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Efficacy of different triazole fungicides in reducing combined incidence of early leaf spot, late leaf spot and rust diseases of groundnut

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Abstract

Groundnut (*Arachis hypogaea* L.) is a significant crop of oilseeds suffering from many diseases, including early and late leaf spot and leaf rust, the most commonly distributed and economically significant foliar diseases of groundnut that cause severe crop damage. To find out the most effective fungicide for management, a field trial with six fungicides was performed. In present study it was revealed that all the triazole fungicides significantly reduced leaf spots and rust and increased pod and haulm yield. However, the per cent disease reduction over control varied with fungicides. Hexaconazole + zineb (0.1%), tebuconazole (0.3%) and tebuconazole (0.15%) significantly reduced early as well as late leaf spot when compared with other fungicidal treatments. Hexaconazole + zineb (0.1%) sprayed plots had minimum disease severity, remained green due to higher chlorophyll content and took 10 days more for harvest which was observed as an additional effect on crop. The efficacy of hexaconazole + zineb (0.1%) treatment was at par with tebuconazole (0.3%) treatment.

Keywords: Triazole Fungicides, Early Leaf Spot, Late Leaf Spot, Rust Diseases, Groundnut.

Introduction

Groundnut (*Arachis hypogaea* L.) is the thirteenth most important crop plant grown for food in the tropical, subtropical and temperate zones of the world. It is extensively grown in India, China, U.S.A., Nigeria, and West Africa (Mangelesdrof, 1961). In India, groundnut is a premier oilseed crop, which occupies about 28 per cent of the area under oilseeds contributing 25.4 per cent of the total oilseeds production. India is a leading groundnut producing country in the world with 38.16 per cent total area and 32.01 per cent of the total production but it ranks eighth in productivity among the groundnut producing countries of the world (Anonymous, 2002a). Groundnut is grown over an area of 223.30 lakh hectares in the world with annual production of 477.70 lakh tones with average productivity of 2148.66 kg/ha. In India, groundnut is grown over an area of 58 lakh hectares with annual production of 49.80 lakh tones with productivity of 858.62 kg/ha (Anonymous, 2004).

Even though, groundnut is not a traditional crop of Konkan region, it is very popular amongst the farmers of this region being a commercial crop. Groundnut is successfully grown in Konkan region in both *Kharif* and *rabi* seasons. The area under groundnut in Konkan region is 0.019 lakh hectares with 0.016 lakh tones of production and productivity of 842 kg/ha in *Kharif* season. In *rabi* season area under the crop is 0.041 lakh hectares with 0.089 lakh tonnes of production and productivity of 2171 kg/ha (Patil, 2006) [12]. Nimbiar *et al.* (1980) estimated that per hectare pod yield of groundnut is around 3.5 tones with fixation of 190 kg N/ha approximately. Groundnut haulms are very nutritious feed for cattle particularly, for milking animals as it contains 8.30 to 15.00 per cent proteins and 22.11 to 35.35 per cent crude fiber. Occurrence of a number of diseases, during different phases crop growth pose a major threat to its productivity. Tirmali (2001) [16] reported three foliar diseases *viz.* ELS (*Cercospora arachidicola* Hori), LLS (*Phaeoisariopsis personata* (Berk and Curt.)) and Rust (*Puccinia arachidis* Speg.) are responsible for low productivity of the crop under Konkan conditions. Subrahmanyam *et al.* (1980) recorded 70 per cent yield losses in susceptible genotypes due to combined effect of early as well as late leaf spot and rust. Losses were more in the rainy season than in the post rainy season. Losses in yield due to leaf spot and rust were 50 per cent (Siddarmaiah *et al.*, 1977) and 27 per cent (Navil, 1980) respectively. Besides reduction in pod yield, these diseases adversely affect the fodder quality.

In order to minimize these losses different fungicides have already been recommended. However, the efficacy of triazole group of fungicides needs to be confirmed against ELS, LLS and rust. The present investigation was therefore, undertaken with the following objective

“efficacy of different triazole fungicides in reducing combined incidence of early leaf spot, late leaf spot and rust.”

Materials and Methods

Effect of triazole fungicides on ELS, LSS and Rust severity

Experimental site

The field trial was conducted at Department of Agronomy, college of Agriculture, Dapoli, Dist. Ratnagiri during *Kharif* season of the year 2010 on variety 'Konkan Gaurav'.

Climate, weather and soil condition

Agronomy farm, college of Agriculture, Dapoli is situated in the sub-tropical region on the 17°45' North latitude and 73°12' East longitude having an altitude of 250 meter above the mean sea level. The climate is subtropical which is characterized by warm and humid days. The normal annual precipitation of Dapoli is 3500 mm distributed from the beginning of June to end of September in normal course. The metrological data during the course of investigation was recorded from metrological observatory at Agronomy farm, College of Agriculture, Dapoli during the period of experimentation. The soil of the experimental site was sandy-clay-loam in texture and slightly acidic in reaction.

Preparation of experimental plot

The soil of experimental plot was prepared by ploughing with a tractor drawn mould board plough followed by two crosswise cultivations with tractor operated tine cultivar. Planking was done after fine cultivation to bring the field into good tilt and to make smooth surface before layout of the experiment. The experimental layout as per the Randomized Block Design was made on the field and treatments were separately randomized in the experimental unit.

Plan of Layout

Season: *Kharif*, 2010, Total plot size: 13× 21m², Spacing: 30 cm × 15 cm, Fertilizer dose: 25:50:50 NPK, Kg/ha., Crop: Groundnut, Variety: Konkan Gaurav, Date of sowing: 23 /06/2010, Design: Randomized Block Design (RBD), Replications: Three, Treatment: Seven.

Application of manures and fertilizers

Nitrogen (25 kg/ha), Phosphorus (50kg P₂O₅/ha) and Potassium (50 kg K₂O/ha) were applied in the form of urea (46.6 per cent N), Single super phosphate (16 per cent P₂O₅) and Murate of potash (60 per cent K₂O) respectively as a basal dose along with FYM (10 t/ha). The fertilizers were placed in single dose just below the seed at the time of sowing.

Schedule of spraying

The crop was observed carefully for initiation of disease. Three sprays of fungicides were applied at an interval of 20 days starting from initiation of disease symptoms of ELS. The spray schedule was as under. First, Second and Third spraying 01.08.2010, 20.08.2010 and 10.09.2010 respectively.

Method of recording observations.

Eight plants per treatment per replication were randomly selected for recording disease incidence for early leaf spot (ELS), late leaf spot (LLS) and rust separately at the start of experiment for recording observations.

Per cent disease intensity (PDI)

The per cent disease intensity was computed by the formula given by McKinney (1923).

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{Total number of leaves examined X Maximum rating}} \times 100$$

Per cent disease control (PDC)

$$PDC = \frac{\text{PDI in control} - \text{PDI in treatment}}{\text{PDI in control}} \times 100$$

Harvesting

For recording pod and haulm yields, different plots were harvested separately and their dry weights were recorded.

Result

Field trial for effective management of leaf spots and rust of groundnut

The observations on severity of leaf spots and rust diseases and pod and haulm yields of cv. 'Konkan Gaurav' is presented in table -11, 12, 13, 14 & 15.

It was revealed that all the fungicides significantly reduced leaf spots and rust and increased pod and haulm yield. However, the per cent disease reduction over control varied with fungicides. Hexaconazole + zineb (0.1%), tebuconazole (0.3%) and tebuconazole (0.15%) significantly reduced early as well as late leaf spot when compared with other fungicidal treatments. Hexaconazole + zineb (0.1%) sprayed plots had minimum disease severity, remained green due to higher chlorophyll content and took 10 days more for harvest which was observed as an additional effect on crop. The efficacy of hexaconazole + zineb (0.1%) treatment was at par with tebuconazole (0.3%) treatment.

Spraying of hexaconazole + zineb (0.1%) was most effective in increasing pod yield (2380 kg/ha), haulm yield (2921kg/ha) with lowest disease intensity of ELS (20.24%), LLS (10.45%) and rust (17.39%) as compared to control. Maximum disease intensity of ELS (55.77%) LLS (42.16%) and rust (50.28%) was recorded in control with minimum yield of pods and haulm (1497 kg and 1612 kg/ha respectively). The per cent disease control (PDC) by hexaconazole + zineb (0.1%) over control treatment was 63.70, 75.21 and 65.44 per cent for ELS, LLS and rust, respectively (Table 1). It was followed by tebuconazole (0.3%) in where pod yield (2298 kg/ha) and haulm yield (2733 kg/ha) was recorded. Per cent disease control (PDC) over check was 58.86%, 70.65% and 50.60% for ELS, LSS and rust respectively. There was 59.2 and 81.20 per cent increase in pod and haulm yields in hexaconazole + zineb (0.1%) treatment followed by tebuconazole (0.3%) which recorded 53.51 and 69.56 per cent increase in pod and haulm yield respectively.

Tebuconazole (0.15%) and tebuconazole (0.3%) were at par in reducing disease intensity of ELS, LLS and rust. Their per cent disease control (PDC) over check was 59.01, 71.06 and 59.42 per cent respectively with pod yield of 2246kg/ha and haulm yield of 2712 kg/ha. Increase in pod and haulm yield was 50.03 and 68.23 per cent respectively.

Tebuconazole (0.15%) was followed by difenconazole (0.1%) in reducing disease intensity by recording ELS (29.89%) LLS (18.57%) and rust (27.77%) with per cent disease control (PDC) over check to the tune of 46.40, 55.95 and 40.30 per cent respectively. It also recorded higher pod and haulm yield (2100.33 and 2461 kg/ha). There was 40.30 and 52.70 per cent increase in pod and haulm yield due to this treatment.

The fungicides propiconazole (0.1%) and tebuconazole (0.1%) were least effective in reducing disease intensity as well as on the yield parameters. In propiconazole treatment, there was 38.20 and 48.28 per cent increase in pod and haulm

yield. Propiconazole (0.1%) recording disease intensity of ELS (32.86%) LLS (21.63%) and rust (29.92%) with per cent disease control (PDC) over check 41.79, 48.69 and 40.49 per cent respectively and recording pod (2069kg/ha) and haulm (2390.33 kg/ha). There was 38.20 and 48.28 per cent increase in pod and haulm yields. While three sprays with tebuconazole (0.1%) recording disease intensity of ELS (35.29%) LLS (27.41%) and rust (29.60%) with per cent disease control (PDC) over check 36.72, 34.98 and 41.12 per cent respectively and recording pod (1756kg/ha) and haulm (1968kg/ha) There was 17.30 and 22.84 per cent. The above results clearly indicate that there was reduction in pod and haulm yields of groundnut when crop was severely affected by early leaf spot, late leaf spot and rust diseases, which occurred concomitantly. However, hexaconazole + zineb (0.1%), tebuconazole (0.3%) and tebuconazole (0.15%) significantly increased the pod yield and haulm yield by reducing early, late leaf spot and rust diseases when compared to other treatments.

Discussion

Efficacy of triazole fungicides

All the triazole fungicides used in present studies were significantly superior to control. Three sprays of hexaconazole + zineb (0.1%), tebuconazole (0.3%) and tebuconazole (0.15%) significantly reduced ELS, LLS and rust as compared to other fungicidal treatments.

Spraying of hexaconazole + zineb (0.1%) was most effective treatment in increasing pod yield (2380 kg/ha) and haulm yield (2921 kg/ha) with lowest disease severity of ELS (20.24%), LLS (10.45%) and rust (17.39%). It was followed by tebuconazole 0.3% and 0.15%. Further, both these treatments were statistically undifferentiable. Difenconazole (0.1%) was less effective than tebuconazole (0.15%). Adiver *et al.* (1995) [1] recommended tebuconazole (0.1%) and difenconazole (0.1%) for control of LLS and rust with 40 to 53 per cent increase in pod yield. Jadeja *et al.* (1999) [6] used hexaconazole (0.025%) and difenconazole (0.0125%) to reduce leaf spot and rust. Narayana (2004) conducted field trails and tested three triazole fungicides against ELS, LLS and rust of groundnut and found lowest disease severity of ELS (10.34%), LLS (12.34%) and rust (12.30%) as compared to control by using hexaconazole (0.1%).

Propiconazole (0.1%) was next to difenconazole (0.1%) in reducing disease severity recording ELS (32.86%), LLS (21.63%) and rust (29.92%). Similar results were also obtained by Biswas and Sing (2005) [2] who reported that propiconazole (0.025%) recorded least disease severity of leaf spot (5.3%) and rust (5.5%). Tiwari, *et al.* (2004) [17] also found hexaconazole (0.1%) and propiconazole (0.1%) were the most effective fungicides for control of ELS, LSS and rust of groundnut.

Table 1: Per cent early Leaf spot intensity (PDI) in Groundnut cv. 'Konkan Gaurav'.

Sr. No.	Treatments	Conc. (%)	Replication			Mean	Per cent disease control over check
			I	II	III		
1	Tebuconazole	0.1	33.87 (35.59)	35.00 (36.28)	32.99 (35.06)	35.29 (33.96)	36.72
2	Tebuconazole	0.15	21.28 (27.47)	22.24 (28.14)	25.06 (30.04)	22.86 (28.55)	59.01
3	Tebuconazole	0.3	22.78 (28.51)	23.25 (28.83)	22.80 (28.52)	22.94 (28.62)	58.86
4	Difenconazole	0.1	27.76 (31.79)	31.32 (34.04)	30.59 (33.58)	29.89 (33.14)	46.40
5	Propiconazole	0.1	30.17 (33.32)	33.62 (35.44)	34.80 (36.15)	32.86 (34.97)	41.79
6	Hexaconazole +Zineb	0.1	20.18 (20.18)	18.75 (25.66)	21.80 (27.83)	20.24 (26.73)	63.70
7	Control (No spray)	-	53.08 (46.76)	59.73 (50.61)	54.51 (47.59)	55.77 (48.32)	-

S.E. \pm = 0.64
C.D. at 5% = 1.98

Table 2: Per cent Late Leaf spot intensity (PDI) in Groundnut cv. 'Konkan Gaurav'.

Sr. No.	Treatments	Conc. (%)	Replication			Mean	Per cent disease control over check
			I	II	III		
1	Tebuconazole	0.1	26.52 (30.99)	27.33 (31.52)	28.37 (32.18)	27.41 (31.57)	34.98
2	Tebuconazole	0.15	12.52 (20.73)	13.52 (21.58)	10.50 (18.96)	12.20 (20.42)	71.06
3	Tebuconazole	0.3	11.94 (20.21)	12.99 (21.13)	12.19 (20.44)	12.37 (20.59)	70.65
4	Difenconazole	0.1	17.81 (24.96)	18.69 (25.62)	19.20 (25.99)	18.57 (25.52)	55.95
5	Propiconazole	0.1	22.32 (28.19)	21.63 (27.72)	20.94 (27.24)	21.63 (27.72)	48.69
6	Hexaconazole +Zineb	0.1	10.96 (19.33)	9.67 (18.13)	10.71 (19.10)	10.45 (18.85)	75.21
7	Control (No spray)	-	42.55 (40.72)	45.74 (42.56)	38.18 (38.16)	42.16 (40.48)	-

S.E. \pm = 0.61
C.D. at 5% = 1.89

Table 3: Per cent Leaf Rust intensity (PDI) in Groundnut cv. 'Konkan Gaurav'.

Sr. No.	Treatments	Conc. (%)	Replication			Mean	Per cent disease control over check
			I	II	III		
1	Tebuconazole	0.1	33.11 (35.13)	27.33 (31.52)	28.36 (32.18)	29.60 (32.94)	41.12
2	Tebuconazole	0.15	20.88 (27.19)	17.41 (24.67)	21.82 (27.85)	20.04 (26.57)	59.42
3	Tebuconazole	0.3	19.45 (26.17)	21.07 (27.33)	21.02 (27.29)	20.51 (26.93)	50.60
4	Difenconazole	0.1	25.50 (30.33)	30.07 (33.26)	27.75 (31.79)	27.77 (31.79)	44.76
5	Propiconazole	0.1	29.28 (32.76)	28.67 (32.38)	31.82 (34.34)	29.92 (33.16)	40.49
6	Hexaconazole +Zineb	0.1	17.40 (24.65)	15.82 (23.44)	18.95 (25.81)	17.39 (24.63)	65.44
7	Control (No spray)	-	51.72 (45.99)	53.01 (46.73)	46.11 (42.77)	50.28 (45.16)	-

S.E. \pm = 0.93
C.D. at 5% = 2.87

Table 4: Effect of fungicidal Spray on pod yield (Kg/ha.) in Groundnut cv. 'Konkan Gaurav'.

Sr. No.	Treatments	Conc. (%)	Replication			Mean	Per cent yield increase over check
			I	II	III		
1	Tebuconazole	0.1	1667	1805	1796	1756.00	17.30
2	Tebuconazole	0.15	2117	2286	2335	2246.00	50.03
3	Tebuconazole	0.3	2335	2468	2091	2298.00	53.51
4	Difenconazole	0.1	2020	2236	2045	2100.33	40.30
5	Propiconazole	0.1	1985	2135	2087	2069.00	38.20
6	Hexaconazole+Zineb	0.1	2259	2318	2565	2380.67	59.02
7	Control (No spray)	-	1696	13.82	1413	1497.00	-
S.E.± = 81.94							
C.D. at 5% = 252.49							

Table 5: Effect of fungicidal Spray on haulm yield (Kg/ha.) in Groundnut cv. 'Konkan Gaurav'.

Sr. No.	Treatments	Conc. (%)	Replication			Mean	Per cent yield increase over check
			I	II	III		
1	Tebuconazole	0.1	1854	1922	2128	1968.00	22.84
2	Tebuconazole	0.15	2541	2652	2943	2712.00	68.23
3	Tebuconazole	0.3	2585	2612	3003	2733.33	69.56
4	Difenconazole	0.1	2443	2408	2534	2461.67	52.70
5	Propiconazole	0.1	2353	2421	2397	2390.33	48.28
6	Hexaconazole+Zineb	0.1	2744	29.84	3035	2921.00	81.20
7	Control (No spray)	-	1651	1717	1448	1612.00	-
S.E.± = 74.47							
C.D. at 5% = 229.46							

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