Effects of sulpher foam and mycorrhizal fungi on Eggplant infested with Nematode(*Meloidogyne javanica*) at seed or seedling stage

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Abstract

Arbuscular mycorrhizal fungi and sulphur foam added either at direct seeding or at transplanting decreased the effects of nematode (*Meloidogyne javanica*) on eggplant growth, and improved plant health. Experiments were conducted to study the possible interactions between the Mycorrhizal fungi (*Glomus mossae* and *Gigaspora* spp.) and sulphur foam to control *M. javanica* on eggplant at seed or seedling stage. Experiment at seed stage treated with Mycorrhiza or sulphur foam alone or together stimulated the growth and reduced Nematode infestation significantly. Treated plant at seedling stage increased plant growth and reduced the number of galls /gm of root system. The interaction between Mycorrhiza and sulpher foam treatments was not significant.

Introduction:

Eggplant is an important vegetative product in Iraq and many other countries. Plant diseases such as the root knot nematode (N) disrupt root function and nutrient absorption, reduce numbers of feeder roots, and suppress plant growth and yield (Hussey, 1985).

In addition, those nematodes influence individual plants and plants community by interfering with the nutrient acquisition and herbivores and by selective feeding on seeds and seedlings resulting in preventing the establishment of particular plant species (Brussaard, 1998).

Mycorrhizal fungi (M) are generally considered 'beneficial' for plant performance and ecosystem processes (Brussaard, 2001). Arbuscular mycorrhizal fungi enhanced number of community and ecosystem parameters such as plant species diversity and productivity .Many research works reported that Growth of tomato plants were increased and nematodes activity were controlled using mycorrhizal technique.(Alraddad,1995;Bagyaraj,et al;1979.;Diedhiu,et al. 2003;Suresh,et al., 1985).

Sulpher foam (F) is a by-product during the process of sulpher. Several reports suggested application of the foam reduced plant damages by diseases. (Aladhami, 1990., Alhassan and Hamad 1981, Alhassani, 2002.; Dawood and Al hassan, 1981; Hassan, 2001).Combination of two such partners (M+F) with complementary mechanisms might increase overall control efficacy and, therefore, provide an environmentally safe alternative to nematicide application.

Interaction between mycorrhizal fungi & endoparasitic nematode depend on host plant, fungi, nematode and inoculums density. (Hussey and Rocadori, 1982.; Atilano,et al., 1976)

This research aimed to study the interaction between nematodes, mycorrhiza and sulphur foam application and their influences on eggplant growth when applied at direct seeding or seedling stage.

Material and methods:

Two experiments were conducted in a green house located in the Ag. Research station, ministry of Ag., Abu Ghraib. Seeds or seedlings (3weeks old) of eggplants (Solanum melongena) local variety were sown in 15 cm diameter plastic pots filled with 2 kg sandy loamy soil sterilized with methyl bromide at 40 gm/m²(Smith, et al, 1986).

Each experiment consisted of eight treatments in which combinations of mycorrhiza, sulphur foam on eggplant interacted with root-knot nematode. Each treatment was replicated 3 times.

Pots were arranged in a complete randomized design in a green house at

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20-25ºC during April,2006. A non inocul- ated treatment was also added.

The nematode *M. javanica* at rate of 3000 j2 /pot was inoculated .Juveniles were added around the seeds or the roots for each experiment. (Hussey & Barker, 1973).

Mycorrhizal fungi *Glomus mosseae* and *Gigaspora* sp. were grown in pots with white corn plants for 12 weeks until the formation of spores and mycelium. Roots of the white corn were cuts into small pieces and mixed with sands. Both types of mycorrhiza were mixed and added at the rate of 30 gm per pot.

Sulpher foam is a by-product supplied by "The Company of sulpher production" in Meshraq. Application of foam was at 10% for each treatment (200gm/pot).

Plants were harvested after 2 months, and root systems were carefully washed to ensure retrieval of all roots. Galls were counted using the root galling index by Taylor & Sasser (1978).Shoot and root weights were recorded after oven drying.

Results and Discussion:

Experiment (1):Infested at seed stage:

Nematode inoculated treatments resulted in dead plants at time of seedling emergence. All other treatments including the control showed live seedling; which means that application of mycorrhiza or foam has protected the plants in the presence of the nematode. There were an increase in Dry shoots and roots wt. compared to the control treatment, but they were not significant (Table 1).Plant growth increased significantly when treated with mycorrhiza in the absence of the nematode.These results in agreement with studies done by Stephan, et al., (1999, 2003).

treatment	No. of galls/root system	No. of Nematode/gm.root	Dry root wt.(gm)	Dry shoot wt.(gm)
Nematode	Dead plant	Dead plant	Dead plant	Dead plant
Foam alone	-	-	0.05	0.16
Mycorrhiza alone	-	-	0.58	0.65
F+M	-	-	0.03	0.12
N+F	60	1167	0.05	0.18
N+M	48	1851	0.03	0.14
N+ F+M	0.15	0.04	1034	37
Control	0.05	0.01	-	-
LSD	0.13	0.30	526.51	14.28

Table-1: Effects of different treatments on growth of eggplant infested with *M.javanica* at seed stage

Interaction between foam and mycorrhiza was not significant. The results from Table-1 may suggest not applying foam or mycorrhiza together to the eggplant, and that could be explained by sulphur foam affect on soil pH. As sulphur foam was found to decrease soil pH (Alhassani, 2002) and that could affect the spore's germination of *G.mosseae*.Green et al., (1976) observed that neutral to alkaline pH's favored the germination of *G.mosseae* while spores of *Gigaspora* germinated best at pH5.Hepper & Smith (1976) showed that solubility of Mno2 increases with decrease in soil pH and this can have an inhibitory affect on spore germination.

The lowest no. of galls/root system (37) occurred at N+F+M Treatment while the highest no.(60) found at N+F treatment compared to dead plants at the infested un treated treatment.Hattar et al(1988) obtained a significant reduction in root galling and egg mass production using elemental sulphur or H_2SO_4. Foam or mycorrhiza has played an essential role by supporting the growing seedlings with a large root system to tolerate the invading of the nematodes.Those results could be very useful in nursery application when seeds are vulnerable to diseases infection.

Experiment(2): Infested at seedling stage:

Mycorrhizal treated seedlings in the absence of the nematodes showed significant increases in dry shoot &root wt.measurements in relation to the control treatment and that was in agreement with Randly et al., (1999).Application of foam treatment increased plant growth significantly in the absence of nematode.

Interaction between foam and mycorrhiza treatments resulted in significant increases of shoot dry wt. in the absence of nematode.

Infection with nematodes showed overall increases (not sig.) on shoot or root wt. compared to the control. That may be due to low inoculums level which may stimulate better growth and larger root system (Gergon et al., 2002)

Infested and non-infested seedlings treated with mycorrhiza showed significant increased in plant growth whereas foam

treatment showed significant results for the non-infested treatment only.

Dry shoot wt.(gm)	Dry root wt.(gm)	No. of Nematode/gm.root	No. of galls/root system	Treatments
0.44	0.13	1024.6	120	N
0.89	0.41	-	-	F
1.62	1.12	-	-	M
0.52	0.23	587.6	120	N+F
1.44	0.77	496.8	150	N+M
0.61	0.41	319.4	130	N+F+M
0.63	0.43	-	-	F+M
0.34	0.16	-	-	CO
0.26	0.23	340.24	16.45	LSD

Table-2.Effects of different treatments on growth of eggplant infested with M.javanica at seedling stage

Inoculated seedlings with nematode measured by no. of Nem/gm of root within the experimental treatments (mycorrhiza or foam) showed significant decrease in no. of nematodes compared to infested untreated plant.Those no. were 587.6,496.8,319.4 N/gm of root for the treatments N+F, N+M, N+M+F compared to infested untreated plant 1024.6 respectively. Those differences appeared to be from mycorrhiza or foam treatments application encouraging root growth to tolerate nematode infection. Smith et al.,(1986) found that nematode numbers were least in mycorrhizal root systems.

Although the gall index was the same (5) but differences in root size due to different treatments can be explained as a potential influence of each factor. Diedhiau et al., (2003) found that application of mycorrhiza did not increase overall nematode control. Whereas Randly et al., (1999) found decreasing in *M.incognita* population under mycorrhiza treatment .Those differences in results due to differences in plant varieties, nematode species, mycorrhizal species and environmental factor.

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تأثيراضافة فوم الكبريت وفطريات المايكورايزا على نباتات الباذنجان المصابة بنيماتودا*Meloidogyne javanica* في مرحلة البذور او البادرات.

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الخلاصة

فطريات المايكورايزا ومادة فوم الكبريت اضيفت بشكل مباشر اثناء زراعة البذور او في مرحلة البادرات ادت الى خفض تاثير النيماتودا *Meloidogyne javanica* على نمو نبات الباذنجان وتحسين حالة النبات. اجريت هذه التجربة لدراسة التداخل مابين فطريات المايكورايزا وفوم الكبريت لمكافحة نيماتودا .M. javanica Glomus mossae and Gigaspora spp على نبات الباذنجان في مرحلة البذور والبادرات. واوضحت النتائج ان تجربة معاملة البذور بالمايكورايزا او فوم الكبريت سوية او منفصلين حفزت نمو النبات وخفضت من الاصابة بشكل معنوي . النباتات التي عوملت في مرحلة البادرات ادت الى زيادة نمو النبات وخفضت عدد العقد الجذرية مقاسة بالغرام/ جذر .التداخل مابين فطريات المايكورايزا وفوم الكبريت لم يكن معنوياً.