

# Effects of Powdery Mildew (*Leveillula Taurica* and *Erysiphe Polygoni*) on Yield and Yield Components of Fenugreek in the Mid-Altitudes of Bale, South Eastern Ethiopia

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**Abstract:** Fenugreek (*Trigonella foenum-graecum* L.) is one of the most important seed spice crops in Ethiopia in general and in the mid-altitudes of Bale in particular. Powdery mildew caused by *Leveillula taurica* and *Erysiphe polygoni* is a common disease of fenugreek in the mid-altitudes of Bale. To determine the effects of this disease on yield and yield components of the crop, a field experiment was conducted using an improved variety, Hunda'ol, at Goro research site of Sinana Agricultural Research Center, south eastern Ethiopia. Four different spray intervals of a systemic fungicide, Lunar sensation (Fluopyram 250 g/L+ Trifloxystrobin 250 g/L), were used to create different levels of powdery mildew severity. The plots were arranged in Randomized Complete Block Design (RCBD) with three replications. There was severe powdery mildew development on plants in the unsprayed plots. The disease had significant effect on two of the yield parameters, number of seeds per pod and thousand seed weight. It inflicted the total yield loss up to 40%. Hence, application of control measure to minimize this loss is necessary. Resistant varieties are cultural tools that could be used for the management diseases of several crops. However, so far there is no powdery mildew resistant fenugreek variety released in this country. Fungicides can be used to effective control of this disease. The present study revealed that powdery mildew of fenugreek can be controlled by applying lunar sensation twice between 21-days starting from the onset of the disease.

**Keywords:** Fenugreek, *Trigonella Foenum-Graecum*, Powdery Mildew, *Leveillula Taurica*, *Erysiphe Polygoni*, Lunar Sensation

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## 1. Introduction

Fenugreek (*Trigonella foenum-graecum* L.) is an annual legume crop belonging to the family Fabaceae [2]. It is indigenous to countries on the Eastern shores of the Mediterranean, but widely cultivated in India, Egypt, Ethiopia, Morocco and occasionally in England [10, 4]. The uses of the seeds and leaves of fenugreek are diverse. They are used as spices in food preparations to enhance or impart flavor. Fenugreek seeds are good sources of protein, fat, minerals and dietary fiber [7]. It has good medicinal values [6] and is used against the digestive disorders [13].

Fenugreek (*Trigonella foenum-graecum* L.) is one of the most important seed spice crops in Ethiopia in general and in the mid-altitudes of Bale in particular. In these areas, farmers

produce it under rain fed condition during both 'Bona' (August - December) and 'Gena' (March - July) cropping seasons for commercial purpose. Despite its importance, this crop is low yielding due to multiple biotic and abiotic factors. Powdery mildew caused by *Leveillula taurica* and *Erysiphe polygoni* is the most destructive disease of fenugreek which causes damage to all above ground plant parts. It appears usually in later stage of the crop and becomes serious when pod formation takes place [11]. In this disease, white powdery patches appear on the lower and upper surface of leaves and other parts of the plant.

Powdery mildew affects both biomass and seed yield of fenugreek [9, 3]. This disease can result seed yield loss as high as 50 per cent [1]. It causes reductions of 22.8-25.6, 16.2-18.8 and 14.3-17.2 percent pods per plant, seeds per pod

and test weight, respectively. It also resulted in significant losses in quality [12].

Studying the effects of a given disease on a specific crop helps to decide on the control measures. Although powdery mildew is the common disease of fenugreek, its effect on yield and yield components of the crop is not yet studied in Ethiopia in general, and in the mid-altitudes of Bale in particular. Hence, this experiment was initiated with the objective of determining the effects of powdery mildew on yield and yield components of fenugreek in the mid-altitudes of Bale.

## 2. Materials and Methods

An improved fenugreek variety, Hunda'ol, was sown in fifteen plots size of 2.5m x 2.4m at Goro research site of Sinana Agricultural Research Center, south eastern Ethiopia. During the onset of powdery mildew on plants in the experimental plots, a systemic fungicide, Lunar sensation (Fluopyram 250 g/L+ Trifloxystrobin 250 g/L), was sprayed at a rate of 0.75 l/ha on plants in twelve of the experimental plots in four different spray schedules viz., every 7-, 14-, 21- and 28-days (three plots for each spray schedule). Spray continued at the specified intervals until the crop attained its physiological maturity. Plants in the remaining three plots were left unsprayed to allow maximum powdery mildew development. During fungicide sprays, plastic sheet was used to separate the plot being sprayed from the adjacent plots to prevent inter-plot interference due to spray drift. The maximum number of sprays i.e. every 7-days interval spray was five. Spray frequencies for 14-, 21- and 28-days interval were three, two and two, respectively. The trial was laid down in Randomized Complete Block Design (RCBD) with three replications. The experiment was conducted for two consecutive *bona* (August to December) cropping seasons of 2014 and 2015.

Powdery mildew severity was evaluated as the percentage of foliage area that is infected. It was assessed on weekly bases from 24 plants which were randomly pre-tagged in the middle six rows of each plot (four plants per row).

Data of yield and yield components and other agronomic parameters, were collected as follows.

- Days to maturity: number of days from planting to 90% of plants of each plot mature
- Plant height (cm): average height of 30 random plants of each plot
- Number of pods per plant: average number of pods of 40 random plants from each plot
- Number of seeds per pod: average number of seeds of 60 random pods from each plot
- Thousand seed weight: weight of 1000 seeds from each plot
- Total yield (q/ha): yield estimated from the middle six rows of each plot and transformed to quintals per hectare.

## 3. Result and Discussion

Severity level of powdery mildew on plants in the unsprayed plots was significantly ( $p \leq 0.05$ ) higher than severity level on plants in sprayed plots. Among fungicide sprayed plants, the highest severity level (5%) was recorded on plants which were sprayed with the fungicide twice between 28-days interval while the lowest (2.3%) was scored from plants which were protected from the disease by spraying the fungicide in every 14-days. However, there was no significant ( $p > 0.05$ ) powdery mildew severity level difference among fungicide sprayed plants and all of the spray schedules were equally effective in controlling the disease (Table 1).

Unlike powdery mildew severity, there was no significant ( $p > 0.05$ ) height difference between fungicide sprayed and unsprayed plants and it varied from 50.3 cm to 57.8 cm (Table 1). Rath *et al.* [12] reported similar observations on the effect of powdery mildew disease on plant height. This implies powdery mildew does not have significant effect on plant height.

Although there was no significant number of pods per plant difference among fungicide sprayed and unsprayed plants, the lowest value (17.8) was recorded from unprotected plants where as the highest value (23.2) was recorded from plants which were sprayed with the fungicide twice between 21-days interval (Table 1).

Similar to powdery mildew severity, there was significant ( $p \leq 0.05$ ) number of seeds per pod difference between fungicide sprayed and unsprayed plants. The minimum number of seeds per pod (8.9) was counted from the unprotected plants (Table 1). There was no significant number of seeds per pod difference among plants under the four fungicide spray schedules. Significant effect of powdery mildew on number of seeds per pod was also reported by Rath *et al.* [12].

There was significant ( $p \leq 0.05$ ) thousand seeds weight difference between fungicide sprayed and unsprayed plants. The highest value (19.3 g) was recorded from plants which were protected from the disease by spraying the fungicide between 14-days interval while the lowest (15.4 g) was recorded from unsprayed plants. According to this result, the disease can cause up to 20.2% reduction in thousand seeds weight in this crop (Table 1). Significant effect of powdery mildew on seeds weight of mung beans has also been observed by Nucharee *et al.* [8].

Similar to the above two yield components, number of seed per pod and thousand seed weight, there was significant ( $p \leq 0.05$ ) difference between total seed yield harvested from fungicide sprayed and unsprayed plants. The highest yield (26.65 q/ha) was harvested from plants in which powdery mildew was controlled by spraying the fungicide twice between 21-days interval while the lowest was obtained from the unprotected ones. The results from this study confirmed that powdery mildew inflicted total seed yield loss as high as 40% (Table 1).

**Table 1.** Effect of powdery mildew on yield and yield components of fenugreek in mid-altitudes of Bale, south eastern Ethiopia.

Spray schedules	PM (%)	PH (cm)	Number of pod/plant	Number of seed/pod	1000 SW	Total seed yield (q/ha)	Total seed yield loss (%)
Unsprayed	81.7	50.3	17.8	8.9 (23.3%)	15.4 (15.9%)	15.82	40.64
Between 28 days	5.0	54.6	21.4	10.4	18.4	25.39	4.73
Weekly	3.7	55.7	20	10.7	18.2	26.03	2.33
Between 14- days	2.3	55.2	21.5	11.0	19.3	24.72	7.24
Between 21-days	3.3	57.8	23.2	11.6	18.3	26.65	
CV (%)	10.5	5.7	17	7.5	3.4	9.44	
LSD (0.05)	5.6	NS	NS	2.2	1.7	6.27	

PM: Powdery mildew; PH: Plant height; SW: Seed weight; q/ha: Quintals per hectare  
Values in parenthesis are per cent reduction

## 4. Summary and Conclusions

Fenugreek (*Trigonella foenum-graecum* L.) is one of the most important seed spice crops in Ethiopia. Mid-altitudes of Bale are among the major fenugreek producing areas in Ethiopia. Despite its importance, this crop is low yielding due to multiple biotic and abiotic factors. Powdery mildew caused by *Leveillula taurica* and *Erysiphe polygoni* is the most common disease of the crop in these areas. However, its effect on yield and yield components of the crop is not yet studied in Ethiopia in general, and in the mid-altitudes of Bale in particular. A field experiment was conducted to study the effects of powdery mildew on yield and yield components of the fenugreek in mid-altitudes Bale.

Among the yield parameters, powdery mildew had significant effect on number of seeds per pod and thousand seed weight. It reduced number of seeds per pod by up to 23% and thousand seed weight by 16%. It also has significant effect on total yield. It inflicted the total yield loss up to 40%. Hence, application of control measure to minimize this loss is necessary. Resistant varieties are cultural tools that could be used for the management diseases of several crops. However, so far there is no powdery mildew resistant fenugreek variety released in this country. Fungicides can be used to effective control of this disease. The present study revealed that powdery mildew of fenugreek can be controlled by applying lunar sensation twice between 21-days starting from the onset of the disease.

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