

Hybrid triticales in Switzerland: past experience

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Abstract

In Switzerland, E. Oehler and M. Ingold started research on triticales during the 1950s. The main goals at that time were spike fertility improvements and octoploid triticales chromosome number stability. In 1976, after a visit to INRA Clermont Ferrand, A. Fossati decided to shift the triticales breeding programme from octoploid to hexaploid triticales. Many genetic exchanges and collaborations took place with Poland (T. Wolski), the USA (R Metzger, MF Kolding), CIMMYT (G. Varughese, W. Pfeiffer) and France (M Bernard). For cultivar development in France, a cooperation started with a company called Claeys-Luck (later changed to Orsem and then to DuPont Hybrinova). One of the main goals of this programme was the improvement of lodging resistance by reducing plant height. Indeed, towards the end of the 1980s, all registered triticales cultivars were tall (135-150 cm). Our nursery contained several significantly short lines (<100 cm), likely with the dwarfing gene *Rht3*. However, these lines, despite highly fertile ears, had a low yield caused by insufficient tillering and a bad grain filling. Since 1987, with the opportunity to use chemical hybridising agents (CHA) for experimental purposes, F₁ hybrids were produced, with the idea to combine the productivity of tall genotypes with the ear fertility of the shortest genotypes. Since 1994, other kind of combinations have been produced.

The hybrids were produced by Delley Seeds and Plants Ltd. using three CHAs provided by Ciba-Geigy, Hybrinova (Croisor®) and Hybritech (Genesis®). The level of sterility of the treated plants was controlled by bagging some ears at heading. The following year, growing-on tests were used to assess the identity and purity of hybrid seeds. The material was evaluated in a lattice design, with two or three replications in three to nine locations, each plot measuring 7 m². To compare the results of the hybrids with the mean of their parents, we calculated the relative values compared to two standards (cvs. 'Brio' and 'Tridel'). Among all produced hybrids, we only analysed the results of those tested together with these two standard cultivars.

The CHA from Ciba-Geigy was highly efficient, but quite expensive, and its use on triticales was only on a small experimental scale. The two other CHAs sometimes had a phytotoxic effect (reducing plant height, producing red coloration or discoloration on the leaves) depending on the genotypes, but the male sterility was almost complete. During the first years of experiments (1987–1994), sig-

nificantly short lines (likely with the dwarfing gene *Rht3*) were combined with taller lines (Table 1). The F₁ hybrids were in general shorter than the mid-parent values. The thousand kernel weight (TKW) was higher, but not the yield due to weak tillering. The specific weight tended to be equivalent to that of the worst parent. The cytological instability of the *Rht3* gene caused a lack of uniformity in the hybrids. In conclusion, the negative characters related to this gene were not compensated by the heterosis effect. In the following years (1995–1998), genotypes of a medium to short plant height, such as the cv. 'Tridel' (≈101 cm), were combined with tall lines. In general, the produced hybrids had good uniformity. Hybrids confirmed that the heterosis effect, as observed in wheat, was most important on grain weight. However, strong parental influences on the TKW and number of grains per square metre were observed. On average, plant height increased only slightly (≈5%). Yield increased as well, sometimes considerably. The effect of heterosis on earliness and specific weight was not important. The average results masked a great variability, but the best hybrids were agronomically highly promising. The highest yielding hybrid exceeded 120 dt ha⁻¹. One of our hybrids was the highest yielding variety (114% of the standards) in the first year in official French trials. After 1996, we also produced some spring triticales hybrids (results not presented). In 1998–1999, four triticales F₁ hybrids based on 'Tridel' were registered, two in France (cvs. 'Kador' and 'Clint') and two in Switzerland (cvs. 'Hybridel' and 'Delrac'). As the CHA owner did not obtain the authorisation for its utilisation in triticales, no commercial development followed the registrations. Combining tall male lines with not-too-short female lines was successful from an agronomical viewpoint. Compared to wheat, F₁ hybrid production in triticales is easy thanks to a huge pollen production. As triticales is a forage cereal with a relatively low price, it is more challenging to compensate for the higher F₁ seed cost using the higher yield.

Keywords

F₁ hybrid · gametocide · heterosis · × *Triticosecale*

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Table 1: Performance of F₁ triticale hybrids compared to the mean of both parents, expressed as the difference between the relative values (%) to two check varieties (cvs. 'Brio' and 'Tridel').

Period		Grain yield	Thousand kernel weight	Plant Height	Test Weight	Heading
1987–1994 (n = 38)	Mean	-8.5	8.6	-3.7	-2.3	-0.04
	Minimum	-29.4	-7.3	-18.1	-10.5	-1.9
	Maximum	30.9	29.3	10.1	5.3	2.5
1995–1998 (n = 235)	Mean	7.5	9.7	5.3	0.3	0.04
	Minimum	-28.4	-23.4	-17.5	-6.6	-7.4
	Maximum	36.4	45.5	21.4	7.1	8.2

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