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30 Influence of 1, 2-dibromo-3-chloropropane (DBCP) fumigation on mycorrhizal infection of field-grown groundnut

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Abstract

An experimental design was established at Patar, Senegal in a typical sandy soil. It consisted of nine randomized blocks, with two treatments: fumigated with DBCP 14 days before planting and non-fumigated. Treated plots were fumigated with DBCP at a depth of 20 cm 14 days before sowing at a rate of 25 l/ha. Groundnut cultivars 28-206 (growth-cycle 120 days), 55-437 (growth cycle 90 days), and GH 119-20 (growth cycle 120 days) were planted on 23 July 1977. During the groundnut growth cycle, rainfall was low (287 mm during June-October), but well distributed. Root systems and soil were sampled twice (16th and 60th day) in order to estimate endomycorrhizal infection, N_2 (i.e. C_2H_2) fixation, and nematode numbers. The crop was harvested on 20 October 1977 (cv. 55-437) and 10 November 1977 (cvs. 28-206 and GH 119-20).

DBCP fumigation totally suppressed nematode populations consisting mostly of *Scutellonema cavenessi*. Mycorrhizal infection, as measured at the first sampling (16th day), was significantly higher in fumigated plots for one cultivar (28-206). Since the roots of groundnuts cvs. 28-206 and GH 119-20 were heavily infected in the fumigated plots as early as the 16th day, endomycorrhizal infection of some cultivars appeared to be a precocious process in the edaphic and climatic conditions of Senegal, provided that there is no limiting factor, such as nematode injury. No significant difference between treated and untreated plots was found at late sampling (60th day). Microscopic observations showed that only very few vesicles and arbuscules were found in roots of groundnut, as reported by Ross and Harper (1973).

DBCP fumigation improved N_2 fixation of cultivars 55-437 and GH 119-20 but not that of cv. 28-206. Whereas endomycorrhizal infection of cv. 28-206 was not improved by fumigation, its N_2 fixation was greatly enhanced by this treatment, at least during the period ranging from day 40 to 50 (Germani 1979).

DBCP fumigation increased phosphorus content of groundnut pods by 134, 99, and 146 per cent and nitrogen content (pods) 127,

Table 30.1. Effect of DBCP fumigation on mycorrhizal infection of field-grown groundnut expressed as percentage of infected roots

	Groundnut cultivar		
	55–437	28–206	GH 119–20
First sampling (16th day)			
No fumigation	28.4 a (a)	22.8 a (a)	53.8 a (b)
Fumigation	33.0 ab (a)	59.6 b (a)	76.5 a (b)
Second sampling (60th day)			
No fumigation	54.0 ac (a)	63.6 b (a)	57.0 a (a)
Fumigation	56.2 c (a)	40.7 ab (a)	57.4 a (a)

Numbers in columns not having same letter and numbers in rows not having same letter between brackets differ $P = 0.05$ by Mann–Whitney test.

135, and 133 per cent respectively for cultivars 55–437, 28–206, and GH 119–20.

These results support the conclusion of Bird, Rich, and Glover (1974) that nematodes might eventually limit mycorrhizal infection, but the related mechanism is still unknown. Nematodes could also impede the establishment and functioning of the double plant symbiosis (Mosse, Powell, and Hayman 1976; Daft and El-Giahmi 1976) (a) with endomycorrhizae (b) with *Rhizobium*, thus indirectly reducing plant phosphorus uptake, and possibly its water uptake (Safir, Boyer, and Gerdemann 1977), and also its nitrogen-fixing ability. Such consequences are presumably most harmful to the plant, especially in phosphorus and nitrogen deficient soils, which commonly occur in semi-arid West Africa. The hypothesis that DBCP could directly enhance endomycorrhizal infection, as suggested by Menge (personal communication) should also be taken into account.

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