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Agronomic performance of durum wheat (*Triticum turgidum* L.) possessing the 1BL/1RS translocation cultivated at Mediterranean environments

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SUMMARY – At CIMMYT, the 1BL/1RS chromosome substitution has been incorporated to durum wheat germplasm (*T. turgidum* L.). Research about the effect of 1RS arm on agronomic performance of this durum wheat germplasm is very limited. Therefore, the objective of this study was to evaluate the yield performance of near-isogenic lines from durum wheat 'Altar 84', four carrying 1BL/1RS translocation and four without the translocation (normal). These lines were cultivated at four different Mediterranean environments of Spain. The growing conditions were different in each environment and explained the major part of the observed yield-trait variability. In average, the 1BL/1RS genotypes showed higher 1000-kernels than normal ones, but they also showed less number of spikes and grains per square meter. This yield-component compensatory behavior may explain the lack of difference in grain yield between these two genotypic groups. Except for grain yield, no environment * genotype interaction was observed for the yield-related traits. In conclusion, the presence of the 1RS chromosome arm showed no clear advantage in grain yield over the normal durum wheat genotypes.

Key words: *Triticum turgidum*,1BL/1RS, agronomic performance, grain yield.

RESUME – *"Performances agronomiques de blé dur (*Triticum turgidum *L.) possédant la translocation 1BL/1RS cultivé dans des environnements Méditerranéens". Au CIMMYT, le chromosome de substitution 1BL/1RS a été incorporé au blé dur (*T. turgidum *L.). Les recherches concernant les effets du bras 1RS sur les performances agronomiques du blé sont très limitées. Par conséquent, l'objectif de cette étude a été d'évaluer les performances au niveau du rendement de génotypes quasi-homozygotes du blé dur "Altar 84", quatre d'entre eux porteurs de la translocation 1BL/1RS et quatre sans cette translocation (normal). Ces génotypes ont été cultivés sous quatre environnements méditerranéens espagnols. Les conditions de culture étaient différentes pour chaque environnement et elles expliquent la plus grande part de la variabilité observée entre les tests de rendement. En moyenne, les génotypes 1BL/1RS présentent des 1000-grains plus élevés que les autres, mais les épis et les grains s'avèrent être moins nombreux par mètre carré. Ce comportement compensatoire lié au rendement, peut expliquer le manque de différence observé entre les rendements en grains de ces deux groupes possédant des génotypes différents. Mis à part pour le rendement en grains, aucune interaction environnement * génotype n'a été observée au niveau des essais comparatifs de rendement. En conclusion, la présence du bras du chromosome 1RS n'apporte pas une amélioration claire du rendement en grain si on compare ce dernier au rendement des génotypes normaux de blé dur.*

Mots-clés : Triticum turgidum, *1BL/1RS, performances agronomiques, rendement en grains.*

Introduction

The 1BL/1RS chromosomal translocation has been widely used by wheat breeding programs around the world. Several researchers had showed that 1RS arm in bread wheat germplasm (*Triticum aestivum* L.) enhances agronomic performance, particularly grain yield and yield stability across diverse environments (Carver and Rayburn, 1994; Moreno-Sevilla *et al.,* 1995a, 1995b; Villareal *et al.,* 1995). At CIMMYT, the 1BL/1RS translocation has been incorporated for durum wheat (*Triticum turgidum* L.) improvement. However, the effect of this chromosomal substitution in this durum wheat germplasm is not well known. The objective of this study was to evaluate the grain yield and some yield components of near-isogenic lines of durum wheat carrying the 1BL/1RS chromosomal translocation at diverse Mediterranean environments.

Materials and methods

Four near-isogenic lines from durum wheat cultivar "Altar 84" with 1BL/1RS translocation (1RS) and four normal ones (1BS) was taken from the germoplam developed at CIMMYT (Mujeeb-Kazi *et al.,* 1996).

The study was conducted at four different Mediterranean environments of Spain, Torregrosa (Lleida) 1994-95 (TORR95), 1995-96 (TORR96), Jerez de la Frontera 1995-96 (AND96) and Gerona 1995-96 (GER96). The Tables included indicate the growing conditions of each environment.

Each trial used a randomized completed-block design with four (1994-95) and three replications (1995-96). Each of the experimental units consisted of six rows, 0.2 m apart and 3 m long. Seeding rate was 210 kg/ha.

Yield components were estimated from a 0.5 m random sample of plants, cut at ground level, after maturity. These plant samples were oven-dried at 70ºC for 48 h. Data collected were no. of spikes/m^2, no. of kernel/m^2 and 1000-kernel weight (grams). Grain yield (t/ha) was estimated by harvesting the entire plot.

Analyses of variance were across environments. Genotypes and environments were considered fixed and random effects, respectively. PROC-GLM procedure was used for estimating the F-test, and Duncan test for mean separation.

Results and discussion

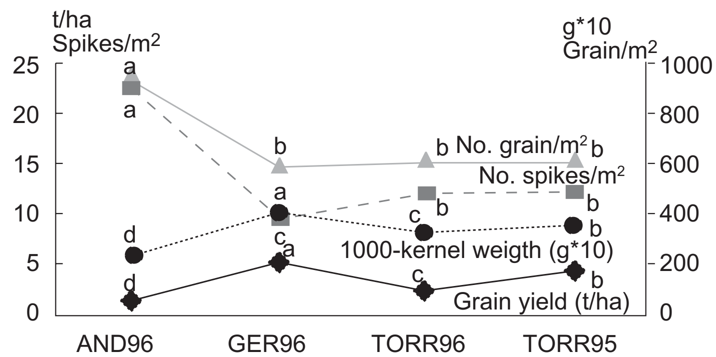
The environment was the main factor of variability for grain yield and yield components. AND96 with worse and GER96 with better growing conditions (Table 1), showed the lowest and highest grain yield, respectively. The grain yield differences between environments were directly associated to significant differences in 1000-kernels weight (Fig. 1).

Table 1. A comparison of climatic conditions for trials

Environment	Mediterranean conditions	Cycle environmental conditions
AND96	Dry: very high temperatures during late spring. Terminal water stress.	High precipitation during winter and very low during spring. No irrigation. Very late seeding data.
GER96	Humid: optimal temperatures and high precipitation	High precipitation during autumn and winter. One irrigation. Late seeding data.
TORR96	Temperate: high temperatures during late spring. Rainfall concentrated in autumn and spring	Very high precipitation during autumn and winter. One irrigation. Very late seeding data.
TORR95		High precipitation during autumn and winter. Three irrigations. Normal seeding data.

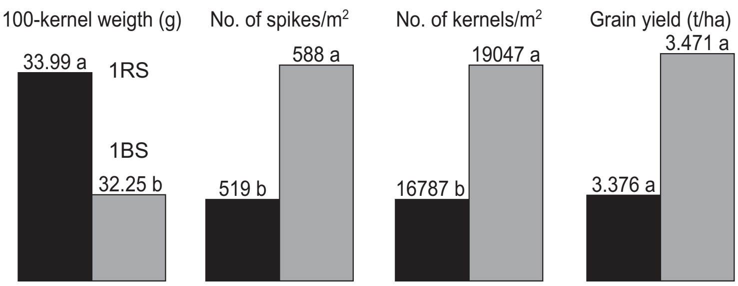
Kernel weight of the 1BL/1RS genotypes was signficantly larger than that of the normal genotypes. However, the normal genotypes had a higher number of spikes and kernels per square meter than the 1BL/1RS ones (Fig. 2). These results were in agreement with the findings reported by Villareal *et al.* (1997) for durum wheat and Moreno-Sevilla *et al.* (1995b) for bread wheat, where also comparison of 1BL/1RS genotypes with normal ones were made. Compensation between kernel weight and number of spikes and kernels per square meter in these researches may explain the lack of differences in grain yield between the two chromosomal classes. The lack of grain yield advantage stability associated to 1BL/1RS translocation did not confirm the findings of other studies on bread wheats (Carver and Rayburn, 1994; Moreno-Sevilla *et al.,* 1995a; Villareal *et al.,* 1995).

The environment * genotype (1BS vs 1RS) interactions were not significant for yield components evaluated. Hence, average response of 1BL/1RS chromosome class to changes in the environment showed not advantage in comparison to normal genotypes. Only for grain yield, the environment * genotype (1BS vs. 1RS) interaction was significant. The results showed yield advantage of 1BL/1RS over the normal ones in lowest-yielding and more stressed environment (Fig. 3 and Table 1). Similarly, Villareal *et al.* (1997) also found that durum isogenic lines from 'Altar 84' carrying 1RS arm expressed yield advantage under reduced irrigation and was attributed to increased kernel weight. However, in this study the better grain yield performance could not be seen at TORR 96, which is considered a stressed low-yield environment.



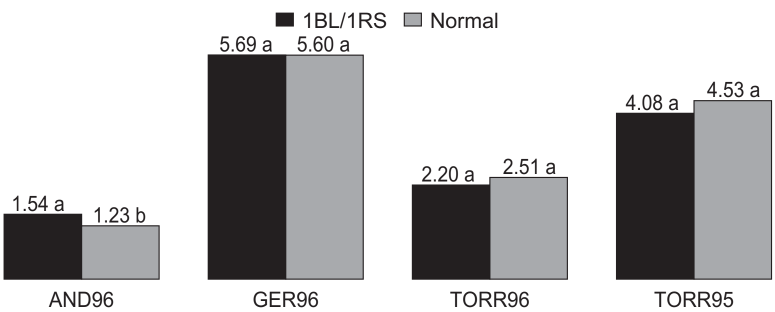
Values with the same letter for the same trait do not differ significantly

Fig. 1. Grain yield and yield components for four Mediterranean environments of Spain, where Vitrón, Altar and their isogenic lines with and without 1BL/1RS translocation were cultivated during 1994-95, 1995-96.



Value with the same letter for the same trait do not differ signicantly

Fig. 2. Mean of grain yield and some yield componentes for near-isogenic lines of durum wheat 'Altar 84' with (1RS) and without (1BS) 1BL/1RS chromosome translocation, cultivated at four Mediterranean environment of Spain.



Value with the same letter for the same location do not differ significantly

Fig. 3. Mean of grain yield (t/ha) for near-isogenic lines of durum wheat with 1BL/1RS translocation and normal ones, cultivated at four Mediterranean environments of Spain during 1994-95, 1995-96.

Conclusion

No grain yield advantage was associated to the 1BL/1RS chromosome translocation in durum wheat cultivated in Mediterranean environment. However, there were yield component differences between genotypes with and without 1BL/1RS translocation, which did not lead to understanding, in a clear way, the contribution in agronomic perfomance of the presence of the 1RS arm in the durum wheat background.

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