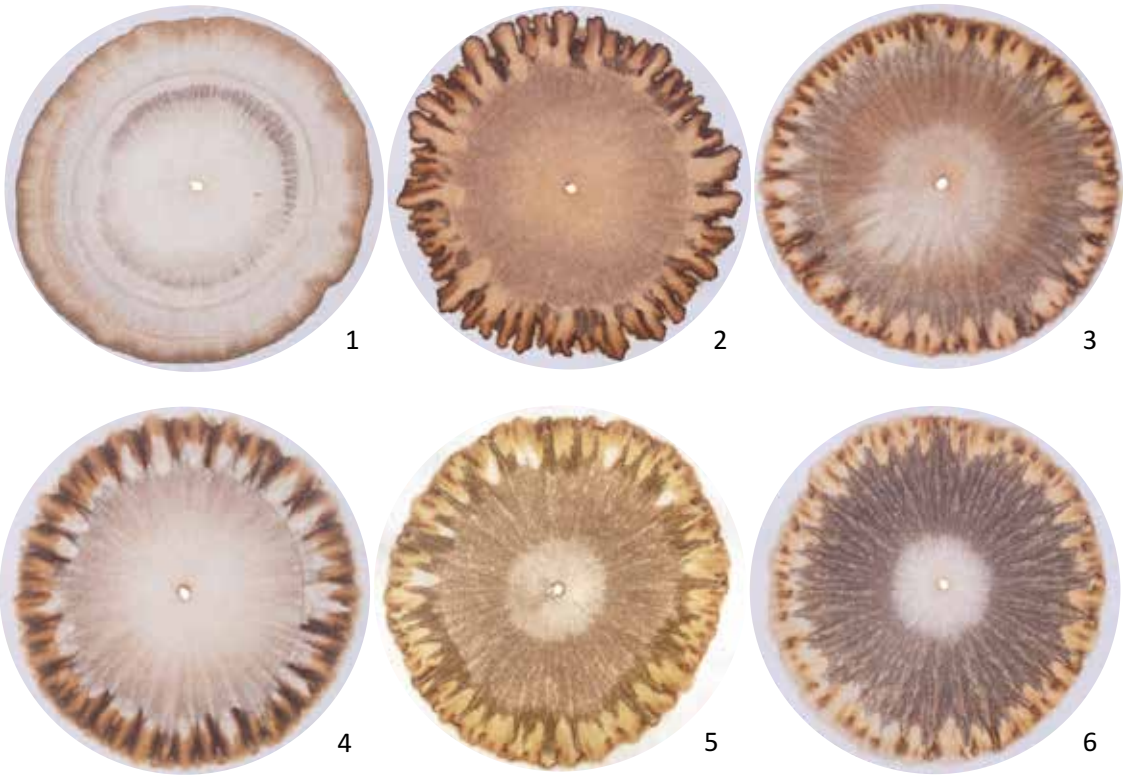

Figure 1. Comparison of vitality images of amendments applied in the trial

Table 1. Chemical analysis of amendments

	1. Pellet fertilizer	2. SGP compost	3. Spent grape pomace (SGP)	4. Chicken manure	5. Local Pelleted Compost (LPC)	6. Bocashi **
EC [dS/m] 1:5 p/v	32,60	7,39	6,87	14,51	6,97	5,41
pH 1:5 p/v	6,25	6,71	5,06	7,25	7,85	7,66
Moisture content* (%)	3,31	24,83	9,62	6,81	17,34	8,32
Organic Matter* (%)	69,53	61,38	65,58	76,48	26,32	22,81
Ash* (%)	30,47	38,62	34,42	23,52	73,68	77,20
Ammonium Nitrogen* (mg/kg)	29922,50	368,00	1308,50	902,50	58,00	231,50
Nitrate Nitrogen* (mg/kg)	544,50	993,50	92,00	148,00	1270,50	30,00
N Total Nitrogen* (%)	5,59	2,47	2,33	3,20	1,27	1,07
P Total Phpsforus* (%)	6,27	0,26	0,25	1,38	0,39	0,35
K Total Potasium* (%)	1,48	2,68	1,13	2,95	0,82	0,91
C/N Ratio	6,98	13,96	15,80	13,39	11,58	11,93

*on a dry weight basis

** Bocashi is a solid amendment produced through a bio-oxidative process involving the semi-decomposition of organic matter. This process raises the temperature to between 65 and 70°C, which eliminates pathogens. The result is a high-vitality fertilizer produced in 15 to 20 days.

Results and Discussion

The amendments evaluated were chicken manure, pelleted fertilizer, spent grape pomace (SGP), SGP compost, local pelletized compost, and bocashi fertilizer (Dibella et al. 2021). Bocashi was one of the poorest amendments in terms of NPK and organic matter content (table 1); however, its chromatography showed the greatest vitality (Fig. 1) expressed in radial, rhythmic, undulating, and blurred features. Mineral forces cause the formation of distinct ring-shaped boundaries, which constitute distinct circular features (Trio Maseda 2016). Two doses were defined for all amendments: a high one (10 t.ha-1) and a low one (5 t.ha-1). The 5 $t.ha^{-1}$ Bocashi treatment yielded the most promising results, showing the highest increases in soil organic matter, nitrogen, and phosphorus (table 2). It significantly enhanced yield (total and commercial kg) (Fig. 2) and improved industrial quality, with higher soluble solids (°Brix) and larger fruit size.

Table 2. *Effect of applying organic amendments on the physicochemical parameters soil after harvest*

	EC (µScm-1)	pH	N (ppm)	P (ppm)	K (ppm)	OM (%)
Control (no treatment)	1.442	7,55	638	18	77	1,06
Chicken Manure10 t.ha-1	3.375	7,60	682	**21**	81	1,33
Pellet Fertilizer 0,5 t.ha-1	3.025	7,65	693	18	79	1,53
Spent grape pomace compost 5 t.ha-1	1.319	7,75	683	17	82	1,47
Spent grape pomace compost 10 t.ha-1	1.792	7,75	757	15	81	1,49
Spent grape pomace 5 t.ha-1	1.009	8,00	713	16	81	1,51
Spent grape pomace 10 t.ha-1	2.535	7,75	717	17	82	1,70
Bocashi 3 t.ha-1	2.724	7,75	795	**22**	84	1,50
Bocashi 5 t.ha-1	3.880	7,70	**814**	**20**	**89**	**1,75**
Bocashi 10 t.ha-1	4.570	7,75	706	**22**	**94**	**1,77**
Local Pelletized Compost 5 t.ha-1	1.888	7,75	807	**21**	86	**1,79**
Local Pelletized Compost 10 t.ha-1	3.010	7,65	792	**22**	87	1,69

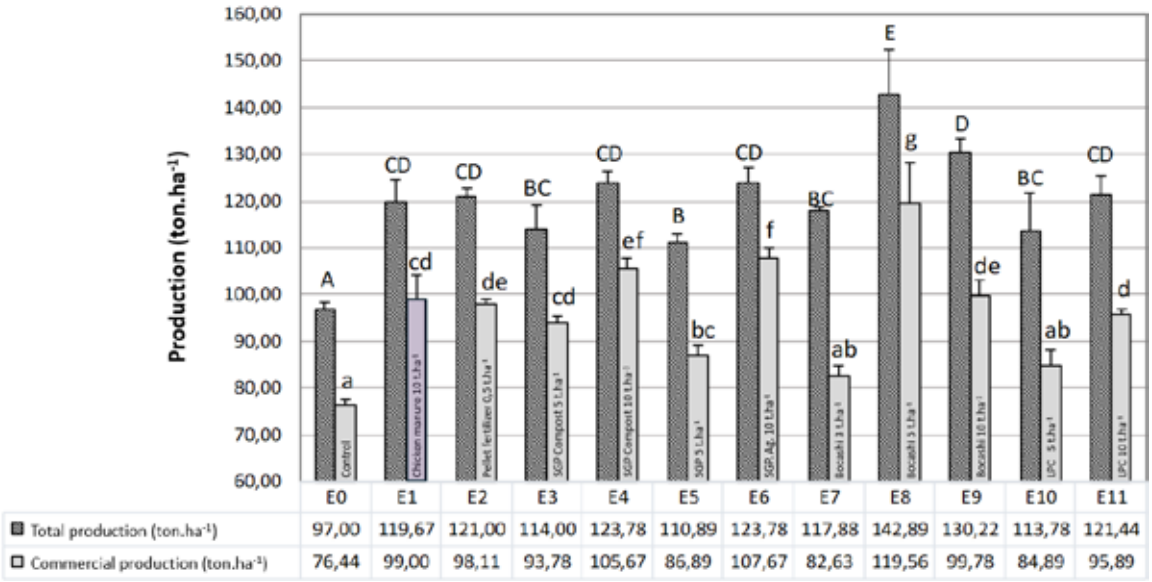

Figure 2. *Effect of organic amendment application on industrial tomato production (2023 – 2024 season). Means and standard deviations are shown. Data was analyzed by ANOVA. Different capital letters indicate significant differences between treatments for total production. Different lowercase letters indicate significant differences between treatments for commercial production (Tukey, α = 0,05)*

Conclusions

The most important advantage achieved by incorporating high vitality amendments is the formation of soil aggregates. In this sense, the quality of the living process is more important than the amount of NPK and organic matter that the amendment contains.

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10.3 Developing a method and a community to access the formative forces in our food

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Abstract

The essence of food refers to its formative forces, in addition to the components. The biocrystallization method has the potential to display these forces and to train our perception to perceive them. In order to make this method available to a wide audience, we plan to 1) develop and validate an inexpensive crystallization chamber 2) found an "Academy" in which researchers can come together to work with the new "chamber-to-go" and to train the awareness to perceive these formative forces.

Background and Aims

There is a substantial body of research demonstrating that the copper chloride crystallisation method is an extremely sensitive tool that reveals the (ethereal) forces that shape biological substances in nature [1]. The method involves the mixing of an aqueous extract of a food product with a thin layer of dihydrate cupric chloride solution in levelled Petri-dishes. Evaporation under standardised conditions results in the formation of two-dimensional crystallisation patterns. Specific changes in the crystallisation patterns, which can be correlated with plant health or agricultural system, suggest the crystallisation process responds to some kind of morphogenetic field signals. Since its inception, the method has been used primarily in the field of biodynamic agricultural research, as it focuses on life processes rather than substances. More specifically, we are referring to the life processes of growth, differentiation (ripening) and ageing.
Since the development of the crystallisation method by Pfeiffer in 1930, many people have applied this method. We found that a large number of initiatives have developed their own conceptions of laboratory procedures, crystallisation procedures and crystallisation chambers, regardless of the extent to which they are supported by scientific research. This results in a lack of a uniform working method, which is not beneficial to a wider (scientific) acceptance of the method and its findings.

Methods

The benefits of biodynamic food products require an understanding of the product as the result of the aforementioned life processes, rather than merely as a source of nutrients. We believe that a fundamental shift in our perception of the living world is necessary, and that the crystallisation method could play a crucial role in achieving this. It is therefore our wish to spread this method and its insights on living processes around the world, and we believe that the following two steps are needed to achieve this:
A) Development and construction of a cost-effective, simplified and standardised 'chamber-to-go' (WP1). The performance will be compared with scientifically validated chambers [2, 3] and tested also under sub-optimal conditions outside the laboratory (WP2). In addition, the practical applicability will be tested by investigating the sensitivity of the 'chamber-to-go', also in comparison to the reference chamber (WP3)[4,5]. We intend to create a fleet of 'chamber-to-go' models, allowing all interested parties to engage in a methodologically sound way with the crystallisation method.
B) Our aim is to establish a 'guardianship' around the method. We are establishing a network of people involved in the method for teaching and training purposes to spread the crystallisation method and its findings effectively (WP4).

Conclusion

Standardised equipment and knowledge-based methods are essential elements if we are to effectively spread the crystallisation method and its findings, allowing more people to experience first-hand the etheric dimension.

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10.4 Empathic Food Testing – an approach to assessing the quality of biodynamic beef?

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Measuring food-induced emotions is a relatively new approach to assessing food quality. One approach to measuring food-induced emotions is the EmpathicFoodTest© developed by Geier et al. (2016). It involves carefully preparing the test subjects. A recent study using the Empathic Food Test compares the effects of meat, tofu and seitan on two panels of trained test subjects (Geier et al. 2025). The biodynamic meat stood out in the comparisons with very positive descriptions. This raises the question of whether this quality of biodynamic beef is also evident in comparisons with conventional or organic products. Two preliminary tests were carried out to investigate this.

10.5 Water Dynamisation and Its Role in Agriculture

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Abstract

We describe collated experiences of various uses of water dynamisation in agriculture. We will share a picture of water as a mediator between the organisms -and between them and the peripheral forces- as a unifier of the agricultural organism.

A conceptual picture of water flow is presented, based on both phenomenology and projective geometry.

We discuss the way this may relate to water a sensitive medium in the life sphere, and to the dynamisation process.

Background and Aims

Much experience has been made with dynamised water- in teas for animal consumption, compost tea, in baking and fermentation processes as well as with the biodynamic preparations. We aim to begin to create a clearer conceptual basis for this.

The water vortex is both a flexible archetypal form of flow and a geometrically defined surface. It is variable yet lawful and transforms between 2 polar forms; the spiral vortex seen when water is draining and the ring vortex created by pressure. We try to relate this to the dynamisation of water as sensitive medium within the sphere of life.

Methods

Most evidence of the benefits of dynamisation is the direct experience of the practitioner. Understanding peripheral forces local and distant requires a contextual approach. Experiences of trials are gathered with details of the context as well as quantitative and qualitative results.

In understanding water flow we use both the phenomenological approach initiated by JW von Goethe (Schwenk 2014) as well as projective geometry (sometimes termed a polar Goethean approach). Path curve surfaces such as the spiral vortex are created in the play of points, lines and planes (Edwards, 1994).

Results and Discussion

Water in flow may be seen to embody a play between 2 form gestures which in the archetype have geometrically defined shapes. In one the surfaces created in flow are stretched to the peripheral horizon and the earth's centre, in the other the surfaces are wrapped around themselves. Dynamisation can be seen as an alternating forming of these gestures. If the surface is where water is sensitive to the forces which enable life, can dynamisation be seen as an opening up to and then an enclosing of these forces?

Conclusions

Dynamisation as initially suggested for biodynamic preparations can be helpful in other appropriate situations and done in a variety of ways.

The same scientific understanding can be attained starting either in the realm of pure concept (geometry) or in the realm of percept (phenomenology) (Hoffman 2020).

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10.6 Methodical Approaches to Study the Living

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Abstract

In this presentation, I revisit the concept of spirit of place, arguing for an expanded paradigm in the field of study. I examine recent developments in understanding the spirit of place that have led to its categorisation into tangible and intangible aspects. While this categorisation provides a strong framework for understanding spirit of place, a critical examination reveals limitations, specifically regarding metaphysical aspects of spirit of place. Providing examples of metaphysical definitions of spirit of place that fall outside the tangible and intangible categories, I question the current thinking on spirit of place. Arising from this, I propose an expanded paradigm and a reconceptualization of spirit of place to integrally include not only the tangible and intangible but also the suprasensible. Crucially, I argue that without including the category of the suprasensible, the study of the spirit of place remains incomplete.
Having established the validity of the suprasensible in the conceptualisation of spirit of place, I also call for a return to phenomenological language, a thinking that lives, dwells, with spirit of place. Following this rethinking into phenomenological language, having established the categories of the tangible, intangible and suprasensible as an imperative for discussing spirit of place, the paper proceeds to argue for the transposition of these three terms into the phenomenological language of earth, human and sky.

Background and Aims

This presentation has two key aims. First, it discusses the concept of spirit of place and proposes a new expanded integrative paradigm of the tangible, intangible, and suprasensible as an adequate framework for understanding spirit of place. Second, it explores a return to the language of phenomenology, from which the study of spirit of place has originated, to describe the categories by which spirit of place can be not only conceptualised but encountered.

Methods

To undertake the aims of the research I review and discuss the literature in the field of spirit of place, critically analysing the discourse.

Results and Discussion

I argue that there are current limitations in how spirit of place is presented in the discourse. These limitations can be overcome through a phenomenological return to the discipline.

11. Rhythms in Nature and Agriculture

11.1 Dynamic Biosinging: A Voice-Based Approach to Rhythmic and Formative Forces in Biodynamics

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Abstract

Dynamic Biosinging is an experiential method developed at the intersection of biodynamic agriculture, music, and environmental education. It seeks to reconnect human beings with the living world through the conscious use of the voice, breath, movement, and observation of cosmic rhythms. This research explores the transformative effects of this method on individuals and communities engaged in regenerative land-based practices. Using a combination of participatory observation, individual interviews, and group experiences in Brazil and abroad, the study reveals improvements in participants' sense of rhythm, ecological perception, emotional wellbeing, and social cohesion. These findings suggest that Dynamic Biosinging may serve as a valuable artistic-ecological tool to support inner and outer renewal in biodynamic contexts.

Background and Aims

Modern lifestyles, shaped by mechanistic thinking, increasingly separate human beings from the web of natural rhythms, leading to disruptions in both ecological balance and human wellbeing (Capra, 2002; Capra & Luisi, 2014). This fragmentation is particularly evident in how individuals relate to their own voice and breath—two intrinsic, yet often neglected, rhythms of life. Inspired by biodynamic principles, Goetheanism observation, and therapeutic singing traditions, Dynamic Biosinging was developed to support the reintegration of human beings with the greater rhythms of the Earth and cosmos. The aim of this research is to explore how artisticecological singing practices can foster deeper ecological awareness, vitality, and social engagement among practitioners of biodynamic agriculture and education. This study specifically seeks to document the experiential impacts of Dynamic Biosinging on individuals and groups, and to investigate its potential as a method for ecological regeneration through human participation.

Methods

The research followed a qualitative approach grounded in participant observation, experiential immersion, and narrative inquiry. Between 2020 and 2024, workshops, retreats, and group sessions were conducted in rural and urban settings across Brazil, Argentina, Chile, Peru, and several European countries. Participants included farmers, educators, musicians, and therapists engaged in biodynamic or regenerative practices. Each session integrated vocal exercises, breath work, gesture and movement inspired by eurhythmy, and contemplative observation of nature and celestial cycles. Data was collected through pre- and post-activity interviews, reflective writing, and audiovisual documentation. The collected material was analysed thematically, identifying recurring patterns in participants' experiences, transformations, and challenges. Particular attention was given to the embodied relationship with time, place, and inner voice, as perceived during the process.

Results and Discussion

The results reveal that participants experienced increased inner calm, enhanced breathing, a renewed sense of connection with nature, and improved group cohesion. Many reported a deeper awareness of the rhythmicity of life and a sense of belonging to a larger cosmic order. For farmers and land workers, the method encouraged more attentive and reverent practices in their relationship to soil, plants, and animals. Several participants noted emotional release, expanded creativity, and a stronger capacity for listening—to themselves, others, and the environment. The findings align with core insights of anthroposophical and biodynamic thinking, especially regarding the formative forces in sound and rhythm such as "Eurythmy as Visible Speech" (Rudolf Steiner, 1924). At the same time, challenges emerged, particularly regarding initial resistance to vocal expression and the integration of subtle perceptions into daily routines. These indicate the need for a gradual, trust-based pedagogical approach. Overall, Dynamic Biosinging appears to offer a valuable complement to biodynamic practice, promoting both individual healing and communal resonance with living rhythms.

Conclusions

Dynamic Biosinging offers a creative and ecological approach to reconnect human beings with cosmic and earthly rhythms. As a practice rooted in artistic, spiritual, and biodynamic foundations, it supports vitality, awareness, and cooperation—key elements in the renewal of agriculture and community life. This research highlights the method's potential as a therapeutic and pedagogical tool within the biodynamic movement and invites further exploration into how voice and sound can foster regeneration, not only of individuals, but of the living landscapes they inhabit.

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11.2 Element concentration changes in fungi and plant species

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Abstract

During the last and the beginning of the current century changes of element concentration in living plants, fungi and bacteria were reported by several researchers. However, the phenomenon of the so-called biological transmutation remains unclear since its mode of action is not yet understood and not establishable using the current models in physics. Therefore, we measured the potential differences in element concentration during the growth phase of living organisms. Our results indicated that changes in element concentration may occur in fungi and plants.

Background and Aims

Research on a potential change of the concentration of chemical elements in living organisms during their growth period dates back to the 18th century. During the 20th century, Hauschka (1942), Baranger (1960), Kervran (1972), Biberian (2015), and others, observed varying element concentrations in fungi, plants, animals and humans. However, peer-reviewed published research on the change of chemical element concentrations within living organisms in closed systems has been rare in the last decade. An exception is the work of Vysotskii (2015), describing the potential of bacterial consortia to reduce the radioactivity of Caesium-137 by transmuting it to Barium-138. In our current project, we are investigating the phenomenon in baker's yeast (*Saccharomyces cerevisiae*) and garden cress (*Lepidium sativum*).

Methods

The organisms S. cerevisiae and L. sativum were allowed to grow in closed environments. A sample was taken before and after the growth phase. The samples were dissolved with an acidic digestion and the element concentrations of Ca, Fe, K, Mg, Mn, Na, P, and Zn were measured by means of inductively coupled plasma with optical emission spectroscopy (ICP-OES).

Results and Discussion

In several experiment series statistically significant differences and trends could be measured between ungrown and grown organisms. The significant differences in yeast were about one percent. The trends in garden cress reached 5-10%.

Conclusions

Our results indicate statistically significant differences in element concentration and therefore they support the hypothesis that biological transmutation takes place in living organisms. However, uncertainties remain and hence the results must be verified in additional experiments.

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11.3 Cosmic and Biodynamic Influences on Soil and Compost Quality

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Background and Aims

Based on the observations from the 2nd Conference, we aimed to achieve the optimal timing for plant growth with the application of BD preparations.

Based on the actions of the cosmos, this occurs in winter. We took soil samples to see the record of this moment in the chromas.

R. Steiner (1924), GA 237, 2nd Lecture

… as January (winter) comes to an end, the mineral substances of the earth have their greatest yearning to be crystallized, and the deeper one goes, the greater is that yearning to become crystallinely pure within the context of nature……

…at this point, plants are more than ever completely self-sufficient and exposed to mineral substances to the least extent; however, for some time before and after—especially before, just as the minerals are about to become crystalline—they radiate forces that are especially important for plant growth….

...What is captured from the cosmos from below must always be able to flow upwards…

…it is during this time that the greatest crystallization power, the greatest formative force for mineral substances, can develop within the Earth. This occurs in winter. It is when the Earth depends less on its own mineral masses and falls under the influence of the morphogenetic forces of the crystalline, forces that are found in the far reaches of the cosmos…

Methods

I found a sensitive method that expresses the farmer's process through the application of biodynamic preparations to the soil and their food.

The sensitive method used is Pfeiffer Chromatography:

Horizontal capillary dynamometer. Pfeifer was developed based on the biodynamic calendar and the annual rhythm of nature: month, day, time, and constellations (See Annex 1; SAMPLING PROTOCOL FOR Pfeiffer's HORIZONTAL DYNAMOLYSIS ANALYSIS)

A dilution table was respected to make the chromas, the running times in all the soil, compost and food samples, so that they are comparable (Table 1)

TABLA DE DILUCIONES Y DETALLES PARA SER USADOS EN CROMATOGRAFIA EN EL NODO PATAGONIA NORTE

Muestras	gramos ml	% Sosa dilución	Extracción con aguja	cambio de pabilo	Tiempos de giros			Tiempo dilución	Observación
Suelo	5	1	si	no	0	15	60	7,15 hs	seco, pulverizar
Compost	2	1	si	no	0	15	60	7,15 hs	seco, pulverizar
Bioles	10 ml	sin dilución	no	si	no				croma indirecto, con cambio de pabilo a los 2 cm, arraste con el 1 % hidroxido
Semillas	1	0,1	no	no	0	15		45 minutos	molido fino
Vegetales	4	0,1	si	no	0	40		2 hs	morterear, se usa jugo y pulpa
Fruta fresca	4	0,1	si	no	0	40		2 hs	morterear, se usa jugo y pulpa
Raices, Tuberculos	4	0,1	si	no	15	30		2 hs	morterear, se usa jugo y pulpa
Miel	2	0,1	si	no	o	30		1,20 hs	
Propóleo	2	0,1	si	no	0	30	70	2hs	
Frutos secos	1	0,1	no	no	0	15		45 minutos	molido fino
Especias	1	0,1	no	no	0	15		45 minutos	molido fino
kefir	10 ml	sin dilución	no	no	no			no	con arrastre hasta los dos cm, con hidroxido al 1% hasta los 6m
Vinagre	10 ml	sin dilución	no	no	no			no	croma indirecto
Vino	10 ml	sin dilución	no	no	no			no	croma indirecto
Aguas	10 ml	sin dilución	no	no	no			no	croma indirecto
Flores	1	0,1	si	no	0	30	70	2hs	
Hojas	2	0,1	si	no	0	30	70	2 hs	
									Ajustado en la práctica y armado de Cromas -Ing Evelyn Iglesias oct ' 2024

Samples were taken before and after each application.

The method for saving and identifying chromas for later scanning was established. The idea is to create a database for consultation by biodynamic farmers and others interested in the subject.

A record was made of the biography of each organization/farmer in relation to the cr

Results and Discussion

A- It was gratifying to hear the stories of the organization members during the chroma sampling; their changes in attitude, the harmony that existed, could be seen in the group, and their manifestation was also reflected in the chroma.

Chroma, as Norma Priemer, our teacher of sensitive methods, told us, reflects a process; it showed us a trace.

B-Sensitive methods record intentions and display them in different areas of the chroma. This method of recording intentions was conceived for areas where before-and-after sampling was conducted, without applying or spreading preparations, simply applying the farmer's intentions.

It was observed that the area of the farm NOT applied with preparations presented in the soil chromas, the same light features, the same integrated areas, the radial axes in the form of a feather, the volcanoes spilling humus similar to the chromas of the areas where preparations had been applied.

To challenge ourselves, we did it on two farms approximately 12 km apart, and the same thing was also recorded. The area where the first intention was made without application suffered a fire surrounding it. The fire did not penetrate, only scorching the sides of a group of trees. We have photos of how those trees sprouted, even with part of their bark burned, in a very vital way, surprising us once again.

Conclusions

The applications made in Christian Festivals have an effect on the soil, and also on the conscious Soul of the farmer and his environment , its manifestation observable in the chromas when analyzing the biography.

This allowed us to open our listening, to feel the value of Brotherhood properly understood, to see the Divinity hidden in the other, and to reach the spirit through thought and thereby achieve a spiritual Experience.

Admiration for the work done by others.

A community of biodynamic farmers is in the making, where research work is everyone's responsibility.

The research was a way to support farmers, allowing them to verify, through the records kept by the chromas, what their intentional work was achieving for the soil and their food.

To do this we put together a Power Point to show the chromas.

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Biodynamic Calendars 2019 to 2025

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“Anthroposophy is a path of knowledge, understanding that would like to lead the spiritual in the Human being towards the spiritual in the Universe” R. Steiner

"The task of agriculture is to transform mobile solar energy, light energy, into the inner force of food for human beings. Light is the basic raw material of the agricultural industry."

ANNEX 1: SAMPLING PROTOCOL FOR Pfeiffer's HORIZONTAL DYNAMOLYSIS ANALYSIS

SOIL SAMPLES

- Reconnaissance tasks, comprehensive diagnosis of the plot.
- Biography of the farmer, his family and the farm organization, age and commitment of the people who perform the tasks, applications of biodynamic treatments (dates and times), and everything that allows us to understand the history of the place over the last 5 years.
- Photographic documentation of the phenomenology, profile, vegetation cover and cultivation on that soil.
- During extraction, document odor, color change, humidity, microfauna, roots (distribution, abundance and/or lack of them), the structure and type of aggregates they present.
- Drainage, irrigation, frequency, periods of drought, flooding, high water tables, presence and aroma of mushrooms.
- Date of the last irrigation close to the sample collection
- Plant biodiversity, crop associations, presence of bees, birds, rodents, animal grazing. Natural grassland.
- Crop rotation
- Livestock management, with crop residues, fallow land, etc.
- Historical and current information related to chemical inputs, foliar fertilizers, bioles, contributions of uncomposted guano, burning or fires within and around the organization, etc.

Soil sample extraction:

In the first sampling, a sample is taken from the zero point, a place where no cultural intervention or applications were ever carried out, e.g.: a fence corner or a place indicated by the farmer.

Depth, 30 cm, except in cases where greater depth is indicated.

Identification: each sample must have the date, time, farmer, and location where it was taken within the organization, according to SPG's sketch.

Collect on the day of the ROOT, during the waning moon, when the earth inhales after 3 p.m. Approximately 200 to 300 grams.

COMPOST SAMPLES

- Farmer's biography, materials used and their origin; check if the six biodynamic preparations were applied for closure; humidity; if there are periods of drought; if there are high temperatures above 60 degrees Celsius (approximately for how long); if there is a lack of cover; and if the area is open, with or without protection.
- Date of completion of production, if there were any subsequent applications of preparations or turning.

Extraction of the compost sample:

It is obtained from the middle section, between 30 and 50 cm deep, after uncovering it and removing the covering. Indicate any details on the label that might be of interest, such as excessive dryness, unpleasant odor, excessive moisture, etc.

Leave it covered again in the compost, after removing the 300 gram sample.

FOOD SAMPLES

Biography of the farmer, the production of these foods, and their processing if they were processed. Application of biodynamic preparations during their development and ripening.

Depending on the type of fruit and food, we must consider the right time for harvesting or processing. To show us their best properties and quality, these are evident in the images.

Extraction of the food sample:

Produced under the surface, remove ROOT day after 15 hours , descending moon

Produced on the surface, remove the FRUIT day, in the morning when the earth exhales. On the ascending moon.

Seeds, FRUIT day: In the morning, remove from the middle of the ear or corn cob. This requires at least three seeds. To grind 15 grams, remove during the ascending moon.

Honey, FRUIT day, ascending moon in the morning

Flowers, Pollen on a FLOWER day, minimum 3 grams. Rising moon tomorrow.

Honeycomb. Wax day of ROOT at least 10 grams. Descending moon

Leaves and stem, LEAF day, ascending moon tomorrow, minimum 9 leaves from the center, bottom and top of the plants and/or trees.

KEEP IN MIND:

- do not take samples on a Node or eclipse day.
- in new bags without contact with bad odors or chemicals.
- use clean tools for extraction.
- contamination-free gloves.
- always label everything, avoid getting it wet and use ink that doesn't run.
- -processed foods, removing them at each stage of the process and the final product.
- Tags: date, time, farmer, location, highlighting any details worth considering, for example, a weather event or the application of a preparation as an offering for the Three Kings. Noteworthy features such as a mushroomy smell, compacted soil, excessive worms, etc.

12. The Ecosystem and Environment

12.1 Biodynamic Agriculture and Autonomy: Sustainability Analysis of Soil Management

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Abstract

Biodynamic agriculture represents an agricultural approach that integrates ecological and spiritual principles to promote sustainability and soil and plant health. This study focused on the JANUS project, located in the Patagonian Alto Valle, Argentina, which implements biodynamic practices to autonomously manage soil fertility. Using the LUME method, the study evaluated how JANUS minimizes dependence on external inputs through composting and biodynamic preparations. Results showed that JANUS exhibits a higher Soil Quality Index compared to conventional and organic systems, characterized by its high organic matter content and microbial diversity. The achieved autonomy reduces vulnerability to market fluctuations and ensures resilience against environmental stresses. This study underscores the importance of Biodynamic Agriculture in promoting sustainable and autonomous agricultural systems.

Background and Objectives

Biodynamic Agriculture creates a self-sustaining and balanced agricultural organism by working harmoniously with nature (Dussi et al., 2020; Koepf et al., 1983; Vargas et al., 2020). This configuration is based on the conservation of the vitality of the environment and its productive capacity, through the dynamic balance between nutrients and energy flows, minimizing external inputs and outputs to the agroecosystem (Steiner, 2010). In this way, it can significantly influence the sustainability of the agricultural organism in relation to soil fertility management.

Thus, this study aimed to determine whether the implementation of biodynamic practices contributes to improving soil fertility and promoting agricultural autonomy.

To this end, data from previously conducted physico-chemical analyses on soils under conventional, organic, and biodynamic management were used, and, focusing on the biodynamic agricultural organism in question, the soil fertility indicators present in the Autonomy Index of the LUME method were examined.

Methodology

The study was carried out on a biodynamic farm, JANUS Proyecto Rural Integrador, located in Contralmirante Cordero, in the province of Río Negro, Patagonia, Argentina (Figure 1). This farm has been developed on the foundations of Biodynamic Agriculture for the past 15 years, since its owners purchased an abandoned conventional farm (Janus, 2025).

Figure 1 - Location of the JANUS agricultural organism

Source: Authors' personal collection, adapted from a printout made using the Google Maps tool.

Thus, to address the proposed objective, three main qualities of the soil were considered: chemical, physical, and biological. The data for this analysis were obtained from research conducted by Buganem (2017). The author carried out this study on three farms located in different towns in the provinces of Neuquén and Río Negro, in the Alto Valle region, with JANUS being one of them. For this, she used descriptive and variance analyses to process the data, as well as various indexes to characterize the studied variables.

On the other hand, we used the analytical method of Petersen et al. (2025), the LUME, to investigate the soil fertility parameters at JANUS. This analysis focused on input management strategies necessary to maintain the regeneration of soil fertility. Data collection was carried out through questionnaires and direct and participatory observation.

Results and Discussion

Regarding the physico-chemical characteristics of the soil, the study compared a biodynamic farm, an organic farm, and a conventional farm (Figure 2): Regarding the physico-chemical characteristics of the soil, the study compared a biodynamic farm, an organic farm, and a conventional farm (Figure 2):

Figure 2 – Comparison of the physico-chemical characteristics of the soils of the studied farms

Fruit Orchards of the Alto Valle of Río Negro and Neuquén			
Characteristic	**Biodynamic**	**Organic**	**Conventional**
Texture	Loam-Silt	Loam-Silt	Loamy-Sand
pH	7.86	7.60	6.55
Conductivity (dS/m)	0.60	1.00	0.30
Organic Matter (%)	4.60	3.21	2.63
Organic Carbon	2.68	1.87	1.53

Source: Adapted from Buganem (2017)

As can be seen, higher values of organic matter and organic carbon fixation were obtained in the biodynamic farm. This has a major influence on the biological characteristics of the soil.

Buganem (2017) also analyzed the richness and diversity of functional groups of microorganisms, divided into three groups: phosphorus solubilizers, nitrogen fixers, and cellulolytic organisms.

JANUS showed a greater number of total bacterial morphotypes, phosphorus-solubilizing microorganisms, and cellulolytic microorganisms, therefore, a greater specific richness.

We analyzed this information using the LUME method, investigating the practices, origin, and flow (Figure 3) of the inputs consumed at JANUS.

JANUS adopts the integration of practices such as crop rotation and the use of the biodynamic calendar. Thus, its fertility is managed in harmony with natural and astronomical rhythms.

Moreover, the impetus to promote plant and soil health through planned or spontaneous plant and animal diversity was verified, which reduces the need for external inputs to the agroecosystem.

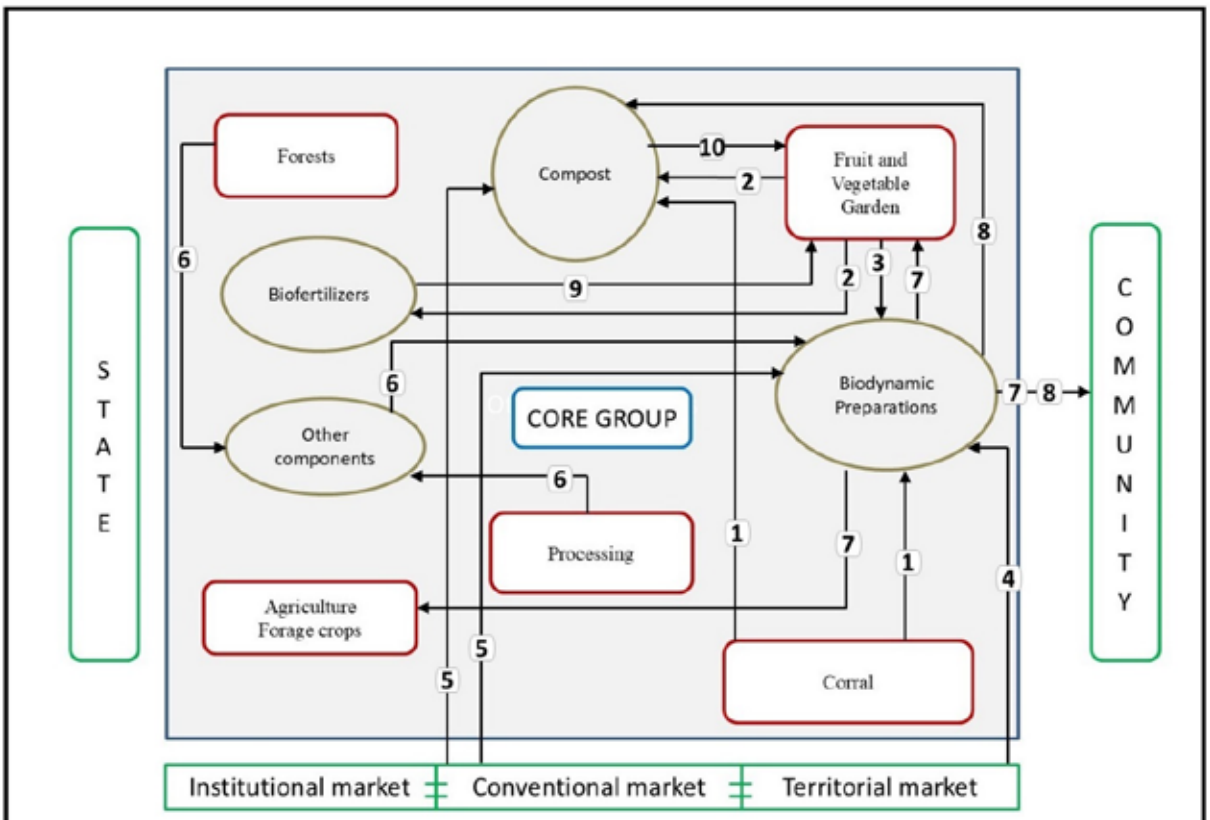
A complex organization of inputs is also observed, resulting in low dependence on external inputs, which are only of mineral and animal origin, necessary for the production of biodynamic preparations.

Thus, in terms of autonomy, JANUS's biodynamic management ensures that most of the nutrients are supplied from within the agricultural organism itself, reducing its vulnerability to market fluctuations, inflation, and input scarcity.

Conclusions

In conclusion, the results of the soil analysis at JANUS, combined with the input flow from the agroecological analysis method LUME, demonstrate a management approach whose practices generate excellent biological qualities in the soil while increasing its fertility, promoting the long-term sustainability of the agricultural organism, and autonomy in its maintenance. The biodynamic worldview, which sees the farm as a living organism, fostered the promotion of regenerative practices that strengthened the health and resilience of the agricultural organism in the face of environmental stresses, while reducing the use of external inputs, demonstrating the potential of Biodynamic Agriculture to design healthy, resilient, and autonomous agroecosystems.

Figure 3 - Input flow at JANUS



Legend: 1 – Manure; 2 – Plant residues (green and dry); **3 – Plants used in Biodynamic Preparations:** Achillea millefolium; Matricaria chamomilla; Urtica dioica; Bark of Quercus robur; Taraxacum officinale; Valeriana officinalis; Equisetum arvense; **4 – Animal-derived inputs for biodynamic preparations:** Horns; Deer bladder; Bovine intestine and mesentery; Skull of a domestic animal; **5 – Mineral inputs:** Silica; Basalt; Diatomaceous earth**; 6 – Other inputs:** Eggshells; Wood ash; **7 – Biodynamic Preparations:** 500, 501, 508 – Fladen; **8 – Compost Preparations:** 502 to 507**; 9 – Infusions, Decoctions, and Macerations; 10 – Compost.**

Source: Authors

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12.2 Cloud Forest Recovery: Endemic Species, Agroforestry and Scientific Inquiry of Emerging Plants

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Abstract

Cloud forests in the Western Hemisphere, 90% deforested since the 1970s, are facing virtual extinction by 2060. The research focuses on agro-native forestry for cloud forest restoration on lands eroded by cattle farming, a principal cause of cloud forest destruction. Only native species are planted, prioritizing at risk of extinction and edible or medicinal tree species. The project incorporates the biodynamic concept of a self-sustaining ecosystem to promote forest recovery. Initial site evaluations included orthophotography mapping of pilot plot areas and identification of native and edible species for planting. The first three years of data show that reforestation exclusively with endemic species accelerates cloud forest recovery vis-a-vis rewilding, with abundant emerging growth and positive wildlife response. Results suggest a symbiotic relationship between planted trees and emerging growth, likely involving arbuscular mycorrhizal fungi, which together with experimental mulching practices accelerate suppression of introduced pasture grasses.

Background and Aims

Cloud Forest Organics (CFO) is a reforestation site in the Andean Amazon of Ecuador. CFO also serves as a buffer zone to the adjacent primary forest of the Cayambe Coca National Park. Previously owned by a cattle rancher, in 2012 the CFO 170-acre farm was 52 percent deforested, with 48 percent of primary and secondary forest remaining.

The project site is home to Crystal Frog, an ecologically constructed research center whose aim is developing methodologies and hosting researchers for cloud forest recovery. This includes best practices for propagating, planting and stewarding endemic species, while testing and experimenting with culinary, cosmetic and medicinal potential of forest-borne foods and ingredients.

CFO is a self-sustaining ecosystem with no external fertilizers, trees or crops. Endemic trees with nutritional value are planted without restricting emerging wild flora and fauna, to respect the natural symbiosis of wild forests while providing opportunities from productive native species (Andres et al., 2023; Dorner Jeanette, 2002).The hope is to offer verifiable alternatives to agroforestry models that rely on non-native commercial species such as coffee.

Methods

The study contemplates five test plots. Plots 1 and 2 are agro-native forestry plots that include trees with nutritional potential and species at risk of extinction. Plot 3 is a rewilding control plot with no planting or intervention. Plots 4 and 5 are iterations recently planted based on observations from Plots 1 and 2 over the last 3 years. More information on methods will be available in the upcoming publication "Reforestation Strategies Applied to Montane Cloud Forest: Key Findings and Techniques." - (Maldonado Andrea, Leon Craig, Torres Vicente).

This study is carried out in stages, some done simultaneously:

1. Understanding of site: topographic, hydrological, and plant coverage mapping, soil sampling, water pH testing, quick survey of existing plant species.
2. Identification of native, at risk of extinction and edible species: *Erythrina edulis, Juglans neotropica, Pouteria sp.1 and sp.2, Ceroxylon sp., Cedrela sp.1 and sp.2, Ocotea sp., Hieronyma duquei, Nectandra membranacea, Croton lechleri, Myrcianthes sp., Persea sp., Guarea kuntiana.*
3. Planting: fertilization using compost and organic matter from the forest.
4. Maintenance: invasive honey grass controlled using mulch and mechanical tools.
5. Monitored variables: height (cm) and diameter (mm).
6. Scientific visits and field cameras to study flora and fauna.
7. Field and meteorological data are collected periodically.
8. Observation and culinary experimentation with cloud forest plant species.
9. Analysis: using data collected over 36 months, analyzed using Excel as data encoder and Origin software for data analysis of mortality and graphing.
10. The literature review described in this document was conducted using scientific article databases.

Results and Discussion

Initial results suggest that fertilization may be unnecessary or even counterproductive, as excessive growth in some species (e.g., *Erythrina edulis, Croton lechleri*) caused stem splitting. Regeneration of species damaged by wildlife is tentatively linked to mycorrhizal activity based on (Haug et al., 2010). Notably, *Juglans neotropica*, *Ceroxylon sp.*, and *Cedrela sp.* showed the best performance in growth and resilience. (Maldonado et al., 2025)

Test Plots 1 and 2 exhibit a high abundance of emerging edible and medicinal plants such as *Clinopodium sp.* (sunfo), *Solanum quitoense et al.* (naranjilla), *Chilca*, *Nasturtium sp.* (watercress), *Rumex sp.* (bitter dock), and *Piper aduncum* (spiked pepper). This spontaneous regeneration suggests a possible symbiotic mechanism between planted species, emerging flora, and soil fungi. Some edible species, like *naranjilla*, emerged spontaneously, raising questions about ecological memory, forest intelligence (Greenhalgh, 2022) and the role of wildlife in forest recovery according to (Estrada-Villegas et al., 2023).

Height Growth Rate of Trees in PLOT #1				
Data sampling start:29/07/2021 end:27/06/2024				
Scientific Name	Common name	Average Seedling Height (cm)		Growth Percentage (2021–2024)
		2021	2024	
Erytrina edulis	Poroton	19,5	91,26	368
Pouteria sp.	Lucma	21,74	107,22	393
Juglans neotropica	Nogal	27	208,07	671
Croton lechleri	Sangre de drago	35	589,8	1585
Ceroxylon sp.	Palma de cera	8,75	93	963
N. membranacea	Canelo	18	81	350
Myrcianthes sp	Arrayan	17,5	36	106
	Overall Average	22	195	634

Table 1. Data of height growth rate from Plot 1

Wildlife observations using field cameras show increased activity, as shown in Figure 1: *Dasyprocta fuliginosa* (agoutis) and *Cuniculus taczanowskii* (mountain pacas) interact with planted trees, feeding on bark with medicinal properties, suggesting wildlife is integrated into the recovery process. In contrast, natural regeneration in the control plot progressed more slowly, with vegetation advancing primarily from the perimeter toward the center.

Height Growth Rate of Trees in PLOT #2				
Data sampling start:23/07/2021 end:27/06/2024				
Scientific Name	Common name	Average Seedling Height (cm)		Growth Percentage (2021–2024)
		2021	2024	
Erytrina edulis	Poroton	19	127	568
Pouteria sp.	Lucma	18	94	422
Juglans neotropica	Nogal	23	253	100
Hyronimia duquei	Motilon	42	239	469
Cedrela sp.	Cedro rojo	25	315	1160
Croton lechleri	Sangre de drago	24	538	2142
Ceroxylon sp.	Palma de cera	29	135	366
G. kunthiana	Logmillo	21	39	86
Ocotea sp.	Aguacatillo	27	156	478
Cedrela sp.	Cedro blanco	32	332	938
N. membranacea	Canelo	22	86	291
	Overall Average	26	210	720

Table 2. Data growth rate from Plot 2.

Growth patterns varied by species, supporting the need to respect different development timelines shown in Tables 1 and 2, where the overall growth rate differs for each species. For instance, *Croton lechleri* shows a rate over 2000%, or 20 times its initial transplant height, in 36 months. Mycorrhizal fungi, particularly arbuscular types, may play a key role, supported

by literature (Tawaraya & Turjaman, 2014) and initial DNA analysis of soil mycelium in 6 distinct test plots such as is reported by (Fritz Jürgen, 2025).

Figura 1. 1A, 1B, 1C from Plot 1. 2A,2B,2C from Plot 2. (1A. *Dasyprocta fuliginosa* - Black agouti) (1B. *Nasua nasua* - Amazonian coatí) (1C. *Herpaiulurus yagouaroundi* - Jaguarundi) (2A. *Mazama rufina* - Red brocket deer) (2B. *Eira barbara* - Tayra) (2C. *Cuniculus taczanowskii* - Mountain paca/Guanta). (Photos: Dario Morales, 2025)

Finally, the project does not follow traditional agroforestry layering as the study (Webber Simone, 2022) suggests. Instead, a simplified, low-intervention model is used: selected native trees are planted, spontaneous growth is encouraged, and promising species are studied and sometimes propagated. This agro-native forestry model may offer a biodiversity-driven alternative for restoring degraded cloud forest ecosystems (Msikula, 2024).

Conclusion

Cloud forests, now 90% gone, are facing extinction by 2060. The study seeks to find and develop alternatives to current bioeconomy models that prioritize commercial crops like coffee but fail to respect wildlife habitats or support cloud forest recovery. The research focuses on cloud forest restoration through agroforestry test plots of only native species, aiming to develop replicable systems for the Andean Amazon and globally. Early findings show low mortality with varied species-dependent growth rates, significant emerging plant growth, and a positive wildlife response. Data also suggests that endemic arbuscular fungi activity is a factor influencing forest growth. Moreover, data shows that unassisted reforestation, or rewilding, is slower and lacks key species. An agro-native forestry system where no external crops are introduced, consistent with Goethe's and Steiner's core philosophical foundation of a self-sustaining ecosystem, could lead to a deeper understanding and new applications of biodynamic agriculture that support cloud forest recovery.

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12.3 Biodynamic vs. Monoculture Farming: A Comparative Study in Macadamia Cultivation

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Abstract

Preliminary results from a baseline study compared two contrasting Macadamia integrifolia agroecosystems in Quindío, Colombia: a biodynamic-regenerative model (Sorrento Farm) and a conventional monoculture (El Alba Farm). Six randomized blocks were established per farm, with georeferenced plots for trees, shrubs, and herbs. Weed biodiversity was analyzed using ANOVA, multiple range tests, and cluster analysis, alongside soil quality parameters such as bulk density, infiltration rate, aggregate stability, weed biomass, and root development. The biodynamic system showed higher weed species richness (42 vs. 5), greater biomass, and better root growth, which correlated with improved soil quality—lower bulk density and higher infiltration rates. These initial findings suggest that regenerative biodynamic practices enhance plant diversity and soil health, supporting sustainable macadamia production.

Background and Aims

Conventional monoculture agriculture often leads to biodiversity loss and soil degradation (Oakley & Bicknell, 2022), while regenerative models can improve ecological conditions (Furey et al., 2021). Studies show that biodynamic farms typically achieve higher soil quality, aggregation, and ecosystem functionality compared to conventional systems, despite slightly lower yields (Reganold, 1995; Massaccesi et al., 2020; Morrison-Whittle et al., 2017). Biodynamic agriculture, as the oldest organic certification system (Paull & Hennig, 2020), uses composting, green manures, and preparations that enhance soil properties and biodiversity (Mäder et al., 2002; Rodas-Gaitan et al., 2022). Root diversity, organic matter decomposition, and soil aggregation are key for healthy agroecosystems (Gould et al., 2016; Primavesi, 1984). Conservation practices and vegetative cover also help sequester carbon and build soil life (Massaccesi et al., 2020; Kaye & Quemada, 2017). This study aims to assess how two macadamia production models differentially impact agroecosystem biodiversity and soil quality.

Methods

The study was conducted on two macadamia farms in Quindío, Colombia: Sorrento (biodynamic, polycultural) and Del Alba (conventional, monocultural). Both sites share similar Andisol soils, climate, and biome, enabling robust comparison. Six randomized blocks were established per farm. Plots of 10×10 m (trees), 5×5 m (shrubs), and 2×2 m (herbs) were georeferenced to record plant diversity and structure. Biodiversity was quantified through species inventories in all plots, following protocols used in previous agroecosystem studies (Massaccesi et al., 2020; Morrison-Whittle et al., 2017).

Weed and root biomass were measured using standard methods for biomass assessment (FAO, 2013). Soil quality was evaluated by measuring bulk density, infiltration rate, and aggregate stability, following USDA (2019) protocols. Georeferenced data and orthophoto-mosaics (acquired via drone and GPS) enabled spatial analysis of plant and landscape structure.

For statistical analysis, normality and homoscedasticity were checked. When assumptions were violated, non-parametric tests (Mann-Whitney U, Kruskal-Wallis) were applied. For soil variables that met assumptions, ANOVA and Tukey HSD were used. Multivariate analysis of community composition was conducted via Bray–Curtis dissimilarity, hierarchical clustering (UPGMA), and PERMANOVA using adonis2() in vegan (Oksanen et al., 2023). All analyses were conducted in R 4.2.2.

Results and Discussion

This preliminary study compared two contrasting macadamia farms to explore the effects of management on weed biodiversity and soil quality. Sorrento Farm (biodynamic-regenerative) consistently showed higher species richness and Shannon diversity (median richness = 4; H’ = 0.66) than Del Alba (conventional; median richness = 3; H’ = 0.00). Cluster analysis confirmed greater diversity and balanced species cohabitation in Sorrento, with no single species dominating, indicating complex and stable plant communities. In contrast, Del Alba’s low diversity was compensated by a higher abundance of a few species occupying large areas, reflecting ecosystem simplification under monoculture.

Soil quality indicators also revealed important differences. Sorrento had lower bulk density (<1.2 g/cm³), faster infiltration (mean 3.8 min), greater herbaceous biomass (1630 g/m²), and longer root systems (median 25 cm), all statistically significant, compared to Del Alba (bulk density 1.3 g/cm³, infiltration 4.4 min, biomass 490 g/m², root length 15 cm). These findings align with international studies (Massaccesi et al., 2020; Mia et al., 2021) that associate regenerative and biodynamic practices with improved soil structure, higher carbon inputs, and greater microbial and invertebrate activity.

Both farms showed similar, moderately high aggregate stability, likely due to their Andisol soil type. However, Del Alba’s greater compaction and reduced infiltration suggest negative impacts from mechanized weeding and low weed cover. Notably, Sorrento’s use of rotational grazing did not result in higher compaction, likely due to diverse ground cover and integrated

management. These results support the hypothesis that diversified, regenerative management can sustain higher biodiversity and soil quality—even under similar soil and climatic conditions.

These findings are preliminary, based on only two farms, and broader studies are needed to validate and generalize these trends.

Conclusions

This preliminary study suggests that macadamia cultivation under biodynamic-regenerative management enhances soil quality, biodiversity, and system complexity compared to monoculture. Sorrento Farm showed higher species richness, greater root and biomass development, and improved soil structure. Conversely, Del Alba's conventional practices resulted in lower biodiversity and poorer soil indicators. These findings highlight the importance of diversified management for sustainable macadamia production. However, as only two farms were studied, further research across more sites is needed to validate and generalize these results.

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13. The Farm Organism

13.1 Four Dramatic UK Biodynamic Experiences

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Abstract

Soil phosphorus, mammal pests, a dying cow, and farm slurry and their lessons for the research community. Dr Steiner's Agriculture Course makes up just a small percentage of his lectures yet offers the foundation for a dynamic and evolving practice. This presentation explores four UK case studies where biodynamics was deepened by engaging with Steiner's broader work—medicine, eurythmy, cosmology, and more. Practical results include improved soil health, successful pest management, animal healing, and waste detoxification. These examples suggest that biodynamics can grow through creative and thoughtful cross-fertilisation with the wider body of anthroposophy.

The second part of this Talk covers the lessons for the research community from these biodynamic experiences in the UK.

13.2 Finding the Individuality of Your Farm

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Abstract

In the agricultural course Rudolf Steiner mentioned several times the term "individuality" in connection with a farm. There have often been questions about how to understand this expression. To find out about the characteristics of the individuality of a farm the farmers should do research themselves, on their own farms. We as researchers can only help to do so by asking questions and stimulating, collecting, and comparing observations, also by bringing them into the picture. For this purpose, we created a so-called "journal - farm individuality" which is a kind of a diary, structured like a calendar. Each month is dedicated to one subject, such as the soil, the history of the farm, the animals, the relations etc. and each month is divided into four weeks which are dedicated to the aspects: "inspiration", "observation", "reflection", and "action". The participating farmers are asked to dedicate at least one hour per week during one year to fill that diary. They get paid for that work. 39 farms and 51 farmers are participating. This work started within a workshop in September 2024. During that year four online-meetings are regularly taking place to exchange on the subjects and discuss on how the work is developing. In September 2025, there will be a collection of the outcomes during another workshop with all participating farmers. As a second step, the diaries will be analyzed with the feedback to harvest the insights for developing a second, further developed diary for educational publication purposes. Additionally, the research method of utilizing such a “diary” for investigating the farm individuality will be assessed.

Background and Aims

That study aims at finding ways to support farmers in their personal in-depth research for the individuality of their farm and so, to perceive the holistic character of their agricultural practice. The research is at an early stage. The project team developed the research journal in early 2024 and presented it in a workshop September 2024. Since then the participating farmers have worked individually on the site of their farms. The project team accompanies them through online meetings and some in-person visits.

Methods

The method is based on a guided observation and reflection diary, filled individually on 39 participating farms. Each month is dedicated to a subject. Each week of the month contains a suggestion for exploring the subject from a particular perspective: inspiration, observation, reflection, and action. After one year, the handwritten journals will be analysed by the project team; the research method of using such a journal for investigating a farm's individuality will be assessed.

Results and Discussion

As the whole project, its research method and approach are process-based and in constant development, the outcome of this research will be measured in a collection of personal experiences. The question will be whether it is possible to find generalisable assumptions or methodological approaches which can be applied in any possible situation. Our project looks more at multiple ways to enhance personal perception, and sensibilise farmers for the concrete impact this might have on their agricultural practice. The most important results will contain the farmer's reactions and reflections to that work of one year: did they get closer to their farm individuality than before? Is this method reasonable and functional within their daily practice? As this project reached already in its very early state a wide audience and received a lot of positive feedback, we realised how important it is for farmers to talk about their relationship to their farm and all it includes.

Conclusions

Depending on the reactions of the participating farmers we will ameliorate or change the idea of the diary to detect the characteristics of a farm's individuality. If that concept is successful, we will write an update and recommend it to farmers in all countries.

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