Will genetic engineering help feed the world or not?

Derek Burke

Why are scientists, and companies, genetically modifying plants? One important aim is to help feed a growing world population. The human population has doubled since 1950; and although the growth rate has declined since 1970 from about 2% to about 1.5%, the UN projects a population of 8 billion by the year 2020. Global population is increasing at about 87 million per year, and because of past population growth a very large number of people are just entering the child-bearing years.

During the 1980s world cereal output per capita plateaued due to a decline in North America/Oceania, while in S. Asia, the Far East and Europe/FSU, where over 70% of humanity live, production per capita was appreciably higher compared with 10 years previously, and output has continued to rise in Europe. In Africa, however, food-production has failed to keep up with population growth.

In addition, loss of land to urbanisation has meant that the amount of cultivated land supporting food production has fallen from 0.44 ha per person in 1961 to 0.26 ha per person now, and is projected to fall to 0.15 ha per person by 2050. The need for irrigation is increasing, climate is changing and as people become more prosperous, they replace plant foods with animal foods-which are less efficient in trapping solar energy. So about one-half of the grain produced in Europe, North America and Russia is already used as feed. How are we going to feed all these people? Surely new approaches will be needed in addition to the continued improvement of existing methods?

Destructive agricultural practises will have to be replaced with more benign ones, and ecologically and socially feasible improvements will have to be introduced; these will include energy-efficient intensive farming, soil and water conservation, maintenance of biodiversity, improved pest and weed control, improved irrigation, better livestock management, new crops of crops and animals, reduced dependency on pesticides and herbicides and improved soil conservation.

Modern biotechnology is one of the ways by which such improvements can be achieved.

On the other hand, others say that genetic modification is not needed to produce more food. They argue that the planet's food problems are solely due to economic and political problems, not because we can't grow enough. There's truth in that; for if the world's food supply in 1994 had been evenly distributed it would have provided an adequate diet of about 2350 calories per day for 6.4 billion people, more than the world population. But distributing it that evenly will never be easy, even if the world's population was not increasing. Of course we should try to change some of these practises, but it seems perverse to me to walk away from a potential increase in the world's food supply.

Conventional plant breeders see genetic modification as simply another tool to bring to bear on the problem. Others oppose this, but if they do, they must produce well worked out proposals for feeding all these new mouths, let alone the 800 million who now do not get enough to eat.

Finally, four examples of ways in which agricultural biotechnology could help the developing world.

First, the introduction of a rice modified by increased levels of beta-carotene, currently in field trials, would help deal with the problems due to the lack of vitamin A. In developing countries one hundred and eighty million children suffer from Vitamin A deficiency and each year two million die from diseases linked to Vitamin A deficiency. This is a particularly serious problem for many poor children in Asia who are weaned on rice gruel and little else.

Second, similar introduction of rice with an over threefold increase in available iron would help deal with the chronic problem of anaemia in women in SE Asia.

Third, scientists in Mexico have added genes to rice and maize that help plants tolerate high concentrations of aluminium, a soil toxicity problem that limits cereal production over vast areas of the tropics.

Finally, the recent isolation of the gene that is responsible for the dwarfing of wheat has the advantage of concentrating energy on grain production rather than on making straw. The gene which is very similar in many plants, and which was so important in the massive increase in yield in the 'green revolution', can now be transferred to other crops such as basmati rice.

Here is a situation where genetic modification offers a clear advantage over plant breeding; for in plant breeding two different sets of 20,000 genes are brought together and the product is selected for a particular new property. In doing so, many of the qualities, which make a particular variety particularly suitable for a particular ecosystem, are lost. In contrast, with GM, the gene to produce dwarfing is introduced into that variety which is most suitable for the particular environment.