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# EFFECT OF NURSERY FERTILIZERS ON PLANT GROWTH AND IN THE CONTROL OF *MELOIDOGYNE JAVANICA* ROOT KNOT NEMATODE ON MUNG BEAN AND OKRA PLANTS

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**Abstract**

The potential impact of five widely used locally available nursery fertilizers viz., flourish, frutan, NPK, urea and fishmeal on the growth of mung bean and okra plants and control of *Meloidogyne javanica* root knot nematodes was examined. All fertilizers enhanced the plant growth as compared to control. The shoot length, root length, shoot weight and root weight were significantly increased in both okra and mung bean plants. Maximum inhibition of knots was achieved by fishmeal @ 0.1% followed by urea @ 0.1% and NPK @0.001% and 0.1%.

## Introduction

The soil borne pathogens play a major role in the development of root rot and root knot disease complex of crop plants. Plant parasitic nematodes, often referred to as "hidden enemies" are amongst the most wide spread and important pathogens causing serious losses to crop plants. Root knot nematode *Meloidogyne* spp., are world wide in distribution and are known to attack a wide variety of crops (Goodey *et al*., 1965). Of a total of 70 *Meloidogyne* spp., identified so far (Luc *et al*., 1988), only 4 species viz., *M. incognita* (Kofoid & White) Chitwood, *M. javanica* (Treub) Chitwood, *M. arenaria* (Neal) Chitwood and *M. hapla* Chitwood, are of major economic importance inducing major morphological and physiological changes within roots attacking nearly every crop sown where yields and quality are reduced (Sasser, 1980). Most of the plants that accounted for the majority of human and animal food supply are susceptible to one or more of the root knot (*Meloidogyne*) species (Taylor & Sasser, 1978). In addition, these nematodes have the ability to interact synergistically with other plant pathogens and cause up to 5-34 % yield losses in vegetables in tropical climates (Sasser, 1989). Root knot nematode, especially *M. incognita* (Kofoid & White) Chitwood is the most abundant and damaging nematode in Pakistan infecting about 102-plant species (Maqbool & Shahina, 2001). Damage caused by root-knot nematode is much higher in tropical and sub tropical countries (Taylor & Sasser, 1978). In Pakistan, *Meloidogyne* root knot nematodes are recognized as important parasites of vegetable crops, where more than 100 plants have been found infested with root knot nematode from different cultivated zones of the country (Maqbool, 1988; Zaki, 2000).

Control of these nematodes has been accomplished through the use of nematicides, crop rotation, destruction of residual infected roots and by use of fungal biocontrol agents (Stephan *et al*., 1977, 1988). Mineral fertilizers increase tolerance to disease with the development of thicker cuticles and cell walls or more sclerenchyma tissue with different nutrient regimes which has been co-related with the difficulties in penetration of pathogens (Huber, 1980). Toxicity of ammonia ions released during degradation of urea exerted adverse effects on the soil-borne pathogens (Oteifa, 1955). Different fertilizers are used for better plant growth. Nitrogen present in the fertilizer is absorbed by the plant which is utilized in a protein synthesis and seed production where as potassium is involved in many cellular functions including photosynthesis, phosphorylation, water maintenance, reduction of nitrates and reproduction. Experiments were therefore carried out to study the effect of different dosages of nursery fertilizers on plant growth and for the control of *Meloidogyne javanica* root knot nematode on mug bean (*Vigna radiata* L.) and okra (*Abelmoschus esculentus* L.) used as test plants.

## Materials and Methods

Roots of brinjal (*Solanum melongena* L.) infested with *Meloidogyne javanica* root knot nematode were collected from the experimental plot of the Department of Botany, University of Karachi. They were washed under running tap water and cut into small pieces then dipped in 100ml of 1% Na $(OCl)_2$ in a bottle and mouth was tightly closed. After shaking vigorously by hand for 5 min., the content was poured onto a 100 mesh sieve fitted over a 400 mesh sieve, followed by washing under running tap water for 1 min. The residues from 400 mesh sieve were transferred into 250ml beaker. Number of eggs and larvae/ml of suspension were determined with the help of counting dish (Hussey & Barker, 1973). Soil obtained from the experimental plots of the Department of Botany, University of Karachi was sieved through 2mm sieve to discard non soil particles and transferred in 8cm diam., plastic pots @ 300gm/pot. The soil used was sandy loam (Sand, Silt, Clay; 70, 19, 11%), pH range from 7. 5 - 8.1 with moisture holding capacity (MHC) of 24.04 % (Keen & Raczkowski, 1922), total nitrogen 1.5 % (Mackenzie & Wallace, 1954), total organic matter 2.4 %. Soil after amendment with nursery fertilizers viz., Flourish, Frutan, NPK and Urea @ 0.001, 0.01 and 0.1% w/w and Fishmeal @ 0.1, 0.3 and 0.5% w/v were kept in 8cm diam, plastic pot @ 300 gm/pot. Soil moisture was adjusted at 40% M.H.C. (Keen & Raczkowski, 1922). Non-amended soil served as control. There were three replicates of each treatment. After 1 week of amendment, 5 seeds of mung bean and okra were sown in each pot. The pots were arranged in randomized complete block design then 2 week old plants were infested @ 2000 eggs/ pot (Hussey & Barker, 1973). After 45 days of inoculation, data on germination, plant height, shoot weight, root weight and root knots were recorded. Data were analyzed and subjected to analysis of variance (ANOVA) following the procedure as given by Gomez & Gomez (1984).

## Results and Discussion

There was a significant increase in seed germination, shoot length, shoot weight, root length and root weight as compared to control plant where urea was used @ 0.001% and 0.1% followed by frutan @ 0.001%, fishmeal @ 0.001%, 0.01% and NPK @ 0.001% and 0.01% w/w ($p<0.05$) (Table 1). Of all the fertilizers used NPK @ 0.1% w/w showed significant suppression of knots in mung bean plants followed by urea @ 0.1% and fishmeal @ 0.1% whereas fishmeal @ 0.1% followed by NPK 0.01% and urea @ 0.1% reduced the formation of knots in okra plants. Present results showed that fertilizers used at low dosages significantly increased the seed germination, shoot length, shoot weight, root length and root weight in both mung bean and okra plants ($p<0.05$) as compared to the high dosages (Table 1). Knots were significantly reduced in both okra and mung bean plants. Similarly, plant growth promoting rhizobacterium alone or in combination with urea and potash significantly suppressed root rot and root knot infection on mung bean roots (Siddiqui *et al*., 1999). The results agree with previous reports (Chun & Lockwood. 1985; Rodriguez-Kabana, 1986) indicating that addition of $NH_3$-based fertilizers to soil reduces population densities of certain fungi and nematodes.

Results of present studies would suggest that fishmeal, urea and NPK have greater potential in controlling *Meloidogyne javanica* root knot nematode.

**Table 1. Effect of nursery fertilizers on plant growth and root knot infestation of mung bean and okra plants.**

| Treatments | Mung bean | | | | | | Okra | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Germination % | Shoot length (cm) | Shoot weight (gm) | Root length (cm) | Root weight (gm) | Number of knots | Germination % | Shoot length (cm) | Shoot weight (gm) | Root length (cm) | Root weight (gm) | Number of knots |
| Control | 60 | 12.87 | 4.88 | 2.88 | 0.163 | 35 | 60 | 17 | 1.1 | 3.58 | 0.14 | 42 |
| Flourish @ 0.001 | 86.6 | 13.4 | 3.93 | 3.93 | 0.17 | 28 | 86.67 | 16.03 | 1.46 | 5.15 | 0.15 | 36 |
| Flourish @ 0.01 | 73.33 | 11.7 | 3.9 | 3.9 | 0.28 | 21 | 66.67 | 12.26 | 1.35 | 4.51 | 0.17 | 32 |
| Flourish @ 0.01 | 66.67 | 12.83 | 3.15 | 3.15 | 0.30 | 29 | 73.33 | 17.11 | 1.22 | 6.08 | 0.19 | 28 |
| Frutan @ 0.001 | 100 | 12.88 | 3.63 | 3.63 | 0.09 | 26 | 80 | 15.32 | 1.61 | 5.59 | 0.193 | 30 |
| Frutan @ 0.01 | 86.7 | 13.34 | 4.35 | 4.35 | 0.28 | 18 | 86.67 | 15.58 | 1.23 | 5.35 | 0.16 | 26 |
| Frutan @ 0.1 | 66.67 | 16.58 | 6.08 | 6.08 | 0.42 | 21 | 80 | 14.81 | 1.30 | 4.89 | 0.11 | 22 |
| NPK @ 0.001 | 86.67 | 12.87 | 4.9 | 4.9 | 0.51 | 15 | 100 | 12.79 | 1.52 | 4.97 | 0.18 | 20 |
| NPK @ 0.01 | 86.67 | 14.76 | 6.47 | 6.47 | 0.51 | 12 | 86.67 | 16.42 | 1.62 | 4.2 | 0.13 | 16 |
| NPK @ 0.1 | 80 | 16.05 | 3.81 | 3.81 | 0.14 | 6 | 73.37 | 14.2 | 1.35 | 6.02 | 0.14 | 18 |
| Urea @ 0.001 | 100 | 14.76 | 5.31 | 5.31 | 0.55 | 16 | 86.67 | 14.84 | 1.33 | 4.13 | 0.18 | 24 |
| Urea @ 0.01 | 100 | 15.3 | 5 | 5 | 0.4 | 18 | 100 | 16.84 | 1.23 | 5.35 | 0.19 | 20 |
| Urea @ 0.1 | 80 | 14.29 | 6.38 | 6.38 | 0.56 | 10 | 60 | 17.69 | 0.4 | 5.25 | 0.18 | 15 |
| Fishmeal @ 0.001 | 93.33 | 13.05 | 4.74 | 4.74 | 1.15 | 19 | 93.33 | 14.93 | 1.25 | 5.25 | 0.41 | 28 |
| Fishmeal @ 0.01 | 86.67 | 15.8 | 7.08 | 7.08 | 0.45 | 12 | 80 | 11.73 | 1.33 | 5.23 | 0.22 | 16 |
| Fishmeal @ 0.1 | 80 | 14.11 | 4.63 | 4.63 | 0.21 | 10 | 80 | 16.36 | 1.67 | 5.60 | 0.21 | 10 |
| $LSD_{0.05}$ | 25.85 | 9.83 | 1.54 | 3.50 | 0.46 | 0.86 | 27.54 | 7.700 | 1.34 | 7.80 | 0.28 | 1.5 |

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