

## YIELDING OF SOME CULTIVARS OF SPRING WHEAT UNDER CONDITIONS OF FREQUENT EPIPHYTOSSES<sup>1</sup>

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**Summary.** The present paper contains results of 3-year experiments carried out on fertile soils (chernozems) in the region of frequently occurring epiphytoses *Puccinia recondita*, *P. graminis* and *Septoria nodorum*. These diseases are the main factor limiting grain yields. The object of the studies were the following cultivars of spring wheat: Kolibri (D), Alfa (PL), Jara (CS) and the breeding strain LGR 36/11 (PL). The breeding formula of the distinguishing strain was: cv. Ostka Popularna (PL) × cv. Pembina (CDN). The yields of the studied forms corresponded to their gradually increasing field resistance to the mentioned diseases. The mean grain yields were: 2.5, 3.2, 4.1 and 4.4 ha, respectively. The yields of crude protein were: 361, 416, 590 and 682 kg/ha.

Species differentiation in resistance to the mentioned fungal diseases suggests that this phenomenon is genetically determined.

According to the FAO data, the annual world losses of yield caused chiefly by diseases are about 78 mld USA dollars (Dorozhkin et al. 1982). How large is the exact loss falling on Poland is unknown. The year 1980, when the yield of cereals (mainly wheat) and potatoes violently declined, convinced us in the importance of that problem. It became clearly evident then that a weak side of the Polish plant breeding is the neglect of resistant culture. The benefits, which can be brought by resistant culture, can be seen on the example discussed in this paper. Under conditions of frequent epiphytoses (south-eastern region of Poland) the size of the real yield depends not only on the degree of variety intensity, but rather on the degree of field (horizontal) resistance to dangerous diseases. There are more than enough evidences in the world supporting the concept of Borlaug — selection for horizontal resistance (Kubicki 1976).

### MATERIAL AND METHODS

The object of the studies were 4 forms of spring wheat with different yield potential and susceptibility to *Puccinia recondita*, *Puccinia graminis* and *Septoria nodorum*. They were: cv. Alfa (PL) — a standard, the only Polish variety; cv. Jara

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(CS) — the most fertile variety in Poland; cv. Kolibri (D) — a variety with highly economic grain; the line LGR 36/11 (bred by the authors) — analogous to the cv. Kolibri with regard to the economic value of the grain, morphotypically similar to moderately intensive forms; the origin of the line: cv. Ostka Popularna × cv. Pembina (Milczak 1980).

The field experiment was performed during 1980 - 1982 at the Station of Plant Breeding in Ułhówek (south-eastern region of Poland) on fertile chernozems. The optimal agrotechniques for spring wheat was applied. The seeds were sown on 2.5 m<sup>2</sup> plots using sowing density corresponding to 6 mln seeds/ha. The experiment was laid out in randomized block design with 4 replications.

In the course of vegetation the infection of plants with diseases was estimated twice (onset and full intensity of a disease) using a 9° scale. The grain yield and the yield of crude protein were estimated after the plant harvesting.

## RESULTS AND DISCUSSION

The dominant type of agricultural soils in the Zamojski Voivodeship — wheat-beet — simultaneously indicates the plant species, which should be cultivated there. In fact, a lot of sugar beet is also successfully cultivated there (Year book 1982), but the wheat culture is characterized there by low and unreliable yields. Losses caused by diseases are twice as high (Płudowski 1981) as in other regions of the country (Pokacka 1982). This results not from a low level of agriculture, but rather from the lack varieties field-tolerant to dangerous fungal diseases, which frequently occur here because of geographical position (the range of steppe climate). Studies by Lisowicz (1982) on winter wheat, as well as our studies on spring wheat, clearly point out to a great role of the factors of varieties in south-eastern Poland. The level of wheat yielding is determined here not so much by yielding potential of the variety, but rather by the degree of horizontal resistance to stem rust, brown rust and leaf spot.

Table 1. Grain yield and protein yield of the studied varieties of spring wheat in 1980 - 1982

Variety	Grain yield (t/ha)				Mean % in relation to standard	Crude protein yield in grain (%)				Crude protein yield (kg/ha)				Mean % in relation to standard
	1980	1981	1982	Mean		1980	1981	1982	Mean	1980	1981	1982	Mean	
Kolibri	2.24	2.69	2.37	2.46	76	15.3	13.2	16.2	14.9	343	355	384	361	87
Alfa	2.77	3.72	3.05	3.18	100	14.2	11.7	13.8	13.2	393	435	421	416	100
Jara	3.32	3.97	4.93	4.07	128	14.8	12.6	15.8	14.4	491	500	779	590	142
LGR 36/11	3.98	4.34	4.86	4.39	138	13.7	15.8	16.8	15.4	545	686	816	682	164
Mean	3.08	3.68	3.80	3.52		14.5	13.3	15.6	14.5	443	494	600	512	123
	NIR <sub>0.05</sub>			1.40										

Results presented in Table 1 show how large differences in the grain yield and to a more extent in the yield of crude protein occur between varieties, particularly during plague years. The year 1980 with extreme precipitations, low temperatures throughout the vegetation period was not favourable for winter and spring wheat in

the whole country and especially in south-eastern Poland. But even in such a catastrophic year, the highest grain yield out of the studied varieties about 3.98 t/ha was obtained in the strain LGR 36/11. That was a result of a high tolerance of that strain to *Septoria nodorum* — the main factor during the mentioned year limiting yielding. The advantages of that strain were confirmed during the next years, through the main diseases limiting high yielding were brown rust (*P. recondita*), and stem rust (*P. graminis*), the last one being particularly dangerous in 1981 (Table 2). The discus-

Table 2. Disease occurrence in some varieties of spring wheat in 1980 - 82 (9° scale)\*

Variety	<i>Puccinia graminis</i>				<i>Puccinia recondita</i>				<i>Septoria nodorum</i>			
	1980	1981	1982	1980 - 1982	1980	1981	1982	1980 - 1982	1980	1981	1982	1980 - 1982
Kolibri	3.7	1.0	6.5	3.7	3.5	1.0	1.0	1.8	4.7	5.2	5.2	5.0
Alfa	6.2	1.0	7.0	4.7	3.7	1.0	1.0	1.9	5.7	6.5	6.5	6.2
Jara	4.2	2.2	7.0	4.5	5.0	1.2	2.0	2.7	5.7	6.8	7.0	6.5
LGR 36/11	8.0	7.2	8.0	7.7	4.5	5.8	7.0	4.3	7.0	7.0	7.0	7.0
Mean	5.5	2.8	7.1	5.2	4.2	2.2	2.8	2.7	5.8	6.4	6.4	6.2

\* 9° — the smallest infestation degree, 1° — the largest infestation degree

sed strain of wheat was also relatively tolerant to the above pathogens. Thus, during a 3-year period the economic value of the studied forms was as follows (according to decreasing yields): LGR 36/11, cv. Jara, cv. Alfa and cv. Kolibri. The last variety from 1980 lost its economic value throughout the country and in 1982 despite a perfect economic value of its grain, it was eliminated from the cultivar selection.

## CONCLUSIONS

1. Fairly good and reliable grain yields may be obtained in south-eastern Poland with its frequent fungal epiphytoses not using chemical control of leaf, stem and spike diseases of spring wheat. A condition of the success is the introduction into a wide culture of varieties having large field tolerance to the most dangerous fungal diseases. This requirement is not fulfilled by actually cultivated varieties in this region, even by the cv. Jara; which is known as very productive.

2. The example of yield of the strain LGR 36/11 (selected under provoking conditions), which is characterized by a large field tolerance to the most important fungal diseases seems to point out clearly to a large role of resistant culture for local conditions. This strain will combine good yielding with a high economic value of grain.

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## PLONOWANIE NIEKTÓRYCH ODMIAN PSZENICY JAREJ W WARUNKACH CZĘSTYCH EPIFITOZ

### Streszczenie

W pracy omówiono wyniki 3-letnich doświadczeń przeprowadzonych na żyznych glebach (czarnoziemy), w rejonie często występujących epifitoz *Puccinia recondita*, *P. graminis* i *Septoria nodorum*. Choroby te są głównym czynnikiem limitującym wysokość plonu ziarna. Obiektem badań były odmiany pszenicy jarej: Kolibri (D), Alfa (PL), Jara (CS) i ród hodowlany LGR 36/11 (PL). (Formuła hodowlana tego wyróżniającego się rodu: Ostka Popularna × Pembina). Uszeregowanie badanych form według wysokości plonów odpowiada stopniowo wzrastającej polowej odporności na wymienione choroby. Średni plon ziarna badanych odmian wynosił odpowiednio 2.5, 3.2, 4.1 i 4.4 t/ha. Plon białka ogólnego kształtował się następująco: 361, 416, 590 i 682 kg/ha. Zróżnicowanie odmianowe odporności na wymienione choroby grzybowe sugeruje genetyczne uwarunkowanie tego zjawiska.

## УРОЖАЙНОСТЬ НЕКОТОРЫХ СОРТОВ ЯРОВОЙ ПШЕНИЦЫ В УСЛОВИЯХ ЧАСТЫХ ЭПИФИТОЗ

### Резюме

В настоящей работе рассмотрены результаты 3-летних экспериментов, проводимых на плодородных землях (чернозёмы) в районе часто выступающих эпифитоз *Puccinia recondita*, *P. graminis* и *Septoria nodorum*. Болезни эти являются главным фактором, ограничивающим урожайность зерна. Объектом исследований были сорта яровой пшеницы: Kolibri (D), Alfa (PL), Jara (CS) и селекционная линия LGR 36/11 (PL). (Формула для отличающейся линии — Ostka Popularna × Pembina). Расположение исследуемых форм согласно величине урожаев соответствует постепенно возрастающей полевой сопротивляемости к упомянутым болезням. Средний урожай зерна исследуемых сортов составлял: 2,5; 3,2; 4,1 и 4,4 т/га. Количество всего общего белка составляло: 361, 416, 590 и 682 кг/га. Различная сопротивляемость сортов к упомянутым грибным болезням свидетельствует о генетической обусловленности этого явления.