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EFFECTS OF SOME AGROCHEMICALS ON VAM INFECTION AND GROWTH OF SUNFLOWER

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Effect of six agrochemicals viz., Captan, Dithane M-45, Agrimycin, Urea, Gibberellic acid and 2,4-D on mycorrhizal infection of sunflower was investigated with *Glomus mosseae* and *Acaulospora morrowea* separately and in combinations. Two fungicides have shown inhibitory effect on all the mycorrhizal fungi. Foliar spray of urea inhibited the mycorrhizal infection. GA and 2,4-D also inhibited the mycorrhizal infection. Phosphorus content of the plant decreased when treated with two fungicides. Agrimycin had shown positive effect on shoot phosphorus. GA has increased the phosphate absorption of the plant whereas 2,4-D inhibited.

Key Words : *Glomus mosseae, Acaulospora morrowea,* agrochemicals, and sunflower.

The beneficial effect of mycorrhizal association can be increased, either by inoculation with highly effective VAM fungi, or by the use of cultural practices that stimulate the population of indigenous VAM fungi. Menge (1982) reported that many chemicals used to control insects, diseases and weeds on crops also affect the VAM, either positively or negatively. Determination of root infection or spore numbers as influenced by pesticides are often inconsistent and contradictory as many pesticides may temporarily lower the population of mycorrhizal fungi. Effects of pesticides on mycorrhizal fungi was summarised by Menge *et al.* (1979). Treatment of mycorrhizal inoculum with selective pesticides is one safe guards that has been proposed (Menge *et al.,* 1977) to asure that inoculum is free of unwanted organisms, especially pathogens. In the present studies, effect of six agrochemicals on the VAM infection, spore population and subsequent effect on growth of sunflower was investigated.

MATERIALS AND METHODS

The present experiments were conducted with a phosphate deficient sandy soil (pH 6.9 : EC 2.5 mho/cm, organic matter 0.38 per cent, available nitrogen 250 kg/hectare, Phosphorus 12.5 P_2O_5 kg/hectare). Two species of VAM fungi viz., *Glomus mosseae* and *Acaulospora morrowea* whose inoculum obtained from ICRISAT, Hyderabad and maintained on *Cenchrus ciliaris* were employed. Approximately 50 g of inoculum was placed below the seeds to ensure that all growing roots passed through the inoculum layer. Five seeds of sunflower (var. Moderan) were sown in each pot and later were thinned to three seedlings after germination. The pots were daily watered to 70 percent moisture holding capacity by weight. Six agrochemicals namely Captan, Dithane, Agrimycin, Urea, GA and 2,4-D at 100 PPM concentration were prepared in sterilized distilled water and sprayed on the plants with four days interval. Experiments were conducted both in sterilised and non-sterilized soil separately in triplicate. Mycorrhizal infection, root, shoot biomass and chlorophyll pigment content were estimated at the time of flowering. The percentage of infection was estimated by gridline intersect method (Phillips and Hayman, 1970; Giovannetti and Mosse, 1980). VAM fungal spores were recorded by wet sieving and decanting method (Gerdemann and Nicolson, 1963). Phosphorus and chlorophyll pigments were estimated by Jackson (1969) and Ikan (1969) and Arnon (1949) methods respectively.

RESULTS AND DISCUSSION

A critical study of the table I reveals that two fungicides under study namely Captan and Dithane M-45 have shown inhibitory effect on all the mycorrhizal fungi. On the other hand, contradictory reports are available on the effect of fungicides on mycorrhizal infection (Sutton and Barron, 1976, Nemec, 1980, and Jalali and Domesh, 1975). Agrimycin has shown a slightly stimulatory effect on native mycorrhizal fungi and *Acaulospora morrowea* and exerted inhibitory effect on *G. mosseae* and mixed populations. Foliar spray of urea inhi-

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Table 1. Effect of some agrochemicals on VAM infection, sporulation and yield of sunflower (cultivar-Moderan)

	Treatment	*Mycorrhizal* infection		Phosphorus content (mg/plant)		Biomass Dry weights (g)		Pigments (mg/g)			Yield			
		% of infection	No. of resting spores/ 100 g	Shoot	Root	Shoot	Root	Chloro-phyll-a	Chloro-phyll-b	Carote-noid	Flower-ing in days	Head dia-meter (cm)	No. of Seeds/ head	Weight of 100 seeds (g)
Control	SS + NM	A		8.6[a]	5.6[a]	1.17[a]	0.5[a]	0.43	0.13	0.54	62	4.9[a]	428[a]	5.1[a]
	NS + NM	57.0	110	10.4[b]	8.4[b]	3.12[c]	0.6[a]	0.61	0.15	0.58	60	7.2[b]	740[c]	5.9[b]
	SS + *G. mosseae*	96.0	182	16.2[c]	13.7[c]	4.95[d]	1.4[bb]	0.78	0.33	0.73	58	7.9[b]	761[c]	6.1[b]
	SS + *A. morrowea*	74.0	156	19.3[c]	12.7[c]	1.3[b]	0.59	0.28	0.77	58	7.4[b]	750[c]	6.1[b]	
	SS + mixed inoculum	76.-	172	15.4[c]	11.02[c]	3.12[c]	1.3[b]	0.62	0.28	0.65	60	7.5[b]	698[c]	6.2[b]
Captan	NS + NM	49.0	96	9.3[a]	7.8[b]	3.62[c]	0.8[b]	0.58	0.18	0.59	59	5.9[a]	569[b]	5.2[a]
	SS + *G. mossese*	36.0	128	14.2[b]	6.3[b]	4.05[d]	0.5[a]	0.61	0.29	0.53	58	6.2[b]	608[b]	5.4[a]
	SS + *A. morrowea*	65.0	133	11.09[b]	5.9[a]	1.89[ab]	0.3[a]	0.52	0.19	0.59	59	5.4[a]	598[b]	4.9[a]
	SS + mixed inoculum	44.0	102	12.8[b]	6.4[ab]	2.01[b]	0.7[b]	0.48	0.23	0.61	57	5.9[ab]	620[ab]	5.3[a]
Dithane m-45	NS + NM	50.0	98	9.4[a]	6.9[b]	2.99[b]	0.5[a]	0.43	0.31	0.63	56	7.0[b]	705[c]	5.1[a]
	SS + *G. mosseae*	31.0	142	13.9[b]	8.3[b]	2.63[b]	0.4[a]	0.27	0.67	58	6.2[b]	618[b]	5.2[a]	
	SS + *A. morrowea*	63.0	138	15.1[c]	9.3[b]	2.0[ab]	0.2[a]	0.58	0.19	0.58	56	5.8[ab]	581[b]	4.9[a]
	SS + Mixed inoculum	69.0	120	12.3[b]	10.08[b]	3.06[c]	0.7[b]	0.61	0.18	0.55	57	5.9[ab]	587[b]	5.3[a]
Strepto-mycin sulphate	NS + NM	59.0	116	14.2[b]	6.8[ab]	2.77[b]	0.4[a]	0.59	0.59	57	6.8[b]	678[b]	5.1[a]	
	SS + *G. mosseae*	41.0	87	17.3[c]	11.2[c]	11.2[b]	3.90[c]	0.7b	0.72	0.21	0.71	59	7.2[b]	756[b]
	SS + *A. morrowea*	78.0	156	15.08[c]	9.07[b]	3.15[c]	0.7[b]	0.68	0.32	0.69	57	5.0[a]	540[b]	5.2[a]
	SS + Mixed inoculum	67.0	127	16.9[c]	11.4[b]	2.70[b]	0.9[c]	0.59	0.28	0.87	59	6.8[b]	786[c]	5.2[a]
Urea	NS + NM	64.-	182	13.8[b]	7.2[ab]	4.2[d]	0.9[c]	0.81	0.21	0.79	56	6.2[b]	598[b]	4.8[a]
	SS + *G. mosseae*	52.0	210	18.3[c]	10.2[b]	2.35[b]	0.8[c]	0.78	0.39	0.88	57	6.7[b]	648[b]	5.4[a]
	SS + *A. morrowea*	52.0	99	19.0[c]	13.08[b]	2.03[b]	0.7[b]	0.62	0.31	0.91	56	7.2[b]	751[c]	5.3[a]
	SS + Mixed inoculum	38.0	128	15.8[b]	11.8[b]	2.22[b]	0.8[b]	0.64	0.33	0.76	58	7.4[b]	721[c]	5.2[a]
Gibbe-rellic acid	NS + NM	53.0	212	14.3[b]	9.2[b]	0.8[c]	0.83	0.28	0.96	51	6.8[b]	691[b]	4.9[a]	4.9[a]
	SS + *G. mosseae*	38.0	96	18.3[c]	12.3[b]	3.07[bc]	0.9[c]	0.76	0.82	50	5.9[b]	582[b]	5.2[a]	5.2[a]
	SS + *A. morrowea*	37.0	128	19.2[c]	11.3[b]	3.47[bc]	0.7[b]	0.59	0.37	0.69	49	5.2[b]	527[b]	5.1[a]
	SS + Mixed inoculum	69.0	132	20.0[c]	14.1[b]	4.10[d]	0.2[a]	0.75	0.32	0.59	52	5.6[b]	523[b]	5.1[a]
2, 4-D	NS + NM	13.0	108	9.8[a]	7.3[b]	2.16[b]	0.4[a]	0.26	0.63	64	5.4[b]	518[b]	4.9[a]	4.9[a]
	SS + *G. mosseae*	18.0	128	11.3[b]	6.9[ab]	1.65[ab]	0.7[b]	0.52	0.21	0.68	62	5.9[b]	560[b]	4.9[a]
	SS + *A. morrowea*	20.0	135	9.5[a]	10.2[b]	1.92[b]	0.6[b]	0.49	0.28	0.62	62	6.0[b]	570[b]	5.1[a]
	SS + Mixed inoculum	19.0	162	12.7[b]	11.4[b]	2.70[b]	0.7[b]	0.23	0.77	64	5.8	520[b]	5.1[a]	5.1[a]

SS = Sterilized : NM = Non mycorrhizal : NS = Non sterilized soil
a Significant at P = 0.05. The values not followed by identical letters in each column are significantly different.

bited the percentage of infection in all the artificial inoculations. However, the sporulation was not consistent on par with the percentage of infection. GA also inhibited the mycorrhizal infection and its inhibitory effect is more obvious on *Glomus mosseae*. 2,4-D has shown a negative effect both on percentage of infection and resting spore production. Howeler *et al.* (1987) reported that in the herbicide treated plots, the build up in spore population was delayed about 3-4 months compared with the hand weeded plants, but eventually reached the same level at 50 weeks after planting.

Phosphorus content of shoot and root decreased when treated with two fungicides. Agrimycin has a positive effect on shoot phosphorus, except in *A. morrowea*. The present investigations reveal no correlation between the availability of nitrogen and phosphorus absorption as evident from the effect of urea on percentage of infection and phosphorus absorption. Foliar spray of GA has increased the phosphate absorption of the plant. Interestingly, the same chemical inhibited the percentage of infection. Thus, it appears possible that GA has enhanced the phosphorus absorption through some other way not involving the VA mycorrhizae. 2, 4-D treatment inhibited mycorrhizal infection, spore population and consequently the phosphorus absorption by the plant.

There is a substantial increase in the dry weight of sunflower plants sprayed with Captan and Dithane M-45. Application of Agrimycin and urea also enhanced the dry weight of the plants except in urea

applied and *Glomus* inoculated plants. GA has enhanced the dry weight in *A. morrowea* and mixed inoculum inoculated plants. However, it has inhibitory effect on *G. mosseae* and indigenous VAM. Interestingly, 2,4-D application has a beneficial effect on dry weight despite its negative effects on infection and phosphorus absorption.

Chlorophyll and carotenoid pigments decreased in the leaves of fungicide sprayed plants. Application of urea has increased the content of all photosynthetic pigments. Gibberellic acid in general has increased the pigment content. 2,4-D has shown inhibitory effect on all the three pigments.

Two fungicides, Agrimycin, Urea and Gibberellic acid sprayed plants came to flowering earlier than untreated plants in all mycorrhizal inoculations. 2,4-D delayed the time of flowering with VAM inoculations. An increase in number of seeds was recorded in Agrimycin, Urea treated plants inoculated with mixed inoculum. Urea treatment did not effect the number of seeds per head. The average seed weight also decreased in different treatments and with all types of inoculations. A direct correlation could be drawn between the percentage of infection, phosphorus absorption and yield parameters.

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