Short communication

Do biodynamic practices influence yield, quality, and economics of cultivation of chilli (*Capsicum annuum* L.)?

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Abstract

Effects of adopting a biodynamic calendar for timing the cultural operations and a manurial schedule involving two biodynamic preparations (separately or together) and *panchagavyam (*a mixture of 5:1 cow dung and ghee in a 5:3:3:5 cow's urine, curd, milk, and water formulation) in conjunction with organic manures as well as 'organic manures alone', and the recommended practices of nutrient management (RP) on yield, quality, and economics of chilli cultivation were evaluated in a field experiment. Results show that RP (i.e., application of 20 Mg ha^{-1} farmyard manure+75:40:25 N:P_2O_5:K_2O kg ha^{-1}) significantly improved fruit yield, net returns, and B: C ratio. Although biodynamic calendar and biodynamic preparations had no spectacular effects on the characters studied, application of organic manures generally promoted fruit quality in chilli. Indeed, *panchagavyam* + organic manure demonstrated the maximum shelf life and the 'organic manures alone' (on nutrient equivalent basis) showed the highest ascorbic acid content of chilli fruits.

Keywords: Biodynamic calendar, Biodynamic preparations, *Panchagavyam,* Integrated nutrient supply.

Biodynamic farming, i.e., combining biological and dynamic agricultural practices, has recently emerged as an advancement of organic agriculture. Just as organic farming, the products of biodynamic agriculture are nutritionally superior and they taste better than the conventional foods (Steiner, 1996), besides having the potential to mitigate some of the negative effects of chemical agriculture. The 'biological' practices usually include a series of organic farming techniques that improve soil health, while the 'dynamic' practices are intended to promote the metaphysical aspects of the farm, e.g., planting seeds during certain lunar phases to adapt to the natural rhythms of the planetary system (Pfeiffer, 1984). The present investigation was aimed to study the influence of certain biodynamic practices on fruit yield, quality, and economics of chilli (*Capsicum annuum* L.) production in southern Kerala.

The experimental variables included chilli planting with or without adopting a biodynamic calendar, and in conjunction with six manurial schedules. In the treatment adopting biodynamic calendar, the cultural operations were timed based on the possible influence of moon, earth, and other planets, i.e., coinciding with certain cosmic events as shown in the next section. The manurial schedule included spraying two homeopathic formulations (BD 500 and 501; alone or in combination, and together with organic manures), *panchagavyam* (a mixture of 5:1 cow dung and ghee in a 5:3:3:5 cow's urine, curd, milk, and water formulation) + organic manures, 'organic manures alone', and the recommended practices of nutrient management (RP; KAU, 2003; Table 1). Farmyard manure (0.56 % N, 0.4 % P_2O_5 and 0.3 % K_2O) formed the source of organic manure, and was applied on nutrient equivalent basis of RP, while urea

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(46 % N), Mussoriephos (20 % P_2O_5), and muriate of potash (60 % K_2O) constituted the chemical sources of nutrients. The field experiment was laid out in factorial randomized block design at Vellayani during Oct. 2004 to Feb. 2005, and was replicated thrice; the test variety was 'Jwalasakhi'. Twenty-nine day-old seedlings were transplanted in 45 x 45 cm plots as per the treatment protocol. Soil of the experimental area was red sandy loam having 229, 36, and 78 kg ha^{-1} of available N, P, and K respectively. Mean maximum and minimum temperatures during the experimental period were 32°C and 22°C respectively.

Preparation and application of the biodynamic products: Two biodynamic formulations (BD 500 and 501) sourced from the Biodynamic Association of India (BDAI), Bangalore were tried. BD 500 (horn manure preparation), the "prime starter of biodynamics," is prepared by stuffing the dung of a lactating cow into a cow horn and buried in the soil during the autumn equinox (September) and taken out during the spring equinox (March). The humified dung from the horn is stored in an earthen pot away from sunlight. For preparing the spray solution for one ha, 62.5 g of this material was dissolved in 40 L of warm (40°C) water with continuous stirring for 1 h (alternately in clockwise and anti-clockwise directions). The liquid mixture was sprinkled as big droplets on soil surface in the evening prior to transplanting. For the treatments based on biodynamic calendar, BD 500 was applied on 16 Nov. 2004, *i.e.,* during the lunar descending period, when the effects are supposedly better. In plots where biodynamic calendar was not adopted, BD 500 was applied on 24 Nov. 2004.

BD 501 is "cow horn silica" and is made form quartz crystals ground to talcum power consistency, stuffed into a cow horn, buried during spring equinox, and taken out during autumn equinox. The material, stored in glass bottle, and exposed to the sun by the windowsill was used to prepare the BD 501 spray solution by dissolving 2.5 g in 40 L of water, which was integrated in a similar way as that of BD 500. Within an hour, the mixture was sprayed as a fine mist on the plant foliage (i.e., before 9.00 a.m.). For plots where the cultivation practices were based on biodynamic calendar, the application dates corresponded to 14 Dec. 2004 and 10 Jan. 2005 (days when moon was opposite to Saturn in the biodynamic calendar). In other treatments, BD 501 was applied at 30 and 60 days after transplanting.

Panchagavyam, an organic formulation, was prepared with 5 kg cow dung, 1 kg ghee, 5 L cow's urine, 3 L curd, 3 L milk, and 5 L water. These materials were mixed together and stirred daily for 15 days. A dilution of 1:10 was used for spraying on full moon days *i.e.,* 27 Nov. 2004, 26 Dec. 2004, and 25 Jan. 2005. In plots not following the biodynamic calendar, it was applied at monthly intervals. Organic manure application in all treatments followed the local recommendations (KAU 2003).

Mature fruit weight on net plot area basis was recorded, as well as the number of fruits $plant^{-1}$, weight of fruits $plant^{-1}$, and fruit length. Changes in fruit colour, shrinkage, and rotting during ambient storage were also noted. Ascorbic acid content of the fruits at red ripe stage was estimated by 2, 6-dichlorophenol indophenol dye method (Sadasivam and Manickam, 1992) and capsaicin content determined by Folin-Dennis method (Mathew et al., 1971). Economic analysis was done taking into account the cost of cultivation and the prevailing market price of vegetable chilli and the data were analyzed using ANOVA.

Results show that yield and the associated characters were strongly influenced by the manurial schedule. However, biodynamic calendar and preparations generally failed to impact fruit yield and net returns. Indeed, number of fruits $plant^{-1}$, fruit length, fruit weight $plant^{-1}$, and fruit yield, were significantly higher in the treatment receiving recommended doses of fertilizers (Table 1). This treatment also gave the maximum net returns and benefit: cost ratio, which is not unusual. Organic manures, however, showed an advantage over the recommended practices in terms of fruit quality. That is, the highest shelf life and ascorbic acid content were noted for the *panchagavyam*+organic manure and 'organic manure alone' treatments respectively, which is consistent with other reports too (e.g., Sharu, 2000). Recommended practices, however, resulted in higher capsaicin concen-

Table 1. Effect of biodynamic calendar and manurial schedule on yield and its attributes, quality, and economics of chilli production in Vellayani, Kerala.

Treatments	Fruits plant^{-1} (no.)	Fruit weight plant^{-1} (g)	Fruit length (cm)	Yield (Mg ha^{-1})	Shelf life (days)	Ascorbic acid content (mg 100 g^{-1})	Capsaicin content (%)	Net returns (Rs ha^{-1})	Benefit cost ratio
Biodynamic calendar									
Adopting biodynamic calendar	46.5	141.6	7.6^{b}	7.4	4.5	97.3	0.58	28265	1.37
Not adopting biodynamic calendar	46.9	144.8	7.8^{a}	7.3	4.3	97.1	0.58	26824	1.32
Manurial schedule									
BD 500 + organic manures[1]	43.4^{b}	140.5^{b}	7.4^{b}	7.4^{b}	4.7^{b}	97.5^{b}	0.56^{b}	25545^{b}	1.2^{b}
BD 501+ organic manures[1]	43.4^{b}	139.8^{b}	7.35^{b}	6.8^{b}	4.5^{b}	97.4^{b}	0.57^{b}	22844^{b}	1.3^{b}
BD 500+BD 501+ organic manures[1]	43.6^{b}	139.2^{b}	7.5^{b}	6.8^{b}	4.8^{b}	97.4^{b}	0.56^{b}	22475^{b}	1.2^{b}
Panchagavyam + organic manures[1]	45.0^{b}	119.8^{b}	7.7^{b}	6.9^{b}	4.8^{b}	97.6^{b}	0.57^{b}	23992^{b}	1.2^{b}
Organic manures alone[1]	44.3^{b}	141.0^{b}	7.6^{b}	7.4^{b}	4.5^{b}	97.8^{b}	0.57^{b}	24147^{b}	1.2^{b}
RP [20 Mg ha^{-1} FYM+75:40:25 N:P_2O_5:K_2O kg ha^{-1}]	60.5^{a}	179.2^{a}	9.0^{a}	8.8^{a}	3.2^{a}	95.4^{a}	0.65^{a}	49266^{a}	1.5^{a}

BD 500=biodynamic preparation 500, BD 501=biodynamic preparation 501 (see materials and methods), RP= recommended practices (KAU, 2003), FYM= Farmyard manure; [1]organic manures applied on nutrient equivalent basis; means with same superscripts do not differ significantly.

tration of the fruits. Lack of response of biodynamic practices is presumably because the present experimental site for many previous seasons has been under chemical farming. Moreover, long-term experimentation may be necessary to elucidate the beneficial effects of biodynamic preparations especially on aspects relating to soil health. Nonetheless, a gradual shift away from chemical to organic practices seems prudent for sustained crop production, and superior quality of the produce.

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