EFFECT OF SARGASSUM SEAWEED AND MICROBIAL ANTAGONISTS IN THE CONTROL OF ROOT ROT DISEASE OF SUNFLOWER

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Abstract

Seaweed viz., Sargassum tenerrimum, S. swartzii and S. wightii bused as soil amendment alone or with Pseudomonas aeruginosa, Bradyrhizobium japonicum and Paecilomyces lilacinus significantly (p < 0.05) reduced infection of Macrophomina phaseolina and Fusarium solani on sunflower. Seaweeds were found less effective or increased Rhizoctonia solani infection. Combined use of seaweed with P. lilacinus and B. japonicum showed better results against M. phaseolina and F. solani than their separate use. Greater plant height was produced where P. aeruginosa was used with S. swartzii. Use of P. aeruginosa with S. tenerrimum and P. lilacinus with S. swartzii produced greater fresh weight of shoot than other treatments.

Introduction

Use of seaweed for better plant growth has received the attention of Plant scientists throughout the world (Atzmon et al., 1994; Staden et al., 1995), since it contains greater potash and equal nitrogen as compared to farm yard manure (Chapman & Chapman, 1980). A wide variety of marine algae have been found to possess useful biochemical compound (Hopps & Levring, 1982). Antimicrobial activity of seaweed has also been reported (Pratt et al., 1951). Seaweed collected from Karachi coast were found to inhibit the growth of fungi in vitro (Usmanghani & Shameel, 1986). Experiments were therefore carried out on the use of seaweed viz., Sargassum spp., in the control of root rot disease of sunflower. Effect of seaweed on the efficacy of biocontrol agent Pseudomonas aeruginosa was also studied and compared with Bradyrhizobium japonicum and Paecilomyces lilacinus.

Materials and Methods

Seaweed viz., Sargassum tenerrimum J.Ag., S. swartzii (Turn.) C.Ag., and S. wightii Grev., collected from Bholeji, Karachi, were washed dried under shade and powdered in an electric blender and mixed in sandy loam soil, pH 8.05 @ 0.5 and 1.0% w/w. The soil had a natural infestation of 3-11 sclerotia g⁻¹ of soil of Macrophomina phaseolina as found by wet sieving and dilution technique (Sheikh & Ghaffar, 1975), 5-10% colonization of Rhizoctonia solani on sorghum seeds used as baits (Wilhelm, 1955) and 3500 cfu g⁻¹ of soil of mixed population of F. solani and F. oxys-
**Fig. 1.** Effect of *Sargassum* spp., and biocontrol agents in the control of root infecting fungi of sunflower:
A = Control, B = *S. tenerrimum*, C = *S. swartzii*, D = *S. wightii*, E = *P. ilacinus*, F = *B. japonicum*,
G = *P. aeruginosa*, H = B+E, I = B+F, J = B+G, K = C+E, L = C+F, M = C+G, N = D+E, O = D+F,
P = D+G, LSD_{0.05}, Treatments = 24.4, Pathogens = 10.5

*porum* as assessed by soil dilution technique (Nash & Snyder, 1962). Amended soil was transferred in 8 cm diam., plastic pots @ 250 g per pot. Pots were watered daily and kept at 50% W.H.C. (Keen and Raczkowski, 1921). After three weeks, aqueous suspension of *P. ilacinus* (10^7 cfu ml^{-1}) multiplied on Potato Dextrose Agar, *P. aeruginosa* (10^8 cfu ml^{-1}) multiplied on Nutrient Agar and *Bradyrhizobium japonicum* (cfu 10^8 ml^{-1}) multiplied on Yeast Extract Mannitol Agar were drenched in each pot @ 25 ml/pot. Five seeds of sunflower (*Helianthus annuus*) cultivar HO-1 were sown in each pot. Each treatment was replicated four times and the pots were randomized on a screen house bench.
After 30 days growth plants were uprooted. After washing in tap water 5 cm long root pieces from each plant were cut, surface sterilized with 1% Ca(OCl)₂ for 3 minutes and transferred on to PDA plates containing penicillin (100000 units/litre) and streptomycin (0.2 gm/litre). Plates were incubated for 5 days at 28°C and incidence of root infecting fungi viz., M. phaseolina, R. solani, and F. solani were recorded. Data on plant height and fresh weight of shoots were also recorded. Data were analysed and subjected to factorial ANOVA followed by Least Significant Difference (LSD) according to Gomez & Gomez (1984).

Results

Soil amendment with seaweed viz., S. tenerrumum, S. swartzii, S. wightii and biocontrol agents viz., P lilacinus, B. japonicum and P. aeruginosa significantly (P < 0.05) reduced infection of M. phaseolina and F. solani on sunflower roots whereas S. swartzii and S. wightii increased R. solani infection. Use of P. lilacinus and P. aeruginosa were found more effective in controlling the infection of R. solani as compared to B. japonicum or S. tenerrumum. Complete control of F. solani infection was found where P. lilacinus was used with S. swartzii. Combined use of P. lilacinus with S. wightii showed better control of M. phaseolina and F. solani than their separate use. Greater plant height was produced where P. aeruginosa was used with S. swartzii followed by B. japonicum with S. swartzii and P. lilacinus with S. wightii. Maximum fresh weight of shoot (4.0 g/plant) was produced as compared to control (1.6 g/plant) where P. aeruginosa was used with S. tenerrumum and P. lilacinus with S. swartzii (Fig. 1)

Discussion

In the present study use of Sargassum spp., and biocontrol agents significantly (p<0.05) reduced the infection of root infecting fungi on sunflower and increased plant growth. Paracer et al., (1987) reported that use of selected seaweeds as biocontrol agent offers a potential novel approach to control population of plant parasitic nematodes. A wide varieties of marine algae have been found to possess useful biochemical compound which have been studied as potential biodidal and pharmaceutical agents (Colwell, 1983; Stein & Borden, 1984; Targett & Mitsui, 1979; Fenical, 1982). Of these Ascophyllum nodosum was found to reduce the fecundity of Meloidogyne javanica root knot nematode in tomato (Whapham et al., 1995). Whereas in vitro growth inhibition of fungi by tropical seaweed (Welch, 1962) and antimicrobial activity of seaweed from the coast of Pakistan have been reported (Usmanghani & Shameel, 1986) but there does not appear to be any previous report on the use of seaweeds in the control of root infecting fungi of sunflower. In the present study combined use of P. aeruginosa (Weller, 1988) or P. lilacinus (Ehteshamul-Haque, et al., 1990) which are used as biocontrol agents for the control of root rot pathogens showed better control of M. phaseolina and F. solani and increased plant growth when used with seaweed than either used alone. A significant increase in plant height and fresh weight of shoot of okra was observed where seaweed was used with rhizobia (Ehteshamul - Haque et al., 1996). It would suggest that Sargassum spp., could be exploited and used as soil
Fig. 2. Effect of Sargassum spp., and biocontrol agents on height and fresh weight of shoot of sunflower plant:

A = Control, B = S.tenerrum, C = S.swartzii, D = S.wightii, E = P.lilacinus, F = B.japonicum,
G = P.aeruginosa, H = B+E, I = B+F; J = B+G, K = C+E, L = C+F, M = C+G, N = D+E, O = D+F,
P = D+G, LSD_{0.05} = 3.1 LSD_{0.05} = 1.6

amendment for the control of root infecting fungi of sunflower which may result in better plant growth. Use of seaweed with a compatible biocontrol agent also seems promising.

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References


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