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Growth and nutrient content of black pepper (*Piper nigrum* L.) cuttings as influenced by inoculation with biofertilizers

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Abstract

Experiments conducted to test the effect of *Azospirillum*, phosphobacteria and vesicular arbuscular mycorrhiza on growth and nutrient content of black pepper (*Piper nigrum*) cuttings indicated that growth parameters were on par with control when these three biofertilizers were applied individually, but their combination enhanced growth significantly over control. Inoculation with a combination of two/three biofertilizers enhanced plant height, leaf area, biomass and dry matter production and nutrient content significantly over uninoculated control.

Key words : biofertilizer, black pepper, *Piper nigrum.*

Production of black pepper (*Piper nigrum* L.) in India can be increased considerably through integrated nutrient management. Singh (1998) stressed the need to enhance the contribution of biofertilizers to meet about one third of plant nutrient needs. Thomas *et al.* (1991) suggested to introduce efficient cultures to harness full benefits from biofertilizers. Inoculation with vesicular arbuscular mycorrhizae (VAM) and N_2-fixing endophytes may increase plant acquisition of phosphorus and nitrogen thereby increasing the growth and yield of plants (Tilak 1993). In black pepper, Govindan & Chandy (1985) reported that inoculation of *Azospirillum* increased growth characters and Bopaiah & Khader (1989) observed that combined inoculation of *Azospirillum*, *Azotobacter* and phosphobacteria improved growth of black pepper. The present study was undertaken to evaluate the effect of inoculation of biofertilizers (*Azospirillum*, phosphobacteria and VAM) on growth and nutrient content of black pepper.

The experiment was conducted during 1996–97 at Indian Institute of Spices Research, Calicut. Three biofertilizers namely, *Azospirillum*, phosphobacteria (both obtained from Tamil Nadu Agricultural University, Coimbatore) and VAM (Source: Pathology Section, IISR, Calicut) individually and their combinations along with unioculated control formed the treatments (eight treatments) that were replicated four times in a CRD. *Azospirillum* (AZY2) (20 g), phosphobacteria (*Bacillus megaterium* var. *phosphaticum.*) (pbl) (20 g) and VAM (*Glomus* sp. raised on sorghum roots) (100 cc) were mixed with 5 kg potting mixture (not sterilized) as per the treatment combinations and filled in polybags (45 cm x 30 cm size, 300 gauge thickness). The potting mixture consisted of soil : sand : FYM (1:1:1) and had nutrient composition of 0.81% N, 0.32% P_2O_5 and 0.78% K_2O and pH of 7.2. A single node cutting of black pepper (cv. Subhakara) with a leaf was planted in each bag maintained in the nursery. Growth parameters like height, number of leaves and leaf area were recorded at 3 and 6 months after planting. Biomass, dry matter and nutrient contents were recorded at 18 months. The data were analysed statistically using MSTATC package.

Black pepper plants responded well to the combined inoculation of biofertilizers. Plant height, leaf area, biomass, dry matter and nutrient contents were higher in inoculated plants than

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uninoculated control (Tables 1 & 2). Growth was significantly higher when all the biofertilizers were inoculated compared to individual inoculation and control. This could be due to the collective effect of biofertilizers. Plants inoculated with both VAM and *Azospirillum* fixed more nitrogen and produced more grain yield than singly inoculated plants in pearl millet (Tilak 1995). Similar growth increase was recorded in black pepper earlier also with combined inoculation of biofertilizers (*Azospirillum, Azotobacter* and phospobacteria) (Bopaiah & Khader 1989). Among individual inoculation, maximum growth was observed in VAM followed by phosphobacteria and *Azospirillum*. Govindan & Chandy (1985) reported increase in root formation, shoot and root biomass and dry matter of black pepper when inoculated with *Azospirillum*. In the dual combination, phosphobacteria + VAM was effective followed by *Azospirillum* + VAM and *Azospirillum* + phosphobacteria. Karthikeyan *et al.* (1995) observed that combined inoculation of VAM fungi and phosphobacteria enhanced dry matter production, VAM colonization and nutrient uptake over uninoculated control and individual inoculation in neem.

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Table 1. Effect of biofertilizers on the growth of black pepper cuttings

Treatment	At 3 months			At 6 months		
	Height (cm)	No. of leaves	Leaf area (cm^2)	Height (cm)	No. of leaves	Leaf area (cm^2)
Azospirillum	23.0	4.1	116.6	50.9	7.7	244.7
Phosphobacteria	23.6	4.1	119.5	51.5	8.2	255.7
VAM	25.5	4.3	120.2	53.2	8.6	279.3
Azo + Phos	25.7	5.1	134.3	54.7	8.7	280.5
Azo + VAM	28.3	5.1	134.8	61.3	9.1	290.4
Phos + VAM	30.2	5.3	150.2	66.6	9.3	309.9
Azo + Phos + VAM	32.9	5.3	155.9	77.0	9.4	343.5
Control	18.9	3.9	111.7	45.6	7.7	235.0
CD (0.05%)	7.7	1.0	30.0	17.6	NS	66.3

Azo = *Azospirillum*; Phos = Phosphobacteria

Table 2. Effect of biofertilizers on biomass, dry matter production and nutrient content of black pepper cuttings (18 months after treatment)

Treatment	Biomass (g/plant)	Dry matter (g/plant)	Nutrient content (%)		
			N	P	K
Azospirillum	61	23	2.80	0.15	1.53
Phosphobacteria	73	24	2.87	0.16	1.57
VAM	74	24	2.98	0.16	1.63
Azo + Phos	89	27	3.10	0.17	1.66
Azo + VAM	92	27	3.15	0.17	1.72
Phos + VAM	132	31	3.17	0.18	1.80
Azo + Phos + VAM	146	34	3.27	0.21	1.94
Control	57	19	2.70	0.13	1.52
CD (0.05%)	22	5	0.17	0.05	0.30

Azo = *Azospirillum*; Phos = Phosphobacteria

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