The key objectives in winter cereals breeding at the Lithuanian Institute of Agriculture

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Production of winter cereals in Lithuania is an important industry in the national economy, which accounts for about 34% of the arable land. The most important winter cereals are winter wheat and winter rye, whose breeding was started in 1922 and has been continued till now at the Lithuanian Institute of Agriculture. 27% of the homebred winter wheat varieties and 38% of winter rye varieties were included in the National Variety List in 2002. Nevertheless, Lithuanian varieties account for 25 and 69%, respectively of the seed production area.

The primary objectives of the winter wheat breeding programs are to develop high yielding varieties with corresponding industrial quality. The released variety 'Alma' is of extremely high, 'Ada', 'Milda', 'Tauras' high, 'Lina' satisfactory bread-making quality. The most important task of winter rye breeding is to improve the pre-harvest sprouting resistance in the new varieties. The new promising breeding numbers meet this requirement.

Key words: winter wheat, winter rye, breeding

INTRODUCTION

Production of winter cereals in Lithuania is an important industry in the national economy and accounts for about 34% of the arable land under cultivation. Such percentage is the result of the particular role of winter cereals in the production and consumption of agricultural products. Lithuanian soil and climate conditions are favourable for the cultivation of two major cereals: winter wheat and winter rye. Lithuanian agriculture possesses a wide range of modern, well-developed varieties of cereals, which can introduce biological progress in food production.

27% of the homebred winter wheat and 38% of winter rye varieties were included in the National Variety List in 2002 [1]. Nevertheless, Lithuanian varieties account for 25% and 69%, respectively, of the seed production area, suggesting that local varieties are more popular than foreign.

MATERIALS AND METHODS

The genetic basis for cereal breeding during the first period (1922–1939) was the local varieties and landraces, as well as the material developed by Prof. D. Rudzinskas at the Moscow Plant Breeding Station [2]. The chief method was analytical breeding. The breeders selected the best plants from the local or foreign varieties [3, 4]. Later the initial breeding material was obtained via intervarietal hybridization programmes. Over the period 1922–2002, the breeders have used several selection schemes and field designs. Up-to-date breeding schemes are based on the new requirements for varietal purity and uniformity.

The scheme of self-pollinating cereals is the following:

1. Crossing block. 2. F_1 nursery, rows. 3. F_2–F_4 nursery, 10–15 m^2 plots. 4. F_5–F_6 nursery, single rows. F_7 nursery, plots 5 m^2, 1 replication. F_8–F_{10} nursery, 15–20 m^2 plots, 4 replications.

The doubled haploid technique is included in the new breeding schemes.

The field experiments were set up at the Lithuanian Institute of Agriculture. $N_{90}P_{60}K_{60}$ fertilisation was applied annually. The grain quality analyses were done using conventional methods and facilities, statistical data processing was performed using STAT ENG and ANOVA software.

RESULTS AND DISCUSSION

The primary objectives of the cereal breeding programme are to develop high-yielding varieties with a range of technological characteristics and, hence, end-uses. The winter wheat breeding programme is divided into the following ports according to their ultimate targets:

1. early ripening varieties with a high protein content and very strong gluten.

2. early-medium-ripening varieties of high bread-making quality.

3. medium-ripening, high-yielding varieties of satisfactory bread-making quality.

4. late-ripening, high-yielding varieties for non bread-making purposes.

Eight winter wheat varieties have been developed at the Lithuanian Institute of Agriculture over the period 1989–2002.

The results of the analysis carried out in 1997–1999 revealed that the early ripening variety 'Alma' had the highest protein content (14.0%), sedimentation value (64) and the strongest dough properties (Table). The grain yield of the variety 'Alma' was the lowest as compared to the other varieties. It confirmed the conclusions of other authors that grain protein negatively correlates with grain yield [5]. The varieties 'Seda' and 'Anyta' were characterized by weak gluten. The highest flour yield was estimated for the varieties 'Milda', 'Tauras', and 'Anyta'.

One of the limiting factors for winter cereals is overwinter survival, because the general tendency of reducing snow cover in winter was observed during the period 1925–1996 [6]. To this end, Lithuanian breeders included varieties from the West- and East-European groups in the mylasestion programmes of winter wheat and rye. Therefore the local varieties are characterised by a good winterhardiness [7].

One of the most important problems of contemporary breeding of winter rye is to develop varieties with a good resistance to pre-harvest sprouting and a low activity of amylases (Table).

For many years Lithuanian winter rye breeders in the breeding programmes have been focusing on the improvement of grain protein content and winter resistance.

Analysis of paired regression between protein content and falling number at the LIA revealed that there exists a significant negative correlation between protein content and falling number of amylases. Contemporary rye breeding programmes should pay attention to this factor, since the pre-harvest sprouting problem is still relevant.

Table. Grain yield and quality of the new Lithuanian winter wheat and rye varieties (1998–2000)

Variety	Grain yield, t/ha	Protein content, %	Falling number of amylases, s	Sedimentation value index	Valorimeter value index
Winter wheat					
'Širvinta 1'	6.05	12.8	316	47	60
'Ada'	6.89	12.9	333	50	78
'Tauras'	7.41	12.3	321	46	54
'Milda'	7.10	13.0	325	59	78
'Alma'	6.74	14.0	308	64	83
'Anyta'	6.32	12.0	274	33	56
'Lina'	7.12	11.9	282	43	54
'Seda'	7.44	11.1	325	18	44
LSD 05	0.46				
Winter rye					
'Duoniai'	3.78	11.4	154	–	–
LŽI 339	3.46	11.3	192	–	–
LŽI 346	3.86	12.2	160	–	–
LŽI 347	3.44	11.8	174	–	–
LŽI 395	3.33	12.0	179	–	–
LSD 05	0.33				

References

1. Tinkamiausių Lietuvoje auginti augalų veislių sąrašas. Vilnius, Lietuvos Respublikos žemės ūkio ministerija. 2002: 86.
2. Bulavas J. Lietuvos žemdirbystės mokslinio tyrimo instituto darbai, 1968; 12: 9–11.
3. Rudzinskis D. "Kosmos", 1935; 4–6: 137–66.
4. Rudzinskis D. "Kosmos", 1936; 4–6: 241–57.
5. Bhatia CR. Euphytica, 1975; 24: 789–94.
6. Bukantis A, Valiuškevičienė L. The Geografical Yearbook. Vilnius, 1999; 32: 57–64.
7. Ruzgas V, Liutkevičius G. Iceland Agr Sci 2001; 14: 29–34.

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LIETUVOS ŽEMDIRBYSTĖS INSTITUTO ŽIEMINIŲ JAVŲ SELEKCIJOS UŽDAVINIAI

S a n t r a u k a

Žieminiai javai Lietuvoje užima 34% dirbamos žemės ploto. Žieminių javų selekcija Lietuvoje buvo pradėta 1922 metais ir tęsiama iki dabar. Selekcionuojami žieminiai kviečiai ir rugiai. Svarbiausi žieminių kviečių selekcijos uždaviniai – sukurti įvairios technologinės paskirties veisles, o žieminių rugių – pagerinti atsparumą dygimui varpose ir sukurti veisles, kurių grūdai pasižymėtų mažu autolitiniu aktyvumu. Naujai sukurta žieminių kviečių veislė 'Alma' yra labai gerų, 'Ada', 'Milda' ir 'Tauras' – gerų, 'Lina' – patenkinamų kepimo savybių. Žieminiai rugiai 'Joniai', kaip ir perspektyviniai selekciniai numeriai, tiriami Valstybiniame augalų veislių tyrimo centre, pasižymi geresnėmis technologinėmis savybėmis.

Raktažodžiai: žieminiai kviečiai, žieminiai rugiai, selekcija