

Current and potential benefits of genetic modification of foods for humans

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Throughout the last century agriculture intensified through development of many new technologies including; improved plant and animal genetics, mechanisation and the use of pesticides. In line with many of these developments the world's population also began to grow faster with survival rates and life expectancies increasing thanks to medicinal advances and adequate food supplies. This trend is expected to continue into the new century albeit at an even faster rate. Agriculture and food production will be a critical element in ensuring sustainability of world populations.

The dynamics of populations are also changing particularly in developed countries. Baby boomers are living longer and are more affluent creating a large group with higher demands for health care and lifestyle products. In developing countries the rapid expansion of populations will place higher demands on food production both internally and externally. These changes in our world represent many challenges for new and developing technologies to address the issues. One such technology breakthrough is biotechnology, which through medicinal and agricultural uses will play a critical part in ensuring sustainability of world populations.

Plant biotechnology has developed rapidly over the past 15 years to the point where it is possible that every major crop could be subjected to precise genetic modification. We anticipate there will be three phases of development of plant biotechnology. These are agronomic traits, differentiated crops and the use of plants as factories.

Agronomic traits are already well developed and a number of crops incorporating these have been commercialised since 1996 firstly in North America but more recently in many other countries including Australia. The crops include, herbicide tolerant soybeans, insect and herbicide tolerant corn and cotton, herbicide tolerant canola and potato with insect and virus tolerance. It has been estimated that 80 million hectares of these crops were planted in 1999. The driving force behind adoption of these technologies has been the direct benefit to growers through flexible farming systems, reduction in pesticide use and increased bottom line profit. At the same time there has been significant environmental benefits accruing through reduced insecticide usage in crops such as corn and cotton. In the future, consumers can expect to see lower priced high quality food as the acreages expand. Further agronomic trait development is continuing expanding to other crops and other issues such as disease control, and tolerance to severe environmental conditions.

Differentiated traits are more focused on output traits and their development through biotechnology will expand on those technologies developed through traditional breeding. Such products will add value in downstream production of foods processed from the grains produced by these crops. While the majority of activity in this area has been on improvements in grain for stock feed there are also developments in nutrient development and taste/texture appeal for human consumption. By increasing the level of phytonutrients it is likely this will lead to health-promoting attributes in humans. At Monsanto we have been working with oil modification in soybeans and canola. One area of this research is the ability to lower cholesterol levels through

reducing the amount of trans-fatty acids in the oil. Through stearate inhibition in plants it is possible to produce trans-fatty acid-free solid or semi solid fats in oilseeds. We have progressed this work in both canola and soybean.

The opportunity to use plants as factories to produce nutrients and potentially nutraceuticals is an exciting phenomenon. There has already been significant progress made in this area, the "Golden Rice" project producing Vitamin A in rice, has been highly publicised. The best sources of Vitamin A are the carotenes found in fruit and vegetables. As these crops are not always readily available to people in poorer countries, the opportunity through biotechnology to produce staple crops naturally fortified with this nutrient should have significant global benefits. At Monsanto we have developed canola with high levels of beta-carotene that also contains a higher level of alpha carotene. Biotechnology also offers the ability to improve the quality of grains in such a way that the most common forms of heart disease may well be easily relieved through an even more healthy diet. Phytosterols are known to reduce cholesterol in humans, however they are not currently available in adequate quantities in food for general consumption. There are now a number of research efforts underway to increase the sterol content of grains.

Biotechnology is already improving the way crops are being grown, providing benefits to farmers and the environment. In the near future the harnessing of this technology to make breakthroughs leading to commercialisation of broadacre crops producing a wide range of beneficial foods will be possible. It has the potential to revolutionise high quality healthy food production.