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THE EFFECT OF PREVIOUS CROP AND WEATHER CONDITIONS ON THE INCIDENCE OF STEM BASE DISEASES IN WINTER WHEAT

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Abstract: The incidence of winter wheat stem base diseases: Fusarium foot rot (*Fusarium* spp.), eyespot (*Ramulispora herpotrichoides*), sharp eyespot (*Rhizoctonia* spp.) and take-all (*Gaeumannomyces graminis*) in the years 1999–2003 was assessed in this study. Previous crops were barley and oilseed rape. Eyespot occurred on the greatest percentage of plants throughout the whole period of the study. In 2000–2003 a deficiency of rainfall was observed, especially at the time of increased water requirements of plants.

Key words: winter wheat, stem base diseases, previous crop, weather conditions

INTRODUCTION

The incidence of stem base diseases in wheat caused by pathogens of stem base and roots increases along with the increasing share of cereals in the structure of crops (Mróz et al. 1990; Truszkowska et al. 1979; 1980; Smiley et al. 1994; Niewiadomski 1995). Weather conditions are another group of factors affecting the incidence of these diseases, caused most frequently by *Fusarium* spp., *Ramulispora herpotrichoides* (Fron.) v. Arx, *Gaeumannomyces graminis* (Sacc.) Arx et Olivier and *Rhizoctonia* spp. Chemical treatments have a considerable effect on the incidence of stem base diseases and apart from that, Fusarium foot rot is also affected by the degree of sowable material contamination.

The aim of this study was to determine the effect of previous crop (barley and oilseed rape) and weather conditions on the incidence of stem base diseases in winter wheat in the years 1999–2003.

MATERIAL AND METHODS

In the years 1999–2003 the incidence of stem base diseases was assessed in winter wheat cv. Roma, grown in the fields of the Experimental Station of the Agricultural University of Poznań in Złotniki near Poznań after two previous crops, i.e. spring bar-

ley and winter oilseed rape. The incidence of Fusarium foot rot (*Fusarium* spp.), eyespot (*Ramulispora herpotrichoides*), sharp eyespot (*Rhizoctonia* spp.) and take-all (*Gaeumannomyces graminis*) was assessed. The occurrence of diseases was determined on the lower internodes of stalks. Observations were conducted at the milk-wax stage. Twenty five plants were collected from each of 6 randomly selected points of each field. The percentage of plants infected by individual pathogens was calculated and the degree of infection was determined in a 3-degree scale where 1° denotes infection affecting up to 25% stalk circumference, 2° – infection of 26 – 50% stalk circumference and 3° – infection present on over 50% stalk circumference.

The obtained results were analyzed statistically using the analysis of variance and means were compared with Student's t-test at the level of significance $\alpha=0.05$. Meteorological data were obtained from the Department of Agrometeorology, the Agricultural University of Poznań.

RESULTS

The percentage of plants infected with stem base pathogens in the years of the study ranged from 0 to 10.0 in case of take-all, and from 3.2 to 93.0 for other diseases (Table 1). Wheat plants with the symptoms of eyespot were found in larger number only in 2002 in the field after barley than after oilseed rape, whereas in the other four years the incidence of this disease depended on weather conditions and was similar after both previous crops. The highest intensity of the disease in the seasons 1998/99 and 2001/02 was accompanied by relatively warm winters and heavy precipitation in that period (Table 2).

Fusarium foot rot occurred in the highest intensity in 1999 on wheat grown after oilseed rape (60.8%) and in 2000 on the site after barley (54.9%) and in that case the highest mean degree of infection was observed, amounting to 2.1. Sharp eyespot (*Rhizoctonia* spp.) occurred most frequently with higher intensity on the sites after barley (52.4 and 31.9% in 2001 and 2002, respectively) or in similar per-

Table 1. The occurrence of *Fusarium* spp., *Gaeumannomyces graminis*, *Ramulispora herpotrichoides* and *Rhizoctonia* spp. on winter wheat cultivated after barley and oilseed rape

Year	Previous crop	*Fusarium* spp.		*Gaeumannomyces graminis*		*Ramulispora herpotrichoides*		*Rhizoctonia* spp.	
		percentage of infected plants	degree of infection	percentage of infected plants	degree of infection	percentage of infected plants	degree of infection	percentage of infected plants	degree of infection
1999	barley	42.4 a	1.7 a	1.2 a	2.3	60.6 a	1.9 b	27.9 a	1.6 a
	oilseed rape	60.8 b	1.3 a	0.0 a	–	68.3 a	1.3 a	28.6 a	2.3 b
2000	barley	54.7 a	2.1 b	10.0 b	2.9 a	43.9 a	1.9 a	10.8 a	2.4 a
	oilseed rape	41.7 a	1.5 a	0.6 a	3.0 a	30.7 a	2.3 b	24.9 b	1.9 a
2001	barley	26.0 a	1.3 a	0.0 a	–	66.9 a	1.6 a	52.4 b	1.9 a
	oilseed rape	37.4 a	1.5 a	0.2 a	3.0	41.8 a	1.6 a	27.6 a	1.7 a
2002	barley	14.2 a	1.5 a	0.2 a	1.0 a	93.0 b	2.0 a	31.9 b	2.0 b
	oilseed rape	22.0 a	1.1 a	2.7 a	3.0 b	61.9 a	1.9 a	3.2 a	1.7 a
2003	barley	47.8 b	1.4 a	0.0 a	–	30.0 a	1.6 a	22.5 a	1.3 a
	oilseed rape	28.5 a	1.2 a	0.0 a	–	39.5 a	1.5 a	27.0 a	1.8 b

Means in columns separately for the years, followed by the same letter do not differ at 5% of significance

Table 2. Temperatures (°C) and precipitation (mm) during winter wheat vegetation period

Months	Years											
	1998		1999		2000		2001		2002		2003	
	temp.	prec.	temp.	prec.	temp.	prec.	temp.	prec.	temp.	prec.	temp.	prec.
January	–	–	1.1	42.5	0.3	27.6	0.6	30.9	0.3	35.2	–1.7	57.4
February	–	–	–0.5	29.7	4.1	37.0	2.1	19.9	4.0	64.8	–2.0	6.8
March	–	–	5.1	59.1	5.4	102.3	3.7	45.9	4.9	52.0	4.9	11.5
April	–	–	9.6	56.7	14.6	18.2	8.8	38.2	8.8	37.0	10.2	23.8
May	–	–	13.5	57.0	18.6	50.6	17.0	9.2	16.8	70.2	18.0	19.1
June	–	–	16.3	81.2	19.9	42.1	16.7	66.9	17.8	45.0	21.2	27.5
July	–	–	20.2	40.7	17.5	69.1	21.8	97.5	20.4	28.3	21.6	83.3
September	13.8	73.9	19.2	63.9	14.3	36.5	12.3	115.5	13.8	27.1	–	–
October	8.2	84.0	9.8	40.9	13.3	16.6	12.3	25.9	7.5	116.5	–	–
November	–0.1	52.8	3.6	33.7	7.3	47.1	2.9	17.3	4.4	57.5	–	–
December	–0.2	40.5	1.9	46.8	2.8	60.9	–2.1	45.9	–3.5	14.8	–	–

centages irrespective of the previous crop (1999, 2003). A mean degree of infection was relatively high and ranged from 1.3 to 2.4. The infection of wheat with *Gaeumannomyces graminis* was the lowest and a mean degree of infection was generally high, reaching 3.0, when rot of stem base tissues was observed on the whole circumference of lower internodes.

Adverse weather conditions during the vegetation season, repeated periods of precipitation deficiency mainly during the spring and early summer and accompanying high tempersatures, especially in the years 2002–2003, were conducive to the incidence of stem base diseases in wheat.

DISCUSSION

The incidence of the most important stem base diseases of winter wheat observed at varying intensity in individual years was reported by Różalski et al. (1997) in Złotniki and by Korbas and Remlein (1996) in various areas under cultivation. The infection of plants with *Fusarium* spp., *Ramulispora herpotrichoides* and *Gaeumannomyces graminis* was observed most frequently. Kurowski and Adamiak (2001) found that eyespot was more severe on wheat grown in the crop rotation system, whereas take-all (caused by a fungal complex) was most severe in monoculture. According to Klima (1992), weather conditions in consecutive years have the highest effect on the incidence of stem base diseases, although crop rotation resulted in lower infection rates of winter wheat and lower crop losses. It can be concluded from results obtained by Remlein (1996) that the worst previous crop for wheat are cereals, oilseed rape and leguminous plants, which are conducive to infection with fungi from genus *Fusarium*. The most advantageous previous crop turned out to be beets and small-seed legumes.

Weather conditions recorded during the vegetation season in the years of the study indicate repeated periods of drought with accompanying higher temperatures. According to Jaczewska-Kalicka (2001) low precipitation in spring and early summer in 1990 resulted in poor development of plants and was conducive to infection with *Ramulispora herpotrichoides*.

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POLISH SUMMARY

WPŁYW PRZEDPLONU I WARUNKÓW POGODOWYCH NA WYSTĘPOWANIE CHORÓB PODSUSZKOWYCH PSZENICY OZIMEJ

W latach 1999–2003 oceniano występowanie chorób podsuszkowych pszenicy ozimej uprawianej po dwóch przedplonach: jęczmieniu jarym i rzepaku ozimym. Występowanie fuzaryjnej zgorzeli podstawy źdźbła (*Fusarium* spp.), łamliwości źdźbła (*Ramulispora herpotrichoides*), ostrej plamistości oczkowej (*Rhizoctonia* spp.) i zgorzeli podstawy źdźbła (*Gaeumannomyces graminis*) określano na dolnych międzywęźlach źdźbeł. Łamliwość źdźbła wystąpiła w największym nasileniu w 2002 r. na polu po jęczmieniu, a w pozostałych latach jej występowanie było podobne po obu przedplonach. Największy odsetek roślin z objawami fuzariozy zanotowano na stanowisku po rzepaku w 1999r. Porażenie pszenicy przez grzyby z rodzaju *Rhizoctonia* było największe na polach po jęczmieniu w latach 2001 i 2002, a zgorzel podstawy źdźbła wystąpiła w najmniejszym nasileniu w całym badanym okresie.

Występowaniu chorób podsuszkowych sprzyjały niedobór opadów w okresie wiosennym i wczesnoletnim i towarzyszące mu wysokie temperatury, szczególnie w latach 2002–2003.