TRITICALE
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Editors: Reginald MacIntyre/Marilyn Campbell
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Editors: REGINALD MACINTYRE/MARILYN CAMPBELL

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Introduction of New Forms and Types from Wheat and Triticale

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Abstract Crossing wheat with triticale offers good possibilities of producing varieties that are resistant to rust, have a higher nutritive quality, and possess higher yield. Such crosses would benefit triticale through incorporation of the more desirable agronomic characteristics of improved wheat. Improved varieties of triticale would enhance prospects for wider commercial acceptance.

Résumé Le croisement du blé avec le triticale offre de bonnes chances de créer des variétés résistantes à la rouille, de qualité nutritive supérieure et à rendement plus élevé. Ces croisements seraient bénéfiques pour le triticale, grâce à l'incorporation des caractéristiques agronomiques les plus désirables des blés améliorés. La production de variétés de triticale meilleures augmenterait les chances d'une acceptation plus grande sur le plan commercial.

At Ciano in the growing season 1962-63, crosses between Mexican dwarf bread wheats and triticale were made for the first time. At that time the purpose was to see whether it was possible to succeed in making such crosses, and at the same time, determine what could be obtained from crosses between the two cereals.

Later, in work carried out by CIMMYT toward the development of hybrid wheats, again wheat was crossed with triticale, with two main objectives: (1) to transfer the cytoplasmic male sterility mechanism and the restoration of fertility from wheat to triticale; (2) to attempt a transfer of the better capacity for cross pollination from triticale to wheat.

It is obvious that these two points are intimately related to the production of hybrid wheats and triticales. At present the crosses of wheat × triticale take place in a more general framework that encompasses two interesting fields of work: (1) the transfer of desired traits from wheat to triticale, such as the mechanism for sterility and fertility restoration, short straw, grain type, disease resistance, ramified heads, etc.; (2) the transfer of desirable characters from triticale to wheat, for instance, high number of spikelets per spike, high number of florets per spikelet, grain size, nutritional quality, disease resistance, etc.

The exchange in germ plasm between these two cereals may lead to plants with better production capacity and superior quality.

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In crossing wheat with triticale, few seeds with low germination due to aneuploidy are obtained in the F<sub>1</sub> and F<sub>2</sub> generations, but in the process of selection in the following generations, one can obtain plants that are completely normal, having the phenotype of triticale, wheat, or a blend of the two parents involved in the cross.

**Results**

**Triticale**

In the development of male sterile triticales and the restores necessary for the production of hybrids in triticale, it has not yet been possible to obtain sterility and restoration as effective as has been realized in wheat, but nevertheless, some progress has been made in obtaining several lines with near total sterility and good plant development.

The following material represents triticales with cytoplasm of *Triticum timopheevi* having the best male sterility:

- Random selections from bulk O × H Armadillo “S”
- X-308-6Y-2B-100Y-1B-100Y
- Tc1 (E<sub>4</sub>)-Arm “S”
- H 277.69-1Y-2B-5Y-101B-7Y-5B-15Y
- Tc1 (E<sub>4</sub>)-Arm “S”

Regarding the triticales with the best partial fertility restoration, several lines are available derived from the crosses H530.70A and H261.71, both of which contain the cytoplasm of *T. timopheevi* and at least a part of the genes responsible for the fertility or restoration genes that are found in this species.

From the first crosses of wheat × triticale, realized in 1962–63, segregants were obtained that phenotypically resemble the triticale parents, but with earlier heading, a high degree of sterility, and shorter stature. In addition, we maintain a line derived from the cross P4160 × triticale and another from My64 × triticale, corresponding to this first group of crosses.

The possibility of transferring the dwarfism of wheat to triticale is also evident in F<sub>2</sub> populations of recently realized crosses. Crosses from wheat with Tom Thumb Dwarfism (40 cm height) with semi-dwarf triticale (90 cm height) result in the appearance of segregant plants with the characteristics of triticale and the height from the wheat parent. An example is the cross CMH72A. 614, whose parents are Tc1 (E<sub>4</sub>)-Arm “S” (mother), and Hua R (E<sub>4</sub>)-Buitres “S” (pollen parent).

Finally, attempts are made to transfer ramification of the head from wheat to triticale, and already a small group of lines is available showing the characteristics of triticale combined with a stable degree of ramification. It is possible that using a system of backcrosses with normal triticale and ramified wheat, we may be able to finally incorporate the full complement of genes conditioning ramification in wheat into the triticale germplasm.

The triticales with stable ramification mentioned above are lines extracted from the cross H 625.71, whose parents are Armadillo “S” (normal triticale) and 11-22609 × H485.65 (wheat with unstable ramification).

The ramification of the wheat parent used in this cross is unstable, whereas the ramification of the lines segregating from this cross is of a small degree, but stable.

In several triticales, there exists a certain tendency to produce ramifications in the heads of several plants, but the plants showing this characteristic are highly sterile, and apparently this ramification is unstable. At present attempts are made to make the crosses from which it can be determined whether it is possible to stabilize the ramification already present in triticale or barring that, to try to transfer the ramification of wheat into triticale.

**Wheat**

The crosses of wheat × triticale represent a useful tool for the triticale breeder that is equally useful to the wheat breeder. Thus we see lines segregating from wheat–triticale crosses, with a phenotype similar to wheat, but showing a higher number of grains per spikelet than the conventional wheat varieties. Similarly, it has been possible to select wheats
with over 17% protein content. The octoploid triticale, derived from the cross Inia × Turkey, yields, when crossed again to Inia 66, plants looking like Inia 66, but with better resistance to *Puccinia recondita*, which gives us the perspective of the transfer with relative ease of various types of resistance from rye to wheat.

**Conclusions**

According to our observations, the crosses of wheat with triticale constitute a field of work that is highly interesting for the breeders of these two crops. In wheat they afford the possibility of incorporating resistance to rusts, a better nutritional quality, and increased grain yields. Triticale, in turn, can be much benefitted, especially by incorporation of the agronomic characteristics that have been highly improved from wheat, such as the ramifications of the head and perhaps also the filling of the grain; this last trait has greatly limited development of triticale varieties with broad commercial acceptance.