

PolicyPennings by Dr. Daryll E. Ray

Using biotechnology to improve the yield and quality of rice?

Demographers project that the World's population will increase over the next thirty years, increasing the demand for all crops, but particularly rice because it is a significant source of calories for half of the world. As a result, rice is receiving considerable attention by plant breeders who are using both conventional and transgenic techniques. The goal of these breeders is to increase rice's yield and quality.

APAC researcher Kelly Tiller has been a part of a consortium of research institutions that has undertaken a "Participatory Assessment of Social and Economic Impacts of Biotechnology" focusing on rice and tobacco. In last week's column, we looked at the use of tobacco in the production of pharmaceutical compounds. This week's column looks at the work that is being done in rice and consumer attitudes toward biotechnology. A full series of fact sheets can be obtained on the internet from www.agecon.vt.edu/biotechimpact. The institutions participating in this research include Virginia Tech, The University of Tennessee, North Carolina State University, Virginia State University, and the International Rice Research Institute.

Rice is grown under a wide range of conditions from fertile, irrigated lowland plots to saline or drought-prone fields that are deficient in essential plant nutrients like zinc. Centuries of selective breeding by peasant agriculturalists has resulted in a wide number of varieties that are adapted to the local growing conditions and the cooking preferences of each area. The traits that are bred into rice by plant breeders can then be transferred to these local varieties.

The traits that geneticists want to breed into rice fall into a number of distinct categories. One of the primary traits is increased photosynthesis. By enabling plants to more efficiently use sunlight, breeders hope to increase rice's yield, producing more rice on the same amount of land.

A second set of traits of interest to breeders are those that protect the plants against insects and disease. Some of the genetic work would help the plant ward off infection by bacteria and fungi that are particularly prevalent in irrigated rice paddies. The Bt technology that is so familiar to U.S. farmers could be bred into rice to reduce the impact of insect infestation, particularly by the stem borer that is endemic in most rice growing countries of Asia.

Another trait that should be of no surprise to U.S. growers is herbicide resistance. Similar to soybeans, herbicide resistant varieties could be sprayed with a herbicide to reduce or eliminate weed pressure on the rice crop, increasing the effective yield.

Because approximately half of the area on which rice is grown is less than optimal, plant breeders are seeking to introduce genes into rice that would increase its tolerance to drought, salinity, excess water, and nutrient deficient soils. More than half of Asia's poor receive at least 50 percent of their calories from rice grown in these fragile environments. Improving rice's stress tolerance would be aimed at reducing malnutrition among the world's most vulnerable populations.

A fifth set of traits that are being bred into the rice genome are those that would improve its nutritional content. The one that has garnered most of the publicity is "Golden Rice" which has been bred to increase the vitamin A content of rice, which is traditionally low in this nutrient. Other breeders are working on increasing the iron and zinc content of rice to increase the availability of these nutrients among the poor for whom rice is the major component of their diet.

Breeding these and other traits into the rice genome is only one part of the story. The other crucial issue is consumer sentiment. Will consumers be willing to eat rice with these traits bred into it? To help assess consumer sentiment, several surveys of attitudes towards genetically modified organisms (GMOs) were conducted in Bangladesh and the Philippines. Several conclusions can be drawn from these surveys.

First, there is the need to assess GMO rice varieties for both environmental impact and health impact with the latter being the most important to consumers and agricultural leaders. Second, the survey respondents indicated a preference for rice GMO research that is conducted by public sector researchers. The results of such research were seen by the survey respondents as more trustworthy than that done by commercial firms. Not surprisingly, the consumer surveys documented that attitudes toward GMO rice was polarized. In such a climate, the trustworthiness and objectivity of the research will be paramount in shaping consumer attitudes.

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