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Field response of mycorrhizal and nonmycorrhizal *Medicago sativa* var. local in the F1 generation

Abstract Seeds were collected from plants of *Medicago sativa* var. local inoculated with *Glomus macrocarpum* and *G. fasciculatum* separately in pot experiments. These seeds were sown in garden soil and the percentage germination, general health and yield of subsequent plants (the F1 generation) were studied. The percentage germination was highest in seeds of *G. macrocarpum*-inoculated parents followed by those inoculated with *G. fasciculatum*; seeds of uninoculated parent plants showed the lowest germination. Vegetative yield of the progeny decreased in the order of plants inoculated with *G. fasciculatum*, with *G. macrocarpum*, and uninoculated. On the other hand, reproductive yield was highest for plants whose parents were inoculated with *G. macrocarpum*, followed by *G. fasciculatum*, and lowest for seeds of uninoculated parent plants.

Key words F1 generation · Mycorrhizal benefits *Medicago sativa* var. local · *Glomus macrocarpum* *Glomus fasciculatum*

Introduction

Many plant species are known to enter into mycorrhizal symbiosis (Crush 1974, 1975; Gerdemann and Trappe 1975). These fungi improve the mineral nutrition of plants in particular by increasing uptake of phosphorus (Smith and Daft 1977). Mycorrhizal plants usually perform better than their nonmycorrhizal counterparts in low-fertility soils (Daft and El-Giahmi 1974). Some variability in mycorrhizal effectiveness has been described among plant species (Baylis 1975; Krishna and Shetty 1985), within species (Hall 1978; Nemec 1978) and within cultivars of the same species (Azcon and Ocampo 1981; O'Bannon et al. 1980; Ollivier et al. 1983). Transfer of mycorrhizal benefits from one generation to the next has been studied only in a few plant species (Mercy et al. 1990).

The objective of the present investigation was to observe the transfer of mycorrhizal benefits to the F1 generation in *Medicago sativa* var. local and to assess the fidelity of the transfer.

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Materials and methods

Seeds were collected from *Medicago sativa* var. local plants independently inoculated (mycorrhizal) with *Glomus macrocarpum* and *G. fasciculatum*. Uninoculated (nonmycorrhizal) seeds were taken as controls. The seeds were shown in garden soil in pot experiments.

Percentage germination was calculated by using the formula:

$$\frac{\text{number of seeds germinated}}{\text{total number of seeds}} \times 100$$

An average of three readings was taken.

Yield was assessed as the number of inflorescences per plant (five plants), the number of fruits per inflorescence (five plants), the number of seeds per pod (five plants) and the fresh and dry weights of 10 seeds.

Results and discussion

Percentage germination, the health of the emerging seedlings (Fig. 1) and the yield of the plants emerging from these seeds were evaluated. Observations are presented in Tables 1 and 2.

The beneficial effects exhibited by the plants of the F1 generation were in accordance with those conferred upon the parent plants in earlier experiments (unpublished data).

The vegetative parameters of growth were enhanced in parent plants inoculated with *G. fasciculatum*. Progeny also followed the same trend. Similarly, parent plants inoculated with *G. macrocarpum* and their progeny showed increase in reproductive parameters of

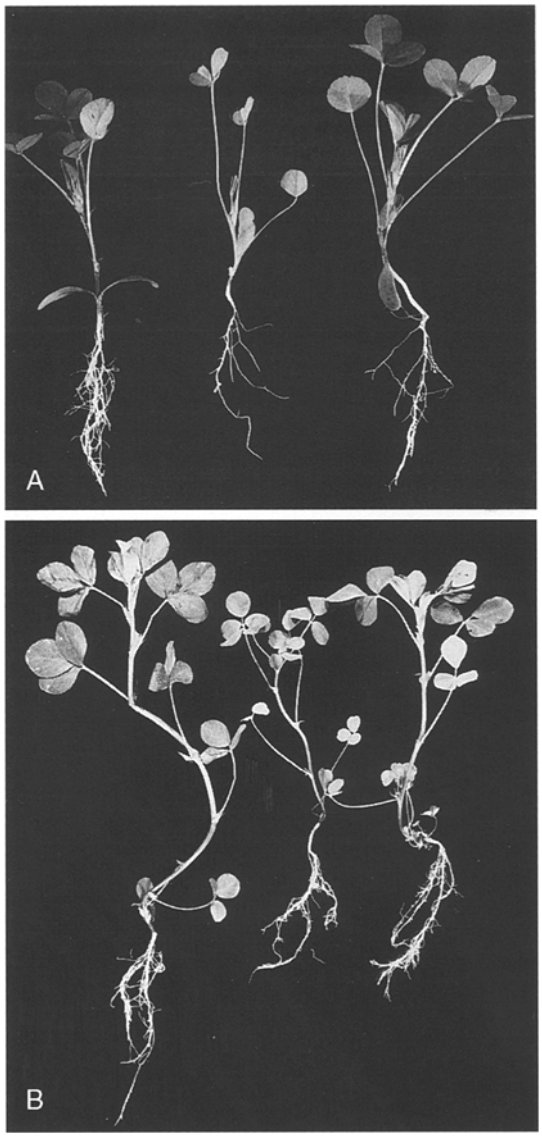

Fig. 1 **A** *Medicago sativa* var. local F1 generation 15 days after germination. *Left* parent plants inoculated with *Glomus fasciculatum*, *right* parent plants inoculated with *G. macrocarpum*, *centre* control. **B** *M. sativa* var. local F1 generation 45 days after germination. *Left* parent plants inoculated with *G. fasciculatum* (note increased growth), *right* parent plants inoculated with *G. macrocarpum*, *centre* control

growth. The uninoculated (control) plants performed less well in both generations.

Bolland et al. (1990) reported that an increase in the P content of seeds of *M. sativa* resulted in increased herbage and yield. Since the role of VAM in P uptake is now well established (Smith et al. 1992; Owusu-Bennoah et al. 1979; Gianinazzi-Pearson and Gianinazzi 1981; Estaun et al. 1987), mycorrhizal seeds probably have higher levels of P than normal seeds. Whether this governs the growth response in the F1 generation remains to be established. Such studies may provide new insights into the role of this important macronutrient on various aspects of plant life.

Table 1 Percentage germination in the F1 generation of mycorrhizal and nonmycorrhizal plants of *Medicago sativa* var. local

Seeds from parents inoculated with	No. of seeds sown	No. of seeds germinated	Germination (%)
Glomus macrocarpum	100	83	
	100	80	81.3
	100	81	
Glomus fasciculatum	100	79	
	100	77	78.0
	100	78	
Controls	100	70	
	100	74	72.3
	100	73	

Table 2 Yield parameters of the F1 generation of mycorrhizal and nonmycorrhizal plants of *Medicago sativa* var. local

Seeds from parents inoculated with	No. of inflorescences per plant	No. of fruits per inflorescence	No. of seeds per pod	Seed fresh wt. (g)	Seed dry wt. (g)
Glomus macrocarpum	23.6	30.0	7.8	0.2042	0.2019
Glomus fasciculatum	13.0	12.0	5.4	0.1096	0.1088
Controls	10.2	8.0	5.0	0.0995	0.0989

The results of the present study indicate that mycorrhizal benefits are heritable from parents to the F1 generation in the case of *M. sativa* var. local, with 100% fidelity of transfer of the traits concerned.

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