

Evaluation of Integrated Management Practices for Diseases of Fenugreek

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ABSTRACT

Fenugreek is one of the oldest annual green leafy herbs mainly cultivated for its seed. It has huge medicinal and nutraceutical value in the life of human beings. The present investigation was carried out during Rabi 2018-19 and 2019-20 on evaluation of integrated management practices for diseases of fenugreek. The experiment consisted ten treatments and three replications. Two years pooled findings indicated that all the treatments were recorded very good germination percentage. Seed treatment with carboxin 37.5% + thiram 37.5% @ 2g/kg + soil application with *Trichoderma viride* @ 2.5 kg/ha + spray of captan 70% + hexaconazole 5% @ 1g/l registered minimum per cent of wilt incidence and powdery mildew intensity with maximum seed yield (1120 kg/ha) while seed treatment with carbendazim @ 2g/kg + seed treatment with metalaxyl @ 5g/kg + spray of metalaxyl 8% + mancozeb 64% @1g/l and seed treatment with metalaxyl @5g/kg + soil application with *Trichoderma viride* @2.5 kg/ha + spray of trifloxystrobin 25% + tebuconazole 50% @0.5g/l both were registered minimum downy mildew disease intensity.

Key words: Fenugreek, Wilt, Powdery mildew, Downy mildew, Fungicides

Introduction

Fenugreek (*Trigonella foenum-graecum* L.) is often referred to as 'methi' in hind belongs to the *Fabaceae* family. It is one in all the vital seed spices and widely used for seasoning to feature flavour in varied foods and in medicines. Fenugreek is originated from South – Eastern Europe and West Africa. It is currently cultivated in many countries besides India. Interestingly, India is the leading country and stand 1st position in production, consumption and exportation of seed spices. Fenugreek is that the third highest most vital seed spice in India after coriander and cumin. In India, the area under fenugreek is about 120.34 thousands hectares with an annual production of 188.48 thousands tones (Anonymous, 2018-19). Rajasthan Gujarat and

Andhra Pradesh are the major fenugreek producing states in India. These major fenugreek producing states have favorable weather conditions and appropriate soil for the higher growth and production of the crop. In India, Rajasthan stand 1st position in fenugreek production. It has 45.31 thousands hectares areas with annual production of 59.16 thousands tones and 1306 kg/h productivity. In Rajasthan, fenugreek is mainly grown in Bikaner, Sikar, Jodhpur, Pratapgar, Nagaur districts (Anonymous 2018-19). The fenugreek leaves and seeds are pleasantly aromatic in odor. Green leaves of fenugreek are used as an edible herb and also used in making of vegetable which are rich in iron, calcium, vitamins and essential amino acid. Medically, it is extremely inhibitor and downplays the blood glucose, insulin, hemoprotein level and polygenic disease in soul.

The seeds of fenugreek contain macromolecule and organic compound like protein, alkaloid-Trigonelline (bitter taste), choline, fatty oil, water, minerals, sugar, calcium, phosphorus, fiber, iron and vitamins (Habib *et al.*, 1971). Healthful properties of fenugreek are because of inhibitor and anti-inflammatory compounds like genistein, kaempferol, quercetin, rutin, apigenin, selenium and superoxide-dismutase (Girardon *et al.*, 1985). Bitterness of fenugreek seed is because of presence of associated organic compound referred to as "Trigonelline". The extracts of fenugreek seeds are normally utilized in preparation of cosmetics productions. Fenugreek is a cold season crop thus generally grown in the winter season. Cold and warm climate improve the vegetative growth and raise the seed production during early stage of the crop. Powdery mildew (*Erysiphe polygoni* and *Leveillula taurica*), downy mildew (*Peronospora trigonellae*), wilt (*Fusarium oxysporum*), root rot (*Rhizoctonia solani*), rust (*Uromyces anthyllidis*), leaf spot (*Cercospora traversiana*) and charcoal rot (*Macrophomina phaseolina*) are the major fungal diseases of fenugreek causing qualitative and quantitative losses (Godara *et al.*, 2010).

Powdery mildew of fenugreek causes significant losses (27-33%) in grain quality as well as quantity. Similarly, downy mildew of fenugreek causes yield losses up to 45-57% (Prakash and Saharan, 2002). In Rajasthan powdery mildew generally appeared in first week of January and reaches at peak in month of March (Kumawat *et al.*, 2015). Whereas, downy mildew appears in the last week of November and reaches peak in January (Jat *et al.*, 2017). Fenugreek wilt is a serious threat and its frequency varies between 40 and 60 per cent (Shivpur and Bansal, 1987 and Khokhar *et al.*, 2012). Keeping visible the aim of the current investigation is to find out the effective integrated management practices to manage the diseases of fenugreek.

Materials and Methods

An experimental trial was laid out during Rabi 2018-19 and 2019-20 at Agricultural Research Station (Agriculture University, Jodhpur), Mandor. Total ten treatments (Table 2) including nine management practices and one control have been evaluated for the integrated disease management in fenugreek.

Table 1. Disease rating scale (0-5) for disease intensity of fenugreek diseases

Disease rating	Description
0	Free from disease
1	1 to 10 per cent area of leaves/plant parts infected
2	11 to 25 per cent area of leaves/plant parts infected
3	26 to 50 per cent area of leaves/plant parts infected
4	51 to 75 per cent area of leaves/plant parts infected
5	More than 75 per cent area of leaves/plant parts infected

Table 2. Details of treatments applied against diseases of fenugreek in field condition

T ₁	Seed treatment with carbendazim @2g/kg + spray of carbendazim @2g/l
T ₂	Seed treatment with metalaxyl @5g/kg + spray of metalaxyl @2g/l
T ₃	Seed treatment with carbendazim @2g/kg + Seed treatment with metalaxyl @5g/kg + spray of metalaxyl 8% + mancozeb 64% @1g/l
T ₄	Seed treatment with metalaxyl @5g/kg + soil application with <i>Trichoderma aviride</i> @2.5 kg/ha + spray of trifloxystrobin 25% + tebuconazole 50% @0.5g/l
T ₅	Seed treatment with carboxin 37.5% + thiram 37.5% @ 2g/kg + soil application with <i>Trichoderma aviride</i> @2.5 kg/ha + spray of captan 70% + hexaconazole 5% @ 1g/l
T ₆	Seed treatment with <i>Trichoderma aviride</i> @4g/kg + soil application of <i>Trichoderma viride</i> @2.5 kg/ha (in 100 kg FYM) + soil application of neem cake @ 250 kg/ha at sowing + spray of azoxystrobin @ 500 ml/ha
T ₇	Seed treatment with <i>Trichoderma viride</i> @4g/kg + soil application of neem cake @ 250 kg/ha at sowing + spray of pyraclostrobin 133G/l
T ₈	Seed treatment with <i>Trichoderma viride</i> @4g/kg + soil application with <i>Trichoderma viride</i> @2.5 kg/ha + soil application of neem cake @ 250 kg/ha.
T ₉	Dusting of sulphur @ 20-30 kg/ha or spray of Dinocap @ 1ml/l + mancozeb @2g/l at an interval of 15 days.
T ₁₀	Control

The fenugreek cultivar Rmt- 305 was sown in randomized blocked design (RBD) in the first week of November during both the seasons with plot size of 4.0 x 3.0 m². The experiment replicated thrice. The treatments were applied as seed treatment as well as sprayed twice at an interval of 15 days starting from the initial appearance (75-80 days after sowing) of the disease. The wilt disease incidence was recorded by remarking the infected plants from total number of plants from sowing to harvest. The diseases intensity for powdery and downy mildew diseases was recorded from plants by using 0-5 disease rating scale as described in Table 1 (Prakash and Saharan, 1999). Twenty leaves was examined from 20 randomly selected plants in each treatment from prior to first & second spray and after 15 days of second spray. The per cent disease incidence and intensity were calculated by using formula given below.

$$\text{Percent disease incidence} = \frac{\text{Total number of plant infected}}{\text{Total number of plant observed}} \times 100$$

$$\text{Percent disease intensity} = \frac{\text{Sum of numerical rating}}{\text{No. of leaves examined} \times \text{Maximum disease rating}} \times 100$$

Seed yield from each plot was recorded and cal-

culated in kg/ha. Cost benefit ratio was also worked out and results were analyzed statistically.

Results and Discussion

Ten completely different integrated practices for management of fenugreek diseases were applied by seed treatment, soil application and spray methods under natural field conditions. Two years pooled results on per cent disease incidence and intensity (Table 3 & 4) revealed that all the treatments were found significantly effective in reducing the disease incidence and intensity over control. All the treatments were recorded very good germination percentage (98.10-89.40%). Minimum per cent of wilt incidence (4.72%) and powdery mildew intensity (11.55%) were exhibited by seed treatment with carboxin 37.5% + thiram 37.5% @ 2g/kg + soil application with *Trichoderma viride* @ 2.5 kg/ha + spray of captan 70% + hexaconazole 5% @ 1g/lit with maximum seed yield (1220 kg/ha). Seed treatment with *Trichoderma viride* @ 4g/kg + soil application of *Trichoderma viride* @ 2.5 kg/ha (in 100 kg FYM) + soil application of neem cake @ 250 kg/ha at sowing + spray of azoxystrobin @ 500 ml/ha was next effec-

Table 3. Percent disease incidence and intensity of fenugreek diseases

Treatment	Germination %			Wilt PDI			Powdery mildew PDI			Downy mildew PDI		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
T ₁	95.33 (77.52)	93.66 (75.42)	94.50 (76.44)	11.05 (19.42)	12.25 (20.49)	12.15 (20.40)	32.54 (34.78)	29.66 (33.00)	33.10 (35.12)	04.66 (12.47)	2.90 (9.80)	3.78 (11.21)
T ₂	97.75 (81.37)	95.50 (77.75)	96.62 (79.41)	11.80 (20.09)	14.00 (21.97)	12.80 (20.96)	41.46 (40.08)	37.1 (37.52)	39.28 (38.81)	02.00 (8.13)	1.40 (6.80)	1.70 (7.49)
T ₃	96.35 (78.99)	94.75 (76.75)	95.55 (77.82)	9.99 (18.43)	11.00 (19.37)	10.94 (19.31)	35.71 (36.70)	31.75 (34.30)	33.76 (35.52)	01.10 (6.02)	0.80 (5.13)	1.05 (5.88)
T ₄	98.80 (83.71)	96.66 (79.47)	97.73 (81.33)	8.88 (17.38)	10.10 (18.53)	9.49 (17.94)	28.94 (32.54)	24.99 (29.99)	26.96 (31.28)	01.88 (7.88)	1.00 (5.74)	1.34 (6.65)
T ₅	98.66 (83.35)	96.66 (79.47)	97.66 (81.20)	03.67 (11.04)	5.10 (13.05)	4.72 (12.55)	13.00 (21.13)	10.1 (18.53)	11.55 (19.87)	02.90 (9.80)	2.50 (9.10)	2.70 (9.46)
T ₆	99.00 (84.26)	97.20 (80.37)	98.10 (82.08)	04.15 (11.90)	6.00 (14.18)	5.32 (13.34)	22.90 (28.59)	18.8 (25.70)	20.85 (27.17)	05.99 (14.17)	3.15 (10.22)	4.57 (12.34)
T ₇	98.00 (81.87)	96.00 (78.46)	97.00 (80.03)	05.90 (14.06)	7.70 (16.11)	6.45 (14.71)	23.00 (28.66)	20.5 (26.92)	21.75 (27.80)	06.75 (15.06)	4.15 (11.75)	5.45 (13.50)
T ₈	98.25 (82.40)	96.25 (78.83)	97.25 (80.45)	05.33 (13.35)	6.90 (15.23)	6.33 (14.57)	43.99 (41.55)	39.00 (38.65)	44.49 (41.84)	08.00 (16.43)	6.55 (14.83)	7.27 (15.64)
T ₉	93.50 (75.23)	91.50 (73.05)	92.50 (74.11)	13.33 (21.41)	16.11 (23.66)	14.33 (22.24)	18.66 (25.59)	14.33 (22.24)	16.5 (23.97)	07.05 (15.40)	5.33 (13.35)	6.19 (14.41)
T ₁₀	90.00 (71.57)	88.80 (70.45)	89.40 (71.00)	24.66 (29.77)	26.99 (31.30)	25.82 (30.54)	64.91 (53.67)	60.55 (51.09)	62.73 (52.37)	11.66 (19.97)	9.55 (18.00)	10.60 (19.00)
SEm+	2.89	1.34	1.35	0.34	0.27	0.25	1.30	1.18	1.30	0.23	0.19	0.21
CD at 5%	8.91	4.13	4.17	0.69	0.84	0.76	4.02	3.62	4.01	0.72	0.59	0.65
CV (%)	5.18	2.46	2.44	5.99	4.04	3.96	6.94	7.10	7.24	7.75	8.84	8.20

tive in reducing the wilt incidence (5.32%). Whereas, dusting of sulphur @ 20-30 kg/ha or spray of dinocap @ 1ml/lit + mancozeb @ 2gm/l was second best in reducing the per cent intensity of powdery mildew (16.5%) after 15 days of second spray. Seed treatment with carbendazim @ 2g/kg + metalaxyl @ 5g/kg + spray of metalaxyl 8% + mancozeb 64% @ 1g/lit recorded minimum per cent intensity of downy mildew (1.05%) with 778 kg/h seed yield followed by seed treatment with metalaxyl @ 5g/kg + soil application with *Trichoderma viride* @ 2.5 kg/ha + spray of trifloxystrobin 25% + tebuconazole 50% @ 0.5g/lit. All the IDM practices were found statistically significant over control. The results of current investigation are compromise with several workers and reported that effective management practices for reducing diseases in different crops. Yadav *et al.* (2020) reported that seed treatment with tebuconazole + trifloxystrobin (@ 0.2%) was found extremely effective in reducing root rot disease (*Rhizoctonia solani*) incidence and in increasing seed yield of fenugreek under field conditions. Palanisamy *et al.* (2010) showed that seed treatment with *Trichoderma viride* @ 4g/kg seed + soil application of *Trichoderma viride* @ 5 kg/ha + soil application of neem cake @ 150 kg/ha recorded minimum percent disease incidence. On the contrary, seed treatment with carbendazim + soil drenching @ 0.1% + soil application of neem cake @ 150 kg/ha recorded the lowest per cent disease incidence of fenugreek root rot. Jarial *et al.* (2013) reported that pea plots sprayed with hexaconazole exhibited minimum powdery mildew disease severity and maximum disease control. Singh (2006) also re-

corded that maximum reduction of powdery mildew in hexaconazole treatment with higher seed yield followed by propiconazole and wettable sulphur in coriander. Shekhawat *et al.* (2016) revealed that minimum per cent intensity of powdery mildew and downy mildew was recorded with soil application of neem cake @ 1.0 t ha + soil application of *Trichoderma viride* @ 1-2.5 kg ha + spray of neem seed kernel extract (NSKE) @ 5.0 percent. Choudhary (2015) tested that efficaciousness of various fungicides and biocides against powdery mildew of fenugreek. Dhruj (1996) also tested triazole fungicides against powdery mildew of fenugreek. Kumawat *et al.* (2016) tested different fungicides and located that hexaconazole and dinocap was effective against powdery mildew of fenugreek. Rani and Hegde (2016) tested bioagents, botanicals, biorationals and chemicals under *in vitro* and *in vivo* conditions. Among them *Trichoderma viride*, garlic extract, jeevamrutha carbendazim and combi product carbendazim 25% + mancozeb 50% were very effective against wilt/root rot of fenugreek. Thus findings of the present study can be concluded that seed treatment with carboxin 37.5% + thiram 37.5% @ 2 g/kg + soil application with *Trichoderma viride* @ 2.5 kg/ha + spray of captan 70% + hexaconazole 5% @ 1g/l registered minimum per cent of wilt and powdery mildew disease incidence with maximum seed yield (1120 kg/ha). Similarly, seed treatment with carbendazim @ 2g/kg + seed treatment with metalaxyl @ 5g/kg + spray of metalaxyl 8% + mancozeb 64% @ 1g/lit and seed treatment with metalaxyl @ 5g/kg + soil application with *Trichoderma viride* @ 2.5 kg/ha + spray of trifloxystrobin

Table 4. Seed yield kg/ha and B: C ratio of different treatments used against diseases of Fenugreek

Treatment	Seed yield (kg/ha)			Net return (Rs./ha)	B:C Ratio
	2018-19	2019-20	Pooled		
T ₁	1025	576	801	11540	0.6
T ₂	1005	500	753	9720	0.5
T ₃	1030	525	778	10620	0.6
T ₄	1055	679	867	14080	0.7
T ₅	1320	1120	1220	28100	1.4
T ₆	1278	845	1062	21880	1.1
T ₇	1083	700	892	14680	0.8
T ₈	1138	754	946	17340	0.9
T ₉	995	384	690	7520	0.4
T ₁₀	901	300	601	4040	0.2
SEM+	38.19	22.70	28.25	-	-
CD at 5%	114.43	69.94	87.03	-	-
CV (%)	6.00	6.17	5.61	-	-

25% + tebuconazole 50% @0.5g/lit both were found effective against downy mildew disease of fenugreek.

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