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Effect of bavistin foliar spray on VAM colonization and growth parameters in six groundnut cultivars

V. UMAMAHESWARA RAO
Department of Microbiology, Acharya Nagarjuna University, Nagrjunanagar, GUNTUR (A.P.) INDIA

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The impact of application of plant protection chemical bavistin as foliar spray on AM colonization and plant growth parameters like root length, shoot length, shoot fresh weight, shoot dry weight, nodule number and nodule weight of six groundnut cultivars *viz.*, 87779 ICGV, CS 52, FDRS 4, 414332, Gangapuri and J 11 was studied. For the study, the cultivars were raised in field plots. The phosphorus and nitrogen contents of plant material was also estimated. The bavistin spray significantly decreased the per cent infection and number of spores in roots of six cultivars at 50days, 70days and 90days samplings. Except the shoot dry weight at 70days and 90days samplings, all the other parameters studied including 'P' and 'N' contents were negatively affected by the bavistin foliar spray.

Key words : Bavistin, Groundnut cultivars, AM colonization.

INTRODUCTION

The tripartite associations, in legumes, formed of plants, nodules and endomycorrhizas have potential for increasing the crop yields. Among the biological processes involved in the rhizoplane, the unique role of symbiotic bacteria and the AM fungi which ensure fixation and mobilization and availability of nitrogen and phosphorus of plants have been well recognized. It is also a well-established fact that the AM always prefer certain host exhibiting maximum symbiotic response and increased the growth and yield of crop mainly through improved uptake of nutrients (Allen, 1991) and especially through uptake of phosphorus in soils of low fertility (Smith and Read, 1997). Most agricultural soils possess an indigenous VAM spore strains, the role of which in crop productivity has been examined in sufficient details (Tilak, 1993). Changing agricultural practices have resulted in increased application of pesticides and fungicides for the control of diseases. There is an increasing awareness on the deleterious effects of these chemicals on the beneficial mycorrhizal fungi (Bailey and Safir, 1978). But the reports on the effect of fungicides or insecticides on VAM fungi when applied as foliar sprays are few, though the practice of spraying agricultural chemicals on crops is so common.

MATERIALS AND METHODS

The investigation was carried out by raising the six cultivars of groundnut in field plots in split-plot design. A field plot of size 16 m x 7 m in the University botanical and experimental garden was selected for the study. The plot was divided into three rows of three blocks each with block size of 5 m x 2 m. In each block, seeds of six groundnut cultivars *viz.*, 87779 ICGV, CS 52, FDRS 4, 414332, Gangapuri and J 11 were sown in three rows of each. Bavistin at a concentration of 1 g/lit and water were sprayed on to foliage as fungicide treatment and control, respectively. The foliar sprays were carried out thrice, at twenty days interval, starting from 40th day after sowing of seeds.

The plant samplings were collected at 50th, 70th and 90th days after sowing. For each cultivar, three plants were sampled from each replicate of the treatment and control. The root samples of treatment and control were collected, processed and stained in 0.1% trypan blue prepared in lactophenol (Philips and Hayman, 1970). The per cent root colonization was calculated by the method of Giovanetti and Mosse (1980). At each sampling time, shoot fresh weight, shoot dry weight, nodule number, nodule weight, root length, shoot length were recorded. The phosphorus content of shoots was estimated by the Vanado-molybdate yellow method (Jackson, 1973). The per cent nitrogen in the plant material was determined by micro-kjeldahl 'N' method (AOAC, 1978). The data of all parameters at each sampling was subjected to statistical analysis to find out the F-value due to treatments as well as cultivars.

RESULTS AND DISCUSSION

The bavistin foliar spray significantly decreased the per cent infection and number of vesicles or spores in all the

six cultivars and at all sampling stages (Table 1 and 2). Greater reduction in infection over control was observed in the cultivar CS 52 at all the three stages due to bavistin spray. The degree of reduction in per cent infection and number of vesicles or spores varied among the cultivars. Gunasekaran *et al*. (1988) observed 89% and 77% reduction in mycorrhizal infection of cowpea roots due to application of two systemic fungicides, benomyl and bavistin as soil drench. The plant parameters *viz*., root length, shoot length, shoot fresh weight, shoot dry weight, nodule number, nodule fresh weight, per cent phosphorus and per cent nitrogen were negatively affected by bavistin spray except the shoot dry weight at 70 days and 90 days samplings (Table 3, 4, 5, 6, 7, 8 and 9). The reduction in

Table 1 : Effect of bavistin spray on VAM fungal colonization in six cultivars of groundnut

Cultivars	Per cent infection					
	50 days		70 days		90 days	
	Control	Sprayed	Control	Sprayed	Control	Sprayed
877791 ICGV	46.6	41.6	55.0	46.6	67.0	56.3
CS 52	43.3	40.0	55.0	47.5	64.0	55.0
FDRS 4	48.3	43.3	60.0	48.3	71.6	58.6
414332	45.0	41.6	58.6	50.0	70.3	60.0
Gangapuri	40.0	36.6	51.6	41.5	66.3	54.6
J 11	53.3	48.3	62.3	51.6	75.6	63.3
F value due to						
treatments :	93.70*		20.17*		21.37*	
cultivars :	139.95*		207.59*		281.15*	

* indicates significance of value at P=0.05

Table 2: Effect of bavistin spray on VAM fungal vesicles / spores in six cultivars of groundnut

Cultivars	No. of vesicles / spores (cm^{-1} root bit)					
	50 days		70 days		90 days	
	Control	Sprayed	Control	Sprayed	Control	Sprayed
877791 ICGV	32.0	28.0	41.0	33.0	56.0	36.0
CS 52	31.0	26.0	44.0	30.0	63.0	42.0
FDRS 4	42.0	31.0	52.0	38.0	71.0	44.0
414332	39.0	28.0	51.0	37.0	68.0	50.0
Gangapuri	27.0	22.0	36.0	28.0	54.0	34.0
J 11	49.0	38.0	60.0	46.0	83.0	62.0
F value due to						
treatments :	30.26*		23.44*		45.80*	
cultivars :	14.72*		90.00*		286.95*	

* indicates significance of value at P=0.05

Table 3 : Effect of bavistin spray on root length of six cultivars of groundnut

Cultivars	Root length (cm)					
	50 days		70 days		90 days	
	Control	Sprayed	Control	Sprayed	Control	Sprayed
877791 ICGV	12.5	12.2	12.7	11.2	14.3	11.9
CS 52	13.1	11.5	13.2	12.3	14.1	11.9
FDRS 4	12.7	10.7	13.3	11.9	14.3	11.6
414332	12.5	11.6	12.5	10.9	15.5	11.6
Gangapuri	12.7	10.8	12.7	11.7	14.1	12.0
J 11	12.2	9.8	12.7	9.3	14.5	11.4
F value due to						
treatments :	1.65		1.99		0.45	
cultivars :	19.39*		97.43*		97.43*	

* indicates significance of value at P=0.05

plant dry matter production due to bavistin foliar spray may be because of its deleterious effect on VAM fungi rather than its direct effect on plant growth as brought out by the reduced VAM development in the treated plants.

The reduction in plant growth and 'N' and 'P' contents was found considerable in bavistin treatment. By and large, the systemic fungicides as a group appear to be more damaging to mycorrhizal symbiosis than non-systemic ones (Jalali, 1990). And by virtue of their nature, systemic fungicides provide an undesirable environment inside the plant system to the invading organisms. Jalali and Domsch (1975) observed that seed as well as foliar applications with conventional and systemic fungal

Table 4 : Effect of bavistin spray on shoot length of six cultivars of groundnut

Cultivars	Shoot length (cm)					
	50 days		70 days		90 days	
	Control	Sprayed	Control	Sprayed	Control	Sprayed
877791 ICGV	32.7	28.9	48.2	44.2	74.0	59.2
CS 52	33.6	29.9	56.2	41.9	73.9	58.0
FDRS 4	36.8	36.2	56.0	48.4	74.4	56.3
414332	26.5	25.1	41.4	39.0	59.9	41.3
Gangapuri	47.3	45.1	77.5	70.5	88.0	85.7
J 11	32.1	28.9	50.4	47.0	75.7	58.3
F value due to						
treatments :	116.71*		28.48*		14.11*	
cultivars :	21.69*		13.14*		33.43*	

* indicates significance of value at P=0.05

Table 5 : Effect of bavistin spray on shoot fresh weight of six cultivars of groundnut

Cultivars	Shoot fresh weight (g/pl)					
	50 days		70 days		90 days	
	Control	Sprayed	Control	Sprayed	Control	Sprayed
877791 ICGV	50.01	39.52	86.60	51.82	108.93	84.75
CS 52	41.22	33.53	75.88	71.33	106.01	70.85
FDRS 4	41.33	35.27	53.95	45.13	66.61	59.80
414332	39.87	36.38	68.33	61.05	82.72	80.00
Gangapuri	47.65	36.85	68.22	56.45	70.46	64.42
J 11	35.71	31.15	53.41	41.36	69.62	54.03
F value due to						
treatments :	6.79*		3.73		5.34	
cultivars :	33.29*		8.75*		8.65*	

* indicates significance of value at P=0.05

Table 6 : Effect of bavistin spray on shoot dry weight of six cultivars of groundnut

Cultivars	Shoot dry weight (g/pl)					
	50 days		70 days		90 days	
	Control	Sprayed	Control	Sprayed	Control	Sprayed
877791 ICGV	10.66	7.63	20.64	10.92	25.99	17.88
CS 52	9.08	8.24	16.08	15.21	22.46	15.11
FDRS 4	9.11	7.49	12.48	10.57	15.42	14.0
414332	8.09	7.75	14.73	14.30	18.83	17.83
Gangapuri	9.66	9.12	14.36	12.12	14.83	13.82
J 11	7.13	5.97	12.10	8.42	15.79	11.03
F value due to						
treatments :	4.35		1.73		3.23	
cultivars :	9.81*		5.07*		5.84*	

* indicates significance of value at P=0.05

Table 7 : Effect of bavistin spray on nodule number in six cultivars of groundnut

Cultivars	Nodule number (Plant^{-1})					
	50 days		70 days		90 days	
	Control	Sprayed	Control	Sprayed	Control	Sprayed
877791 ICGV	98.7	82.6	110.9	94.6	137.6	101.4
CS 52	91.9	58.0	95.6	70.6	131.2	76.6
FDRS 4	108.3	68.3	114.1	73.5	116.4	77.5
414332	94.2	68.5	117.9	70.5	175.4	102.0
Gangapuri	99.7	73.2	111.2	81.6	121.6	82.4
J 11	58.0	49.0	76.4	56.8	96.1	77.9
F value due to						
treatments :	5.92		4.51		4.20	
cultivars :	29.68*		36.08*		35.12*	

* indicates significance of value at P=0.05

Table 8 : Effect of bavistin spray on nodule fresh weight in six cultivars of groundnut

Cultivars	Nodule fresh weight (mg/50 tap root nodules)					
	50 days		70 days		90 days	
	Control	Sprayed	Control	Sprayed	Control	Sprayed
877791 ICGV	293.25	221.89	327.29	226.02	336.45	260.58
CS 52	304.01	272.56	359.54	282.84	425.41	337.18
FDRS 4	307.33	215.00	332.12	269.02	373.35	275.51
414332	377.20	305.49	395.12	323.56	445.83	341.17
Gangapuri	325.25	226.14	328.02	231.07	372.07	280.68
J 11	330.09	307.29	410.12	356.82	356.82	379.64
F value due to						
treatments :	4.53		21.50*		57.40*	
cultivars :	25.69*		101.58*		312.52*	

* indicates significance of value at P=0.05

Table 9 : Effect of bavistin spray on phosphorus and nitrogen contents of shoots in six cultivars of groundnut at 70 days after sowing

Cultivars	% Phosphorus		% Nitrogen	
	Control	Sprayed	Control	Sprayed
877791 ICGV	0.466	0.438	3.099	2.623
CS 52	0.465	0.404	2.893	2.753
FDRS 4	0.474	0.368	2.982	2.459
414332	0.386	0.297	2.767	2.660
Gangapuri	0.448	0.378	2.800	2.581
J 11	0.448	0.398	2.977	2.660
F value due to				
treatments :	35.640*		19.439*	
cultivars :	7.689*		0.536*	

* indicates significance of value at P=0.05

toxicants restricted the development of mycorrhizal endophytes on host roots in wheat. They also postulated that since foliarly applied pesticides may not be translocated intact to the roots, but the side effects on mycorrhizae may be brought about by changes in the spectrum of root exudates as a result of the stress exerted by the pesticides. A changed pattern of amino acid exudation was also observed when systemic fungicides namely triforine and tridemorph were applied to the wheat foliage (Jalali and Domsch, 1977). Oliveira *et al.* (1987) studied the effect of spraying benomyl, captafol, copper oxychloride on VAM colonization of Rangpur lime and observed that, except captafol the others reduced mycorrhizal infection and consequently growth stimulus of the inoculated plants. In conclusion, it is necessary to evaluate the impact of foliar sprays with plant protection chemicals on VAM development in crop plants which form mycorrhizal association in the field.

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