MARUMEGH

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Available online at www.marumegh.com

 ISSN: 2456-2904

BIODYNAMIC FARMING - A STEP TOWARDS SUSTAINABILITY

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Introduction:

Agriculture occupies about 38% of Earth's land cover. Although agriculture meets our increasing demand of food and other products, it is a major contributor to greenhouse gases, biodiversity loss, agrochemical pollution and soil degradation. Mostly these environmental consequences come from arable land which comprises around 12% of the land cover. The challenge of feeding a growing population expecting to reach 9 to 10 billion by 2050 while protecting the environment is challenging. Adopting truly sustainable farming systems on a wide scale is our best opportunity for meeting this grand challenge and ensuring future food and ecosystem security. Concerns about the un-sustainability of conventional agriculture have promoted interest in other farming systems, such as biodynamic farming.

Concepts and definition:

Biodynamic farming is anapproach of farming system in which the farm is treated as a living system and significant emphasis is given on overall development of the farm. The inter-relationship between components of the farm i.e. soil, plants, animals and microbes is also taken into consideration. Biodynamic system is a combination of "biological" practices which involvesage-old organic farming techniques that improve soil health, and "dynamic" practices which involve the influence of cosmic forces to develop the farm, its inhabitants and products with energy (Sharma,2012). Biodynamic farming practices also follow the astronomical calendar for sowing and planting of crops and for the application of biodynamic preparations in the fields to enhance the crop productivity (Ponzio *et al.*, 2013). Biodynamic preparations are added to composting organic material in low amount, so the main purpose of these preparations is not only to add nutrients, but also to enhance the process of nutrient recycling, hastened composition and to improve soil and crop quality.

Incipience of biodynamic farming and its international status:

It is found that Biodynamic farming was first started in Germany in the year 1924 in response to the continuous degradation of soil health. Dr. Rudolf Steiner, the Austrian philosopher was the founder of biodynamic farming. Biodynamic practices are being followed in Europe, North America, Asia and Australia also. Among all countries Germany singly accounts for 45.1 % of the total biodynamic area, followed by Italy and India. These leading countries account for 56.3 % of the world's total biodynamic area (Paull, 2011).

Indian scenario:

Biodynamic movement started in India in the early 1990's. The inceptions were fromShri A. M. M. Murugappa Chettiar Research Centre in Chennai, Kuriniji farms near Kodaikanal, the maikaal cotton project in Madhya Pradesh and the tea projects in Darjeeling.

Table 1. Biodynamic preparations along with the main ingredients and agricultural applications:

Preparation	Main ingredient	Application
BD-500	Cow manure Field spray	Field spray
BD-501	Silica	Field spray
BD-502	Yarrow flowers (*Achillea millefoliumL.*)	Compost additive
BD-503	Chamomile flowers (*Matricaria recutitaL.*)	Compost additive
BD-504	Stinging nettle shoots (*Urtica dioicaL.*)	Compost additive
BD-505	Oak bark (*Quercus robur L.*)	Compost additive
BD-506	Dandelion flowers (*Taraxacum officinale*)	Compost additive
BD-507	Valerian extract (*Valeriana officinalis* L.)	Compost additive
BD-508	Horsetail (*Equisetum arvense L.*)	Field spray

(Reeve *et al*. 2011)

Techniques of producing different Biodynamic preparations:

- The BD 500 preparation also known as cow horn manure is made from cow dung fermented in a cow horn which is buried in soil for six months during the winter season and is used as foliar and soil spray to stimulate plant growth and humus formation.
- The BD 501 preparation known as horn-silica is made from powdered quartz which is packed inside a cow horn and buried in the soil for six months during summer season, and is applied as a field spray to hasten plant growth in a concentration of 3 g per hectare soil (Bacchus 2010).
- The preparation BD 502 is prepared by putting moistened yarrow blossoms (*Achillea millefolium*) into the urinary bladder of red deer (*Cervus elaphus*). The bladder is hung in sun during summer season, then buried in earth during winter season and retrieved during the spring season.
- BD 503 is prepared by stuffing moistened chamomile blossoms *(Matricaria recutita*) into the small intestine of cow and is buried in humus-rich soil in the autumn and withdrawn during the spring season.
- BD 504 is prepared by burying stinging nettle (*Urtica dioica*) plants in soil for 1 year, covered in a mantle of peat moss. The preparation helps in the process of humification of compost.
- BD 505 is prepared by placing the scrapings of the outer rind of oak bark (*Quercus robur*) in the skull cavity of domesticated animal and is buried in a muddy place where rain water percolates.
- BD 506 is prepared by stuffing dried flowers of dandelion (*Taraxacum officinale*) into the peritoneum of cow; and buried in soil during winter and withdrawn during spring season.
- The preparation BD 507 is prepared by extracting the juice of valerian flowers (*Valeriana officinalis*) and diluting in rain water.

- BD 508 preparation is made from silica-rich horsetail plant (*Equisetum arvense*) and used as foliar spray to suppress fungal diseases in plants.

Effect of Biodynamic manures on different properties of soil:

❖ **Physical properties:**

Biodynamic management improves soil structure, population of microbes, hastens humus formation, earthworm activity and supports deeper root penetration in plants. It is a promising technology that can be used in bioremediation process of problematic soils. (Ansari and Ismail,2008)

❖ **Microbial properties:**

BD 500 preparation increases calcium, copper, magnesium, manganese thus stimulate soil microbial activity with increase in micro- flora and humus forming bacteria. This system enhances microbial biomass nitrogen and microbial biomass carbon compared to conventional farming practices. Greater dehydrogenise activity in biodynamically treated compost results in greater microbial activity (Reeve *et al*., 2010).

❖ **Biological properties:**

The application of biodynamic preparations in addition to FYM significantly increases crop biomass, number of earthworms and their activities. It also results in better aggregate stability and higher soil density.(Kirchmann, 1994).

Effect of Biodynamic manures on crops:

❖ **Growth and physiology of crops:**

Use of biodynamic preparations has positive influence on the accumulation of dry matter in cereals. Biodynamic compost increases carbohydrates, reducing sugar, protein content, chlorophylls ‘a’, ‘b’ and total chlorophyll content of soybean crop at different stages of growth.(Bindhu *et al.*,2013)

❖ **Disease and pest resistance:**

Application of BD 501 immunises the crop against fungal infection whereas liquid pesticides prepared from casurina leaves provide disease tolerance to crops. Nettle leaf extract spray controls midge, leaf minor and mites etc. (Pathak and Ram, 2013)

A case study of improvement of soil properties following biodynamic practices:

Application of biodynamic preparations significantly enriches the nutrient status of the soil as well as the microbial profile. Through a case study,a rising count of ‘Yeast and mould’ and bacteria was recorded by practicing biodynamic nutrient management for successively four years.

Constituents	**Improvement after biodynamic cultivation**			
	Initial	II year	III year	IV year
Organic carbon(%)	0.53	0.80	1.00	1.16
P(ppm)	8.66	8.66	22.66	56.27
K(ppm)	140.00	142.50	202.50	1062.25
Yeast and mould(cfu g^{-1})	$1.3x\ 10^4$	$5.8x10^4$	$8.5x10^4$	$8.5x10^4$
Bacteria (cfu g^{-1})	$3.7x10^6$	$4.8x10^6$	$8.0x10^6$	$3.1x10^8$

(Pathak *et al.*2010)

Conclusion:

Several experiments and trials throughout the world reveal the superiority of biodynamic agriculture over the existing farming systems. Application of biodynamic preparations is better for long term fertility status of the soil. Presently in the 21st century, when agriculture is suffering from depletion of available soil nutients it is high time to opt for the sustainable management techniques. Till now the use of biodynamic preparations in modern day agriculture is not that much popular. If proper knowledge about the usage, benefits and advantages of this sustainable agricultural approach are spread around the farming community, it can certainly gain more acceptance in future.

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