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2. Biodynamic Farming, Principle and Practices

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Abstract:

Biodynamics, stemming from Rudolf Steiner's insights in the 1920s, presents a holistic and ethical approach to agriculture, intertwining scientific knowledge with spiritual recognition of nature's essence. The biodynamic method of agriculture started very slowly but has been becoming popular in the last few decades throughout the world. This farming system treats soil fertility, plant growth and livestock care as ecologically interrelated tasks, emphasizing spiritual and mystical perspectives. By encompassing the natural environment in its overall vision, biodynamic agriculture aims to produce the best possible in ways that allow future generations to obtain the same – or even better – results. The soil itself is a key in this type of agriculture, because it is ultimately dirt on which all life on earth depends. Biodynamic agriculture focuses on ensuring self- sustainability of the soil, by using special manures and herbal preparations to enhance soil health, integrating plants and animals and encouraging biodiversity. With over 5,500 adherents worldwide and increasing certification, particularly in countries like Germany, biodynamics offers a promising avenue for future agriculture sustainability. By treating the farm as a cohesive organism and prioritizing soil health, biodynamic farming not only enhances crop yield but also improves nutritional quality and pest management. Its gradual but steady rise in popularity underscores its potential to shape the future of agriculture, ensuring both current productivity and the ability for future generations to thrive. This chapter will have discussed about principle and practice of biodynamic farming at present.

Keywords:

Biodynamic farming, Practices, Principle

2.1 Introduction:

2.1.1 Definitions of the Biodynamic Farming:

Biodynamic agriculture derived from the Greek words for “life” and “energy”, represents a holistic and ethical approach to farming that acknowledges the natural principles governing ecosystems and aims to restore balance and vitality to the soil (Chavda & Vala, 2022). It views the farm as a living organism within its environment, striving to nurture healthy soil and produce nourishing food for both humans and animals. (Kopriva, *et al.*, (2022) stated that, biodynamic agriculture is the oldest form of alternative /organic farming, eschews inorganic fertilizer and chemicals, relying instead on healthy soil enriched with microorganisms and organic matter.

While there's no scientific backing for the purported effects of biodynamic preparations and cosmic rhythms on plant and animal physiology leading many to label it pseudoscience (Rigolot, 2023; Parisi *et al.*, 2021).

2.1.2 Origin and Development of Biodynamic Farming:

The biodynamic method originated based on the suggestions given by Dr. Rudolf Steiner; s, which responded to farmer's concerns during the rise of chemical farming in Europe in the 1920s. Steiner's approach integrated spirituality and science, addressing issues such as soil degradation and declining crop quality.

Biodynamic agriculture, rooted in the philosophy of anthroposophy, emphasizes understanding the interconnectedness of human nature and the universe. It began to take shape after Steiner's lectures in 1924, with Ehrenfried Pfeiffer later spreading its concepts to the United States in the 1930s (Chavda & Vala, 2022).

Further developments included the formation of the "Association for Research in Anthroposophical Agriculture" by Erhard Bartsch, aiming to assess biodynamic methods' effects on soil, plants, and animals. Bartsch also established Demeter, a sales organization for biodynamic products, which introduced the Demeter symbol and standards in 1928. Ehrenfried Pfeiffer's book, "BioDynamic Farming and Gardening," published in 1938, solidified biodynamic farming principles for decades. (Beluhova-uzunova & Atanasov, 2018)

Demeter International, encompassing a network of individual certification organizations in 45 countries, certifies around 8,000 biodynamic farms globally. This highlights the significant role biodynamic agriculture plays in the realm of alternative farming practices.

2.1.3 World Scenario on Biodynamic Farming:

According to Santoni *et al.* (2022), the method endorsed by the international certification label Demeter has gained widespread adoption.

This certification has seen a significant increase in the number of certified farms and the total certified surface area, as noted by Willer *et al.* (2020). Since the beginning of the millennium, there has been a notable surge in the number of Demeter-certified farms, surpassing 5900 farms by June 2019, with the certified surface area nearly doubling to over 200,000 hectares across 63 countries.

Germany boasts the largest biodynamic area, comprising 34% of the global total, followed by Australia (20%) and France (6%) (Paull *et al.*, 2020).

A substantial portion of the Demeter-certified area, approximately 15,000 hectares, is dedicated to biodynamic vineyards, with Europe leading in the number of BD wineries, particularly France with 375 wineries (Willer *et al.*, 2020). However, despite its growth, biodynamic farming remains a niche market, covering only 0.35% of the global certified organic hectares, as highlighted by Paull and Hennig (2020).

2.1.4 Organic and Biodynamic Farming:

Biodynamic and organic agriculture are closely aligned in their fundamental principles and regulations. However, Demeter's production standards diverge from conventional organic farming guidelines to bolster the farm's multifunctional role. Demeter-certified farms adhere to organic agriculture standards but incorporate additional requirements. Variances between Demeter and organic production regulations, as outlined by the International Federation of Organic Agriculture Movements (IFOAM), primarily revolve around the utilization of specific preparations in minute quantities on crops or soil, the mandate to allocate 10% of the total farm area for ecological infrastructures, and the stipulation to raise animals on-site (0.2 livestock units per hectare). While the use of preparations has long been obligatory, the recent introduction of the minimum ecological infrastructure area rule and the current requirement for animal husbandry are specific to Italian farms under Demeter Association in Italia. (Demeter Association Italia).

2.1.5 Biodynamic Calendar:

The Biodynamic Calendar, influenced by Rudolf Steiner's insights (Chavda & Vala, 2022; Gowri *et al.*, 2021), serves as a guide for agricultural activities, integrating both cosmic and earthly rhythms. Rhythmic is emphasizes aligning farming practices with natural cycles, enhancing soil vitality and ultimately improving food quality and human well-being. This calendar delineates various rhythms, cosmic, solar, lunar, and earthly which sustain life on Earth. By adhering to these rhythms, biodynamic farmers aim to revitalize the soil and enhance crop vitality. For instance, certain lunar phases, such as the period before the full moon, are deemed favourable for activities like seed sowing and applying liquid manures, while the moon's position relative to Saturn influences plant strength. Additionally, the calendar highlights the significance of the Moon's ascension and descension, its nodes, and its movements through zodiac constellations. (Chariali, 2021).

2.2 Principles of Biodynamic Farming:

The major principles of biodynamic farming include crop diversification and rotation, animal husbandry, composting, homeopathic solutions and life forces.

2.2.1 Crop Diversification and Rotation:

Crop diversification, through a variety of plants on uncultivated land, fosters soil health by enabling plants to complement each other nutritionally, while crop rotation prevents nutrient depletion and soil infertility common in conventional monoculture farming (Chariali, 2021).

Including diverse plant types such as annuals, perennials, herbs, and fruits enhances farm resilience and vitality, crucial in biodynamic farming (Shah *et al.*, 2021; Cropaia; Scavo *et al.*, 2022). Through strategic crop choices and cover crops, biodynamic practices enrich soil with essential nutrients, reducing reliance on synthetic fertilizers and controlling pest and disease outbreaks (Shah *et al.*, 2021; Scavo *et al.*, 2022). Additionally, biodynamic farming practices emphasize soil coverage with crops or mulch to prevent erosion and maintain soil quality, especially during vulnerable periods (Cropaia; Shah *et al.*, 2021).

2.2.2 Animal Husbandry:

Biodynamic farming emphasizes the symbiotic relationship between livestock and crops, minimizing external inputs while promoting ecological balance (Chariali, 2021). Livestock integration serves multiple purposes, with animal waste enriching soil as natural fertilizer and crops providing feed for animals (Chariali, 2021).

In biodynamic farming, livestock management is the belief in animals having souls, dictating respectful treatment and prohibiting practices like dehorning and isolated breeding (Baars and Spengler, 2003). animal welfare is a key feature in biodynamic farming, ensuring that farm animals lead natural lives, free-range and pasture-fed, and receive appropriate feed without animal by-products (Demeter, 2022a).

Practices like mutilation and artificial feeding are strictly prohibited, allowing animals to retain natural functions like beaks for chickens and horns for cows (Demeter, 2022a).

Overall, the biodynamic approach integrates livestock into farming systems in a holistic manner, prioritizing the well-being of animals and the environment alike.

2.2.3 Composting:

Biodynamic farming incorporates composting as a fundamental practice, emphasizing the utilization of recycled manures and organic waste to produce humus, essential for cultivating healthy soil on the farm.

This process involves spreading the resulting humus on fields, effectively stabilizing nitrogen and promoting crop productivity (Devi and Kaushal, 2022).

Biodynamic compost is preparing by using BD 502-507. Mixture the protein rich and carbon rich raw material at 60% protein and 40% carbonaceous.

Then Make five deep holes in the side of the compost heap and put 1 g each of the BD 502 - 506 preparations as 1 BD/hole. Apply 10 t/acre (Kopriva *et al.*, 2023). biodynamic compost helps harmonize the soil with the broader farm ecosystem, augmenting soil life and stability of organic matter, while also contributing to carbon sequestration, thereby aiding in climate balance (Demeter, 2022a).

2.2.4 Life Forces:

Biodynamic farmers and gardeners observe the rhythms and cycles of the earth, sun, moon, stars, and planets and seek to understand the subtle ways that the environment and wider cosmos influence the growth and development of plants and animals.

Biodynamic calendars support this awareness and understanding by providing detailed astronomical information and indications of optimal times for sowing, transplanting, cultivating, harvesting, and using the biodynamic preparations (Demeter, 2022a).

The fundamental differentiator of biodynamic farming lies in its emphasis on life forces, distinguishing it from conventional agricultural approaches. Beyond conventional factors such as biology, physics, and chemistry, biodynamic farming acknowledges the significance of cosmic forces, including lunar phases and celestial cycles, in shaping farm life (Reddy, 2019).

This holistic perspective integrates planetary influences and astrological cycles into agricultural practices, recognizing, for instance, the impact of a full moon's "cosmic force" on fruit formation and the role of Venusian forces in plant growth and animal reproduction.

Such cosmic cycles are central to the biodynamic approach, setting it apart from conventional methods and imbuing it with a mystical and astrological orientation (Beluhova-uzunova & Atanasov, 2018).

2.2.5 Homeopathic Solutions:

There are nine homeopathic preparations based on extracts from animal, plant and mineral manure, each diluted into sprays and used sparingly to homoeopathically treat compost, soil and plants in a process called dynamization.

Basically, there are two types of biodynamic preparations.

- Biodynamic field spray (BD 500 – BD 501 and BD 508)
- Biodynamic compost preparations (BD 502–BD 507)

BD 502-507 - 1 g of each is added directly to every 5 cubic meters of compost and 10 ml of preparation is mixed at 5% in 2-5 l of water can be used.

These could be added to liquid manures and cow pat pits also.(Vaish *et al.*, 2020; Chowdhury *et al.*, 2021)

BD 508 is applying by Diluting the tincture, 50 g tincture to 10 L of water Spray onto the soil or over the plants in the early growing stages (Kopriva *et al.*, 2023)

Table 2.1: BD 500- BD 501 preparation

Preparation	Method of preparation	Application and uses
BD 500 Cow Horn Manure	Fill the cow horn with fresh cow dung and placed in a pit, 1 inch apart with base downwards surrounded with 50% compost and soil. Then cover the pit with moist soil and left to 4-6 months for fermentation.	100g in 25-50 L of water/ha. Use warm water and stir for 1 hr alternatively clockwise and anti-clockwise forming a vortex, spray in late afternoon or evening as 4 times /year. Use to stimulate plant growth and humus formation, enhance seed germination, root formation and primary root development

Preparation	Method of preparation	Application and uses
BD 501 Cow horn silica	Crush silica until powdered and then moisten with water to make a stiff paste, then fill horns with the silica paste. Buried them in soil pit, 1 inch apart with base downwards surrounded with 50% compost and soil during summer time	1 gm silica+15 l of warm water, stirred for 1 hr before sunrise, alternately in clockwise and anticlockwise forming a vortex. sprayed on the plants using a low-pressure sprayer 2 times/ planting cycle in early morning only after spraying of BD 500. This Enhances metabolism, photosynthesis & helps to improve color, aroma, flavor and keeping quality of plants.

Table 2.2: BD 502- BD 507 preparation

Preparation	Method of Preparation	Uses
BD 502 Yarrow	Bladder of red deer (<i>Cervus elaphus</i>) is moistened and flowers (<i>Achillea millifolium</i>) are filled up to top with the help of small cut and after filling cut sealed with cotton thread and buried it from September to March in a mud pot with earth inside	Help to processes of Potassium (K), Sulphur (S) and trace elements
BD 503 Chamomile	unwashed intestine of cow or bull is cut into 15 cm bits and one end of bit is closed with a cotton string and another end is used to fill dry flowers (<i>Matricaria chamomilla</i>), in it with the help of funnel. Bundle of filled sausages are placed in mud pot surrounded with fertile soil. Bundles were buried in soil in the month of October and let remained till February/ March.	Help to processes of Calcium (Ca) and Nitrogen (N)
BD 504 Himalayan stinging nettle	Fill the dried leaves (<i>Urtica parviflora</i>) into terracotta pipes or mud pots then Press well into the containers. Ensure that the lid is on Place the pot under the influence of Mars. Preparation is lifted in September after a year.	It helps process of Iron (Fe) and Magnesium (Mg)
BD 505 Himalayan oak bark	Fill the brain cavity of skull of domestic animal with crushed oak bark (<i>Quercus glauca</i>). The opening is closed with a bone piece. It should be placed in a location where there is exchange of water such as rain drain/swamp. The preparation is buried in September and lifted in March.	It helps processes of Calcium (Ca)
BD 506 Dandelion	The unwashed mesentery of cow is filled with dried flowers of dandelion (<i>Taraxicum officinalis</i>) and wrapped into a parcel and tied with a jute thread. The parcel is placed in a good mixture of soil and compost into a pot in the month of September while lift in March	It helps processes of Silica (Si)

Preparation	Method of Preparation	Uses
BD 507 Valerian	A paste is prepared after grinding of flowers (<i>Valeriana officinalis</i>) into a mortar and pestle. The paste is added to water in ratio of 1:4 in a bottle and kept it in cool place	helps in regulating availability of soil phosphorus
BD 508 Casurina tea	Make a strong tea/tincture by boiling the <i>Equisetum arvense</i> or Casuarina in hot water for 2 hrs. Let it sit for 2 days	It helps to cope with fungus diseases

Source : (Vaish *et al.*, 2020; Chowdhury *et al.*, 2021;Kopriva *et al.*, 2023)

2.3 Practices of Biodynamic Framing:

2.3.1 Increase the Soil Fertility by Adding Compost and Green Manure:

Composting creates healthy soil, humus, Nitrogen to support healthy crops Consist of different herbs, vegetative matter, sheep manure, herbs, cow manure. it improves the structure of soil, allows more air into the soil, improves drainage and reduce erosion.

Compost improves soil fertility, by adding nutrients and by making it easier for plants to take up the nutrients already in the soil.

Grow green manure to add organic matter to soil Discourage the spread of weeds Helps to prevent the valuable nutrients of leaching away. (Chariali, 2021; Demeter, 2022a)

2.3.2 Pest and disease management in holistic manner:

Biodynamics emphasizes creating ideal conditions for soil, plant, and animal well-being by promoting balanced nutrition and strong immunity.

By fostering a diverse ecosystem with various plants and animals, while also encouraging natural predator habitats, farms and gardens can limit the proliferation of pests and diseases.

When disease or pest attack arise, they're viewed as signals of an underlying imbalance within the farm's ecosystem.

Biodynamic farmers not only employ biological controls to address immediate concerns but also strive to understand the root cause of the imbalance and adjust management practices accordingly to promote overall farm health. (Demeter, 2022a)

2.3.3 Planting of Cover Crops:

use of cover crops for dynamic accumulation of soil nutrients, nematode control, soil loosening and soil building Used in the areas which are prone to soil erosion.(Chariali, 2021)

2.3.4 Mulching:

Mulch keeps sunlight from reach the soil, minimizing evaporation. Organic mulch breaks down and release nutrients that plant use. Weed seeds are kept dormant under the mulch.

2.3.5 Crop Rotation:

Crop rotation provides soil enrichment, natural habitat, encourage beneficial insects while reducing soil compaction and recycling plant nutrients into soils Stabilizes soil during heavy rains and hold moisture during drought period (Chariali, 2021)

2.3.6 Companion Plants:

Planned association of two or more plant species in close proximity, so that some cultural benefits (pest control, higher yield is derived) Increase biodiversity on the farm which leads to a more stable agro ecosystem.

2.4 Advantages of Biodynamic Farming:

2.4.1 Environmental Benefits:

- Total Elimination of Toxic Chemicals
- Conservation of Water
- Improvement in Water Quality
- Conservation for Wildlife
- Reductions in Energy Use
- Improvement in Air Quality
- Formation of soil structure
- Stimulate microbial activity

2.4.2 Soil Quality:

- Decrease in Erosion
- Decrease in Toxicity
- Decrease in Soil Compaction
- Increase in Nutrients and Richness
- Increase in Water Holding Capacity
- Broad Crop Rotation

2.4.3 Health Benefits:

- Supply more nutritious and better-quality foods
- Free from Toxic Chemicals
- Therapeutic

2.5 Disadvantages of Biodynamic Farming:

- Small scale and limited distribution
- Labour and time intensive
- More expensive for the consumers
- Against the mainstream because, it is Difficult to persuade people away from corporation farming due to an overall lack of environmental concern in our society and the cosmic aspects of the practice could possibly frighten or deter people from becoming involved.

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