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Evaluation of Azoxystrobin 7.5% and Propiconazole 12.5% SE against Foliar Diseases in 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 one of the important oilseeds of the world suffer from fungal diseases like early and late leaf spots and rust. These diseases are most economically important foliar diseases of groundnut causing severe damage to the crop are the major constraints in the cultivation. To know the efficacy of combiproduct, Azoxystrobin 7.5% + Propiconazole 12.5% SE, field experiments were laid out in Randomized Block Design with seven treatments and three replications during *Rabi* 2014-15 and *Rabi* 2015-16. During *Rabi* 2014-15, the treatment Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml/ha recorded 8.56 PDI of rust disease and 10.85 PDI of tikka disease with the yield of 25.25 q/ha followed by Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 ml/ha recorded 8.85 PDI of rust disease and 11.34 PDI of tikka disease with the pod yield of 24.85 q/ha compared to 30.33 PDI of rust disease and 36.78 PDI of tikka disease recorded in untreated control with the pod yield of 15.14 q/ha. Similar trend was also observed during the second season of *Rabi* 2015-16, where Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml/ha recorded 10.07 PDI

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of rust and 9.00 PDI of tikka with the yield of 25.41q/ha which was on par with Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 ml/ha (10.24 PDI of rust disease and 9.67 PDI of tikka disease with yield of 25.18q/ha) and maximum PDI of rust 33.67 and tikka 40.25 PDI with yield of 16.35 q/ha were recorded in untreated control treatment. The foliar application of Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 ml/ha and Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml/ha were found on par in controlling of Rust and Tikka disease incidence and resulting higher pod yield of groundnut during both the seasons.

Keywords: Azoxystrobin 7.5% + propiconazole 12.5% SE; fungicides; groundnut; rust; tikka.

1. INTRODUCTION

"Groundnut (*Arachis hypogaea* L.) is one of the important principal oilseeds and food crops of the world suffer from many diseases among them, fungal diseases like early (*Cercospora arachidicola*) and late leaf spots (*Phaeoisariopsis personata*) and rust (*Puccinia arachidis*) are most widely distributed and economically important foliar diseases of groundnut causing severe damage to the crop are the major constraints in the cultivation of groundnut. India is the second largest producer of groundnuts after China. Groundnut is the largest oilseed in India in terms of production. In India during *kharif* 2020, groundnut was sown around 38.88 lakh hectares (96.07 lakh acre) which was 2.82 per cent lower than the corresponding period of last year 40.01 lakh hectares (98.86 lakh acre)" [1]. "Early leaf spot and late leaf spot are commonly present wherever groundnut is grown" [2]. "Groundnut normally suffers with leaf spot known as "Tikka" disease that appears during warm and humid Kharif season" [3]. "Besides causing quantitative losses, these diseases are responsible for reduction in protein content and oil recovery" [4]. "If not controlled, early leaf spot and late leaf spot diseases can cause extensive defoliation. Early leaf spot and late leaf spot are major destructive disease of groundnut production due to defoliation of leaves and caused 50 per cent or more reduction in pod yield" [5,6]. "The leaf spot diseases can cause 30 to 70 per cent loss in pod yield and reduction in the kernel quality" [7]. "Losses yield due to the diseases was recorded about 15 to 59 per cent in groundnut" [8]. "Various studies report 50% or more yield loss due to these foliar diseases" [9]. "Groundnut rust occurs in epidemic form in parts of northern Karnataka. The losses up to 29-42 per cent due to rust have been reported" [10]. "Therefore an effective management of crop is required from early stage of diseases development which can be assured by proper fungicides. Perusal of literature indicated that the application fungicides is quite effective in the management of foliar diseases" [11] and "several fungicides have been identified and evaluated to control these diseases at different places" [12]. "Few systemic and non systemic fungicides have been recommended to manage these diseases in the region" [13,14,15]. According to Mohammed [16] "control of *Cercospora* leaf spot through systemic fungicides can lead to the increased yield and high haulm quality". Looking to the knowledge on the severity of the disease, yield loss incurred due to leaf spots and rust in groundnut, field experiments were conducted to evaluate the fungicide Azoxystrobin 7.5% + Propiconazole 12.5% SE along with other fungicides for management of Rust and Tikka leaf spot diseases in Ground nut.

2. MATERIALS AND METHODS

Field experiment were conducted at farmer field in Eachanal village in the jurisdiction of Agricultural Extension Education Centre, Lingsugur, during *Rabi* 2014-15 and *Rabi* 2015-16. The groundnut variety TMV-2 was sown in plot size of 5 m x 4 m with 30 cm X 10 cm spacing on 19.11.2014 and 05.11.2015, respectively. Experiment was laid out in Randomized Block Design with seven treatments and three replications. All other agronomical practices were followed as per university package of practices for the *Rabi* cultivation. Combiproduct, Azoxystrobin 7.5% + Propiconazole 12.5% SE was tried at three concentrations as indicated below. Treatments were as follows:

T1 - Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 750 ml / ha; T2 - Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 ml / ha; T3 - Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml / ha; T4 - Azoxystrobin 23 % SC @ 500 ml / ha; T5 - Propiconazole 25% EC @ 500 ml / ha; T6 - Tebuconazole 25.9% EC @ 750 ml / ha; T7 - Untreated control.

The fungicides were applied as foliar spray treatment in the replicated plots just after the appearance of rust and tikka disease in the main

field during *Rabi* cultivation seasons of 2014-15 and 2015-16. The plots were inspected regularly to see the disease development and further two more spray were applied at an interval of 10 days. Control plot was sprayed with water only. Total quantity of spray liquid used was @ 500 l/ha. Observations on rust and leaf spot disease incidence were recorded before as well as 10 days after each spray from the randomly selected ten plants per plot. Ten plants were selected randomly from each plot and plants were graded on 1-9 scale on the basis of scoring of the diseases as per the disease rating scale [17]. Observation of intensity was observed in each replicated plot for each treatment and Per cent of disease index (PDI) was calculated by using the following formula [18]. The PDI values were transformed by angular transformation and analyzed statistically.

$$Percent\ Disease\ Index\ (PDI) = \frac{Sum\ of\ numerical\ rating}{Total\ no.of\ plants\ observed \times Maximum\ rating\ scale} \times 100$$

In order to record the yield, crop was harvested from the individual replicated plots on 20.04.2015 and 23.03.2016 during *Rabi*, 2014-15 and *Rabi*, 2015-16, respectively. Average pod yield per plot was recorded after allowing the pods to dry in sun for ten days after the harvest and converted into qt/hectare. All the data were statistically analyzed [19].

3. RESULTS AND DISCUSSION

3.1 Rust Disease

Among the treatments, Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml/ha and Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 ml/ha were found to be the best treatments as there were 8.56 PDI and 8.85 PDI of rust disease in groundnut were recorded respectively as compared to 30.33 PDI of rust disease in untreated control during first season (Table 1). The effect of foliar treatment on rust disease control with Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml/ha and Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 ml/ha were statistically on par with each other. Similar trend was also observed during the second season where Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml/ha recorded 10.07 PDI which was on par with Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 ml/ha (10.24 PDI) and found superior than rest of the treatments (Table 2). Maximum PDI i.e. 33.67 was recorded under untreated control condition during second season trial.

Fig. 1. Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1.75 ml/l i.e., 875 ml/ha sprayed plot

Fig. 2. Untreated control

Table 1. Efficacy of azoxystrobin 7.5% + Propiconazole 12.5% SE on rust and tikka disease incidence and yield of groundnut during *Rabi* 2014-15 (1st Season)

Treatments	Doses (per ha)		PDI of Rust disease				PDI of Tikka disease				Pod Yield (Q/ha)
			Initial score	10 days after			Initial score	10 days after			
	Formulations (g or ml)	g a.i.		I spray	II spray	III spray (Terminal score)		I spray	II spray	III spray (Terminal score)	
Azoxystrobin 7.5% + Propiconazole 12.5% SE	750	56.25 + 93.75	8.76 (17.22)*	11.05 (19.42)	14.23 (22.16)	16.89 (24.27)	9.80 (18.24)	12.45 (20.66)	14.67 (22.52)	16.80(24.20)	19.43
Azoxystrobin 7.5% + Propiconazole 12.5% SE	875	65.62 + 109.38	8.67 (17.12)	8.89 (17.35)	8.67 (17.12)	8.85 (17.31)	9.84 (18.28)	10.56 (18.96)	11.76 (20.06)	11.34(19.68)	24.85
Azoxystrobin 7.5% + Propiconazole 12.5% SE	1000	75+125	9.33 (17.79)	8.67 (17.12)	8.45 (16.90)	8.56 (17.01)	9.90 (18.34)	10.02 (18.45)	11.34 (19.68)	10.85 (19.23)	25.25
Azoxystrobin 23% SC	500	125	9.00 (17.46)	10.33 (18.75)	13.33 (21.41)	16.78 (24.18)	10.54 (18.94)	12.67 (20.85)	14.66 (22.51)	16.78 (24.18)	22.89
Propiconazole 25% EC	500	125	8.87 (17.46)	11.33 (19.67)	13.67 (21.70)	15.87 (23.48)	10.33 (18.75)	12.87 (21.02)	15.45 (23.15)	17.45 (24.69)	20.34
Tebuconazole 25.9% EC	750	187.5	9.45 (17.33)	11.67 (19.98)	13.00 (21.13)	15.66 (23.31)	10.65 (19.05)	12.33 (20.56)	15.30 (23.03)	17.50 (24.73)	21.40
Untreated control	-	-	8.98 (17.90)	18.33 (25.35)	26.78 (31.16)	30.33 (33.42)	10.56 (18.96)	16.65 (24.08)	23.65 (29.10)	36.78 (37.33)	15.14
CD (0.05)	**--**	**--**	**NS**	**1.78**	**1.07**	**1.50**	**NS**	**1.06**	**0.97**	**1.03**	**1.13**

**Data in the parenthesis is angular transformed value*

Table 2. Efficacy of azoxystrobin 7.5% + propiconazole 12.5% SE on rust and Tikka disease incidence and yield of groundnut during *Rabi* 2015-16 (2nd Season)

Treatments	Doses (per ha)		PDI of Rust disease				PDI of Tikka disease				Pod Yield (Q/ha)
			Initial score	10 days after			Initial score	10 days after			
	Formulations (g or ml)	g a.i.		I spray	II spray	III spray (Terminal score)		I spray	II spray	III spray (Terminal score)	
Azoxystrobin 7.5% + Propiconazole 12.5% SE	750	56.25 + 93.75	9.67 (18.12)*	12.33 (20.56)	14.52 (22.40)	16.77 (24.17)	8.70 (17.15)	10.95 (19.32)	14.12 (22.07)	16.83 (24.22)	20.31
Azoxystrobin 7.5% + Propiconazole 12.5% SE	875	65.62 + 109.38	8.83 (17.29)	10.45 (18.86)	10.66 (19.06)	10.24 (18.66)	8.56 (17.01)	8.83 (17.29)	9.33 (17.79)	9.67 (18.12)	25.18
Azoxystrobin 7.5% + Propiconazole 12.5% SE	1000	75+125	9.87 (18.31)	9.96 (18.40)	10.33 (18.75)	10.07 (18.50)	9.12 (17.58)	8.64 (17.09)	8.97 (17.43)	9.00 (17.46)	25.41
Azoxystrobin 23% SC	500	125	10.34 (18.76)	12.58 (20.77)	14.50 (22.38)	16.56 (24.01)	8.89 (17.58)	10.14 (18.57)	13.12 (21.24)	16.67 (24.10)	21.81
Propiconazole 25% EC	500	125	10.25 (18.67)	12.84 (21.00)	15.33 (23.05)	17.33 (24.60)	8.83 (17.35)	11.23 (19.58)	13.55 (21.60)	15.74 (23.37)	20.45
Tebuconazole 25.9% EC	750	187.5	10.56 (18.96)	12.03 (20.29)	15.08 (22.85)	17.15 (24.46)	9.33 (17.29)	11.33 (19.67)	12.95 (21.09)	15.43 (23.13)	21.65
Untreated control	-	-	10.45 (18.86)	16.62 (24.06)	23.45 (28.96)	33.67 (35.47)	8.76 (17.79)	18.25 (25.29)	26.72 (31.13)	40.25 (39.38)	16.35
CD (0.05)	**--**	**--**	**NS**	**1.15**	**1.03**	**1.12**	**NS**	**1.64**	**1.35**	**1.28**	**1.47**

**Data in the parenthesis is angular transformed value*

3.2 Tikka Disease

In the first season, tikka disease PDI in the treatment of Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml/ha was found 10.85 which was on par with Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 m/ha (11.34 PDI) and these treatments were significantly superior to all other treatments (Table 1). Similar trend was also observed in the second season where Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml/ha recorded the lowest incidence of tikka disease (9.00 PDI) and was on par with Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875l/ha (9.67 PDI) (Table 2). "Maximum tikka disease incidence i.e. 36.78 PDI and 40.25 PDI were recorded on untreated control treatment during first and second season, respectively. Findings with respect to disease management of late leaf spot and rust under field condition by use of fungicides were well endorsed by earlier workers" [20,21,22,23,22]. Salako [24] also reported that "fungicide mixture were more effective in controlling leaf spots and rust diseases of ground nut". "Most farmers in both developed and developing countries resort to chemical control method in managing the leaf spot disease" [25,26,27]. The results of some findings of the present study are in agreement with Adiver et al. [13], Jadeja et al. [14] and Gururaj Sunkad et al. [15] who reported that "triazoles such as hexaconazole, difenconazole and propiconazole provide excellent control of foliar fungal diseases such as late leaf spot and rust". "Fungicides belonging to trialzoles group inhibit biosynthesis of ergosterol which plays an important role in structure of cell membrane of fungi" [28,29]. "These fungicides have systemic character and can penetrate the inside of seed and can be used as seed treatment and applied to green plants safely" [30]. Anco et al. [31] also revealed that "the application of prothiaconazole with fluxapyroxad and pyralostrobin was effective in an integrated disease management of groundnut leaf spot disease".

3.3 Groundnut Pod Yield

The result presented in the Tables 1 and 2 showed that highest pod yield was obtained from the treatment with Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml/ha i.e. 25.25 q/ha and 25.41 q/ha during first and second season, respectively which was also at par with Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 ml/ha recorded 24.85 q/ha and 25.18 q/ha of pod yield during first and second season, respectively. All the treatments were significantly superior with respect to control (Tables 1 and 2). Minimum pod yield i.e. 15.14 q/ha and 16.35 q/ha were recorded on untreated control treatment during first and second season, respectively. According to the reports of Atri et al. [25], "grain yields in groundnut increased significantly when fungicides were applied". "Fungicide application in high-value crops has contributed immensely to the great harvest of higher quality produce and with uniform appearance" [31,32]. "The efficacy of combination fungicide of triazole and strobilurin group, i.e. tebuconazole 50%+trifloxystrobin 25% WG @ 0.25% concentration was found very effective against early and late leaf spots of groundnut and increasing the pod yield also" [33].

4. CONCLUSION

The foliar application of Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875-1000 ml/ha were effective in control of Rust and Tikka disease incidence during both the seasons tested and resulting higher pod yield of groundnut. Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 ml/ha and Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 1000 ml/ha were found on par at all the observation days during both the seasons. Hence, it can be concluded that Azoxystrobin 7.5% + Propiconazole 12.5% SE @ 875 ml/ha is effective in managing the Rust and Tikka leaf spot diseases of groundnut.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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