Incidence and Severity of Septoria Leaf Blotch in Winter Wheat in Relation to Reduced Dosage of Fungicides

I. GAURILČIKIENĖ

Plant Protection Department, Lithuanian Institute of Agriculture, 5051 Kėdainiai District, Lithuania

E-mail: irenag@lzi.lt

Abstract

The trials were carried out over the period 1999–2000 with a view to testing the efficacy of reduced doses of triazole fungicides on winter wheat cv. Zentos. Septoria diseases (*Septoria* spp.) occurred on winter wheat annually. Full and reduced dosages of fungicides were highly effective against Septoria leaf blotch at an early milk stage, especially on flag leaf. Later the efficacy of reduced dosages of the fungicides was lower, than that of full doses. Due to full dosage of fungicides we obtained a sufficient yield increase annually. The yield increase through the use of ¾ reduced doses was lower. But yield increase through reduced dosage to ½ was low and insufficient.

Keywords: Septoria leaf blotch; winter wheat; triazole fungicide

INTRODUCTION

The two major pathogens comprising the Septoria disease complex on wheat are *Septoria tritici* (Rob.) Desm., causing Septoria leaf blotch or speckled leaf blotch, and *Stagonospora nodorum* (Berk.) Cast. (syn. *Septoria nodorum* (Berk.)), causing Septoria leaf and glume blotch. Both pathogens are economically important worldwide (CUNFER & UENG 1999). The level of leaf blotch caused by *S. tritici* was influenced by a lower temperature, but growth stage had no effect on the disease severity. *S. nodorum* caused high levels of leaf and glume blotch at higher temperatures and was more pathogenic at late growth stages. The cooler temperatures of spring favour development of leaf blotch caused by *S. tritici*, but the greater prevalence of *S. nodorum* later in the season may be a consequence of increasing susceptibility of wheat plants to pathogen (WAINSHILBAUM & LIPPS 1991; SHANER & BEUCHLEY 1995). The epifytotic incidence of Septoria leaf blotch in winter wheat canopy have been determined by amount of rainfall, number of rainy days, previous crop, straw residue on soil surface and other factors (HANSEN *et al.* 1994). Gradual epidemics of Septoria leaf blotch were characterized by disease arising on successive leaf layers as they appeared during sustain periods of weather suitable for inoculum's transport and infection. Sudden outbreaks of infection can be due to short, heavy rain storms in which pycnidiospore inoculum in basal leaves ere evaluated up to 60 cm through the crop canopy (ROYLE *et al.* 1986). The optimum regeneration time for *S. tritici* in field crops is 21 days, but for *S. nodorum* it takes only 7–15 days (SHANER & BEUCHLEY 1995). To provide the acceptable control of Septoria leaf blotch until the end of grain filling without increasing the risk of yield losses reduced fungicide inputs need to be investigated further.

MATERIALS AND METHODS

The trials were conducted during 1999–2000 at the Lithuanian Institute of Agriculture in Dotnuva. The winter wheat variety Zentos was sown at a rate of 4.5 million seed per ha with 12 cm interrow spacing. The trials were arranged in 10 m long and 2.5 m wide plots with four replicates. The registered rates of fungicides (a.i.) were referred to as full dose. The fungicides were applied in 1999 at the end of booting stage (GS 47) and at 2000 at the beginning of heading (GS 53). Disease assessment was conducted twice – at early and late milk ripe stage. Plant growth stages

Table 1. Incidence and severity of Septoria leaf blotch in winter wheat in relation to reduced dosage of fungicides at early (GS 73) and late milk stage (GS 79) in 1999 – Dotnuva

Treatment	GS 73						GS 79		
	F			F-1			F		
	full dose	¾	½	full dose	¾	½	full dose	¾	½
Incidence of Septoria leaf blotch (%)									
Untreated	20.0	15.6	26.7	80.0	55.6	82.2	97.8	100	100
Cyproconazole 80 g/ha	2.2	6.7	6.7	22.2	37.8	37.8	100	100	100
Tebuconazole 250 g/ha	0	4.5	0	6.7	8.9	22.2	40.0	82.2	86.7
Propiconazole 125 g/ha	0	0	0	4.5	8.9	6.7	77.8	97.8	86.7
Flutriafol 125 g/ha	4.5	2.2	2.2	26.7	35.6	31.1	88.9	100	100
Fluqvinconazole 125 g/ha	2.2	2.2	4.4	37.8	42.2	37.8	97.8	100	100
Metconazole 90 g/ha	2.2	2.2	2.2	6.7	20.0	28.9	62.2	75.6	93.3
LSD_{05}	6.02	9.09	14.42	19.91	25.82	19.85	20.68	19.70	7.62
Severity of Septoria leaf blotch (%)									
Untreated	0.30	0.17	0.33	1.63	1.83	1.93	19.00	12.51	20.40
Cyproconazole 80 g/ha	0.02	0.06	0.06	0.30	0.57	0.47	5.51	11.27	13.00
Tebuconazole 250 g/ha	0	0.05	0	0.06	0.10	0.30	0.76	1.53	3.73
Propiconazole 125 g/ha	0	0	0	0.05	0.09	0.06	1.52	4.09	4.93
Flutriafol 125 g/ha	0.05	0.02	0.02	0.26	0.43	0.30	4.73	8.53	13.67
Fluqvinconazole 125 g/ha	0.02	0.02	0.03	0.63	0.60	0.56	4.93	6.95	13.73
Metconazole 90 g/ha	0.02	0.02	0.02	0.06	0.19	0.27	0.98	2.29	3.73
LSD_{05}	0.118	0.096	0.193	0.295	0.899	0.451	3.529	3.049	3.816

were assessed according to the BBCH scale (1997). The leaf positions on tillers are numbered relative to the uppermost leaf the flag leaf F, the leaf immediately below the flag leaf – F-1. Percent of leaf area showing symptoms of Septoria leaf diseases was used to quantify disease severity. Disease severity was assessed on each plot at five randomly selected places on three adjacent tillers F, F-1 leaves using a percentage scale 0, 1, 5, 10, 25, 50, 75. Percent of affected leaves was used to quantify the disease incidence. The plots were harvested and yields in t/ha were adjusted to 15% moisture content.

RESULTS

The dry spring of 1999 was unfavourable for plant growth and for the incidence of Septoria leaf blotch. At the time of fungicide application (GS 47) Septoria had affected 25% F-2 leaves the disease severity was 0.4%. Due to hot weather conditions two weeks after application winter wheat reached the early milk stage. At that time Septoria affected 15.6–26.7% F and 55.6–82.2% F-1 leaves, but the severity of the disease was as low as 0.17–0.33% of F and 1.63–1.93% of F-1 leaf surface (Table 1). Full and reduced doses of fungicides effectively suppressed the incidence and severity of Septoria on F and F-1 leaves till early milk stage. Late in the season rain and cooler weather resulted in heavy incidence of Septoria. At the end of milk stage almost all F leaves in the control were affected. Only a full rate of Tebuconazole and Metconazole highly suppressed the incidence of Septoria. The incidence and severity of Septoria were higher in treatments with reduced doses of fungicides. At high infection level 5 weeks after application at late milk the reduced doses of Cyproconazole, Flutriafol and Fluqvinconazole provided only a slight effect against Septoria.

In 2000 due to spring drought Septoria leaf blotch appeared in winter wheat late. At the time of application (GS 53) only initial symptoms of Septoria appeared on third leaves. Three weeks after application at early milk the incidence of Septoria was weaker than that in 1999. Due to favourable weather conditions a sudden outbreak of infection occurred at late milk. At early milk all rates of fungicides provided a good control of Septoria, but at late milk 5 weeks

Table 2. Incidence and severity of Septoria leaf blotch in winter wheat in relation to reduced dosage of fungicides at early (GS 73) and late milk stage (GS 79) in 2000 – Dotnuva

Treatment	GS 73						GS 79		
	F			F-1			F		
	full dose	¾	½	full dose	¾	½	full dose	¾	½
Incidence of Septoria leaf blotch (%)									
Untreated	20.0	3.4	11.7	51.6	45.0	55.0	100	100	100
Cyproconazole 80 g/ha	1.7	0	0	15.0	5.0	13.3	100	100	97.5
Tebuconazole 250 g/ha	0	0	0	0	0	3.3	74.8	80.2	88.5
Propiconazole 125 g/ha	0	0	0	1.7	1.7	3.4	88.1	94.9	100
Flutriafol 125 g/ha	0	0	0	0	3.3	5.0	94.3	97.6	96.6
Fluqvinconazole 125 g/ha	0	1.7	0	0	3.4	0	95.0	97.0	99.1
Metconazole 90 g/ha	0	0	0	0	0	0	76.3	78.2	94.2
LSD_{05}	5.70	2.88	5.18	11.61	11.57	8.41	14.65	15.38	7.32
Severity of Septoria leaf blotch (%)									
Untreated	0.20	0.04	0.12	0.72	0.73	0.95	18.30	19.28	18.44
Cyproconazole 80 g/ha	0.02	0	0	0.15	0.05	0.20	10.34	14.21	16.50
Tebuconazole 250 g/ha	0	0	0	0	0	0.03	3.88	3.25	5.96
Propiconazole 125 g/ha	0	0	0	0.02	0.02	0.04	5.65	6.49	9.46
Flutriafol 125 g/ha	0	0	0	0	0.03	0.05	7.45	10.03	13.70
Fluqvinconazole 125 g/ha	0	0.02	0	0	0.04	0	10.02	8.22	8.02
Metconazole 90 g/ha	0	0	0	0	0	0	4.38	3.77	6.14
LSD_{05}	0.095	0.029	0.052	0.207	0.154	0.141	2.34	4.00	4.656

after application only full doses of Tebuconazole and Metconazole suppressed the incidence of disease (Table 2). At late milk severity of Septoria was higher in treatments with reduced doses. The efficacy of full and reduced doses of Cyproconazole, and Fluqvinconazole and reduced doses of Flutriafol was weaker.

Due to full and reduced to ¾ dosages of fungicides we obtained a sufficient yield increase annually, but the yield increase through the use of ¾ reduced doses was lower. In 1999 grain yield increase in all treatments through the use of reduced dosage to ½ was insufficient, but in 2000 in plots applied with Tebuconazole, Metconazole and Fluqvinconazole was obtained a significant yield increase.

DISCUSSION

In order to minimize disease – induced yield loss, it is necessary to protect the flag leaf and leaf 2 until the end of grain filling (JORDAN & HUTCHEON 1994). The average from flag leaf fully emerged (GS 39) to anthesis equates to 16 days and the period from anthesis until the end of grain filling equates to 45 days (PORTER *et al.* 1987). This indicate that a 60-day period of disease protection is required from flag leaf fully emerged until the end of grain filling. The cost effective disease control responses from fungicide dose reduction. Investigation of the incidence and severity of Septoria leaf blotch in winter wheat in relation to reduced dosage of fungicides suggested, that reduction of the rate of triazole fungicides to half dose can be insufficient and economically risky. The reduced dosage to ½ of fungicides showed a higher level of control in the first 2–3 weeks after application, but in the case of disease sudden outbreaks could not provide an adequate control of Septoria leaf blotch until the end of grain filling without increasing the risk of yield losses.

References

CUNFER B.M., UENG P.P. (1999): Taxonomy and identification of *Septoria* and *Stagonospora* species on small-grain cereals. Annu. Rev. Phytopathol., **37**: 267–284.

HANSEN J.H., SECHER B.J.M., JORGENSEN L.N. (1994): Thresholds for control of *Septoria* spp. in winter wheat based on precipitation and grows stage. Plant Phytopathol., **43**: 183–189.

JORDAN V.W.L., HUTCHEON J.A. (1994): Strategies for optimal fungicide use in less-intensive cereal growing systems. In: Pest and Diseases. Brighton Crop Protection Conf.: 687–694.

Phonological growth stages and BBCH-identification keys of cereals (1997): In: MEIER U. (ed): Growth stages of Mono- and Dicotyledonous Plants. BBCH-Monograph. Berlin, Wien: 12–16.

PORTER J.R., KIRBY E.J., DAY W., ADAM J.S., APPLEYARD M., APYLING S., BAKER C.K., BEALE P., BELFORD R.K., BISCOE P.V., CHAPMAN A., FULLER M.P., HAMPSON J., HAY R.K.M., HOUGH M.M., MATHEWS S., THOMPSON W.J., WEIR A.H., WILLINGTON V.B.A., WOOD D.W. (1987): An analysis of morphological development stages in Avalon winter wheat crops with different sowing dates and at ten sites in England and Scotland. J. Agr. Sci., **109**: 107–121.

ROYLE D.J., SHAW M.W., COOK R.J. (1986): Patterns of development of *Septoria nodorum* and *S. tritici* in some winter wheat crops in Western Europe, 1981–1983. Plant Pathol., **35**: 466–476.

SHANER G., BEUCHLEY G. (1995): Epidemiology of leaf blotch of soft red winter wheat caused by *Septoria tritici* and *Stagonospora nodorum*. Plant Dis., **79**: 928–938.

WAINSHILBAUM S.J., LIPPS P.E. (1991): Effect of temperature and growth stage of wheat on development of leaf and glume blotch caused by *Septoria tritici* and *S. nodorum*. Plant Dis., **75**: 993–998.