

S. R. Roux¹, T. Miedaner², H. H. Geiger², E. Knopf³, P. Wilde⁴, H. Wortmann⁵

¹Federal Centre for Breeding Research on Cultivated Plants, Institute of Agricultural Crops, Rudolf-Schick-Platz 3a, D-18190 Groß Lüsewitz, ²University of Hohenheim (720+350), D-70593 Stuttgart, ³Pflanzenzucht Dr. h.c. Carsten, D-29553 Bienenbüttel, ⁴Lochow-Petkus GmbH, D-29296 Bergen, ⁵Hybro GmbH, D-76669 Bad Schönborn 2

COMBINING ABILITY VS. POPULATION PERFORMANCE OF GENETIC RESOURCES IN RYE

ABSTRACT

The comparison of the population *per se* performance and the combining ability of 19 genetic resources and 5 adapted populations demonstrated that genetic resources might be integrated in hybrid rye breeding programmes without previous selection for yield. However, highly heritable traits like straw length and susceptibility to lodging should be improved before.

Key words combining ability, genetic resources, hybrid rye breeding programme

INTRODUCTION

Variety breeding unavoidably leads towards decreased genetic variability in breeding populations. In long-term selection this reduces also the potential gain of selection. Genetic variability can be increased by the introgression of genetic resources. Generally, a genetic resource is any material which becomes accessible for breeding purposes through selection for better adaptation (Hallauer and Miranda, 1981). The present study aimed at the analysis of combining ability and population *per se* (pps) performance of genetic resources in comparison with several adapted populations in rye.

MATERIAL AND METHODS

A total number of 24 self-incompatible populations (19 genetic resources and five adapted varieties; Table 1) were tested in this investigation. These 24 populations were crossed in 1997 with two testers of the seed-parent gene pool. In 1998 and 1999 the testcross and pps per-

formance were evaluated for grain yield and plant height in ten environments (five locations, two years) while the lodging tendency was determined in five environments. The field tests were carried out in a 5×5 -lattice with three replications and a plot size of 5 m^2 . Seed density and N-fertilisation were reduced and growth regulators were applied for two times on the pps test to prevent early lodging. The computer programme PLABSTAT (Utz, 1993) was used for the statistical analysis of the results.

Table 1

Tested populations		
No.*	Name	Origin
1	Galma	Belgium
2	Chinese Rye	China
3	Breno	CSFR
4	Slowak Landrace	Slowakia
5	Brandts Marien	Germany
6	Otterbacher	Germany
7	Römers Riesengebirgsroggen	Germany
8	Autuma	Japan
9	AMD II/2	Poland
10	Sangaste	Poland
11	Belorusskaja 23	Russia
12	Gibrid 173	Russia
13	NEM 1	Russia
14	NEM 2	Russia
15	NEM 3	Russia
16	NEM 4	Russia
17	Orlonskaja	Russia
18	Saratowskaja	Russia
19	Fontane	-
20	Halo	Germany
21	Carokurz	Germany
22	Genepool Groß Lüsewitz	Germany
23	Gloria	Romania
24	Jec	Poland

*1-19: genetic resources; 20-24: adapted populations

RESULTS AND DISCUSSION

As expected, the genetic resources revealed, on average, less grain yield in all experiments (Fig. 1). For pps performance, the genetic resources showed a high genetic variance in respect to yield whereas the mean combining ability was only slightly reduced compared to the adapted testcrosses and had a low genetic variance. The pps and the

mean testcross performance were highly correlated (0.82), probably due to the high genetic variance of the pps performance. Five genetic resources (1, 9, 13, 15, 16) produced a similar grain yield like the adapted populations for both pps and testcross performance and are representing favorable candidates to be crossed with rye breeding populations. Another two resources (5, 14) showed no significant difference concerning the testcross performance. The heterotic increase, defined as the difference between the testcross and the pps performance, ranged between 11.5% and 87.9% (Fig. 2). This is a clear indication that genetic resources might be integrated in hybrid rye breeding programmes without previous selection for yield adaptation.

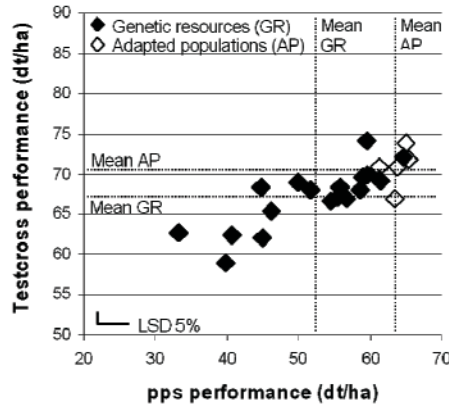


Fig. 1 Population *per se* (pps) and mean testcross performance for grain yield (dt/ha); average of 5 locations and 2 years

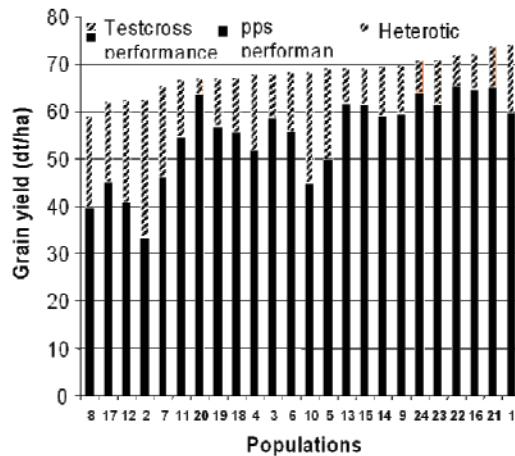


Fig. 2 Comparison of the mean testcross performance and the pps performance for grain yield (average of 5 locations and 2 years) and the resulting heterotic increase; 20–24: adapted populations

Despite of the specific conditions of the pps performance test, the genetic resources revealed, on average, a significantly higher straw length (+21.5 cm) and a distinct susceptibility to lodging (+0.9 scoring units) in comparison to the adapted populations. Therefore, these highly heritable traits should be improved by a simple selection procedure before the integration of genetic resources in hybrid rye breeding programmes.

The introgression of new alleles from genetic resources may not only increase genetic variability in breeding materials but may also widen the genetic divergence between the different gene pools for advanced exploitation of heterosis.

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