Seed Yield and Diseases in Kentucky Bluegrass After Fungicide Application

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ABSTRACT

The effect of fungicides (Bayleton 25 WP, Corbel, Impact, Sportak 45 EC, Tilt 250 EC) on the occurrence of leaf diseases (rusts, *Drechslera* spot) and seed yield of two cultivars of Kentucky bluegrass was investigated over three seasons. Estimation was also made of ergot sclerotia weight. Disease incidence was very low and there was only a slight decrease in the severity of leaf diseases in the fungicide-treated plots, but increased spikelet numbers, seed weight per ear, and thousand seed weight, and decreased sclerotia weights were recorded. The fungicide Impact was the best of those tested, but results varied with cultivar and season.

Additional index words: **fungicides, Kentucky bluegrass, leaf diseases, seed yield parameters.**

INTRODUCTION

In spite of the recent increase in area, the seed production of Kentucky bluegrass (*Poa pratensis* L.) in Czechoslovakia is not high. In the last five years the average seed yield has been about 270 kg ha^{-1}. Some outstanding agricultural farmers reached yields of nearly 700 kg ha^{-1}. Low yields can often be due to a heavy spread of diseases and pests under the hot and dry conditions of Mid-Europe. While silver top, originally the main cause of low seed yields has been eliminated through control of the insect *Leptopterna dolobrata* L., the incidence of ergot and leaf diseases such as rusts, spots, and powdery mildew is very common. The aim of the present work was to investigate whether disease could be controlled and seed yield increased by the application of five different fungicides.

MATERIALS AND METHODS

The effect of five fungicides was studied in field trials conducted at the Grassland Research Station (Zubri) during 1987-1989. Two Kentucky bluegrass cultivars, namely Slezank (meadow type) and Parade (lawn type) were used in the experiments. The trials consisted of 8 treatments each with four replicates, using a randomised block design. The study was done at the same site in the three consecutive years.

Table 1. Fungicides and application rate.

Common name	Active ingredient	rate a.i. ha^{-1}
Bayleton 25 WP	triadimefon 25%	1 kg
Corbel	fenpropimorph 750 g l^{-1}	1 l
Impact	flutriafol 12 g l^{-1}	1 l
Sportak 45 EC	prochloraz 450 g l^{-1}	1 l
Tilt 250 EC	propiconazole 250 g l^{-1}	0.5 l

Three of the fungicides under study, ie Impact, Sportak 45 EC and Tilt 250 EC (Table 1), were applied at full ear emergence only, while Corbel and Bayleton were used at full emergence and before anthesis.

The effect of the fungicides was evaluated as follows:

i) the incidence of leaf diseases (rusts - *Puccinia brachypodii* Otth *var. poae-nemoralis* (Otth) Cummins et Greene; *Puccinia poarum* Nielsen, and leaf spot, *Dreschslera poae* Baudys) was assessed each year from 5 May to seed harvest. Five samples (20 plants per sample) were taken from each replicate. The level of disease on the flag leaf and the second leaf was evaluated using the key of Lam (1983) and calculated as:

$$\frac{\%\ \text{incidence} \times \%\ \text{infection on infected leaves}}{100}$$

ii) the effects on seed yield and its components were assessed by taking 50 heads at random from each replicate and recording spikelet number and weight of seed per head. Seed yield (kg ha^{-1}) was determined after combine harvesting of each plot

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and cleaning to commercial standards. Thousand seed weight was obtained from the average weight of 8 lots of 1000 seeds, and germination tested for 100 seeds per replicate.

iii) the occurrence of ergot sclerotia was determined by taking 20 heads per replicate before seed harvest, and determining the weight of sclerotia.

The significance of differences was determined by analysis of variance using the Tukey separation test.

RESULTS

Leaf diseases

Rusts did not occur in 1988, while *D. poae* was recorded in 1988 on both cultivars, and in 1989 on cv. Parade only. Disease levels were very low in all three years (0.2-4.0%) and fungicide application did not significantly ($P < 0.05$) reduce either rust or *D. poae* infection (data not presented).

Table 2. Effect of fungicide application on seed weight per head, thousand seed weight and seed yield in cvs Slezanka and Parade over three seasons.

Treatment		cv. Slezanka			cv. Parade		
		seed weight mg head^{-1}	TSW g	seed yield kg ha^{-1}	seed weight mg head^{-1}	TSW g	seed yield kg ha^{-1}
control	1987	96.1	0.272	426.7	55.7	0.360	388.8
	1988	69.6	0.282	332.1	40.9	0.336	190.2
	1989	82.3	0.276	172.0	27.3	0.315	147.3
triadimefon	1987	89.7	0.279	510.9	71.0	0.398	478.9
	1988	78.1	0.292	311.1	40.8	0.350	266.9
	1989	77.2	0.279	160.6	40.4	0.302	157.7
triadimefon (2 applications)	1987	88.2	0.286	480.9	54.2	0.384	362.3
	1988	51.3	0.276	275.5	41.1	0.330	222.9
	1989	93.2	0.271	159.6	39.9	0.300	153.3
fenpropimorph	1987	95.3	0.300	456.6	50.3	0.386	419.9
	1988	59.1	0.284	287.7	39.1	0.338	252.6
	1989	74.0	0.272	243.5	37.5	0.304	160.3
fenpropimorph (2 applications)	1987	78.3	0.292	474.8	60.1	0.370	408.5
	1988	53.4	0.270	275.7	34.7	0.321	251.8
	1989	58.7	0.282	195.4	39.8	0.311	152.3
flutriafol	1987	113.7	0.277	437.1	86.5	0.361	447.8
	1988	72.2	0.290	271.3	52.3	0.354	277.6
	1989	83.1	0.264	229.5	44.4	0.284	190.2
prochloraz	1987	93.6	0.280	439.9	71.9	0.373	395.3
	1988	61.3	0.283	301.9	41.1	0.333	275.9
	1989	77.7	0.277	173.6	41.2	0.294	170.9
propiconazole	1987	111.8	0.299	404.1	63.9	0.367	422.0
	1988	69.5	0.286	276.3	40.9	0.337	238.1
	1989	93.2	0.260	212.1	34.2	0.281	160.6
LSD $P < 0.05$	1987	17.4	NS	NS	21.4	0.034	NS
	1988	NS	NS	NS	13.6	NS	NS
	1989	28.4	NS	NS	NS	NS	NS

Spikelet number

In 1987 flutriafol application significantly ($P < 0.05$) increased spikelet number in cultivar Parade (from 115 to 140 spikelets per head), and all treatments produced small (10-15%) but non significant increases in cv Slezanka (data not presented). However, in 1988 and 1989 no differences in spikelet number were recorded.

Seed weight per head

Flutriafol significantly increased seed weight per head of cv. Slezanka in 1987 and of cv. Parade in 1987 and 1989 (Table 2), while prochloraz also increased seed weight of cv. Parade in 1989. Other treatments did not differ significantly from the control, although particularly for cv. Parade in 1987 and 1989, percentage differences ranging from 15 to 50% were recorded (Table 2).

Thousand seed weight

In 1987 triadimefon increased TSW in cv. Parade, but no other significant differences were recorded (Table 2).

Seed yield

Fungicide treatment did not significantly increase seed yield per hectare (Table 2), although for cv. Parade, yield following fungicide application was greater than the control in each year (by 5-46%), and in 1989 the yield of cv. Slezanka was 42% higher following fenpropimorph application.

Table 3. Effect of fungicide treatment on weight of ergot sclerotia (mg/20 heads) in Kentucky bluegrass cultivars Slezanka and Parade over three seasons.

Fungicide	Year	Slezanka	Parade
control	1987	55.3	15.0
	1988	15.4	16.7
	1989	15.6	9.1
triadimefon	1987	28.2	8.3
	1988	20.8	19.5
	1989	8.2	3.3
triadimefon (2 applications)	1987	33.4	5.8
	1988	5.5	9.9
	1989	9.5	1.7
fenpropimorph	1987	36.6	6.3
	1988	26.5	27.0
	1989	2.4	9.9
fenpropimorph (2 applications)	1987	18.5	10.5
	1988	6.7	4.2
	1989	0.8	3.9
flutriafol	1987	31.9	7.2
	1988	6.6	13.3
	1989	6.1	1.2
prochloraz	1987	23.9	6.4
	1988	8.4	16.5
	1989	3.4	7.6
propiconazole	1987	43.8	5.1
	1988	6.9	12.2
	1989	6.4	1.3
LSD $P < 0.05$[1]	1987	NS	9.1

[1] data for 1988 and 1989 are not significantly different.

Germination

Germination of cv. Slezanka was 88, 78 and 95% in 1987, 1988 and 1989 respectively, while that of cv. Parade was 88, 64 and 89% in the same three years. Fungicide application did not significantly alter germination, with the exception of cv. Parade in 1988 where prochloraz reduced germination (data not presented).

Ergot sclerotia weight

In all years, fungicide treatment reduced sclerotia weight (Table 3), with the exception of the single application of fenpropimorph in 1988. Both propiconazole and two applications of triadimefon significantly reduced sclerotia weight in cv. Parade in 1987.

DISCUSSION

The incidence of leaf diseases was low in all three years and disease level on the flag leaf and second leaf did not reach more than 0.6% in 1987, 3.5% in 1988 and 4.0% in 1989. More rust was recorded in cv. Slezanka than cv. Parade, while the reverse occurred for *D. poae*, particularly in 1988 and 1989. All fungicides apart from prochloraz reduced the incidence of rust, but none had any effect on *D. poae*. This observation supports the results of Welling and Nordestgaard (1988) who recorded a lower rust incidence in Kentucky bluegrass cv. Erte after propiconazole application, but no change in *D. poae* severity.

Although disease levels were low, fungicide application tended to increase seed weight per head and hence seed yield, although differences were not often significant. Flutriafol produced the most consistent response in both cultivars, while cv. Parade produced greater responses to fungicide application than cv. Slezanka. There were also differences between seasons. For example, in cv. Parade the average seed yield response to fungicide application was 9%, 34% and 11% in 1987, 1988 and 1989 respectively, and for flutriafol was 15%, 46% and 29% in the same cultivar in the same three seasons. The significant increases in seed weight per head recorded presumably resulted from an increased number of seeds per spikelet, as thousand seed weight did not differ. Increased seed number per spikelet, TSW and seed yield of perennial ryegrass (*Lolium perenne* L.) following fungicide application was reported by Hampton (1986), and seed yield increases in the absence of disease have also been recorded in prairie grass (*Bromus willdenowii* Kunth) and in cocksfoot (*Dactylis glomerata* L.) (Rolston, Hampton, Hare and Falloon, 1989). Horeman (1987, 1989) found no relationship between Kentucky bluegrass seed yield and severity of rust attack, but did report increased ryegrass seed yields following fungicide application, even in the absence of fungal pathogens.

Fungicide effects on seed yield have been summarised by Hampton and Hebblethwaite (1984), and Hampton, Clemence and McCloy (1985). They reported that seed yield increases after fungicide application to perennial ryegrass were related to an increase in leaf area duration brought about by delays in senescence of photosynthetic tissue, rather than to pathogenic effects. The delay in leaf senescence is a major impact of fungicide application.

In the majority of treated plots it was surprising to observe a decrease in ergot sclerotia weight (*Claviceps purpurea* (Fr.) Tul.) Some of the fungicides under study had a long-term action, and these results require further investigation.

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