Editorial

Second Green Revolution

The First Green Revolution which started in the 60s culminated in a tremendous yield increase of two major cereal crops of the world - rice and wheat - through the development of semi-dwarf, high-yielding varieties. The result was that starvation of millions of people in developing world was halted or much reduced. Due to population pressure, we are now approaching a period of food shortage once again. About 800 million people all over the world are presently starving or malnourished. As we are running short of arable land on which we can expand our agriculture, so food production has to be expanded by increased yields. Essentially, we need another Green Revolution. This is not an easy task for the agricultural scientists because of the existence of a wide range of problems. One of the most important ones is that the new Green Revolution has to be more environmentally sustainable. We have to avoid the problems of pesticides and the overuse of fertilizers, the approach used in the First Green Revolution. Secondly, we have to have a greater diversity of cropping systems, making use of a greater diversity of crops and other facilities. Most importantly, the Second Green Revolution must reach the poor. After the seemingly successful First Green Revolution, people living in the urban areas, poor people in the Green Revolution lands, and those living in marginal lands did not get the benefit of such Green Revolution. The Second Green Revolution must aim at these groups of people as well.

The problems to be tackled are the problems poor farmers are facing. These are drought, salinity, poor soil fertility, toxicity in the soil, etc. Biotechnology is the key to solve such problems. Three approaches are envisaged, viz.: (i) tissue culturing to cross species what would only very rarely cross in nature, (ii) marker-aided selection, and (iii) genetic engineering.

To solve the problem of crossing barrier, scientists use tissue culture technique. Examples can be seen in the crossing of African species of rice, *Oryza glabberima*, which grows vigorously in dry conditions and smothers weeds, with Asian species, *O. sativa*, which produces good quality and high yields. The hybrid starts out as African rice and then becomes like Asian rice in its yield.

The marker-aided selection technique helps to identify a gene in normal crossing. To produce blast-free variety of rice, for example, involves growing the plant and then infecting it with blast to see whether it is resistant. Using molecular markers the whole procedure is accelerated because this process detects whether the resistance gene is present in a new cross without actually going through the whole plant cycle.

To transfer certain genes, which would not be possible conventionally through the use of genetic engineering approach, results in a new variety of crop that are insect resistant, disease resistant, higher yield with better nutritional quality, etc. A good example is the case of Golden rice with beta carotene, a pro-vitamin A, in the endosperm deriving through such approach; using traditional means, it was not possible. Many people are suffering from vitamin A deficiency, especially those in the urban areas who depend on few kinds of food, or those who live in drought-stricken areas that cannot be put to grow crops in the dry season, or the early weaned babies from the mother's breast. These are the people who need Golden rice with plenty of pro-vitamin for their diet.

Of course, there are precautions to accepting the products of genetic engineering. Considering its benefits versus ill effects, one has to decide on the approach to increase the yield to fight against hunger and malnutrition.