P L A N T B R E E D I N G A N D S E E D S C I E N C E
Volume 52 2005

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INFLUENCE OF PARENTAL COMPONENTS ON TECHNOLOGICAL QUALITY OF HYBRIDS OF *X TRITICOSECALE* WITTMACK WITH *AGROTRITICUM* SP.

ABSTRACT

Crossing a wild species of *Triticeae* tribe, e.g. *Agrotriticum* sp., with cultivated form of them, can enrich them in new, valuable genes as well as their recombinations, which determines their favorable traits from a breeding and agricultural point of view. The aim of present paper was to analyze some traits affecting the grain technological value at hybrid strains of triticale with *Agrotriticum* and to evaluate the influence of particular parental forms on value of tested traits at hybrids. There are no data on the subject in literature.

Five hexaploid breeding triticale strains produced by crossing triticale with *Agrotriticum* (Gruszecka, 1992) and parental components: two triticale and two *Agrotriticum* forms were studied. Plants were harvested in 2000 and 2001.

Kernels of obtained triticale hybrid forms were characterized by high amylolytic activity expressed by low falling number. Two strains were distinguished with higher falling number and higher flour strength, but they did not come up to *Agrotriticum* referring to the trait value. Gluten content was lower at studied strains than at corresponding parental components and its low quality was worse than that for *Agrotriticum* forms. Yield of total flour was low and not exceeding 60%. Obtained laboratory breads had pleasant and aromatic flavor. Crumb of bread produced from *Agrotriticum* was more elastic and had less moisture than that baked from triticale. Excellent strain No 2 – CZR 028/19/95 - {[(Lanca × L 506/79) × CZR 142/79] × (*Triticum aestivum* × *Agropyron* 1)} was characterized by porosity structure similar to that of *Agrotriticum* parental form. Bread achieved from the strain's flour was distinguished with low baking loss, and high efficiency and volume. However, slight effect of parental *Agrotriticum* forms on qualitative trait values of tested strains triticale with *Agrotriticum* cross-combinations was proved.

Key words: *Agrotriticum* sp., technological quality, triticale hybrids

INTRODUCTION

Wide crossing is an important element of initial stage of modern plant breeding. Wild species from *Triticeae* tribe, after crossbreeding with cultivated ones, can enrich them in new, valuable genes and their recombinations, determining favorable traits from a breeding and agricultural point of view (Friebe *et al.*, 1995; Gruszecka, 1997; Kowalczyk and Gruszecka, 2000).

Agropyron genus that contains genes determining the high value of agricultural and technological traits was used mainly for wheat improvement (Dong *et al.*, 1992; Chen *et al.*, 1989). Triticale, although is a relatively young species, is economically promis-

Communicated by Danuta Miazga

ing. It could compete with wheat and rye on lighter soils. Therefore, it is recommended to perform works on improving triticale in order to replace it with rye on better rye soils and to find its wider application.

Attempts of improvement the triticale variability through direct triticale crossbreeding with *Agropyron* not always is successive, i.e. ends with achieving the hybrid plants, even despite of the kernel setting. Substitute method of hybrid plant achievement due to crossbreeding triticale with *Agrotriticum* is applied then (Gruszecka, 1992). The method was used to obtain the material for present study. Such created hybrids can be characterized with many much favorable qualitative and quantitative traits than parental triticale forms (Gruszecka and Marciniak, 1995; Gruszecka and Strzembicka, 1995; Masłowski and Gruszecka, 1997; Makarska and Gruszecka, 1996, 1998).

The aim of present study was to analyze some traits that may affect the kernels technological value of triticale with *Agrotriticum* hybrid strains, as well as to evaluate the influence of particular parental forms on hybrid's tested traits values.

MATERIALS AND METHODS

Five hexaploid breeding triticale strains obtained from crossing of *X Triticosecale* Wittmack with *Agrotriticum* (Gruszecka, 1992) and parental components: two *X Triticosecale* Wittmack and two *Agrotriticum* sp. forms were objects for study (Table 1).

Table 1

Material for study

No	Strain/Line	Origin
	Hybrid strains	
1	CZR 040/3/1/95	Presto × (*Triticum aestivum* × *Agropyron* 1)
2	CZR 028/19/95	[(Lanca × L 506/79) × CZR 142/79] × (Triticum aestivum × Agropyron 1)
3	CZR 030B/911/6/95	[(Lanca × L 506/79) × CZR 142/79] × PPG 115
4	CZR 030P/18/95	{[(Lanca × L 506/79) × CZR 142/79] × PPG 115} × Presto
5	CZR 010/4/95	Presto × PPG 115
	Parental components	
6	Presto	triticale variety
7	CZR 1125/90	Secondary hexaploid triticale(Lanca × L 506/79) × CZR 142/79
8	*T. aestivum* × *Agropyron* 1	*Agrotriticum*
9	PPG 115	*Agrotriticum*

Plants were harvested in 2000 and 2001. Following traits were investigated: amylolytic activity expressed as falling number applying 9 g samples (ICC Standard No 107), baking quality using SDS sedimentation test (Axford *et al.*, 1979), gluten content and quality using Glutomatic device by means of "Index gluten" method (ICC Standard No 137). Grain milling was done in laboratory mill CD2 by Chopin (Producer's instructions) and efficiencies of break, reduction and total flour (sum of break and reduction flours) as well as bran were evaluated. On a base of prepared kernels milling balance, milling quality was estimated. Evaluating the triticale's flour strength, details of wheat

quality were accepted as reference, because it is one of triticale's parental forms. Moreover, many authors (Czubaszek, 1995; Haber and Lewczuk, 1990) tested flour strength of 'Presto' triticale as similar to that of wheat. Applying wheat one-phase baking method from Chorleywood (Axford *et al.*, 1979) worked out particularly for flour with weak gluten and achieved from sprouting kernels, bakery that was organoleptically assessed and referring to physical traits was produced (Jakubczyk and Haber, 1983).

Two-factor variance analysis (with no interactions) and multiple T-Tukey's sections were applied in statistical calculations. However, due to small number of replications, the analysis can play only approximate role.

RESULTS AND DISCUSSION

Insufficient triticale's kernels resistance towards sprouting makes impossible its wide utilization, among others, for baking the products by traditional means (Wolski *et al.*, 1998; Ceglińska *et al.*, 2002). Kernels of obtained hybrid triticale strains were characterized by high amylolytic activity expressed by low falling number (Table 2). Strains 2 and 3 (according to ordinal) were slightly distinguished with higher falling number, but none was similar – referring to the value – to one of the parental components – *Agrotriticum* PPG 115. Estimating the preliminary flour strength using SDS sedimentation test also points out to better quality of hybrid strains 2 and 3. Value of above test mainly depends on content and quality of gluten. Unfavorable weather conditions during plant's growth in the second year of study affected the decreasing grain quality, which reflected in much lower SDS test results and the lack of possibility of gluten extraction. Gluten content was lower at studied strains than at corresponding parental components and its low quality was worse than that for *Agrotriticum* forms (Table 2).

Table 2

Quality characteristics of triticale hybrids grain and their parental forms

No	Falling number [g × s^{-1}]	SDS [cm^3]	Wet gluten [%]	Gluten index
1	62 a	23.0	25.7*	3*
2	85 a	31.5	21.7*	10*
3	64 a	31.5	23.4*	7*
4	62 a	26.5	20.7*	7*
5	63 a	25.5	23.6*	3*
6	62 a	33.5	26.2*	16*
7	71 a	29.4	24.5*	4*
8	90 a	60.5	28.9	65
9	129 b	64.0	25.8	90
LSD	68	ns	ns	ns

* - result from one year

a, b – homogeneous groups, ns – differences not significant at = 0.05

Almost twice as much reduction as break flour was achieved during milling the grain from tested hybrid strains (Table 3). However, efficiency of total flour was low and not exceeding 60%. *Triticum aestivum* × *Agropyron* 1 had the worst milling quality among all tested forms, which could be caused by thicker and stronger binding of seed coat with endosperm in kernels. Hybrid strains created on a base of

the *Agrotriticum* form (strains No 1 and 2) did not come up to corresponding triticale component referring to the trait's value. At remaining strains, flour efficiency was higher or at the level of triticale as compared to corresponding parental forms.

Table 3

Milling result of triticale hybrids grain and their parental forms

No	Break flour [%]	Reduction flour [%]	Yield of flour [%]	Bran [%]
1	22.4	34.6	57.0	43.0
2	20.4	36.8	57.2	42.8
3	24.2	35.8	60.1	39.9
4	20.6	39.2	59.8	40.2
5	21.4	37.8	59.1	40.8
6	21.7	37.3	59.0	41.0
7	23.4	37.0	60.4	39.6
8	17.8	36.2	54.0	46.2
9	20.2	39.4	59.6	40.4
LSD	ns	ns	ns	ns

ns – differences not significant at = 0.05

Bakery achieved due to laboratory baking was organoleptically assessed. It was characterized with shining, smooth or slightly rough skin surface of light-brown to dark-brown color. Skin color and taste showed the association with the value of falling number. The lower falling number, the darker skin's color and the sweeter bakery was. Assessed bakery had pleasant and aromatic flavor. Its crumb had grey shade. Crumb of bakery produced from *Agrotriticum* was obviously more elastic and less wet than that achieved from triticale. Similar crumb's properties were showed by the bakery produced from hybrid triticale strain No 2, i.e. strain that was distinguished with lower amylolytic activity and higher SDS test value. Crumb's porosity of bakery from parental *Agrotriticum* forms was more uniform with thin-wall fine pores as compared to triticale forms. Strain No 2 was characterized with porosity structure similar to that of *Agrotriticum* parental form. Bakery achieved from the strain's flour was distinguished with low baking loss, high efficiency and volume, comparable to that baked from triticale (Table 4).

Little progress of qualitative traits at hybrids as compared to parental forms could result from the increase of yield structure trait values at tested strains (Kowalczyk and Gruszecka, 2000). It is also probable that the share of genetic material in hybrids is insignificant or gene cooperation is unfavorable. Molecular analysis illustrating the share of foreign genome in tested triticale strains would extend the knowledge upon the subject.

Table 4

Analysis of bread quality from flour of triticale hybrids and their parental forms

No	Baking loss [%]	Bakery efficiency [%]	Volume of 100g bread [cm^3]	Porosity of crumb (Dallmanna)
1	17.4	132.2	241.5	2.5
2	16.7	133.2	249.0	6.5
3	17.2	132.2	239.0	5.0
4	17.6	131.7	170.0	2.5
5	17.2	132.5	256.0	3.0
6	18.1	130.8	243.0	4.0
7	21.4	125.9	240.0	6.5
8	20.0	127.4	291.0	6.5
9	19.4	133.0	291.0	6.0
LSD	ns	ns	ns	ns

ns – differences not significant at = 0.05

CONCLUSIONS

Slight effect of parental *Agrotriticum* forms on qualitative trait values at tested strains of X *Triticosecale* Wittmack with *Agrotriticum* cross-combinations was proved.

Among triticale hybrid strains, No 2 – CZR 028/19/95 – {[(Lanca × L 506/79) × CZR 142/79] × (*Triticum aestivum* × *Agropyron* 1)} is noteworthy due to its lowest amylolytic activity and qualitative virtues of bakery achieved, that exceeded parental triticale form.

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