Australian Government

Department of Agriculture and Water Resources

Biotechnology and agriculture in Australia: policy snapshot

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Introduction

Biotechnology is a powerful enabling technology that has the potential to revolutionise many industries, including agriculture. We believe biotechnology offers benefits for farmers, the food manufacturing industry, consumers and the community. We support the development and use of biotechnology that has been assessed as safe.

In this document we examine the benefits of biotechnology and its potential contribution to innovation in the Australian agricultural sector, describe factors preventing take-up of biotechnology in agriculture and show how we can support its use.

Biotechnology

Biotechnology is a broad term used to describe the process of using living things to create or change products.

Gene technology is a subset of biotechnology. It involves the targeted transfer of genes between organisms or the manipulation of genes within an organism. The organisms altered using these techniques may be referred to as genetically modified organisms (or GMOs). A constituent and/or product derived from a genetically modified organism may be referred to as a genetically modified product (or GM product).

'Biotechnology' is used in this document to refer to gene technology.

Opportunities for innovation in agriculture

Innovation has long underpinned agricultural productivity growth in Australia. For example, in 1996 Australian cotton farmers first used plants that had been genetically modified for pest resistance. This enabled them to significantly reduce their use of pesticides. Since 2000 total farm income from use of genetically modified cotton has increased by approximately $78.6 million (Brookes & Barfoot 2014).

The Australian agricultural sector uses biotechnology to continue to innovate.

Benefits

Agricultural biotechnology could offer a wide range of benefits for Australia's farmers and the community, including:

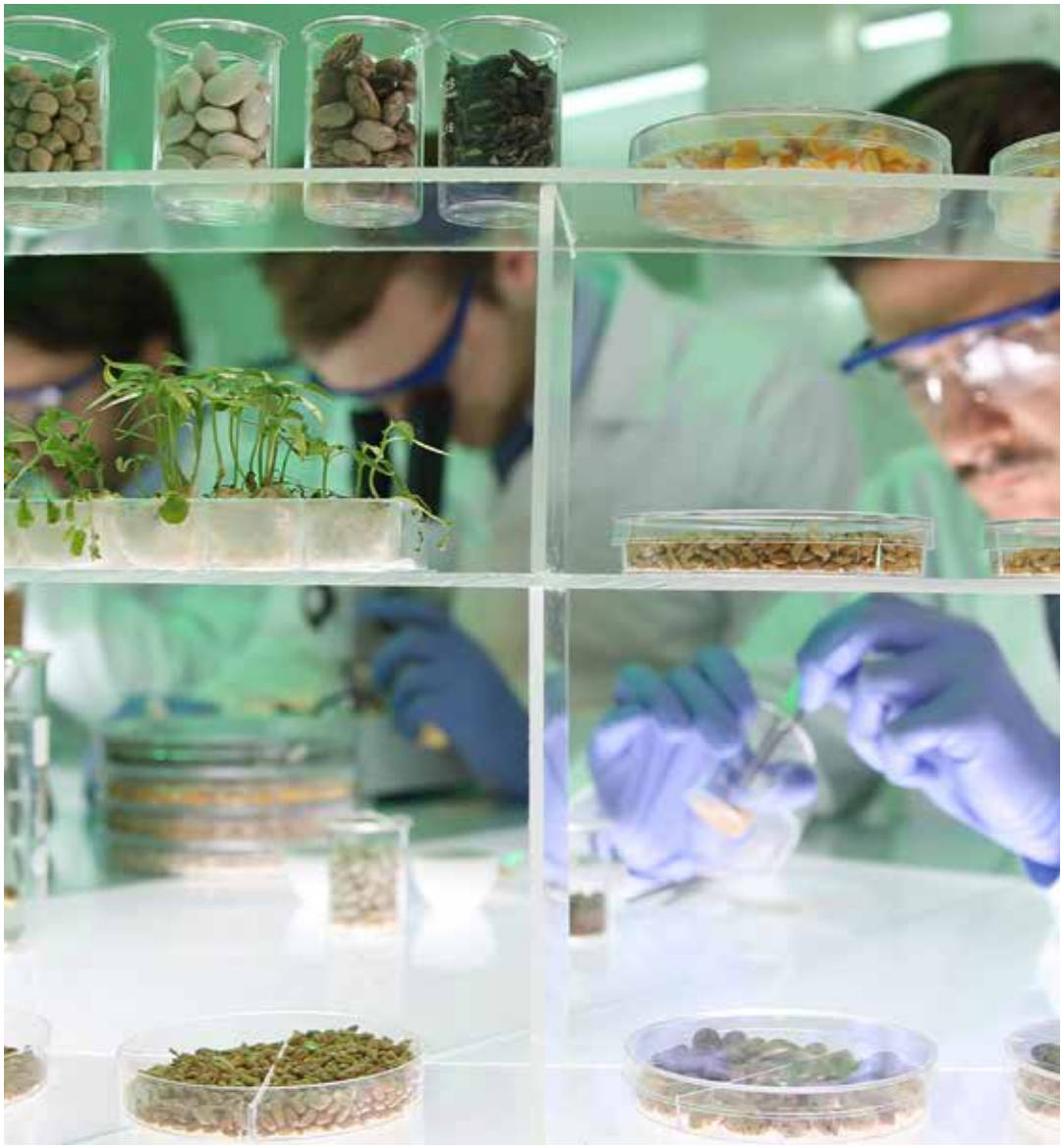
- improved productivity—through increased yield, biomass and product quality
- improved sustainability—through reduced chemical applications
- better management of pests, weeds and diseases—through prevention, management and eradication
- development of new industries—through use in medicines, biofuels or to produce other functional products
- improved ability to address emerging challenges—through mitigating the effects of adverse environmental conditions and increasing productivity.

Improved productivity

Biotechnology can help farmers boost production and increase productivity.

Genetically modified crop technology initially focused on developing insect resistance and herbicide tolerance. Researchers are now working on developing other traits to improve agricultural productivity—including increasing yield, biomass and product quality. For example:

- The Victorian Government Department of Economic Development, Jobs, Transport and Resources is researching genetically modified perennial ryegrass varieties—for higher yields and better pasture productivity, and improved digestibility for animals. This research could improve the productivity of pastures for dairy grazing in Victoria and lead to a more efficient production system (Agriculture Victoria 2017).
- University of Adelaide researchers are studying wheat with increased micronutrients. Biofortification of wheat to increase iron levels will be useful in regions of the world where wheat is a staple crop and iron deficiency is common (OGTR 2017).



Case study 1 Genetically modified cotton in Australia

Genetically modified cotton was first planted in Australia in 1996 and has been a major success since. Insect-resistant genetically modified cotton, also known as Bt cotton, was developed using a gene from the soil bacterium *Bacillus thuringiensis* (Bt). Bt cotton enables the plant to produce the Bt protein, which kills cotton's major pest—*Heliothis* or the cotton bollworm—when it eats the leaves. New varieties of genetically modified cotton have since been developed. These contain multiple genes to increase the longevity of the technology and prevent pests developing resistance.

Before the introduction of genetically modified cotton, growers spent approximately $50 million annually on insecticides. In the 20 years since genetically modified varieties were introduced, improved pest control has led to a 92 per cent reduction in insecticide use and encouraged very high rates of adoption (Cotton Australia 2017). In 2016 genetically modified cotton accounted for 98 per cent of total area planted to cotton in Australia (ISAAA 2016).

Other important environmental, economic and social benefits of biotechnology arising from the use of genetically modified cotton are:

- increased populations of beneficial insects and wildlife in cotton fields
- reduced pesticide run-off
- improved soil quality
- improved opportunities to grow cotton in areas of high pest infestation
- reduced production costs
- increased yield
- reduced risks
- decreased labour and fuel usage
- improved farm worker and neighbour safety
- increased farmer recreation time.

Improved sustainability

Biotechnology can help improve the sustainability of agriculture.

Crops that are genetically modified for insect resistance provide selective protection against key pests and can reduce or even eliminate the need for chemical pesticides.

Herbicide-tolerant crops allow farmers to use relatively inexpensive broad spectrum herbicides to control most weeds found in agricultural fields rather than more toxic weed-specific herbicide mixes. Reductions in chemical applications have led to lower costs for the agricultural industry and the environment, and reduced contamination of soils and groundwater.

Better management of pests, weeds and diseases

Biotechnology can help farmers better manage pests, weeds and diseases.

Biotechnology can be used to improve Australian biosecurity—including in prevention, surveillance, detection, management and eradication of pests, weeds and diseases. For example:

- The soil-borne fungus Panama disease (Panama disease Tropical Race 4) can be devastating to Cavendish bananas. Queensland University of Technology researchers are conducting field trials of genetically modified banana in the Northern Territory, hoping to find a variety resistant to Panama disease Tropical Race 4.

Development of new industries

Biotechnology can lead to the development of bio-industries.

Biotechnology can expand the agricultural value chain through development of bio-industries. For example, engineering plants could produce specific metabolites including medicines, biofuels and other functional products.

- The CSIRO and the Grains Research and Development Corporation (GRDC) have established the Crop Biofactories Initiative (CBI) to engineer oilseeds with fatty acid compositions that match specific industrial applications. Their aim is to launch production and processing value chains in Australian agribusinesses. CBI has produced Super-High Oleic (SHO) safflower—safflower seed oil containing over 92 per cent oleic acid. Oleic oils have many uses, including as lubricants, solvents, cosmetics, plastic additives, resins and polymers, biofuels, coatings, paints and inks. This concentration of oleic acid is the highest of any commercially available plant-derived oil world wide.
- The CSIRO, GRDC and Nuseed have developed a genetically modified canola variety to help alleviate pressure on wild fish stocks. This variety is an alternative high-quality, renewable and reliable source of long chain polyunsaturated fatty acids. Recent fish-feeding trials in Australia and Norway indicate that this can be used as an excellent substitute for fish oil in aquaculture diets (Frazer 2018).

Improved ability to address emerging challenges

Biotechnology can help farmers manage emerging challenges, including those arising from climate change and pressure on global food supplies.

Genetically modified crops can mitigate the effects of adverse environmental conditions through improved tolerance to drought, salinity and variable temperatures. Biotechnology can potentially boost plant yield and animal production—by increasing productivity and by helping to address increasing pressure on land resources and availability, and global demand for food and fibre.

- CSIRO researchers are investigating the potential of different genetically modified wheat varieties to help us address emerging challenges unique to Australia. They are focusing on drought adaptation and conducting field trials of genetically modified wheat varieties that can tolerate drought and heat.
- Australian Centre for Plant Functional Genomics and AgriBio scientists are developing frost-resistant cereal crop varieties using genes from Antarctic hair grass. Their aim is to breed plants that can tolerate temperatures two degrees lower than current non-GM varieties, helping to make them less susceptible to frost damage. A changing climate may cause less cloud cover in southern Australia resulting in more frost events.

Safety of biotechnology in agriculture

The Australian Government ensures that food derived from genetically modified crops is safe and the environment and biosecurity is protected. The Office of the Gene Technology Regulator assesses genetically modified organisms and Food Standards Australia New Zealand assesses genetically modified foods.

Consumer attitudes on the potential impact of genetically modified food crops on human health and the environment have important implications for use of agricultural biotechnology.

Moratoria on the commercial cultivation of genetically modified food crops implemented by some state and territory governments deny farmers access to technological advances and constrain the use of more efficient production techniques. These moratoria are based on the presumption that farmers will achieve premium prices as a result of the state or territory's GM-free status rather than to protect human health or the environment. However, research has shown that farmers in South Australia do not receive a premium as a result of the moratorium in that state (Whitelaw, Dalgleish & Agar 2018).

Segregating genetically modified, non–genetically modified and organic crops would be a better solution to managing this important issue for industry and consumers. This would provide stakeholders with certainty and confidence that crops are managed to meet market and customer requirements.

Public attitudes towards genetically modified food crops are mixed. In a survey on community attitudes towards genetically modified organisms, 10 per cent of respondents were completely in favour and 13 per cent completely against (Cormick and Mercer 2017). Consumers generally accept the use of genetically modified organisms in production of medicine rather than food.

Our role

The department's biotechnology-related work is diverse. We advise government on biotechnology policy, and we are a researcher, program administrator, market access negotiator and regulator.

Economic and scientific research

We conduct economic and scientific research and analysis on possible effects of the application of biotechnology.

We conduct social science research into farmer and consumer attitudes towards biotechnology.

Certification

We provide information about export certification requirements for all agricultural products, including genetically modified, non–genetically modified and organic products.

We assist exporters to meet importing country requirements, including by providing statements on behalf of the Office of the Gene Technology Regulator that plant exports have not been commercially released as genetically modified organisms in Australia (where required).

Regulation

We ensure that imports achieve Australia's appropriate level of biosecurity protection.

We support controls on the development and use of genetically modified organisms in Australia to protect the health and safety of people and the environment. We advocate for the abolition of state-based moratoria on genetically modified organisms and the phasing out of moratoria legislation.

International forums

We engage in international forums and encourage science-based policy settings that allow innovations in biotechnology with appropriate risk management, and to ensure as far as possible that any decisions do not adversely affect Australia's agricultural exports.

Trade and market access

We negotiate new and maintain existing trade and market access for agricultural products, including for conventional, genetically modified and organic products, in the context of the Australia's export legislation and importing country requirements.

Use of biotechnology in agriculture

Australian use

Commercial farming of genetically modified plants in Australia has been limited to insect-resistant and herbicide-tolerant cotton, herbicide-tolerant canola and carnations with altered flower colour.

In 2016 genetically modified cotton accounted for 98 per cent of total area planted to cotton in Australia. In 2016–17 genetically modified canola accounted for 23 per cent of canola area in New South Wales, Victoria and Western Australia (ISAAA 2016).

As at mid 2018 Australia had 87 active field trial licences for genetically modified plants, including for banana, barley, perennial ryegrass, safflower, sugar cane, wheat and white clover (OGTR 2018). Traits being trialled include disease resistance, product quality, human health, yield improvement, and herbicide and stress tolerance.

Global use

In 2016 genetically modified crops were grown by more than 18 million farmers in 26 countries, including Argentina, Brazil and the United States (ISAAA 2016).

Globally, area planted to genetically modified crops increased more than 100-times from 1.7 million hectares in 1996 to over 185.1 million hectares in 2016 (ISAAA 2016), making genetically modified crops the fastest-adopted crop technology in recent history.

The most commonly grown genetically modified crops across the world are canola, soybeans, corn and cotton—grown for food, fibre or animal feed.

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