EFFECT OF MYCORRHIZAL BIOFERTILISER AND CHEMICAL FERTILIZER IN GLYCINE MAX.

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ABSTRACT

Arbuscular mycorrhizal (AM) associations are integral, functioning parts of plant roots and are widely recognized as enhancing plant growth. Isolation of the indigenous and presumably adapted VAM fungi can be a potential biotechnological tool for inoculation of plants for successful restoration of degraded ecosystem. The study evaluated the response of soyabean (Glycine max 58) to arbuscular mycorrhizal fungi species Glomus fasciculatum, Nostoc paludosum of different strains and chemical fertilizers. The results demonstrate the significantly increase in the plant biomass, % of root colonization, no. of vesicles, no. of spores in the dual inoculation of comparison to single inoculation.

Keywords: Glycine max, Nostoc paludosum, Arbuscular mycorrhiza, Glomus Fasciculatum, wild

INTRODUCTION

The endomycorrhizal fungi produce branched hyphal structure within the plant cell. This infection creates an absorptive structures with a very high surface area of transfer for nutrients between the plant and the fungus. Biofertilisers are commonly called as microbial inoculants which are capable of mobilizing important nutritional elements in the soil from non-usable to usable form by the crop plants through their biological process. Killian and Fether (1939) discussed several problems relating to interaction between plant and soil microorganisms.

Role of biofertilisers in improving the soil fertility has been emphasized by number of workers. The dual inoculation of VAM and Blue green algae proved beneficial not only in terms of economizing N and P fertilizers by 50% but also improved the growth of plants. Microorganisms convert bound phosphates such as super phosphate and rock phosphate into forms which are easily assimilated by plants (Gerretsen, 1948 ; Sperber, 1957 ; Sundararao, 1968). The study has been undertaken to find out the effect of VAM and algae along with the addition of chemical fertilizers to some extent, which showed the improved results in growth parameters.

MATERIAL AND METHOD

The culture of *Glomus fasciculatum* was brought from the Tata Energy Research Institute (TERI) New Delhi and mass cultured under grasses in open clay pot, while different heavy metallic Zn ,Cu , Cd strains of *Nostoc paludosum* and *Glomus fasciculatum* were prepared in the laboratory by taking dilutions of various concentrations.

The mycorrhizal and cyanobacterial biofertilisers were inoculated in soils of seedling plants. The amount of inoculation was 3.5 gm/plant. The chemical fertilizers were given to each plant in following week. The proportion of N,P,K to soils were different with different plants as ICAR. The chemical fertilizers were given in different ratio with and without combination of mycorrhizal, cyanobacterial biofertilisers. The strain used in the experiment were carried out in the department of Botany.

Glomus fasciculatum (w strain)		*Nostoc paludosum* (w strain)	
Zn – t	400 mg kg^{-1}	Zn – t	9.0
Cd – t	800 mg kg^{-1}	Cd – t	0.5
Cu – t	1500 mg kg^{-1}	Cu – t	0.7

The treatment details are as given below.

I. Chemical fertilizers treatment.

Glycine max

N level	Symbol	P level	Symbol
0KgN/ha	N_0	0Kg P/ha	P_0
5KgN/ha	N_1	30KgP/ha	P_1
10KgN/ha	N_2	45KgP/ha	P_2
20KgN/ha	N_3	60KgP/ha	P_3
30KgN/ha	N_4	75KgP/ha	P_4

No treatment (T_0 + N_0 + P_0) = T

Treatment with *Glomus* (w, Cu-t , Zn-t , Cd-t) = T_1

Treatment with *Nostoc* (w , Cu-t , Zn-t ,Cd-t) = T_2

II .Mycorrhizal biofertiliser and cynobacterial treatment

Treatment with (T_1 + T_2) = T_3

III . Mycorrhizal biofertiliser , cynobacteria and chemical fertililizer

Treatment with (T_3 + N_1 + P_1) = T_4

Treatment with (T_3 + N_2 + P_2) = T_5

Treatment with (T_3 + N_3 + P_3) = T_6

Treatment with (T_3 + N_4 + P_4) = T_7

Treatment with (N_4 + P_4) = T_8

RESULTS AND DISCUSSION

Table 1

Effect of W, Cu – t , Zn – t , Cd – t strains of *Glomus fasciculatum* , *Nostoc* and chemical fertilizers on plant height (cm) of *Glycine max*

Treatment	T	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
W	30.6	31.4	32.3	32.5	35.7	48.9	40.1	42.5	34.7
Cu – t	29.5	32.4	32.0	32.7	36.3	40.2	37.8	37.4	35.4
Zn – t	27.4	31.4	33.7	34.1	34.7	49.2	37.5	39.6	32.5
Cd – t	24.3	24.7	27.4	27.6	28.7	38.3	35.6	31.4	32.1
Mixed Metallic	24.3	27.6	29.4	31.0	36.3	48.7	38.4	37.7	34.1

Table 2

Effect of W, Cu – t , Zn – t , Cd – t strains of *Glomus fasciculatum* , *Nostoc* and chemical fertilizers on number of pods per plant of *Glycine max*

Treatment	T	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
W	38	39	40	42	50	65	52	58	41
Cu – t	37	40	40	41	45	55	51	53	40
Zn – t	38	40	41	42	50	67	54	58	42
Cd – t	38	40	40	42	48	69	58	64	40
Mixed Metallic	38	39	40	42	45	63	56	59	41

Table 3

Effect of W, Cu – t , Zn – t , Cd – t strains of *Glomus fasciculatum* , *Nostoc* and chemical fertilizers on Test weight per 100 seeds (gm) of *Glycine max*

Treatment	T	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
W	10.39	11.03	11.04	11.9	11.12	11.60	11.43	11.57	11.20
Cu–t	10.34	11.03	11.05	11.12	11.12	11.50	11.24	11.30	11.40
Zn–t	10.36	11.07	11.07	11.10	11.11	11.90	11.23	11.28	11.40
Cd–t	10.37	11.06	11.07	11.10	11.12	11.46	11.30	11.41	11.23
Mixed Metallic	10.38	11.06	11.08	11.12	11.12	11.60	11.47	11.54	11.25

Table 4

Effect of W, Cu – t , Zn – t , Cd – t strains of *Glomus fasciculatum* , *Nostoc* and chemical fertilizers on % of root colonization of *Glycine max*

Treatment	T	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
W	12.5	22.7	22.8	60.6	68.4	78.0	69.0	71.0	32.8
Cu – t	17.8	39.7	43.1	61.3	64.3	65.2	61.2	60.0	42.1
Zn – t	40.4	43.0	67.4	70.1	73.2	85.6	80.4	84.1	45.3
Cd – t	32.7	39.6	47.0	49.3	54.2	65.9	61.3	62.2	39.0
Mixed Metallic	50.0	53.7	60.2	67.5	70.7	83.0	80.0	81.0	61.4

Table 5

Effect of W, Cu – t , Zn – t , Cd – t strains of *Glomus fasciculatum* , *Nostoc* and chemical fertilizers on number of vesicles per 100 (gm) soil of *Glycine max*

Treatment	T	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
W	15	16	18	21	21	25	23	19	18
Cu – t	17	20	24	25	28	40	33	35	20
Zn – t	20	24	25	27	30	40	34	35	25
Cd – t	25	27	30	30	35	38	36	37	17
Mixed Metallic	21	25	27	30	34	39	37	38	28

Table 6

Effect of W, Cu – t , Zn – t , Cd – t strains of *Glomus fasciculatum* , *Nostoc* and chemical fertilizers on number of spores per 100 (gm) soil of *Glycine max*

Treatment	T	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
W	5	7	9	10	11	20	15	17	15
Cu – t	9	10	12	15	16	23	21	19	12
Zn – t	11	13	14	17	18	32	25	28	18
Cd – t	11	15	17	19	20	27	25	28	12
Mixed Metallic	12	16	18	21	24	30	26	27	16

DISCUSSION

Our data indicates maximum and improved results were observed due to application of all mycorrhizal and cyanobacterial biofertiliser along with the combination of chemical fertilizer. The effect of wild strain Cu, Cd strains of *Glomus* and *Nostoc* along with 10 kg N/ha and 45 kg P/ha of chemical fertilizers showed increased results. The combine effects of inoculum and urea produced significantly the highest plant height recorded by (Alam et al, 1988). Seed yield of soyabean was significantly increased due to 25 to 54 kg P_2O_5 /ha and 75 kg P_2O_5 was reported by (Nimje and Potkude ,1998). Due to addition of Cu in soil, the concentration in plants become double and increase markedly upto 15 ppm thereafter there was margical in Belvatagi soil graded upto 25 ppm in Prabhunagar soil (Raghupati and Vasuki, 1994). Root shoot ratio of Cadmium inoculated plants were highest in mycorrhizal plants of *Trifolium* Sp (Schupp et al, 1987). While in zinc strain of *Glomus* and *Nostoc* needed lower quantity of chemical fertilizers of 5 kg N/ha and 30 kg P/ha to show increased results, Synergistic relationship between the elements was recorded for seeds and dry matter yields upto the dose of 45 kg S and 20 kg Zn/ha in *Linseed.* The present study demonstrated that the dual inoculation along with chemical fertilizers of soyabean plant increased height of plant, number of pods , test weight, % of root colonization, number of vesicles, spores to different level over single inoculation with *Glomus,* or *Nostoc* alone. The present results suggest that to find the dual inoculation along with chemical fertilizers is more competitive than single inoculation. Therefore the usage of *Glomus fasciculatum, Nostoc paludosum* of particular strain with combination of chemical fertilizers would be more effective for better crop production.

Conclusion

In the present study it has been shown that *Glomus fasciculatum* and *Nostoc paludosum* can adapt more heavy metals zinc, cadmium and copper. The magnitude of toxicity varies from metal to metals and dependant upon the organism. The accumulation of heavy metals in the rhizosphere of mycorrhizal structures have high heavy metal binding capacity which could represent as a biological barrier.

From the individual crop study, the maximum growth and yield of plant due to combination of wild or metallic strains of mycorrhizal and algal biofertiliser with lower concentration of recommended doses of N and P followed by the combined effect of higher or too lower concentrations of N and P with mycorrhizal and algal biofertiliser shows significantly more beneficial than their separate use.

Use of wild and metallic strains of mycorrhizal algal biofertilisers culture improved growth yield and quality of crop along with improved soil fertility and could save 25% of chemical fertilizers needed for crop plants.

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