

## An introduction to biodynamic approach in agriculture

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**B**iodynamic agriculture is a method of organic farming that treats farms as unified and individual organisms (Burkitt *et al.*, 2007). Emphasizing balancing the holistic development and interrelationship of the soil, plants, animals as a self-nourishing system without external inputs (Carpenter *et al.*, 2000). As in other forms of organic agriculture, artificial fertilizers, toxic pesticides and herbicides are strictly avoided. There are independent certification agencies for biodynamic products, most of which are member of the international biodynamics standards group. Demeter Internationalr regarded by some as the first modern ecological farming system and one of the most sustainable, (Chalker-Scott, 2004). Biodynamic farming has much in common with other organic approaches, such as emphasizing the use of manures and composts and excluding of the use of artificial chemicals on soil and plants. Methods unique to the biodynamic approach include the use of fermented herbal and mineral preparations as compost additives and field sprays and the use of an astronomical sowing and planting calendar (Harwood, 1990). Biodynamics originated out of the work of Rudolf Steiner on development of biodynamic agriculture began in 1924 with a series of eight lectures on agriculture given by Rudolf Steiner at Schloss Koberwitz in what was then Silesia, Germany, (now in Poland east of Wroc<sup>3</sup>aw). The course was held in response to a request by farmers who noticed degraded soil conditions and a deterioration in the health and quality of crops and livestock resulting from the use of chemical fertilizers Kirchmann (1994). An agricultural research group was subsequently formed to test the effects of biodynamic methods on the life and health

of soil, plants and animals.

Today biodynamics is practiced in more than 50 countries worldwide. Demeter International is the primary certification agency for farms and gardens using this methods.

### **Biodynamic method of farming:**

Biodynamic agriculturalists conceive of the farm as an organically self-contained entity with its own individuality, within which organisms are interdependent. "Emphasis is placed on the integration of crops and livestock, recycling of nutrients, maintenance of soil, and the health and well being of crops and animals; the farmer too is part of the whole. Cover crops, green manures and crop rotations are used extensively and the farms foster bio-diversity.

Green revolution started on a organic carbon rich soil and the responses to applied fertilizer were spectacular. With passage of time, green revolution is showing symptoms of fatigue and responses to applied fertilizers have started dwindling. Decline in food production, degeneration in native soil fertility and deterioration in environmental

In natural condition the ecosystem, in which the living is converted in to non living and nonliving in to living, maintain the biological balance of soil. During this process the nutrients removed from the soil are returned to it in a cyclic manner. Unfortunately from the 6<sup>th</sup> decades of nineteenth century, removal of nutrients has increased more in comparison to enhanced and the natural equilibrium was skewed towards negative balance. To avoid the indiscriminate use of chemical fertilizers, pesticides, weedicide etc. and to ameliorate the Indian soils from multi-nutrient deficiencies the Integrated

Plant Nutrient Management(IPNM) and Integrated Pest Management(IPM) were considered as a remedy to above problems and to ameliorate the Indian soil from multi-nutrient deficiencies.

Thus the combined and cogent use of bio-fertilizer and bio-pesticide have become essential part of agriculture. Due to the limited availability and knowledge the IPNM and IPM are not being adopted as per expectations

#### **Impact of chemical based agriculture:**

- Compaction of soil structure.
- Low organic matter content in the soil.
- Poor water holding capacity of the soil
- Increase in salinity, sodicity and land submergence.
- Deterioration in quality of produce and factor productivity.
- Increased hazards and outbreak of pest and disease including weeds.
- Varying degree of displacement of human settlement.

Government of India seriously consider the future of Indian agriculture and a task force to suggest alternatives to conventional agriculture was constituted

Under chairmanship of Dr. Kunwarji Bhai Jadav of Rajkot and Commissioner of Agriculture, Government of India as member secretary, the task force pointed out the following observations.

- The "organic farming" is being practiced by thousand of farmers and institutions in the country.
- The success stories indicate the benefits of organic farming.
- There is no awareness among people in general about the benefits of organic farming, as there is no state or central Government support.
- No markets have been developed in the country for the sale/ promotion of organic produce.
- The system of export of organic produce is also presently at a limited level and exact data are not available.
- Huge subsidy is given per ton of production of chemical fertilizers whereas no subsidy or incentive is given for use of organic manures.
- The ministry of Commerce, Government of India has set up standards for organic farming and defined the system of certification and Accreditation only in April 2002, which may facilitate further growth of organic farming in the country.

Most of the horticultural crops are eaten fresh or used for health care hence any contamination may lead to various kinds of health hazards. Hence organic production offers a better possibility in horticulture crops rather than in the field crops.

Since chemical dependent farming has started giving negative response so Organic farming, Homa farming, Ecological farming, Natural farming so on are also being tried by various organizations in different countries.

#### **Biodynamic farming:**

It is based on sound principal of soil biotechnology and microscopic doses of few of the preparations have shown profound effects on growth, metabolism, crop yield and quality. It is interesting that these practices do not require sophisticated facilities and most of them can be created at earn itself by simple training. They are components of biological or soft agriculture, capable of affording long-term sustainability to agriculture and particularly to the ecosystem. The system is based on the principles of harnessing the synergy between cosmos, mother earth, cow and plants. Now a days biodynamic farming is becoming popular in several countries such as Germany, Australia, New Zealand and U.S.A.etc. In India, some farmers in Ooty, Indor and around Nainital have attempted biodynamic agriculture. The soil is not only a chemical mineral or organic system but it also has a physical structure. The maintenance of a crumbly, friable and well aerated structure is essential feature of fertile soil.

Biodynamic farming spawned by the late anthroposophist, Rudolf Steiner, has grown and increased in popularity since 1992. The term biodynamic is taken from the words bios meaning life and dynamics meaning energy. Hence biodynamic forming refers to working energy. Hence biodynamic farming refers to working with the energies also which create and maintain life. by side-stepping the typical preconception that light makes chlorophyll plants grow, biodynamic farmers realize that other energies also contribute to a plants growth. Because of the difference in these contributing energies, planting crop one day will be totally different than planting it on another day. In fact, planting during certain days of the moon cycle is important and had been in practice earlier.

According Pfeiffer (2006) Biodynamic farming is defined as working with energies, which create and maintain life. It involves certain principles and practices for healthy soil, healthy plant and healthful food for human being and feed for animals. In this system, energies from Cosmos, Earth, Cow and Plants are systematically and synergistically harnessed. It is based on the knowledge that soil, plant, animals and men work together in one agriculture cycle. Biodynamic agriculture work together in one agriculture works on the following principles.

#### **Principles of biodynamic agriculture:**

- To restore the fertility of soil through incorporation of organic matter in the form of humus.
- To established, maintain and increase soil living system.
- Organic matter as the basis factor for the soil life.
- Biodynamic method is not only the fertilizing of soil but skilful application also, to establish system that bring in to balance all factors which maintain life.

The soil is not only the system of chemical, mineral or

organic system, but it also has acumbly, friable, well aerated physical structure. Central Institute for subtropical horticulture, Lucknow has been associated with biodynamic practices for the two year and different components related of its are discussed as below:

### Cosmic integration:

#### *The zodiac principal:*

Fine tuning of biodynamic principles lies in the harnessing cosmic and earthy influences for cultivation. The best growth of a particular part of a plant is depend on a particular times of month or year and the cosmic influences. The cosmic factor that determines a month is the moon. The movement of the moon is relation to the zodic is interesting. These zodiac symbols are greek in origin. The system has twelve constellations though represented by different archetype figures and animals. With in these 12 signs, there are four groups of these constellation each of which have same qualities. They are related to four basic elements *i.e.* earth, water, fire and air. These four elements can be placed in relation to the four parts of the plant *i.e.* the root, the leaf, the flower and the fruit and seed. Root is associated with earth. Without earth, there is no root growth. Leaf is associated with water. Flower is associated with air and light. Without air light is impossible (no light on the moon because there is no atmosphere). Fruits and seed are associated with fire because there is no fruit ripening and seed maturity without optimum warmth.

The light of sun, moon, planets and stars reaches to the plants in regular rhythms. Each contributes to the life, growth and form of the plant. Planet affect the metals, rocks, plants, animals and man. This effect of planets called as “asteral influences”. In greek aster means star. The planets have been divided in inner planet Moon, Mercury and Venus) situated in between earth and sun and outer planets(mars, Jupiter and Saturn).The inner planets work directly through atmosphere and indirectly via water, humus or calcium(lime stone, potassium and sodium) on growth of plants.

#### *Biodynamic calendar:*

Constellation are more effective and beneficial on the agricultural practices such as field preparation, sowing, manuring harvesting etc. The effect and influence of costellation on four parts of the plants are enumerated as below:

#### **Ascending period of moon:**

Any agricultural practice such as spray propagation etc. during this period show effect due to the activeness of Cosmic forces above the earth’ ground.

#### **Descending period of moon :**

During this period, cosmic forces are active below the ground/earth. Any agricultural practices such as field

**Table 1 : The effect of constellation on plant parts**

Element	Plant parts	Constellation
Earth	Root	Taurus, Virgo, Capricorn
Air/ light	Flower	Gemini, Libra, Aquarius
water	Leaf	Cancer, Scorpio, Pisces
Fire	Fruit/seed	Aries, Leo, Sagittarius

preparation, sowing, manuring and harvesting of root crops etc. performed during the period show beneficial effect.

#### **Moon rhythms :**

- Moon node- 27.2 days
- Ascending period of moon- 27.3 days
- Descending period of moon- 27.3 days
- Moon posses through all constellation-27.3 days
- Moon opposite to Saturn- 27.3 days
- Perigee-Apogee- 27.5 days
- Full-new moon 29.5 days

#### **Field preparations:**

##### *Field preparations, for stimulating humus formation:*

**500:** (horn-manure) a humus mixture prepared by filling the horn of a cow with cow manure and burying it in the ground (40–60 cm below the surface) in the autumn. It is left to decompose during the winter and recovered for use the following spring.

**501:** Crushed powdered quartz prepared by stuffing it into a horn of a cow and buried into the ground in spring and taken out in autumn. It can be mixed with 500 but usually prepared on its own (mixture of 1 tablespoon of quartz powder to 250 liters of water) The mixture is sprayed under very low pressure over the crop during the wet season, in an attempt to prevent fungal diseases. It should be sprayed on an overcast day or early in the morning to prevent burning of the leaves.

Both 500 and 501 are used on fields by stirring about one teaspoon of the contents of a horn in 40–60 liters of water for an hour and whirling it in different directions every second minute. Although some biodynamic beliefs refer to buried quartz “fermenting”, a 2004 review commented that it is unclear what this actually means, as rock does not ferment(Koep and Herbert, 2009).

##### *Compost preparations*

Compost preparations, used for preparing compost, employ herbs which are frequently used in medicinal remedies:

**502 :** Yarrow blossoms(*Achillea millefolium*) are stuffed into urinary bladdersfrom Red Deer (*Cervus elaphus*), placed in the sun during summer, buried in earth during winter and retrieved in the spring.

**503:** Chamomile blossoms (*Matricaria recutita*) are stuffed into small intestinesfrom cattle buried in humus-rich earth in the autumn and retrieved in the spring.

**Table 2 : Position of earth and moon for harnessing the cosmic forces**

Sr. No.	Ascending moon	Descending moon
1.	The earth breathes out the development occurs in upper parts of the plant. Light energy forces are actives.	The earth breathes in- the development of the plant occurs parts below the ground e.g. root, earth forces are active.
2.	Cosmic forces work above the rhizosphere	Cosmic forces work below the rhizosphere
3.	Spring and summer season	Autumn and winter season
4.	Suitable for, Foliar applications Propagation activities Sowing of seeds Harvesting of crop related to air/light constellation	Suitable for, Top working of tree Transplanting Land preparation and manure application Harvesting of root crop
5.	At sunset	The earth breathes in and earth forces are active.
6.	At sunrise	The earth breathes out and light energy forces are active.

504: Stinging nettle (*Urtica dioica*) plants in full bloom are stuffed together underground surrounded on all sides by peat for a year.

505: Oak bark (*Quercus robur*) is chopped in small pieces, placed inside the skull of a domesticated animal, surrounded by peat and buried in earth in a place where lots of rain water runs past.

506: Dandelion flowers (*Taraxacum officinale*) is stuffed into the peritoneum of cattle and buried in earth during winter and retrieved in the spring.

507: Valerian flowers (*Valeriana officinalis*) are extracted into water.

508: Horsetail (*Equisetum*)

One to three grams (a teaspoon) of each preparation is added to a dung heap by digging 50 cm deep holes with a distance of 2 meters from each other, except for the 507 preparation, which is stirred into 5 liters of water and sprayed over the entire compost surface. All preparations are thus used in homeopathic quantities. Each compost preparation is designed to guide a particular decomposition process in the composting mass.

One study found that the oak bark preparation improved disease resistance in zucchini (Paul, 2006).

#### **Astronomical planting calendar:**

The approach considers that there are astronomical influences on soil and plant development, specifying, for example, what phase of the moon is most appropriate for planting, cultivating or harvesting various kinds of crops. This aspect of biodynamics has been termed “astrological” in nature (Paul, 2006).

#### **Treatment of pests and weeds:**

Biodynamic agriculture sees the basis of pest and disease control arising from a strong healthy balanced farm organism. Where this is not yet achieved it uses techniques analogous to fertilization for pest control and weed control. Most of these

techniques include using the ashes of a pest or weed that has been trapped or picked from the fields and burnt. A biodynamic farmer perceives weeds and plant vulnerability to pests as a result of imbalances in the soil.

– Pests such as insects or field mice (*Apodemus*) have more complex processes associated with them, depending on what pest is to be targeted. For example field mice are to be countered by deploying ashes prepared from field mice skin when Venus is in the Scorpius constellation.

– Weeds are combated (besides the usual mechanical methods) by collecting seeds from the weeds and burning them above a wooden flame that was kindled by the weeds. The ashes from the seeds are then spread on the fields, then lightly sprayed with the clear urine of a sterile cow (the urine should be exposed to the full moon for six hours), this is intended to block the influence from the full moon on the particular weed and make it infertile.

#### **Seed production:**

Biodynamic agriculture has focused on open pollination of seeds (permitting farmers to grow their own seed) and the development of locally adapted varieties. The seed stock is not controlled by large, multinational seed companies (Nastati, 2010).

The term *Biodynamic* is a trademark held by the Demeter association of biodynamic farmers for the purpose of maintaining production standards used both in farming and processing foodstuffs. The trademark is intended to protect both the consumer and the producers of biodynamic produce. Demeter International is an organization of member countries; each country has its own Demeter organization which is required to meet international production standards. The original Demeter organization was founded in 1928; the U.S. Demeter Association was formed in the 1980s and certified its first farm in 1982. In France, Biodivin certifies biodynamic wine Schilthuis (2003). In Egypt, SEKEM has created the Egyptian Biodynamic Association (EBDA), an association that

provides training for farmers to become certified (Raupp, 1998).

### Studies of efficacy:

Studies have compared biodynamic farming methods to both other organic methods and to conventional methods. Most studies have found that biodynamic farms have soil quality significantly better than conventionally farmed soils but comparable to the soil quality achieved by other organic methods; the decisive factor is likely to be the use of compost.<sup>[20]</sup> Studies of yields differ in their conclusions.

– A 1993 study compared soil quality and financial performance of Biodynamic and conventional farms in New Zealand. The study reported that, “The Biodynamic farms proved in most enterprises to have soils of higher biological and physical quality: significantly greater in organic matter, content and microbial activity, more earthworms, better soil structure, lower bulk density, easier penetrability, and thicker top soil. The biodynamic farms were just as financially viable on a per hectare basis. The study compared biodynamic farms with adjacent conventional farms, but didn’t attempt to compare farms of similar size, or with similar crops (Reganold *et al.*, 1993).

– A further study investigated whether biodynamic preparations had any effect on the yield and growth of lentil and wheat crops, weed populations and soil fertility in the short term. The study found that “[i]n general, soils and crops treated with biodynamic preparations showed few differences from those not treated”. Plots tended with biodynamically treated compost produced results for yield, crop quality and soil fertility that were similar to those tended with non-biodynamic composts and NPK fertilizers. Some alteration was observed in the nitrogenous chemistry of the soil and grain where biodynamic field sprays were applied, however the study did not ascribe or discern any biological significance to the difference. Among the variables considered by the study, some measured outcomes correlated with biodynamic field spray usage, including a higher per-unit biomass yield ratio for lentils and a lowering of carbon and crude protein contents in wheat grains. The study’s conclusion remarked that “any additional short-term benefits from biodynamic preparations remain questionable (Schilthuis, 2003).

– A long-term study conducted at a commercial vineyard in California compared vineyard blocks treated with biodynamic preparations alongside those tended with general organic farming methods, to examine effects upon soil and crop quality. “No differences were found in soil quality” during the first six years of the study, and analyses of other indicators including the yield per vine, clusters per vine, cluster and berry weight also showed there were no differences. The study did find a statistically significant (p-value <0.05) difference in the yield-to-pruning weight ratio, indicating an “ideal vine balance for producing high-quality wine grapes” for the

biodynamically treated crop, but noted the control vines had been “slightly overcropped”. In one particular year of the study the biodynamically treated wine grapes had significantly higher Brix and notably higher total phenols and anthocyanins. In conclusion, the study found that biodynamic preparations “may affect” the vine canopy and chemistry, but showed no effects on the soil and tissue nutrient parameters measured in the study Gegenwart(2007). A 21-year study by the FIBL Institute in Switzerland compared the agronomic and ecological performance of biodynamic, organic and two conventional systems. The study found that nutrient input in the biodynamic and organic systems was 34 to 51 per cent lower than in the conventional systems but crop yield was only 20 per cent lower on average, indicating more efficient production. The total energy (for fuel, production of mineral fertilizer and pesticides, etc.) to produce a dry-matter unit of crop was 20 to 56 per cent lower for the biodynamic and organic systems, and pesticide input was reduced by 97 per cent (by 100% for the biodynamic system). In regard to soil aggregate stability, soil pH, humus formation, soil calcium, microbial biomass, and faunal biomass (earthworms and arthropods), the biodynamic system was superior even to the organic system, which in turn had superior results over the conventional systems. With the significant increase in microbial diversity in the biodynamic and organic systems, there was a significant associated decrease in metabolic quotient, indicating a greater ability to use organic material for plant growth (Reganold *et al.*, 1993).

Kirchmann(1994) asserted that when methods of biodynamic agriculture were tested scientifically, the results were unconvincing. Further, in a 2004 overview of biodynamic agriculture, Linda Chalker-Scott pointed out that many of the research articles comparing biodynamics with conventional agriculture did not separate the use of biodynamic preparations from practices used in organic agriculture. The term “biodynamic” should not be used interchangeably with “organic” agriculture.

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