

In the Wheat Fields of Kenya, a Budding Epidemic

Stem Rust, Vanquished by Science Five Decades Ago, Has Returned in a Destructive New Form

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By Sharon Schmickle
Special to The Washington Post
Wednesday, February 18, 2009; A08

GREAT RIFT VALLEY, Kenya -- A virulent new version of a deadly fungus is ravaging wheat in Kenya's most fertile fields and spreading beyond Africa to threaten one of the world's principal food crops, according to the United Nations' Food and Agriculture Organization.

Stem rust, a killer that farmers thought they had defeated 50 years ago, surfaced here in 1999, jumped the Red Sea to Yemen in 2006 and turned up in [Iran](#) last year. Crop scientists say they are powerless to stop its spread and increasingly frustrated in their efforts to find resistant plants.

Nobel Peace laureate Norman Borlaug, the world's leading authority on the disease, said that once established, stem rust can explode to crisis proportions within a year under certain weather conditions.

"This is a dangerous problem because a good share of the world's area sown to wheat is susceptible to it," Borlaug said. "It has immense destructive potential."

Coming on the heels of grain scarcity and food riots last year, the budding epidemic exposes the fragility of the food supply in poor countries. It is also a reminder of how vulnerable the ever-growing global population is to the pathogens that inevitably surface somewhere on the planet.

The first hint of danger came in an e-mail in 1999 to Ravi Singh, a wheat expert at the International Maize and Wheat Improvement Center in [Mexico](#).

A scientist who had trained under Singh was reporting findings from field trials in Uganda. Singh said he could not believe what he saw: Plants that were bred to resist stem rust had succumbed to the fungal parasite.

"It was shocking," Singh said. "We had never seen such susceptibility. . . . The first thing you think is that it probably is not true."

Researchers in [South Africa](#) and Minnesota discovered why it was true. In the biological churning that constantly endows old pests with new genetic combinations, stem rust had acquired a frightening ability to punch through the resistance that had guarded wheat for decades.

Eighty percent of Asian and African wheat varieties are now susceptible, and so is barley, FAO experts said. Scientists named the new menace Ug99 for its discovery in Uganda in 1999. But they say it probably started earlier in Kenya, where more wheat is grown.

The research center in Mexico published a warning of "a pending disaster in global agriculture."

Last March, the FAO confirmed that the fungus had spread to Iran and said in a news release that "[Afghanistan](#), [India](#), [Pakistan](#), Turkmenistan, Uzbekistan and Kazakhstan, all major wheat producers, are most threatened by the fungus and should be on high alert."

Unlike common rust infestations, which reduce but do not wipe out yields, stem rust can topple a whole field. "It can take everything," said Robert McIntosh, former director of Australia's rust-control program. "It is the most damaging of the rusts."

From a ridge overlooking Kenya's fertile Great Rift Valley, the plants in Joseph Atrono's field are a tangle of broken stems topped by empty hulls in which grain should have formed. Along with the crop went the income he needed to feed his wife and four children. Now, a few scrawny chickens pecking at the dirt outside his mud-and-stick house are his last defense against hunger. Atrono is selling hens one by one to keep beans in the pot that his wife, Sally Rono, tends over a wood fire.

"I keep asking myself what I will do when the hens are gone," Atrono said. "Where will I get the income to feed my family?"

Better-off farmers such as Geoff and Luke Nightingale -- a father-son team that farms 1,350 acres near Atrono's field -- spray fungicides to salvage at least some of their crops.

"Everything got stem rust, and it went down fast," Luke Nightingale said. "We sprayed twice in three weeks, once by tractor and once by plane."

Still, Geoff Nightingale said, the yields were "terrible, awful."

Throughout the developing world, hundreds of millions of small-scale farmers like Atrono are the most vulnerable.

Atrono spent most of his 35 years working for others and saving for the day when he could farm on his own. He saw his chance last year when wheat prices skyrocketed because supplies were tight. So in June, Atrono rented two acres of land, bought seed and planted his family's dreams along with the crop. The seeds worked their magic, and the field was a model display of dazzling green young grass, he said.

"When I looked at it, I felt so good," Atrono said.

What Atrono couldn't see was the parasitic fungus that was latching onto the stems and hijacking nutrients that should have fed the growth of grain.

Even when Atrono saw the powdery, rust-colored blisters, he said, he couldn't afford enough fungicide to combat them. So the rust spread unrestrained.

Now he has no grain to harvest. He said he planned to chop down the barren stalks in hopes of selling them for forage and using the cash to plant beans and potatoes his family could eat in a few months.

In all, Atrono estimates that he has lost 25,000 Kenyan shillings, the equivalent of more than \$300, plus the value of his labor since June. Before the farming venture, the family was able to save small sums on 70,000 shillings a year. "Now I have nothing," he said.

The story was the same all along the ridge where Atrono farms.

Joseph Kangogo said he planned to harvest what he could from his 10 acres of wheat and use the cash to buy cornmeal to feed his six children. The occasional meal of beef would have to be given up.

"I spent the last of my cash spraying the plants," said Kangogo, 47. "This is the worst crop I have seen in my lifetime, and I have farmed all of my life."

Like firefighters responding to an alarm, wheat experts from around the world have mobilized to fight the rust. Headquarters for the effort is the Kenya Agricultural Research Institute's station near the village of Njoro.

Borlaug is among the big-name crop scientists who came. Known as the father of the Green Revolution, he is credited with breeding the rust-resistant wheat that saved

millions from hunger. In 2005, the Kenyans took him to nearby Narok, where farmers from the Maasai tribe were losing crops to stem rust.

"I was scared by what I saw because I knew it could spread to big regions," Borlaug, 94, said in a telephone interview from his home in Dallas.

Because there hasn't been a major epidemic in 50 years, only a few living scientists have seen the destructive power of stem rust.

But Borlaug needed no history lesson. He recruited scientists from wheat-producing countries and raised funds to underwrite their work. Foundations in the United States and [Japan](#) pitched in, as did the governments of Canada, India and the United States, Singh said. Last year, the Bill and Melinda Gates Foundation gave \$26.8 million to a project led by Cornell University scientists.

A key first step was to comb the world's wheat for resistant plants that could provide genetic ammunition to hold off the rust.

At Njoro, researchers planted seeds the scientists had sent, then exposed the plants to Ug99. It was a high-stakes showdown between Ug99 and the planet's toughest strains of wheat.

In most plots, the grain took a severe beating.

Last fall, Yann Manes, a French wheat breeder who also works in Mexico, stripped the head on a typical plant and harvested a handful of chaff. No grain.

"You get this in India on 20 million hectares and you will see the effects on world markets," he said.

Yue Jin, a plant pathologist with the U.S. Department of Agriculture, gathered samples of Ug99 in Kenya and shipped them through biologically secure channels to the USDA's Cereal Disease Laboratory in St. Paul, Minn., and another lab in Winnipeg, Canada.

The usually brutal winters in Minnesota and Manitoba will add an extra layer of biosecurity during the analysis because spores of the fungus couldn't survive the cold if they escaped from the laboratories. Stem rust that devastated crops of the upper Midwest long ago typically wintered farther south, then rode the wind north in spring.

While scientists talk in urgent tones, they have no choice but to proceed in measured, methodical steps. At the research center in Mexico, Singh gets frequent calls from grain traders asking how much time is left before a large-scale disaster strikes. But there is no reliable answer, Singh said.

"You cannot predict a rust epidemic," he said. "It depends on too many factors."

Wind, the timing of rainfall and myriad other factors play into the fate of the fungus.

"All of these puzzle pieces have to come together to give you a major epidemic," Singh said.

Freelancer Sharon Schmickle traveled to Kenya on a grant from the [Pulitzer Center on Crisis Reporting](#). An [audio slideshow](#) can be viewed at the [Pulitzer Center Web site](#).

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