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INTERACTION EFFECT OF *GLOMUS FASCICULATUM* AND *TRICHODERMA VIRIDE* ON THE GROWTH OF SUNFLOWER

S. SUJATHA LILLY and P. SANTHANAKRISHNAN

Department of Agricultural Microbiology

TNAU, Coimbatore - 641 003.

ABSTRACT

Combined inoculation of *Glomus fasciculatum* and *Trichoderma viride* showed a positive influence on the growth, per cent root colonization by *Glomus fasciculatum* and uptake of phosphorus by sunflower when compared to individual inoculation or uninoculated control at different stages of sampling. The results show a synergistic effect of *Glomus fasciculatum* and *Trichoderma viride* on the growth of sunflower and indicate the potential benefits of using combined inoculations.

KEY WORDS : *Glomus fasciculatum*, *Trichoderma viride*, Compatability

VAM fungi can improve plant growth through increased uptake of phosphorus and other nutrients. Plants infected with mycorrhizal fungi show significant increase in yield as compared with non-mycorrhizal plants. Some specific interactions have been reported between VAM fungi and other microbial groups commonly present in the plant rhizosphere. Chandrasekara *et al.* (1995) reported that at flowering and maturity stages of sunflower, root colonization, spore count, total dry biomass and total P uptake were higher in VAM inoculated plants. Sunflower plants inoculated with dual inocula of *Glomus intraradix* and *Glomus mosseae* increased the growth of plant when compared to those inoculated with single inocula of VAM fungi (Mehrotra *et al.*, 1995). Windham *et al.* (1986) reported that *Trichoderma* spp. produced a growth regulation factor that increased the rate of seed germination and dry weight of shoots and reduced the root rot incidence (Ramakrishnan *et al.*, 1994). Calvet *et al.* (1992) reported that four different strains of *Trichoderma* spp. stimulated spore germination and mycelial growth of *Glomus mosseae* in monoxenic culture on water agar and one of them exerted a growth stimulation effect on marigold plants (*Tagetes erecta* L.) inoculated with *Glomus mosseae* (Calvet *et al.*, 1993). *Trichoderma aureoviride* and *Glomus* spp. when applied in combination to citrus increased mycorrhizal root colonization and plant growth (Camprubi *et al.*, 1995).

MATERIALS AND METHODS

Trichoderma viride was multiplied on molasses yeast medium (Papavizas *et al.*, 1984). Formulation of *Trichoderma* was prepared by mixing with talk powder at 1:2 (v/w) and dried in shade. About 10 gram of VA-mycorrhizal bulk inoculum consisting of soil with spores and vegetative mycelium was mixed with 5 kg soil

Table 1. Interaction between *Glomus fasciculatum* and *Trichoderma viride* on the shoot length and root length of sunflower.

Treatment	Shoot length (cm/plant)				Root length (cm/plant)			
	DAS				DAS			
	30	45	60	Mean	30	45	60	Mean
Glomus fasciculatum	52.50	75.50	86.00	71.33	5.10	7.90	9.20	7.40
Trichoderma viride	48.40	63.60	78.10	63.37	4.30	5.50	7.30	5.70
Glomus fasciculatum+ *Trichoderma viride*	57.80	85.60	92.80	78.73	6.10	8.90	10.30	8.43
Uninoculated control	41.00	56.20	68.50	55.23	3.80	4.70	6.10	4.87
Mean	49.93	70.22	81.35	67.17	4.83	6.75	8.23	6.60

DAS - Days after sowing

	SEd	C.D	SEd	C.D
Treatment	0.25	0.51	0.13	0.27
Stages	0.22	0.44	0.12	0.24
Treatment x stages	0.44	0.88	0.24	0.48

before sowing. Sunflower seeds (Var. Co-4) were treated with *Trichoderma* at 4g /kg and sown below the soil surface and five replications were maintained for each treatment.

Treatment details are as follows :

1. *Glomus fasciculatum*
2. *Trichoderma viride*

Table 2. Interaction between *Glomus fasciculatum* and *Trichoderma viride* on plant dry weight of sunflower

Treatment	Plant dry weight (g/plant)			
	DAS			
	30	45	60	Mean
Glomus fasciculatum	0.933	3.943	5.970	3.615
Trichoderma viride	0.842	3.492	5.597	3.311
Glomus fasciculatum+ *Trichoderma viride*	1.135	4.380	6.196	3.904
Uninoculated control	0.727	3.010	4.579	2.772
Mean	0.910	3.706	5.586	3.400

DAS - Days after sowing

	SEd	C.D
Treatment	0.034	0.068
Stages	0.030	0.059
Treatment x stages	0.060	0.119

3. *Glomus fasciculatum* + *Trichoderma viride*
4. Uninoculated control

Plant samples were collected periodically at 30th, 45th and 60th day after sowing and shoot length, root length and plant dry weight were recorded. The VA-mycorrhizal spore count was determined by wet sieving and decanting technique (Gerdemann and Nicolson, 1963) and the percentage mycorrhizal colonization by staining roots with tryphan blue (Philips and Hayman, 1976). Total phosphorus uptake by plant was estimated by the vandomolydate phosphoric yellow colour method. *Trichoderma* population was enumerated by employing *Trichoderma* selective medium.

RESULTS AND DISCUSSION

In the present study, there was an increase in shoot length and root length (Table 1) and dry weight (Table 2) of sunflower due to combined inoculation of *Glomus fasciculatum* and *Trichoderma viride*. The increase might be attributed to the increased phosphorus uptake by *Glomus fasciculatum* release of plant growth substances and suppression of plant pathogens by *Trichoderma viride*. The combined inoculation of *Glomus fasciculatum* and *Trichoderma viride* registered the highest VAM colonization and VAM spore load (Table 3). Similar results were obtained by Azcon Aguilar and Barea (1985) and Meyer and Linderman (1986) who reported an increase in mycorrhizal infection due to combined inoculation of VAM with synergistic organisms.

Seed treatment with *Trichoderma* spp. showed an increase in crop growth and similar positive effect have been reported by many authors (Baker. 1989; Windham *et al.*, 1986 and Sridar. 1996). Synergistic interaction between *Glomus fasciculatum* and *Trichodermaviride* has been obtained which is in confirmity with the findings of Calvet *et al.* (1993) in marigold and Camprubi *et al.* (1995) in citrus Calvet *et al.* (1992) reported that development of VAM mycelium from germinated spores was enhanced by the presence of *Trichoderma* spp. Stimulation caused by *Trichoderma* might be attributed to the production of volatile compounds.

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Table 3. Interaction between *Glomus fasciculatum* and *Trichoderma viride* on per cent root colonization and spore number of VAM fungi

Treatment	Per cent root colonization				Spore number (100 ml^{-1} soil)			
	DAS				DAS			
	30	45	60	Mean	30	45	60	Mean
Glomus fasciculatum	27	31	33	30	31	43	52	42
Trichoderma viride	11	14	16	14	17	21	27	22
Glomus fasciculatum+ *Trichoderma viride*	27	33	37	32	36	44	66	49
Uninoculated control	14	16	18	16	13	18	23	18
Mean	20	24	27	23	24	32	42	33

DAS - Days after sowing

	SEd	C.D	SEd	C.D
Treatment	0.73	1.46	0.75	1.50
Stages	0.63	1.26	0.65	1.30
Treatment x stages	1.26	2.52	1.30	2.60

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GENETIC ARCHITECTURE AND ORDER EFFECT IN TRIPLE CROSSES OF GROUDNUT (*Arachis hypogaea* L.)

P. VINDHIYA VARMAN

Regional Research Station
Vridhachalam - 606 001.

ABSTRACT

Sixty, three-way hybrids involving six parents were tested. The data on 20-pod mass were analysed as per a triallel analysis model. The character showed predominantly epistatic genetic variance. The magnitude of additive x dominance type of epistasis was maximum followed by dominance x dominance and additive gene effects respectively. The dominance and additive x additive type of interactions were negative and considered equal to zero. The cross combination (ALR 2 x JL 24) x Girnar 1 recorded the highest three-line specific effects, whereas, the other combinations of the same three parents, (Girnar 1 x JL 24) x ALR 2 and (Girnar 1 x ALR 2) x JL 24 exhibited negative estimates.

KEY WORDS: Groudnut, Epistasis, Additive gene effects, Order effects

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop grown under varying climatic conditions. In the semi arid tropics, it is mostly grown under rainfed conditions in marginal and sub-marginal lands. Hence, developing varieties with stability in performance is one of