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IN KENYA, A MIRACLE IS MADE ORDINARY

by ROWAN SHIRKIE

Almost exactly on the equator in Africa, near the small agricultural town of Njoro in the heart of the wheat growing district of Kenya, a rich, lush looking grain crop ripples and whispers in the warm breeze. "This is our best triticale," says Bernard Wabwoto, looking up across the field, "We're releasing it to farmers for the next season."

For Dr Wabwoto and his colleagues at the Njoro National Plant Breeding Station in Kenya, it is the culmination of 10 years of painstaking, patient work. Triticale is a cross between durum wheat and rye, the first artificially created crop plant. Such are its potentials in terms of yield, growing capabilities, protein balance and content, that in the first stages of its development, triticale was dubbed "miracle grain" and "super plant". The exhilaration of discovery soon gave way to a more cautious optimism, as scientists realized that the new cereal was not perfect.

Triticale -- its name is drawn from the Latin for wheat (*Triticum*) and rye (*Secale*) -- combines the high protein content of wheat with the high lysine (an essential amino acid affecting the quality of cereal protein) content of rye, the good yield characteristics of wheat with the hardiness of rye. But because wheat and rye come from two different plant groups there was some genetic incompatibility in their marriage. Triticale, the offspring, was for many years plagued by sterility. It inherited only a single set of chromosomes from each parent, and two such unique sets cannot pair for reproduction. Until the discovery in 1937 of a chemical treatment that caused the two parent chromosome sets to double within the triticale, it could not reproduce itself from seed.

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Much of the early work on triticale was done at the University of Manitoba, Canada, and as progress was made, collaborative links with organizations such as the Interntional Wheat and Maize Improvement Centre (CIMMYT) in Mexico led to larger international programs. With funding provided by Canada and managed through the International Development Research Centre (IDRC), the collaboration between Manitoba and CIMMYT was turned toward a Triticale Project, and the search began for ways to use the crop for the benefit of developing countries.

At first, triticale did not do well. Because they were derived from temperate zone parents adapted to higher latitudes and longer days, the first varieties were maturing too late in the short, regular, equatorial days of Kenya. And as many of the early triticales came from tall, weak-strawed parents, the tropical sun encouraged them to grow even taller and weaker. Grain shrivelling, which led to problems in fertility and caused difficulties in extracting flour during milling, was common. Similar problems were encountered in triticale programs in other parts of the world.

The reason was lack of history. Triticales did not have the thousands of years of opportunity to adapt and develop that wheats and other grains have had. In an effort to break this "time barrier", scientists mounted an international testing program, growing triticale in many locations around the world to accelerate its development and broaden its adaptation. By 1974, with the aid of an IDRC grant, Dr Wabwoto and his colleagues were participating in the network.

The Kenyan breeding and selection program had two aims: to add better rust-resistance to triticale's genetic makeup, and to make the adaptations needed to establish it as an economic crop in Kenya.

Like many cereals, fertile triticale is normally a self-pollinating plant. To combine the desired characteristics of two separate varieties -- a strong straw variety, for example, with a variety having plump grain but weak straw -- a cross must be made between two parents. The early generations often vary greatly in height, maturity, disease resistance, straw strength, and so on. The plant materials must be grown and grown again until a pure line is developed.

"Notoriously poor in adaptation", when the international testing program was begun in 1969, triticale yields averaged only about 75 percent those of the wheats grown with them for comparison. By the end of 1978, triticale was being grown in 83 countries for testing in 400 locations. Average yields outstripped the top wheats by 20-30 percent. In Kenya, triticale consistently outperforms wheat by 20-40 percent, and in one trial, held during a drought, triticale outyielded wheat by 60 percent.

After ten years of crossing, selecting, screening, yield and field trials, it can now be said that triticale and Kenya were made for one another. Seventy percent of Kenya's total land area of 57 million hectares is semi-arid. Population pressure and landholding patterns have forced people to move onto marginal areas where rainfall is unreliable and poorly distributed, and the danger of drought and crop failure is great.

At the same time, Kenya's wheat requirements continue to rise and domestic production falls further and further behind consumer needs and demands. A poor harvest this year has meant that the country's wheat imports — an expensive item in an economy already under pressure — will reach record levels.

Necessity is pushing triticale out of Dr Wabwoto's experimental plots and into farmer's fields and consumer's plates.

The basic problems of adaptability, fertility, disease resistance, and yield have large been resolved. The most persistent problem, grain shrivelling, is giving way before new varieties recently introduced into breeding programs.

According to Dr Mathias Oggema, Director of the Njoro station, "the biggest obstacle that faces triticale now is an economic one." It must become more attractive to farmers, millers, bakers, and consumers. A producer price must be negotiated so that farmers will be assured a good return and encouraged to plant more hectares to triticale. Yet it must not be so attractive as to further disrupt already uncertain wheat production. Wheat and triticale are not likely to compete for the same land, however, as triticale was designed to extend production onto the marginal lands of smaller farmers.

It is also vital that triticale gain consumer acceptance soon. Like other grains, triticale can be used as animal feed, and it is already being grown for use in poultry and cattle rations in Kenya. If it becomes identified as animal food before it is recognized as food for people, its introduction as a food crop may be hindered.

Part of the reason why triticale is not more widely consumed in developing countries is that its baking and milling qualities are slightly different than wheat's, and the baking and milling industries in the developing countries are not familiar enough with the new grain to risk substituting it for imported wheat.

The industries are more likely to respond to consumer "pull" combined with scientific or governmental "push". The IDRC is therefore supporting a small project of the Home Economics Department of Egerton College in Njoro to develop recipies using triticale to replace wheat in common foods, and to stimulate a demand for these products.

Still, consumers in developing countries are growing increasingly fond of Western style loaf bread. In addressing this demand, the Kenyan Ministry of Agriculture set up a steering committee to investigate the potentials of triticale use and production, and arranged with Dr Oggema for some of the best varieties to undergo commercial milling and baking trials early last spring. The grain performed well, with a good flour extraction rate at the mill and an acceptable loaf at the bakery.

The field where Bernard Wabwoto stood — by his estimate the largest field of triticale in Kenya and possibly in Africa — was being grown under contract for the station by a local farmer. The grain was slated for larger milling, baking and consumer trials, and as seed stock for other farmers.

"We've done excellent work with triticale," Dr Oggema says, "... the best in Africa."

For Dr Oggema and Bernard Wabwoto, the work that has gone before and the work that is ahead has been directed toward turning that potential into reality. Success will come from making the "miracle" ordinary.

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Rowan Shirkie, a science writer with IDRC's Communications Division, recently visited a number of African countries.