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EFFECT OF DIFFERENT DOSAGES OF NURSERY FERTILIZERS IN THE CONTROL OF ROOT ROT OF OKRA AND MUNG BEAN

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Abstract

The potential impact of different dosages of widely used locally available nursery fertilizers viz., flourish, frutan, NPK, urea and fishmeal were used to examine their effect in the suppression of root infecting fungi viz., *Macrophomina phaseolina, Rhizoctonia solani* and *Fusarium* spp., on okra and mung bean plants. Nursery fertilizers were applied in soil @ 0.001, 0.01 and 0.1% w/w whereas fish meal @ 0.1%, 0.3% and 0.5% v/w.Highest shoot length and shoot weight of okra and mung bean were observed when fish meal @ 0.5% v/w and NPK @ 0.1% w/w were used. Infection of *Fusarium* spp., significantly reduced in okra and mung bean plants where soil was treated with urea @0.01% and 0.001%. Frutan and fishmeal @ 0.1% showed inhibition of *Rhizoctonia solani*. Frutan at all doses and urea @0.001 and 0.1% suppressed *M. phaseolina* infection on mung bean whereas flourish @0.1% and urea @ 0.1% significantly reduced *M. phaseolina* infection on okra plants. The shoot length, root length, shoot weight and root weight were significantly increased in both okra and mung bean plants. Maximum plant height was achieved where fish meal @ 0.5% and NPK @ 0.1% were used.

Introduction

The soil borne pathogens viz., fungi, actinomycetes, bacteria and nematodes play a major role in the development of root rot and root knot disease complex of crop plants. The soil borne disease causing pathogens are difficult to eliminate since they produce resting structure like sclerotia, chlamydospores which are well adapted to survive for longer periods under adverse environmental conditions. These pathogens infect roots of the plants, limiting nutrient uptake by plants and produce root rot disease complex resulting in death of the plant. Losses to the crop plants through such diseases are underestimated and generally go unnoticed (Baker & Cook, 1974). Of the soil borne root infecting fungi, *Macrophomina phaseolina* (Tassi) Goid is reported to produce charcoal rot, seedling blight, root rot, stem rot, pod rot on more than 500 species of plants (Dhingra & Sinclair, 1978) where at least 72 hosts have been reported from Pakistan (Mirza & Qureshi, 1978; Shahzad *et al*., 1988). *Rhizoctonia solani* exists as active mycelium in soil and is known to produce seed rot, damping off of seedling, wilt and root rot on over 2000 species plant (Parmeter, 1970), of which at least 63 hosts have been reported from Pakistan (Mirza & Qureshi, 1978; Ghaffar, 1988). *Fusarium solani* and *Fusarium oxysporum*, which are very common in agriculture fields of Pakistan, are known to cause root rot, stem rot and wilt disease on a wide range of plants (Nelson *et al*., 1983; Ghaffar, 1992). Use of fungicides, fertilizers and biological antagonists in the control of soil borne root rot of crop plants is a common practice. 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 whereas potassium is involved in many cellular functions including photosynthesis, phosphorylation, water maintenance, reduction of nitrates and reproduction. Potassium is also known to reduce *Fusarium oxysporum* infection on tomato (Ellet, 1973) and *Rhizoctonia solani* infection on hemp (Pal & Choudhary, 1980). Urea also inhibits soil borne root-infecting fungi. The aim of the present investigation was to determine the effectiveness of fertilizer amendment in soil for the control of root rot disease on mug bean (*Vigna radiata.* L) and okra (*Abelmoschus esculentus* L).

Materials and Methods

Different nursery fertilizers viz., flourish, frutan, NPK, urea and fishmeal were used for the control of root rot of crop plants. The nursery fertilizers purchased from the local market contains several essential micro and macronutrients in their composition.

Soil used for the experiment was obtained from the experimental plots of the Department of Botany, University of Karachi and sieved through 2mm sieve to discard particles. The soil was 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 24 %. Soil had natural infestation of 1-3 sclerotia of *Macrophomina phaseolina* /g as found by wet sieving dilution technique (Sheikh & Ghaffar, 1975), 5-10% colonization of *Rhizoctonia solani* on sorghum seeds used as baits (Wilhelm, 1955) and 3000cfu *Fusarium* spp., as assessed by soil dilution technique (Nash & Snyder, 1962). NPK and urea was used @ 0.001, 0.01 and 0.1% w/w **w**hereas Fishmeal @ 0.1, 0.3 and 0.5%v/w. After seven days of soil amendment, 5 seeds of okra and mung bean were sown in each pot. Soil without fertilizer served as control. There were three replicates of each treatment and pots were kept randomised in a screen house bench of the Department of Botany, University of Karachi, where soil was kept at 50% M.H.C (Keen & Raczkowski, 1922). After 30 days, roots of okra and mung bean were washed in running tap water, surface sterilized in 1% $Ca(OCl)_2$ for 3 min., and then five 1cm long root pieces were transferred on PDA plates containing penicillin @ 100,000/litre and streptomycin @ 20mg/ l. Petri dishes were incubated for 5 days at room temperature to confirm infection of roots by root infecting fungi.

Data were analysed and subjected to analysis of variance (ANOVA) following the procedure as given by Gomez & Gomez (1984).

Results and Discussion

Use of nursery fertilizers viz., flourish, frutan, NPK, urea and fishmeal at different rates significantly increased the plant height ($p<0.001$) as compared to control. Greater plant height was observed in mung bean where NPK @ 0.1% w/w was used whereas fishmeal when used @ 0.5% increased the height of okra plants (Fig. 1). Nursery fertilizers significantly increased the fresh weight of mung bean shoot ($p<0.01$) (Fig. 1) whereas shoot length, shoot weight, root length and root weight of okra plants were significantly increased ($p<0.001$). Maximum shoot and root weight were observed in mung bean where fishmeal @ 0.5% and NPK@ 0.1% were used. In Okra plants flourish, NPK and fishmeal showed better plant growth (Fig. 2). Urea @ 0.001, 0.01 and 0.1% w/w were more effective in the suppression of *Fusarium* spp., infection on mung bean (p<0.001) and okra followed by flourish, frutan, NPK and fish meal (Fig. 3). Urea used @ 0.1%w/w significantly suppressed the infection of *Fusarium* spp., in mung bean whereas complete suppression of *Fusarium* spp., was observed in okra plants. NPK used @ 0.001% and Urea @ 0.001 and 0.1% showed complete suppression of *M. phaseolina* infection in mung bean whereas in okra, flourish @ 0.01 and urea @ 0.1% (p<0.01) showed complete suppression of *M. phaseolina* (Fig. 3). Urea, NPK, frutan and fishmeal showed more than 50% inhibition of *R. solani* infection. Infection of *R. solani* decreased with the increase in concentration of nursery fertilizers (Fig. 3).

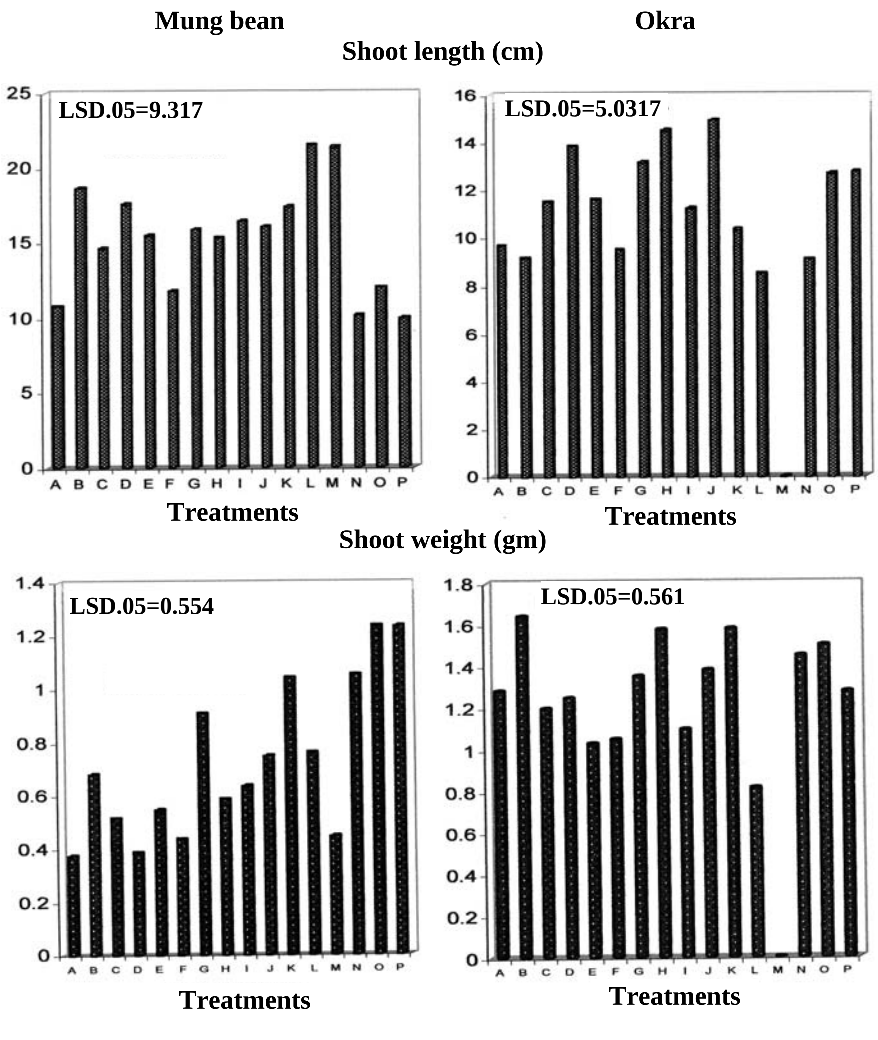

Fig. 1. Effect of different dosage of nursery fertilizers on shoot length and shoot weight of okra and mung bean plants.

A= Control=Flourish @ 0.001, C= Flourish @ 0.01, D= Flourish @ 0.1, E= Frutan @ 0.001, F= Frutan @ 0.01, G= Frutan @ 0.1, H= NPK @ 0.001, I= NPK @ 0.01, J= NPK @ 0.1, K= Urea @ 0.001, L= Urea @ 0.01, M= Urea @ 0.1, N= Fish meal @ 0.1%, O= FM @ 0.3%, P= FM @ 0.5.

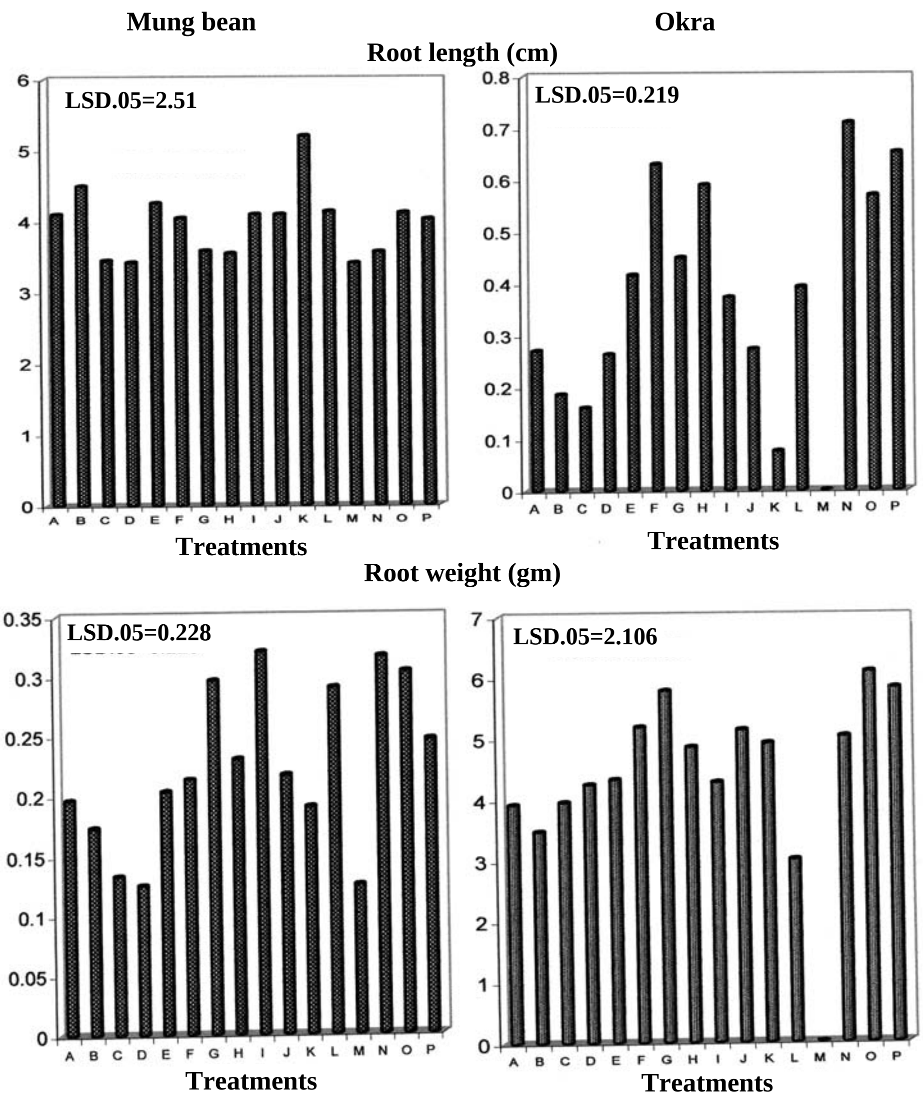

Fig. 2. Effect of different dosage of nursery fertilizers on root length and root weight of okra and mung bean plants.

A= Control=Flourish @ 0.001, C= Flourish @ 0.01, D= Flourish @ 0.1, E= Frutan @ 0.001, F= Frutan @ 0.01, G= Frutan @ 0.1, H= NPK @ 0.001, I= NPK @ 0.01, J= NPK @ 0.1, K= Urea @ 0.001, L= Urea @ 0.01, M= Urea @ 0.1, N= Fish meal @ 0.1%, O= FM @ 0.3%, P= FM @ 0.5%.

Present study showed that nursery fertilizers frutan at all doses was more effective in the control of *M. phaseolina* infection in mung bean but in okra flourish @ 0.1% and urea @ 0.1% significantly reduced *M. phaseolina* infection. Nursery fertilizer NPK @ 0.1% was more effective in the control of *R. solani* infection. Control of root infecting fungi with the use of mineral fertilizers could presumably be due to the increase in tolerance

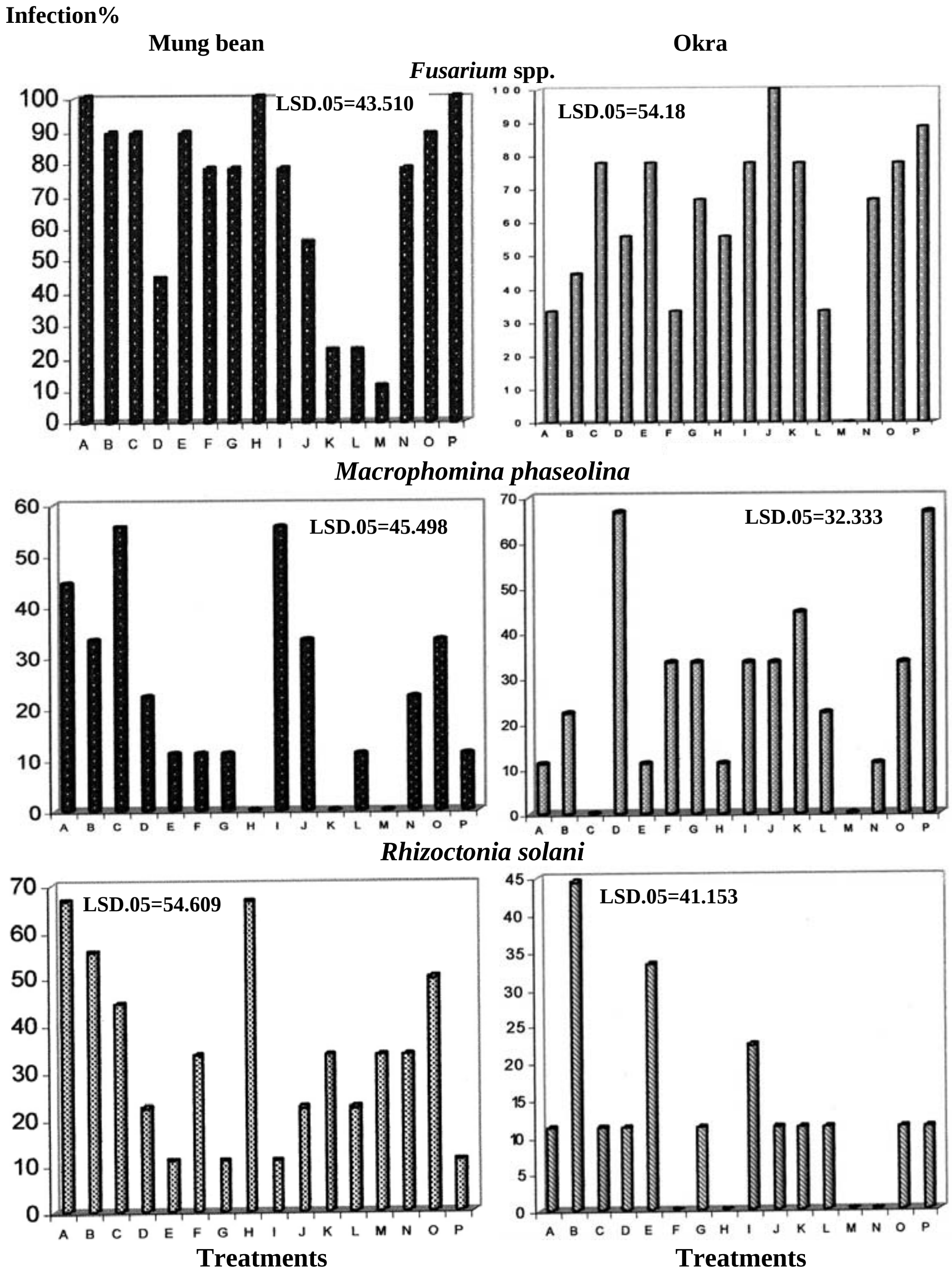

Fig. 3. Effect of different dosage of nursery fertilizers in the control of *Fusarium* spp., *Macrophomina phaseolina* and *Rhizoctonia solani* infection on okra and mung bean plants.

A= Control=Flourish @ 0.001, C= Flourish @ 0.01, D= Flourish @ 0.1, E= Frutan @ 0.001, F= Frutan @ 0.01, G= Frutan @ 0.1, H= NPK @ 0.001, I= NPK @ 0.01, J= NPK @ 0.1, K= Urea @ 0.001, L= Urea @ 0.01, M= Urea @ 0.1, N= Fish meal @ 0.1%, O= FM @ 0.3%, P= FM@ 0.5%.

with the development of thicker cuticle and cell wall or more schlerenchyma tissue with different nutrient regimes which has been correlated with the difficulty in penetration of pathogen (Huber, 1980). Toxicity of ammonia ion released during degradation of urea exerted an adverse effect on soil borne pathogen (Oteifa, 1995). Pal & Choudhary (1980) also found that root rot disease caused by *F. oxysporum* and *R. solani* reduced by the addition of mineral fertilizers. Experiments for the control of root rot fungi showed that growth of *Fusarium* spp., *M. phaseolina* and *R. solani* were significantly reduced by nursery fertilizers. Dawar & Ghaffar (2003) reported that urea showed significant reduction in *M.phaseolina* infection on mung bean. Similarly, Siddiqui *et al.*, (1999) also reported that root rot diseases in mung bean caused by root infecting fungi viz., *Fusarium* spp., *M. phaseolina* and *R. solani* also reduced by the addition of urea and potash. Present observations showed that NPK @ 0.1% and fish meal @ 0.5% increased the plant height and weight as compared to untreated control whereas different dosage of urea and frutan decrease the infection of soil borne root infecting fungi. The plants with proper nutrients are able to produce new roots to replace the older roots, which are destroyed by soil borne pathogens. The best root and shoot growth requires a balanced level of the major nutrients. The newly developed roots have the capacity to become more resistant against root infecting fungi.

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