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Soil Borne Diseases Management in Groundnut – An Integrated Approach

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***Abstract*: Ground nut (*Arachis hypogea* L.), is one of the most important oil seed crops of India, is affected by several soil borne diseases *viz*., root rot and stem rot. A study was conducted for the development of IPM module for the management of these soil borne fungicides using fungicides and biocontrol agents. Among the nine modules tested, module with deep summer ploughing using mould board plough combined with soil application of *Trichoderma* @ 4 kg/ ha enriched in 250 kg FYM/ha and seed treatment with Tebuconazole 2DS recorded minimum incidence of stem rot (9.5 %) with a pod and haulm yield of 2566 kg/ha and 6428 kg /ha respectively. This treatment also recorded minimum incidence of late leaf spot (Grade 4) and rust (Grade 5).**

***Keywords*: soil borne diseases, groundnut, management, fungicides.**

1. Introduction

Ground nut (*Arachis hypogea* L.), is one of the most important oil seed crop of India, contributing about 36 % of the world oil seed production. The major peanut growing states area Gujarat, AndraPradesh, Tamil Nadu, Rajasthan and Maharastra which contributes around 90% of the area and production. Seed and soil borne diseases causes severe seedling mortality resulting in the patchy crop stand mostly in the sandy loam soils and reduces yield from 25 to 50%. Among the soil borne diseases, collar rot (*Aspergillus niger* Van Tieghem), stem rot (*Sclerotium rolfsii* Sacc) and dry root rot (*Macrophomina phaseolina* (Tassi Goid) = *Rhizoctonia bataticola* (Taub.) Butler) have been recognized as a major disease. Among the foliar diseases ELS, LLS and rust are commercially important and cause yield losses up to 50 per cent. The fungicides *viz.,* azoxystrobin, chlorothalonil and tebuconazole were found to be effective for the management of leaf spot and stem rot in groundnut (Hagan *et al*., 2010). Wann *et al.,* 2011 reported the management of leaf spot in ground nut using fungicides.

Integrated management of diseases by combining chemical and biological method would be an effective method for the management of diseases compared to adopting single method. With this view, the present work was carried out to find out effective IDM module for the management stem rot and foliar diseases in ground nut.

2. Materials and Methods

Three field trials were conducted to test the efficacy of different fungicides for the management of foliar diseases in groundnut during 2016-17, 2017-18 and 2018-19 in Kharif season at Coconut Research station, Aliyarnagar, TamilNadu Agricultural University (Longitude: 77.49°E latitude: 10°N MSL- 260 msl). The ground nut var CO-2, was used for sowing at 30x 10 cm spacing in 15 m2 (5m x 3m) plots and the plots were laid out in Randomized Block Design (RBD) with three replications. Treatments were given as per schedule. The incidence of stem rot was recorded on 45-50 DAS by Percent Diseases Incidence (PDI). Foliar disease incidences were recorded periodically by adopting 1-9 scale (Subramanyam *et al*., 1995). The pod and haulm yield were also recorded after harvest.

The treatments were:

T1	(M5): Popular variety + Deep summer ploughing with mold board plough + Soil application of *Trichoderma viride* @ 4 kg/ ha enriched in FYM+Seed treatment with Tebuconazole @ 1.5 g/kg of seed
T2	(M10): Popular Variety + Deep summer ploughing with mold board plough + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM + Seed treatment with *T.viride* @ 10 kg of seed + Soil application of Trichoderma @ 4 kg/ ha enriched in FYM at 35 days after sowing (DAS)
T3	(M11): Popular Variety + Deep summer ploughing with mold board plough + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM + Seed treatment with Tebuconazole @ 1.5 g/ kg of seed + Soil application of Trichoderma @ 4 kg/ ha enriched in FYM at 35 days after sowing (DAS)
T4	Deep summer ploughing with mold board plough + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM + Seed treatment with Tebuconazole 2DS @ 1.5 g/ kg of seeds followed by seed treatment with PGPR @ 625 g for per ha of seeds + Soil application of *T.viride* @ 4 kg/ ha enriched in 250 kg FYM/ ha at 35 and 70 DAS
T5	(M15): Popular Variety + Deep summer ploughing with mold board plough + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM + Seed treatment with PGPR @ 625g/ for per ha of seeds + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 35 days after sowing (DAS) + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 80 days after sowing (DAS)
T6	(M17): Popular Variety + Deep summer ploughing with mold board plough + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM + Seed treatment with Tebuconazole @ 1.5 g/kg of seeds + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 35 days after sowing (DAS) + Soil application of *T.viride*a @ 4 kg/ ha enriched in FYM at 80 days after sowing (DAS)
T7	Deep summer ploughing
T8	Farmers Practice (respective centre)
T9	Control (Without any treatments)

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3. Results

The results of the trial conducted during 2017-18 indicated that, among the nine treatments tested, T4 treatment *i.e.*, Deep summer ploughing with mold board plough+ Soil application of *Trichoderma* @ 4 kg/ ha enriched in 250 kg FYM/ha+ Seed treatment with Tebuconazole 2DS recorded minimum incidence of stem rot (8.47%) with a pod and haulm yield of 3099 kg/ha and 5997 kg /ha respectively. This treatment also recorded minimum incidence of Late leaf spot (Grade 4) and rust (Grade 6). This treatment is followed by T5 treatment i.e. Popular Variety + Deep summer ploughing with mold board plough + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM + Seed treatment with PGPR @ 625g/ for per ha of seeds + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 35 days after sowing (DAS) + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 80 days after sowing (DAS) that recorded an incidence of 17.7 % and pod and haulm yield of 3057 kg/ha and 5989 kg/ha respectively, while in control the stem rot incidence was 36.7%.with pod and haulm yield of 2062 and 5308 kg/ha respectively (Table 1). In control plots, the incidence of late leaf spot and rust were maximum (Grade 8).

The results of the trial conducted during 2018-19 indicated that, among the nine treatments tested, T4 treatment i.e.: Deep summer ploughing with mold board plough+ Soil application of *Trichoderma* @ 4 kg/ ha enriched in 250 kg FYM/ha+ Seed treatment with Tebuconazole 2DS recorded minimum incidence of stem rot (12.5%) with a pod and haulm yield of 2342 kg/ha and 6650 kg /ha respectively. This treatment also recorded minimum incidence of Late leaf spot (Grade 3) and rust (Grade 4). This treatment is followed by T5 treatment i.e. Popular Variety + Deep summer ploughing with mold board plough + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM + Seed treatment with PGPR @ 625g/ for per ha of seeds + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 35 days after sowing (DAS) + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 80 days after sowing (DAS) that recorded an incidence of 13.6 % and pod and haulm yield of 2286 kg/ha and 6180 kg/ha respectively, while in control the stem rot incidence was 30.6%.with pod and haulm yield of 1231 and 4398 kg/ha respectively. In control plots, the incidence of late leaf spot and rust were Grade 7 and Grade 6 respectively (Table 2).

The results of the trial conducted during 2019-20 indicated that, among the nine treatments tested, T4 treatment *i.e.,* Deep summer ploughing with mold board plough+ Soil application of *Trichoderma* @ 4 kg/ ha enriched in 250 kg FYM/ha+ Seed treatment with Tebuconazole 2DS recorded minimum

Table 1
Validation of Management module for the soil borne diseases (2017-18)

Treatments	Germination (%)	Collar rot (%)	Stem rot (%)			Dry root rot (%)				Foliar diseases (1-9 scale)		Pod rot (%)	Pod yield (kg/ha)	Haulm yield (kg/ha)
		20-30 DAS	40-45 DAS	70-75 DAS	At harvest	30-35 DAS	60-65 DAS	85-90 DAS	At harvest	LLS	Rust			
T_1	85.1	0	0	0	19.7(26.4)	0	0	0	0	4	7	0	3003	5943
T_2	90.2	0	0	0	23.3(28.8)	0	0	0	0	5	7	0	3016	5729
T_3	87.5	0	0	0	21.3(27.4)	0	0	0	0	5	7	0	3055	5737
T_4	84.9	0	0	0	8.47(10.8)	0	0	0	0	4	6	0	3099	5997
T_5	86.8	0	0	0	17.7(24.8)	0	0	0	0	4	6	0	3057	5989
T_6	91.2	0	0	0	25.6(30.4)	0	0	0	0	4	7	0	3018	5670
T_7	89.3	0	0	0	28.7(32.3)	0	0	0	0	4	6	0	2983	5676
T_8	88.7	0	0	0	18.9(25.8)	0	0	0	0	5	7	0	2495	5651
T_9	89.1	0	0	0	36.7(37.2)	0	0	0	0	8	8	0	2062	5308
SEm+1					1.80								66.9	374.8
CD at 5%					3.79								140.6	787.6
CV%					8.09								2.86	7.99

Table 2
Validation of management modules for soil borne diseases (2018-19)

Treatments	Germination (%)	Collar rot (%)	Stem rot (%)			Dry root rot (%)				Foliar diseases (1-9 scale)		Pod rot (%)	Pod yield (kg/ha)	Haulm yield (kg/ha)
		20-30 DAS	40-45 DAS	70-75 DAS	At harvest	30-35 DAS	60-65 DAS	85-90 DAS	At harvest	LLS	Rust			
T_1	85.7	0	0	0	19.6(26.33)	0	0	0	0	4	5	0	2084	5980
T_2	83.7	0	0	0	16.9(24.33)	0	0	0	0	3	5	0	2190	6092
T_3	84.4	0	0	0	15.3(23.00)	0	0	0	0	4	6	0	2262	6149
T_4	86.9	0	0	0	12.5(20.77)	0	0	0	0	3	4	0	2342	6650
T_5	85.5	0	0	0	13.6(21.64)	0	0	0	0	4	5	0	2286	6180
T_6	84.1	0	0	0	20.1(26.64)	0	0	0	0	4	4	0	2042	5720
T_7	81.2	0	0	0	23.5(29.00)	0	0	0	0	5	6	0	1582	4872
T_8	85.5	0	0	0	22.4(28.25)	0	0	0	0	3	5	0	1849	5290
T_9	79.8	0	0	0	30.6(33.59)	0	0	0	0	7	6	0	1231	4398
SEm+1	1.05				1.90								136.4	682..94
CD at 5%	2.22				4.04								264.33	1553.43
CV%	1.53				12.01								7.43	16.09

Table 3
Validation of management modules for soil borne diseases (2019-20)

Treatments	Germination (%)	Collar rot (%)	Stem rot (%)			Dry root rot (%)				Foliar diseases (1-9 scale)		Pod rot (%)	Pod yield (kg/ha)	Haulm yield (kg/ha)
		20-30 DAS	40-45 DAS	70-75 DAS	At harvest	30-35 DAS	60-65 DAS	85-90 DAS	At harvest	LLS	Rust			
T_1	92.1	0	0	0	20.0(26.5)	0	0	0	0	4	7	0	1923	6076
T_2	90.2	0	0	0	22.7(28.3)	0	0	0	0	3	5	0	1832	6306
T_3	85.5	0	0	0	21.7(27.7)	0	0	0	0	5	7	0	1821	6381
T_4	87.9	0	0	0	7.5(15.9)	0	0	0	0	4	6	0	2226	6637
T_5	88.8	0	0	0	15.5(23.1)	0	0	0	0	4	5	0	2003	6594
T_6	87.2	0	0	0	21.5(27.5)	0	0	0	0	4	7	0	1842	6217
T_7	86.3	0	0	0	26.7(31.1)	0	0	0	0	4	6	0	1352	5459
T_8	90.2	0	0	0	22.8(28.4)	0	0	0	0	5	7	0	1494	5259
T_9	89.6	0	0	0	37.1(37.5)	0	0	0	0	8	8	0	1158	4436
SEm+1					2.05								129.50	779.94
CD at 5%					4.36								274.53	1653.43
CV%					9.22								7.59	16.09

Table 4
Validation of management modules for soil borne diseases (Pooled data), Centre: CRS, Aliyarnagar

Treatments	Germination (%)	Collar rot (%)	Stem rot (%)			Dry root rot (%)				Foliar diseases (1-9 scale)		Pod rot (%)	Pod yield (kg/ha)	Haulm yield (kg/ha)
		20-30 DAS	40-45 DAS	70-75 DAS	At harvest	30-35 DAS	60-65 DAS	85-90 DAS	At harvest	LLS	Rust			
T_1	85.7	0	0	0	19.8	0	0	0	0	4	6	0	2337	6000
T_2	83.7	0	0	0	21.0	0	0	0	0	4	6	0	2346	6042
T_3	84.4	0	0	0	19.4	0	0	0	0	5	7	0	2379	6089
T_4	86.9	0	0	0	9.5	0	0	0	0	4	5	0	2556	6428
T_5	85.5	0	0	0	15.6	0	0	0	0	4	5	0	2449	6254
T_6	84.1	0	0	0	22.4	0	0	0	0	4	6	0	2301	5869
T_7	81.2	0	0	0	26.3	0	0	0	0	4	6	0	1972	5336
T_8	85.5	0	0	0	21.4	0	0	0	0	4	6	0	1946	5400
T_9	79.8	0	0	0	34.8	0	0	0	0	8	7	0	1484	4714
SEm+1					1.9								111.9	577.4
CD at 5%					4.1								226.5	1331.5
CV%					9.8								6.1	13.4

incidence of stem rot (7.5%) with a pod and haulm yield of 2226 kg/ha and 6637 kg /ha respectively. This treatment also recorded minimum incidence of Late leaf spot (Grade 4) and rust (Grade 6). This treatment is followed by T5 treatment *i.e*. Popular Variety + Deep summer ploughing with mold board plough + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM + Seed treatment with PGPR @ 625g/ for per ha of seeds + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 35 days after sowing (DAS) + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 80 days after sowing (DAS) that recorded an incidence of 15.5 % and pod and haulm yield of 2003 kg/ha and 6594 kg/ha respectively, while in control the stem rot incidence was 37.1%.with pod and haulm yield of 1158 and 4436 kg/ha respectively (Table 3). In control plots, the incidence of late leaf spot and rust were maximum (Grade 8).

The pooled results of the three years (2017-18, 2018-19 and 2019-20) trial data indicated that, all the treatments recorded germination percentage of more than 80.0 per cent. Among the nine treatments tested, T4 treatment i.e., Deep summer ploughing with mould board plough + Soil application of *Trichoderma* @ 4 kg/ ha enriched in 250 kg FYM/ha+ Seed treatment with Tebuconazole 2DS recorded minimum incidence of stem rot (9.5 %) with a pod and haulm yield of 2566 kg/ha and 6428 kg /ha respectively. This treatment also recorded minimum incidence of Late leaf spot (Grade 4) and rust (Grade 5). This treatment is followed by T5 treatment i.e. Popular Variety + Deep summer ploughing with mold board plough + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM + Seed treatment with PGPR @ 625g/ for per ha of seeds + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 35 days after sowing (DAS) + Soil application of *T.viride* @ 4 kg/ ha enriched in FYM at 80 days after sowing (DAS) that recorded an incidence of 15.6 % and pod and haulm yield of 2499 kg/ha and 6254 kg/ha respectively, while in control the stem rot incidence was 34.8%.with pod and haulm yield of 1484 and 4714 kg/ha respectively. In control plots, the incidence of late leaf spot and rust were Grade 8 and grade 7 respectively (Table 4).

The pooled result of trials indicated that combing of cultural, chemical and biological method i.e., Deep summer ploughing with mould board plough + Soil application of *Trichoderma* @ 4 kg/ ha enriched in 250 kg FYM/ha+ Seed treatment with Tebuconazole 2DS is highly effective in reducing the incidence of stem rot and also foliar diseases.

The effect of seed treatment in increasing the yield was reported by several workers. Dandnaik *et al*., 2009 reported that seed treatment with hexaconazole gave higher pod yield in

ground nut. De *et al*., (2003) with carbendazim + Thiram in linseed against wilt, Ramkishore and Singh (2008) in linseed against wilt, Dudi and Lodha (2003) in pea nut against seedling diseases, Dutta and Das (2002) against collar rot in tomato were also already reported. Integrated disease management of foliar and soil borne diseases with fungicides, Castor cake and Trichoderma in ground nut was reprted by Jadon et al., 2017. They reported that, lowest incidence of soil borne diseases was recorded in seed treatment with mancozeb and seed treatment with tebuconazole compared to untreated control.

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