

Efficacy of Biodynamics, Biofertilizer and Farm Yard Manure on Betelvine (*Piper betle* L.) Crop

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Abstract

A field experiment was conducted during 2004-05 and 2005-06 at betelvine conservatory (bareja) to study the effect of biodynamics, biofertilizers and farm yard manure on growth parameters, leaf yield, shelf life, disease incidence, nutrient uptake, soil nutrient status and economics of betelvine (*Piper betle* L.) cv *Bangla*. The treatments comprised biodynamics with N 100 kg/ha as FYM; *Azotobacter* 10 kg/ha + phosphobacter 10 kg/ha with N 100 kg/ha as FYM; biodynamics + *Azotobacter* 10 kg/ha + Phosphobacter 10 kg/ha with N 100 kg as FYM; 100 kg N as FYM; 200 : 100 : 100 kg/ha (N:P₂O₅ : K₂O) (inorganic) and one control (no nutrient application). Application of biodynamics + biofertilizers (*Azotobacter* and phosphobacter at 10 kg/ha each) with N 100 kg/ha as FYM recorded significantly higher crop growth parameters, marketable leaves (lac/ha), shelf life of leaves, nutrient uptake soil nutrient status and economics than all other treatments. Treatment having biodynamic with FYM, biofertilizers with FYM and recommended dose of NPK fertilizers responded equally, showing superiority over only FYM treatment and control. Keeping quality of leaves (shelf life or days to 50% rotting) and per cent disease incidence were reduced appreciably with all manurial treatments including control but application of only inorganic nutrients noticed significantly inferior result in respect of disease incidence and shelf life of betelvine leaves.

Key words : Biodynamics, *Azotobacter*, Betelvine, Farm yard manure, Leaf yield.

Betelvine is highly labor intensive, provides employment throughout the year, the seasonal fluctuations being negligible. Almost all the members of a grower's family are gainfully employed in its cultivation, harvesting, grading, packing, marketing. The return are good in the years when the loss due to diseases and pests and natural calamities like flood, cyclone are minimal. A healthy plantation offers a steady income to the growers throughout the year at regular intervals unlike other crops which give only seasonal income to the farmers. Being a commercial crop, the betelvine crop must preferably be grown with organic sources of nutrient, which are easily available at domestic level. Production of healthy, broad, succulent, tasty with good shelf life of leaves might be possible due to adoption of INM, IPM and organic management as well. There is need to search various sources of easily available cheap and effective and sustainable technology of nutrient management for betelvine crop production. Keeping these in view, present investigation was carried out under all India network project on betelvine, to evaluate pro-

duction potential and economic viability of biodynamics and other sources of nutrients.

Methods

The experiment was carried out in permanent plots at betelvine conservatory (bareja) of Rajendra Agricultural University, Pusa, Samastipur during 2004-05 and 2005-06. The soil was clay loam, alluvial calciorthent (calcareous) type having pH 8.4, organic carbon 0.55% and 214.23, 30.22 and 115.90 kg/ha available nitrogen, phosphorus and potassium, respectively. There were six treatments combinations, replicated five times in a randomized block design in permanent fixed layout. Betelvine *Bangla*, a popular variety was grown for the purpose. Treatments comprised: T₁—biodynamics with N 100 kg/ha as FYM, T₂—*Azotobacter* 10 kg/ha + phosphobacter 10 kg/ha with N 100 kg/ha as FYM, T₃—Biodynamics + *Azotobacter* 10 kg/ha + phosphobacter 10 kg/ha with N 100 kg/ha as FYM, T₄—N 100 kg/ha as FYM, T₅—200 : 100 : 100 kg/ha (N : P₂O₅ : K₂O) recommended inorganic, T₆—

Table 1. Effect of BD, biofertilizers and FYM on growth, yield, disease incidence and dry matter production of betelvine crop. T₁—Biodynamics with N 100 kg/ha as FYM, T₂—*Azotobactor* 10 kg/ha + Phosphobactor 10 kg/ha with N 100 kg/ha as FYM, T₃—Biodynamics + *Azotobactor* 10 kg/ha + Phosphobactor 10 kg/ha + N 100 kg/ha as FYM, T₄—N 100 kg/ha as FYM, T₅—200 : 100 : 100 kg/ha (N : P₂O₅ : K₂O) (inorganic), T₆—Control.

Treatment	Vine growth cm/month		No. of leaves (lac/ha)		Fresh weight of 100 leaves (g)		Shelf life (days to 50% rolling)		Disease incidence (%)		Leaf area (cm) ²		Dry matter (t/ha)	
	2004- 05	2005- 06	2004- 05	2005- 06	2004- 05	2005- 06	2004- 05	2005- 06	2004- 05	2005- 06	2004- 05	2005- 06	2004- 05	2005- 06
	T ₁	16.73	14.50	32.82	31.44	257.52	280.63	18.04	16.23	6.22	7.12	73.83	81.27	4.90
T ₂	17.98	14.98	32.34	31.57	241.90	280.50	18.26	17.33	5.50	6.35	66.75	84.34	4.30	4.52
T ₃	18.37	17.06	36.19	35.54	290.34	305.15	18.26	17.86	6.20	6.13	81.17	90.12	5.40	5.83
T ₄	12.09	12.50	24.84	24.36	223.36	246.25	18.38	16.89	6.12	6.00	65.40	79.54	3.98	4.15
T ₅	18.15	16.88	32.50	31.76	285.18	300.00	12.10	11.43	16.28	14.67	80.66	91.65	5.35	5.23
T ₆	8.48	8.40	16.57	14.83	194.48	188.50	17.58	17.50	5.50	6.10	44.57	40.49	2.15	1.97
CD (P=0.05)	2.26	1.91	3.50	2.27	18.57	22.06	2.50	2.44	1.02	1.14	3.64	5.08	1.15	1.21

control (no nutrient application). Farm yard manure applied during April with biofertilizers and inorganic sources were in four equal splits in a year (April, July, October and January), Cow horn manure (BD 500) at 25 g/acre was dissolved in 13.5 liters of water in a plastic bucket by making vortex in clock and anticlock wise for one hour in the evening and spread over on bunds of crop as droplets immediately during April. Cow horn silica (BD 501) at 5 g/acre was dissolved in 13.5 liters of water in a plastic bucket by making vortex in clock and anticlock wise for one hour and applied on the leaves in the form of mist in the morning at the sunrise when the best constellation was moon opposite to Saturn in October during both the years of experiments. All agronomic practices required for betelvine crop adopted properly maintaining 1.50 lac/ha plant population. For nutrient uptake and soil fertility status, composite samples of all replications were

used in analysis in March. Initial nutrient status of soils were analyzed after earthing up of plots from transported soils of ponds and before start of new schedule of applying the treatments in April in both years and averaged. Economics of treatments was calculated on present market price of yield and inputs.

Results and Discussion

Growth Parameters and Yield

Table 1 revealed that significantly higher growth parameters such as yield of leaves (lac/ha), shelf life (keeping quality or days to 50% rotting), leaf area and dry matter yield of betelvine crop were noticed with treatment receiving T₃—biodynamics + *Azotobactor* 10 kg/ha + phosphobactor 10 kg/ha with N 100 kg/ha as FYM over all the treatments. Application of only

Table 2. Effect of BD, biofertilizer and FYM on nutrient content, nutrient uptake and soil nutrient status of betelvine crop.

Treatment	Nitrogen content in plant (%)						Nutrient uptake					
	N		P		K		N		P		K	
	2004- 05	2005- 06	2004- 05	2005- 06	2004- 05	2005- 06	2004- 05	2005- 06	2004- 05	2005- 06	2004- 05	2005- 06
T ₁	1.11	1.10	0.16	0.15	1.56	1.59	54.40	54.56	7.84	7.44	76.44	78.86
T ₂	1.13	1.10	0.14	0.15	1.52	1.54	48.60	49.72	6.02	6.78	65.36	69.61
T ₃	1.25	1.20	0.26	0.25	1.69	1.71	67.50	69.96	14.02	14.58	91.26	99.69
T ₄	1.12	1.14	0.15	0.14	1.48	1.59	44.61	47.31	6.00	5.81	58.90	62.25
T ₅	1.26	1.26	0.24	0.24	1.70	1.75	67.41	65.90	12.85	12.55	90.95	91.52
T ₆	1.08	0.98	0.12	0.10	1.32	1.29	23.22	19.31	2.60	1.97	28.38	25.41
CD (P=0.05)	0.11	0.13	0.07	0.04	0.32	0.41	12.98	11.30	1.81	1.40	12.01	12.76

Table 2. Continued.

Treatment	Soil nutrient status (kg/ha)					
	N		P ₂ O ₅		K ₂ O	
	2004-05	2005-06	2004-05	2005-06	2004-05	2005-06
T ₁	248.18	253.29	38.41	40.63	126.15	128.24
T ₂	248.10	253.33	40.25	40.98	128.45	128.82
T ₃	268.36	270.67	43.23	44.26	136.42	138.25
T ₄	246.43	250.32	38.98	40.00	128.31	130.53
T ₅	248.42	251.00	38.23	39.71	128.63	130.29
T ₆	238.23	240.11	32.23	32.41	114.30	115.65
CD (P=0.05)	12.42	11.21	4.65	4.05	7.11	5.66

100 kg N/ha through FYM recorded significantly inferior response than other manurial treatments. FYM gave optimum betel leaf yield when it is applied for N 200 kg/ha as a full source (1). Though inorganic recorded at par growth parameters to T₃ but comparatively high incidence of diseases lead to harvest marketable leaves similar to T₁ and T₂. Keeping quality and per cent disease incidence were reduced to appreciable level with all treatments including control but significantly inferior with application of recommended dose of NPK through inorganic. Das et al. (2) also reported that addition of nutrients as organic (oil cake) alone resulted in significant reduction in disease complex, however, incidence increased proportionately with increase in level of N (inorganic) irrespective of sources. Treatment T₃, T₂, T₁ and T₅ recorded 40.12, 24.82, 25.50 and 25.51% additional leaf yield than T₄ (100 kg N/ha as FYM), while the increment in leaf yield was observed to be 128.47% higher by T₃ followed by others in descending successions as compared to control treatment.

Over all higher response due to biodynamics + biofertilizers + FYM or biofertilizers + FYM might be

due to food supplied to micro organisms through carbonaceous sources under appropriate moisture and favorable temperature, enable them for their multiplication and activity to increase mineralization of nutrients and capacity to make available the atmospheric and edaphic nutrients to the betelvine crop all round year. *Azotobacter* is known to secrete some growth promoting and antifungal substances (3). Beneficial effect of phosphobactor (P-solubilizers) as higher P-uptake, growth and yield of cabbage and tomato (4) and P-solubilizing action of phosphobactor is due to secretion of organic acids and forming stable complex of P with cations (5) have already been documented. Biodynamics appears to be suitable, economic and eco-friendly with minimum risk of residual toxicity and improve the biological property of soil. They also reported that shelf life, quality and nutritive value of crop produce also improved due to application of biodynamics. Dubey (6) advocated that biodynamic products contain more vitamin C, Fe, Mg, P and better protein quality than conventional crop products. Thus cumulative effect of biodynamics, biofertilizers and FYM improved the performance of

Table 3. Effect of BD, biofertilizers and FYM on economics of betelvine crop.

Treatment	Leaves yield (lac/ha)		Cost of leaves (Rs/60/1000)		Average expenditure of two years (Rs/ha)	Net return		B : C (Rs/Re)	
	2004-05	2005-06	2004-05	2005-06		2004-05	2005-06	2004-05	2005-06
T ₁	32.82	31.44	5,25,120	5,02,720	95,260	4,29,860	4,07,460	1 : 4.50	1 : 4.28
T ₂	32.34	31.57	5,17,440	5,05,120	95,900	4,21,540	4,09,220	1 : 4.40	1 : 4.27
T ₃	36.19	35.54	5,79,040	5,68,640	96,100	4,82,940	4,72,540	1 : 5.03	! : 4.92
T ₄	26.84	24.36	4,29,440	3,89,760	95,150	3,34,290	2,94,610	1 : 3.51	1 : 3.10
T ₅	32.50	31.76	5,20,000	8,08,160	94,275	4,22,750	4,13,885	1 : 4.48	1 : 4.39
T ₆	16.57	14.83	2,65,120	2,37,280	88,150	1,76,970	1,49,130	1 : 2.00	1 : 1.69

betelvine crop.

Nutrient Uptake and Soil Nutrient Status

Nutrient content of plant, nutrient uptake and finally nutrient status of soil had significantly increased due to application of T₃ over others (Table 2). All other sources of nutrients also recorded additive effect on nutrient uptake and status of soil, while control treatment resulted significantly poor uptake and negative trend in nutrient status of soil. Enhancement in soil fertility including physico-chemical and biological properties of soil due to application of bio-dynamics (7) manures, balanced fertilizers and bio-fertilizers (8) have also been recognized.

Economics

Table 3 reveals that the use of T₃ (biodynamics + 100 kg N/ha as FYM), T₂ (biofertilizers + 100 kg/ha as FYM), T₃ (biodynamics + biofertilizers + 100 kg N/ha as FYM) and T₅ (recommended of NPK, inorganic) recorded B : C more than 1 : 4.00, though higher B : C ratio (1 : 4.79 and 1 : 4.92) was noticed by T₃ during both the years. Application of nutrients in form of FYM (T₄) resulted poor economics than other while control showed least and poor benefit.

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