

Research Article

Effect of Cultural practices and Host Range on Powdery Mildew (*Erysiphe polygoni*) of Fenugreek, *Trigonella foenum graecum* L.

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Abstract

Date of sowing and crop geometry greatly influenced the disease incidence of powdery mildew on fenugreek during the two consecutive years 2012-13 and 2013-14. Early sown crop exhibited more disease development as compared to late sown crop. 30th November sown crop recorded minimum per cent disease intensity, whereas 10th October sown crop recorded maximum per cent disease intensity and minimum seed yield. The crop was sown on 30th October registered maximum seed yield (16.48 q/ha) with 61.10 per cent disease intensity. The wider spacing of 15 x 45cm, 15 x 30cm and 10 x 45cm between rows and within rows recorded minimum per cent disease intensity (36.11, 39.66 and 45.39) respectively. However, closer spacing 5x15cm recorded maximum seed yield and per cent disease intensity. Out of fifteen host species *Pisum sativum*, *Cuminum cyminum*, *Coriandrum sativum*, *Calendula officinalis*, *Lathyrus odoratus* and *Foeniculum vulgure* were observed susceptible against *Erysiphe polygoni* under caged conditions.

Keywords: Sowing date, spacing, host range, powdery mildew, Fenugreek, *Erysiphe polygoni*

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Introduction

Spices are the low volume, high value and export oriented commodity crops. Fenugreek (*Trigonella foenum graecum* L.) is an important seed spice crop belongs to family *Fabaceae*, cultivated widely in India. The importance of this crop has increased due to its medicinal values and presence of diosgenin that is used for the synthesis of sex hormone and oral contraceptive. Fenugreek seeds are rich source of protein [1] and leaves are rich in minerals, proteins, vitamin A and C. In industry, seeds are used for dye making and for extraction of alkaloids and steroids. The dried leaves and flowers are used for flavouring vegetable curries [2]. Fenugreek can be grown in all types of soils provided that they are rich in organic matter with good drainage.

Fenugreek is attacked by a number of diseases. Powdery mildew of fenugreek is an important and serious disease especially during flowering and pod formation stage of the crop and cause significant losses (33.27 per cent) in grain quality as well as quantity [3].

In Rajasthan, powdery mildew disease caused by *Erysiphe polygoni* appeared in first week of January and reaches at peak in March [4]. The disease is characterized by white floury patches appear on both sides of leaves as well as tendrils, stems, pods etc. As the plant become older, the powdery growth almost covers the entire plant, become more or less greyish brown and the infected part impart dirty appearance. In later stage, powdery growth also covers the pods. The seeds in pods do not either set or remain very small.

Date of sowing and spacing is considered very important and has shown considerable effect on several diseases. The present study was undertaken to know the effect of sowing date, spacing and host range on the fenugreek powdery mildew caused by *Erysiphe polygoni*.

Materials and Methods

Effect of sowing dates and spacing

To understand the role of sowing dates and spacing on occurrence and development of powdery mildew on fenugreek, the field experiments were conducted during *rabi* 2012-13 and 2013-14 in randomized blocked design (RBD) on susceptible fenugreek local cultivar (Rmt-1) at Agronomy farm of S.K.N. College of Agriculture, Jobner (Sri Karan

Narendra Agriculture University, Jobner). The crop was sown in the last week of October in both the years with plot size of 2 x 2 m². To know the effect of sowing dates and spacing, the sowing was done at ten days interval starting from 10th, 20th, 30th October, 10th, 20th and 30th November and nine with different spacing viz., 5 x 15cm, 5 x 30cm, 5 x 45cm, 10 x 15cm, 10 x 30cm, 10 x 45cm, 15 x 15cm, 15 x 30cm and 15 x 45cm in the experimental farm during both seasons. Powdery mildew is known to occur in severe form under natural field conditions in this area. The crop was observed regularly for foliar infections. Disease intensity was recorded by examining 20 leaves from ten plants randomly selected in each plot starting from the initiation of the disease at 10 days intervals. For disease scoring on leaves 0-5 scale (**Plate 1**) was used as mentioned below [5]. Per cent disease intensity was calculated by using formula given below. At harvesting, seed yield per plot was also recorded and calculated in kg/ha.

Disease rating, per cent disease intensity (PDI) was calculated as per method suggested with slight modifications [5].

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

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

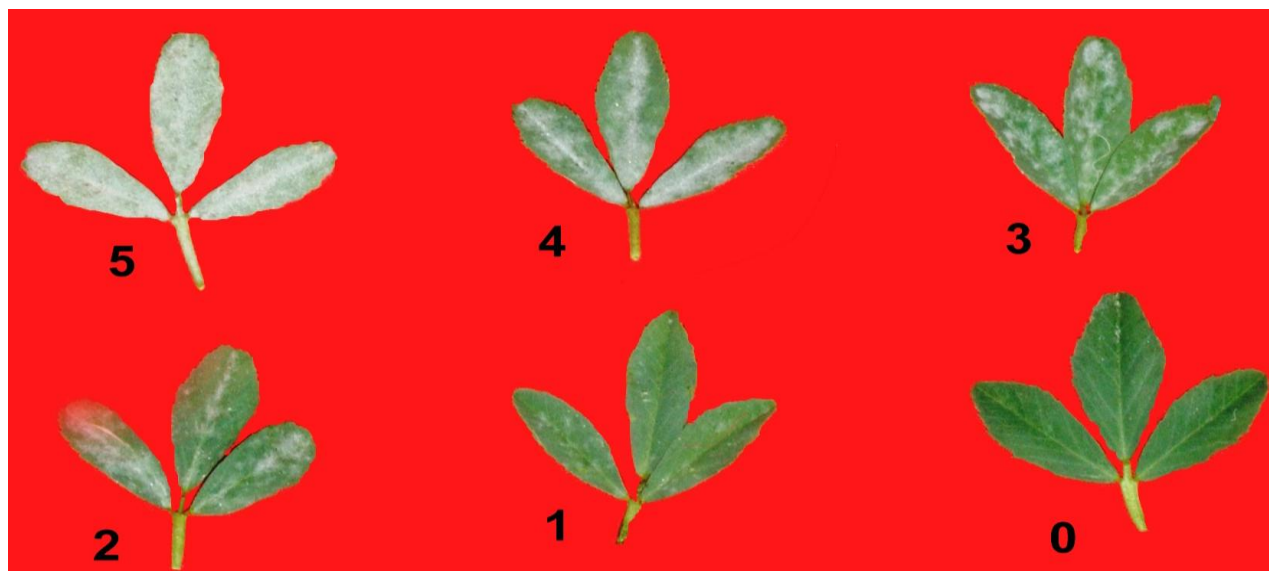


Plate 1 Area of leaf affected by powdery mildew disease (0-5 scale rating)

Host range

Fifteen host species, *Beta vulgaris*, *Ranunculus acutus*, *Chenopodium album*, *Chenopodium murale*, *Pisum sativum*, *Daucus carota*, *Cuminum cyminum*, *Launea asplenifolia*, *Asphodelus tenuifolius*, *Coriandrum sativum*, *Anagalis arvensis*, *Foeniculum vulgure*, *Calendula officinalis*, *Cosmos bipinatus*, and *Lathyrus odoratus* belonging to different families were used in host range studies. Seeds of these species were obtained from local market of Jobner. The seeds were sown in 15 cm earthen pots pre-sterilized with copper sulphate solution and filled with sterilized soil which was autoclaved at 1.045 kg/cm² for 1 hour on 3 consecutive days. Seeds were sown at a depth of about 2 cm and 5 seedlings were kept in each pot. The watering was applied as and when required. After 45 days of sowing, plants were inoculated by dusting the inoculum of *Erysiphe polygoni* [6] and covered with polythene bags to maintain humidity. Symptoms were observed after 96 hours of incubation. Species showing symptoms were designated as positive (+) host and those not showing any symptoms were designated as negative (-) host.

Results and Discussion

Effect of sowing date

The result of pooled data presented in **Table 1** and **Figure 1** indicated that powdery mildew disease intensity showed a decreasing trend with the delayed sowing, where disease intensity was maximum 72.37 per cent on 10th October sowing crop closely followed by 69.26 per cent on 20th October sowing crop. Minimum 40.71 per cent disease intensity was observed in 30th November sowing crop followed by 47.56 per cent in 20th November sowing crop. 30th October sown crop registered 61.10 per cent disease intensity.

Table 1 Effect of dates of sowing on powdery mildew disease intensity and seed yield of fenugreek

Date of sowing	Per cent disease intensity*			Increase/decrease in PDI over standard recommended date of sowing** (%)	Yield (q/ha)*			Decrease in yield over standard recommended date of sowing** (%)
	2012-2013	2013-1014	Pooled		2012-2013	2013-2014	Pooled	
10 Oct.	73.62 (59.10)	71.12 (57.49)	72.37 (58.13)	18.44	12.70	12.18	12.44	24.51
20 Oct.	70.87 (57.24)	67.64 (55.33)	69.26 (56.32)	13.35	4.01	14.79	14.40	12.62
30 Oct.	62.45 (52.10)	59.75 (50.62)	61.10 (51.40)	-	15.37	17.59	16.48	-
10 Nov.	54.44 (47.55)	50.10 (45.06)	52.02 (46.15)	14.86	14.05	16.30	15.17	7.94
20 Nov.	49.22 (44.56)	45.90 (42.65)	47.56 (43.61)	22.16	14.65	16.25	15.45	6.25
30 Nov.	42.25 (40.54)	39.16 (38.74)	40.71 (39.64)	33.38	13.89	14.66	14.28	13.34
SEm±	1.65	1.62	1.63		0.54	0.53	0.54	
CD (p=0.05)	5.08	4.97	5.03		1.65	1.62	1.65	
CV	8.41	8.48	8.45		9.49	9.40	9.51	

* Average of four replications; **Standard recommended date of sowing 30th October; Figures in parenthesis are angular transformed values

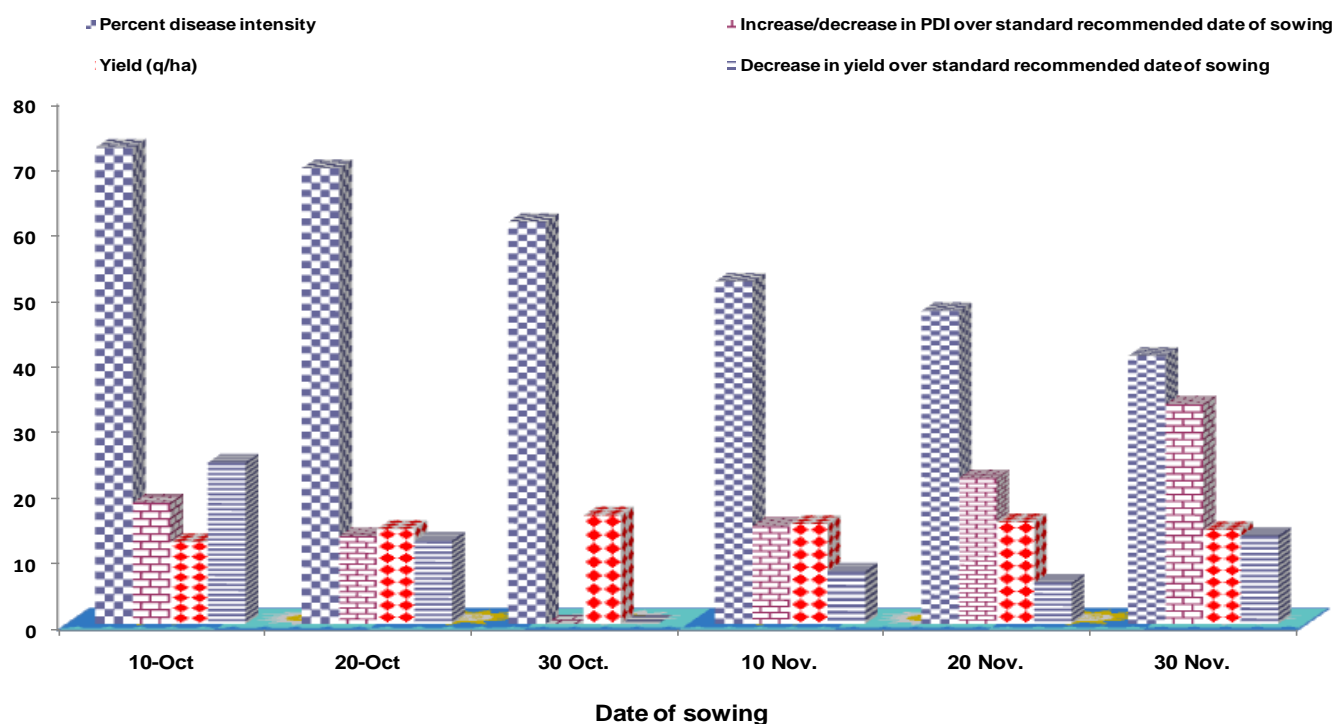


Figure 1 Effect of dates of sowing on powdery mildew disease intensity and seed yield of fenugreek

The pooled analysis of seed yield data (Table 1 and Figure 1) indicated that seed yield was lowest (12.44 q/ha) in case of 10th October sown crop followed by 30th November sowing crop (14.28 q/ha). However, inspite 30th October sowing crop recorded maximum (16.48 q/ha) seed yield it was at par with 10th and 20th November sown crop with 15.45 q/ha and 15.17 q/ha seed yield, respectively. The present findings are in contradiction with finding of [7] as observed severity of powdery mildew disease of pea was more on 10th October sown pea crop was more in comparison to early sown crop. The reason is that in early sown crop (10th October), the incidence of disease was more as in January as during this period pathogen have more congenial climatic conditions and surface area of host plant (including both vegetative and reproductive) area for their development. Maximum seed yield per hectare of pea was obtained in 30th October sowing crop [8]

Effect of spacing

Plant population greatly influenced powdery mildew disease intensity of fenugreek during both the years of study. Analysis of pooled data presented in **Table 2** and **Figure 2** showed that spacing 5 x 15cm showed highest 77.88 per cent disease intensity and the disease was significantly higher than other spacing. However, spacing of 5 x 45cm and 10 x 30cm was found at par. Minimum 36.11 per cent disease intensity was recorded when crop was sown in 15 x 45cm spacing with 43.68 per cent decreased in disease intensity followed by 15 x 30cm (39.66 per cent) and 10 x 45cm (45.39 per cent) spacing with 38.13 per cent and 29.20 per cent decrease in disease intensity.

Table 2 Effect of spacing on powdery mildew disease intensity and seed yield of fenugreek

Spacing (cm) (P x R)	Per cent disease intensity*			Increase/decrease in PDI over standard recommended spacing** (%)	Yield (q/ha)*			Increase/decrease in yield over standard recommended spacing** (%)
	2012- 2013	2013- 2014	Pooled		2012- 2013	2013- 2014	Pooled	
5X15	78.21 (62.17)	77.54 (61.71)	77.88 (61.94)	21.48	16.93	18.86	17.90	11.80
5X30	67.32 (55.13)	65.88 (54.26)	66.60 (54.70)	3.88	17.04	17.18	17.11	6.87
5X45	62.22 (52.07)	59.99 (50.76)	61.11 (51.42)	4.68	14.69	15.00	14.84	7.30
10X15	71.99 (58.04)	68.33 (55.75)	70.16 (56.89)	9.43	15.90	16.25	16.08	0.43
10X30	65.44 (53.99)	62.77 (55.39)	64.11 (53.19)	-	15.23	16.80	16.01	-
10X45	46.11 (42.76)	44.66 (41.93)	45.39 (42.35)	29.20	14.97	15.20	15.09	5.75
15X15	60.55 (51.09)	58.10 (49.66)	59.33 (50.37)	7.45	15.75	16.10	15.90	0.68
15X30	40.22 (39.36)	39.10 (38.70)	39.66 (39.03)	38.13	14.07	14.70	14.39	10.11
15X45	36.44 (37.13)	35.77 (36.73)	36.11 (36.93)	43.68	13.54	13.90	13.72	14.30
SEm±	1.72	1.69	1.61		0.66	0.64	0.65	
CD (p=0.05)	5.28	5.19	4.96		2.02	1.97	2.00	
CV	3.32	3.28	3.12		4.08	4.01	4.05	

*Average of three replications; ** Standard recommended spacing 10 x 30cm; Figures in parentheses are angular transformed values

Seed yield data indicated that spacing 5 x 15cm, 5 x 30cm, 10 x 15cm and 10 x 30cm were significantly superior to 15 x 45cm spacing. Maximum 17.90 q/ha seed yield was recorded in 5 x 15cm spacing with increasing 11.80 per cent seed yield over standard recommended spacing. Spacing 10 x 15cm and 10 x 30cm statistically at par with 5 x 15cm and recorded 16.08 and 16.01 q/ha seed yield.

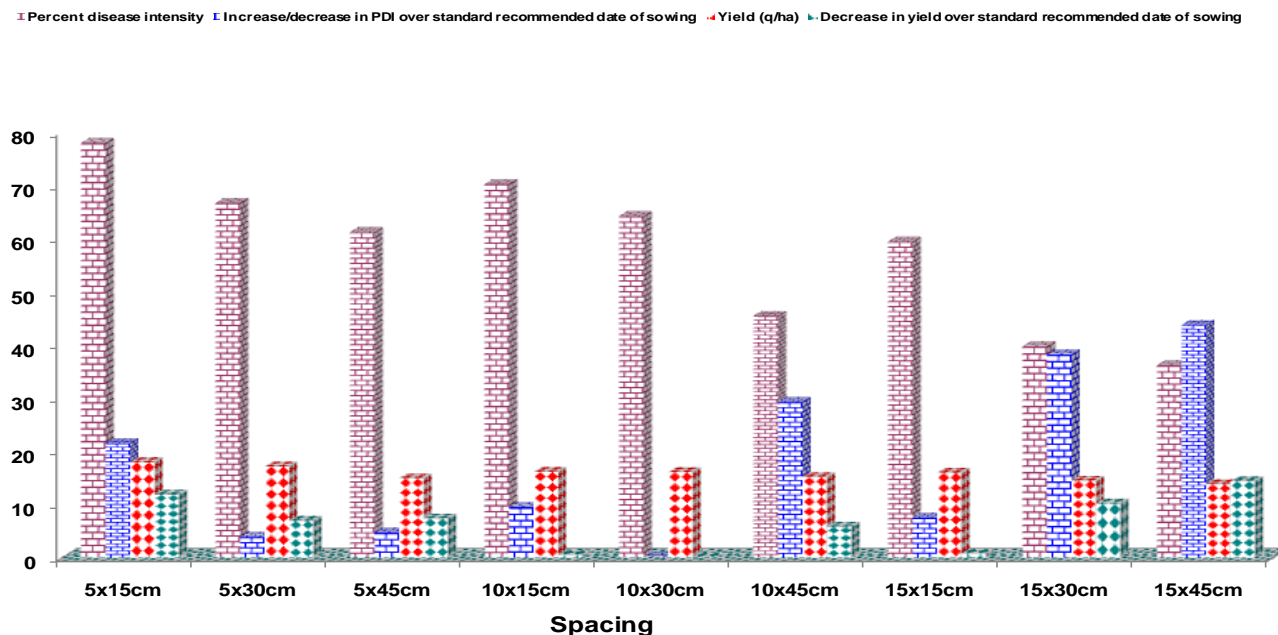


Figure 2 Effect of spacing on powdery mildew disease intensity and seed yield of fenugreek

The spacing of 15 x 45cm resulted in lowest (13.72 q/ha) seed yield with less disease intensity but showed significant yield loss than other higher spacing. Sharma and Sharma (2002) showed that maximum seed yield of pea was obtained in 30th October sown crop at 20cm spacing along with moderate disease severity followed by 30th October sown crop at 40cm spacing. Similar results was observed when methi crop grown in rows 20cm apart gave higher seed yield than grown at 30 and 40cm apart rows [9].

Host range study

Fifteen host species were tested under green house conditions for infection of *Erysiphe polygoni* as per method described earlier. Observation recorded after 96 hours of incubation showed (**Table 3**) that *Chenopodium album* L., *C. murale*, *Beta vulgaris* L., *Ranunculus acutus*, *Daucus carota*, *Launea asplenifolia*, *Asphodelus tenuifolius*, *Anagalis arvensis* and *Cosmos bipinatus* were found resistant. Plant species inoculated and showed symptoms were *Pisum sativum*, *Cuminum cyminum*, *Coriandrum sativum*, *Foeniculum vulgur*, *Calendula officinalis* and *Lathyrus odoratus*. *Erysiphe polygoni* of pea was infecting various species of plant which included both weeds and cultivated crops [10].

Table 3 Infection of *Erysiphe polygoni* on different hosts

S.No.	Host	Symptoms produced
1.	<i>Anagalis arvensis</i>	-
2.	<i>Asphodelus tenuifolius</i>	-
3.	<i>Beta vulgaris</i>	-
4.	<i>Calendula officinalis</i>	+
5.	<i>Chenopodium album</i>	-
6.	<i>Chenopodium murale</i>	-
7.	<i>Coriandrum sativum</i>	+
8.	<i>Cosmos bipinatus</i>	-
9.	<i>Cuminum cyminum</i>	+
10.	<i>Daucus carota</i>	-
11.	<i>Foeniculum vulgur</i>	+
12.	<i>Lathyrus odoratus</i>	+
13.	<i>Launea asplenifolia</i>	-
14.	<i>Pisam sativum</i>	+
15.	<i>Ranunculus acutus</i>	-

- = No symptoms observed; += Symptoms observed

Conclusion

Early sown crop exhibited more disease development as compared to late sown crop. Crop planted on 30th October gave highest seed yield and 61.10 per cent disease intensity. The wider spacing of 15 x 45cm, 15 x 30cm and 10 x 45cm between rows and within rows caused significant reduction in disease intensity over standard recommended spacing *i.e.* 30 x 10cm.

Hosts like *Coriandrum sativum*, *Cuminum cyminum*, *Foeniculum vulgare*, *Pisum sativum*, *Calendula officinalis* and *Lathyrus odoratus* were found susceptible to powdery mildew disease.

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