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Effects of Different Sowing Frequencies on Barley Leaf Scald and Some Yield Components

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Abstract: Effect of different seed frequencies on infection severity of *Rhynchosporium secalis* and some yield components was investigated on Blenhaim barley cv. sown with six different densities. The firs sowing density was 300 seeds m^{-2} and 100 plus seeds m^{-2} was added for each later sowing. The last sowing frequency was 800 seeds m^{-2}. Severe leaf scald was displayed in all infected plots. The average severity of disease in infected plots was about 71%. Exception of some sowing frequencies, grain yield generally increased in both control and infected plots dependent upon sowing frequencies increased. Thousand grain weight, however, generally decreased in both plots depending on seed densities increased. Compared to the control, important yield looses were observed in each sowing frequency of infected plots. The highest yield of the infected plots was lesser than the lowest yields of the control plots.

Key words: Sowing frequencies, leaf scald, *Rhynchosporium secalis*, barley, yield components

INTRODUCTION

Barley is a cool cereal crop sown in 650.000 ha farmlands in south eastern Anatolian district and is more preferred in some years than wheat because of earlier completed its life cycle. Sanliurfa with about 252.000 ha farmland is the second province having widest barley fields in Turkey after then Konya[1]. The district is have the arid climate conditions and yield production decreases in some years due to insufficient rainfall. There are important parasitic agents affecting the yield quantity and quality in district. Barley leaf scald caused by *Rhynchosporium secalis* (Oud.) J. Davis was reported as a common pathogen in barley farmlands of district[2]. In district, during long summer season dried climate with high temperature is dominated. Most of the rainfall occur during November to April. Economic yield losses can happen on susceptible barley cultivars in district in some year under suitable climate for barley leaf scald[3]. Although the winter climate is generally mild, the typical properties of the terrestrial climate dominates in some day of winter season. Due to described properties almost all cereal sowings are performed in November. In recent years, irrigated areas in Sanliurfa district has increased at the very high level and will continue to rise depending upon completed levels of the GAP project. About 180.000 ha farmlands has been aimed by this project in arid district of Turkey. In the parallel of the irrigated areas increased in district, the importance of the barley sowing as a first crop has increased in the progressing time. In addition, as well as the traditional barley variety sown for only animal food, malt barley varieties have also been treated in district. Blenhaim is a malt barley with foreign originated and very susceptible to leaf scald disease[4].

The aim of this study was to determine the effect of different sowing frequencies on disease severity of barley scald and some yield components and to search a protection method without fungicide to be controlled of this disease.

MATERIALS AND METHODS

The effect of different sowing frequency on disease severity of *R. secalis* was investigated on Blenhaim barley, susceptible to leaf scald during 2002 growing season. The sowings were performed in six different seed density. The first sowing was made as 300 seeds m^{-2} and 100 seeds m^{-2} was added for latter each sowing. The latest sowing density was the 800 seeds m^{-2}. Treatments were established in plots as three and one replicate and as infected and control, respectively. The dimension of plots were 2x4 m and scattered according to Randomised Complete Block Design. Except of the controls, all plots were inoculated by the straws infected with *R. secalis* This inoculum had been derived from one barley field in previous season after harvesting and rotovated into the soil surface pre sowing. The same plots were inoculated by spores of leaf scald at the end of tillering Growth Stages (GS) of barley as second time. Control plots were sprayed with the Bayleton (triadimefon) 250 g a.i L^{-1} the

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GS of 29 and 37[5] to protect the infection of *R. secalis*. Powdery mildew (*Erysiphe graminis* D.C. f.sp. *hordei*) was controlled by spraying all plots with tridemorph at 375 g a.i. ha^{-1} at GS 26.

Spores used for second inoculations were derived from fresh barley leaves. Leaf samples bearing many young symptoms of leaf scald were collected from fields and dipped within a crystallised dish including sterilised distilled water. The dish was incubated at 11°C in the dark for 36 h[6]. After many spores of *R. secalis* were dispersed in water as free, the suspension was filtered throughout by a cheesecloth to be removed of the leaf segments. The spore density were adjusted to $2x10^5$ mL^{-1} and sprayed onto plants via a hand pump.

Yields of control and infected plots were measured in 1 m^2 at the centre of the plots. Thousand grain weight was measured in both infected and control plots. Disease severity was assessed on upper five leaves of ten plants randomised per plot. The infected area of each leaf was determined based on the percentage value using the scale of James *et al.*[7]. After weighted means of infected area, results were tested by Duncan's Multiple Range Test. Grain yield and 1000 grain weight of infected plots were compared with controls using the t-test.

RESULTS AND DISCUSSION

Yield of control plots in per m^2 increased significantly and statistically up to fourth sowing density. At the fifth and sixth sowing frequencies, there were low significant increases in yields. The reverse relation was determined in 1000 grain weight. This decreased until fourth sowing frequency but not after then. Except of the last two sowing frequencies, disease severity in infected plots did increase with the minor differences. High disease levels were observed in all infected plots. However, there was 4.5% numeric differences between plots sown with the lowest and the highest seed densities. The yield did increase in plots in the first fourth sowing frequencies, but not in the last two sowing frequencies. Thousand grain weight decreased in plots depending upon seed density increased. These increases were not significant in the first three plots but significant in the last three plots (Table 1). The plot yield, 1000 grain weight decreased very significantly in infected plots as compare to control (Table 2).

A partial increase in yield depending upon sowing frequency was observed in control plots. It is considered that this increase was due to tiller and ear density per m^2 related to seed densities increased in per m^2. However, yield increases mentioned were not occurred with the same rate of seeds density increased in plots. This may have due to the better tiller in infrequent sowings compared to the frequent sowings. In addition, competition depending upon seed density risen may have possible and more crowded plants may have permitted the limited increases in yield. Although, great differences between 1000 grain weights in plots were not occurred, low increases were observed until frequenter sowings. This may be also based on competition between plants reported[8]. In control plots, there was no damage due to *R. secalis*. However, different yields between plots were occurred in plots due to different seed frequencies. According to Pavylychenko[8] differences in yield was due to interior competition between same species.

Table 1: Yield components of the control and infected plots with the disease severity

Seed No. (m^{-2})	Control: Yield (m^{-2})	Control: 1000 seeds weight (g)	Disease severity (%)	Infected: Yield (m^{-2})	Infected: 1000 seeds weight (g)
300	339.2±0.64^a	47.83^d	69.1^a	232.6±0.95^a	34.40^d
400	352.1±1.20^b	46.73^{cd}	69.7^{ab}	247.0±1.20^b	34.26^d
500	367.4±0.90^c	46.36^c	70.4^{bc}	263.7±1.50^c	34.13^d
600	379.0±1.80^d	44.93^b	71.2^c	283.6±1.50^d	33.40^c
700	382.5±1.20^{de}	43.36^a	72.5^d	298.3±1.40^e	32.46^b
800	385.3±1.10^e	42.80^a	73.6^d	304.5±1.50^e	31.70^a

Table 2: The comparison of the infected plots with the control plots

Seed No. (m^{-2})	Control: Yield (m^{-2})	Infected: Yield (m^{-2})	Control: 1000 seeds weight (g)	Infected: 1000 seeds weight (g)
300	339.2±0.64	232.6±0.95**	47.83	34.40*
400	352.1±1.20	247.0±1.20**	46.73	34.26*
500	367.4±0.90	263.7±1.50**	46.36	34.13*
600	379.0±1.80	283.6±1.50**	44.93	33.40*
700	382.5±1.20	298.3±1.40**	43.36	32.46*
800	385.3±1.10	304.5±1.30**	42.80	31.70*

*Significant at $p = 0.001$, **Significant at $p=0.00001$, t-test

High infection levels due to leaf scald were displayed in all infected plots sown different frequencies (Table 1). Associated with infection severity there was minor differences in plots. These differences may have resulted from low plant rates dependently low seed rates sown per m^2. Compared to the low frequencies, plants sown high frequencies may preserve the high humidity and be resulted with the higher disease severity. The humidity effect on leaf scald was also reported by Ryan and Clare[9] and Rotem *et al.*[10]. Secondly, distances between plants in same plots may effect the spore dispersion and more spores may have reached on their hosts in frequent positions as reported by Stedman[11].

Differences related to the crop yield were also observed among the infected plots. Yield increased progressively in infected plots particularly sown higher densities. Despite of leaf scald in all infected plots, these partial increases may have been arisen from extra number of tiller and ears related to the seed densities in plots. The highest yield degrees between infected plots was about 25%. This numeric value did not reach to the lowest yield level in control plots. Compared to the control plots, great decreases from leaf scald were observed in all sowing frequencies of infected plots (Table 2). It is considered that to be increased of the seed rate in fields can not compensate the lose from leaf scald when a susceptible barley cv. is sown and the climate became suitable for epidemic of leaf scald. However, the current method may useful when sown the moderate resistant barley variety.

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