

Original Research Article

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Evaluation of Fungicides against Leaf Spot Disease of Pearl Millet Caused by *Drechslera setariae* under Field Conditions

Rajendra Nasnwa¹, S.L. Godara¹ and Manjeet Singh^{2*}

¹Department of Plant Pathology, COA Bikaner, India

²Department of Plant Pathology, CCS Haryana Agricultural University, Hisar, Haryana, India

*Corresponding author

ABSTRACT

Keywords

Pearl millet, Leaf spot, Management, Fungicides *Drechslera setariae*

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Foliar application of fungicides was found to be highly effective against leaf spot disease of pearl millet and resulted in increased grain yield, length of spike, plant height and reducing per cent disease intensity. Two sprays of propiconazole 25 EC @ 0.2% at fifteen days interval found to be highly effective against leaf spot of pearl millet followed by tebuconazole 25 EC @ 0.2% and carbendazim 12 WP + mancozeb 63 WP @ 0.2%. Propiconazole 25 EC @ 0.2% has highest avoidable loss in grain yield. This treatment also increased the grain yield, length of spike, plant height with highest disease control efficacy.

Introduction

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] $2n = 14$ commonly known as bajra, satta, combo, bari, ganti or kambam, is an allogamous crop having protogynous nature. It belongs to family *Poaceae*. It is an important food and forage crop in Asia, Africa and important forage in America. It has great potential because of its suitability to the extreme limits of agriculture. The pearl millet grains are very good nutritious and form the staple food or diet of approximately ten per cent of population in India. It has high quality protein with superior amino acid profile. It is a

good source of protein (11.5%), fat (4.1-6.4%), carbohydrate (59.8-78.2%) and also rich in good amount of minerals particularly phosphorus and iron (2.8%). India is the largest producer of pearl millet with annual production of 9.25 million tonnes from an area of 7.0 million hectares with productivity 1250 kg/ha (Anonymous, 2014-15a). Pearl millet is mainly grown in Rajasthan, Haryana, Uttar Pradesh, Madhya Pradesh, Gujarat, Maharashtra, Karnataka, Tamil Nadu, and Andhra Pradesh states of the country. Rajasthan occupies first position in area and production of pearl millet in India. In Rajasthan, it is cultivated on 40.76 lac hectare

area with the production 44.56 lac tonne and productivity 1093 kg/ha (Anonymous, 2014-15b). Major pearl millet producing districts of Rajasthan are Bharatpur, Alwar, Karoli, Dholpur, Swai Madhopur, Barmer, Jhunjhunu, Jaisalmer, Churu, Jaipur, and Bikaner. Leaf spot of pearl millet comes every year in almost all the pearl millet growing area including Rajasthan. Among the various diseases of pearl millet, leaf spot incited by the fungus *Drechslera setariae* has attained the status of the economically important disease. The disease is characterized by the presence lesions have dark margins and ash coloured centers vary in size and sometimes blight the leaves completely.

Leaf spot of pearl millet is a common foliar disease caused by *Drechslera setariae*. *Drechslera setariae* was isolated from the rotted seeds and infected parts of seedlings. The seed used was obtained from Mysore (Karnataka), India and was found to be infected with *Drechslera setariae*, which has been reported from the United States to be seed borne in pearl millet, causing seed rot, blight and leaf spotting (Wells and Winstead, 1965; Wells and Burton, 1967). The disease has also been noticed in India by Bhowmik (1972) and Balasubramanian (1980).

Materials and Methods

The efficacy of selected fungicides evaluated against *Drechslera setariae* at two concentrations (0.1 and 0.2 per cent) under field conditions during *kharif* 2015.

Experiments on management of leaf spot disease by fungicides were conducted on research farm of College of Agriculture, Bikaner (Rajasthan). Seven fungicides *viz.*, mancozeb 75 WP, chlorothalonil 75 WP, hexaconazole 5 EC, propiconazole 25 EC, difenconazole 25 EC, carbendazim 12 WP + mancozeb 63 WP, tebuconazole 25 EC at 0.1

and 0.2 per cent concentration were evaluated as foliar spray (Table 1). Pearl millet variety RHB-177 was shown in 5 x 3.6 m² plot size with 45 X 15 cm row to row and plant to plant spacing on July, 2015. The trial was laid out in random block design with three replications.

Two sprays of each fungicide were made starting from first appearance of the disease and second spray at fifteen days interval. Before first spray, the crop was inoculated by suspension twice to ensure the proper disease development. Observations on disease intensity were recorded at 7 days interval from randomly selected plants in each replication of a treatment using 0-9 scale (Neal *et al.*, 1971). Yield (q/ha), length of spike (cm) and plant height (cm) was also recorded.

$$\text{Per cent Disease intensity} = \frac{\text{Sum of all numerical ratings}}{\text{Total number of plant observed} \times \text{Maximum grade}} \times 100$$

Results and Discussion

The efficacy of fungicides *viz.*, mancozeb 75 WP, chlorothalonil 75 WP, hexaconazole 5 EC, propiconazole 25 EC, difenconazole 25EC, carbendazim 12 WP + mancozeb 63 WP, tebuconazole 25 EC (0.1 and 0.2 per cent of each) evaluated against leaf spot disease of pearl millet under field conditions. All the fungicides were found to be significantly superior over check in controlling the disease during *kharif* 2015 (Table 2). The minimum disease intensity was recorded with Propiconazole (9.62%) followed by tebuconazole (14.07%), carbendazim + mancozeb (16.29%), difenconazole (23.71%), hexaconazole (42.96%), mancozeb (47.40%) and chlorothalonil (50.38%) at 0.2 per cent concentration (Table 2). Per cent disease intensity ranged from 21.48 to 52.57 and 9.62 to 47.40 per cent at 0.1 and 0.2 per cent concentration.

Table.1 Selected fungicides used for control of leaf spot disease of pearl millet

S. No.	Trade name	Common name	Doses (%)	
1	Dithane M-45	Mancozeb 75 WP	0.1	0.2
2	Kavach	Chlorothalonil 75 WP	0.1	0.2
3	Contaf	Hexaconazole 5 EC	0.1	0.2
4	Tilt	Propiconazole 25 EC	0.1	0.2
5	Score	Difenconazole 25EC	0.1	0.2
6	Companion	Carbendazim 12 WP + Mancozeb 63 WP	0.1	0.2
7	Folicur	Tebuconazole 25 EC	0.1	0.2
8	Control*	-	-	-

*Without fungicide

Table.2 The efficacy of fungicides against leaf spot disease of pearl millet under field conditions (*kharif*, 2015)

Fungicides	Conc. (%)	Disease intensity (%)	Disease control (%)	Grain yield (q/ha)	Yield increased over the control (%)	Length of spike (cm)	Spike length increase over control (%)	Plant height (cm)	Plant height over the control (%)
Mancozeb	0.1	51.33 (45.76)*	41.28	14.90	23.86	16.00	22.14	167.20	7.56
	0.2	47.40 (43.50)	45.77	17.60	46.30	19.90	51.91	172.07	10.69
Chlorothalonil	0.1	52.57 (46.47)	39.86	14.00	20.53	15.50	18.32	166.10	6.85
	0.2	50.38 (45.21)	42.37	14.50	41.32	19.50	48.86	170.08	9.41
Hexaconazole	0.1	44.44 (41.81)	49.16	15.20	26.35	16.15	23.29	167.90	8.00
	0.2	42.96 (40.95)	50.85	18.00	49.62	20.07	53.21	172.85	11.19
Propiconazole	0.1	21.48 (27.61)	75.42	19.40	61.27	18.99	44.97	175.93	13.17
	0.2	9.62 (18.06)	88.99	22.10	83.70	23.33	77.32	179.10	15.21
Difenconazole	0.1	42.95 (40.95)	50.86	16.70	38.42	16.40	25.19	168.16	8.18
	0.2	23.71 (29.14)	72.87	19.30	60.43	20.40	55.73	173.08	11.34
Carbendazim + mancozeb	0.1	34.07 (35.71)	61.02	17.50	45.47	16.11	22.98	171.21	10.14
	0.2	16.29 (23.80)	81.36	19.77	64.34	21.10	61.07	175.49	12.89
Tebuconazole	0.1	28.15 (32.04)	67.80	18.10	50.46	17.11	30.60	174.15	12.03
	0.2	14.07 (22.03)	83.90	21.42	78.06	22.10	68.70	178.07	14.55
Control	-	87.42 (69.22)	-	12.03	-	13.10	-	155.45	-
SEm±		0.42		0.43		0.45		1.51	
CD at 5%		1.21		1.25		1.28		4.35	

* Figures given in parenthesis are angular transformed values



Plate : 1 A view of field experiment of pearl millet

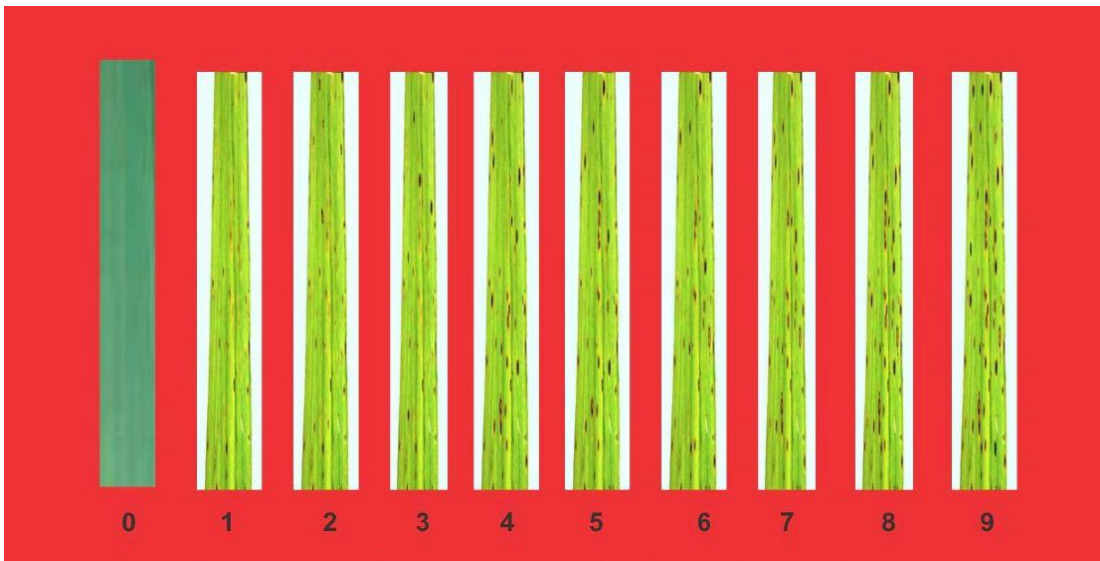


Leaf spot infected plants



Infected seedling

Plate.2 Rating scale of leaf spot of pearl millet



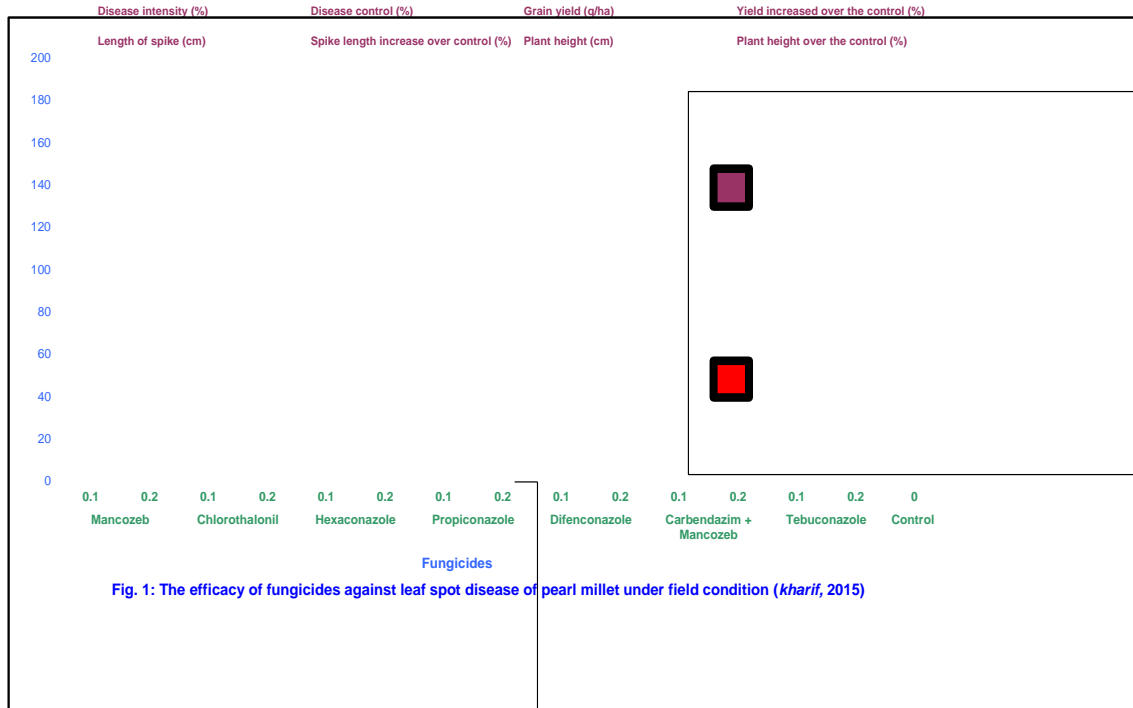


Fig. 1: The efficacy of fungicides against leaf spot disease of pearl millet under field condition (kharif, 2015)

It is concluded that when increase the concentration of fungicide then decrease the per cent disease intensity in all the selected fungicides. However, propiconazole was highly effective, significantly superior and recorded maximum disease control (88.99%) followed by tebuconazole (83.90%) and carbendazim + mancozeb (81.36%), difenconazole (72.87%), hexaconazole (50.85%) and mancozeb (45.77%). Chlorothalonil was least effective fungicide which gave minimum disease control (32.45%) at 0.2 per cent concentration against leaf spot disease of pearl millet during *kharif* 2015.

Similarly, fungicidal foliar sprays against leaf spot disease of pearl millet were significant effective on grain yield, length of spike and plant height. Analysis of grain yield, length of spike and plant height data revealed that two sprays with propiconazole (0.2%) gave maximum yield of 22.10 q/ha, maximum spike length 23.33 cm and maximum plant height 179.10 cm followed by tebuconazole (0.2%), at the 21.42 q/ha, 22.10 cm and

178.07 cm and carbendazim + mancozeb (0.2%), 19.77 q/ha, 21.10 cm and 175.49 cm, difenconazole (0.2%), 19.30 q/ha, 20.40 cm 173.08 cm, hexaconazole (0.2%), 18.00 q/ha, 20.07 cm, 172.85 cm and mancozeb (0.2%), 17.60 q/ha, 19.90 cm, 172.07 cm, respectably over check which gave grain yield (12.03 q/ha), spike length (13.10 cm) and plant height (145.55 cm) (Table 2). The lowest grain yield 14.00 q/ha, length of spike 15.50 cm and plant height 160.10 cm were recorded in Chlorothalonil at both (0.1 and 0.2%) the concentrations.

In the present investigation, fungicides studies were also done to find out the efficacy on disease control against leaf spot, grain yield and length of spike and plant height in pearl millet cultivar RHB-177. Total seven fungicides tested *viz.*, mancozeb 75% WP (Dithane M-45), chlorothalonil 75% WP (Kavach), hexaconazole 5% EC (Contaf), propiconazole 25% EC (Tilt), difenaconazole 25% EC (Score), carbendazim 12% WP + Mancozeb 63% WP (Companion) and tebuconazole 25% EC (folicur) at 0.1 and 0.2

per cent concentrations were evaluated against leaf spot disease of pearl millet under field conditions during *kharif* 2015. Among these fungicides tested for the management of leaf spot disease of pearl millet, Propiconazole (0.2%) and tebuconazole (0.2%), they performed better as compared to other fungicides and also found significantly higher grain yield, spike length and plant height. The minimum per cent disease control were recorded with both the concentrations of chlorothalonil (0.1 and 0.2%), followed by mancozeb (0.1% and 0.2%) over check. The observations are also in confirmation with result obtained by Sunder *et al.*, (2004) they reported that amongst 7 fungicides evaluated under *in vitro*, hexaconazole and propiconazole were most in inhibitory to mycelial growth of *Drechslera oryzae* followed by iprobenphos and edifenphos. Under field trials, both the fungicides reduced the leaf spot disease by 86.2 and 78.7 per cent accompanied with an increase of 14.6 and 14.2 per cent in grain yield followed by mancozeb and edifenphos. Hossain and Hossain (2011) the evaluated that efficacy of benzothiazole (50 mg/l), azoxystrobin (1 ml/l) and propiconazole (1ml/l) for controlling brown spot and narrow brown spot disease of rice under *in vivo* conditions. The resulted in marked significantly reduced brown spot and narrow brown spot disease and higher grain yield over the control when sprayed at tillering stage. Kumar *et al.*, (2013), they evaluated systemic and contact fungicides, among four systemic fungicides, carbendazim + mancozeb found most effective followed by difenconazole and among five contact fungicides, mancozeb found most effective followed by captan, least effective was chlorothalonil in inhibiting the mycelial growth of *Drechslera setariae*. Among the 8 fungicides tested against *Cochliobolus miyabeanus* (*Drechslera sp.*), Propiconazole 25% EC gives the highest radial growth inhibition (89.16%) of the fungus followed by

Carbendazim 12%+Mancozeb 63% WP, Hexaconazole 4%+Zineb 68% WP, Mancozeb 75% WP and Difenoconazole 25% EC showing 88.33%, 87.49%, 87.49% and 83.89% growth inhibitions, respectively (Hemayatullah *et al.*, 2014; Jayasena, *et al.*, 2002). Gupta *et al.*, (2013) tested seven fungicides *viz.*, propiconazole, tricyclazole, hexaconazole, tridimefon, carbendazim, mancozeb and azoxystrobin at different concentrations against *Bipolaris oryzae* causing brown spot disease of rice, propiconazole was found most effective with maximum growth inhibition (97%) at 250 ppm concentration, tricyclazole and propiconazole at 0.1 per cent significantly reduced the disease severity under field conditions. Lore *et al.*, (2007) evaluated the efficacy of Tilt (propiconazole) 25 EC at 0.1% was the most effective fungicide against the three diseases, where the lowest mean disease severity was 9.0% for brown spot 15.7% for sheath blight and 6.7% for sheath rot as compared to 48.5%, 51.4% and 24.8% in controls.

Further, it can be concluded that minimum disease intensity 9.62 per cent of leaf spot and maximum grain yield 22.10 q/ha, maximum spike length 23.33 cm and maximum plant height 179.10 cm were recorded in propiconazole (Tilt) followed by tebuconazole (Folicur), and carbendazim + mancozeb (companion) at 0.2% concentration. Chlorothalonil (Kavach) was found least effective fungicide and recorded maximum disease intensity, minimum per cent of leaf spot and minimum grain yield, minimum spike length and minimum plant height Among the selected fungicides minimum per cent disease intensity, maximum per cent disease control, maximum grain yield (q/ha), maximum per cent yield increased over the control, maximum length of spike (cm), maximum per cent spike length increase over control, maximum plant height

(cm) and maximum per cent plant height over control was recorded at 0.2 per cent concentration as compare to 0.1 per cent concentration.

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