Genetic Engineering Creates Rice Resistant to Destructive Blight

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Using genetic engineering, scientists have made rice plants resistant to bacterial leaf blight, a disease that routinely destroys rice crops around the world.

It is the first time that a disease-resistance gene has been put into rice and the first such gene isolated in a cereal crop, agricultural experts said. Cereals provide three-fourths of the calories consumed by the human race.

The achievement is being described in today's issue of the journal Science. The researchers were led by Dr. Pamela Ronald, an assistant professor of plant pathology at the University of California at Davis.

Engineering of the rice gene heralds "a new era in plant genetics and resistance breeding," said Gary Toenniessen, deputy director of agricultural sciences at the Rockefeller Institute in New York.

"What would normally take several years or decades to do through classical breeding techniques can now be done in a year or less," he said.

The newly found rice gene is particularly valuable, Dr. Toenniessen said, because it confers resistance to many strains of bacterial leaf blight. "It's a super-resistance gene," he said.

Dr. Ronald said yesterday in a telephone interview that leaf blight is the worst bacteria plant disease in the world. It affects many plant species, including tomatoes and walnuts. Most cultivated plants lack resistance to the disease and efforts to breed in resistance have met with limited success, she said.

But five years ago, scientists at the International Rice Research Institute in Manila found a wild strain of rice with strong resistance to leaf blight, Dr. Ronald said. They cross-bred wild and cultivated strains and determined that the resistance gene lay on rice chromosome 11. Rice has 24 chromosomes.

Dr. Ronald and her colleagues set out to isolate the gene. They found eight candidate stretches of DNA, all on chromosome 11, that had profiles suggestive of known resistance genes.

These candidate genes were cut out of the rice chromosome and inserted into nonresistant strains of rice. The strains were then planted in a greenhouse, and mature plants were exposed to leaf blight.

Plants carrying one of the genes, dubbed Xa21, were highly resistant to leaf blight, Dr. Ronald said. The researchers then sequenced the gene and found that it made a protein receptor that straddles the rice cell membrane.

The receptor recognizes something from the leaf blight bacterium, Dr. Ronald said, so that when it hooks up with the bacteria, an alarm is sounded inside the cells and defense mechanisms are deployed. Toxic substances are sent to the cell surface, where they kill the bacteria, she said.

Now that the gene has been isolated, it can be put into many rice varieties, Dr. Ronald said. It is possible that the bacteria may some day evolve resistance to the Xa21 gene, but deeper knowledge of rice genetics could help plant

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pathologists develop more durable resistance genes, she said.

Currently, Dr. Ronald is using the rice gene to hunt for resistance genes in other crops. Many such genes have similar DNA sequences, having evolved from a common ancestor.

It is hoped that the rice gene for blight resistance can be inserted into other plants, Dr. Ronald said. Sometimes plants accept foreign genes with a little help from plant geneticists.

The work is "very exciting," Dr. Ronald said, adding, "It's really the beginning of a new era in agriculture."