RESEARCH PAPER International Journal of Agricultural Sciences, Vol. 7 Issue 2 (June, 2011) : 282-285

Loss of yield of groundnut (*Arachis hypogaea* L.) due to dry root rot (*Macrophomina phaseolina*) and their management under *in vivo* condition

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ABSTRACT

A field survey was done during 2002-2003 at Main oilseeds Research station, Junagadh Agricultural university, Junagadh to study the loss of yield of groundnut due to dry root rot. The maximum plant mortality (root rot) of 29.3 per cent due to *Macrophomina phaseolina* with highest yield loss of 435kg/ha was found in Keshod tehsil of Junagadh district of Saurashtra region. Therefore, a field experiment was conducted to manage root rot disease through various fungicides as seed treatment and bio-agent as seed/soil application. It was observed that increase in seed germination by 21.3 per cent as compared to control by seed treatment of vitavax. Similarly highest dry root rot disease control of 69.4 per cent with lowest disease 11.1 per cent was found in the seed treatment with vitavax + soil application of *Trichoderma viride* isolate I with neem cake followed by seed treatment of raxil + soil application of *Trichoderma viride* isolate I with neem cake and seed and soil application of *Trichoderma viride* isolate I with neem cake. The pod yield was highest *i.e.* 1427 kg/ha in the treatment combination of seed treatment with vitavax + soil application of *Trichoderma viride* isolate I with neem cake where pod yield was increase by 35.1 per cent followed by seed and soil application of *Trichoderma viride* isolate I with neem or castor cake.

Moradia, A.M. and Khandar, R.R. (2011). Loss of yield of groundnut (*Arachis hypogaea* L.) due to dry root rot (*Macrophomina phaseolina*) and their management under *in vivo* condition. *Internat. J. agric. Sci.*, **7**(2): 282-285.

Key words : Groundnut, Yield loss, *Macrophomina phaseolina*, Control

INTRODUCTION

Groundnut is a major edible oilseed crop and its uses are as edible oil, seeds, vines and dry fodder as an excellent nutrient for cattle and *Rhizobium* bacterial root nodule provide nitrogen status of the soil. Groundnut grown accounts 40 per cent area (6.28 million hectare of land) and 30 per cent production (7.00 million tones) of groundnut pods with productivity of 1124 kg/ha in the year of 2004-05 (Anonymous, 2004). Fifty five pathogens including fungus, bacterial and viral have been reported in groundnut crop (Grover and Sakhuja, 1981). Among these diseases *Macrophomina phaseolina* (Tassi) Goid pycnidial stage of *Rhizoctonia bataticola* (Toub) Butler cause seedling blight, collar rot and charcoal rot in 500 plants species and it was 33.33 per cent seed rotting and 23.80 per cent post emergence mortality due to this disease (Gupta and Kolte, 1980).

MATERIALS AND METHODS

Groundnut is a major edible oilseed crop and its uses are as edible oil, seeds, vines and dry fodder as an excellent nutrient for cattle and *Rhizobium* bacterial root nodule provide nitrogen status of the soil. Groundnut grown accounts 40 per cent area (6.28 million hectare of land) and 30 per cent production (7.00 million tones) of groundnut pods with productivity of 1124 kg/ha in the year of 2004-05 (Anon., 2004). Fifty five pathogens including fungus, bacterial and viral have been reported in groundnut crop (Grover and Sakhuja, 1981). Among these diseases *Macrophomina phaseolina* (Tassi) Goid pycnidial stage of *Rhizoctonia bataticola* (Toub) Butler is cause seedling blight, collar rot and charcoal rot in 500 plants species (Zak, 1971 and Gangopadhyay *et al.,* 1982) and it was 33.33 per cent seed rotting and 23.80 per cent post emergence mortality due to this disease (Gupta and Kolte, 1980).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Assessment of losses :

The survey data revealed that the maximum yield loss was of 435 kg/ha in groundnut variety GG 2 under rainfed condition in Keshod tehsil, where the plant mortality or root rot was 29.3 % (Table 1). However, minimum yield loss of 19kg/ha with plant mortality of 1.0 per cent was also recorded from the same area but in var GG 10. The present findings are in agreement with the findings of Mathur *et al.* (1967) who also found that bunch varieties were more

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Table 1 : Per cent root rot disease (*M. phaseolina*) and yield loss in groundnut

Tehsil	Variety	Root rot (%)	Actual yield kg/ha	Yield loss kg/ha
Junagadh	GG 2	11.0	1378	170
	GG 20	5.0	1736	91
	GG 10	2.0	1965	40
	GG 2	14.7	1275	220
	GG 2	16.5	1305	258
Keshod	GG 2	23.0	1242	371
	GG 10	1.0	1863	19
	GG 2	29.3	1050	435
	GG 20	7.2	1684	131
	GG 2	8.4	1346	123

susceptible to root rot disease. In case of castor crop also (Rajani, 1998) and (Das and Prasad, 1989) also assessed the higher root rot and higher yield loss.

Management through chemicals, bioagent and oilcakes under in field conditions :

All the treatments were effective and improved germination compared to control during both the years and in pooled. The highest seed germination of 92.8 per cent was recorded in treatment number 7 (Table 2) seed treatment with vitavax (@ 3 g/kg seed) with 21.3 per cent increase over control, followed by seed germination of 91.2, 90.5 and 89.2 % (Table 2) and per cent increase over control of 19.2, 18.3 and 16.6 % (Table 3) in treatment numbers 15, 14, 3 and 12, respectively *i.e.* seed treatment with *T. viride* (@ 4g/kg seed) + its soil application with neem cake (@ 162 kg/ha), seed treatment with mancozeb (@ 3g/kg seed), seed treatment with *T. viride* (@ 4g/kg seed) + its soil application with castor cake (@ 500 kg/ha) and seed treatment with raxil (@ 1.25g/kg seed) + soil application of *T. viride* with neem cake (@ 162kg/ha). These findings were confirmed with Mayee (1997) who suggested that seed treatment of carbendazim, carboxin were better for plant stand, disease control, growth of crop and increase in yield of sunflower by 26 to 38 %. Improved seed germination in groundnut with seed treatment of bavistin (Mathukia, 1982 and Petkar *et al.*, 1977) as well as seed treatment of *T. viride* were found better for higher survival of safflower crop. The perusal of data on dry root rot disease caused by *M. phaseolina* clearly indicate that all the treatments significantly reduced dry root rot incidence and increased the pod yield as compared to control. The lowest dry root rot incidence of 11.1 % and highest pod yield of 1427kg/

Table 2 : Effect of fungicides, cakes and *Trichoderma viride* on seed germination, dry root rot and pod yield (kg/ha) of groundnut caused by *M. phaseolina* under field condition

Sr. No.	Treatments	Seed germination (%)*			Root rot (%)*			Pod yield (kg/ha)*		
		Year		Pooled	Year		Pooled	Year		Pooled
		2002	2003		2002	2003		2002	2003	
1.	S.T. Antracol @ 3g/kg seed	85.1	86.7	85.8	7.6	19.6	18.6	1450	1117	1283
2.	S.T. Folicur @ 3ml/kg seed	81.0	79.3	80.2	30.1	33.2	31.7	1222	900	1061
3.	S.T. Mancozeb @ 3g/kg seed	91.3	89.7	90.5	22.7	26.2	24.4	1361	1028	1194
4.	S.T. Carbendazim @ 2g/kg seed	87.3	85.7	86.5	21.4	22.6	22.0	1400	1067	1233
5.	S.T. Thiram @ 3g/kg seed	83.7	82.0	82.8	23.6	24.5	24.0	1394	1061	1228
6.	S.T.Chlorothalonil @ 3g/kg seed	84.7	82.3	83.5	27.9	30.4	29.2	1283	950	1117
7.	S.T. Vitavax 200 WP @ 3g/kg seed	95.0	90.7	92.8	14.4	18.4	16.4	1478	1144	1311
8.	T_7+S.A.of T.v. @ 2.5 kg in 500kg C.c./ha	81.7	79.7	80.7	15.9	18.9	17.4	1494	1172	1333
9.	T_7+S.A.of T.v. @ 2.5 kg in 162kg N.c./ha	88.0	86.0	87.0	10.3	12.0	11.1	1583	1270	1427
10.	S.T. Raxil 2% D.S. @ 1.250g/kg seed	88.3	86.3	87.3	18.9	20.5	19.7	1422	1089	1256
11.	T_{10}+S.A.of T.v. @ 2.5 kg in 500kg C.c./ha	86.7	83.3	85.0	19.8	21.6	20.7	1428	1094	1261
12.	T_{10}+S.A.of T.v. @ 2.5 kg with 162kg N.c./ha	90.0	88.3	89.2	13.8	14.8	14.3	1511	1194	1342
13.	S.T. *Trichoderma viride* @ 4g/kg seed	83.0	81.3	82.2	27.3	29.9	28.6	1300	967	1133
14.	T_{13}+S.A.of T.v.@ 2.5kg in 500kg C.c./ha	91.0	90.0	90.5	14.6	16.7	15.7	1506	1183	1344
15.	T_{13}+S.A.of T.v.@ 2.5kg in 162kg N.c./ha	91.7	90.7	91.2	13.9	16.2	15.1	1511	1194	1353
16.	Control	77.7	75.3	76.5	34.8	38.0	36.4	1222	889	1056
	Treatment (T)-CD 5 %	6.44	4.93	3.97	6.09	8.75	5.72	121.3	127.5	86.2
	Year (Y)- CD at 5 %	-	-	1.40	-	-	1.93	-	-	30.45
	Y X T – C D at 5 %	-	-	NS	-	-	NS	-	-	NS

* = Average of three replications Where, S.T. = Seed treatment, S.A. = Soil Application, T.v.= *Trichoderma viride* (isolate I) talk formulation , C.c.= Castor cake, N.c.= Neem cake, ha = Hectare NS=Non-significant

Table 3 : Effect of fungicides, cakes and *Trichoderma viride* on % increase in seed germination, % disease control and % pod yield increase over control of groundnut caused by *M. phaseolina* under field condition

Sr. No.	Treatments	% increase in seed germination	% disease control	% pod yield increase over control
1.	S.T. Antracol @ 3g/kg seed	12.3	48.9	21.5
2.	S.T. Folicur @ 3ml/kg seed	4.8	13.1	0.5
3.	S.T. Mancozeb @ 3g/kg seed	18.3	32.9	13.1
4.	S.T. Carbendazim @ 2g/kg seed	13.1	39.6	16.8
5.	S.T. Thiram @ 3g/kg seed	8.3	34.1	16.3
6.	S.T.Chlorothalonil @ 3g/kg seed	9.2	19.9	5.8
7.	S.T. Vitavax 200 WP @ 3g/kg seed	21.3	54.9	24.2
8.	T_7+S.A.of T.v. @ 2.5 kg in 500kg C.c./ha	5.5	52.3	26.2
9.	T_7+S.A.of T.v. @ 2.5 kg in 162kg N.c./ha	13.7	69.4	35.1
10.	S.T. Raxil 2% D.S. @ 1.250g/kg seed	14.2	45.9	18.9
11.	T_{10}+S.A.of T.v. @ 2.5 kg in 500kg C.c./ha	11.1	43.2	19.4
12.	T_{10}+S.A.of T.v. @ 2.5 kg with 162kg N.c./ha	16.6	60.8	27.1
13.	S.T. *Trichoderma viride* @ 4g/kg seed	7.4	21.4	7.3
14.	T_{13}+S.A.of T.v.@ 2.5kg in 500kg C.c./ha	18.3	57.0	27.3
15.	T_{13}+S.A.of T.v.@ 2.5kg in 162kg N.c./ha	19.2	58.6	28.1
16.	Control	-	-	-

Where, S.T. = Seed treatment, S.A. = Soil Application, T.v.= *Trichoderma viride* (isolate I) talk formulation, C.c.= Castor cake, N.c.= Neem cake, ha = Hectare

ha with highest disease control of 69.4 % including 35.1 % increase in pod yield was recorded in seed treatment with vitavax + soil application of *T. viride* with neem cake (Table 2 and 3). Control of root rot disease caused by *M. phaseolina* in various crops with different chemicals have been reported by various workers *viz.,* in uridbean with bavistin (Ramasami *et al.,*1976); groundnut with bavistin (Mathukia, 1982 and Sheikh *et al.*, 1989); with vitavax (El. Wakil and Ghonim, 2000); incase of sunflower with carbendazim (Bhatiai *et al.,* 1997). Seed treatment with raxil + soil application of *T. viride* with neem cake found to be the next best treatment for the control of disease. Looking to the overall effect of various treatments it can be concluded that seed treatment with chemicals + soil treatment of *T. viride* either with neem or castor cake was found effective for the management of dry root rot and increase in yield in groundnut. Regarding effect of biocontrol agent, present findings are in accordance with the finding of Sheikh *et al.* (1989). Prashanthi *et al.* (1997) reported that seed treatment of *T. viride,* wheat straw and carbendazim provided good root rot control. Hooda *et al.* (2000) also reported that *T. viride and T. harzianum* gave good control of root rot disease in cotton. Vimala *et al.* (2000) noted lowest root rot in groundnut where seeds were treated with *T. hamatum* + its soil application.

Conclusion:

In loss assessment study the maximum plant mortality (root rot) of 29.3 per cent with highest yield loss of 435kg/ha was found in Keshod tehsil of Junagadh district of Saurashtra region. The highest seed germination of 92.38 per cent was obtained with seed treatment of vitavax where per cent increase in seed germination was 21.3 as compared to control. Similarly highest dry root rot disease control of 69.4 per cent with lowest disease incidence of 11.1 per cent was found in the seed treatment with vitavax + soil application of *Trichoderma viride* isolate I with neem cake followed by seed treatment of raxil + soil application of *T. viride* isolate I with neem cake and seed and soil application of *T. viride* isolate I with neem cake. The pod yield was highest *i.e.* 1427 kg/ha in the treatment combination of seed treatment with vitavax + soil application of *T. viride* isolate I with neem cake where pod yield was increased by 35.1 per cent followed by seed treatment with *T. viride* isolate I + its soil application with neem or castor cake.

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Received : December, 2010; Accepted : March, 2011