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**POST GRADUATION PROGRAM IN INTERDISCIPLINARY STUDIES ON AGROECOLOGY, WATER AND RESILIENCE**


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# EXPLORING VITALITY IN SUSTAINABLE AGRICULTURE: THE EFFECTIVENESS OF A MULTI-METHOD APPROACH ON STRAWBERRY CROP SYSTEMS

**Lages, BR**

**Coventry, UK**

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Thesis presented to the post-graduation programs of Plant Sciences from Santa Catarina State University and Interdisciplinary Studies on Agroecology, Water and Resilience from Coventry University as partial requirement to obtain the title of PhD on Plant Sciences and Interdisciplinary Studies on Agroecology, Water and Resilience.

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# Certificate of Ethical Approval

Applicant:

Leonardo Faedo

Project Title:

homeopathy and biodynamic: understanding challenges & identifying innovations in agriculture.

This is to certify that the above named applicant has completed the Coventry University Ethical Approval process and their project has been confirmed and approved as Medium Risk

Date of approval:

18 August 2020

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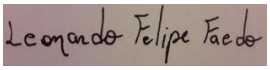
|  | **17/08/2022** |

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*Viva, on the 19th of October de 2022.*

**To the primordial consciousness**

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## ABSTRACT

Agriculture is among the most important activities for humanity to thrive. However, the mainstream practices performed in agriculture today stem from Cartesian and mechanistic ontology and have had deleterious effects on ecosystems by significantly reducing biodiversity and contaminating soil and water with soluble fertilizers and pesticides. This approach to agriculture has ultimately threatened farmers' livelihood and food security in general. Agroecology offers a holistic model of agriculture based on biodiverse interactions, methods, and the use of non-toxic products to stimulate ecosystems' homeostasis to eliminate the dependence of pesticides and soluble fertilizers. This study evaluates the potential use of Homeopathy and dynamized high dilutions (DHDs) as plant biostimulators to be used in the agriculture, to substitute to the use of pesticides and synthetic fertilizers. It explores how a deeper understanding of the vitality of the agroecosystem can contribute to farming and research strategies towards sustainability. The thesis is presented in 6 complementary chapters. Chapter 1: General introduction; Chapter 2: A systematic review identifies and clusters data on the topic of vitality in agricultural research in the last 20 years; Chapter 3: Presents the results of a two year agronomical experiment testing DHDs as biostimulator on strawberries plants (*Fragaria* × *ananassa*); Chapter 4: It presents and explore the data surveyed from farmers who use Homeopathy and DHDs and, examining the impact that the method has had on their farming approach; Chapter 5: Discuss the results from the interviews with researchers, farmers and advisors who work with Homeopathy and dynamized high dilutions as a means to promote agroecosystem vitality. Chapter 6: General conclusion. The systematic review identified 21 scientific terms addressing vitality in agriculture and verified an increase of 80 % in the number of related publications since 2017. China, India, France, Germany, Poland, and Brazil were the countries with multiple publications on the subject. The results of the agronomical experiments testing DHDs as plant bio-stimulator on *Fragaria* × *ananassa* show that dynamized high dilutions (DHDs) stimulated crop production, plant growth, and development and resistance to pests and disease without the need for pesticides. Furthermore, the survey revealed that farmers perceived improvements in crop quality (80%), livestock growth (40%), ecosystem development (77%) and human health (67%). In addition, farmers reported reduced production costs (49%) and higher yields (46%) when using Homeopathy and dynamized high dilutions in their agroecosystems. Additionally, the interviews exposed how different professional

backgrounds can benefit from learning about, and using, Homeopathy. More importantly, it evidences the contributions of Homeopathy and dynamized high dilutions as scientific subject with significant transdisciplinary potential. The emerging shared dialogues help spread and create new forms of knowledge aligned with the interests of sustainability and social equity. Thus, the use of Homeopathy and dynamized high dilutions constitutes a viable strategy for promoting the vitality of agroecosystems and for successfully advancing agroecological farming and research.

**KEY WORDS:** Agroecology; Homeopathy; Dynamized High Dilutions; Vitality; *Fragaria* × *ananassa*; Interdisciplinarity

# 1. GENERAL INTRODUCTION

This section will introduce the thematic explored in this research. In addition, the philosophical and methodological approaches used in this research will also be presented. This chapter will set the bases for comprehension of the following chapters, which individually will specifically address one or more of the research questions.

## 1.1. Exploring innovations towards holistic agriculture

Agriculture is one of the most important activities for the humanity to thrive and recently, environmental, social and economic issues worldwide have been encouraging the review of paradigms in agriculture (WRIGHT, 2021). Such changes are reflected in the search for innovative farming methods as well as the focus on multidisciplinary dialogue to produce food whilst protecting the environment, calling up for change on the worldview and the way human societies interact with the ecosystem (GLISSMAN, 2014).

The word agriculture, according to Mazoyer and Roudart, (2010), is derived from the Latin *agricultūra*, from *ager* 'field' and *cultūra* "culture/cultivation". As the authors comment, more than its literal definition, the cultivation of the land reflects how humans changed their relationship with nature, switching it from one that was directed by nature to one where it is cultivated by man-nature relationship. However, the nature of this relationship is be framed according to different ontologies.

The current approach used in mainstream agriculture is the heritage of Cartesian and mechanistic ontology, which focus on understanding the parts rather the whole (BANCHETTI-ROBINO, 2011). Descartes (1637) proposed the reductionist approach - which consists of breaking down the observable reality into their minimum parts and arranging them in a logical order, to understand it – serving as the base for the forthcoming industrial scientific revolution which ultimately would assist the Industrial Revolution (WINNING, 2020). Within this understanding, any agroecosystem should be torn apart, and its components dealt independently. Interestingly, Lakatos (1978) summarized the Cartesian approach to nature as a fixed universe composed of elements (the atoms of atomism) that preserve their identity regardless of context and that any whole is taken to be a purely additive combination of its elements.

This worldview has influenced authors to argue that agriculture and food production should be dealt as any other industry, based on sectorization and

interconnected input chains (CORALLO et al., 2018). Proposing that farming practices should focus on new technological approaches such as robotics and controlled environments to produce high volumes of food and fibre (BELFORTE et al., 2007). Some authors mention that the positive aspects of such an approach can be observed in all the modern technologies available today, which were only possible because of the mechanist/materialistic ontology (HACKING, 2005). In the same sense, it is argued that international policies should be focusing on industrial scales to solve food security and environmental crises (MULET, 2018).

The outcome of cartesian approach is a continued redress approach, focusing on chemical inputs to handle diseases and pests and to fertilize the soil, because they are identified as independent components (VANLOQUEREN 2009; WENCESLAU et al., 2014; NOGEIRE-MCRAE et al., 2018). Undoubtedly, the Cartesian approach has contributed to develop agriculture, nevertheless, unquestionably it has also created the problems we face today: an unsustainable system based on non-renewable resources, highly consumptive of energy and water, extremely dependent on external inputs and dangerously polluting (STREIMIKIS and BALEŽENTIS, 2020).

The evidence from agricultural research worldwide, points out that the remediation approach in agriculture is responsible for increasing the appearance of new pests and diseases, killing off pollinators, soil degradation, water contamination and endangering family farmers livelihood (MACHADO et al, 2014; MAHMOOD et al., 2016; PIMBERT et al., 2017).

In denying this intrinsic understanding, industrial agriculture has caused huge impacts on the environment and for decades now, research has proved deleterious effects of such practices on the ecosystem, for example, compromising carbon sequestration, altering hydrological rhythms, biodiversity lost and increasing persistent hunger worldwide - even though huge quantities of food are produced (PIMBERT et al., 2017). Such impacts were estimated at a value of US $33 trillion a year (ALTIERI, 2002).

Nevertheless, valuing these impacts only through the monetary optic is not enough. Overexploitation of natural resources have also inflicted a major danger to human health because the decline in fundamental ecosystems, caused by a non-stoppable industrialization (DUBÉ et al., 2012). Many people have been under the illusion that these ecosystem services are free, invulnerable, and infinitely available (KIBBLEWHITE and SWIFT, 2008). Altieri (2002) argues that partially, this misunderstanding reflects a

knowledge gap, where people thinks that food can be produced on artificially modes and relying exclusively on external modern technological tools.

To overcome the above cited problems, advances in disciplines such as agroecology, offer a holistic approach that embodies processes, the environment, and culture all as constitutive features for any agricultural production (PRIMAVESI, 2018).

To put in perspective, to approach anything holistically means to understand that the whole is not an aggregate of independent elements but an organized system, each part being defined by its relations to other parts and to the whole, meaning that the analysis of parts must occur in the context of the parts' functioning in the whole (FREEMAN, 2005). Holism as an axiom is the principle that propose the identities of objects and events derive from the context in which they are embedded, where the whole defines parts and parts define the whole, composing a coherent set of intertwined ontological and epistemological principles (DREYFUS, 1980). Holism as a scientific method approach makes possible to investigate complex systems such as ecosystems, climate systems, social systems whose behaviours cannot be understood by studying the individual system components in isolation (HEALY, 1991). For agriculture, the holistic approach is the solution to overcome agriculture problems, and agroecology can synthesize this holistic axiom and its applications at its best (BOFF, et al., 2021).

Some examples of holistic approach within the agroecological farming methods are the permaculture principles (HOLMGREN and MOLLISON, 2020) where the farm is designed to accumulate water and biomass (plant and manure) that will be used as fertilizers for crops or food for husbandry in a cyclical process. Also, the biodynamic farming methods proposed by Rudolf Steiner and Ita Wegg (TURINEK et al., 2009) which considers the landscape as a single organism, focusing on development and interrelationships of the soil, plants, animals and their spiritual counterparts for a self-sustaining system (ZANARDO et al., 2020). Biodynamic agriculture uses various herbal and mineral components for compost additives and field sprays, some of which are high-dynamized dilutions (KOLISKO and KOLISKO, 1978; ZANARDO et al., 2020), a similar approach is used by the Agrohomeopathy.

Agrohomeopathy is a form of agriculture that uses homeopathic principles and preparations to enhance crop growth and health (KAVIRAJ, 2012). It is based on the idea that plants, like humans, can benefit from treatments that stimulate their natural ability to heal and maintain balance (BOFF et al., 2021). Agrohomeopathy practitioners argues that this approach can help to improve soil health, increase crop yields, and reduce the need

for chemical inputs (SEN et al., 2018). Some of the techniques used in agrohomeopathy include the application of homeopathic preparations to the soil or to the plants themselves, the use of biodynamic preparations, and the use of holistic crop management strategies (MORENO, 2017; BOFF et al., 2021). Agrohomeopathy is still a relatively new and controversial field, and more research is needed to fully understand its potential benefits and limitations.

Therefore, Agroecology offers a holistic model of agriculture based on diversifying farms and landscapes, using non-toxic products, optimizing biodiversity, stimulating interactions between different species, as part of strategies to build soil fertility, guarantee yields and secure livelihoods (MCMICHAEL, 2016). After decades of studies and increment on the number of farms producing agroecologically, data has shown that agroecological systems can contend with industrial agriculture in terms of total yields, performing particularly strong under environmental stress (JOHNS et al., 2013; PRIMAVESI., 2018).

In particular, Agroecology embeds natural and social sciences, aiming to connect complementary facets, putting biology and sociology to be understood fully only through each other (GLIESSMAN, 2014). By virtue of such entanglement, ecological functions establish interdependence with human interaction, and through that action, spontaneously put the agroecosystems to self-organization (LOVELOCK, 2003). Agroecology considers the human being as part of the agroecosystem and not as an outsider or controller of nature, which is crucial to develop sustainable activities (GLISSMAN 2014; MORRIS et al., 2022).

Still, there are some issues to be addressed. Wagenet (1998) mentions that scaling up agroecological products are challenging, being one of the reasons for the lack of availability of these products on market shelves. Other reasons addressed are the need for improving marketing, networking, and information exchange with farmers and consumers (NIEMEYER and LOMBARD, 2003). In this sense, Reddy (2010) argues that supportive public policies are highly needed to improve research and entrepreneurism regarding agroecological farming.

Although the challenges are a fact, agroecology and its holistic approach are still one of the most valuable tools to solve the structural problems created by industrial food systems. More than that, it represents a freedom attitude to break a series of vicious cycles, helping to decrease the external dependence on chemical fertilizers, pesticides, and the use of antibiotics (GLISMAN, 2014; NEFF ET AL., 2015; PRIMAVESI, 2018),

offering diverse ways to reduce the environmental and economical inequalities (MCMICHAEL, 2016; PIMBERT, 2017).

It is relevant to mention though, that agroecology also must improve its notions of holism in farming systems. Wright (2021) argues that agroecology could only be considered as totally holistic if it considers subtle phenomena and subtle methods used to interact with nature.

More recently, the use of holistic methods such as agrohomeopathy and biodynamic farming were included under the innovative line of research named Subtle Agroecologies (Table 1). Explained in a resumed way, Subtle Agroecologies doesn't constitute a farming system in itself, but superimposes a non-material dimension upon existing, materially based agroecological farming systems (WRIGHT, 2021). Subtle agroecological practices are grounded in the lived experiences of humans working on, and with, the land and with nature, over thousands of years to the present.

**Table 1 – Subtle Agroecological Practices**

| | | |
|---|---|---|
| Agro-homeopathy | Astronomy/ planting calendars | Biodynamic preparations |
| Communication with other-than-human | Dowsing | Electromagnetism |
| Feng Shui/ Geomancy | Intuition/direct knowing | Mantras/chanting |
| Paramagnetism | Prayer/intention | Psychoactives /teacher plants |
| Radionics | Ritual | Sacred geometry / 'organising forces' |
| Sound/ultrasound | Water dynamisation | Brews and potions |

Source: adapted from Wright 2021.

This research was interested in the perspective from two major strands of subtle techniques that have been largely used in farming systems across the globe: agrohomeopathy and biodynamic farming (BOFF et al., 2021; PAULL and HENNIG, 2020). These two approaches are articulated over a set of knowledge and practices that have interconnected dimensions: a concept of a vitality; a therapeutic system (which explains the nature of health and disease); a diagnostic system; and a cosmology that presents the worldview that provides the basis for the previous dimensions

(WENCESLAU et al., 2014; PARAMESH et al., 2015; PAULL, 2011; HAHNEMANN, 1842). Even though having similarities they do not follow the same principles nor the same methods to make the organism diagnosis (FISHER, 2012).

Beside the ontological similarities mentioned above, both methods also share other important methodological characteristics: their preparations come from natural sources and are made under unique circumstances and methods; they have a holistic way to understand and manage the system; both approaches view farms as a living organism; the preparations act over the organism's vitality (LOVEL, 2014; OLIVEIRA et al., 2019).

It is interesting to notice how homeopathy and anthroposophical medicine, both human therapies – have developed an agriculture branch. Within the holistic worldview of these two methods, the interconnectedness of the components within an agricultural system leads to presuppose that what makes the soil, water, plants or animals sick does the same for humans (KHATOUNIAN, 2001; BOFF, 2009; CASALI et al., 2009; PARAMESH et al., 2015; BAVEC and BAVEC, 2015).

Recently, their benefits for human therapy and agricultural practices have led to the methods to be integrated into public services in some countries. For instance, in Brazil since 2006 the Integrative Practices Program has included in the national health service (SUS), practices such as homeopathy, anthroposophical medicine, ayurvedic medicine, reiki, acupuncture and more. In the same sense but regarding agriculture practices, since 2004, homeopathy and biodynamic farming were legally included as organic approaches for food production (BRAZIL, 2011).

Despite the numerous methodological and ontological similarities, perhaps, the strongest bond that both approaches share is the use of dynamized high dilutions (DHD).

### 1.2. Dynamized high dilution (DHD)

The term dynamized high dilutions (DHD) referrers to the technique of sequential dilution and dynamization process of a substance (BONOAMIN, 2020), and according to the La Groupe International de Recherche sur l'Infinitésimal (G.I.R.I) the technique shouldn't be exclusively linked to homeopathic or biodynamic preparations.

The term dynamized high dilution (DHD) defines any solution that has been produced using the technique of sequential dilutions and succussions – producing therefore a dynamized solutions (RUPP et al 2012; SEN et al., 2018;). A homeopathic

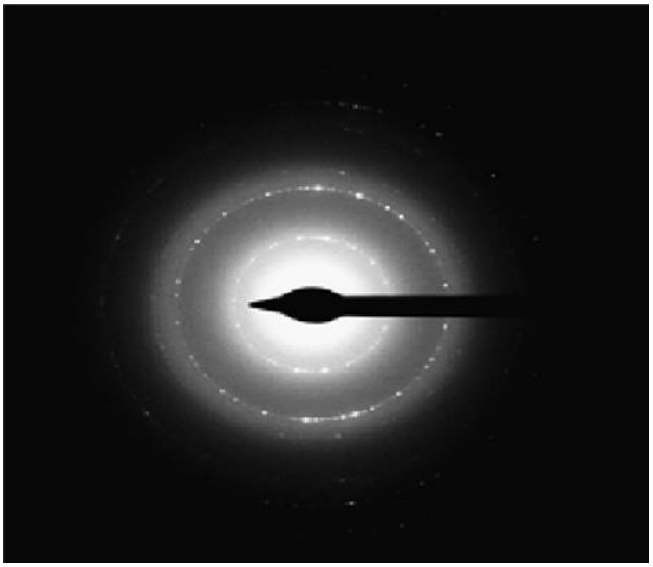
preparation, however, is a dynamized solution in such level called potency that is described into Homeopathic Pharmacopeia. Another difference is observed in the fact that the term DHD is commonly used by researchers from across disciplines who investigates the potentialities of DHD on the fields such as physics, chemistry, crystallography, material sciences and others. On the other hand, the term homeopathic preparation is commonly used pharmacy, medicine etc. In studies in agriculture both terms are utilized and the purpose of research they are equivalent

According to Lovel (2014), one explanation for the use of dynamized high dilution in agriculture could be elucidated in this way: farmers who think only of particles share the world view that everything around us is made up of particles with mass - these farmers will eventually support their crops solely with particles, for example adding chemical fertilizers or applying pesticides etc. On the other hand, farmers who think of waves/vibration share the world views that the nature expresses itself as vibrational patterns – thus these farmers will eventually support their crops with biodynamic and homeopathic preparations, sounds, mantras magnetic impulses or transmit UV frequencies and others (LOVEL, 2014).

This kind of mindset is supported by the innumerous implications of the quantum and resonance theories (HARAMEIN, 2013). Plank (1858 -1947) and Bohr (1885 - 1962) explained on their Quantum Theory, that just describing the reality from a particle perspective is incomplete and incorrect, all particles also have a wave nature and vice versa (NAUENBERG, 2016).

There is no unanimous explanation for the observable effects of the dynamized high dilutions over biological systems. However, some plausible arguments can be considered when linking the effects of DHDs with the wave-nature theories such as the quantum physics (PLANK, 1922) information theory (BERTALANFY and SUTHERLAND, 1974), and morphic resonance (SHELDRAKE, 2009). In doing so, one can comprehend DHD would act like an electromagnetic pulse (figure 1) in the system; this pulse transmits a set of information to the system and the information is carried by the means of the DHD.

Figure 1 - Electromagnetic irradiation pulse pattern of a dynamized high dilution (DHD) obtained with a Transmission Electron Microscopy.



*Source: Chickamane et al., 2010*

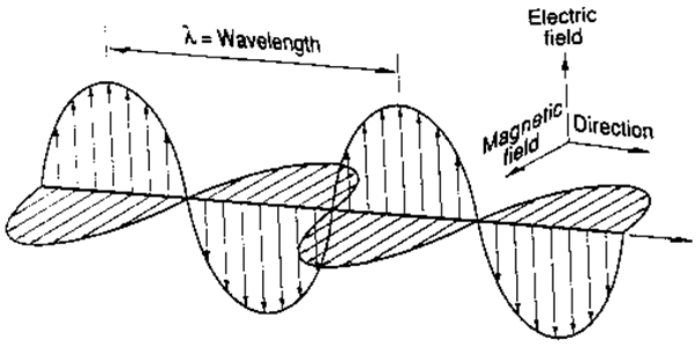
Now, information is a term with many meanings but when taking the perspectives from information theory (BRILLOUIN, 2013), information is related to stimulus, like in any pattern represented (wavelength, frequency, pixel etc), having the quality to send the message (BEKENSTEIN, 2003) from the sender (in this case the DHD) to the recipients (biological system). This view assumes neither accuracy nor parts that directly communicate, but instead assumes a separation between the object to and its representation, as well as the involvement of someone capable of understanding this relationship (SERRA, 2007). In this case, we have to consider nature and the ecosystem as a system capable of receiving diverse forms of stimulus or information patterns (BRIGHTMAN al., 2015, AL-KHALILI and MCFADDEN, 2016).

This understanding has a very pragmatic application. Energy can be transferred by vibration or electromagnetism and turned into information that ultimately leads to a response in the form of a stimulus (ENGEL, 2007). One of the most fundamental aspects of quantum physics is the idea that energy, and therefore the information it contains, is quantized and this connects to a specific amount of the energy's frequency, down into the smallest possible parts (HAREMEIN, 2013).

Max Plank in 1918 proposed the radical idea that materials called quanta vibrate at certain discrete frequencies. His simple and radical theory drew him completely away from the classical theory of radiation. For Plank, energy was considered to emanate – like

a pulse – and frequency and energy were closely related (HARAMEIN, 2013). Soon after, in the late 19th century, the Scottish physicist James Clerk Maxwell demonstrated that electrical and magnetic forces were two facets of the same electromagnetic force (figure 1.3).

Figure 2- Electromagnetic wave/particle pattern

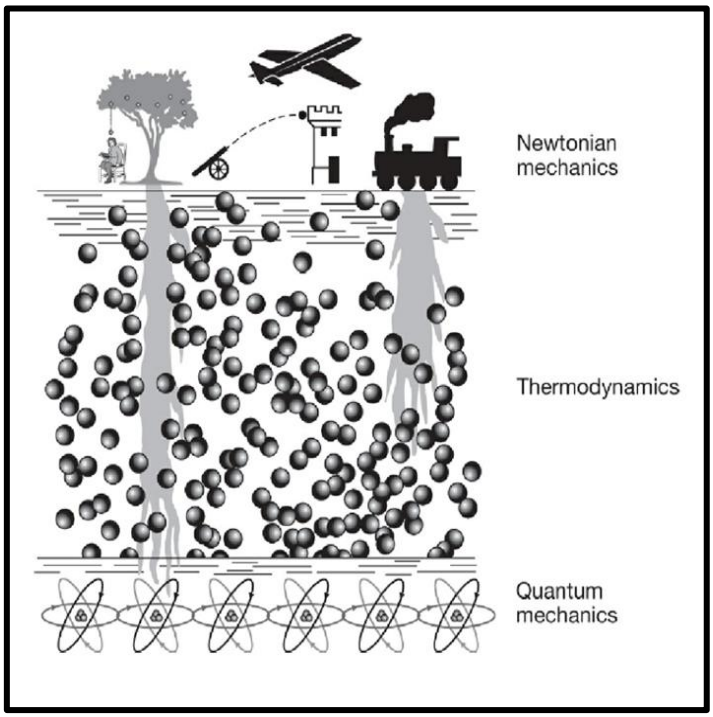



Source: Available in https://minerva.union.edu/malekis/CVision2003/MainPage/Course%20Content/Osc&waves/E&MWaves.htm, 2021

According to Norton (2013), these smallest parts or quantum entities exhibit a quantum coherent behavior, like being in two places at once, spinning in two directions at once, tunneling through insurmountable barriers, or having eerie tangled bonds with a distant partner – the quantum entanglement. The quantum entanglement (figure 3) would then explain how electromagnetic structure of the starting material is transmitted through out the DHDs.

The quantum entanglement allows particles that were once together to remain, in instantaneous communication, despite being separated by immense distances or dilutions (ARBAB and AL-AJMI, 2014). Quantum entanglement explains how smallest particles - as atoms - transmit information patters *ad eternum* influencing biochemical reactions (SHULTEN, 1976). In 1982, Alain Aspect in Paris demonstrated through experiments with polarized light photons the phenomenon of entanglement.

Figure 3- Quantum field information.




Source: Life in the Edge, Al-Khalili and McFaden, 2016.

As mentioned above, a complementary assumption is related to information exchanges from the Systems Theory (BERTALANFFY, 1967), which stresses the importance of exchanges of energy, matter and information among living organisms and their external environment, at all levels, from the quantum to the macro-dimensional. The system theory would then lay the bases used by Manzalini and Galeazzi (2019) to explain dynamized high dilutions under a quantum electrodynamics, proposing that the homeopathic preparations (DHD), have each a microwave function with its own oscillatory pattern, that resonates with other specific oscillatory patterns (organism) in a perfect orchestration of multiscale coherence and resonance. Thus, obtaining a biological response.

In fact, the principle of resonance is a fundamental aspect of the wave-particle understanding of nature. The principle of resonance as explained by Haramein (2013), is triggered when a system's natural frequency, or relative vibration rate, matches the relative rate of vibration or range of frequencies. In other words, the energetic resonance occurs when an electromagnetic pulse acting on a system coincides with its natural frequency of vibration. A useful example to clarify the resonance principle is given below:

*"Examples of this natural frequency of vibration are the sympathetic vibration of a stretched string in response to an appropriated sound wave; the tunning of the radio set to the frequency of a particular radio wave frequency given out by transmitters; the absorption of light waves or particular wavelength by atoms and molecules and atomic nuclei in the presence of magnetic fields to electromagnetic radiation in electronic spin resonance and nuclear magnetic resonance. Common to all this these types of resonance is the principle of selectivity: out of a mixture of vibrations, however complicated, the systems respond only to a particular frequency" (SHELDRAKE, 2009, pg 85).*

To summarize Sheldrake's theory (2009), it assumes that all living systems are influenced by morphogenetic fields during their development process. The resonance morphic fields are energy-like but are neither a type of mass nor energy *per se* and would operate more likely as a kind of information pattern, however, this energy is related to the wave-particle nature and analogous to energetic resonance in its specificity, but not explicable in terms of any type of resonance, nor does it involve the transmission of energy (SHELDRAKE, 2009). This exchange may take place through time and space. According to him, the exchange of bio-information is primarily mediated by electromagnetic fields. Any disorder in Sheldrake's view arises when an electromagnetic field is disturbed and fails to maintain its equilibrium. However, it's important to mention that morphic resonance fields are still not widely accepted in the scientific community, as most of its methodology are still under theoretical essay and more empirical data is needed to further develop this theory.

Non the less, interconnecting these assumptions by means of a multidisciplinary background - quantum theory, resonance patterns, systems theory, information theory, morphic resonance theory, etc. – it could be hypothesized that in the process of dynamization, the DHD information maintains itself throughout the entire dynamization process, under the influence of the starting material, explaining specific energy/resonance patterns as observed in studies that looked into the DHD by its electromagnetic nature (CHICKAMENE et al., 2010).

However, in considering these theories, it would eventually lead to the question: How is the information/resonance pattern created in the DHDs in the first place?

### 1.3. Water as vehicle and information carrier

It seems as though that water has a crucial role in this process. Russo et all (2017) explains that water is the known substance with the biggest number of physic-chemical

and biological anomalies (63), due to its electrochemical characteristic with tetrahedric hydrogen bonding and dipole distribution. A wide range of atypical properties are attributable to this structure, including the including the Earth's climate.

Water is one of the most important elements for life to thrive. It's one of the most common but also one of the least understood substances. For example, it's the only substance that naturally exists in three states (liquid, solid and gas), it has the highest surface tension of all liquids, it creates the structure of proteins and, it's the most powerful solvent on earth (Taiz et al.,2017).

Interestingly, studies have shown that any substance that gets in contact with water leaves a trace, because of water unique electrochemical nature, it tends to form clusters of the substances that are dissolved on it, thus adopting its properties, recording this information on its electrochemical structure (HANKEY 2019; MEESSEN 2021).

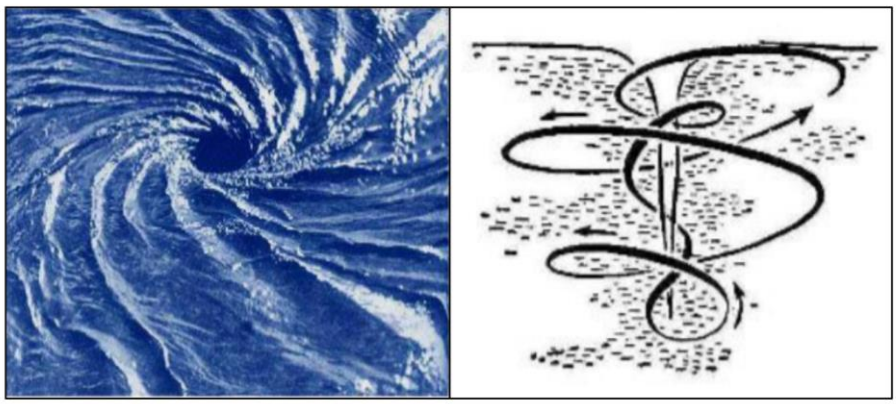
The phenomena of crystallization and transferring of electrochemical structure in water molecules happen via the process of coherence and epitaxy. Bellavite et al. (2014), explain that due to the heterogeneous composition of water, its electrochemical structure can be influenced by interactive phenomena such as coherence and epitaxy – on which the atomic structure of any template structure is transferred to a liquid without any material transfer. This process is often used in the semiconductor industry to produce thin layers of semiconducting solutions for use in electronic devices (BELLAVITE et al. 2014). Furthermore, water coherence also transfers electrochemical structure as observed in the process of colloidal nanobubbles formation. These nanobubbles contain gaseous inclusions of oxygen, nitrogen, carbon dioxide, silica, and the original active ingredient. In this way, water molecules serve as nucleation centers, amplifying the formation of supramolecular structures and organizing the solvent (BELLAVITE et al., 2014).

Similarly, other authors point out to water as the vehicle for containing and transferring information. Chikramane and colleagues (2010), suggest that succussion process on dynamized high dilutions causes acoustic cavitation, which transfers the DHD information throughout its process. They were able demonstrate the correspondent electromagnetic pattern between the nanoparticles of the DHD and the ones of the starting material. Previously, Reys (2003) had also confirmed that, despite their dilution beyond the Avogadro number, the HDD's emitted light was specific of the original salts dissolved initially and they had correspondent irradiation patterns. Bonamin (2008) also suggests that this effect, which is similar to that of electro-magnetic fields, is the result of an ultra-molecular action, and that information is exchanged with the living organism through

dynamic structures of communication, which are continuously modified when information with the inner and outer environments is changed.

It's possible to assume then, that the dynamization process (figure 4), whether by the vortex (CHEN, 2019) or succussion (SCHWUCHOW et al., 2013), influences the quality of a solution; and that the pattern is transferred through vibrations created by the dynamic movements having electromagnetic identities (POLK and POSTOW, 1995; GEESINK et al., 2016).

Figure 4 - Sources of cavitation in water



*Source: Adapted from Chen, 2019.*

The importance of studying dynamized high dilutions (DHD) could be borrowed from Nicolai Tesla (1956 – 1943) who said "*The day that science begins to study non-physical phenomena, it will make more progress in a decade than in all previous centuries of its existence*"

It's clear that the DHD offer an innovative, non-conventional methodological and epistemological approach to agriculture that should be investigated to be better understood.

### 1.4. Homeopathy in agriculture

Throughout the world for more than 200 years, homeopathy has been used as a science and art of healing (BOFF et al., 2021). It was created by the German physician Samuel Hahnemann in 1796 as a therapy for humans and since then, homeopathy has

been expanding in areas beyond human medicine because of its capacity to act on all living systems (NUNES et al., 2021).

Its method analyses the organism issues as a whole rather than focusing only a specific part of the system (eg., pest or disease problem in agriculture). This line of though aligns with the one of the systems theories (BERTALANFFY, 1967). According to Silva et al (2022), in light of the biological response observed with the use of homeopathic preparations, it seems reasonable to assume that the curative property of homeopathy may be preserved in the hydroalcoholic solution of the high dynamized dilutions.

Nonetheless, some authors argue that homeopathy lack of scientific evidence. Mullet (2018) discusses that homeopathic remedies usually continue well past the Avogadro number; therefore, no molecule of the original preparation remains in the solution, constituting a biochemical problem. According to Cartesian science, this ought to limit the action of the homeopathic preparation (SILVA et al., 2005), and this fuels the argument that a placebo effect is involved.

However scientific evidence shows otherwise. The homeopathic preparations can be explained by extrapolating mechanistic rationality through nonlinear systems models (BELL et al., 2002; BONAMIN et al., 2008). Homeopathy has had its theoretical-methodological framework legitimised by scientific peers in several internationally recognised journals working in agrarian and/or related sciences (BETTI et al., 2009; BONFIN and CASALI, 2012; JÄGER et al., 2015; ÜCKER et al., 2018; PEREIRA et al., 2019). The biological effects of the original ingredients have been proved methodically and consistently in plants, animals, and people despite their apparent absence of molecules (BONFIN et al., 2012). Also, double-blind trials have eliminated the possibility of a subjective (placebo) effect between the patient and the researcher (BETTI et al., 2009).

### 1.5. The impact of applying homeopathy in agriculture as a means to promote plant growth and control pests and diseases

As discussed previously, the current agriculture models heavily rely on the use of agrochemicals including pesticides to manage crops. Consequently, food and ecosystems have been contaminated leading to ecosystem destruction and compromising food health security and sovereignty (PIMBERT et al., 2017).

Therefore, the non-pollutant, non-toxic, non-residual and biodegradable nature of homeopathic preparations offers an alternative to be used in agriculture without compromising the ecosystem and contaminating food (MORENO, 2017).

To illustrate the potential of homeopathic preparations in agriculture, it's important to investigate the scientific information by peer-reported data. This data informed that homeopathic preparations (DHDs) have being used successfully in agricultural research.

For instance, to manage plant disease, the homeopathic preparations of *C. citriodora, C. carbonica*, *Silicea* and *Sulfur* showed potential as elicitors of peroxidase, catalase, kinase, β-1-3-glucanase and phytoalexins inducing the biochemical defense mechanism of bean plants (OLIVEIRA et al., 2014). In vitro studies, the homeopathic preparation *Natrum muriaticum* 5CH inhibited *Aspergillus niger* growth in 66% (GAMA et al., 2014). In field trials with beans, *Sulfur at 12 and 30CH*, *Ferrum sulphuricum* at 6, 12 and 30CH and Propolis in all dynamizations reduced disease progress curve by 17% to 49% (TOLEDO et al., 2015).

Also, widely reported are the use of homeopathic preparations as plant vigour promoters. Panda and collegues (2013) increased seed germination, seedling development and photosynthetic activity in pea plants using *Propolis* at 30 and 60CH, increasing root volume by 39 and 33%, fresh shoot mass by 35% and dry root mass by 38%. With onions, *Sulfur* 12CH increased shoot mass by 23% to 37%, and at 60CH increased root mass by 59%, as did *Ferrum sulphuricum* 60CH (65% increment) (TOLEDO et al., 2015).

Another very important feature of homeopathic preparations resides in the fact that it does not act against the organism or system itself but rather promotes an equilibrium of it. An example to illustrate this, are the results from Giesel et al., (2016) using *Belladonna* 6CH and 30CH, which significantly reduced the foraging activity of ants, *Acromyrmex laticeps Emery*, which were causing a problem for pastures in Santa Catarina/BR. Therefore, the colony of ants itself didn't have to be eliminated.

The positive impacts of using homeopathy in agriculture, have proven it itself as an ecological tool, in harmony with the concept of sustainability (BONAMIN, 2020). Therefore, in 2004 the use of homeopathy in agriculture was certified by UNESCO as an effective social technology, meaning that this technology has the potentiality to solve social problems of rational and ecological land use to produce healthy food, respecting biodiversity and eliminating the use of pesticides (KHOLER and NEGRÃO, 2018).

## 1.6. Challenges of applying homeopathy in agriculture

Homeopathy is primarily based on the principle of similarity (CARNEIRO, 2011). Essentially, this means correlating the symptoms described in the Homeopathic *Materia Medica* - originally developed for and on humans - to those of diseased plants and animals. The preparations should be selected based on the "total" set of symptoms/indicators (VIGANÒ et al., 2015). However, these approaches were not categorized and there is a need to have them as a source of reference for literature and practical and research purposes. According to Teixeira e Carneiro (2017), the existence of systematic preparation selection is needed, and it would facilitate the selection of the individualized drug for each plant species and type of disease.

One more challenge regards the preparation potency to be used. This is mostly decided upon based on the practitioner's experience as the main decision parameter, while other practitioners use electronic instruments, electro-acupuncture devices or pendulums and in some cases intuition (GREENHALGH, 2002; JONAS et al., 2003).

These two features are crucial because a proper selection of the remedy and its potency is the most effective way of ensuring the long-term health of the agroecosystem (BOFF, 2009). With that in mind, research on agrohomeopathy should consider collecting more data on DHD's selection, modes and frequency of application etc. (CORREOSO et al., 2022). Another knowledge gap identified as crucial to enhance the debate and use of homeopathy in agriculture is the nuances of crop vitality promotion. According to many authors, the major benefit of using homeopathy is the promotion of vitality, health, or harmony enabled by a dynamic force (PARAMESH et al., 2015), which ultimately is endorsed by homeopathic preparations.

## 1.7. The underlying question of vitality in agriculture

Understanding the concept of vitality manifestation in agriculture is essential for this research. Firstly, because one of homeopathy's axiom is its action over the vitality of the organism. Secondly, the ontological implications of exploring vitality could help to reframe the agricultural research and practices towards sustainability. Therefore, comprehending and assessing vitality is included in this research. However, this task needs a thoroughly analyses.

The word vitality according to the Oxford dictionary (2010) comes from Latin *vīta* 'life'; from middle French *vitalité*; is the capacity to live, grow, or develop; to have energy or vigour; liveliness, spirit, spiritedness, high-spiritedness, vivacity. Now, this definition helps us to understand why the word is so commonly used in daily life when trying to express something on its best condition/state. For instance, architects and urbanists use the term revitalizing for renewing a park or a building to better conditions of use. In the same way, psychologists, nutritionists, and other therapists refer to the term when directing measurements to improve one's life quality. Perhaps from the medical care, the expression vital functions express its best pragmatic meaning… functions that allows one to be alive.

However, in agriculture the term is scarcely used. This constitutes a paradigm difference because an agroecosystem itself is a complex living organism (LOVELOCK, 2003).

So why is the term not commonly used in agriculture? When examining the literature on vitality, it was possible to draw some inferences.

For a start, this could be linked to the ontological tension between the Vitalist philosophy and Materialistic philosophy that continues to the day (BANCHETI-ROBINO, 2011). The term vitality is rooted in western societies to Vitalism, an ontological perspective that shaped the intellectual and scientific thought from the 16$^{th}$ century until late 18th centuries (ALLEN, 2005). Briefly, vitalism is the doctrine that affirms the existence of an irreducible principle to the physical-chemical domain to explain the vital phenomena. In this conception, the physical body of living beings is animated and dominated by an immaterial principle called *vital force*, whose presence would distinguish the living being from inanimate bodies and its lack or failure would determine the phenomenon of death (NORMANDIN and WOLFE, 2013).

Moreover, the difference between organic substances (only produced in nature) and inorganic substances (synthetized by man) would be distinguished by the action of the vital principle (FONTECAVE, 2010). However, it was during the 1800s when biochemistry was developing its methods to explain life manifestation that the discovery made by two German chemists Friedrich Wöhler (1800–1882) and Justus Von Liebig (1803–1873) put vitalism aside from mainstream science. For the first time a biological compound (urea – a nitrogen substance) was produced under an artificial environment. This result demonstrated for the first time that a biological molecule could be made without the assistance of vital functions. From that period onwards and with the aid of the

reductionist approach to biology and chemistry, the scientific community alleged that life could be solely explained in terms of chemical and physical reactions (HÄGGLUND, 2016).

However, while the reductionist and non-vitalistic biochemistry evolved, one of the most prominent scientists of that time, Louis Pasteur (1822–1895), through his discoveries of molecular dissymmetry and fermentation, revived the vitalist view at the end of the 19th century. According to him, these fascinating properties were indissociably tied to a living organism and could only be explained in terms of an unknown force that specifically ensures they are introduced to living systems (FONTECAVE, 2010). Fascinating is the fact that one of the most significant contributions of vitalism to the history of science was its influence on the development of the theory of evolution. Many early proponents of evolution, such as Jean-Baptiste Lamarck and Erasmus Darwin, were influenced by vitalist ideas and believed that the vital force was responsible for the evolution and adaptation of living things (BANCHETI-ROBINO, 2011).

The situation is thus highly paradoxical.

The ontological tension between the vitalist philosophy and materialistic philosophy can also be observed over the historical identification that scientists tend to link themselves in a sort of knowledge heritage or tradition. In that period (16th and 17th centuries), the vitalism dominated the natural philosophy and it hold within its epistemology the Neoplatonic and hermetic traditions which were strongly correlated to alchemy, even during the transition from alchemy to modern chemistry (NORMANDIN and WOLFE, 2013). Bancheti-Robino (2011) explains that there is no figure like a Euclid, Archimedes, or Ptolemy in the history of chemistry, instead, modern chemists find themselves in the somewhat disconcerting company of alchemists, druggists, sorcerers, astrologers such as Paracelsus (1493–1531). Although Paracelsus's chemical philosophy contained many mystical elements, it also contained elements that would later become modern chemistry and modern scientific method (BANCHETI-ROBINO, 2011). Therefore, for validation purposes and to be accepted as a “modern science”, its historical roots linked to metaphysical disciplines that dealt with vital forces should be avoided. This scenario still hasn’t changed, so a term that could possibly being linked to such nuances should be avoided when trying to explain how well an organism manifests.

This idea of a vital force as a life force that somehow transcends the known material world overall is marginalized in current western thought, even though this concept is intrinsic to, and widespread across, different cultures and times throughout

human history, both in western and eastern ontologies (POOLE et al, 2006). Some concepts related to the vital force are displayed in the table 2. Normandin and Wolfe (2013), explains that humanity when observing and studying nature, constantly experienced a supra physical element to its manifestation. The authors explain that by acknowledging this facet, humanity was able to integrate practices that not only delt with the physical issues of human and crop health. This approach has influenced the development of medical and agricultural practices, bonding the treat of the land and human organism in a complex organism that should have tools or approach to deal and interact with the different levels of life manifestation. In agriculture for example its common to see a mixture of common practices like sowing and harvest aligned with rituals aiming to both at the same time, perform physical and metaphysical outcomes (NORMANDIN et al., 2015).

Furthermore, Oyama and collegues (2010) point out, that with the evolution of biological theory, new concepts such as organicism, complexity and systems theory, homeostasis and others resuscitated vitalism, even though under new terms. These terms express vitalistic thoughts without using the "bed word vitalism or vital force" and are accepted in current scientific dialogues (GILBERT et al., 2000; HUNEMAN et al, 2010). Driesch (1867 -1941) adopted the term entelechy, taken from Aristotle, to describe his belief in a teleological nature in living things that challenged the mechanistic synthesis in biology prompting biologists to ask questions about the driving forces in cell development, a call that was severely criticized. All in all, contemporary biological debate acknowledges that there may be such a thing as a "vitalism heuristic" in biology and ecology (CHANG, 2011), however, it is still seen as an outsider in modern biology.

Table 2 - Vitalist conceptions across different periods and cultures

| Origins | Ontological Principle | Axioms | Description |
|---|---|---|---|
| | | | |
| | Pneuma | A universal principle that permeates all nature, living and inanimate beings, acting towards cohesion, harmony and balance It hem to harmony and balance. | *Vis medicatrix naturae*<br><br>Nature has the capacity to heal and harmonize itself<br><br>An immaterial energy that makes life possible |

| | | | |
|---|---|---|---|
| **Greek and Egyptian thought** | Phys | An *archeus* or a ruling principle of the universe | A universal energy that coexists with the body allowing life manifestation |
| | *Humors theory* | Energy animates the body, and its functionality depends on the balance of the 4 *humors*: blood (fire), black bile (air), yellow bile (earth, phlegm (water) | Stabilized the bases for the allopathic intervention – e.g., fever (fire) should be treated with cold (water)<br><br>Any unbalance in the being was caused by excesses or lack of the four constituent elements of nature. |
| | *Aechaeans* | Universal principle that animates and shapes nature and manifest itself in nature through "signatures" or forms | Use of mineral, plants and animals "signatures" to treat people, animal and crops. To create preparations to achieve a archeus who preside the functions of the organs – biological responses |
| **Renaissance and post modern** | Vital force | A dynamic universal principle that primarily keeps the harmony of any living system. It is an autocratic immaterial force that drives organisms toward its maximum expression of life | Vitalism – a force that insufflates life and organization in nature<br><br>Use of homeopathic preparations to sensibilize the vital force and re-establish harmony |
| | *Entelech* | A dynamic universal force that drives all biological system towards is maximum potential of life manifestation | A fundamental metaphysical force that enables biological systems to perform their physicochemical metabolisms and roles in a harmonious way. |
| | Chi | Universal force that permeates and shapes everything. Commonly observed in traditional Chinese Japanese and Korean medicines | Universal energy compost by 5 elements/essences. *Ad eternum* balance movement principle know as yin - yang |
| | Prana | Etheric and material forces are entangled | Use of ayurvedic preparations and |

| | | | |
|---|---|---|---|
| **Indigenous and eastern traditional knowledge** | | and influence each other directly. Based on indigenous yogi. | rituals to treat human, animal and land |
| | World Spirit | Based on indigenous traditions across the globe.<br><br>It involves attributing sentience to the environment, people, animal, plants specific rocks and places | Based on animism and panpsychism<br><br>Diverse forms of ritual and preparations performed in specific time of the year using specific materials to interact with spirits that are part of the nature. |

Sources: Adapted from Pole et al., 2006; Normandin and Wolfe, 2013; Normandin et al 2015.

Despite the criticism from the western scientific sphere, the concept of vitality shows its versatility by being applied within the context of philosophical, natural-historical, psychological and biomedical reflections on the nature of living beings to designate even biopolitical positions (GAYON et al, 2010; NORMANDIN, 2011).

It's also clear that much of the discussion of vitalism has been either overly enthusiastic, or overly negative. However, it is impressive that vitalism continues to re-emerge in the life sciences in all sorts of fascinating, complex, dynamic, even heretical ways in our theories of knowledge (FEYERABEND, 1975; GRECO, 2005; WAISSE-PRIVEN, 2009).

In the history of vitalism, there are many facets that can't be separated from the metaphysical and the material, reductionism and holism, the inert and the animated, the structuring and the liberating, order and chaos, the dead and the living, rigidity and fluidity, structure and spontaneity, and even old and new. Vitalism evolves and changes over time, which gives it a vibrant life of its own (WAISSE-PRIVEN, 2009).

Therefore, assessing vitality in agriculture would be useful to explore and expand the relationship regarding plant growth and production, pest and disease resilience and food quality. Also, it would be fundamental to understand how people experience the phenomena (vitality) in order to foment the debate on research and agricultural practices. Because the term helps to raise questions about practices that affect human goals such as yields, food quality and human wellbeing. In addition, exploring vitality in agriculture would be useful to describe tacit knowledge end heuristic perspectives, which can help to

generate innovative forms of knowledge, because it does not limit to understand its functionality by its parts, but rather how well the parts are coexisting. In this sense, evidence obtained under a multidisciplinary approach could possibly led to a better comprehension of the phenomena of vitality.

## 1.8. Research objectives and general methodology

In this research, the objective was to evaluate the potential use of homeopathy and dynamized high dilutions (DHDs) to substitute the use of pesticides in agriculture and to assess how a deeper understanding of the vitality in the agroecosystem could help to improve farming and research strategies.

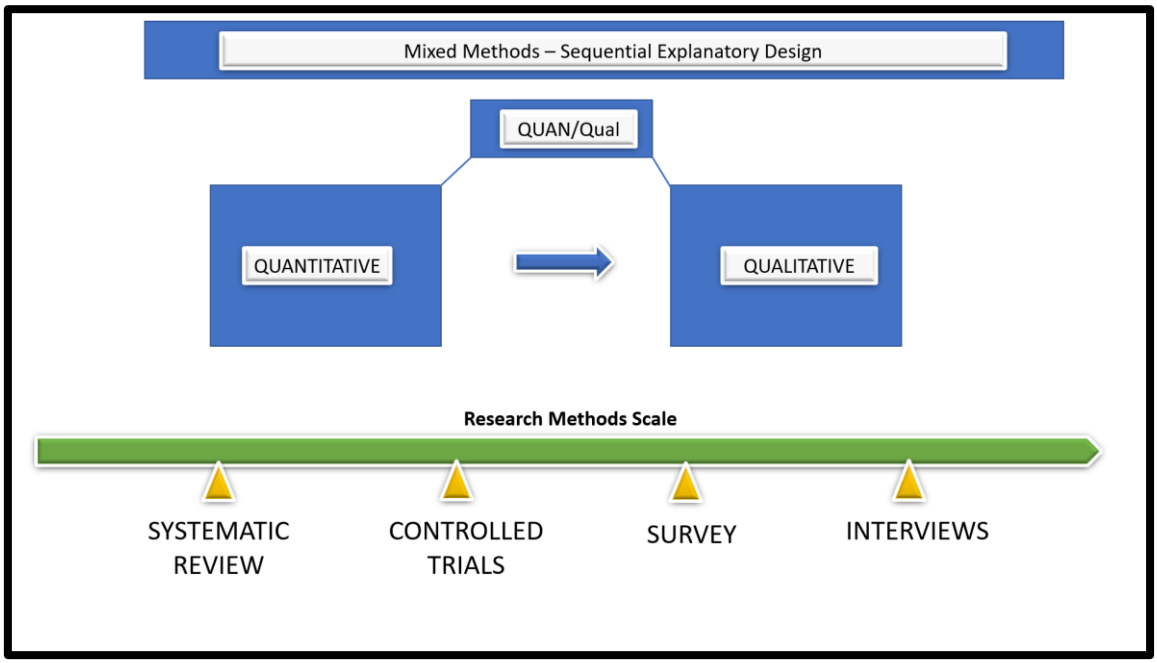
To answer the research questions, this research design uses a hybrid epistemology and methodology, combining natural and social sciences in the study framework. From the natural sciences, the study takes advantage of the positivist and etic approach to nature, based on quantitative data and its properties, observed through logic and reasoning, ultimately leading to a deductive analysis of the results (MACIONIS and GERBER, 2011). From the social sciences, the research is empowered with the relativist approach to reality, constructed via qualitative data, examining the meanings as well as the particularities originated from the human component, leading to a subjective analysis of the phenomena (PATTON, 2014).

At first, the contrasting approach could be seeing as antagonistic, however, as Knox (2004) points out, methodologies are best used in a complementary way to ensure the bigger picture is not lost. It is important to mention though, that they are used at different stages and for different areas of the research. The research design aimed to collect qualitative and quantitative data, using a mixed method sequential exploratory design (CRESWELL, 2015).

Figure 5 displays a diagram containing the mixed methods sequential explanatory design and its research elements. The data variety, in this case quantitative and qualitative data sets, are indicated by the blue coloured elements of the diagram. The blue arrow is the vector indicating that quantitative data is embedded in qualitative data (QUAN/Qual). The research methods used in this study and are indicated in the green scale in the diagram. The yellow markers distributed across the green scale indicates where each method was placed inside the thesis structure: systematic review; controlled agronomical

trials; farmers' surveys and interviews with key stakeholders. The interpretation of the qualitative data followed content analysis whereas for the quantitative data descriptive statistics was used.

Figure 5 - Research design diagram and the Mixed Methods Sequential Explanatory Design Elements.




Source: developed by the author (2022).

The justification for such a research design is due to the nature of the investigated phenomena. For a start, the systematic review helped to cluster information on how vitality had been assessed in agricultural research, selecting parameters and definitions to be compared with the data obtained from the other methods used in this study. Next, the controlled trials which are based on deductive statistical analyses; hence the etic approach is applied to establish a theory and hypotheses that are then tested through the collection of data. In addition, the survey collected evidence on agronomic, ecological and sociological aspects of farmers who use Homeopathy and DHDs in agriculture. This information complemented the more in-depth analysis enabled by the interviews with key-stakeholders within a qualitative and phenomenological research approach.

The mixed methods research approach is essential when combining numbers and stories, when the research aim is to explore and understand as well as test and measure (CRESWELL, 2013). In this sense, the qualitative approach used in this research is

influenced by phenomenology (SMITH, 2013) focusing on heuristic inquiry (SULTAN, 2018) and grounded theory. The grounded theory used here focuses on the concepts proposed by Charmaz (2006), where the research conducts simultaneously data collection and analysis in a cyclical process; requiring a research-data-reflection, understanding changes over time that continually informs the next steps or the return to previous steps of the research.

The phenomenological approach is crucial to this research because phenomenology expresses that comprehending the meaning of a phenomenon can only be understood subjectively and intuitively grasped in its essence, particularly focusing on interpretation phenomenology (PATTON, 2014). Within phenomenology, the heuristic inquiry refers to a process of internal research whereby one discovers the nature and meaning of experience and develops methods and procedure for further investigation analyses (MOUSTAKOS, 1990). Heuristics is about living relationships with phenomena and people (SULTAN, 2018). It's a methodology deeply rooted in tacit knowledge that leads to a deeply subjective and creative connection between the researcher and phenomenon (SELA-SMITH, 2002).

The disciplines guiding this hybrid research are multiple: Ecology, Agronomy, Agroecology, Sociology and Psychology which helped to study the agricultural practices, as well as the human experiences, gathered from the interviewees, surveys and experiments. This research was conducted both in Brazil and in the UK. Coming from natural sciences background at UDESC university (BR), it was particularly intensive the immersion in subjects such as sociology and psychology, experiencing a learning curve that was only possible due to a co-tutelle research program with Coventry university (UK). The researcher ascertain the importance of encompassing different disciplines and different sources of knowledge as well as the multi-level and multi-scale character of these subjects. Following on from the recognition of the complexity of dynamic systems, this research adopts a holistic and inclusive approach that has the potential to increase the resilience of food systems (REID et al. 2015).

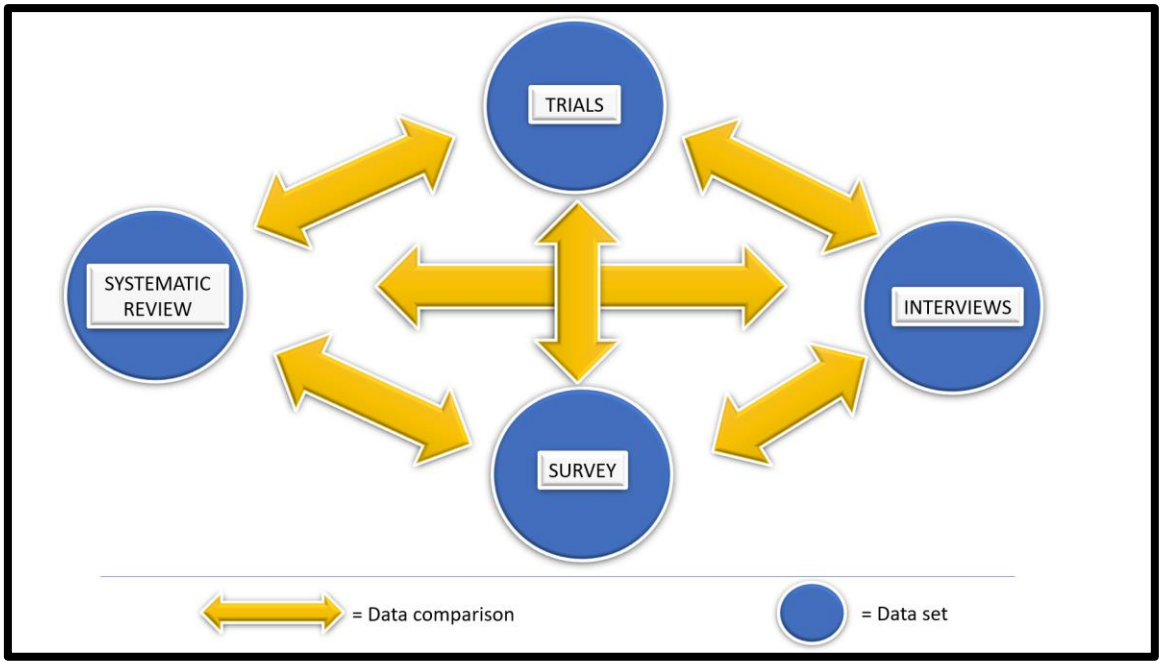
According to Creswell, (2013) one way to better comprehend the results yielded from mixed methods research is by doing theoretical saturation and data triangulation (figure 6).

This research used data triangulation, because such method enables the comparison between different sets of information. Furthermore, as Guion et al (2011) explains, triangulation leads to synergy, enrichment and complementarity of data,

although it can be very costly in terms of time, money and energy as triangulation results in large amounts of data requiring much time on analysis. However, the benefits of triangulation include increasing confidence in research data, creating innovative ways of understanding a phenomenon, revealing unique findings, challenging or integrating theories, and providing a clearer understanding of the problem (THURMOND, 2001).

Each data set could have limitations and, triangulation is used here to help overcome these limitations, to establish a connection between the data sourced from different methods and knowledges (FORAN et al. 2014).

Figure 6 - Data triangulation and theoretical saturation amongst complementary forms of data used in this study.




Source: developed by the author (2022).

The research used data triangulation with the help of in NVivo® as well as on paper, creating flowcharts and diagrams to organize and make sense of the research topics, as well as engaging in regular discussions with the research team and other researcher-peers.

There are no set of perfect and complete methods in research (NIGHTINGALE, 2003). However, the most important factor is how the methods are used to ask questions and how the results are interpreted (SHEPPARD, 2001). According to Munuya et al (2010), combining qualitative and quantitative research encourages creativity and

enriches the understanding of problems being investigated to get a deep understanding of it. Particularly, this research approach offers a reliable basis to explore ways of strengthening linkages and improving the sharing of agricultural knowledge and information (HOFFMANN, 2007).

In the same sense, Knox (2004) points out that combined methodologies are best used in a complementary way to ensure a holistic view of the investigated phenomena. This research design offers the possibility to identify opportunities to improve a knowledge and information system, such as the one being explored in this research.

## 1.9. Thesis structure

The study is divided into six chapters: 1, Introduction to the thesis; In the chapter; 2 a systematic review was carried out on the topic of vitality in agriculture. This chapter helped to identify and cluster research data on the topic. It supported the choice of parameters to assess crop vitality regarding the use of homeopathic preparations (DHD) in agriculture in the next chapter (chapter 3). It also it helped to source information on vitality to be contrasted and compared with the information from the survey and interviews; (b) In chapter 3, the results of the agronomical experiments testing homeopathic preparations will be presented. The contributions of homeopathic preparations (DHD) to the sustainable management of strawberries (*Fragaria* × *ananassa*), aiming for the replacement of agrochemicals will be examined; (c) The chapter 4 explores the results yielded from a survey circulated among farmers who use homeopathy and dynamized high dilutions. The web survey was designed to grasp information on user profiles – which kind of farming approach is using DHDs; what are users' experiences in using DHDs; what are the main DHDs they have been using. The survey helped to deepen understanding of the main benefits and challenges farmers are facing in using DHDs and to observe how the use of DHDs is influencing their ways of farming and how farmers defined vitality; (d) The chapter 5 dwells on data from interviews with key stakeholders (researchers, farmers and advisors) purposing to gather descriptions of the lifeworld of the interviewees with respect to interpretation of the meaning of vitality and the use of homeopathic preparations in agriculture. The interview results helped to highlight the roles and relationships between different actors, what they do, how they learned, and how they shared ideas and experiences on using homeopathy

in agriculture and how they experience vitality in the agroecosystem. Ultimately, the data from interviews allows to characterize a personal world view and work experience, understanding how the interviewees encounter the phenomena of homeopathy in agriculture as a means to promote crop vitality; (e) Chapter 6 is the general discussion in which the research results are reviewed and the implications of using homeopathic preparation in agriculture as well as the role of vitality could play in associating integrated scenarios of research and farming strategies towards sustainable agriculture are proposed.