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Bio-Efficacy of Seed Dressing Fungicide Carbendazim 12% + Mancozeb 63% WP against Important Fungal Diseases of Groundnut

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Groundnut is an important legume and oil seed crop and oil seed crop in world, which is prone to many soil borne diseases *viz*., Collar rot *(Aspergillus niger)*, Dry root rot *(Macrophomina phaseolina)* and foliar disease like tikka leaf spot (*Cercospora arachidicola)* causes major economic losses in yield. The field experiment was conducted on bio efficacy of carbendazim 12% + mancozeb 63% WP as a seed treatment against collar rot, dry root rot and tikka leaf spot in groundnut at college of Sericulture, Chintamani during *Kharif* 2019-20. The seed treatment of Carbendazim 12% + Mancozeb 63% WP @ 3.0 g/kg of seeds treated plot recorded 95.17% seed germination with minimum early leaf spot, (PDI 7.18) dry root rot incidence (2.20%) and collar rot incidence (1.98%) having highest pod yield of 27.23 q/ha and fodder yield of 41.72 q/ha with cost to benefit ratio of 1:4.05 which was on par with Carbendazim 12% + Mancozeb 63% WP @ 2.5 g /kg of seeds treated plot with 94.17% seed germination with least severity of early leaf spot (PDI 8.22), dry root rot (2.42%) and collar rot (2.18%) incidence having pod yield of 26.90 q/ha and fodder yield of 41.13 q/ha with cost to benefit ratio of 1:4.01.

Keywords: Ground nut; collar rot; early leaf spot; dry root rot and fungicide.

1. INTRODUCTION

"Groundnut is important oil seed crop and supplementary food crop, It is fourth most important source of edible oil and third most important source of vegetable protein. The only species in the genus significant economic importance is *A. hypogaea*, distinguished primarily on branching pattern and distribution of vegetative and reproductive axes. India is a second largest producer of groundnut accounting for 25 – 30% of global production. India's total groundnut production stood at a record 99.70 lakh tones from an area of 6.74 million hectares. The average yield in India is around 1450 kg/hectare" [1]. "Gujarat state has highest production of groundnut in India. In India, groundnut is cultivated in one or more seasons (*Kharif, Rabi* and *Summer*) but nearly 80 per cent of the annual acreage and production comes from *Kharif* crop (June to October) season" [2]. "Groundnut is susceptible to many pathogens like fungi, bacteria, viruses and nematodes etc., which attack the crop at various stages of growth and cause severe yield loss of 70% and decrease the productivity of crop" [3]. "The diseases mainly caused by fungi, such as early leaf spot (*Cercospora arachidicola*), collar rot *(Aspergillus niger)* and dry root rot *(Macrophomina phaseolina)* are most detrimental diseases of Groundnut" [4]. These pathogens were more prevalent in favorable seasons and cause mortality of crop and reduction in the yield. The yield loss due to collar rot disease was reported 28 to 50 per cent [5], stem rot is reported to cause losses in yield up to 25 per cent in India [6] and [7]). The losses may account to 40-50 per cent in terms of mortality of crop particularly in *Kharif* [8] when the climatic conditions are more favourable for pathogen stem rot of groundnut causes 13 to 59 per cent yield loss during both the rainy and summer seasons (Nautiyal, 2002) These pathogens causes yield losses to an extent of 80 per cent depending on the stage of the crop [9].These pathogens were more prevalent in favorable seasons and cause mortality of crop and reduction in the yield. These pathogens causes yield losses to an extent of 80 per cent depending on the stage of the crop [9]. By observing the yield losses due to these diseases, fungicide carbendazim 12% + mancozeb 63% WP was evaluated at different concentrations for testing its bio-efficacy by seed treatment at different concentrations against collar rot, early (tikka) leaf spot and root rot diseases.

2. MATERIALS AND METHODS

The field trial was conducted during *Kharif* 2019-20 at College of Sericulture, Chintamani to evaluate the bioefficacy of Carbendazim 12% + Mancozeb 63% WP against major diseases of Groundnut. All the standard agronomic practices were followed as per the recommendations of the University of Agricultural Sciences, Bangalore. The evaluation of the test fungicide was done along with standard checks and untreated control against the incidences of Tikka Leaf spot (early leaf spot), Collar rot, and Dry root rot diseases of Groundnut. The observations on germination were recorded on 10th day after sowing. For tikka leaf spot disease, 15 leaves were randomly selected from five Groundnut plants/plot and were assessed for scoring the incidence of diseases. The data were computed to percent diseases index (PDI) using following formula:

$$PDI = \frac{\text{Sum of numerical values}}{\text{Number of leaves observed}} \times \frac{100}{\text{Maximum disease rating value}}$$

For soil borne diseases like collar rot, dry root rot diseases, per cent incidence (mortality/rotting) was calculated as under:

$$\text{Per cent incidence} = \frac{\text{No. of plants affected}}{\text{Total no of plants observed}} \times 100$$

To treat the seed, slurry with requisite quantity of test fungicide with 10 ml of water per kg of seed was made and swirled in a closed container to make uniform quoting on the seeds. Coated seeds were then shade dried and was sown on the same day or next day.

The observation on leaf spot and collar rot were recorded on 30, days after sowing and dry root rot at harvest. The PDIs and per cent rotting data were suitably transformed into arcsine values, analyzed and presented with DMRT symbols. The weights of Groundnut pods harvested were summed up for calculating plot-wise total yield and converted into q/ha and statistically analyzed.

3. RESULTS AND DISCUSSION

1. Effect of seed treatment on seed germination

Significant improvement in seed germination was observed due to Seed treatment with different chemicals as compared to untreated plots. Maximum germination of 95.17% and 94.17% were recorded in plots treated with Carbendazim 12% + Mancozeb 63% WP @ 3.0 g/kg of seeds and @ 2.5 g/kg of seeds, respectively, which were at par with Carboxin 37.5% + Thiram 37.5% DS @ 3.0 g/kg of seeds (94.33%) and Tebuconazole 2% DS @ 1.25 g/kg of seeds (91.33%). Germination count under these treatments was significantly superior to rest treatments. Carbendazim 50% WP @ 2.0 g/kg of seeds was the next treatment in order of superiority providing 87.33% germination and at par with lower dose of Carbendazim 12% + Mancozeb 63% WP @ 2.0 g/kg of seeds (85.33%), insignificantly followed by Mancozeb 75% WP @ 2.5 g/kg of seeds (84.67%). Control plots in which seeds were not treated with any chemical and recorded 77.67% germination only (Table 1).

2. Effect on Early (Tikka) Leaf spot of groundnut *(Cercospora arachidicola)*

Spraying of different chemicals provided significant control of early leaf spot disease as compared to unsprayed plots (Table 1). However, seed treatment of Carbendazim 12% + Mancozeb 63% WP @ 3.0 g/kg of seeds provided the maximum control (PDI 7.18) of the early leaf spot disease which was on par with middle dose of Carbendazim 12% + Mancozeb 63% WP @ 2.5 g /kg of seeds (PDI 8.22). Standard check, Carboxin 37.5% + Thiram 37.5% @ 3.0 g /kg of seeds (PDI 9.37) proved next best effective treatment and found at par with Tebuconazole 2% DS @ 1.25/kg of seeds (PDI 9.62). These treatments were found significantly superior over rest treatments and differing insignificantly with lower dose of Carbendazim 12% + Mancozeb 63% WP @ 2.0 g/kg of seeds (PDI 11.70), Carbendazim 50% WP @ 2.00 g /kg of seeds (PDI 11.80), Mancozeb 75% WP @ 2.5 g /kg of seeds (PDI 14.94). Highest Disease incidence (PDI 19.33%) was recorded from untreated control plot.

The results are in confirmation with Patel *et al.,* [10], “wherein they used sevan fungicidal sprays, First spray of the fungicides was done immediately after the initial appearance of disease symptoms and control plot was sprayed by water. Among them minimum disease intensity was recorded by spraying of carbendazim 12% + mancozeb 63% at 0.15% (31.83%) in checking the leaf spot of groundnut. The maximum disease intensity (55.96%) was recorded in untreated control during both the Years individuals as well as polled also. The economics of spraying of different fungicides revealed that the highest incremental cost: benefit ratio (ICBR) was obtained by three spraying of carbendazim 12% + mancozeb 63% at 0.15%, followed by Hexaconazole 5% at 0.005% (1:10.00)”.

Table 1. Evaluation of Bioefficacy of Carbendazim 12 % + Mancozeb 63 % WP against major diseases of groundnut

Sl. No.	Treatments	At 10 DAS	At 30 DAS		At Harvest	Dry pod Yield (q/ha)	Fodder yield (q/ha)	Increased Yield over Control (%)	Cost to Benefit ratio
		*Germination (%)	*Collar rot (%)	*Early leaf spot (PDI)	*Dry root Rot (%)				
1	ST with Carbendazim 12 % + Mancozeb 63 % WP @ 2.0g/kg seeds	85.33 (67.49)	4.50 (12.25)	11.70 (20.00)	3.67 (11.04)	24.37	37.31	24.47	1:3.64
2	ST with Carbendazim 12 % + Mancozeb 63 % WP @ 2.5g/kg seeds	94.17 (76.03)	2.18 (8.50)	8.22 (16.66)	2.42 (8.94)	26.90	41.13	37.39	1:4.01
3	ST with Carbendazim 12 % + Mancozeb 63 % WP @ 3.0g/kg seeds	95.17 (77.31)	1.98 (8.10)	7.18 (15.55)	2.20 (8.53)	27.23	41.72	39.08	1:4.05
4	ST with Mancozeb 75 % WP @ 2.5g/kg seeds	84.67 (66.95)	6.18 (14.40)	14.94 (22.74)	5.77 (13.90)	25.33	35.33	29.37	1:3.78
5	ST with Carbendazim 50 % WP @ 2.0g/kg seeds	87.33 (69.16)	5.10 (13.06)	11.80 (20.09)	4.65 (12.45)	25.63	35.19	30.90	1:3.83
6	ST with Tebuconazole 2% DS @ 1.25 ml/kg seeds	91.33 (72.88)	3.13 (10.20)	9.62 (18.07)	4.82 (12.68)	25.67	39.58	31.11	1:3.82
7	ST with Carboxin 37.5 % + Thiram 37.5 % DS@ 3.00 ml/kg seeds	94.33 (76.23)	2.85 (9.72)	9.37 (17.83)	3.23 (10.36)	26.75	39.08	36.62	1:3.89
8	Untreated Control	77.67 (61.80)	15.70 (23.34)	19.33 (26.09)	12.98 (21.12)	19.58	31.50	-	1:2.94
	SEm ±	0.604	0.215	0.311	0.358	0.338	0.700		
	C.D Value (*P=0.05*)	1.833	0.652	0.944	1.087	1.067	2.124		

**Figures in parentheses are angular transformed values; PDI: Per cent disease index; DAS: Days after sowing*

3. Effect on Dry root rot of groundnut

Minimum rotting due to dry root rot was observed from seed treatment of Carbendazim 12% + Mancozeb 63% WP @ 3.0 g /kg of seeds (2.20% rotting) which was on par with Carbendazim 12% + Mancozeb 63% WP at the rate of 2.5 g /kg of seeds (2.42% rotting) and standard check Carboxin 37.5% + Thiram 37.5% DS @ 3.0 g /kg of seeds (3.23% rotting). Control provided by these treatments was significant as compared to other treatments. The next effective seed treatments, lower dose of Carbendazim 12% + Mancozeb 63% WP @ 2 g/kg of seeds (3.67% rotting), Carbendazim 50% WP @ 2.00 g /kg of seeds (4.65% rotting) and Tebuconazole 2% DS @ 1.25 g/kg of seeds (4.82% rotting) which were at par with each other. Mancozeb 75% WP @ 2.5 g /kg of seeds was recorded 5.77% rotting incidence. Untreated control plots exhibited 12.98% rotting due to dry root rot disease (Table 1). Similar results obtained by Devi (2016) where in field trial was conducted with the new fungicide product (Carbendazim 12% + Mancozeb 63% WG) during the season of July to October, 2012 and 2013 at TNAU indicated that this product (Carbendazim 12%+Mancozeb 63% WG)@ 2.5 g kg-1 seed dose can effectively control dry root rot of groundnut.

4. Effect on Collar rot of groundnut *(Aspergillus niger)*

The incidence of collar rot in the trial ranged between 1.98 and 15.70 per cent (Table 1). Seed treatment with different chemicals provided significant control of collar rot disease. Minimum rotting of 1.98% was recorded from seed treatment of Carbendazim 12% + Mancozeb 63% WP @ 3.0 g /kg of seeds which was on par with Carbendazim 12% + Mancozeb 63% WP at the rate of 2.5 g /kg of seeds (2.18% rotting). Carboxin 37.5% + Thiram 37.5% @ 3.0g /kg of seeds (2.85% rotting) was found next effective treatment and at par with Tebuconazole 2% DS @ 1.25 g /kg of seeds (3.13% rotting). These treatments were found significantly superior over rest chemicals. Lower dose of Carbendazim 12% + Mancozeb 63% WP @ 2.0 g /kg of seeds was recorded 4.50% rotting. The Seed treatment of the Carbendazim 50% WP @ 2.0 g /kg of seeds was recorded 5.10% collar rot, Mancozeb 75% WP @ 2.5 g /kg of seeds was recorded 6.18% collar rot incidence. Untreated control plots recorded 15.70% plant mortality due to collar rot disease. Similar, results obtained by Devi [11] where in field trial was conducted with the new fungicide product (Carbendazim 12% + Mancozeb 63% WG) during the season of July to October, 2012 and 2013 at TNAU indicated that this product (Carbendazim 12%+Mancozeb 63% WG)@ 2.5 g kg-1 seed dose can effectively control collar rot of groundnut.

5. Dry Pod and Fodder Yield (q/ha)

Pod and fodder yield recorded from different treatments are presented in Table 1. Carbendazim 12% + Mancozeb 63% WP @ 3.0 g /kg of seeds recorded the maximum pod and fodder yield of 27.23 q/ha and 41.72 q/ha respectively which was on par with Carbendazim 12% + Mancozeb 63% WP @ 2.5 g /Kg seeds (pod yield 26.90 q/ha and fodder yield of 41.13 q/ha), Carboxin 37.5% + Thiram 37.5% DS @ 3.0 g/ha (pod yield 26.75 q/ha and fodder yield of 39.08q/ha) and Tebuconazole 2% DS @ 1.25 g /kg of seeds (pod yield 25.67 q/ha and fodder yield of 39.58q/ha). These treatments provided significant increase in yield over control ranging between 31.11 to 39.08 per cent. Carbendazim 50% WP @ 2.0 g /kg of seeds dose proved the next best treatment (pod yield 25.63 q/ha and fodder yield of 35.19q/ha) which was on par with the treatment of Mancozeb 75% WP @ 2.5 g /kg of seeds (pod yield 25.33 q/ha and fodder yield of 35.33q/ha) and lowest dose of Carbendazim 12% + Mancozeb 63% WP @ 2 g/kg of seeds recorded pod yield 24.37 q/ha and fodder yield of 37.31q/ha. Untreated control yielded least pod yield of 19.58 q/ha and fodder yield of 31.50q/ha.

6. Cost Benefit ratio

Cost benefit ratio calculation revealed that the highest CB ratio was observed in the treatment SAAF (Carbendazim 12% + Mancozeb 63% WP) @ 3.0 g/kg of seeds and followed by its next lower dose @ 2.5 g/kg of seeds compared to its solo formulations (Table 1).

4. CONCLUSION

The field trial conducted during *Kharif* 2019-20 at College of Sericulture, Chintamani indicated that fungicide seed treatment with Carbendazim 12% + Mancozeb 63% WP @ 3.0 g and 2.5 g /kg of seeds recorded seed germination of 95.17% and 94.17% % respectively can effectively control Early (Tikka) Leaf spot (PDI 7.18 and 8.22), Dry root rot (2.20% and 2.42% incidence) and Collar rot (1.98% and 2.18%)

diseases of Groundnut with better pod yield (27.23 q/ha and 26.90 q/ha) and fodder yield (41.72 q/ha and 41.13 q/ha) than its lower dose and other treatments with highest cost to benefit ratio of 1:4.05 and 1:4.01 respectively.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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