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Effect of weed invasion on *Ramularia* blight disease incidence in fennel (*Foeniculum valgare* Mill.)

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Abstract

A field experiment was carried out to observe the effect of weeds on *Ramularia* blight disease incidence in fennel during *rabi* season of 2012 to 2014. The experiment was included eleven different treatments in fennel (var. AF-1) crop. The pooled data revealed that the effect of weeds on incidence of *Ramularia* blight disease was significantly higher. *Ramularia* blight incidence was found highest (PDI-42.0) in the crop that was kept weed free up to 30 Days After Sowing (DAS) and later allowed weeds grow freely up to harvesting, followed by in the crop that was kept weed free up to 15 DAS (PDI-34.50) and later allowed weeds grow freely up to harvesting the crop. *Ramularia* blight disease was reduced drastically and reported minimum disease incidence (PDI 18.0) in the plots that were kept weed free for whole life spawn (up to harvesting). The maximum grain yield (2185.2 kg ha^{-1}) was also obtained in the same plots those were kept weed free whole life spawn. The minimum grain yield (224.1 kg ha^{-1}) was recorded in the plots that had weeds up to 135 DAS and later kept weeds free.

Key words : Fennel, ramularia blight, weed, weed free, yield

Introduction

Fennel (*Foeniculum valgare* Mill.) belonging family Apiaceae, is a cross pollinated diploid plant species with chromosome number, 2n = 22. It is one of the most important seed spice crop and is native of Europe and Meditarean region. Fennel is cultivated throughout the temperate and sub tropical region in the world mainly in Romania, Russia, Hungary, Germany, France, Italy, India, Srilanka, Malaysia, Japan, Argentina and USA (Mittal *et al.*, 2016). In India it is mainly grown in the states of Rajasthan and Gujarat and some extent in Uttar Pradesh, Karnataka, AP, Panjab, MP, Bihar, Haryana and Jammu & Kashmir. In India total cultivated area is about 76000 ha and production 129350 tonns (DASD, 2015-16). Fennel is vulnerable to many diseases including fungal diseases (Mukerji and Basin, 1986). Productivity of the fennel crop is very low in India against its potential yield one of the key reasons for the lower productivity is *Ramularia* blight disease. *Ramularia* blight disease caused by *Ramularia foeniculli* is one of the most important diseases and causes tremendous yield loss due to reduction in photosynthetic capacity of the plants (Jaiman *et al.*, 2013; Meena *et al.*, 2014). It has become a serious concern in recent years especially in Rajasthan and Gujarat states. After severe infection the host plant is made weak by the pathogen and yield loses occurs tremendously. The disease is mainly airborne and comparatively appears in later stage of the crop before harvesting and maturation. The environmental factors such as moisture, relative humidity, temperature, weather and air blowing affect the incidence of the disease (Kumari and Prasad, 1998; Parasar and Lodha 2012; Meena *et al.* 2014). Crop stages also concern the disease incidence and play a key role in the appearance of the *Ramularia blight* disease. Weeds have been seen as promoter and alter pathogen as well as host plant physiology by various means of interactions such as competing for nutrient, water, light, space etc. Therefore the present study was carried out to evaluate the possible effect of weeds on the *Ramularia* disease incidence on fennel crop.

Materials and methods

The experiment was laid out including different treatments to evaluate the effect of weeds on the disease incidence at ICAR-National Research Centre on Seed Spices, Ajmer, Rajasthan (India) during *rabi* season from 2012-2014. The experimental site soil was sandy loam and the fennel crop was sown at row distance of 50cm and 30 cm between plants using 12 kg seeds per hectare. The experiment

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was designed including eleven different treatments under natural conditions (*in vivo*) in fennel crop. The crop variety used was Ajmer Fennel-1 (AF-1). The effect of weeds on incidence of *Ramularia* blight disease was recorded at 150-180 days after sowing (DAS). All the eleven treatments replicated thrice statistically in Randomized Block Design (RBD) with the plots size was kept 5x5 M. All the treatments were kept with 15 days interval for weeds such as "complete weed free for whole crop span, weed free up to 15 DAS, weed free up to 30 DAS, weed free up to 45 DAS, weed free up to 60 DAS, weed free up to 75 DAS, weed free up to 90 DAS, weed free up to 105 DAS, weed free up to 120 DAS, weed free up to 135 DAS and weed free up to 150 DAS". All the treatments were screened for the *Ramularia* blight incidence under natural conditions (*in vivo*). Disease severity was recorded on leaf surfaces, stems, inflorescences and fruits at before flowering stage (120 DAS) and flowering stage (160 DAS). From each plot, twenty plants were selected randomly and *Ramularia* blight severity was recorded by referring the following 0-5 disease scale (Kakani *et al*., 2010; Jaiman *et al*., 2013). After appearing of the disease the data were recorded at an interval of 10 days up to harvesting. The observation on the disease intensity was recorded after randomly selected plants from each plots using above given scale as: 0 = No incidence/Healthy; 1 = Symptoms on leaf tip and leaves only; 2 = Symptoms on leaves and petiole; 3= Symptoms on leaves, petiole and stem; 4 = Symptoms on leaves, stem and inflorescence; 5 = Symptoms on leaves, stem, and inflorescence including seeds. Based on these observations, per cent disease intensity (PDI) of the disease was worked out using formula developed by Wheeler (1969) and disease response was indicated as the degree of the disease incidence Very low (0-10 DI %), Low (11-20 DI %), Medium (21-30 DI %), High (31-40 DI %) and Very high (>40 DI %). The seed yield from individual plots was also recorded and converted in per hectare basis. The data recorded from the experiment was statistically analyzed and found out the influence of weeds infestation (invasion) on the *Ramularia* blight and seed yield.

$$PDI = \frac{\text{Sum of the individual disease ratings}}{\text{Total number of plants observed} \times \text{maximum grade}} \times 100$$

Results and discussion

Results presented in Table 1 revealed the weed invasion was not only affected negatively reducing fennel grain yield but also created favorable environment to the *Ramularia* blight pathogen. Certainly almost all the plots those were kept weed free comparatively longer duration in terms of day gave higher seed yield and lower *Ramularia* blight incidence while the plots those were not kept weed free comparatively for longer duration produced lower seed yield and were recorded higher the *Ramularia* blight incidence. *Ramularia* blight incidence was found highest (PDI-42.0) in the plots which were weed free up to 30 DAS and later allowed weeds grow freely up to harvesting the crop followed by in the plots which were kept weed free up to 15 DAS (PDI-34.50) and later allowed weeds to grow freely up to harvesting the crop. *Ramularia* blight disease was reduced drastically and reported minimum incidence (PDI 18.0) in the plots those were kept weed free up to harvesting.

Similarly the maximum grain yield (2185.2 kg ha^{-1}) was obtained in the plots kept weed free for whole life spawn, while the minimum grain yield (224.1 kg ha^{-1}) was reported in the plots that had weeds up to 135 DAS and later kept weed free (Fig. 1). Almost similar results were reported by various workers earlier. Various cropping practices can cause shifts in weed composition within crop fields (Barberi and Mazzoncini, 2001; Tworkoski *et al*., 2000). Weeds harbored diseases that can be transferred to crop plants by insects feeding first on weeds, and then on the crop (Chellemieet *et al*. 1994). Elimination of the source of the disease and vectors is often the most effective approach to manage and weed control (Agrios, 1997). Meena *et al*. (2015) reported that pre-emergence application of oxadiargyl @ 75 g ha-1 + one hand weeding at 45 DAS is the best economically feasible weed control treatment resulting in efficient weed control which ultimately leads to higher yields.

Table 1. Effect of weed invasion (infestation) showed on *Ramularia* blight incidence in fennel (pooled from 2012-14)

S. No.	Weed free crop duration	Disease incidence	Disease % response
1	Weed free whole crop span	18.0	Low
2	Weed free 15 DAS	41.5	Very high
3	Weed free 30 DAS	42.0	Very high
4	Weed free 45 DAS	41.0	Very high
5	Weed free 60 DAS	36.0	High
6	Weed free 75 DAS	36.5	High
7	Weed free 90 DAS	35.0	High
8	Weed free 105 DAS	33.5	High
9	Weed free 120 DAS	31.5	High
10	Weed free 135 DAS	29.0	Medium
11	Weed free 150 DAS	30.5	High
	CD at 5%	1.55	
	SEm±	0.74	

PDI : Percent disease index/disease incidence (DI)

DAS : Days after sowing

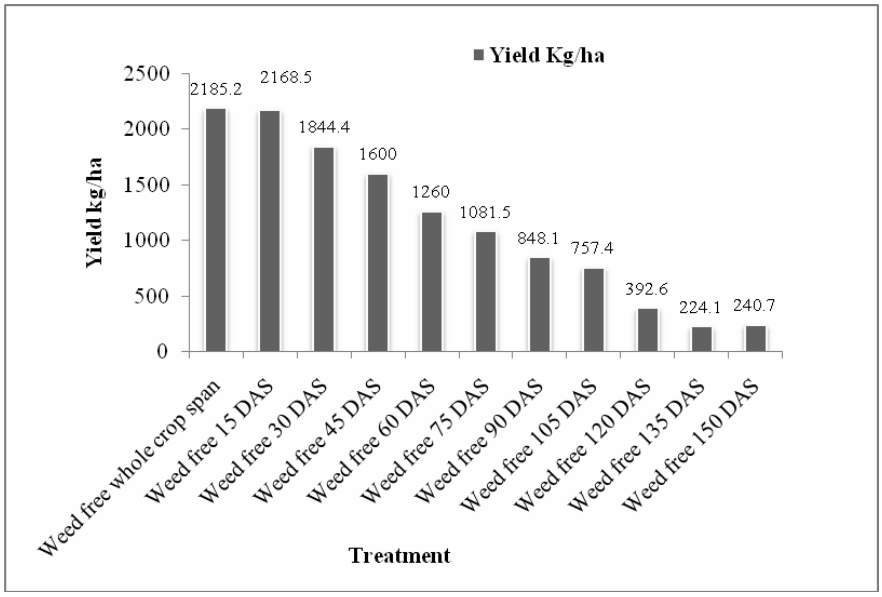

Fig. 1: Effect of weed invasion on fennel seed yield

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