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ASSESSMENT OF BARLEY YIELD LOSSES DUE TO POWDERY MILDEW IN SOME IMPROVED BARLEY CULTIVARS

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Abstract

Yield losses due to powdery mildew infection for the barley cultivars Giza 123, Giza 124, Giza 125, and Giza 126 were determined during two consecutive seasons, 1994/95 and 1995/96 at Giza and Gemmeiza, respectively. The single tiller technique was used. Yield components, 1000-kernel weight (1000-KWT) and weight of grains per head were determined. The results indicated that gradual reduction in 1000 KWT and weight of grains per headregularly correlated with the increase in mildew severity to 40%. A relatively slight reduction in 1000-KWT due to mildew infection was noticed in Giza 123 compared with the other cultivars. Grain yield losses was also observed and was amounted to about 18%.

INTRODUCTION

Powdery mildew caused by *Erysiphe graimiinis* f.sp. hordei is one of the most important barley diseases in Egypt. The problem wih powdery mildew is tile susceptibility of most of the commercial barley cultivars to this disease (Ghobrial et al., 1990). During the last few years, obvious yield losses in barley due to powdery mildew infection was observed indicating the importance of this fungal disease in barley production and productivity, especially on the new released barley cultivars, Giza 124, Giza 125, and Giza 126. This reduction was correlated with the increase in mildew infection. The average yield losses in barely due to powdery mildew infection reached 5.5% in 1000-TKW and 27.3% in grain yield (El-Sayed et al., 1994).

The objective of the present study was to investiate the magnitude of yield losses due to powdery mildew infection in some local barley cultivars under natural infection at Giza and Gemmeiza Research Center.

MATERIALS AND METHODS

Two field experiments were carried out at Giza, and Gemmeiza Experimental Reserch Stations during two consecutive growing seasons; 1994/95 and 1995/96. Four barley cultivars; Giza 123, Giza 124, Giza 125, and Giza 126 were used in this study. The experiment was arranged in a randomized complete blocks in a split plot design with four replications. Barley cultivars were arranged in the main plots and subjected to natural infection with Erysiphe graminis f sp. hordei in the field. To obtain different levels of infection, Bayleton was used as a mildew fungicide, in tile sub-plots as follow: 1) one spray immediately after tile appearance of mildew, 2) two sprays, the second spray after 15 days of the first one, and 3) no spray with fungicide (check).

Disease score was recorded according to Saari and Prescott (1975) and Large and Doling (1962) being an estimate of the mean percentage of leaf area covered with the fungus at growth stage 10.5on the feek's scale (Large, 1954). At the early dough stage, 200 plants of every level of mildew severity were label marked. At maturity, labeled heads of the main tillers were collected and grouped into classes according to mildew severity. The spikes were separately hand threshed and the weight of grains of each spike was recorded, then losses in grain weight was measured. The loss percentage in each yield component, as averages of the total samples were calculated. Statistical parameters including regression coefficient (b) and coefficient of determination (r) were used to find out the relation between yield loss and powder), mildew severity (James and Teng, 1979).

RESULTS AND DISCUSSION

Yield losses due to powdery mildew infection of four barley cultivars was assessed during 1994/95 and 1995/96 growing seasons oil tile basis of linear relationship between yield and disease severity. The yield components including 1000-KWT and weight of grains per head (Gwt/llead) were determined and loss percentages in each yield component was calculated.

Results of the 1994/95 and 1995/96 seasons presented in Table 1-2 show that the gradualreduction in 1000-KWT of barley cultivars Giza 123, Giza 124, Giza 125, and Giza 126 was correlated with the gradual increase in powdery mildew severity up to 40% when the yield dropped sharply, especially in Giza 124, and Giza 125. A relatively slight reduction in 1000-KWT was noticed in the cultivar Giza123

Table 1. 1000-kernel weight (g) and the losses caused by different levels of powdery mildew infection for four barley cultivars grown at Giza, 1994/95.

Severity	Giza 123		Giza 124		Giza 125		Giza 126	
	1000 KWT	% loss	1000 KWT	% loss	1000 KWT	% loss	1000 KWT	% loss
0	56.9	0	53.1	0	54.8	0	54.7	0
10	56.5	0.8	51.2	3.6	54.0	1.5	53.5	2.2
20	54.1	5.1	50.1	5.7	54.6	0.3	52.6	4.0
30	54.6	4.2	50.7	4.7	54.7	0.1	50.4	7.9
40	51.6	9.4	50.5	5.1	54.6	0.2	46.8	14.5
50	49.6	12.8	45.7	14.1	50.1	8.6	47.0	14.1
60	49.1	13.8	43.0	19.1	54.0	17.8	43.4	20.7

Table 2. 1000-kernel weight (g) as affected by the different levels of powdery mildew infection for four barley cultivars grown at Giza, 1994/95.

Severity	Giza 123		Giza 124		Giza 125		Giza 126	
	1000 KWT	% loss	1000 KWT	% loss	1000 KWT	% loss	1000 KWT	% loss
0	57.5	0	72.9	0	59.7	0	62.6	0
5-20	56.0	2.6	68.0	17.9	56.9	4.7	60.0	4.2
20-50	54.2	5.7	57.9	20.7	53.9	9.6	56.5	9.8
50-80	47.5	17.5	51.7	28.9	45.4	23.9	43.9	29.9

compared with the other three cultivars. These results are confirmed with the previous study of El-Sayed et al. (1994).

Results presented in Tables 3 and 4 indicated that losses in weight of grains per head was also correlated with the gradual increase in mildew severity iii the four barley cultvars. In general, it was found that tile gradual reduction in 1000-KWT and grain weight/head of the four cultivars was regularly correlated with the increase in mildew infection up to 40% when losses ehibited a sharp increase, especially in Giza 125.

Coeffient of determination (r2) and regression coefficient (b) for the four barley cultivars between disease severity and yield losses were determined (lable 5). Data in this Table showed high and significant r2 for both 1000-KWT and grain yield/head between disease severity and yield losses. Regression coefficient (b), which expresses the slope of the line, showed significant difference from the unity for grain yield/head for all four cultivars. This explains the gradual decrease in grain yield corresponding to disease severity as was mentioned earlier.

The yield losses due to powdery mildew infection in the untreated plots compared to the two spray treatment with the fungicide (Bayleton) was about 14.9, 2 1.7, 20.1, and 14% in Giza 123, Giza 124, Giza 125, and Giza 126, respectively. Varietal differences in grain yield were observed where Giza 124 and Giza 125 had the maximum rate of losses, while Giza 123 had the least reduction in grain yield. The average loss in grain yield over tile four cultivars was about 17.6%. It was evident that grain yield measures reflect, to some extent, powdery mildew infection and that the highest yield were corresponding to tile lowest mildew infection. This reduction in grain yield may attributed to fewer number of fertile, smaller grains, and sometimes to fewer number of grain per head. These findings confirm those obtained from previous studies by Rizk et al. (1995).

CONCLUSION

In was concluded from this study that as powdery mildew infection increased, 1000-KWT and GY/head decreased. Tile losses due to powdery mildew infection was relaively low in Giza 123, the recommended barley cultivar in irrigated areas and proved to be, somewhat, resistant to powdery mildew and had the least damage compared to tile other barley cultivars. Yield losses in barley due to powdery mildew was evident and should be considered in the planting of the breeding program to

Table 3. Grain yield/head (g) and the losses caused by different levels of powdery mildew infection for four barley cultivars grown at Giza, 1994/95.

Severity	Giza 123		Giza 124		Giza 125		Giza 126	
	g/ head	% loss	g/ head	% loss	g/ head	% loss	g/ head	% loss
0	3.94	0.0	4.33	0.0	4.02	0.0	3.85	0.0
10	3.86	2.0	4.13	4.6	3.95	1.74	3.67	4.7
20	3.11	21.1	3.68	15.0	3.06	23.9	3.54	8.1
30	3.21	18.5	3.46	20.1	2.85	29.1	3.03	21.3
40	2.79	29.2	3.11	28.2	2.86	28.9	2.99	22.3
50	2.35	40.3	2.98	31.2	2.22	44.8	2.75	28.6
60	2.45	37.8	2.71	37.4	2.31	42.5	2.28	40.8

Table 4. Grain yield/head (g) and the losses caused by different levels of powdery mildew infection for four barley cultivars grown at Giza, 1994/95.

Severity	Giza 123		Giza 124		Giza 125		Giza 126	
	g/ head	% loss	g/ head	% loss	g/ head	% loss	g/ head	% loss
0	5.59	0.0	5.40	0.0	4.65	0.0	5.80	0.0
5-20	5.02	15.6	4.95	8.3	3.94	15.3	4.63	20.2
20-50	4.93	24.0	3.96	26.7	3.68	20.9	3.91	32.6
50-80	3.82	35.8	3.15	41.7	2.70	41.9	2.85	50.9

for powdery mildew tolerance/resistance, especially in those areas which are suitable for the disease infestation.

Table 5. Coefficient of determination (r2) and regression coefficient (b) between disease servity and yield losses for four barley cultivars 1994/95.

Character	Giza 123		Giza 124		Giza 125		Giza 126	
	r2	b	r2	b	r2	b	r2	b
1000-KWT	0.75**	3.92*	0.71*	2.81*	0.56*	3.25*	0.75**	2.83*
GY head	0.73**	N.S	0.76**	N.S	0.72**	N.S	0.63**	N.S

*,** Significant at 5 and 1% level of probability.
NS : not significant.

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دراسة تقدير الخسارة في أصناف الشعير المحسنة نتيجة للإصابة بمرض البياض الدقيقى

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تم دراسة تأثير الإصابة بمرض البياض الدقيقي علي محصول بعض أصناف الشعير المحسنة وهي جيزة ١٢٣ ، جيزة ١٢٤، جيزة ١٢٥ وجيزة ١٢٦ في محطتي بحوث الجيزة والجميزة في الموسمين الزراعيين ١٩٩٤ / ١٩٩٥ و ١٩٩٥ / ١٩٩٦ . وقد إستخدم في تقدير الخسارة وزن الألف حبة ووزن حبوب السنبلة وقد أظهرت النتائج نقص تدريجي في هاتين الصفتين مع زيادة الإصابة بالبياض الدقيقي حتي ٤٠٪. وكانت نسبة النقص في وزن الألف حبة للصنف جيزة ١٢٣ أقل منه في باقي الأصناف الأخري كما شوهد النقص في محصول الحبوب وصل إلي ١٨٪ نتيجة للإصابة بمرض البياض الدقيقي.