

EFFECT OF CROP ROTATIONS INVOLVING HOST AND NON-HOST PLANTS ON VESICULAR-ARBUSCULAR MYCORRHIZAL INFECTION OF HOST PLANTS

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KEY WORDS

Endomycorrhiza *Glomus mosseae* Crop rotation

SUMMARY

The effects of crop rotations involving two host (lettuce and lavender) and two non-host (cabbage and radish) plants on the development of mycorrhizal infection in host plants were studied in unsterile soil and in sterilized soil with or without rock phosphate and inoculated with *Glomus mosseae*. As in previous experiments, pre-cropping with non-host plants did not decrease VA infection in the host plants. On the other hand, pre-cropping with a host plant increased VA infection in the same or another host plant grown afterwards. These effects were noted irrespectively of rock phosphate additions and of soil sterilization.

INTRODUCTION

Competition between two host plant for mycorrhizas has been reported^{3,9}. This effect may be due to preferential colonization of specific plant roots⁹. In other experiments, however, strongly mycorrhizal plants increased infection in a weakly mycorrhizal plant¹⁰ and non-host plants may have slightly increased VA infection in host plants⁹. It appears that plant interactions may operate through mechanisms other than (or in addition to) root competition, such as the production of root exudates from one species which alter mycorrhizal infection in the other. This effect can be tested with different crop rotations.

Crop rotation is a normal practice in agriculture, and different crop regimes have been described which induce different affects on mycorrhizal development in plants⁸. Prolonged monoculture of a given host plant sometimes depressed spore numbers⁵, although mycorrhizal infection can be increased in the same host plants grown successively^{2,4}.

Possible beneficial or detrimental effects on VA mycorrhiza of crop rotations with the same or different host plants compared to non-host-host plant rotations are studied in this paper, under different conditions from previous experiments⁸.

MATERIALS AND METHODS

Two mycorrhizal host plants, viz lettuce (*Lactuca sativa* L. 'Romana') and lavender (*Lavandula spica* L. var. vera) and two species believed to be non-host plants, viz cabbage (*Brassica oleracea* L.) and radish (*Raphanus raphanistrum* var. 'Aplastada de Egipto') were used in these experiments.

The soil was collected from Granada Province, Spain. It was a 'reddish brown calcareous' type, pH = 7.6 (for full details see⁷), containing spores mainly resembling *Glomus mosseae* (Yellow vacuolate spore type). This soil was mixed with 25% (w/w) of sand, and used either unsterile (Exp. 2) to allow infection by the indigenous VA endophytes, or sterilized by steaming, and inoculated with soil from stock culture of a Rothamsted isolate of *Glomus mosseae* which contained spores, mycelium and infected root fragments. 5 g soil inoculum mixed with 5 g sand were added per pot. Half of the sterilized soil received rock phosphate at the rate of 0.04 g per 100 g soil.

Seeds were sown in moist sand, and four-week-old seedlings were transplanted to pots containing 250 g of the soil:sand mixture. Plants were watered from below using a capillarity system and fed with Hewitt's nutrient solution every fortnight.

The following treatments were tested: pots with inoculum kept with no plant (fallow), and pots with soil from stock culture of a Rothamsted isolate of *Glomus mosseae* which contained spores, combinations were established: a) Lettuce planted after: fallow, cabbage roots removed, cabbage roots retained, lettuce roots removed, lettuce roots retained, lavender roots removed, lavender roots retained and in fresh soil with (Exp. 1) or without fresh inoculum (Exp. 2); and b) Lavender planted after: fallow, radish roots removed, radish roots retained, lettuce roots removed, lettuce roots retained, lavender roots removed, lavender roots retained and in fresh soil with (Exp. 1) or without fresh inoculum (Exp. 2) (see⁸). Plants were harvested after 4, 8 and 12 weeks, and the dry matter recorded. After harvesting, the whole root systems were cleared and stained, and infection recorded on 30 random 1 cm root segments per replicate at $\times 160$ magnification as before⁹.

RESULTS

Experiment 1

Mycorrhizal infection in lavender and lettuce plants grown in sterilized soil inoculated with *G. mosseae* was not depressed by the presence of roots of non-host plants grown previously in this soil as compared with the controls (fallow and fresh treatments) (Tables 1 and 2). These results agree with those obtained by other authors⁸.

There was more infection in host plants grown in soil previously cropped with host plants than in the controls without pre-cropping or in plants grown after non-host after four weeks, but after eight weeks VA infection became similar in all treatments. Plants grown in soil kept fallow for 10 weeks de-

Table 1. Amounts of VA infection in mycorrhizal host plants grown in sterilized soil inoculated with *Glomus mosseae* and given different pre-cropping treatments

Plant	Pre-crop treatment	% root length infected After (weeks)			% root cortex infected After (weeks)		
		4	8	12	4	8	12
Lettuce	Fallow	11 ± 1.4	28 ± 3.1	57 ± 3.3	6 ± 0.2	14 ± 0.7	35 ± 0.6
	Cabbage-rm	15 ± 0.7	43 ± 2.8	53 ± 1.6	6 ± 1.4	29 ± 1.4	38 ± 1.4
	Cabbage-rt	10 ± 2.2	48 ± 1.8	63 ± 0.7	7 ± 0.6	30 ± 1.3	45 ± 2.1
	Lettuce-rm	34 ± 2.6	69 ± 10	47 ± 2	21 ± 1.6	50 ± 3.9	31 ± 16
	Lettuce-rt	43 ± 2.9	75 ± 5	36 ± 1	27 ± 2.6	60 ± 1.3	23 ± 1.1
	Lavender-rm	27 ± 4.6	57 ± 2	47 ± 2.1	17 ± 7	39 ± 15	30 ± 0.4
	Lavender-rt	35 ± 6.3	64 ± 7.3	53 ± 8.7	22 ± 1.1	54 ± 8.4	34 ± 6.3
	Fresh	8 ± 3.6	6 ± 3	52 ± 2.3	4 ± 1.4	14 ± 1.2	37 ± 1.9
Lavender	Fallow	15 ± 4.4	25 ± 2.8	61 ± 4.4	9 ± 2.8	19 ± 2.4	48 ± 3.8
	Radish-rm	19 ± 8.1	41 ± 4.5	67 ± 5.3	16 ± 8.4	25 ± 2.8	46 ± 4.2
	Radish-rt	20 ± 0.9	35 ± 3.1	57 ± 9.9	13 ± 1.3	22 ± 16.8	40 ± 8.6
	Lettuce-rm	32 ± 0.7	60 ± 12	59 ± 12	19 ± 2	48 ± 12	42 ± 0
	Lettuce-rt	35 ± 3.8	64 ± 15	53 ± 1	25 ± 1.4	49 ± 4.9	36 ± 1.5
	Lavender-rm	28 ± 1.8	54 ± 5	56 ± 12	18 ± 5.1	41 ± 4.3	42 ± 9.1
	Lavender-rt	26 ± 1.4	46 ± 9.6	66 ± 6.2	19 ± 5.8	34 ± 8.6	47 ± 3.9
	Fresh	11 ± 0.9	21 ± 7.4	63 ± 3.3	6 ± 0.1	14 ± 1.9	45 ± 4.8

rm = root removed; rt = roots retained

Fresh soil given inoculum stored at 2°C. Each figure is the mean of 3 pots and 90 cm root. Standard errors of mean are given.

veloped similar infection levels to plants grown in soil amended with fresh inoculum (inoculum stored at 2°C during this time).

There were generally more entry points and arbuscules (Tables 2 and 4) in plants grown after hosts than after non-host, but arbuscular development became similar between treatments after the first harvest.

Differences between VA infection in host plants grown in soil with (Table 3) or without rock phosphate (Table 1) were not significant.

Shoot dry weights (Tables 7 and 8) were not correlated with VA infection levels in these plants. Differences in shoot dry weights between treatments were not significant.

Experiment 2

The development of mycorrhizal infection in host plants grown in unsterile soil (Table 5) showed a similar pattern to that in the sterilized soil inoculated with *G. mosseae* (Tables 1 and 3), although it was slower in the unsterile soil. After 8

Table 2. Formation of entry points and arbuscules in mycorrhizal host plants grown in sterilized soil inoculated with *Glomus mosseae* and given different pre-cropping treatments

Plant	Pre-crop treatment	Entry points/cm root After (weeks)			Arbuscules* After (weeks)		
		4	8	12	4	8	12
Lettuce	Fallow	0.2 ± 0.1	1.2 ± 0.5	1.7 ± 0.7	0	0.4 ± 0.2	3 ± 0.3
	Cabbage-rm	0.5 ± 0.3	1.5 ± 0	2.8 ± 0.07	0	0.3 ± 0.2	2 ± 0.4
	Cabbage-rt	0.4 ± 0.3	1.6 ± 0.07	3.0 ± 0.3	0	0.3 ± 0.2	3 ± 0.1
	Lettuce-rm	1.1 ± 0.2	2.9 ± 0.1	3.7 ± 0.6	0.3 ± 0	1.1 ± 0.07	3 ± 0.3
	Lettuce-rt	1.9 ± 0.4	3.1 ± 0.1	3.6 ± 0.07	0.4 ± 0.2	1.2 ± 0.1	3 ± 0
	Lavender-rm	1.1 ± 0.1	2.5 ± 0.2	3.5 ± 0.07	0.3 ± 0	0.4 ± 0	1 ± 0.07
	Lavender-rt	1.0 ± 0.1	2.5 ± 0.5	3.2 ± 0.07	0.7 ± 0.6	0.9 ± 0.4	2 ± 0.07
	Fresh	0.2 ± 0.1	0.8 ± 0.2	2.0 ± 0.9	0	0.2 ± 0.1	2 ± 0.4
Lavender	Fallow	0.2 ± 0.2	1.3 ± 0.1	2.6 ± 0.2	0	0.1 ± 0.1	2 ± 0.2
	Radish-rm	0.6 ± 0.3	1.4 ± 0.1	2.5 ± 0	0	0.8 ± 0.3	3 ± 0.1
	Radish-rt	0.8 ± 0.2	1.3 ± 0.1	2.8 ± 0.4	0	0.9 ± 0.3	3 ± 0.5
	Lettuce-rm	0.9 ± 0.2	2 ± 0.2	3.8 ± 0.3	0.3 ± 0.1	1.7 ± 0.4	3 ± 0.7
	Lettuce-rt	1.4 ± 0.1	2.8 ± 0.2	3.4 ± 0.3	0.8 ± 0	1.8 ± 0.3	3 ± 0.2
	Lavender-rm	1.1 ± 0.07	1.9 ± 0.2	3.9 ± 0.4	0.5 ± 0.4	1.4 ± 0.4	3 ± 0.1
	Lavender-rt	0.7 ± 0.2	1.8 ± 0.2	3.7 ± 0.6	0.6 ± 0.4	1.3 ± 0.2	3 ± 0.1
	Fresh	0.2 ± 0	1.0 ± 0.1	2.1 ± 0.4	0	0.1 ± 0.07	2 ± 0.1

* Estimated in categories; 1 = 10% infection; 2 = 20%; 3 = 30%; 4 = 40%. Rest of legend same as for Table 1.

Table 3. Amounts of VA infection in mycorrhizal host plant grown in sterilized soil, with rock phosphate added, inoculated with *Glomus mosseae* and given pre-cropping treatments

Plant	Pre-crop treatment	% root length infected After (weeks)			% root cortex infected After (weeks)		
		4	8	12	4	8	12
Lettuce	Fallow	16 ± 0.1	22 ± 3.2	62 ± 2.5	7 ± 0.2	9 ± 0.8	41 ± 4
	Cabbage-rm	15 ± 1.5	47 ± 4.3	53 ± 8.8	6 ± 0.1	29 ± 0.1	36 ± 8
	Cabbage-rt	15 ± 4.2	60 ± 11.6	62 ± 11	6 ± 1.4	42 ± 7.4	43 ± 12
	Lettuce-rm	33 ± 10	66 ± 3.4	60 ± 14	21 ± 5.6	52 ± 1.8	45 ± 12
	Lettuce-rt	38 ± 9.2	68 ± 2	36 ± 3.8	24 ± 5.7	55 ± 1.4	24 ± 1.7
	Lavender-rm	32 ± 10	62 ± 2.5	64 ± 7.4	22 ± 8.4	48 ± 2.2	45 ± 8.7
	Lavender-rt	34 ± 2.8	67 ± 2.4	41 ± 4	21 ± 1.4	48 ± 1	27 ± 3.2
	Fresh	7 ± 0.3	21 ± 0.8	53 ± 6.9	1 ± 0.4	8 ± 0.9	36 ± 6.7
Lavender	Fallow	13 ± 0.6	24 ± 8.2	65 ± 11.3	7 ± 2	18 ± 5	48 ± 9.8
	Radish-rm	19 ± 1.2	42 ± 14.5	68 ± 24	16 ± 1.2	32 ± 14.3	54 ± 24
	Radish-rt	15 ± 6.1	35 ± 3.8	52 ± 11.8	9 ± 4.6	25 ± 1.4	37 ± 7.7
	Lettuce-rm	33 ± 7	68 ± 12	78 ± 6.5	24 ± 4	49 ± 10	60 ± 7.3
	Lettuce-rt	37 ± 3.1	71 ± 2.6	77 ± 14	24 ± 6.4	54 ± 1.1	46 ± 15
	Lavender-rm	19 ± 2.6	34 ± 6.8	73 ± 24	10 ± 5.8	25 ± 4.5	55 ± 21
	Lavender-rt	26 ± 3.7	46 ± 3.4	47 ± 9.4	18 ± 2.8	35 ± 0.7	33 ± 5.7
	Fresh	12 ± 8.6	26 ± 4	64 ± 3.5	10 ± 4.4	17 ± 3.4	45 ± 2.6

Legend as for Table 1.

Table 4. Formation of entry points and arbuscules in mycorrhizal host plants grown in sterilized soil, with rock phosphate added, inoculated with *Glomus mosseae* and given different pre-cropping treatments

Plant	Pre-crop treatment	Entry points/cm root After (weeks)			Arbuscules After (weeks)		
		4	8	12	4	8	12
Lettuce	Fallow	0.2 ± 0.1	1.7 ± 0.2	2.4 ± 0.07	0	0.3 ± 0.1	2 ± 0.4
	Cabbage-rm	0.5 ± 0.3	1.7 ± 0.2	2.1 ± 0.4	0	0.4 ± 0.3	3 ± 0.7
	Cabbage-rt	0.7 ± 0.3	1.8 ± 0.4	2.6 ± 0.1	0	0.6 ± 0.1	3 ± 0.8
	Lettuce-rm	1.7 ± 0.2	3.1 ± 0.2	3.3 ± 0.4	0.3 ± 0.2	1.4 ± 0.2	3 ± 0.7
	Lettuce-rt	1.4 ± 0.2	3.6 ± 0.1	4 ± 0.7	0.2 ± 0.07	1.7 ± 0.7	3 ± 0.7
	Lavender-rm	1.6 ± 0.3	2.7 ± 0.3	3.7 ± 0.6	0.4 ± 0.2	0.8 ± 0.2	4 ± 0.7
	Lavender-rt	1.2 ± 0.07	2.5 ± 0.07	3.2 ± 0.2	0.2 ± 0.07	0.6 ± 0.4	4 ± 0.4
	Fresh	0.2 ± 0.1	0.4 ± 0.4	2 ± 0.3	0	0.1 ± 0.1	2 ± 0.4
Lavender	Fallow	0.1 ± 0.1	0.9 ± 0.2	1.5 ± 0.7	0	0.5 ± 0.4	2 ± 0.3
	Radish-rm	0.3 ± 0.2	1.4 ± 0.4	1.6 ± 0.4	0	0.7 ± 0.3	2 ± 0.2
	Radish-rt	0.3 ± 0	1.4 ± 0.1	1.6 ± 0.07	0	0.8 ± 0	3 ± 0.4
	Lettuce-rm	1.7 ± 0.4	2.9 ± 0.2	3.1 ± 0.07	0.8 ± 0.07	1.7 ± 0.4	4 ± 0
	Lettuce-rt	1.6 ± 0.7	3.6 ± 0.1	3.5 ± 0.7	0.5 ± 0.4	2.1 ± 0.3	4 ± 0.3
	Lavender-rm	1.0 ± 0.1	2.4 ± 0.6	3.5 ± 0.6	0.1 ± 0	0.9 ± 0.07	4 ± 0.2
	Lavender-rt	0.6 ± 0.2	2.5 ± 0.3	3.8 ± 0.9	0.3 ± 0.1	1.2 ± 0.07	2 ± 0.2
	Fresh	0.1 ± 0.1	0.6 ± 0.2	1.3 ± 0.6	0	0.3 ± 0	2 ± 0.4

Legend as for Table 2.

Table 5. Amounts of VA infection in mycorrhizal host plants grown in unsterile soil with different pre-cropping treatments

Plant	Pre-crop treatment	% root length infected After (weeks)			% root crotes infected After (weeks)		
		4	8	12	4	8	12
Lettuce	Fallow	4 ± 0.3	7 ± 2.1	28 ± 2.8	3 ± 0.1	3 ± 2	19 ± 7.2
	Cabbage-rm	6 ± 0.6	9 ± 2	28 ± 1.5	3 ± 0.3	5 ± 0.2	19 ± 1.3
	Cabbage-rt	5 ± 0.4	9 ± 3	25 ± 6	3 ± 0.4	5 ± 1.9	15 ± 4.2
	Lettuce-rm	13 ± 2.5	15 ± 1.1	33 ± 9.5	6 ± 1.5	9 ± 2.4	22 ± 7.5
	Lettuce-rt	18 ± 3.3	26 ± 2.2	48 ± 2.6	9 ± 2.2	17 ± 2.3	29 ± 1.4
	Lavender-rm	8 ± 3.6	14 ± 3	42 ± 2.2	4 ± 1.5	7 ± 0.5	29 ± 0.5
	Lavender-rt	16 ± 4	25 ± 0.2	52 ± 2.1	8 ± 0.5	13 ± 2.1	35 ± 3.9
	Fresh	4 ± 0.1	5 ± 0.6	36 ± 0.5	2 ± 0.2	3 ± 0.6	22 ± 2.1
Lavender	Fallow	1 ± 0.4	11 ± 1.2	45 ± 2.4	0.5 ± 0.3	5 ± 0.2	31 ± 0.1
	Radish-rm	1 ± 0.2	14 ± 2.3	62 ± 8.9	1 ± 0.4	7 ± 1.7	49 ± 13.5
	Radish-rt	4 ± 2	12 ± 6.2	54 ± 18	2 ± 1.7	9 ± 4.2	37 ± 13
	Lettuce-rm	9 ± 0.8	18 ± 4.5	65 ± 3.2	3 ± 0.4	9 ± 2.8	40 ± 8.6
	Lettuce-rt	10 ± 1.3	20 ± 11	60 ± 18	5 ± 1.3	10 ± 3.8	48 ± 5.4
	Lavender-rm	5 ± 0.8	15 ± 4.6	57 ± 9.9	5 ± 0.2	13 ± 2.4	45 ± 5.8
	Lavender-rt	6 ± 0.4	13 ± 5.7	68 ± 7	6 ± 0.3	11 ± 7.4	43 ± 14.9
	Fresh	1 ± 0.5	10 ± 0.2	41 ± 4	0.5 ± 0.4	5 ± 0.3	25 ± 2.7

Legend as for Table 1.

Table 6. Formation of entry points and arbuscules in mycorrhizal host plants grown in unsterile soil with different pre-cropping treatments

Plant	Pre-crop treatment	Entry points/cm root After (weeks)			Arbuscules After (weeks)		
		4	8	12	4	8	12
Lettuce	Fallow	0.1 ± 0.05	0.2 ± 0.1	0.8 ± 0.2	0	0	0.2 ± 0.1
	Cabbage-rm	0.1 ± 0.05	0.5 ± 0.2	0.9 ± 0.2	0	0.06 ± 0.01	0.1 ± 0.1
	Cabbage-rt	0.1 ± 0.05	0.3 ± 0.1	0.9 ± 0.3	0	0.08 ± 0.02	0.2 ± 0.05
	Lettuce-rm	0.2 ± 0.04	0.5 ± 0.2	1.2 ± 0.4	0	0.1 ± 0.07	0.2 ± 0.2
	Lettuce-rt	0.3 ± 0.04	0.8 ± 0.1	1.6 ± 0.4	0	0.2 ± 0.07	0.3 ± 0.1
	Lavender-rm	0.2 ± 0.03	0.4 ± 0.05	1.6 ± 0.5	0	0.05 ± 0.01	0.1 ± 0.05
	Lavender-rt	0.7 ± 0.3	0.9 ± 0.6	1.5 ± 0.3	0	0.02 ± 0.01	0.2 ± 0.2
	Fresh	0.1 ± 0.05	0.1 ± 0.05	0.7 ± 0.1	0	0.01 ± 0.01	0.1 ± 0.1
Lavender	Fallow	0.05 ± 0.05	0.3 ± 0.02	0.9 ± 0.2	0	0.02 ± 0.02	0.9 ± 0.1
	Radish-rm	0.08 ± 0.02	0.6 ± 0.02	1.3 ± 0.3	0	0.03 ± 0.02	1.3 ± 0.07
	Radish-rt	0.1 ± 0.05	0.8 ± 0.07	1.7 ± 0.3	0	0.06 ± 0.01	0.9 ± 0.2
	Lettuce-rm	0.4 ± 0	0.5 ± 0.05	2.2 ± 0.07	0	0.1 ± 0.1	1.1 ± 0.2
	Lettuce-rt	0.3 ± 0.1	0.5 ± 0.04	2 ± 0.6	0	0.1 ± 0.08	1.4 ± 0.2
	Lavender	0.2 ± 0.09	0.5 ± 0.02	1.8 ± 0.7	0	0.02 ± 0.01	0.8 ± 0.5
	Fresh	0.04 ± 0.05	0.4 ± 0.01	1.2 ± 0.3	0	0.02 ± 0.01	0.2 ± 0.02

Legend as for Table 2.

Table 7. Shoot dry weight (g/plant) of mycorrhizal host plants grown in sterilized soil inoculated with *Glomus mosseae* and given different pre-cropping treatments

Plant	Pre-crop treatment	After (weeks)		
		4	8	12
Lettuce	Fallow	0.01 ± 0.01	0.1 ± 0.08	0.8 ± 0.07
	Cabbage-rm	0.02 ± 0.01	0.06 ± 0.01	0.5 ± 0.1
	Cabbage-rt	0.02 ± 0.02	0.08 ± 0.02	0.6 ± 0.1
	Lettuce-rm	0.05 ± 0.007	0.1 ± 0.07	0.6 ± 0.1
	Lettuce-rt	0.03 ± 0.01	0.1 ± 0.08	0.7 ± 0.01
	Lavender-rm	0.08 ± 0.02	0.3 ± 0.06	1.0 ± 0.2
	Lavender-rt	0.10 ± 0.02	0.2 ± 0.01	1.1 ± 0.01
	Fresh	0.01 ± 0.01	0.1 ± 0.08	0.3 ± 0.1
Lavender	Fallow	0.01 ± 0.002	0.06 ± 0.05	0.5 ± 0.3
	Radish-rm	0.01 ± 0	0.10 ± 0	0.7 ± 0.1
	Radish-rt	0.01 ± 0.001	0.05 ± 0	0.6 ± 0.1
	Lettuce-rm	0.01 ± 0	0.1 ± 0.1	0.9 ± 0.2
	Lettuce-rt	0.01 ± 0.004	0.1 ± 0.02	0.9 ± 0.2
	Lavender-rm	0.01 ± 0.007	0.07 ± 0.02	1.0 ± 0.2
	Lavender-rt	0.01 ± 0.001	0.1 ± 0.03	1.2 ± 0.2
	Fresh	0.01 ± 0	0.06 ± 0.01	0.5 ± 0.4

Legend as for Table 1.

Table 8. Shoot dry weight (g/plant) of mycorrhizal host plants grown in sterilized soil, with rock phosphate added, inoculated with *Glomus mosseae* and given different pre-cropping treatments

Plant	Pre-crop treatment	After (weeks)		
		4	8	12
Lettuce	Fallow	0.04 ± 0.007	0.1 ± 0.08	1.0 ± 0.3
	Cabbage-rm	0.02 ± 0.01	0.05 ± 0.03	0.6 ± 0.2
	Cabbage-rt	0.01 ± 0.007	0.08 ± 0.007	0.4 ± 0.1
	Lettuce-rm	0.06 ± 0	0.1 ± 0.01	0.5 ± 0.007
	Lettuce-rt	0.03 ± 0.007	0.1 ± 0.07	1.0 ± 0.1
	Lavender-rm	0.06 ± 0.05	0.1 ± 0.05	0.7 ± 0.2
	Lavender-rt	0.03 ± 0.01	0.08 ± 0.01	0.6 ± 0.2
	Fresh	0.03 ± 0.01	0.08 ± 0.01	0.6 ± 0.2
	Lavender	Fallow	0.01 ± 0.01	0.05 ± 0.03
Radish-rm		0.01 ± 0.002	0.05 ± 0.04	0.6 ± 0.07
Radish-rt		0.01 ± 0.002	0.04 ± 0.03	0.5 ± 0.07
Lettuce-rm		0.01 ± 0.002	0.1 ± 0.02	0.7 ± 0.2
Lettuce-rt		0.02 ± 0.01	0.1 ± 0.02	0.8 ± 0.3
Lavender-rm		0.01 ± 0.005	0.1 ± 0.03	0.7 ± 0.2
Lavender-rt		0.01 ± 0.005	0.1 ± 0.02	1.0 ± 0.2
Fresh		0.01 ± 0.001	0.06 ± 0.007	0.5 ± 0.07

Legend as for Table 1.

Table 9. Shoot dry weights (g/plant) of mycorrhizal host plants grown in unsterile soil with different pre-cropping treatments

Plant	Pre-crop treatment	After (weeks)		
		4	8	12
Lettuce	Fallow	0.03 ± 0.01	0.1 ± 0.02	0.9 ± 0.1
	Cabbage-rm	0.01 ± 0.01	0.1 ± 0.06	0.8 ± 0.09
	Cabbage-rt	0.02 ± 0.01	0.06 ± 0.01	0.8 ± 0.2
	Lettuce-rm	0.04 ± 0.02	0.05 ± 0.01	0.9 ± 0
	Lettuce-rt	0.02 ± 0	0.1 ± 0.02	0.8 ± 0
	Lavender-rm	0.02 ± 0	0.1 ± 0.04	1.0 ± 0.1
	Lavender-rt	0.01 ± 0.01	0.2 ± 0.09	0.6 ± 0.5
	Fresh	0.03 ± 0.01	0.1 ± 0.1	0.6 ± 0.4
	Lavender	Fallow	0.01 ± 0	0.07 ± 0.04
Radish-rm		0.01 ± 0	0.08 ± 0.01	0.7 ± 0.2
Radish-rt		0.01 ± 0.002	0.07 ± 0.02	0.8 ± 0.3
Lettuce-rm		0.01 ± 0	0.1 ± 0.002	1.0 ± 0.1
Lettuce-rt		0.01 ± 0.007	0.1 ± 0.03	1.1 ± 0.1
Lavender-rm		0.01 ± 0.002	0.09 ± 0.01	0.8 ± 0.1
Lavender-rt		0.01 ± 0	0.1 ± 0.07	1.1 ± 0.07
Fresh		0.01 ± 0.003	0.1 ± 0.02	0.7 ± 0.07

Legend as for Table 1.

weeks, all plants were well infected. VA infection by indigenous endophytes, as with *G. mosseae*, was unaffected by the presence of non-host roots. Host plants grown after other host plants generally had more VA infection (Table 5), arbuscules and entry points (Table 6) than plants in other treatments after four weeks period of growth, but later all treatments were similar.

Shoot dry weights of host plants were very similar in all pre-cropped treatments (Table 9).

DISCUSSION

These results confirm previous results with different plant-soil-endophyte combinations^{8,9} that non-host plants do not inhibit VA infection in host plants. It is possible that toxic substances may be produced by non-host plants but this did not appear to happen on a scale large enough to reduce the inoculum potential of VA fungi in this soils. Experiments on the possible role of root exudates are in progress.

The non-harmful effects of non-host plants on VA infection in host plants cannot be related to any decrease of soil phosphate, because mycorrhizal infection was similar in soil with or without the addition of rock phosphate. Although it is known that rock phosphate is sparingly soluble in neutral-alkaline soils⁶, it is possible that some ions could dissociate chemically to restore the natural equilibrium disturbed by mycorrhizal uptake of soluble phosphate¹. Also the effect of non-host plants on mycorrhizal infection in host plants cannot be attributed either to reduced soil nutrient status, because all treatments were given regular addition of nutrient solution, or to enhanced soil nutrient status from residues of non-host roots, because shoot dry weights were similar in all treatments.

The positive effect of precropping with host-plants on VA infection of the same or another host-plant was considered likely because host plants can increase inoculum potential in the soil. This was observed mainly in the early stages of infection, because after the first harvest crop rotations with host and non-host plants had the same effect as crop rotation involving two host plants.

The observation that VA infections from stored inoculum were similar to those in the fallow treatment in all experiments, is different to that of others authors⁸, perhaps, because of differences in the different experimental conditions (endophyte, soil, light *etc.*) used in the present study.

ACKNOWLEDGEMENTS

The author thanks Dr. D. S. Hayman, Rothamsted Experimental Station, England and Dr. J. M. Barea, Estacion Experimental del Zaidin, Spain, for helpful advice, criticism and for grammatical correction of the manuscript.

Received 3 January 1980

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