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Breeding spring *Triticum turgidum* L. var. *durum* on bread-making quality in Yurjev Plant Production Institute

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SUMMARY – During the last 30 years the varieties of *T. turgidum* L. var. *durum*. Kharkovskaya 5, Kharkovskaya 13, Kharkovskaya 15, Kharkovskaya 29, Kharkovskaya 31 and numerous breeding lines were created, the grain of which combines a good macaroni and bread-making quality. The peculiarity of the gliadin electrophoretical patterns of these varieties is presence of 45 bands in gamma-zone. This character is being used for selection of durum wheat breeding material with bread-making qualities. The phenol test and sedimentation method do not give positive results.

Key words: Durum wheat, bread-making quality, macaroni quality, electrophoresis.

RESUME – *"Amélioration de* Triticum turgidum *L. var.* durum *de printemps pour la qualité boulangère à l'Institut de Production Végétale de Yurjev". Pendant les dernières 30 années ont été créées les variétés* T. turgidum *L. var.* durum *Desf. De Kharkovskaja 5, Kharkovskaja 13, Kharkovskaja 15, Kharkovskaja 29, Kharkovskaja 31 et des lignées de sélection, dont le grain combine une bonne qualité pour les macaronis et une bonne qualité boulangère. La particularité du spectre électrophorétique de ces variétés est la présence de 45 bandes dans la zone gamma. Ce caractère était utilisé pour la sélection de matériel de sélection de blé dur avec de bonnes qualités boulangères. Le test du phénol et la méthode de sédimentation ne donnaient pas des résultats positifs.*

Mots-clés : *Blé dur, qualité boulangère, qualité des macaronis, électrophorèse.*

Introduction

The use of durum wheat for bread in countries of the Mediterranean, Near and Middle East (Hlynka, 1968) and as a flour improver of bread wheat in Russia (Smirnov and Marushev, 1968) gives basis for creation of *T. durum* Desf. varieties with good bread-making quality.

Bread from durum wheat in comparison with bread wheat has long life expectancy, pleasant specific taste and smell as well as a more aesthetic natural crust and crumb colours. The new forms *T. durum* Desf. are a valuable initial material for crossing with *T. aestivum* L. on such characters: heat resistance, size and quality of a grain, type of a root system development.

Materials and methods

Local breeding material was used for the research. Hybridization and selection methods were used for obtaining new hybrid combinations and bread strains. Traditional evaluation methods of macaroni and bread-making grain quality – phenol test, gliadin electrophoresis and others were used in the work (Kuchumova and Kravec, 1982).

Results and discussion

At the first period local durum wheat breeding material with good bread-making and macaroni quality was investigated. The line 59-204 was best representative of this material. Its comparison with the standards Kharkovskaya 46 (*durum*) and Saratovskaya 29 (bread wheat) on a grain quality in 1965-1970 years (Table 1) revealed singularity: higher characters of viscosity and specific gluten extensibility, mixing ability, relation of groups SS/SH, exclusive dough stability at batch on farinograph, low level of gluten hydration. In general, this strain had such a feature – its grain combines bread wheat protein substances and a durum wheat carbon hydrate complex.

Table 1. Characteristics of the spring wheat varieties

Characters	Durum wheat		Bread wheat	
	Strain 59-204	Kharkovskaya 46 yield st.	Artemovka yield st.	Saratovskaya 29 quality st.
Mean from 1965, 1967-1970 years				
Grain yield, t/ha	3.02	3.05	2.96	2.96
Mass 1000 grains, g	46.0	45.2	36.6	37.4
Gluten content, %	31.1	37.7	37.0	34.7
Strength of flour, W	321	140	221	409
Farinograph, min	34.0	5.4	11.2	10.4
Loaf volume, ml	607	437	552	636
Common loaf evaluation	5.0	2.1	3.4	5.0
Mean from 1967-1970 years				
Protein content, %	15.1	16.0	15.1	14.0
Crumb porosity	4.8	2.2	2.7	4.4
Mean from 1969-1970 years				
SS/SH in 1 g of protein	5.1	1.6	2.3	3.7
Gluten viscosity, sec	718	31	49	336
Gluten hydration, %	160	198	214	203

The variety Kharkovskaya 5 was created by mass selection on a grain from 59-204 strain and was carried out in 1976. During the 1970-1980 years, 290 special hybrid combinations were received by hybridization, from which 952 strains were selected and tested. The varieties Kharkovskaya 13 and Kharkovskaya 15 stable during the years 1981-1985 by manifestation of bread-making properties with strong bread wheat characters were selected (Table 2). The variety Kharkovskaya 15 was realized in 1992 and is now the national standard for the Ukranian steppe zone (Golik, 1996).

Table 2. Yield and grain quality of spring wheat varieties, 1981-1985 years

Character	Durum wheat				Bread wheat	
	Kh†-46 Yield st.	Kh-5	Kh-13	Kh-15	Kh-2 yield st.	Kh-93 quality st.
Grain yield, t/ha	2.32	2.13	2.36	2.59	2.53	2.25
Gluten, %	33.1	30.8	30.1	30.4	34.6	34.8
Protein, %	14.91	13.79	15.36	14.46	14.23	14.93
P/L	1.6	2.1	2.0	3.1	0.7	1.1
Loaf volume, ml	493	658	639	606	560	616
Common loaf	3.3	5.0	4.8	4.5	3.9	4.6
Macaroni colour	4.4	4.2	4.3	4.2	–	3.7
Macaroni strength, g	1106	1077	1099	1099	–	981
Overcooking factor ††	3.3	3.5	3.3	3.5	–	3.6
Dry residuum, %	4.6	4.6	4.5	4.9	–	4.2

†Kh = Kharkovskaya.

††Data for 1983-1985 years.

New durum wheat varieties Kharkovskaya 29 and Kharkovskaya 31 were created during 1985-1996 years and realized in the years 1995 and 1996.

104 durum wheat varieties and 102 bread wheat varieties in a competitive institute trial were evaluated by mixture of methods – yield and grain quality (bread-making and macaroni common analysis, phenol

test, gliadin electrophoresis and others) during the years 1988-1989. It was established that most durum wheat varieties belong to the first and second phenol test groups and bread wheat varieties to the third. The varieties – populations (3-4 groups) on colouring by phenol are closen. Kharkovskaya 5 also belongs to this group.

The bread wheat varieties Saratovskaya 29, Luganskaya 4 and Kharkovskaya 6 and also durum wheat varieties Kharkovskaya 51 and Kharkovskaya 9 with a similar response on phenol belonged to 3 and 4 phenol test groups. The durum wheat varieties of the first phenol group has good macaroni quality and mediocre or bad bread-making properties, for the second group – high characteristics of a flour force (W), volume and common evaluation of loaf and dough colour. The worse index of dough colour is noted for the varieties of the third and fourth groups.

The durum wheat varieties with good bread-making properties in a comparison with typical durum wheat varieties had the lower characters of a glassy, protein and gluten content, macaroni properties and higher characteristics of a flour force (W), ratio P/L, volume of bread and common evaluation of it. Thus, connections with the phenol test are not established.

Kosmolak *et al.* (1980) had established that *T. durum* Desf. varieties with a band 42γ of a gliadin electrophoresis spectrum have good cooking macaroni properties. In our research (Golik *et al.,* 1992), according the gliadin electrophoresis data, 97 durum wheat varieties were differentiated in 3 groups:

(i) The first group (15 varieties) is characterized by availability of band 42γ, a typical representative of this group is the variety Kharkovskaya 46.

(ii) The second group (30 varieties) has components of 45γ with tracks 42γ.

(iii) The third intermediate group (52 varieties) has components 42γ with tracks 45γ.

Between these groups connections are not established on grain yield, colour and strength of macaroni, dough colour, but the close connection with character of bread-making properties is noted.

The evaluation of bread-making quality of durum wheat varieties by sedimentation method gives negative results.

Conclusions

The correlation of good bread-making quality of durum wheat varieties with 45γ band of gliadin electrophoresis spectrum gives a foundation for its use as the test for a selection of the forms with good bread-making quality from a breeding material. Use of a phenol test and sedimentation method for this purpose has given negative results.

The task of improving a loaf crust and crumb appearance and magnification of its volume stands before breeding on perspective.

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