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PROSPECTS AND PROBLEMS OF HYBRID RYE BREEDING IN BELARUS

ABSTRACT

Polish F_1 rye hybrids were tested in the field trials under Belarussian climatic conditions and compared to local varieties used as standards. Five–year investigations proofed that in spite of harder Belorussian winter conditions in comparison to these ones in Poland, winter–hardiness of hybrids was at the same level as of the population local standards. All hybrids were characterized by higher lodging resistance compared to standards, mainly due to lower plants height. One of the main problems which have to be solved is to find a reliable restorer. Use of population cultivars as pollinators so far was not resulted in a development of high–yielding hybrids. It is known that for P–CMS the genes of fertility restoration are scarce.

Key words: breeding, diploid cultivars, gentypes, hybrid rye, tetraploid cultivars

INTRODUCTION.

Winter rye is one of the most important crops in Belarus. Rye breeding is concentrated on open–pollinated tetraploid and diploid cultivars. But tetraploid population cultivars still occupy about 90% of all rye area (Puhovchanka, Verasen, Igumenskaya) and diploid cultivars (Kalinka, Radzima, Jaselda) — only 10%. In spite the fact that hybrid rye super–sedes population rye from year to year in many countries of Europe, there are no hybrid rye cultivars in Belarus, with the exception of Ger–man cultivar Marder, which so far occupies not considerable area, mostly because of more expensive cost of seeds. The main aim of this study was to ascertain the advantages of hybrid rye in comparison with population rye– under the climatic conditions of Belarus.

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MATERIALS AND METHODS.

A number of Polish F_1 hybrids, provided by Plant Breeding and Acclimatization Institute (PBAI), Radzików, were tested in field trials for 5 years (1994–1998) under the Belarussian climatic conditions (central region). Every year from 10 to 25 hybrids in 4 replications (plots – 5–10 m^2; 320 seeds/in^2) have been tested as compared to 2–4 the best Belarussian diploid population cultivars (Kalinka, Radzima, Jaselda, Zubrowka). The number of morphological and quantitative traits for vegetation period have been assessed: winter–hardiness, disease resistance, height, lodging, yield, etc

RESULTS AND DISCUSSION.

Most of Polish hybrids surpassed Belorussian population standards on the average by 15% (Fig.1). Several hybrids had grain yield by 30–35% higher as compared to standards. It was established, that much higher grain productivity of hybrid rye was mostly conditioned by higher kernels weight per spike, number of kernels per spike and 1000–kernel weight as compared to population standards. Average values for stem density of hybrids as well as for population rye were the same. Other researchers; Geiger and Miedaner (1992), Geiger and Wahle 1978 obtained the similar results for P–CMS. Kobylianski (1982) found that P–CMS heterosis was mainly influenced by stem density. Other traits like kernels per spike and that 1000–kernel weight usually showed negligible heterosis.

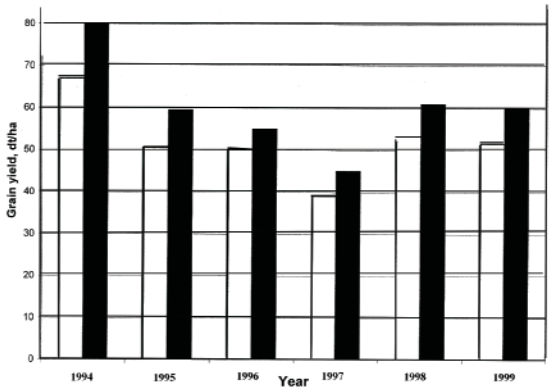

Fig. 1 Grain yield of the Polish hybrid rye compared to the best open–polinated cultivars in Belarussian trials

In spite of harder Belorussian winter conditions in comparison to these ones in Poland, winter–hardiness of hybrids was at the same level as of the population local standards. Also resistance against the main

rye diseases (powdery mildew, leaf and stem rust) was similar to Belarussian cultivars for almost all Polish hybrids.

All hybrids were characterized by higher lodging resistance compared to standards, mainly due to lower plants height.

Thus, the results of field trials of hybrids have shown superiority of hybrid rye and good adaptation of Polish breeding material to the cli–matic conditions of Belarus. It was found that commercial use of hybrid cultivars is profitable if superiority of grain yield is not less than 10%. In this case, more higher cost of hybrid seeds compared to seeds of popula–tion rye is covered. Taking into consideration the fact, that the tested hybrids were developed for the climatic conditions of Poland, where the climate is more mild in comparison to Belarus, using of local Belarussian adaptive genotypes as the initial material for hybrid rye breeding in Belarus would result in, perhaps, even more high–yielding hybrids.

In the middle of the 1990s there were started research in order to deve1ope hybrid rye basing on initial material (MS–sources "Pampa", non–restorers, restorers), provided by PBAI. Besides, our local geno–types were involved. At present the work is concentrated on CMS–sys–tem development. Non–restorers with high GCA and SCA were selected, ms–analogues of non–restorers through 4–5 backcrosses were developed. One of the main problems which have to be solved is to find a reliable restorer. Use of population cultivars as pollinators so far was not resulted in a development of high–yielding hybrids. It is known that for P–CMS the genes of fertility restoration are scarce. Moreover, an ef–fective restorer must be characterized by: high grain yield performance, high restoration index, equal terms of flowering with female parent. Development of the first trial hybrids is planned in the nearest several years.

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