



What are the future applications of biotechnology to Australian agriculture?

Examples of future applications include:

- the development of high throughput automated DNA sequencing and low cost genotyping identification
- the expansion of tests for soil diagnostics to incorporate other soil-borne pathogens, which could allow more productive use of land
- greater utilisation of the technology to ensure quality through verifying crop identity and purity
- extension of the pesticide cleanup technology to other intractable pesticides.

What are the overall benefits?

There are many benefits to be gained from the increased use of biotechnology in agriculture.

They include:

- improved speed to market
- reduced environmental damage
- healthier and more valuable livestock and crops
- maintenance of, or improvements in, productivity.

How do I find out more?

This brochure is one of a series of Biotechnology briefs on biotechnology and Australian agriculture.

More information is available in the report:

Thorburn L., Parbeen S. and Ironfield D. 2007, The Value of Biotechnology Applications to Australian Agriculture, Australian Government Department of Agriculture, Fisheries and Forestry.

Other titles in this series of Biotechnology briefs:

GM canola: Potential impacts on organic farming in Australia

GM grains in Australia: Identity preservation

GM oilseed crops and the Australian oilseed industry

Market acceptance of GM canola

GM crops: Tools for insect pest and weed control

GM canola: An information package

The Australian Government's National Biotechnology Strategy funded the production of these brochures and reports.

How can I get copies?

For a free copy of these and other DAFF publications please email: agbiotech@daff.gov.au

Visit the Australian Government Department of Agriculture, Fisheries and Forestry website for regular updates and information on agricultural biotechnology:

www.daff.gov.au/agbiotech

'We want to ensure that developments in biotechnology are captured for the benefit of the Australian community, industry and the environment, while safeguarding human health and ensuring environmental protection.'

Biotechnology

Value of biotechnology applications to Australian agriculture

briefs

This brochure reviews the current status of biotechnology in Australian agriculture, excluding genetically modified (GM) crops. It looks at the wide-ranging benefits that biotechnology currently provides along the supply chain and the substantial potential of this exciting new range of tools and techniques.

Which biotechnology tools and techniques exist in Australia's agricultural industries?

There are four main categories of non-GM biotechnology:

1. DNA and RNA technologies – used to study genes and gene expression
2. protein technologies – used to study protein production and function in different species and varieties
3. cell and tissue culture and engineering – used to understand and manipulate cellular processes, including immune reactions and embryonic development
4. process biotechnologies – using micro-organisms or their chemicals for the purpose of transforming materials into a product.

Non-GM biotechnology is currently used extensively in Australia for plant and animal breeding and disease management.

Its wide-ranging impact can best be appreciated in light of the component parts of the supply chain:

- growing and husbandry
- logistics and support
- processing
- waste management.

What are the applications in growing and husbandry?

Breeding: Marker-assisted selection (MAS) is widely used, particularly in the grains and cattle industries. MAS helps breeders obtain detailed genetic information about breeding stock and allows new, more productive or higher value varieties of plants and breeding lines of livestock to be developed faster than through the use of conventional technology.

Examples include:

- development of strawberry varieties with superior flavour and flowering characteristics
- rapid development of new barley varieties with improved quality e.g. enhanced malting quality, weed competitiveness and disease resistance
- use of genetic markers to identify cattle with improved meat quality e.g. marbling and tenderness.

New, rapid and cheaper genome screening techniques are being developed which may enable a greater proportion of agricultural industries to capture the value of this technology.

Disease diagnosis and management: The use of biotechnology for disease diagnosis is well established, and Australia has the capacity to develop new diagnostics for emerging threats.

Examples include the use of DNA technologies to:

- measure the genetic diversity of sugarcane smut and enable production of Australian sugarcane smut-resistant cultivars

- screen soil to identify and semi-quantify the presence of certain fungi and nematodes, which enables producers to choose the most suitable rotation crops
- develop and deliver new vaccines, including a one-dose, intra-nasal vaccine against bovine herpes virus-1, a cause of sickness and death in Australian feedlot cattle.

What are the applications in logistics and support?

Commercial applications of both protein and DNA techniques are being developed to improve product quality and meet increasing domestic and international requirements for verification and trace back, along the supply chain.

Examples include:

- the WheatRite® anti-body based test which allows wheat and barley damaged by pre-harvest sprouting to be identified and separated
- the commercial availability of tests to verify grain variety and purity
- the availability of genetic tests that enable cattle feed efficiency to be maximised
- the development of genetic identification systems to prevent product substitution in the fish industry.

What about processing?

Currently there is limited use of biotechnology in processing of agricultural products in Australia beyond traditional food manufacture. A few Australian companies are developing functional food or nutraceutical ingredients.

And waste management?

Biotechnology applications have great potential in waste remediation.

Examples of current use include:

- the development of Landguard™ OPA to speed remediation of organophosphate chemicals used on crops and in sheep dip
- use of bacteria to remove excess nitrogen and phosphorus from heavily contaminated abattoir wastewater.

What is Australia's use of biotechnology in agriculture in relation to our competitors?

Australia is considered to be generally ahead of competitors in the use of genetic markers and artificial insemination for animal breeding, and is on par in the use of DNA and protein-based diagnostic tests and disease treatments.

However, our competitors are well ahead in other areas, including:

- some genome sequencing projects involving Australian species e.g. Eucalyptus spp
- proteomics for agriculture, which involves studying an organism's proteins and their role in its structure, growth, health, disease, etc.
- development of new vaccines for livestock applications
- biofuels
- functional foods and nutraceuticals
- use of biotechnology in the fibre industry e.g. wood pulp.