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ECONOMICAL ASPECTS OF DISEASE CONTROL IN WINTER WHEAT

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Abstract: The experiment was conducted in the years 2001–2003 at the Experimental Station in Złotniki. The aim of the performed investigations was to evaluate economic effectiveness of different fungicidal protection programs in winter wheat. Winter wheat of cv. Sakwa was cultivated using the following two variants of seed treatment: 1) Raxil 060 FS at the dose of 60 ml/100 kg grain, 2) Raxil 060 FS + Latitude 125 FS at the doses of 60 and 200 ml/100 kg, and five variants of fungicidal foliar protection: 1) Vista 228 SE, 2) Sportak Alpha 380 EC, 3) Sportak Alpha 380 EC + Vista 228 SE, 4) Sportak Alpha 380 EC + Vista 228 SE + Juwel 250 SC, 5) control – without protection.
The use of the above plant protection products contributed to the increase of winter wheat grain yield from 0.60 t/ha to 2.07 t/ha. This increase of yield covered costs of performed chemical control. The economic analysis showed that most effective variant of winter wheat chemical protection was seed treatment with Latitude 125 FS with additional two foliar treatments with the following fungicides: Sportak Alpha 380 EC and Vista 228 SE. Irrespective of the applied seed dressing, additional application of Juwel 250 SC at the stage of early milk maturity turned out to be economically not justified.

Key words: winter wheat, seed treatment, fungicidal protection, economical aspect

INTRODUCTION

The increase of the acreage under cereal cultivation, in particular of winter wheat, observed in Poland in recent years creates favourable conditions for the increased infestation of this crop with fungal diseases negatively affecting both the quantity and quality of yields (Jaczewska-Kalicka 2005; Parylak and Kordas 2001; Szmigiel 1999). One of important elements in the cultivation of cereals is a complex approach to limiting the occurrence of pathogens attacking roots, stem base, leaves and ears. The first step in this complex approach is seed dressing and, later on, spraying with appropriate fungicides during plant vegetation (Lipa 1999). The treatment of seeds with a proper dressing preparation is the first step aiming at the improvement of plant health as it affects the initial development of plants and this, in turn, is responsible

for their condition allowing to influence yield levels during later stages of growth and development (Dawson and Bateman 2000; Krzyzińska et al. 2004; Schoeny et al. 2001). Only complex plant protection programs restrict the incidence of various pathogens and allow the achievement of high yields.

The purpose of these studies was to evaluate economic effectiveness of different fungicidal protection programs in winter wheat.

MATERIALS AND METHODS

Experiments were carried out at the Experimental Station in Złotniki on the basis of two-factorial trials established in the years 2001–2003 as a depended design in four replications. The experimental design comprised two types of seed treatment: Raxil 060 FS and Raxil 060 FS+Latitude 125 FS as well as five variants of foliar protection with fungicides: 1) Vista 228 SE, 2) Sportak Alpha 380 EC, 3) Sportak Alpha 380 EC +Vista 228 SE, 4) Sportak Alpha 380 EC+Vista 228 SE+Juwel 250 SC, 5) control object (without foliar protection). Sportak Alpha 380 EC was applied at the stage of BBCH 31, Vista 228 SE – at the stage of BBCH 58–59, while the Juwel 250 SC – at the stage of BBCH 73.

After reaching the stage of full harvest ripeness, winter wheat grain was harvested with a plot combine. Water content in grain was determined and obtained grain yield was converted to 15% humidity.

In the analysis of economic profitability of different variants of winter wheat protection programs applied against fungal diseases in this experiment partial calculations were performed which comprised only costs of seed treatments, fungicides as well as the actual application of seed treatment, foliar treatment and the value of grain yields. Prices of seed dressing and fungicide application as well as purchase prices of wheat grain were adopted after Voivodeship Agriculture Advisory Centre in Poznań in 2003 (seed dressing operation – 45 PLN/t, spraying – 29 PLN/ha, price of wheat grain – 520 PLN/t), whereas the prices of seed dressings and fungicides – after the Dalgety Agra Polska – Company (Raxil 060 FS – 194 PLN/l, Latitude 125 FS – 270 PLN/l, Vista 228 SE – 57 PLN/l, Sportak Alpha 380 EC – 69 PLN/l, Juwel 250 SC – 168 PLN/l). In the analysis of economic profitability of chemical treatments used to control diseases the method given by Mierzejewska was applied (Mierzejewska 1985).

RESULTS AND DISCUSSION

In the years 2001–2003 at the growth stage BBCH 92 on control plots of the experiment most plants were infected with stem base pathogens. The intensity of infection was usually moderate. The infection of second leaf with pathogenic fungi was low or moderate, and ears were infected to a lesser degree. The applied programs of plant protection consisting of seed treatment and spraying with fungicides significantly lowered leaf infection and also improved healthiness of stem bases. It was noted that the seed treatment product Latitude 125 FS used jointly with Raxil 060 FS improved much better stem base health status in comparison to Raxil 060 FS used alone. The applied programs did not ensure full control of occurring diseases. In spite of this obtained economical effect could be regarded as satisfactory.

Table 1. Economic effect of control fungal of diseases in winter wheat (mean of 2001–2003)

Crop protection during vegetation period	Grain yield [t/ha]		Grain yield increase with reference to standard seed dressing (Raxil 060 FS)				Cost of protection [PLN/ha]		Coefficient of profitability		Profit [PLN/ha]	
			[t/ha]		[PLZ/ha]							
	Raxil 060 FS	Raxil 060 FS + Latitude 125 FS	Raxil 060 FS	Raxil 060 FS + Latitude 125 FS	Raxil 060 FS	Raxil 060 FS + Latitude 125 FS	Raxil 060 FS	Raxil 060 FS + Latitude 125 FS	Raxil 060 FS	Raxil 060 FS + Latitude 125 FS	Raxil 060 FS	Raxil 060 FS + Latitude 125 FS
Untreated	3.61	4.45	–	0.84	–	436.80	–	128.70	–	0.25	–	308.10
Vista 228 SE	4.21	4.93	0.60	1.32	312.00	686.40	114.50	243.20	0.22	0.47	197.50	443.20
Sportak Alpha 380 EC	4.54	5.11	0.93	1.50	483.6	780.00	132.50	261.20	0.25	0.50	351.10	518.80
Sportak Alpha 380 EC + Vista 228 SE	4.89	5.53	1.28	1.92	665.6	998.40	247.00	375.70	0.48	0.72	418.60	622.70
Sportak Alpha 380 EC + Vista 228 SE + Juwel 250 SC	5.06	5.68	1.45	2.07	754.00	1076.40	477.60	606.30	0.92	1.17	276.60	470.10

The economical results were calculated in relation to the object on which the sown seeds of winter wheat treated only with the standard Raxil 060 FS dressing without additional foliar fungicidal protection (Table 1). Grain yield of winter wheat increased by 0.84 t/ha, following additional seed treatment with Latitude 125 FS in comparison with the standard Raxil 060 FS treatment. The costs of the additional seed treatment were equivalent to 0.25 t/ha wheat grain. Therefore, it can be concluded that the effect of application of Latitude 125 FS seed treatment was high because the additional profit reached 308.10 PLN/ha. Each of the experimental variants with foliar application of fungicides generated yield increases which allowed to cover costs of treatments in comparison with yields obtained after treatment with Raxil 060 FS or without application of fungicides. The grain yield increase of winter wheat ranged from 1.32 t/ha (one treatment with Vista 228 SE) to 2.07 t/ha (three treatments with Sportak Alpha 380 EC, Vista 228 SE and Juwel 250 SC).

The expenditures incurred to protect winter wheat crops which included costs of the preparation as well as spaying varied in different variants of the experiment. The cheapest was the variant with one treatment with Vista 228 SE (114.50 PLN/ha), while the most expensive one – with a triple treatment with Sportak Alpha 380 EC, Vista 228 SE and Juwel 250 SC (477.60 PLN/ha).

The direct profit per 1 ha calculated from the difference between the value of grain yield increase and costs incurred by chemical treatments was the highest in the variant where seed treatment with Raxil 060 FS + Latitude 127 FS was combined with two treatments with Sportak Alpha 380 EC and Vista 228 SE. The performed economical assessment showed that, irrespective of the applied seed treatment, use of additional Juwel 250 SC at early milk stage of wheat development was unjustified because the direst income per 1 ha was lower than the profit obtained after two foliar treatments (Sportak Alpha 380 EC + Vista 228 SE) and one treatment with Sportak Alpha 380 EC after the start of spring vegetation of wheat. Moreover, in the variant in which application of Raxil 060 FS + Latitude 125 FS seed treatment was combined with Vista 228 SE fungicide sprayed after heading of winter wheat, the additional income was higher than in the best fungicide treatment of the object where wheat was sown and treated only with the standard Raxil 060 FS seed treatment.

The use of fungicides in the course of vegetation on the basis of economic harmfulness thresholds constitutes a separate problem. Each zloty invested in the protection against diseases should generate profit which becomes higher as more yields is saved; and obtaining grain of a better quality parameters is an additional advantage (Dahab and O'Callaghan 1997; Jaczewska-Kalicka and Grala 1997; Kaniuczak 2002; Korbas 2001). Economic effects of control of fungal diseases has been decreasing in recent years due to the observed continuous trends of growing costs of plant protection and falling prices of wheat grain (Jaczewska-Kalicka 2003).

CONCLUSIONS

1. The applied plant protection treatments permitted to obtain grain yield increase of winter wheat from 0.84 t/ha (seed treatment with Raxil 060 FS + Latitude 125 FS) to 2.07 t/ha (three fungicidal treatments with Sportak Alpha 380 EC, Vista 228 SE and Juwel 250 SC).

2. The variant with an additional seed treatment with Latitude 127 FS combined with two treatments with Sportak Alpha 380 EC and Vista 228 SE turned out to be the most effective method of chemical protection of winter wheat.
3. The additional application of Juwel 250 SC at the stage of early milk maturity turned out to be economically not justified.

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POLISH SUMMARY

EKONOMICZNE ASPEKTY ZWALCZANIA CHORÓB GRZYBOWYCH PSZENICY OZIMEJ

Doświadczenie przeprowadzono w latach 2001–2003 w Stacji Badawczej w Złotnikach. Celem podjętych badań było określenie wpływu zróżnicowanej ochrony fungicydowej na nasilenie występowania chorób grzybowych liści, kłosów, podstawy źdźbła i korzeni pszenicy ozimej. Pszenicę ozimą odmiany Sakwa uprawiano stosując dwa warianty zaprawiania nasion: 1) Raxil 060 FS w dawce 60 ml/100 kg ziarna,

2) Raxil 060 FS+Latitude 125 FS w dawkach odpowiednio 60 i 200 ml/100 kg ziarna oraz pięć wariantów nalistnej ochrony fungicydowej: 1) kontrola bez ochrony, 2) Vista 228 SE, 3) Sportak Alpha 380 EC, 4) Sportak Alpha 380 EC +Vista 228 SE, 5) Sportak Alpha 380 EC+Vista 228 SE+Juwel 250 SC.

Zastosowane środki ochrony roślin pozwoliły na uzyskanie wzrostu plonu ziarna pszenicy ozimej w zakresie od 0,60 t/ha do 2,07 t/ha. Ocena ekonomiczna wskazuje, że najbardziej efektywnym wariantem chemicznej ochrony w uprawie pszenicy ozimej było zaprawianie ziarna preparatami Raxil 060 FS+Latitude 125 FS połączone z dwukrotnym zabiegiem fungicydowym preparatami Sportak Alpha 380 EC i Vista 228 SE. Nieuzasadnione ekonomicznie było zastosowanie dodatkowego opryskiwania preparatem Juwel 250 SC w fazie dojrzałości wodno-mlecznej pszenicy, niezależnie od zastosowanej zaprawy nasiennej.