



Evaluation Efficacy of Fertilizer and Bio-Agents on Field Pea Against Root-Knot Nematode

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ABSTRACT

The study was made to evaluate the efficacy of NPK (20:10:10) fertilizer alone and in combination with bio - agents namely, *Trichoderma harzianum* and *Pseudomonas fluorescens* against *Meloidogyne incognita* on field pea (*Pisum sativum*) under glass house condition. Maximum plant growth parameters of tested plant were recorded in treatment of NPK @ 2 g / plant + *T. harzianum* + *P. fluorescens* @ 1 g / plant. Significant reductionon number of galls, egg masses / plant and final soil nematode population was also documented from the same treatment as compared to other one. When the untreated tested plant was cultivated in unsterilized soil, minimum value of growth characters was noticed.

KEY WORDS: Bio - agents, Fertilizer, Management, *Meloidogyne incognita*, *Pisum sativum*, Plant growth..

INTRODUCTION

Field pea (*Pisum sativum* L.) is belonging to the legume family (Fabaceae). It's cultivated in temperate regions at high elevations or during cool season in warm region throughout the world. This crop grown for different purpose such as edible seed or seed pods, silage and green fodder, desirable in crop rotations because of conserve soil water and economic diversity, green manures and cover crop due to grow quickly and also adapted to many soil types but grow best on fertile, light texture soil, (Lupwayi, N.Z., 1998; McGee, R., 2012).

Among the various pests and diseases associated with filed pea, the plant parasitic nematodes particularly *Meloidogyne incognita* is an important limiting factor for successful cultivation and productivity of the crop. In recent year, use of nonchemical means for the control of nematodes is gaining importance because of increased awareness of environmental and human health hazards associated with the chemical control (Cook, J.L., R. Bridge, 2004; Abuzar, S., 2012). The present investigation was therefore undertaken with view to study the efficacy of fertilizer and bio - agents on field pea against root – knot nematodealone and in combinations under glass house condition.

MATERIALS AND METHODS

Two glass house studied were conducted to test the effect of NPK fertilizer alone and in combination with bio - agents namely *Trichoderma harzianum* and *Pseudomonas fluorescens*. For this, healthy and uniform size of field pea cv. Baran was sown into 5 kg capacity pots. The treatments in this study were T₁ = NPK @ 1 g / plant in sterilized soil, T₂= NPK @ 1 g / plant in unsterilized soil, T₃= Untreated control in sterilized soil, T₄= NPK with *T. harzianum* and *P. fluorescens* @ 1 g / plant, T₅= NPK with *T. harzianum* and *P. fluorescens* @ 1 g / plant in unsterilized soil, T₆= NPK 2 g / plant in sterilized soil, T₇= NPK @ 2 g / plant in unsterilized soil, T₈= NPK with *T. harzianum* and *P. fluorescens* @ 2 g / plant in sterilized soil, T₉= Untreated control in unsterilized soil and T₁₀= NPK with *T. harzianum* and *P. fluorescens* @ 2 g / plant in unsterilized soil, under glass house condition.

Pure culture of *M. incognita* was raised from single egg mass of the nematode by inoculating field pea grown in the sterilized soil. The freshly hatched j₂ were counted in Hawkshley nematode counting dishes. Inoculation was made adding *M. incognita* @ 1 j₂ / g of soil 15 days after the treatments were given. The experiment was conducted in CRD with five replications. Pure culture of bio – agents were also obtained from Shiraz Agricultural Research Center, Iran.Fertilizer was procured from authorized market (NPK

20:10:10). Observation on shoot length, shoot weight, root length, root weight, number of galls / plant, number of egg masses / plant and final soil population were recorded 35 days after nematode inoculation as one life cycle of *M. incognita* was completed in 30 – 35 days. The final soil nematode population was estimated. Date were recorded and analyzed statically using One – way ANOVA (Duncan, D.B., 1995).

RESULTS AND DISCUSSION

Data represented in Table clearly indicated that the application of NPK along with bio – agents, *T. harzianum* and *P. fluorescens* significantly increased the plant growth parameters viz., shoot length and shoot weight, root length and root weight in both sterilized and unsterilized soil as compared to control. In both sterilized and unsterilized soil, highest plant growth characters were observed in the treatment, NPK @ 2 g / plant along with *T. harzianum* and *P. fluorescens* and NPK alone @ 2 g / plant. The maximum shoot length and shoot weight was observed in NPK @ 2 g / plant along with *T. harzianum* and *P. fluorescens* when applied in the sterilized soil. But the root length and root weight were on par with the same treatment when applied in both sterilized and unsterilized soil. All the plant growth parameters treatment, NPK @ 1 g / plant along with *T. harzianum* and *P. fluorescens* in sterilized soil were on par with the treatment of NPK @ 2 g / plant in unsterilized soil. Similarly, the plant growth parameters were the same except shoot length in the treatment of NPK @ 1 g / plant along with *T. harzianum* and *P. fluorescens* in unsterilized soil.

Table 1: Effect of NPK and bio – agents on plant growth of field pea and *M. incognita*^a

Treatment	Shoot		Root		Number of galls / plant	Number of egg masses / plant	Final soil population (100 cc)
	Length (cm)	Weight (g)	Length (cm)	Weight (g)			
T ₁	44.5 ^d	30.1 ^{c,d}	19.0 ^{c,d}	7.5 ^c	105.0 ^b	91.0 ^b	166.3 ^c
T ₂	47.05 ^c	31.5 ^c	20.3 ^c	9.1 ^b	76.0 ^c	67.6 ^c	142.0 ^d
T ₃	49.5 ^{b,c}	35.4 ^b	22.0 ^b	11.1 ^{a,b}	60.0 ^d	44.0 ^d	133.6 ^d
T ₄	55.6 ^a	40.3 ^a	26.5 ^a	13.2 ^a	48.0 ^e	39.6 ^e	109.3 ^e
T ₅	36.3 ^e	23.0 ^e	15.0 ^e	4.4 ^d	145.0 ^a	133.0 ^a	292.0 ^a
T ₆	42.8 ^d	27.2 ^d	17.6 ^d	6.1 ^c	112.0 ^b	95.0 ^b	193.0 ^b
T ₇	46.1 ^c	30.2 ^{c,d}	19.0 ^{c,d}	8.5 ^{b,c}	84.0 ^c	69.0 ^c	169.0 ^c
T ₈	47.6 ^c	23.9 ^c	20.5 ^c	10.1 ^b	66.3 ^c	49.0 ^d	146.6 ^d
T ₉	52.8 ^b	38.2 ^a	25.8 ^a	12.3 ^a	54.0 ^d	40.3 ^e	109.6 ^e
T ₁₀	34.6 ^e	21.6 ^e	14.0 ^e	3.2 ^d	158.0 ^a	141.0 ^a	313.0 ^a

^a each value represented of five replicates, Column letter followed by different letters are significantly different at P= 0.05 level by DMRT.

The plant growth parameters of control except shoot weight from sterilized soil significantly different from unsterilized soil. Results revealed that the application of NPK along with bio – agents significantly increased the plant growth characters when compared to the application of NPK alone in both sterilized and unsterilized soil.

All the treatments significantly reduced the number of galls and number of egg masses / plant and final soil population when compared to control in both sterilized and unsterilized soil. Lowest number of galls, number of egg masses and final soil population were recorded in the treatment with NPK @ 2 / plant along with *T. harzianum* and *P. fluorescens* in sterilized and unsterilized soil, respectively. Number of egg masses in the plants treated with NPK @ 2 g / plant alone was also on par from the treatment of NPK @ 2 g / plant along with *T. harzianum* and *P. fluorescens* in both sterilized and unsterilized soil. The study also revealed that all the treatments effectively reduced the number of galls, number of egg masses and final soil population of nematode. However, maximum effect was observed in the treatment of NPK along with *T. harzianum* and *P. fluorescens*. The presence of *T. harzianum* and *P. fluorescens* could be the possible reason for the effect on nematodes. These finding are in accordance with (Pradhan, A., 2003; Pandey, G., 2006) as they reported that *Glomus fasciculatum* was most efficient in promoting plant growth infested with *M. incognita* on tomato and chickpea, respectively. In other study, the combined treatments of farmyard manure, urea, ammonium sulphate (20.5 N%), ammonium nitrate (33.5 N%), agerin, nemaless, nile fertile and yeast were more effective in reducing numbers of the second stage juveniles in soil and root gall formation more than the single treatments on squash plant. Also, the tested materials improved fruit yield as compared to the untreated check (Noweer, E.M.A. and A.A.H. Susan, 2005). Bio – agents (*T. viride* and *Paecilomyces lilacinus*) alone or in combination with mustard cake and furadan promoted plant growth, reducing number of galls / plant, egg masses / root system and eggs / egg masses of infested tomato plant (Goswami, B.K., 2006). Pot experiment was conducted twice with a sterilized soil to evaluate the efficacy of organic manures (cow dung, domestic waste and poultry) and inorganic manures (NPK 15:15:15) on the growth attributes of root – knot nematode infected eggplant. They have documented that all of manures were effective in suppressing nematode activities as manifested in enhanced growth observed in both organic and inorganic manures treatments compared with control (Abolusoro, S.A., 2013). Soil application with urea fertilization combined with *T. harzianum* is considered as applicable, safe and cost effective method for controlling the causal organism of root – rot disease of lupine (Nehal, S., 2014) . Root galling of cucumber roots caused by *M. javanica* was more effectively suppressed under field condition using ammonium containing salts

and in a similar effect level of the nematicide (oxmyl or ethoprophos). The reduction of nematode final population number was also reported (Karajeh, M.R. and M.Al. Farah, 2014). The treatment combinations of acasia compost with different bio – agents performed well with highest growth shoot, root length, root weight, yield and lowest root – knot index under field condition (Ravindera, H., 2014)]. From the results of investigation made by (Shraf, R., 2014)] indicated that combined application of the biofertilizer viz., *T. viride* and *Pochonia chlamydosporia* and nitrogen fertilizer (urea) improved all the growth characters as well as biochemical parameters namely, chlorophyll, protein, nitrate reductase, nitrogen and phosphorus contents in comparison to control and other treatments. Further, they have also reported that number of egg masses and number of galls per root system were significantly reduced in all the treatments (Shraf, R., 2014).

On the basis of present study it could be suggested the use of bio – agents and fertilizer as soil amendment for the managing of root – knot nematode in the endemic soil where susceptible crop are to be grown.

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