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Comparison of bio-agents and botanicals with fungicides against tikka and anthracnose diseases of groundnut (*Arachis hypogea* L.)

■ MOHAMMAD FAISAL* AND SHASHI TIWARI

Department of Plant Protection, Sam Higginbottom Institute of Agriculture, Technology and Sciences, ALLAHABAD (U.P.) INDIA

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*Corresponding author:
Email: mfaisal710@gmail.com

ABSTRACT

Groundnut is an important oilseed crop and contributes about 40 per cent of total oilseed production in India. Due to its nutritional value and oil production, it is very valuable and economical crop but several diseases like tikka, collar rot, rust, peanut bud necrosis and anthracnose take heavy toll every year decrease the yield severely. A field trail was conducted in *Kharif* season in the month of August, 2012 to test the effect of seed treatment with bio-agents, botanicals in comparison to chemical fungicides against tikka disease and anthracnose of groundnut to minimize the disease intensity. The treatments were control (water irrigation), *Trichoderma harzianum* 1 per cent, *Trichoderma viride* 1 per cent, Neem seed kernel extract 5 per cent, *Pseudomonas flourescens* 5 per cent, Bavistin 0.2 per cent, Thiram 0.2 per cent, Neem oil 5 per cent. Seed treatment with Bavistin @ 0.2 per cent was found superior among all the treatments in managing the tikka leaf spot, whereas, neem oil showed better results next to it. However, anthracnose infection was very little or negligible.

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INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the important oilseed crops containing 48 per cent edible oil and 25 per cent high quality protein. It is the world's fourth most important source of edible oil and third most important source of vegetable protein. China is the world's largest groundnut producer, with 40 per cent of world's production, followed by India (23 %) (Diop *et al.,* 2004). Groundnut seed contains moisture (5.529 %), crude fibre (1.149 %), lipid (46.224 %), crude protein (25.20 %), carbohydrate (21.26 %), ash (2.577 %), calcium (0.087 %), phosphorus (0.29 %) and energy (601.856 %). The total fatty acid composition is 10.44 and 33.51per cent for saturated and unsaturated fatty acid, respectively (Ingale and Shrivastava, 2011). The groundnut plant has a distinct main stem and varying number of lateral branches is an important character which determines the growth habit. Based on this character the cultivated varieties of groundnut mainly grouped into two habit forms, base of the stem *viz.*, bunch and spreading type. Under rain-fed conditions, the average yield of semi-spreading and spreading varieties of groundnut is 1200-1400 kg. of unshelled pods per hectare; and that of bunch types is 800-1000 kg./ha. Fields with supplementary irrigation produce 3000 kg. more of pods

per hectare. The pods yield 70 to 75 per cent of kernels by weight. The yield of haulms is usually two to two-and-a-half times that of pods (Anonymous, 2012). Groundnut is grown on nearly 23.95 million ha worldwide with the total production of 36.45 million tons and an average yield of 1520 kg./ha (FAOSTAT, 2011).

Among the fungal diseases of groundnut, tikka disease and anthracnose are most common. Early leaf-spot (ELS) caused by *Cercospora arachidicola* (Agrihunt, 2011) and late leaf-spot (LLS) due to *Cercospora personatum* (Meena, 2011) are mainly prevalent during the *Kharif* than the *Rabi* season almost all groundnut growing areas of the world and become endemic frequently (Ghewande and Misra, 1983). Yield losses caused by leaf-spots and rust ranged from 15 to 80 per cent. Losses in pod yield can be up to 29 per cent (Siddaramaiah *et al.*, 1977).

MATERIAL AND METHODS

A field experiment was conducted at the crop research farm, Allahabad School of Agriculture, SHIATS, Allahabad during *Kharif*, 2012 to study the comparison of bio-agents and botanicals with fungicides against tikka and anthracnose diseases of groundnut. The experiment was laid out in Randomized Block Design with three replications. Seven treatments including an untreated control and application was done as seed treatment. The treatments were control (water irrigation), *Trichoderma harzianum* 5 per cent, *Trichoderma viride* 5 per cent, neem seed kernel extract 5 per cent, *Pseudomonas flourescens* 5 per cent, Bavistin 0.2 per cent, Thiram 0.2 per cent, Neem oil 5 per cent. Bio-agent powdered formulation was brought to the laboratory and the viability was checked by serial dilution method, the C.F.U. was found to be 10^6 (appropriate) for seed treatment. The seeds were sown in 2×1.5 m^2 plot size with a spacing of 30 cm row to row and 10 cm plant to plant. The crop was sown as line sowing on 2.8.2012. The biometric observations were taken on five randomly selected plants in a net plot area. Thinning was done two weeks after sowing to maintain a uniform plant distance in respective treatments for uniform plant population. The disease intensity was recorded at 30, 45 and 60 DAS and pod yield was recorded.

RESULTS AND DISCUSSION

Data presented in Tables 1, 2 and 3 revealed that Bavistin @0.04 per cent was best but somewhat lower, the similar results were shown by neem oil 5 per cent followed by NSKE 5 per cent, Thiram 0.4 per cent, *Pseudomonas flourescens* 5 per cent, *Trichoderma harzianum* 5 per cent, *Trichoderma viride* 5 per cent and gave the significant reduction in the severity of tikka disease of groundnut over control. Table A shows that T_5 (Bavistin 0.2 %) was most effective treatment in which the disease intensity of tikka was 17.68 followed by T_7 neem oil 5 per cent (18.29) which was much reduced over the control (26.20) and thus, these two treatments were found significantly superior than all other treatments. Similar findings have also been reported by Dubey *et al.* (1995) who tested the efficiency of 5 fungicides, Bordeaux mixture, derosal (carbendazim), Bavistin (carbendazim), Dithane M-45 (mancozeb) and Fytolan (copper oxychloride), to control *Cercospora personata* (*Mycosphaerella berkeleyi*) and rust (*Puccinia arachidis*) on groundnut. All fungicides provided control but derosal and Bavistin were the most effective. Twumasi (1993) tested five fungicides, benomyl, carbendazim, metiram, tridemorph and triphenyltin hydroxide, over 3 and 4 years in the field as weekly and forthnightly foliar sprays and as seed-dressing chemicals against *Cercospora arachidicola* and *Cercosporidum personatum* leaf spots of groundnut. For spraying, concentrations of 0.2 per cent (benomyl, carbendazim, triphenyltin hydroxide) and 0.3 per cent (Metiram and tridemorph) were used. For seed-dressing, the rates were 3.0 g /kg of seed (benomyl, carbendazim and triphenyltin hydroxide). Benomyl and carbendazim significantly reduced leaf spot incidence more than triphenyltin hydroxide which, in turn, significantly reduced the disease more than tridemorph and metiram when sprayed weekly and fortnightly.

Thus, in comparison to Bavistin, neem oil showed equivalent results as earlier done by Srinivas *et al.* (2000) who tested the effect of some plant extracts and chemicals on the management of tikka leaf spot of groundnut (*Arachis hypogaea* L.) by conducting an experiment under field conditions. Results indicated that plant extracts *viz.*, Calotropis leaf suspension at 1 per cent concentration or neem oil at 0.5 per cent concentration effectively controlled the leaf spot disease and significantly increased the yield over control and even Ganapathy and Narayanaswamy, 1990 performed lab. and field tests neem oil from *Azadirachta indica* and leaf extract from Nerium odorum reduced the incidence of late leaf spot [*Phaeoisariopsis personata* (*Mycosphaerella berkeleyi*)], rust (*Puccinia arachidis*) and ring mosaic (tomato spotted wilt virus) and reported that neem oil is also effective in managing the disease. In addition, neem oil increased pod yield by 62.3 per cent.

The cost benefit ratio in case Bavistin was lower (1:1.55) as already concluded by Singh and Baiswar (2007) after the study during 2004 and 2005 in Meghalaya, India, to manage the early leaf spot disease [*Cercospora arachidicola* (*Mycosphaerella arachidis*)] of groundnut (*Arachis hypogaea* cv. JL 24) by minimum application of fungicides and plant-based chemicals. Treatments comprised: triadimefon 25 WP (bayleton), tricyclazole 75 WP (sivic), mancozeb 75 WP (dithane M-45)+carbendazim 50 WP (Bavistin), propineb 70 WP (antracol), 12 per cent carbendazim (saaf) + 63 per cent mancozeb, bitertanol 25 WP (baycor), 25 per cent

propiconazole (tilt) and two botanicals [0.03 % *Azadirachtin* (tricure) and *Cymbopogon* spp.]. Out of the fungicides tested, maximum control was recorded by Dithane M-45 + Bavistin (40.2%) and Saaf (39.1%) with a cost : benefit ratio of 1:2.85 and 1:2.67, respectively. It is evident from the findings that early leaf spot can be effectively and economically managed by using saaf under rainfed conditions in hills where late leaf spot and rust are not major problems but was higher than that of neem oil (1:1.3) which showed that use of Bavistin is costlier than that of neem oil but both have almost same results. Antifungal activity of extracts of some botanicals have been reported from India and abroad by a number of past workers (Tiwari *et al.*, 2005; Nduagu *et al.*, 2008; Noriel and Robles, 1990; Bandara *et al.*, 1989; Natarajan and Lalithakumari, 1987; Moradia, 2012; Angadi *et al.*, 2013 and Jha *et al.*, 2013) which are in line to the present investigation.

Table 1 : Effect of treatments on Tikka disease intensity at 30, 45 and 60 DAS of groundnut

No. of treatments	Treatments	30 DAS	45 DAS	60 DAS
T_0	Control	1.93	3.99	26.20
T_1	*Trichoderma harzianum* @ 5%	1.74	3.77	20.29
T_2	*Trichoderma viride* @ 5%	1.74	3.78	20.33
T_3	NSKE @ 5%	1.52	3.29	19.85
T_4	*Pseudomonas flourescens*@ 5%	1.67	3.69	19.96
T_5	Bavistin @ 0.2%	1.23	2.52	17.68
T_6	Thiram @ 0.2%	1.58	3.55	19.94
T_7	Neem oil @ 5%	1.41	3.20	18.29
F- test		S	S	S
S.E. ±		0.057	0.138	0.455
C.D. (P = 0.05)		0.121	0.292	0.966

Table 2 : Effect of treatments on anthracnose disease incidence at 30, 45 and 60 DAS of groundnut

No. of treatments	Treatments	30 DAS	45 DAS	60 DAS
T_0	Control	0.84	4.30	8.07
T_1	*Trichoderma harzianum* @ 5%	0.46	3.77	6.42
T_2	*Trichoderma viride* @ 5%	0.39	3.09	4.61
T_3	NSKE @ 5%	0.59	3.82	6.5
T_4	*Pseudomonas flourescens* @ 5%	0.45	3.72	6.19
T_5	Bavistin @ 0.2%	0.44	3.45	5.89
T_6	Thiram @ 0.2%	0.44	3.29	5.22
T_7	Neem oil @ 5%	0.16	2.49	3.29
F- test		S	S	S
S.E. ±		0.048	0.161	0.327
C.D. (P = 0.05)		0.103	0.342	0.693

Table 3 : Cost benefit ratio

Sr. No.	Treatments	Yield of q/ha	Cost of yield	Total cost of yield (Rs.)	Common cost (Rs.)	Treatment cost (Rs.)	Total cost	C:B ratio
1.	T_1 *T. harzianum* @ 5%	5.95	11,000 Rs./q	65,450/-	51,766/-	640/-	52,406/-	1:1.25
2.	T_2 *T. viride* @ 5%	5.93	11,000 Rs./q	65,230/-	51,766/-	640/-	52,406/-	1:1.24
3.	T_3 NSKE @ 5%	8.44	11,000 Rs./q	92,840/-	51,766/-	680/-	52,446/-	1:1.77
4.	T_4 *P. flourescens* @5%	7.37	11,000 Rs./q	81,070/-	51,766/-	640/-	52,406/-	1:1.55
5.	T_5 *Bavistin* @ 4g/kg seed	10.5	11,000 Rs./q	1,15,500/-	51,766/-	672/-	52,438/-	1:2.20
6.	T_6 *Thiram* @ 4g/kg seed	7.44	11,000 Rs./q	81,840/-	51,766/-	936/-	52,702/-	1:1.55
7.	T_7 Neem oil @5%	10.44	11,000 Rs./q	1,14,840/-	51,766/-	1,360/-	53,126/-	1:2.16
8.	T_0 Control	5.93	11,000 Rs./q	65,230/-	51,766/-	---------	51,766/-	1:1.3

Conclusion :

In the present study, on the basis of observation, it was found that for controlling leaf spot diseases of ground Bavistin 50 WP @ 0.2 per cent (17.68) was the best effective in comparison to other treatments followed by neem oil (18.29) as effective next to chemical and even the cost benefit ratio of Bavistin (1:1.55) was higher than that of using the neem oil (1:1.3) for seed treatment. Hence, from the present study it can be concluded that neem oil in comparison to chemical fungicides like Bavistin, can be used effectively to reduce the disease intensity as both are non-significant to each other and got better yield similar to that with the use of chemicals. Even neem oil is easily available, easy to use, will be safer, will not harm non-targeted organisms, biodegradable and is effectively highly cost benefited.

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