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Short communication

Management of soil borne diseases of groundnut through seed dressing fungicides

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ABSTRACT

Soil borne diseases *viz.*, stem rot, collar rot and aflaroot are potential threat to groundnut cultivation. Although some plant diseases may be managed through resistant varieties and alteration of cultural practices, some diseases are only managed effectively with the application of suitable fungicides. About 150 chemicals belonging to different classes are used as fungicides in various countries. In this context, we evaluated ten systemic seed dressing fungicides and their combinations for management of major soil borne diseases of groundnut during *kharif* 2009 and 2010 at Directorate of Groundnut Research (DGR), Junagadh Experimental Farm. The fungicides *viz.*, hexaconazole, tebuconazole, propiconazole, difenconazole, vitavax, carbendazim along with captan and mancozeb and various combinations were applied as seed treatment at recommended doses. The results indicated that tebuconazole 2 DS @ 1.5 g kg^{-1} seed, mancozeb 75% WP @ 3 g kg^{-1} seed, carbendazim 12% + mancozeb 63% WP @ 3 g kg^{-1} seed, were very effective in the management of soil borne diseases when used separately, with apparent yield advantage over untreated plots.

1. Introduction

Groundnut (*Arachis hypogaea* (L.)) is an important oilseeds and ancillary food crop in India with 4.7 million tonnes production from 4.7 million ha area (2012–13), and also has good export potential with about 0.56 million tonnes in 2012–13. India is the largest grower of groundnut and second largest producer after China with a national average productivity about 821 kg ha^{-1} in *kharif* and 3000 kg ha^{-1} during *rabi*-summer (2012–13) [Kharif and rabi season in India is cropping seasons. Kharif crops are the crops which sown in the month of May to June and harvested in the month of September and October mainly it is rain fed season. Rabi is particularly for the crops, sown in the month of October to November and harvested in the month of March to April]. Major groundnut growing states in India are Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Rajasthan and Maharashtra. The rest of the area are mainly scattered in the states of Odisha, Punjab, Uttar Pradesh and Madhya Pradesh (Anonymous, 2013). The productivity of groundnut in India is low in comparison to world average i.e. 1646 kg ha^{-1} and much lower than major groundnut growing countries like USA (4699 kg ha^{-1}), China (3572 kg ha^{-1}), Myanmar (1559 kg ha^{-1}), and Indonesia (2236 kg ha^{-1}) (FAO, 2012). Low productivity may be attributed to the rain-fed cultivation of the crop coupled with damage caused by diseases and insect pests. About 80% of groundnut crop is cultivated in rain-fed areas where productivity fluctuates between 500 and 1500 kg ha^{-1}. Diseases cause considerable yield losses in groundnut. Fungal, virus and bacterial pathogens attack the crop at various stages of growth and cause severe yield losses, and in some cases impairing quality. The major soil borne diseases of groundnut caused by fungi are collar rot/crown rot/seedling blight (*Aspergillus niger*), stem rot/Sclerotium wilt (*Sclerotium rolfsii Sacc.*), aflaroot (*Aspergillus flavus*) and dry root rot/dry wilt (*Macrophomina phaseolina*). Among all diseases, stem rot is reported to cause losses in yield up to 25% (Mayee and Datar, 1988) and collar rot up to 40% in India (Chohan and Singh, 1973). The losses may amount to 40–50% in terms of mortality of crop (Aulakh and Sandhu, 1970) particularly in *kharif* groundnut when the climatic conditions are more favourable for pathogen. Mehan and Chohan (1974), was first to report aflaroot of groundnut. Besides causing disease, *A. flavus* is known to produce aflatoxins. Both the toxigenic and non-toxigenic strains have been reported (Subramanyam and Rao, 1977; Gangawane and Jadhav, 1982). Among various methods, fungicides serve as important

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tools for managing diseases in agricultural crops. Although some plant diseases may be managed through resistant varieties and alteration of cultural practices, several diseases are only managed acceptably with the application of a suitable fungicide (Thind, 2008). A convenient means of applying crop protection treatments involves treating the seed. Seed treatments can be particularly useful, since they can provide protection to young plants during a vulnerable stage in their development (Walters et al., 2013). Fungicide seed treatment is a cheap insurance for peanut seed producers and growers. Correct fungicide use can contribute to better performance of the propagation material, increasing the yield (Zhang et al., 2001). In view of the above facts, the present study was undertaken with ten systemic seed dressing fungicides and a few combinations thereof for the management of major soil borne diseases of groundnut.

2. Materials and methods

An experiment was conducted at the research farm of Directorate of Groundnut Research, Junagadh, Gujarat (70° 36′ E longitude and 21° 31′ N latitude and at an altitude of 60 m above mean sea level). The climate of the region is semi-arid with a mean annual rainfall of 850 mm. The rainfall is mainly confined during June to September months. The monthly average temperature is minimum in January (12 °C) and maximum in May (42 °C). The soils under study were shallow (<30 cm), very dark grey in colour having clay texture (>40%), medium black and are calcareous in nature underlain by weathered or hard milliolithic limestone parent materials, having good drainage facility. The surface soils (0–15 cm) were also alkaline (pH 8.2) in reaction, medium in organic carbon (0.49%) and phosphorus (10 kg ha^{-1}), low in nitrogen (130 kg ha^{-1}), high in potassium (167 kg ha^{-1}) and micronutrients were in the range of medium to high (Jat and Meena, 2014) and (Meena et al., 2014). The experiment was conducted on a fixed site for two years (twice) from 2009 to 2010 in the *kharif* season, using randomized block design with eleven treatments including appropriate control in 15 m^2 (5 m × 3 m) plot size with 30 cm × 10 cm spacing in three replications. The groundnut variety (GG2) was selected for the study. Plots were inoculated with *A. niger* and *S. rolfsii* by incorporation of infested sorghum grains (@ 15 kg ha^{-1} area) to soils (Branch and Brenneman, 1999). *S. rolfsii* and *A. Niger* were mass multiplied using virulent cultures of both fungus isolated from the groundnut crop and grown on potato dextrose agar in petri plates and sub cultured the extensive mycelial growth (7 day old culture) of fungus onto sterile, rehydrated, autoclaved sorghum grains in autoclavable polythene bags and incubate at 28 ± 2 °C for 15–17 days. The fungus produced profuse mycelium and sclerotia of *S. rolfsii* on the sorghum grains and used for soil inoculation. (Mehan et al., 1995) The following treatments (fungicides) were used as seed dressing:

The detail of fungicides used are given below:

Two hundred grams of groundnut seed was treated with each seed dressing fungicides seven days before sowing. The seeds were shaken separately with each fungicide at their respective doses for 20–30 min to ensure uniform coating. The experiment was conducted in a randomized block design. Observations were recorded on initial 20 DAS and final plant stand (at harvest), incidence of collar rot at 30 DAS (Days after sowing), and incidences of stem rot, root rot and pod rot at harvest. Severity of foliar diseases *viz*., early leaf spot (ELS, *Cercospora arachidicola*), late of leaf spot (LLS, *Phaeiosariopsis personata*), and rust (*Puccinia archidis*) were recorded after 45 and 70 DAS (Days after sowing) by adopting a 1–9 modified scale (Subrahmanyam et al., 1995) and in case of soil borne diseases per cent disease incidence was computed. Per cent Soil-borne Disease incidence, Per cent efficacy of disease control (PEDC), Per cent yield increase over disease control (PIDC) was calculated by using the following formulae:

$$\text{Per cent Soil} - \text{borne Disease incidence} = (\text{number of infected plant units}/\text{total number of plant units assessed}) \times 100$$

$$\text{Per cent efficacy over Disease Control (PEDC)} = [(\text{Disease severity or incidence in control} - \text{Disease severity or incidence in treatment})/\text{Disease severity or incidence in control}] \times 100$$

$$\text{Per cent yield increase over Disease Control (PIDC)} = [(\text{Yield in treatments} - \text{Yield in Control})/\text{Yield in Control}] \times 100$$

The incremental cost benefit ratio (ICBR) and Benefit:Cost Ratio (B:C ratio) of all the treatments was calculated using following formulae:

$$\text{ICBR} = \text{ICBR} = \text{Additional income received (from the particular treatment)}/\text{Additional cost incurred (for the particular treatment)}$$

Treatment	Treatment detail
T_1	hexaconazole 5% SC @ 2 ml kg^{-1} seed
T_2	hexaconazole 5% SC @ 1 ml kg^{-1} seed + captan 50% WP @ 3 g kg^{-1} seed
T_3	carbendazim + mancozeb @ 3 g kg^{-1} seed
T_4	tebuconazole 2 DS @ 1.5 g kg^{-1}seed
T_5	propiconazole 25% EC @ 2 ml kg^{-1}seed
T_6	difenconazole 25% EC @ 2 ml kg^{-1}seed
T_7	vitavax 75% WP @ 2 g kg^{-1}seed
T_8	carbendazim 50% WP @ 2 g kg^{-1}seed
T_9	mancozeb @ 3 g kg^{-1}seed
T_{10}	captan @ 3 g kg^{-1}seed
T_{11}	control i.e. without any seed treatment