Indian Journal of Agricultural Sciences 59 (10) : 682–3, October 1989

Effect of bio-fertilizers on growth of black pepper (*Piper nigrum*)

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Received: 6 February 1989

The inoculation of nitrogen-fixing bacteria and vesicular-arbuscular mycorrhizal (VA-mycorrhizae) fungi increases the growth of plants, especially in low-fertility soils (Hayman 1975). The mycorrhizal fungi help in phosphorus nutrition of plants and also in the uptake of zinc and copper. Hence an experiment was conducted to study the effect of *Azotobacter*, *Azospirillum* and VA-mycorrhizal inoculation on the growth of black peper (*Piper nigrum* L.).

Table 1 Influence of bio-fertilizers on growth, nutrient status, and vesicular-arbuscular mycorrhizal colonization in black pepper

Treatment*	Plant height (cm)	Weight (g)		Total N (%)		Total P (%)		Total K (%)		VAM colonization (%)
		Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	
Azotobacter	119.0	40.4	3.61	0.85	0.85	0.30	0.38	0.68	0.53	24
Azospirillum	129.0	41.3	3.68	0.90	0.89	0.30	0.37	0.62	0.57	30
VA-mycorrhizae	135.5	43.8	3.70	0.88	0.84	0.38	0.42	0.59	0.58	80
Azotobacter + *Azospirillum* + VA-mycorrhizae	161.7	49.5	3.70	0.90	0.88	0.38	0.45	0.65	0.58	72
Control	108.4	35.8	3.40	0.75	0.80	0.28	0.36	0.54	0.53	20
CD (P = 0.05)	14.5	4.4	0.20							38

*Average of 10 plants

The experiment was conducted in September 1986, using polythene bags filled with 5 kg garden soil. The rooted pepper cuttings were dipped in peat-based culture slurry of *Azotobacter* and *Azospirillum* before transplanting. In VA-mycorrhizal treatment, the cuttings were planted in the soils inoculated with *Glomus mosseae* (Nical. & Gerd.) Gerdemann Trappe, comb. nov. (300 spores/5 kg soil). A combined inoculation with *Azotobacter*, *Azospirillum* and VA-mycorrhizae, as well as control without any biofertilizers. was maintained. Two cuttings were planted in each bag with 5 replications for each treatment. After 12 months the plants were removed and the growth parameters (plant height, and dry weights of shoot and roots) were recorded. The N, P, K levels in the shoot and root tissues were determined by standard method. The VA-mycorrhizal colonization was recorded after clearing and staining the roots with 0.05% trypan

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blue (Phillips and Hayman 1970).

The bio-fertilizer inoculation increased the plant height, weight (shoot and root) and the NPK status of the plant compared with the uninoculated control (Table 1). The combined inoculation showed greater influence on the plant growth. The inoculation of *Azotobacter* and VA-mycorrhizae increased the plant growth in cashew (*Anacardium occidentale* L.) seedlings (Krishna *et al.* 1983, Oblisami *et al.* 1985). Similarly, in the present investigation, the inoculation of nitrogen fixers and VA-mycorrhizae to black pepper showed increased plant growth.

ACKNOWLEDGEMENT

We are grateful to Dr G Oblisami, Head, Division of Agricultural Microbiology, Tamil Nadu Agricultural University, Coimbatore, for supplying the cultures of bio-fertilizers.

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