

Effect of various fungicides for controlling powdery mildew(*Erysiphe polygoni*) in fenugreek (*Trigonella foenum graceum L*)

Abstract

India grows fenugreek (*Trigonella foenum graceum L.*), it's a legume crop but its seeds are used as spice. *Erysiphe polygoni* DC caused powdery mildew is one of the major disease of fenugreek production. In Rabi 2019 to 2022, a field experiment was carried out to ascertain the impact of fungicides on the *Erysiphe polygoni* caused powdery mildew disease of fenugreek. Infield conditions, Total six fungicides, along with treated and untreated control were evaluated for their efficacy to control the powdery mildew disease of fenugreek. All the fungicides were significantly effective in reducing the powdery mildew disease intensity over control. Among these fungicides, at maturity the minimum per cent disease intensity 29.25 was recorded with the spray of hexaconazole (0.005%) @ 1 ml/l and followed by propiconazole (0.025%) @ 1 ml/l showed 31.23 per cent disease intensity. Wettable sulphur (0.2%) @ 2.5 g/l 33.07 % disease intensity was observed. The highest net returns were recorded with hexaconazole 5% EC (Rs. 20,198/ha) and an ICBR of 1:6.23, followed by propiconazole 25% EC with a net return of Rs. 16,568/ha and an ICBR of 1:5.26, and sulfur 80% WP with a net return of Rs. 14,858/ha and an ICBR of 1:5.24.

Keywords: *Erysiphe polygoni*, Fenugreek, Fungicides, Powdery mildew.

Introduction

Fenugreek (*Trigonella foenum graceum L.*) is a short living important legume crop belongs to the family Fabaceae and known as *methi/metha* with multifarious uses and it is cultivated for seed, leafy vegetable and also for fodder. It is used against the digestive disorders (Sharma *et al.* 1991) and has good medicinal properties, such as antioxidant, anti-inflammatory, antidiabetic, antiobesity, anticancer, hepatoprotective, antihyperlipidemic, immunomodulatory and antioxidant activities (Kirtikar and Basu, 1975). Fenugreek is rich source of carbohydrates: 58.35 g, protein: 23 g, fat: 6.40 g, vitamin C: 3 mg, vitamin B6: 0.6 mg, iron: 33.53 mg, zinc: 2.5 mg, magnesium: 191 mg, phosphorus: 296 mg and potassium: 770 mg (Anonymous, 2024^a). In industry, seeds are used for dye making and for extraction of alkaloids and steroids (Balodi and Rao 1991). The dried leaves and flowers are used for flavoring vegetable curries (Arya 2002).

Fenugreek has been cultivated in most of states of India. It is grown as an extensive scale in Gujarat, Rajasthan, Madhya Pradesh, Uttar Pradesh, Maharashtra and Punjab (Anonymous, 2024^b). The performance of the agricultural sector has been constrained by both biotic and abiotic causes, which have affected its contribution to the loss of production. One of the main biotic factors producing losses in fenugreek production's quantity and quality is powdery mildew. Diseases that cause damage to all parts of the plant above ground include powdery mildew (*Erysiphe polygoni* DC.; *Leveillula Taurica* (Lev.), downy mildew (*Peronospora trigonellae*), charcoal rot (*Macrophomina phaseolina*), leaf spot (*Cercospora traversiana*), damping off (*Pythium aphanidermatum*), and fusarium wilt (*Fusarium oxysporum*).

The most detrimental fenugreek disease powdery mildew has a significant negative influence on all plant portions that are above ground and causes 50 per cent seed yield losses (Kumawat *et al.*, 2016^a). It is identified by the development of white, floury patches on the leaf surface as well as other aerial parts (flowering stage and pod formation stage), at which point the powdery mildew becomes destructive to crops (Gojiya and Pandiya, 2019). The disease generally appears during December to January and spreads throughout the field until the crop is fully mature, when the environmental conditions are like temperature, relative humidity, light, and host age all have a significant impact on the development of the disease

and are causes of fenugreek infected by *Erysiphe polygoni* (Kumawat *et al.*, 2016^a). A key element in the development and dissemination of powdery mildew is humidity. Powdery mildew typically becomes a problem during cool days and humid nights because high relative humidity promotes spore development and low relative humidity supports spore dissemination.

Fenugreek powdery mildew fungus, known to survive by means of mycelium and cleistothecia (fruiting bodies), overwinters on winter crops, crop residue and weeds as primary inoculum. Spores get released into the air by cleistothecia when the weather warms in the spring. These spores are secondary spreaders; they get transported by insects or raindrops, which eventually infect nearby plants that are susceptible. Nearby winter crop spores can damage spring crops. In order to stop the spread and resurgence of this fungal disease, it is necessary to implement comprehensive field and seed management techniques Anonymous, (2024^b).

As a foliar pathogen, powdery mildew causes heavy yield loss in the field and is very difficult to control (Ushamalini and Nakkeeran, 2017). One of the most suitable strategies is chemical control for effective management of powdery mildew. Fungicides have the ability to suppress spore germination. By targeting this critical stage of the disease, we can improve our chances of successful management (Patel, *et al.*, 2023). The present study was undertaken to assess the yield losses in fenugreek due to powdery mildew disease at varying disease intensities.

Materials and Methods

To evaluate the effectiveness of fungicide on powdery mildew of fenugreek, the field experiment was conducted at Department of Plant Pathology, N.M.C.A., NAU, Navsari-389540 during rabi season with respective years 2019-20, 2020-21 and 2021-22 in randomized blocked design (RBD) on susceptible fenugreek local variety with different chemical fungicides shown in (Table 1). The crop was sown with respective dates, i.e. 18/01/2020, 26/11/2020 and 02/11/2021 with three repetitions and spacing was (30 cm × 15 cm) with Plot size are Gross- 4.05 × 1.2 m² (4 row × 27 Plants) and Net-3.45 × 0.6 m² (2 rows × 23 Plants) (Fig.1, 2, 3, 4, 5, 6, 7 and Anonymous, 2024^c).

Table 1. Experimental details

Tr. No.	Name of Treatments	Concentrations (a. i %)	Quantity (g or ml/l)	Quantity (g or ml/10 lit)
1	Carbendazim 50 % WP	0.025	0.5 g	5 g/10 lit
2	Sulphur 80 % WP	0.2	2.5 g	25 g/10 lit.
3	Propiconazole 25 % EC	0.025	1.0 ml	10 ml/10 lit.
4	Hexaconazole 5% EC	0.005	1.0 ml	10 ml/10 lit.
5	Difenoconazole 25% EC	0.025	1.0 ml	10 ml/10 lit.
6	Pyraclostrobin 13.3 % WG	0.025	2.0 g	20 g/10 lit.
7	Treated (Water Spray)	-	-	-
8	Untreated (No Spray)	-	-	-

Total six fungicides, treated and untreated control treatment was maintained in experiment. Fungicides were sprayed twice at an interval of 15 days starting from the initial appearance of the disease. The per cent disease intensity was recorded after 15 days of last spray of fungicides by examining 20 leaves from 10 randomly selected plants in each treatment. For disease, scoring on leaves 0-5 scale (Table 2) was used as mentioned below (Prakash and Saharan 1999). Per cent disease intensity was calculated by using formula given below. At harvesting, seed yield per plot was recorded and calculated in kg/ha. Cost benefit ratio was also worked out and results were analyzed statistically. Disease rating and per cent disease intensity (PDI) was calculated as per method suggested with slight modification (Prakash and Saharan 1999).

Table 2. Disease rating scales

Scale	Percentage	Description of the Symptoms
0	0-5	Healthy
1	6-20	Suppressed colonies
2	21-40	Upper leaf surface only
3	41-60	Upper and lower surface both side
4	61-80	On leaves and petioles
5	>80	On leaves, petioles and stems

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{No of leaves examined} \times \text{Maximum disease rating}} \times 100$$



Fig 1. Leaf area affected by powdery mildew disease (0-5 scale)



Fig 2. Initiation of powdery mildew disease on fenugreek leaves

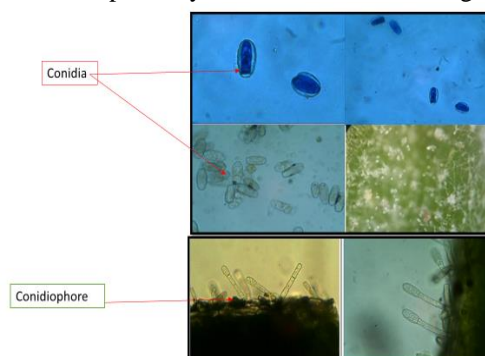


Fig 3. Microscopic view of fenugreek powdery mildew



Fig 4. Field view of fenugreek powdery mildew



Fig 5. Effect of three spray of Hexaconazole 5 % EC @ (0.005%) @ 10 ml/ 10 lit against powdery mildew disease

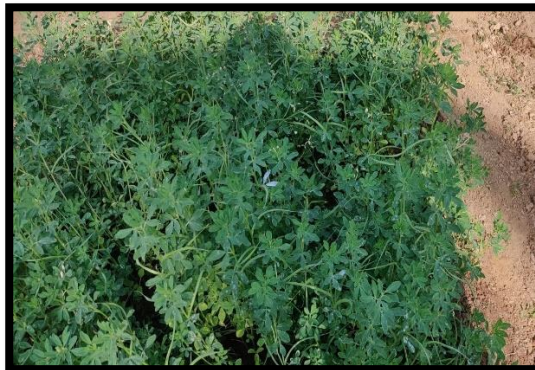


Fig 6. Effect of three spray of Propiconazole 25 % EC (0.025%) @ 10 ml/10 lit against powdery mildew disease



Fig 7. Effect of Control (No spray) against powdery mildew disease

Results and Discussion

Total six fungicides, treated and untreated were evaluated for management of powdery mildew of fenugreek by spraying twice at 15 days interval under natural field conditions. Three years pooled results on per cent disease intensity (Table 3) that all the fungicides were significantly effective in reducing the powdery mildew disease intensity over control.

Year 2019-20

The powdery mildew intensity recorded at disease initiation stage (before spraying) ranged from 8.33 to 9.72 per cent. Sprays of different fungicides were under taken at initiation of disease followed by second spray of an interval of 15 days. The per cent disease intensity was recorded before first spray, 15 days after first spray (before second spray), 15 days after second spray and maturity stage. The data revealed that before spray, all the treatment showed non-significant *i.e* the disease appearance was more or less similar in all the treatments.

After 15 days of first spray, per cent disease intensity in all the treatments were significantly superior over control. The minimum per cent disease intensity (20.56%) was observed in foliar spray with hexaconazole (0.005%) @ 1 ml/l which is at par with propiconazole (0.025%) @ 1 ml/l (23.61%), wettable sulphur (0.2%) @ 2.5 g/l (24.72%) and difenconazole (0.025%) @ 1 ml/l (27.22%). Highest per cent disease intensity was observed control treatment with no spray (46.94%). After 15 days of second spray, per cent disease intensity in all the treatments were significantly superior over control. Similar trend was observed as shown in after 15 days of first spray. The minimum per cent disease intensity (20.83%) was observed in foliar spray with hexaconazole (0.005%) @ 1 ml/l which is at par with propiconazole (0.025%) @ 1 ml/l (24.45%) and wettable sulphur (0.2%) @ 2.5 g/l (25.55%) and difenconazole (0.025%) @ 1 ml/l (28.33%). Highest per cent disease intensity was observed control treatment with no spray (51.11%).

At maturity stage, the minimum per cent disease intensity (22.50%) was observed in foliar spray with hexaconazole (0.005%) @ 1 ml/l which is at par with propiconazole (0.025%) @ 1 ml/l (25.83%) and wettable sulphur (0.2%) @ 2.5 g/l (26.94%). The highest per cent disease intensity was observed control treatment with no spray (64.72%).

Year 2020-21

In year 2020-21 the powdery mildew intensity recorded at disease initiation stage (before spraying) ranged from 9.44 to 11.11 per cent. At maturity the minimum 24.44 per cent disease intensity was recorded with the application of hexaconazole (0.005%) @ 1 ml/l at par with propiconazole (0.025%) @ 1 ml/l showed 26.39 per cent disease intensity followed by wettable sulphur (0.2%) @ 2.5 g/l 30.83% disease intensity were observed. Fungicides, carbendazim (0.025%) @ 0.5 g/l 44.44% followed by 44.17 per cent was recorded in the treatment of pyraclostrobin (0.025%) @ 2 g/l, respectively. In case of water spray and no spray, recorded 58.32 and 66.17 per cent disease intensity, respectively.

Year 2021-22

The powdery mildew intensity recorded at disease initiation stage (before spraying) ranged from 9.44 to 10.56 per cent. At maturity the minimum 24.72 per cent disease intensity was recorded with the application of hexaconazole (0.005%) @ 1 ml/l with up to 66.94 per cent disease intensity over control. However, propiconazole (0.025%) @ 1 ml/l showed 24.72 per cent disease intensity and wettable sulphur (0.2%) @ 2.5 g/l 31.67 per cent disease intensity were observed. Among the fungicides, maximum 42.78 and 45.83 per cent was recorded in the treatment of carbendazim (0.025%) @ 0.5 g/l and pyraclostrobin (0.025%) @ 2 g/l, respectively. In case of water spray and no spray, recorded 59.72 and 66.94 per cent disease intensity, respectively.

(Pooled result 2019-22)

The powdery mildew intensity recorded at disease initiation stage (before spraying) ranged from 9.35 to 9.91 per cent (Table 4). It is very clear from the results that, all the fungicides were significantly effective in reducing the powdery mildew disease. At maturity the minimum per cent disease intensity 29.25 was recorded with the spray of hexaconazole (0.005%) @ 1 ml/l and followed by propiconazole (0.025%) @ 1 ml/l showed 31.23 per cent disease intensity. Wettable sulphur (0.2%) @ 2.5 g/l 33.07 % disease intensity was observed. 39.25 and 40.65 per cent disease intensity was recorded in carbendazim (0.025%) @ 0.5 g/l and pyraclostrobin (0.025%) @ 2 g/l, respectively. In case of treated and untreated, recorded 49.38 and 54.31 per cent disease intensity, respectively (Table 6 and Fig. 5, 6, 7).

Narayana, *et al.* 2005 reported that hexaconazole provided the highest control of grape powdery mildew disease and crop yield. Singh, 2006 recorded that all the fungicides reduced the disease severity significantly over the control, with maximum reduction with hexaconazole (0.1%), which was on par with propiconazole (0.1%) and wettable sulfur (0.3%). Yield of coriander was higher by 2.54 and 2.20 times compared to the control, hexaconazole (0.1%), propiconazole (0.1%) and wettable sulfur (0.3%), respectively. Cost-benefit ratio was 1:5.3, 1:4.0 and 1:4.5 in hexaconazole (0.1%),

propiconazole (0.1%) and wettable sulfur (0.3%), respectively to control of powdery mildew disease of coriander (*C. sativum*), caused by *Erysiphe polygoni*. Kumawat, *et al.* 2016^b also studied those fungicides, hexaconazole recorded minimum (9.60%) per cent disease intensity with maximum (84.68%) per cent disease control and seed yield (24.61 q/ha) by increasing 63.08 per cent seed yield. Dinocap with two sprays was second best and recorded 10.39 per cent disease intensity with 56.05 per cent increased seed yield after two sprays at 15 days interval over unprotected check.

Economics

The economics is calculated by considering the profit increase over control for different treatments. The treatment hexaconazole 5% EC registered higher net realization (Rs. 20,198/ha) and ICBR (1:6.23) followed by propiconazole 25% EC with net realization (Rs. 16,568/ha) with ICBR (1:5.26) followed by sulphur 80% WP with net realization (Rs. 14,858/ha) with ICBR (1:5.24). However, the other treatment had significantly higher disease and less yield than hexaconazole 5% EC, propiconazole 25% EC, Sulphur 80% WP (Table 7).

Conclusion

Before spraying, the powdery mildew intensity ranged from 9.35 to 9.91 percent during the disease starting stage. When hexaconazole (0.005%) was sprayed at 10 ml/10 lit, the least 29.25 percent disease intensity was observed. When propiconazole (0.025%) was sprayed at 10 ml/10 lit, the least 31.23 percent disease intensity was recorded. Wettable sulfur (0.2%) at 2.5 g/l showed 33.07 percent disease intensity.

The treatment hexaconazole 5% EC registered higher net realization (Rs. 20,198/ha) and ICBR (1:6.23) followed by propiconazole 25% EC with net realization (Rs. 16,568/ha) with ICBR (1:5.26) followed by sulphur 80% WP with net realization (Rs. 14,858/ha) with ICBR (1:5.24).

Three sprays of hexaconazole 5 EC (0.005%) @ 10 ml/ 10 lit. or propiconazole 25 EC (0.025%) @ 10 ml/10 lit or sulphur 80 WP (0.2%) @ 25g/10 lit of water for effective management of powdery mildew and to get higher yield. The first spray should be given with anyone fungicides after initiation of disease and subsequent two sprays at 15 days of interval to manage powdery mildew of fenugreek.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

- 1.
- 2.
- 3.

References

- Anonymous (2024^d). <http://14.139.232.166/opstat/>
- Anonymous, (2024^a). <https://foodprocessingbihar.com/mdpr/Spices-dpr-df/leaves.pdf>
- Anonymous, (2024^b). <https://nrss.icar.gov.in/Upload/637876998736044582.pdf>
- Anonymous, (2024^c). <https://eos.com/blog/powdery-mildew/>
- Arya, P. S. (2000). Spices Crop of India. *Kalyani Publishers*. pp-327.
- Balodi, B. and Rao. R. (1991). The genus *Trigonella* L. (Fabaceae) in the Northwest Himalaya. *J. Econ. Taxon.*, **5**:11-16.
- Gojiya, A. U. and Pandya, J. R. (2019). Occurrence and study of powdery mildew disease of fenugreek (*Trigonella foenum-graecum* L.) in South Gujarat. *Int. J. Plant Prot.* **12**(1): 58-61.
- Kirtikar, K. R. and Basu, B. P. (1975). Indian Medicinal Plants. *Periodical Experts*, Delhi.
- Kumawat, R., Shekhawat, K. S. and Kumawat, K (2016^a). Effect of different abiotic environmental factors and host age on development of fenugreek powdery mildew (*Erysiphe polygoni*). *Ann. Agric. Res. New Series.* **37**(4): 424-428.
- Kumawat, R., Shekhawat, K. S., Godika, S. and Kumawat, K. (2016^b). Evaluation of Fungicides against Powdery Mildew (*Erysiphe polygoni*) of Fenugreek *Trigonella foenum graecum* L. *J. Microbiol. Res.* **8**(6):759-761.

- Narayana, D. S. A., Nargund, V. B., Benagi, V. I., Somasekhar, G., Shankarappa, M. R. and Venkataravanappa, K. S. V. (2005). Efficacy of fungicides against grape powdery mildew caused by *Uncinula necator* (Schw.) Burr. *Environ. Ecol.* **23**(4):790-795.
- Patel, D. N., Kedar, N. and Bala, M. (2023). Management of Powdery Mildew of Coriander (*Coriandrum sativum* L.) incited by *Erysiphe polygoni* DC with Fungicides. *Biolo. Forum – An Int. J.* **15**(9): 217-221.
- Prakash, S. and Saharan, G.S. (1999). Source of resistance to downy mildew and powdery mildew of fenugreek. *J. Mycol. Pl. Pathol.* **29**(3):383-384.
- Sharma, R.D., Raghuram, T.C. and Rao, V.D. (1991). Hypolipidaemic effects of fenugreek seeds- A clinical study. *Phytotherapy Res.* **5**:145-147.
- Singh, A.K. (2006). Evaluation of fungicides for the control of powdery mildew disease in coriander (*Coriandrum sativum* L.). *J. Spices Aromatic Crops.* **15**(2):123-124.
- Ushamalini, C and Nakkeeran, S. (2017). Studies on management of powdery mildew in coriander using new generation fungicides. *J. of Spices and Aromatic Crops.* **26**(1): 59-62.

1.1 Table 3. Field evaluation of fungicide for the management of fenugreek powdery mildew 2019-20

Tr. No.	Name of Treatments	Concentrations (a. i %)	Quantity (g or ml/l)	PDI				Average Yield (Kg/ ha)
				Before 1 st spray	15 days after 1 st Spray	15 days after 2 nd Spray	At Maturity	
1	Carbendazim 50 % WP	0.025	0.5 g	8.61(16.99)	31.67(34.23)	32.22(34.54)	33.06(35.06)	973.21
2	Sulphur 80 % WP	0.2	2.5 g	8.89(17.34)	24.72(29.76)	25.55(30.35)	26.94(31.24)	1299.67
3	Propiconazole 25 % EC	0.025	1.0 ml	8.61(17.06)	23.61(28.75)	24.45(29.47)	25.83(30.45)	1315.29
4	Hexaconazole 5% EC	0.005	1.0 ml	8.33(16.77)	20.56(26.96)	20.83(27.15)	22.50(28.31)	1387.38
5	Difenconazole 25% EC	0.025	1.0 ml	9.17(17.62)	27.22(31.44)	28.33(32.14)	29.72(33.03)	1114.49
6	Pyraclostrobin 13.3 % WG	0.025	2.0 g	9.17(17.59)	29.44(32.86)	33.89(35.58)	31.89(34.37)	1026.72
7	Water Spray	-	-	8.89(17.32)	34.44(35.90)	43.89(41.47)	54.72(47.72)	1052.14
8	No water Spray	-	-	9.72(18.04)	46.94(43.25)	51.11(45.64)	64.72(53.58)	919.16
	S.Em±(T)			0.91	1.5365	1.52	1.50	78.67
	(YxT)			-	-	-	-	-
	CD @ 5%(T)			NS	4.661	4.62	4.56	238.62
	(Y xT)			-	-	-	-	-
	CV (%)			9.06	8.09	7.64	7.09	11.99

- Figure in parenthesis are arcsine transformed value
- Figure outside are original value

1.2 Table 4. Field evaluation of fungicide for the management of fenugreek powdery mildew 2020-21

Tr. No.	Name of Treatments	Concentrations (a. i %)	Quantity (g or ml/l)	PDI				Average Yield (Kg/ ha)
				Before 1 st spray	15 days after 1 st Spray	15 days after 2 nd Spray	At Maturity	
1	Carbendazim 50 % WP	0.025	0.5 g	10.56(18.94)	35.56(36.60)	36.67(37.27)	44.44(41.81)	1153.14
2	Sulphur 80 % WP	0.2	2.5 g	10.83(19.18)	26.39(30.89)	28.33(32.15)	30.83(33.73)	1261.16
3	Propiconazole 25 % EC	0.025	1.0 ml	9.44(17.89)	19.72(26.36)	23.33(28.87)	26.39(30.91)	1296.12
4	Hexaconazole 5% EC	0.005	1.0 ml	9.72(18.15)	11.11(19.45)	20.00(26.55)	24.44(29.62)	1386.62
5	Difenconazole 25% EC	0.025	1.0 ml	10.00(18.43)	31.11(33.90)	33.06(35.10)	38.06(38.08)	1225.26
6	Pyraclostrobin 13.3 % WG	0.025	2.0 g	9.44(17.87)	33.61(35.41)	37.78(37.92)	44.17(41.65)	1206.93
7	Water Spray	-	-	11.11(19.33)	40.00(39.23)	44.72(41.97)	49.72(44.84)	1060.45
8	No. Spray	-	-	10.28(18.70)	49.72(44.84)	52.78(46.59)	58.06(49.64)	1019.96
	S.Em±(T)			0.83	0.77	0.63	0.54	70.01
	(YxT)			-	-	-	-	-
	CD @ 5%(T)			NS	2.33	1.91	1.65	212.37
	(Y xT)			-	-	-	-	-
	CV (%)			7.7	3.98	3.05	2.43	10.10

- Figure in parenthesis are arcsine transformed value
- Figure outside are original value

1.3 Table 5. Field evaluation of fungicide for the management of fenugreek powdery mildew 2021-22

Tr. No.	Name of Treatments	Concentrations (a. i %)	Quantity (g or ml/ l)	PDI				Average Yield (Kg/ ha)
				Before 1 st spray	15 days after 1 st Spray	15 days after 2 nd Spray	At Maturity	
1	Carbendazim 50 % WP	0.025	0.5 g	9.44(17.89)	35.28(36.43)	38.06(38.09)	42.78(40.85)	1130.18
2	Sulphur 80 % WP	0.2	2.5 g	9.72(18.15)	25.83(30.54)	29.72(33.03)	31.67(34.24)	1329.47
3	Propiconazole 25 % EC	0.025	1.0 ml	10.00(18.42)	21.11(27.35)	22.50(28.32)	28.61(32.33)	1381.97
4	Hexaconzole 5% EC	0.005	1.0 ml	10.00(18.42)	14.17(22.09)	17.78(24.94)	24.72(29.81)	1400.10
5	Difenconazole 25% EC	0.025	1.0 ml	10.56(18.94)	28.06(31.98)	32.78(34.93)	39.44(38.90)	1356.28
6	Pyraclostrobin 13.3 % WG	0.025	2.0 g	9.44(17.87)	32.22(34.58)	35.28(36.44)	45.83(42.61)	1287.96
7	Water Spray	-		9.72(18.14)	39.17(38.74)	46.39(42.93)	59.72(50.61)	1069.73
8	No. Spray	-		9.72(18.16)	51.11(45.64)	54.44(47.55)	66.94(54.91)	1032.50
	S.Em±(T)			0.49	0.54	0.25	0.48	83.85
	(YxT)							
	CD @ 5%(T)			NS	1.64	0.76	1.46	254.34
	(Y xT)							
	CV (%)			4.65	2.81	1.21	2.06	11.63

- Figure in parenthesis are arcsine transformed value
- Figure outside are original value

Table 6. Field evaluation of fungicides for the management of fenugreek powdery mildew 2019-2022 (Pooled)

Tr. No.	Name of Treatments	Concentrations (a. i %)	Quantity (g or ml/ l)	PDI				Yield (Kg/ ha)
				Before 1 st spray	15 days after 1 st Spray	15 days after 2 nd Spray	At Maturity	
1	Carbendazim 50 % WP	0.025	0.5 g	9.54 (17.93)	35.75 (34.14)	35.65 (40.77)	39.25 (40.03)	1085.51 ^{de}
2	Sulphur 80 % WP	0.2	2.5 g	9.81 (18.23)	30.40 (25.61)	27.87 (35.42)	33.07 (29.77)	1296.77 ^{ab}
3	Propiconazole 25 % EC	0.025	1.0 ml	9.35 (17.79)	27.49 (21.30)	23.43 (32.10)	31.23 (26.88)	1331.12 ^{ab}
4	Hexaconzole 5% EC	0.005	1.0 ml	9.35 (17.79)	24.66 (17.41)	19.54 (29.16)	29.25 (23.87)	1391.37 ^a
5	Difenconazole 25% EC	0.025	1.0 ml	9.91 (18.33)	32.44 (28.77)	31.39 (37.95)	36.67 (35.67)	1232.01 ^{bc}
6	Pyraclostrobin 13.3 % WG	0.025	2.0 g	9.35 (17.77)	34.28 (31.73)	35.65 (40.86)	40.65 (42.43)	1173.87 ^{cd}
7	Water Spray	-		9.91 (18.27)	37.96 (37.83)	45.00 (46.79)	49.38 (57.61)	1060.77 ^{de}
8	No. Spray	-		9.91 (18.29)	44.58 (49.26)	52.78 (51.77)	54.31 (65.96)	990.54 ^e
	SEM± (T)			0.44	0.5948	0.5561	0.5825	42.34
	CD 5% (T)			NS	1.6983	1.5877	1.6632	119.96
	SEM± (Y×T)			0.7624	1.0302	0.9631	1.0090	77.72
	CD 5% (Y×T)			NS	NS	NS	NS	NS
	CV %			7.321	5.34	4.72	4.46	5.73

- Figure in parenthesis are arcsine transformed value
- Figure outside are original value

Table 7. Cost benefit ratio of various treatments used for managements of fenugreek powdery mildew

Sr. NO	Treatment	Yield (Kg/ha)	Yield increase over control (Kg/ha)	Total additional income (Rs/ha)	Quantity of inputs used (kg/lit/ha)	Total cost of treatment (Rs/ha)	Net realization (Rs/ha)	ICBR
			Main product	= main product x 60				
1	Carbendazim 50 % WP	1086	95	5700	750	3494.5	2205.50	1.63
2	Sulphur 80 % WP	1297	306	18360	3750	3502	14858.00	5.24
3	Propiconazole 25 % EC	1331	341	20460	1500	3892	16568.00	5.26
4	Hexaconazole 5% EC	1391	401	24060	1500	3862	20198.00	6.23
5	Difenconazole 25% EC	1232	241	14460	1500	9202	5258.00	1.57
6	Pyraclostrobin 13.3 % WG	1174	183	10980	3000	10702	278.00	1.03
7	Water Spray	1061	70	4200	1500	3202	998.00	1.31
8	No. Spray	991	0	0	0	1072	0.00	0.00

- Total additional income=Yield x 60 Rs/kg seed price of fenugreek
- Labour cost=355/person= (2 labour & 3 time) = (6x 355=2130)
- Total cost of treatment= price of fungicides+ harvesting cost (4 * 268=1072) (T1=292.5, T2=300, T3=690, T4=660, T5=6000, T6=7500)
- Quantity of inputs used= Net realization=total additional income-Total cost of treatment
- ICBR= total additional income/Total cost of treatment

2. UNDER PEER REVIEW