TRITICALE
Proceedings of an international symposium
El Batan, Mexico, 1-3 October 1973
Editors: Reginald MacIntyre/Marilyn Campbell
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Triticale Program and Potential in Kenya

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Abstract Work on triticale has been going on at the Plant Breeding Station at Njoro, Kenya, since 1967, when material from the University of Manitoba was received. Later, in 1970, CIMMYT also forwarded triticale material. Triticale lines chosen for disease-resistance trials have fared better than wheat checks, and have done very well under dry conditions.

The breeding program aims to develop varieties of triticale with wide adaptability and resistance to stem, stripe, and leaf rusts, through a cooperative program with CIMMYT and the University of Manitoba.

The objectives of the agronomy program are to determine the optimum levels of nitrogen and phosphate fertilizers, to determine the optimum seeding rates and row spacings, and to evaluate the weed problems and other cultural methods and practices.

Triticale is also being considered as a livestock and poultry feed. Feedlot industries requiring grains have been started up in Kenya, and as well egg and broiler production and processing factories are developing that will be able to use triticale.

Résumé Les travaux sur le triticale ont commencé en 1967 à la station de phytosélection de Njoro, au Kenya, à la suite de l'envoi de sélections de triticale de la part de l'Université du Manitoba. En 1970, c'est le CIMMYT qui fait parvenir à Njoro des plants de triticale. Les lignées retenues pour les essais de résistance aux maladies se sont mieux comportées que les blés témoins et se sont fort bien comportées dans des conditions sèches.

Le programme de sélection a pour but de créer des variétés de triticale qui puissent largement s'adapter et résister à la rouille de la tige, à la rouille striée et à la rouille des feuilles, et cela en collaboration avec le CIMMYT et l'Université du Manitoba.

Les objectifs du programme agronomique sont de déterminer les doses optimales d'engrais azoté et phosphaté, le nombre de semis et l'espacement des rangs maxima, ainsi que de faire le point sur les problèmes d'adventices et les diverses méthodes et procédés de culture.

On se préoccupe également de la place du triticale en tant qu'aliment du bétail et des volailles. L'engraissement en parcs au moyen de grains vient de démarrer au Kenya, ainsi que la production industrielle des œufs et des poulets en même temps que s'installent des établissements de transformation qui pourront utiliser le triticale.
STEM rust of wheat is probably more severe in Kenya than in any other area of the world. Triticale is also attacked by this same stem rust. Since the highly virulent races of stem rust prevalent in East Africa are distinctly different from races prevalent in other parts of the world, selection and breeding for rust-resistant triticale cultivars for Eastern Africa must be carried out in Eastern Africa. The Plant Breeding Station at Njoro, Kenya, has a climate ideally suited to screening for resistance to stem rust with a medium altitude (2300 m) above sea level. At higher altitudes (3000 m) at Molo and other areas, screening for stripe rust is possible. Because altitudes where wheat is grown vary from 1800 to 3000 m and the soil types and amount of rainfall vary, the Njoro area is ideal for agronomic trials and selection of lines of wide adaptability.

Triticale work at Njoro started in a small way in 1967 when Dr L. E. Evans introduced triticale material from the University of Manitoba, Winnipeg, Man., Canada. These were screened for disease resistance and selections were made for stem, stripe, and leaf rust resistance. The second major source of material was the first International Triticale Screening Nursery grown in 1970. In that year 21 out of 46 strains were retained for further screening in 1971. By 1971 there was enough screened material for a trial at two sites. Thus the Plant Breeding Station at Njoro conducted the first Kenya Triticale Variety Trial in 1971, which consisted of five triticale lines and two wheat checks. In 1972, the station conducted the second Kenya Triticale Variety Trial consisting of 14 triticale lines and two wheat checks. Results of the two trials at Njoro and Molo so far are very encouraging, particularly concerning yield and disease resistance. In these trials the best triticale lines gave higher yields than the best wheat lines in adjacent trials. The severely rusted wheat checks gave very low yields. The early part of the 1973 main season was very dry. The wheat crop at the station generally appeared to suffer extensively; the triticale crop planted at the same time was doing very well under these dry conditions. We had only 169 mm of rain at Njoro for the period mid-April–July.

Breeding Program

The objective of the breeding program is to develop varieties of triticale with wide adaptability and resistance to stem, stripe, and leaf rusts. This objective can be achieved most rapidly through a cooperative program with the existing triticale projects at CIMMYT, Mexico, and University of Manitoba in Canada. F_2 and F_3 material obtained from the existing projects will be screened at sites in Kenya that are at high, medium, and low altitudes for stem, stripe, and leaf rust resistance. Field screening for rust resistance would be accompanied by a program of testing seedling reactions of promising lines to individual races and a program of race identification. Superior lines with plump seed types will be yield-tested at various locations to select for wide adaptability, and promising lines will also be returned to the existing projects for quality testing and use in crosses. Crosses will be made to incorporate rust resistance into triticale using Kenya rust-resistant bread wheat lines and varieties. Crossing among triticale lines with different objectives will also be done at this station.

Agronomy Program

The objectives of this program will be to determine the optimum levels of nitrogen and phosphate fertilizers, to determine the optimum seeding rates and row spacings, and to evaluate the weed problems and other cultural methods and practices.

The current triticale program in Kenya includes the following materials:

1. Triticale Variety Trial (TVT/73): consists of 16 introduced triticale strains and four wheat checks grown at three sites: low (1900 m), medium (2100 m), and high (2800 m) altitudes. The 16 triticale strains included in this test were reselected from either TVT/72 or Triticale Preliminary Trials 1972.
(2) Preliminary Trial J/73: included are 21 triticale lines and four wheat checks grown only at Njoro. The 21 triticale lines were selected from triticale nurseries last year.

Other nurseries consisted of: (1) 68 F₃ triticale lines of plump seed and resistant to stem, stripe, and leaf rusts, selected from F₂ bulk at Njoro and Molo in 1972; (2) 517 F₃ triticale lines resistant to the three rusts but with less plump seed, selected from the same F₂ bulk; (3) 270 F₂-F₈ plots, selections from Toluca, Mexico, in 1972; (4) 33 F₂ plots sent by the CIMMYT triticale program; (5) five large plots of CIMMYT triticale increases for quality testing at CIMMYT; (6) 64 TCL plots, observation lines from previous introductions; (7) 4-ha space plants of F₂ TCL bulk from the University of Manitoba and CIMMYT.

Food crops have been the most important source of protein and they will certainly continue to have this function in the future. To date in many parts of the developing countries 80% of the entire direct consumption of protein originates from plants. Cereals play a key role in the supply of vegetable protein. In developing countries such as ours, maize, sorghum, millet, rice, and wheat contribute more than half of the protein supply in direct human consumption. These cereals are generally considered to be of reduced nutritional quality in comparison to other protein sources. This is due to their low protein content, and low levels of the amino acids, lysine and tryptophan.

Qualitative improvement in nutrition by better provision of vegetable food in areas where the population lives partly or fully on subsistence can be achieved by the cultivation of plants in protein and vitamins. Many triticale lines have higher protein potential than most cereals grown under the same environmental conditions. Furthermore, triticale protein contains more lysine.

As the income of individuals in Kenya has been increasing, so has the consumption of leavened bread. Triticale could be used in the production of bread, but generally the tetraploid wheats (2n = 28) are being used as the wheat parents for triticale rather than the hexaploid type (2n = 42), and tetraploid wheats lack the D genome, which is the location of most genes for elasticity in the gluten, an essential bread-baking quality character. This is, therefore, lacking in hexaploid triticale (Larter 1968). The type of normal leavened loaf of bread usually made from bread wheat flour is unlikely to be baked from hexaploid triticale flour. However, triticale flour can be blended with wheat flour of high baking quality to produce an acceptable loaf of bread.

Considering the eating habits of Africans — West Africans, East Africans, and Kenyans in particular — bread in the form of a loaf is used by fewer people. Hunger in Kenya is felt not when there is a wheat crop failure but a maize crop failure.

Ugali is the main food in Kenya and is made of maize meal. When there was a surplus of wheat in Kenya in 1968–70, there was a shortage of maize resulting from excessive maize export. Wheat flour was used in enriched maize meal consisting of 80% granulated maize meal and 20% wheat flour. However, this product was generally unacceptable to the consumers since wheat flour gluten is elastic, making it more difficult to cook ugali. Hexaploid triticale flour, which has nonelastic gluten, would be acceptable to the consumer if used in enriched maize meal. Therefore, triticale can fit directly into the diet of the largest number of the population more easily than bread wheat.

Livestock and Poultry Feed

Triticale appears to be an excellent livestock and poultry feed. Data from triticale research in other countries indicate that feeding efficiency of triticale is equal or superior to that of wheat, barley, and grain sorghum in high-energy finish rations for cattle and pigs. With the introduction of feedlot feeding initiated by the Beef Research Station at Lanet Nakuru in 1971, wheat, barley, maize, and other small grains will be in demand for livestock feed in Kenya, and other East African countries will follow Kenya's example. Many farmers who hitherto had to feed their livestock ongrassland are changing
and starting feedlot industries in Kenya. Five large farmers had finished constructing their feedlots by the end of 1972 in Rift Valley Province alone. Each of them was to put through approximately 5000 head of cattle per year. And there are 7 million head of beef cattle in the country. The first mobile feed mill was stationed at Nakuru in August 1972 and by the end of the year, 273 tons of feed were processed from roughages, grain, and molasses–urea mixture. The great demand for the mill indicates an expanding feedlot industry where triticale and other cereal grains will fit in.

The "back yard" poultry-rearing system still practiced by poultry farmers in Kenya is now proving uneconomical, since the markets are situated in large urban centres. Egg and broiler production and processing factories are being formed (e.g., BAT). These will certainly need large quantities of layers of mash, chick and broiler mash, or feed. Triticale grain will certainly be used in these industries.

The high yield potential of triticale has already been demonstrated in East Africa. It is expected that with further breeding, varieties with wide adaptability and resistance to stem, stripe, and leaf rusts will result in making triticale a new commercial food for humans and for livestock and poultry feed in East Africa.

References


