Original Research Article

Estimation of yield losses for major diseases (late leaf spots) in High Incidence Areas on groundnut (*Arachis hypogaea* L.)

ABSTRACT

Late leaf spot (LLS, *Phaeoisariopsis personata* L.) is the major biotic constraint of groundnut (*Arachis hypogaea* L.) productivity in hot spot location in Maharashtra, India.The aim of this study was to determine the yield losses due to attack of diseases, with and without using the fungicide tebuconazole. Management of LLS through fungicides was evaluated with eight treatments in randomized block design with three replications during *Kharif*, 2021, 2022 and 2023 at Oilseed Research Station, Jalgaon, Maharashtra, India. ~~Applications of f~~Fungicidal~~e~~ sprays~~s~~ impacted ~~on~~ the development of *Cercospora* late leaf spot and reduced ~~its~~ the disease intensity. ~~The significantly lowest~~No pod or haulm loss was observed when Tebuconazole was sprayed at 25.9 EC (T4) at 50, 65, 80, and 95 DAS when compared to control treatment (T8), which showed losses of 36.85 % and 15.07 % respectively. ~~pod yield loss 0% and haulm yield loss 0 % was shown by the treatment T4 *i.e* foliar spray of Tebuconazole 25.9 EC at 50, 65, 80 and 95 Days After Sowing (DAS) as compared to control treatment (T8) *i.e* (36.85 %) and (15.07 %), respectively~~. It was followed by treatment T3 *i.e.* Tebuconazole 25.9 % EC at 50, 65 and 80 DAS and treatment T5 *i.e*. Tebuconazole 25.9 %EC at 65, 80 and 95 DAS. ~~Influence of fungicide used for disease management was apparent on yield.~~ The pod and haulm yield loss in treatment T5 was ~~(~~7.75%~~)~~ and ~~(~~5.89 %~~)~~, respectively. The highest BCR was recorded by treatment T4 (5.41), ~~it was~~ followed by treatments T5 (5.32) and ~~treatment~~ T3 (5.08), respectively. The results indicated that the use of fungicide significantly influenced disease management and, consequently, yield.

Key words: Disease management, Late leaf spot, disease, groundnut

INTRODUCTION

Groundnut (*Arachis hypogea* L.) also known as peanut or earthnut or money nut is a member belongs to family *Leguminosae* and sub-family *Papilionaceae*. It is one of the important oilseed crops in the world often known for its global economic significance not only for its wide spread distribution, but also for the even wider areas of processing and consumption. Groundnut was introduced in India by around 16th century by the Portuguese. It is grown under a wide range of environmental conditions encompassing latitudes between 40° South and 40° North of the equator. There are a few economically important foliar fungal diseases, such as early and late leaf spots, commonly called as 'tikka'diseases. Late leaf spot (LLS) caused by *Phaeoisariopsis personata* are commonly present wherever groundnut is grown. As the area under groundnut is predominant in *kharif* (rainy) season the foliar diseases like late leaf spotmay cause yield losses up to 50% in the semi-arid tropics. In India, late leaf spot is more severe than early leaf spot (Ghewande, 1990). It causes severe defoliation and

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reduces pod yields by more than 50% if the crop is not protected with chemicals (Shew *et al*.,1988).The fungicides are the most common tools for controlling disease losses. It contributes significantly to food and nutrition security, as a good source of dietary protein, fats, vitamins, minerals and micronutrients. The crop also contributes to improving soil fertility *via* biological nitrogen fixation and organic matter returns to the soil while its haulms and provide valuable supplementary feed for livestock especially during the long dry season [21,22].

India is the second largest producer of groundnuts after China. Groundnut is the largest oilseed in India in terms of production with 86.54 lakh tons production in 2023 (Anon., 2023). Late leaf spot caused by *Cercosporidium personatum* (Berk. and Curt) Arx., ~~are the~~is a major diseases of groundnut worldwide. The leaf spot diseases can cause 30 to 70% ~~per cent~~ loss in pod yield and reduction in the kernel quality (Reddy *et al.,* 1997). Besides causing quantitative losses, these diseases are responsible for reduction in protein content and oil recovery (Gupta *et al*., 1987). Losses yield due to the diseases was recorded about 15 to 59% ~~per cent~~ in groundnut (Kumar and Thirumalaisamy, 2016). In the semi-arid tropics, where chemical control is generally not practiced, losses in excess of 50% ~~per cent~~ were common. This disease of groundnut is very destructive on a world-wide scale as evident from maximum yield losses ranging from 10 to 50% ~~per cent~~. Without the foliar application of fungicides, the disease could cause up to 100% ~~per cen~~t defoliation ~~prior to~~before harvest and losses in excess of 50% ~~per cent~~ of potential yield. But this loss varies considerably from locality to locality and also between seasons (McDonald *et al*., 1985).

Leaf spots are the most common and serious diseases of groundnut in northern Ghana. Previous research on identifying yield gaps in northern Ghana showed that Early leaf spot (**ELS)** and ~~Late leaf spot (~~**LLS)** together cause pod yield losses in the range of 10 to 50% ~~per cent~~ (Tsigbey *et al*., 2001 a,b). These diseases also have an adverse influence on seed quality as well as on quality of haulms (SARI, 2002).

Leaf spot can be managed by applying fungicides during the most vulnerable periods of fungal infection; that is, when excessive moisture and humidity occurs (Smith & Littrell, 1980). A few studies have shown that applying fungicides can reduce the severity of leaf spot and improve yields in West Africa (Waliyar *et al*., 2000).

Keeping this in view, the present work on 'Estimation of yield losses for major diseases **(LSS)** in hot spot location on groundnut.

MATERIALS AND METHODS

A field experiment was laid out during *kharif*, 2021, 2022 and 2023 using groundnut with susceptible variety SB-XI for late leaf spot. Randomized block design with eight treatments of fungicides applied on different dates after planting distributed in three replications. The fungicides, was sprayed~~s~~ at 50, 65,80, ~~&~~and 95 DAS. The natural incidence of LLS was recorded at 50, 65,80, ~~&~~ and 95 DAS using 0–9 scale suggested by Mayee and Datar (1986). On the basis of dry pod yield and haulm yield, pod yield and haulm yield losses were calculated and also the Benefit Cost Ratio was calculated.

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Experimental Details

Variety: SB-XI Plot Size: 4.2 x5 m^2 (Gross), 3.5 x5 m^2 (Net)

Design: RBD

No. of Treatments: 8 No. of replications: 03

Treatment No.	Treatment Detail
T1	Tebuconazole 25.9 %EC **at 50 DAS**
T2	Tebuconazole 25.9 %EC **at 50 and 65 DAS**
T3	Tebuconazole 25.9 %EC **at 50, 65 and 80 DAS**
T4	Tebuconazole 25.9 %EC **at 50, 65, 80 and 95 DAS**
T5	Tebuconazole 25.9 %EC **at 65, 80 and 95 DAS**
T6	Tebuconazole 25.9 %EC **at 80 and 95 DAS**
T7	Tebuconazole 25.9 %EC **at 95 DAS**
T8	Water spray

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RESULTS AND DISCUSSION

The statistically significant differences were observed in respect of per cent intensity of LLS as well as dry pod yield and haulm yield of groundnut. The results presented in ~~table no.~~Table 1 revealed that, the treatment T_4 *i.e.*, foliar spray of Tebuconazole 25.9 EC at 50, 65, 80 and 95 DAS was found statistically significant and showed lowest per cent disease index (19.97 %) which was ~~found~~ at par with T_5 (20.72 %) as compared to control and ~~rest of the~~other treatments. The per cent disease index in control treatment was 55.44% ~~per cent~~. The significantly highest pod yield of ~~(~~13.94 q/ha~~)~~ and haulm yield of ~~(~~22.79 q/ha~~)~~ was ~~shown by the~~observed in treatment T4 ~~*i.e* foliar spray of(~~ Tebuconazole 25.9 EC sprayed at at 50, 65, 80, and 95 DAS~~)~~ ~~as~~ when compared to ~~control (~~8.93 q/ha for pod yield ~~)~~ and ~~(~~16.43 q/ha for haulm yield), respectively for control. It was followed by treatment T5~~*i.e.* Tebuconazole 25.9 %EC at 65, 80 and 95 DAS~~.

~~The significantly lowest~~ No pod ~~yield loss 0 % and~~or haulm yield loss ~~0 %~~ was ~~shown by the~~evident in treatment T4 ~~*i.e* foliar spray of Tebuconazole 25.9 EC at 50, 65, 80 and 95 DAS~~ as compared to control treatment (T8) where the pod and haulm loss was ~~*i.e* (~~35.95 %~~)~~ and (29.46 %~~),~~ respectively. It was followed by treatment T5 and treatment T3.The pod and haulm yield loss in treatment T5 was ~~(~~9.10%~~)~~ and ~~(~~9.46 %~~)~~, respectively. The highest BCR was recorded by treatment T4 *i.e* 4.67, it was followed by treatment T5 (4.51) and treatment T3 (4.47), respectively.

So overall it was concluded that, the fungicidal sprays treatment reduced the late leaf spot

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severity as compared to control. The pod yield and haulm yield losses due to late leaf spot disease was ~~(~~35.95 %~~)~~ ~~and (29.46 %) respectively~~ in unprotected fungicidal spray~~s~~ treatment when compared ~~with~~ to 29.46% in highly protected sprays treatment. Moreover, the fungicidal sprays treatment was really effective and increased pod and haulm yields significantly as compared to control.

These research findings agree with the earlier workers Alabi *et al*.(1993) who evaluated the efficacy of Benlate, DithaneM-45 and Hexaconazole fungicides f~~ortheirefficiency~~ against foliar diseases of groundnut under field conditions. The results of this study showed that the fungicide and~~found~~ Hexaconazole ~~fungicide as~~was most effective in controlling the foliar diseases and increased pod and haulm yields. Jadeja *et al*. (1999) reported sprays of Hexaconazole (0.0025%) and Difenconazole (0.0125%) at three times on 30, 45- and 60-days old plant to manage leaf spots and rust of groundnut and reported that the fungicides reduced leaf spot and increased the yields significantly. Hexaconazole treatment showed 71% increase in pod yield and 87% increase in fodder yield (Jadeja *et al*. 1999).

Johnson and Subrahmanyam (2003) reported that on groundnut hexaconazole (0.2%) fungicide recorded minimum Percent Disease Index (PDI) of 18.8 (LLS) and increased the pod and haulm yields by 43 and 41%~~percent~~,respectively when sprayed two times on 60 and 75-days old plant. Seed treatment with Mancozeb @ 2 g/kg + three sprays of Hexaconazole @ 1ml/lit. at 45, 60 and 75 DAS i.e.,T1 was superior in minimizing the late leaf spot disease. The highest pod yield and maximum **CBR** (1:30) was recorded when seed treatment with Mancozeb @ 2g/kg + three sprays of Hexaconazole @ 1ml/lit at 45, 60 & 75 DAS.

Patel *et al*.~~,~~ (2022) reported tebuconazole 50% + trifloxystrobin 25% at 0.05% (26.53%) followed by spraying of carbendazim 12% + mancozeb 63% at 0.15% (31.83%) in checking the leaf spot of groundnut. 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%. Nath *et al*.(2023) evaluated that impact of fungicides used for disease control was apparent on yield per plot. Tebuconazole @0.15% gave best result and increased yield up to 67 %.

Nutsugah *et al*. (2005) reported yield losses varied considerably, depending on entry and its yield potential. Pod yield losses due to early and late leaf spot diseases ranged from 9.7 to 81.2% ~~per cent~~ in 2003, and from 19.5 to 65.9% ~~per cent~~ in 2004 when yield of protected entries was compared with yield of unprotected entries. Paul and Yahaya~~,~~ (2017) reported from Ghana that late leaf spot, ***Cercosporidium personatum*** **(Berk. & Curt)** are the most important in Ghana.apart from damaging the leaves, these fungi also cause lesions on petioles, pegs, and main shoots leading to substantial defoliation and yield losses. The leaf defoliation of greater than 80% and yield losses of up to 78% caused by *Cercospora* leaf spots on-farm in the Guinea savannah of Ghana.

Khan *et al*.~~,~~ (2014) reported that maximum disease control with high pod yield was observed with Nativo and Triazole treatments. Efficacy of Chlorothalonil was also better than Mancozeb and Propineb. Maximum disease control and pod yield was observed when Nativo was used @ 0.97g/L

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of water, followed by @ 0.65g/L and 0.32 g/L, respectively.

CONCLUSION

The significantly lowest pod yield loss 0% and haulm yield loss 0 % was shown by the treatment T4 *i.e.*, foliar spray of Tebuconazole 25.9 EC at 50, 65, 80 and 95 DAS as compared to control treatment **(T8) *i.e* (36.85 %) and (15.07 %),** respectively. It was followed by treatment T3 and treatment T5. The pod and haulm yield loss in treatment T5 was (7.75%) and (5.89 %), respectively. The highest BCR was recorded by treatment T4 *i.e* 5.41, it was followed by treatment T5 (5.32) and treatment T3 (5.08), respectively.

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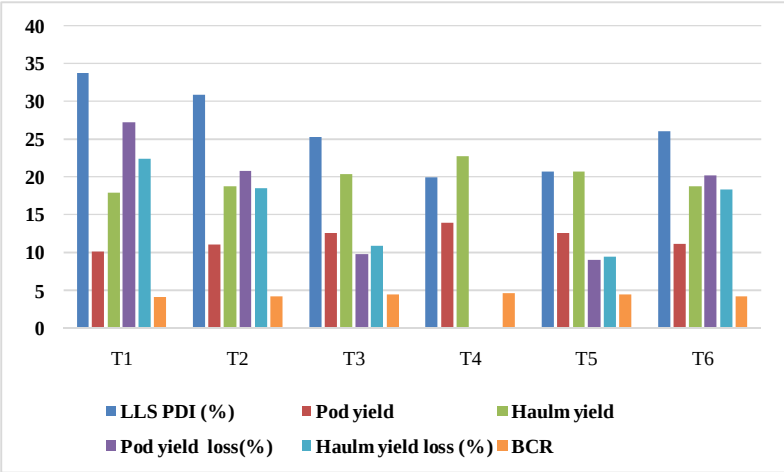

Fig .1 Bar graph showing **Pod yield ratio**

Table 1 : Estimation of yield loss for Late Leaf Spot in Groundnut

Yield loss for Late Leaf Spot in Groundnut Pooled data: Kharif - 2021 to 2023

Treatments	LLS PDI (%)	Yield (q / ha)		% Yield Loss		BCR
		Pod yield	Haulm yield	Pod yield	Haulm yield	
T1	33.76 (35.47)	10.14	17.93	27.24	22.39	4.18
T2	30.84 (33.67)	11.04	18.78	20.85	18.58	4.21
T3	25.35 (30.21)	12.58	20.40	9.83	10.87	4.47
T4	19.97 (26.51)	13.94	22.79	0.00	0.00	4.67
T5	20.72 (27.04)	12.61	20.72	9.10	9.46	4.51
T6	26.06 (30.65)	11.12	18.83	20.21	18.34	4.25
T7	36.53 (37.07)	9.91	17.61	28.98	23.66	4.07
T8	55.44 (43.33)	8.93	16.43	35.95	29.46	0.00
SEm ±	1.39	0.10	0.36	0.73	2.31	0.13
CD at 5%	4.22	0.31	1.11	2.20	7.02	0.40