

Biodynamic agriculture: An advance stage of organic farming

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ABSTRACT

Biodynamic farming refers to “working with the energies which create and maintain life. Bio dynamics is process of healing earth with vital forces through human efforts. Using biodynamic preparations regularly opens the soil to cosmic activities and allows these to work through soil into the plants. The aim of biodynamic concept is to establish a system that brings balance into all factors, which maintain life. In biodynamic farming energy harnessed from cosmos, plant earth and cow. Biodynamic compost, BD-500, 501, cow pat pit and biodynamic liquid manure/ pesticides is produced at the farm for nutrient and insect pest management.

Key words: Biodynamic, agriculture, organic farming

Biodynamic agriculture, conceptualized by Rudolf Steiner in 1924, is a super organic farming system in which all the inputs required for crop production are produced at the farm and is being practiced on 161,074 hectares in 60 countries (Paul, 2016). Steiner (1997) emphasized that one must nourish Earth in such a way that the cosmic influences could continue to flow in freely. The more biologically active Earth, the more beneficial forces can work through plant and animal (Procter, 2008). The degenerative effects of intensive farming practices on soil fertility and ecological balance have now forced the farming community to follow agro-chemical based alternative system of farming. This includes organic/ecological/natural or in the recent years “Biodynamic” system of farming that mainly works on principles of relationship between plant growth and cosmic rhythms and importance of maintaining sustainable soil fertility. In these, maximum reliance is placed on self-regulatory agro-ecosystem locally or ‘farm derived’ renewable resources minimizing reliance on external inputs. Organic production has gained momentum in countries like Germany, New Zealand, USA Canada etc. In India sporadic attempts are being made at few farms and the results are very encouraging.

Harnessing cosmic energy through use of agriculture calendar

For harnessing cosmic energies, agriculture calendar for the year, based on planetary configuration is made available for use for different agricultural operations. Even few of the BD preparations are prepared as per calendar. On observation, it is evident that human, animal and plant life is strongly dependent on Earth rhythms. Sun travels for six months in ascending and six months in descending mode. Similarly, moon travels in Earth’s orbit in 27 days, 14.5 days in ascending and 14.5 days in its descending phase. In ascending phase there is out flow of energy above Earth while in descending phase it is below the Earth.

Maria Thun had developed a procedure of sowing of seeds according to the position of the moon related to the twelve zodiac constellations. These constellations were classified into four groups according to the elemental influence (Earth, Water, Air and Fire) and astrological relationship. Root, leaf, flower and fruit crops showed increased yields, if sown when the Moon stood in front of Earth, Water, Air and Fire constellations, respectively (Thun, 2001). Thun and Heinze worked together on potato, radish, carrot, bean and other crops for eight years and concluded that constellations affects germination rate (Maw, 1967), water absorption (Brown and Chow, 1973) and metabolic activities (Brown, 1960) responded to this cycle. In a systematic study, lemon grass planted as per moon position showed significant increase in plant height, suckers, plant spread and was free from insect pests (Punam *et al.*, 2012). The twelve constellations for which different signs have been assigned are classified in four groups depending upon their similarities in influence. These are related to four basic elements, affected by phase of the Moon are Earth, Water, Air and Warmth (Fire). These four elements can be placed in relation to the four parts of plant i.e. root, leaf-stem, flower and fruit/seed which are influenced by the Moon facing the constellations and enables these particular elemental forces to work more strongly into plant life.

- Water - Pisces (Fishes), Cancer (Crab), and Scorpio (Scorpion) - tendency to watery element. Green vegetative parts are linked to moisture flow, hence ideal for leafy crops;
- Fire - Aries (Ram), Leo (Lion), Sagittarius) Archer - tendency towards warmth element- fruit is slowly ripened by warmth of Sun, which seals seed. Well suited for fruit and seed crops.
- Earth with -Taurus (Bull), Virgo (Virgin) and Capricorn (Goat) - tendency to Earth element (cold tendency) - suited to underground crops.

- Air -Gemini (Twins), Libra (Scales) and Aquarius (Waterman) - a tendency to airy or light element. Flowers opens into airy element well suited for flower crops.

The use of crop calendar (Anneexure-1) is summarize as under:

- Crop activities need to be performed when four elements are energized with cosmic forces as indicated in the calendar;
- Moon opposite to Saturn is ideal day for spraying of BD-501 and sowing/planting of any crop,
- Forty eight to twelve hours before the full moon is ideal time for sowing,
- Four days in a month i.e. node days, apogee, perigee need to be avoided for any farm/crop activities,
- Activities associated with soil need to be performed in descending phase of Moon, while above the soil in ascending phase,

Biodynamic calendar

Agricultural practices (field preparation, sowing, manuring harvesting etc.) done as per constellation are more effective and beneficial. Every constellation has dominant elemental influence and affects four specific parts of the plants.

Agricultural practices for better root activity (manuring, rooting), flowering, growth and fruiting/seed is to be done as per constellation.

Any agricultural practice (spray, propagation, harvesting etc.) performed during the ascending period of moon, when cosmic forces are active above the earth ground, show beneficial effect, while field preparation, sowing, manuring and harvesting of root crops undertaken during the descending period of moon, when cosmic forces are active below the earth, are beneficial.

Elements	Plant parts	Constellation
Earth	Root	Virgo, Capricorn, Taurus
Air	Flower	Gemini, Libra, Aquarius
Water	Leaf	Cancer, Scorpio, Pisces
Fire	Fruit	Sagittarius, Aries, Leo

Preparations	Substances	Effects
BD-502	Fermented flower heads from Yarrow (<i>Achilles millefolium</i>)	Activates potassium and sulphur effect in the soil.
BD-503	Fermented heads of Chamomile (<i>Matricaria chamomilla</i>)	This being combination of lime and sulphur acts as fungicide.
BD-504	Stinging Nettle (<i>Urtica dioica</i>) fermented in the soil	Balances iron into soils
BD-505	Fermented Oak bark (<i>Quercus robur</i>)	Helps the calcium process in the cell wall of plants.
BD-506	Fermented flower heads of Dandelion (<i>Taraxacum officinale</i>)	Make plants to absorb required nutrients.
BD-507	Valerian or garden heliotrope flower juice (<i>Valeriana officinalis</i>)	Enable plants by making available phosphoric substances in rhizosphere.
BD-508	Common horse tail (<i>Equisetum arvense</i>)	Has antifungal properties.

Biodynamic preparations

Two basic types of biodynamic preparations are known. These are biodynamic compost preparations (BD-502-507), biodynamic field sprays (BD-500-501) and field preparations.

Biodynamic compost preparations (BD 502-507) are special herbal preparation that fixes and mineralizes trace nutrients required for plant growth, facilitates in harnessing the abundant, unused cosmic forces for crop productivity and replenishes/rectify the macro and micronutrient deficiencies. The details of various preparations and the substances from which these are produced as also as its application are given in as under:

All these preparations are prepared during the descending period of moon, except the BD-507, which is prepared in the air/light day. These were fermented for a specific period and stored at dark place with optimum moisture. 1 g compost of each and 10 ml of BD-507 were added in compost heap, cow pat pit and biodynamic liquid pesticides to catalyse the fermentation process (Koepl *et al.*, 1990; Steiner, 1993).

BD-502-507 is included in one to provide a safer and balanced invigorating spray for plants and soil. The biodynamic preparations are made from garden herbs like valerian, stinging nettle, chamomile, yarrow, dandelion and oak along with cow manure and silica. These have speeded up soil development, composting and strengthen plants to resist insect pests. Two sets per 60 kg of cow dung, 1 set per 200 liters and 1 set per 5 M³ were required for specific preparation of cow pat pit (CPP), liquid manure/pesticides and biodynamic compost, respectively.

Biodynamic field sprays (BD 500-501) and field preparations

BD-500 (Horn manure)

Preparation-500 is made by burying cow horns filled with cow dung for six months during autumn and winter in the soil. Those prepared using indigenous cow dung in indigenous cow horn are more effective. The cow horn has the ability to absorb the life energies during the decomposition of cow dung tilled in it and buried in the soil during winter.

The manure so prepared is dissolved in water by making vortex in clock and anti clockwise direction for an hour. Spraying of BD-500 (@ 25 grams acre⁻¹ dissolved in 13.5 liters of water) should be done at least twice in a year in spring and autumn at the time of field preparation in evening during descending period of the moon (Pathak and Ram, 2004). The best time of application is the descending period of the moon rhythm in the afternoon. Microbial analysis of biodynamic preparations showed that it contained fungi, actinomycetes, *Pseudomonas*, gram positive bacteria, gram negative bacteria, p-solubilizing bacteria, Rhizobium, *Azotobacter* and *Azospirillum* (Ram and Singha, 2017).

BD-500 promotes soil texture, earthworm activity, porosity, and activity of humus forming bacteria, crumb structure, nodulation, and root penetration. It has been noticed that regular applications over the years provide four-fold increase in moisture-absorbing capacity, that extended down the humus depth up to about 30 cm, at four-leaf stage and again at the flowering or fruit maturation stage.

501-Horn silica

501 horn silica is made by filling the horns with 'mealy' silica powder and burying them in the soil during spring (March/April) at a time when BD-500 is taken out. The preparation gets ready for use within 6 months. Light yellowish silica powder is taken out from the horn and stored in light near the house window in glass jars (Pathak and Ram, 2003). 1 g is dissolved in 13.5 liters of water is sprayed on the leaves in the form of 'mist spray' at the sunrise when moon is opposite to saturn.

It is traditionally used to harden and strengthen plants. This aids in fungal control, nutrition, and ripening, keeping quality and drought resistance. However, by itself it can cause reduction in fruit size and burning when the weather is very dry. It is used where an extra burst of ripening is needed in the autumn or in dull seasons. BD-501 spray can be applied every few days to speed up ripening and enhancing the quality of vegetables, fruits and the herbs. It effectively controls powdery mildew appearing during opposite weather conditions. The spray is applied at the first sight of dry weather or when the mildew first appears. The application may be repeated after a fortnight when infections reappear. However, ripening is slowed down with over use. Spraying of seedlings few days before transplanting or through irrigation water is beneficial. A spray after transplanting is also good. Quicker plant establishment and successful plant propagation can be achieved with the use of BD-501. Cuttings before planting may be soaked in BD-501 solution for faster root growth.

Cow pat pit (CPP)

CPP also called as "soil shampoo" is a strong soil conditioner that enhances seed germination, promotes rooting in cutting and grafting, soil texture, provides resistance against pests and diseases and replenishes and rectifies the trace element deficiency. It is used in the seed treatment and foliar applications.

The CPP may be prepared throughout the year in pits of 90 x 40 x 30 cm lined by the bricks, in a root zone free area having good drainage. These pits are filled with mixture of 60 kg cow dung, 250 grams eggshell powder and 250 g of basalt/bentonite powder up to a maximum depth of 25 cm (any deeper will delay the break down into humus). Three sets of BD preparations 502-507 are injected by pressing them into the dung to a depth of 5 cm. Two sets of valerian preparation BD 507, stirred in one liter of water, is sprinkled over the mixture and later covered with the gunnysack bags to retain the moisture. Depending upon the weather and temperature, the preparation becomes ready for use in approximately three months. 500 grams of CPP dissolved in water is used per acre of land. This has showed highest load of *Rhizobium* (1.9×10^6), *Azospirillum* (0.2×10^6), *Azotobacter* (8.0×10^5) and fungi (2.5×10^6) (Ram *et al.*, 2010). It also contained the highest amount of *B. subtilis* (1.9×10^6) responsible for disease tolerance (Proctor, 2008) in plants. Cow pat pit is reported to contain plant growth hormones such as indole acetic acid IAA (28.6 mg kg^{-1}), kinetin (7.6 mg kg^{-1}) and gibberellic acid (23.6 mg kg^{-1}) (Perumal *et al.*, 2006). Stalin *et al.*, (2014) have enumerated microorganisms in organic and biodynamic manures and showed that cow pat pit contained highest bacterial load ($4.8 \times 10^6 \text{ cfu g}^{-1}$) with predominance of *Bacillus subtilis*.

Biodynamic compost heap

Biodynamic compost is an effective soil conditioner and is an immediate source of nutrient for a crop. It can be prepared by using green (nitrogenous material) and dry leaves (carbonaceous material) piled up in an alternative layers of 15-25 cm thickness in the size of 5 x 2 x 1.5 meters in 8-12 weeks. Integrating these with cow dung is always good in the decomposition process. For enriching the compost with different nutrients, rock phosphate-P, slacked lime - Ca, wood ash-K etc. can be used as per the need. The composition of air, moisture and warmth is very important in the breakdown and decomposition of the material. Its use has been summarized in the chart below:

Dandelion (506)	Yarrow (502)	
	Nettle (504)	Oak bark (505)
Valerian (507)	Chamomile (503)	

Biodynamic tree paste

The biodynamic tree paste is prepared by mixing of cow dung, farm soil (clay) and sand in the ratio of 1:1:1 and BD-500. It is used for the management of orchards and gardens. This when pasted on the tree trunks nourishes, strengthens and protects the bark and cambium of tree to make it healthy, seals and heals wounds, prevents and control diseases and on its application after pruning stimulates tree growth.

Biodynamic liquid pesticides

These are prepared using cow dung, cow urine and neem, *Pongamia*, *Calotropis* and some medicinal plant leaves having pesticidal properties. A plastic drum of 200 liters capacity is taken, filled with 5 liters of cow urine, 5 kg of cow dung, 150 liters of water and 20-25 kg chopped plant leaves and later, of one set BD-502-506 is hanged in the drum (like a tea bag) or put inside in folded leaves. BD-507 (10ml) is mixed in 2-3 liters of water for 15-20 minutes and later poured in the drum. Liquid is stirred every day in the morning and evening. The drum is covered with gunnysack bags and the preparation gets ready for use within 10-15 days depending upon the temperature and humidity.

Spraying of one liter of liquid, dissolved in 2-3 liters of water, sprayed on the plants to manage insect pests. In an experiment, this liquid pesticide has been found managing mango hopper effectively. The hopper population before spray (3.07 hoppers panicle⁻¹) reduced to 0.95 hopper panicle⁻¹ up to 15th SMW (standard meteorological week). The second spray taken up at 14th SMW reduced hopper population to 0.4 hoppers panicle⁻¹ up to 19th SMW. Powdery mildew was managed with spraying of BD-501 and 02 per cent wettable sulphur (Ram *et al.*, 2017).

Peppering

'Peppering', a method of pest control suggested by the founder of the biodynamic agricultural movement, Rudolf Steiner in 1924, has been used to manage everything from weeds to insects to possums, rabbits and rats successfully in many different circumstances. This is prepared using insects essentially its ash, obtained after their burning and processing it into liquid form (diluted to D-6 to D-8 level). This can be easily sprayed over orchards by incorporating it into existing spraying rounds.

The aim of 'peppering' is to inhibit the reproductive potential of any plant, insect or animal. Steiner suggested that this method of crop management may take up to four

years to become fully effective. However, few experiments have shown effective results within days. With the passion vine hopper, Jane Cooks orchard has reported that she used the pepper for the first time 3 seasons ago. The vine hopper infestation level in the first season was very small, while, in the last year it was observed to have no great concern. Several other growers have also reported good level of control.

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