TRITICALE
Proceedings of an international symposium
El Batan, Mexico, 1-3 October 1973
Editors: Reginald MacIntyre/Marilyn Campbell
TRITICALE

Proceedings of an international symposium,
El Batan, Mexico, 1–3 October 1973*

Editors: REGINALD MACINTYRE/MARILYN CAMPBELL

This symposium was co-sponsored by the Centro Internacional de Mejoramiento de Maíz y Trigo, the University of Manitoba, and the International Development Research Centre.

*The views expressed in this publication are those of the individual author(s) and do not necessarily represent the views of the International Development Research Centre.

ISBN 0-088936-028-6
UDC: 633.1
© 1974 International Development Research Centre
Head Office: 60 Queen Street, Box 8500, Ottawa, Canada K1G 3H9
Microfiche Edition $1
**Contents**

<table>
<thead>
<tr>
<th>Section</th>
<th>Author</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>W. David Hopper</td>
<td>5–7</td>
</tr>
<tr>
<td>List of Participants</td>
<td></td>
<td>8–11</td>
</tr>
<tr>
<td>Historical review of the development of triticale</td>
<td>Arne Müntzing</td>
<td>13–30</td>
</tr>
<tr>
<td>Development of triticale in Western Europe</td>
<td>E. Sanchez-Monge</td>
<td>31–39</td>
</tr>
<tr>
<td>Triticale-breeding experiments in Eastern Europe</td>
<td>Á. Kiss</td>
<td>41–50</td>
</tr>
<tr>
<td>Research work with 4x-Triticale in Germany (Berlin)</td>
<td>K.-D. Krolow</td>
<td>51–60</td>
</tr>
<tr>
<td>Triticale research program in the United Kingdom</td>
<td>R. S. Gregory</td>
<td>61–67</td>
</tr>
<tr>
<td>Progress in the development of triticale in Canada</td>
<td>E. N. Larter</td>
<td>69–74</td>
</tr>
<tr>
<td>Triticale: its potential as a cereal crop in the United States of America</td>
<td>R. J. Metzger</td>
<td>75–80</td>
</tr>
<tr>
<td>The triticale improvement program at CIMMYT</td>
<td>F. J. Zillinsky</td>
<td>81–85</td>
</tr>
<tr>
<td>Prospects of triticale as a commercial crop in India</td>
<td>J. P. Srivastava</td>
<td>87–92</td>
</tr>
<tr>
<td>Triticale breeding experiments in India</td>
<td>N. S. Sisodia</td>
<td>93–101</td>
</tr>
<tr>
<td>Triticale research program in Iran</td>
<td>M. A. Vahabian</td>
<td>103–105</td>
</tr>
<tr>
<td>Triticale research program in Ethiopia</td>
<td>F. Pinto</td>
<td>107–115</td>
</tr>
<tr>
<td>Triticale research program in Algeria</td>
<td>Herb Floyd</td>
<td>117–119</td>
</tr>
<tr>
<td>Triticale program and potential in Kenya</td>
<td>B. A. Nganyi Wabwoto</td>
<td>121–124</td>
</tr>
<tr>
<td>Triticale breeding experiments in Chile</td>
<td>Patricio C. Parodi</td>
<td>125–128</td>
</tr>
<tr>
<td>Expanding the CIMMYT outreach programs</td>
<td>R. G. Anderson</td>
<td>129–135</td>
</tr>
<tr>
<td>Meiotic, gametophytic, and early endosperm development in triticale</td>
<td>Michael D. Bennett</td>
<td>137–148</td>
</tr>
<tr>
<td>Improving seed formation in triticale</td>
<td>F. J. Zillinsky</td>
<td>155–157</td>
</tr>
<tr>
<td>Univalency in triticale</td>
<td>P. J. Kaltsikes</td>
<td>159–167</td>
</tr>
<tr>
<td>Cytogenetics of hexaploid triticale</td>
<td>Arnulf Merker</td>
<td>169–172</td>
</tr>
<tr>
<td>Use of chromosome analysis to detect favourable combinations from octoploid × hexaploid crosses</td>
<td>M. H. de Sosa</td>
<td>173–180</td>
</tr>
</tbody>
</table>
Preliminary report on the cytogenetics of tetraploid \( \times \) diploid wheat crosses  
**R. J. Metzger and B. A. Silbaugh**  181–185

Triticale diseases review  
**Santiago Fuentes Fuentes**  187–192

Triticale diseases in CIMMYT trial locations  
**M. J. Richardson and J. M. Waller**  193–199

Agronomy and physiology of triticales  
**R. A. Fischer**  201–209

Early steps on triticale breeding at CIMMYT  
**Marco A. Quiñones**  211–212

Introduction of new forms and types from wheat and triticale  
**Ing. Ricardo Rodriguez**  213–215

Extending adaptability and sources of new genetic variability in triticale  
**M. M. Kohli**  217–226

Production of triticale germ plasm  
**J. Perry Gustafson**  227–233

Broadening of the triticale germ plasm base by primary hexaploid triticale production  
**Armando Campos Vela**  235–236

Nutritional value of triticales as high-protein feed for poultry  
**James McGinnis**  237–240

Comparison of the vole, rat, and mouse as assay animals in the evaluation of protein quality  
**B. E. McDonald and E. N. Larter**  241–246

Future role of triticales in agriculture  
**L. H. Shebeski**  247–250
Triticale Research Program in Algeria

HERB FLOYD

Centro Internacional de Mejoramiento de Maíz y Trigo
Londres 40, Mexico 6, D.F.


Abstract The CIMMYT outreach program began in Algeria in 1971 and had two main objectives: (1) to help identify problems and suggest solutions to the Algerian government; (2) to help establish a viable and effective cereals research program staffed by Algerians. Although triticale would probably rank low in priority with durum and bread wheats and alfalfa, the Algerian cereals project is willing to support a modest triticale research effort oriented solely toward production until more highly trained staff are available to assume a more ambitious program.

The limited experience with triticale in Algeria has indicated that triticale has excellent disease resistance particularly to Septoria; that although varieties suited to and selected under Mexican conditions are not particularly suited to Algerian conditions, the nurseries revealed the existence of very promising material in the F2 bulks from Mexico; and that triticales promise to give more latitude in planting dates, which is greatly needed in Algeria.

Triticales might provide an option in the Algerian cropping program as partial replacements for barley and oats, and as forage crops and human food, depending on product acceptability.

Résumé Le programme de rayonnement du CIMMYT a démarré en 1971 en Algérie, avec deux objectifs principaux: (1) participer à l'identification des problèmes et suggérer des solutions au gouvernement algérien; (2) participer à la mise en œuvre d'un programme viable et efficace de recherches céréalières conduites par des Algériens. Bien que sur le plan des priorités, le triticale se classe sans doute dans ce pays bien après le blé dur, le blé tendre et la luzerne, le programme céréalier de l'Algérie comporte une modeste initiative de recherche sur le triticale et ce, uniquement sur le plan de la production jusqu'à ce que l'on ait pu former un personnel plus compétent, lequel pourra alors mener à bien un programme plus ambitieux.

Selon l'expérience limitée que l'on a du triticale en Algérie, cette céréale a une excellente résistance aux maladies, en particulier à Septoria; bien que les variétés sélectionnées en fonction des conditions existant au Mexique et qui leur sont adaptées ne le soient pas particulièrement à celles de l'Algérie, les essais en pépinière ont révélé l'existence d'un matériau très prometteur dans les ensembles de F2 d'origine mexicaine; en outre, les triticales semblent devoir fournir une gamme de dates de semis plus étendue, ce qui répond en Algérie à des nécessités de tout premier ordre.
ALGERIA has been independent for just over 10 years. But one should not think of it as an underdeveloped country in the traditional sense. The French colonizers had developed much of the agricultural land of Algeria during their 130 years of occupation. They planted vineyards, olive groves, citrus orchards, cleaned much of the land of rocks and laid out fields for cereal culture in a manner that is highly suited to modern production methods.

During the final years of the French presence in Algeria, the country exported wheat, mostly to Europe, and supplied France with much of the high quality durums used in the pasta industry. Over 300,000 tons were exported in the last important exporting year before the French departed.

When they left, management left with them. Algeria soon became a grain-deficit country, importing recently as much as 300,000-400,000 tons annually.

The 1972 harvest was particularly good and domestic supply and demand was nearly equal. However, dry weather, combined with severe grassy-weed infestations in late spring, greatly reduced yields in 1973, with the result that Algeria may have to import up to 500,000 tons of wheat to meet its needs before the 1974 crop is harvested.

Algeria's population is about 15,000,000 and various estimates suggest that population growth is about 3% annually. This means 450,000 extra people have to be fed every year.

The main cereal products consumed are couscous, made mainly from durum wheat, and bread, both of which are consumed in large quantities.

Because of the absence of management previously mentioned, the weed problem is building up in the country's wheat fields. Sheep are permitted to graze wherever a crop is not actively growing, including land that is theoretically in clean fallow. However, they do not eat all the weeds and thus the field is well sown with weed seeds for the following year when it will be in wheat. This results in severe infestations of weeds and since the grassy ones, like ryegrass and wild oats, cannot be controlled by 2,4-D, they take over, resulting in what Dr F. J. Zillinsky of CIMMYT describes as the production of "short-headed varieties."

The CIMMYT outreach program in Algeria began in 1971 with a wheat breeder and three production agronomists. The program has two main objectives: (a) to help identify problems and suggest solutions to the Algerian government; (b) to help establish a viable and effective cereals research program staffed by Algerians.

The Algerian government has given main priority to the production of durum and bread wheats. It is also greatly interested in the development of Medicago (annual alfalfa) as an alternative to fallow. Successful introduction of Medics into Algeria might relieve grazing pressure on fallow land, decrease the need for nitrogen fertilizers, improve soil tilth, reduce erosion, and aid in weed control.

Triticale would probably rank fourth in priority. However, the Algerian cereals project is willing to support a modest triticale research effort, oriented solely toward production, while awaiting the return of Mr Benbelkacem, now in training at CIMMYT, to assume direction of a more ambitious program.

The existing triticale program in Algeria is oriented solely toward production. Last year we included Cinnamon and three advanced lines in several yield trials throughout Algeria. In an irrigated trial near the Moroccan border, Cinnamon ranked 16th in a trial including 20 bread and durum varieties with a yield of 37.8 Qx/ha. In the same trial, Inia was the top yielder with 50 Qx/ha. This was the highest yield obtained with any triticale in any of our trials.
In another trial (rain-fed), Cinnamon was 10th of 20 varieties with a yield of 26.4 Qx/ha and Mexi 1601 (Utique) was a high yielder with 34.4 Qx/ha.

At Sfisef, the three advanced triticale lines were last in a trial of 20 bread and durum varieties.

Two nurseries were established: one near Oran at 90 m elevation in a 400-mm rainfall zone, and a second near Sfisef at 600 m elevation with 430 mm rainfall.

We space-planted about 20 kg of F₀ bulk sent by Dr Zillinsky. We observed wide variability in this population and were able to select 3000–4000 plants with high fertility and promising agronomic characteristics. These will be planted in head rows this autumn at both sites and from these rows we hope to select perhaps 100 promising lines for replanting in 1974.

What have we learned from this limited experience with triticales?

(a) Varieties suited to and selected under Mexican conditions are not particularly suited to Algerian conditions; (b) triticales have excellent disease resistance, particularly to Septoria — this is very significant because in 4 of the 5 years I have worked in North Africa, Septoria has been a serious problem in wheat production; (c) the nurseries revealed the existence of very promising material in the F₀ bulks from Mexico — perhaps our experience will be the same as California’s, where similar results were obtained; (d) triticales promise to give us more latitude in planting dates, which is greatly needed in Algeria.

Possible Uses of Triticale in Algeria

Triticales might provide an additional option in the Algerian cropping program. They could be used: (a) to partially replace barley — the area planted to barley is roughly the same as that planted to bread wheat; (b) to replace oats in the vetch-oat crop now used for hay; (c) as a forage crop; (d) as a human food, depending, of course, on product acceptability.