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BIODYNAMIC FARMING IN INDIA

This summary document provides an overview of the state of biodynamic farming in India. And also covers a literature review of impact studies conducted on biodynamic farming in India. **It is a part of the larger CEEW study,** *Sustainable Agriculture in India 2021: What We Know and How to Scale Up*

Sustainable Agriculture in India 2021: What We Know and How to Scale Up, is a handbook on the prevalence, practices and state of affairs of the 16 most promising sustainable agriculture practices in the country. It presents the economic, social and environmental impacts of these practices with recommendations on their potential to scale-up sustainable agriculture in India.

The study is available at: https://www.ceew.in/publications/sustainable-agriculture-india-2021

Image: Pixabay

Biodynamic is a combination of two Greek words: "bios," which means life, and "dynamos," which means energy. In biodynamic agriculture (BDA), the farm is considered an autonomous and living organism that interacts with the environment to build healthy and living soil and produce healthy and nutritious food.[1] It stresses spirituality and follows a calendar for planting and sowing crops dependent on the moon and stars' position. Biodynamic farming first originated in the context of anthroposophy. It was developed by Rudolf Steiner in 1924 at Koberwitz as part of a series of lectures for farmers: "Spiritual Foundations for a Renewal of Agriculture: A Series of Lectures."[2]

The biodynamic farming system mainly works on the relationship between plant growth and cosmic rhythms and emphasises the importance of maintaining sustainable soil fertility.[3] For instance, some biodynamic practices considered biodynamic pillars are the lunar and cultural calendar synchronisation, the use of preparations (for crops and/or compost) made from medicinal plants, cow dung, quartz, and living animals on the farm.[4]

Biodynamic preparations are the core elements of biodynamic farming. These preparations, named BD-500 to BD-507, are not the usual compost starters but can stimulate compost organisms in various ways. They are biologically active dynamic preparations, which help harvest the potential of astral and ethereal powers to benefit the soil and different biological cycles in the soil.[5] While farmers in the field can prepare them, it is a labour-intensive exercise. In addition to these preparations, cow pat-pit, liquid manures, peppering for pesticides, and biodynamic compost heaps are crucial elements of the practice.

Image: Unsplash

Biodynamic farming linkages to FAO's agroecological elements

In principle, biodynamic agriculture adheres to and has great potential to promote many agroecological elements. It allows for a wide range of agroecological practices - composting, green manuring, crop rotations, intercropping, trap crops, etc., thus taking a holistic approach in the farming system.

Elements	Description of agroecological linkages
Diversity	Biodynamic farming ensures a mixed and diverse farm – the right balance of animals and crops. Mixed cropping and intercropping allow for spatial diversity, and crop rotation ensures temporal diversity. For instance, if one plant depletes one kind of nutrient, another plant on the farm releases these nutrients, replenishing the soil with the lost nutrients. Crop rotation ensures plant diversity, and raising varied animals on the farm reduces health risks from parasites.
Co-creation and sharing of knowledge	Indian farmers have traditionally followed the ancient "panchanga" – the Hindu calendar that records the solar cycles. The use of the biodynamic calendar for planting and harvesting crops, along with scientifically tested formulations like "soil shampoo" or "cow pit-pat," is simply a blend of traditional and indigenous knowledge with scientific knowledge.
Synergies	BDA is a participatory and responsible way of farming, which brings in the synergy of soil, plants, animals, people, and the planet. It considers a farm as an independent entity (system) in itself – which has an internal environment in which various agents of the farm interact among themselves and also has a dynamic relationship with its external context (Biodynamic Association of India)
Efficiency	One of the fundamental principles of biodynamic farming is zero use of chemical fertilisers. Instead, natural materials, mostly produced on the farm, are used for preparing fertilisers, manures, and sprays. It creates a closed system – of crops and livestock – wherein all the inputs are retrieved from within the farm itself.
Recycling	Composting is fundamental in biodynamic agriculture, fulfilling the recycling principle of agroecology. BDA dictates that no waste be produced, as all the things that would be termed as waste are recycled in other parts of the farm, creating a vital energy transfer that further increases self-renewal capacity. Biodynamic compost made of protein-rich materials such as animal manure, fresh green leaves, and carbon-rich materials such as paddy straw, wood chips, dry leaves, etc., serves to recycle animal manures and organic waste, stabilise nitrogen, and build soil humus. The recycled manures and organic waste in the compost pile create humus which is vital to the farm. All the preparations used under BDA are keys to composting – two are used to stimulate humus and suppress fungal disease in crops.[6]
Resilience	The diversification and integration of crops and animals increase farmers' economic resilience by reducing dependence on a single crop or livestock species. Also, reducing reliance on external inputs reduces farmers' financial risk.
Human and social values	From a social equity and responsibility view, biodynamic agriculture encompasses the main principles of social sustainability, co-creation of knowledge, cultural diversity, social equity, and above all, acceptance of everyone.

A brief context in India

In India, the biodynamic movement started in the early 1990s, when T.G.K Menon, Director of the Kasturbagram Krishi Kshethra invited Peter Proctor, a New Zealand consultant Biodynamic Association, to conduct a workshop on biodynamic methods. Today, the most prominent advocate and promoter of BDA is the Biodynamic Association of India (BDAI). Its Demeter Certification office (DCO) conducts the certification process carried out by the international certification office of Demeter International. Much like organic certification, to get Demeter certification, the farmer (or processor or handler) submits an application for biodynamic certification, and the farm is inspected and evaluated. Based on the evaluation, a farm may be certified as Demeter Certified Biodynamic, In-conversion to Demeter Biodynamic, Aurora Certified Organic and/or Stellar NOP Organic (for when a farm is on its way to becoming biodynamic).

Biodynamic agriculture now finds mention in many government policy documents. For example, it is mentioned in a technical brochure on organic farming systems – An Integrated Approach for Adoption under *National Horticulture Mission* by the Department of Agriculture and Cooperation, Ministry of Agriculture. The practice is also mentioned under the *Paramparagat Krishi Vikas Yojana (PKVY)* and the Federal Ministry of Agriculture & Farmers' Welfare, as well as in the report of the Committee on Doubling Farmers' Income Volume VI (of XIII), titled "*Strategies for Sustainability in Agriculture.*"[7]

Biodynamic farming: acreage, geographies, and cultivation details

How much area in India is under biodynamic farming? According to Demeter International, there are 9,131.89 hectares of certified biodynamic farms in India. However, our consultations with the Biodynamic Association of India suggested the uncertified area could be around 60,000-70,000 hectares.

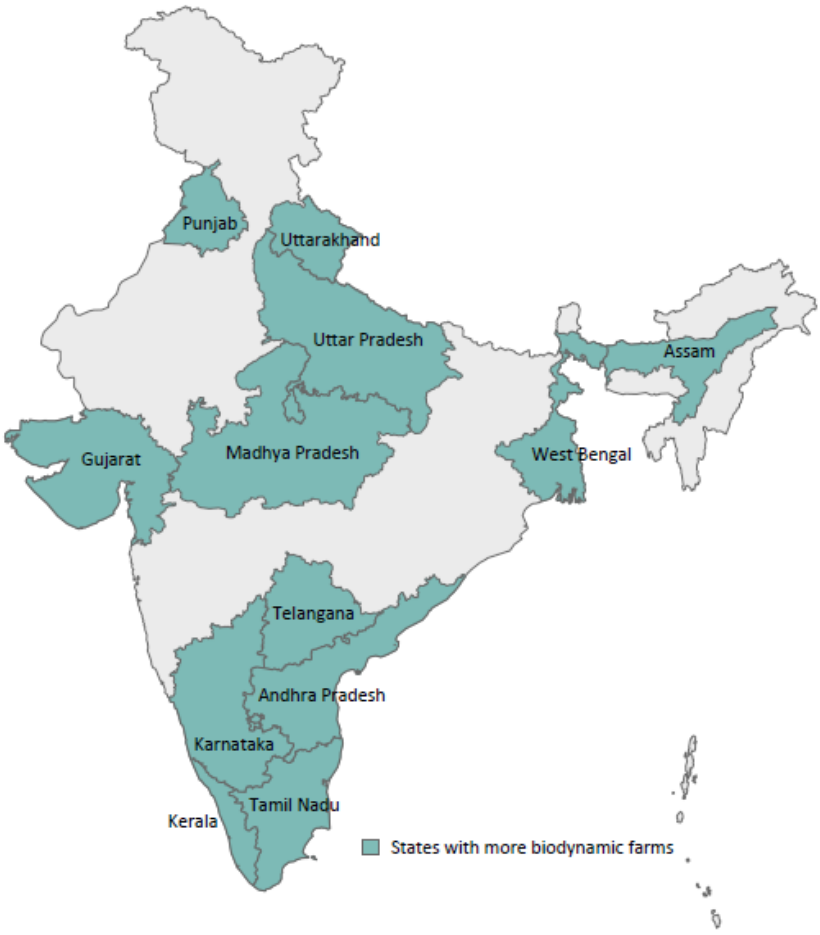
At what farm size is biodynamic farming practised? While no official data are available on the farm scale, from the discussions, we also learned that BDA's labour-intensive nature means it is mostly practised by small and marginal farmers. According to information provided by the Biodynamic Association of India, more than 500 small and big farms practice biodynamic agriculture throughout the country. However, these farms are not certified under Demeter, making it difficult to quantify the area and farm-scale where BDA is practised.

How many farmers in India are practising biodynamic farming? While databases on organic farmers are regularly maintained and updated in India, there is no information on the number of farmers adopting biodynamic practices. Our stakeholders' consultations revealed that many farmers in India use biodynamic preparations alongside organic farming. But as they have not got themselves certified, they are not recorded in the official database maintained by Demeter International for biodynamic farmers. No reports were found on this in the grey literature either. However, according to Sundeep Kamath, the ex-secretary of

BDAI, India has nearly 100,000 farmers practising some form of biodynamic farming, based on sales of biodynamic preparations and self-reports.

Where in India is biodynamic farming prevalent? According to the Demeter International database, there are around 48 certified projects across the country. Gujarat, Madhya Pradesh, Uttarakhand, Uttar Pradesh, Andhra Pradesh, Kerala, Punjab, Karnataka, Tamil Nadu, Telangana, West Bengal, and Assam are among the states where biodynamic farms are most widespread (Figure 1).

Figure 1.The map indicates the states where biodynamic farms are most widespread.



Source: Author's compilation from Demeter database, and the stakeholder's consultation

Which are the major crops cultivated under biodynamic farming in India? Biodynamic farming is mainly adopted in India for growing herbs, spices, tea, and coffee. The organisations certified for biodynamic products include Darjeeling Organic Tea Estates, Selimbong Tea Estates, Mother India Farms, Ambootia Tea Exports, etc. The entire list of certified organisations is available on the Demeter database. Other crops cultivated by certified biodynamic farms include fruit, mangoes, herbs, cardamom, quinoa, medicinal herbs, oil crops, fodder crops, essential oils, vanilla, ginger, turmeric, cloves, etc.

Impact of biodynamic farming

This section considers the economic, social, and environmental impacts of biodynamic agriculture.

ECONOMIC IMPACT

1. Yields

A few studies comparing organic management with and without biodynamic preparations in India showed increased yields for the crops studied. Most of these are field experiments conducted by scientists at the Indian Council of Agricultural Research (ICAR). Due to the short-term nature of the results for yield, and

the lack of a longitudinal assessment through crop-cutting experiments, definitive conclusions about the comparative agronomic and economic performance of BDA cannot be drawn, however.

During 2003-2006, field experiments were conducted on the impact of BDA on horticulture crops such as carrot, French bean, and potato at the horticulture research station in Ooty and some farmer's fields. The study concluded that yield potentials are equal or better than conventional agriculture. The quality of products concerning nutrition, appearance, and shelf life was also better under biodynamic agriculture.[8]

A few challenges were also highlighted in the consultations, including the appropriation of farming and land fragmentation. Landless farmers cannot reap the full potential of biodynamic farming due to uncertainties of yields in the shorter term. Weather fluctuations and lack of marketing support were some other challenges mentioned.

2. Income

A critical component of BDA is reducing input costs, as most fertilisers, manures and sprays are produced using on-farm resources. The stakeholder consultations stated that many farmers in India practise biodynamic farming because they receive premium prices for their products, such as certified tea and coffee. However, this was also highlighted as a challenge for small, landless, and uncertified farmers, as the certification process is expensive and cumbersome. Still, without it, they are not able to benefit from the premium prices.

While we could not find any long-term study that evaluates the cost of cultivation and income implications for farmers, a few scientific papers look at the economic efficiency under different BDA preparations in conjunction with other organic manures. The Department of Agronomy at Kerala University looked at the impact of biodynamic cultivation on the net return from chillies. Returns were reportedly lower than with the recommended nutrient management practices (application of 20 Mg per hectare of farmyard manure +75:40:25 N: P2O5:K2O kgs per hectare) but higher than organic manure treatment alone. The study highlighted the need for long-term experimentation to elucidate the beneficial effect of BDA.

SOCIAL IMPACT

1. Human health

While there are studies outside India that have looked into the quality of biodynamically grown food, Indian studies are limited. In general, biodynamically grown foods are nutritionally superior as they contain higher levels of vitamins, minerals, and amino acids.[9]

Biodynamic researchers use different image-forming methods to analyse the quality of food. Some of these methods include sensitive crystallisation, circular chromatography, capillary dynamo lysis, and the drop-picture method. A case study on biodynamic vegetable cultivation used biodynamic circular paper chromatographic techniques to compare the quality of carrots, ladies' fingers, and onions grown biodynamically with commercially grown vegetables. The analysis reported a clear difference in the colour, pattern, and shape of the spikes in each zone of the chromatograms of the carrot, which reflects the presence

of minerals, starch, and proteins. A biodynamically grown carrot showed a central inner zone of 3.5 cm diameter compared to a 2cm zone for the commercial carrot, indicating qualitative differences in the availability of minerals.[10]

While such studies indicate improvement in food quality and human health, extensive large-scale field trials in different agro-climatic zones are missing from the literature and need to be conducted.

2. Gender

No literature is available.

ENVIRONMENTAL IMPACTS

Soil

The basic principles of biodynamic farming are to restore organic matter in the soil in humus, increase the microbial population, and treat manure/compost in a biodynamic way. The skillful application of these factors contributes to soil life and health. A few studies are based on field experiments that indicate improved soil conditions using BD-500, BD-501, and cow pat pit. However, details of all soil types are missing from the literature.

BD-500, one of the most commonly used preparations, requires a fermentation process within a cow horn. This creates a very fine humus-like material that is said to improve the soil structure and porosity, increase humus-forming bacteria's activity, promote upright plant growth, nodulations, root penetration, and boost the soil microbial population and earthworm activity.[11]

Similarly, cow pat pit (CPP), also called "soil shampoo," acts as a soil conditioner and improves texture, provides resistance against pests and diseases, replenishes, and rectifies trace element deficiency. The ingredients used in preparing biodynamic fertilisers – like cow manure, quartz, and herbs, in compost or liquid form – are said to increase biological activity in the soil. Biodynamically managed soil shows better physical, chemical, and biological properties like texture, porosity, organic matter. A case study using chromatographic images of the soil indicated improved soil health under BD.[12]

Cover crops and crop rotation are both practised under biodynamic agriculture. Using cover crops, BDA advocates the dynamic accumulation of soil nutrients, soil loosening, soil building, and nitrogen fixation.

3. Water/Emissions/Energy/Carbon/Biodiversity

No literature is available.

Impact evidence

State of available research discussing the impact of biodynamic farming on various outcomes

Evidence Type	Yield	Income	Health	Gender	Soil and nutrients	Water	Energy	GHG emissions	Bio-diversity
Journals	17	5	5	0	18	0	0	0	0
Reports	0	0	0	0	1	0	0	0	0
Articles/ case-studies	1	1	0	0	2	1	0	0	0
Total	**18**	**6**	**5**	**0**	**21**	**1**	**0**	**0**	**0**

*** Thesis, guidelines, conference papers, etc*

Source: Authors' compilation

Note – The evidence is from the first 75 results examined in Google Scholar Advanced search and the first 30 results from Google Advanced Search. Only those papers which clearly established the evidence for different indicators were selected.

Stakeholder mapping

The following institutions are involved in the research and promotion of biodynamic farming; a few were consulted for this research

Research/implementation institutions	NGOs/Civil society organisations
Biodynamic Association of India	SARG Vikas Samiti
ICAR – Central Institute for Subtropical Horticulture	Bhaikaka Krishi Kendra
	Lipok Social Foundation

Source: Authors compilation

Note – The stakeholders list is indicative and not exhaustive

Endnotes

[1] Ministry of Environment, Forest and Climate Change. 2017. *Report of the Committee on Doubling Farmer's Income - Strategies for Sustainabilty in Agriculture*. Department of Agriculture, Cooperation and Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare.
[2] Brock C et. al. 2019. "Research in biodynamic food and farming - a review". Open Agric 4:743–75
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[6] Ram R.A, and K.A. 2019. "Bio-dynamic agriculture: an advance stage of organic farming". *J Eco-friendly Agric* 14
[7] Ministry of Environment, Forest and Climate Change. 2017. *Report of the Committee on Doubling Farmer's Income - Strategies for Sustainabilty in Agriculture*. Department of Agriculture, Cooperation and Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare.
[8] Nabi A, Narayan S, and Afroza B, et al. 2017. "Biodynamic farming in vegetables". *J Pharmacogn Phytochem* 6:
[9] Perumal, K., and Vatsala, T.M. n.d.. *Utilization of local alternative materials in cow horn manure (BD 500) preparations: A case study on biodynamic vegetable cultivation*. Shri A.M.M. Murugappa Chettiar Research Centre Tharamani, Chennai, Retrieved January 11, 2021, from http://www.biodynamics.in/Perumalcowman.htm
[10] Ibid
[11] Ram R.A, and K.A. 2019. "Bio-dynamic agriculture: an advance stage of organic farming". *J Eco-friendly Agric* 14
[12] Perumal, K., and Vatsala, T.M. n.d.. *Utilization of local alternative materials in cow horn manure (BD 500) preparations: A case study on biodynamic vegetable cultivation*. Shri A.M.M. Murugappa Chettiar Research Centre Tharamani, Chennai, Retrieved January 11, 2021, from http://www.biodynamics.in/Perumalcowman.htm

Suggested citation: Gupta, Niti, Shanal Pradhan, Abhishek Jain, and Nayha Patel. 2021. *Sustainable Agriculture in India 2021: What We Know and How to Scale Up*. New Delhi: Council on Energy, Environment and Water

The **Council on Energy, Environment and Water (CEEW)** is one of Asia's leading not-for-profit policy research institutions. The Council uses data, integrated analysis, and strategic outreach to explain – and change – the use, reuse, and misuse of resources. It prides itself on the independence of its high-quality research, develops partnerships with public and private institutions, and engages with wider public. In 2021, CEEW once again featured extensively across ten categories in the *2020 Global Go To Think Tank Index Report*. The Council has also been consistently ranked among the world's top climate change think tanks. Follow us on Twitter @CEEWIndia for the latest updates.

FOLU Coalition: Established in 2017, the Food and Land Use Coalition (FOLU) is a community of organisations and individuals committed to the urgent need to transform the way food is produced and consumed and use the land for people, nature, and climate. It supports science-based solutions and helps build a shared understanding of the challenges and opportunities to unlock collective, ambitious action. The Coalition builds on the work of the Food, Agriculture, Biodiversity, Land Use and Energy (FABLE) Consortium teams which operate in more than 20 countries. In India, the work of FOLU is being spearheaded by a core group of five organisations: Council on Energy, Environment and Water (CEEW), the Indian Institute of Management, Ahmedabad (IIMA), The Energy and Resources Institute (TERI), Revitalising Rainfed Agriculture Network (RRAN) and WRI India.

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