Science & Technology AUSTRALIA

Moratorium on the Cultivation of Genetically Modified Crops in South Australia

19 October 18

To the Select committee on Moratorium on the cultivation of Genetically Modified Crops in South Australia,

Thank you for the opportunity to provide feedback regarding the Moratorium on the cultivation of genetically modified crops in South Australia.

Science & Technology Australia (STA) is the peak representative body for more than 70,000+ scientists and technologists in Australia through our member organisations, including associations and societies, research institutes, and research strategy bodies such as councils of deans. Our mission is to connect science and technology with governments, business, and the community, to enhance the role, reputation and impact of science.

One of STA's primary goals is to ensure that government policy and legislation reflects the best available evidence rather than ideology or rhetoric. The debate over genetically modified (GM) crops is one that attracts much consternation and fear from the public, which can drown out the scientific evidence.

The development of genetically modified crops, according to the available evidence, is safe.

GM crops also provide significant benefits to farmers, consumers, and even the environment. These benefits strongly outweigh concerns that are often expressed without the provision of peer-reviewed evidence.

It is STA's opinion that the moratorium on GM crops hampers the agricultural industry in South Australia while providing little, to no gains. **STA therefore recommends the South Australian government considers lifting the moratorium**.

Kind regards,

Kylie Walker
CEO
Science & Technology Australia

As the peak body for science, technology, engineering, and mathematics, STA makes this submission to highlight the science of genetically modified organisms, rather than any related business practices.

Through thousands of years of selective breeding in agriculture, humanity has been altering the genes of both plants and animals to increase yield, alter temperament, or enhance specific traits. Through this selective breeding there have often been unexpected side-effects, occasionally resulting in near catastrophe for the organisms involved and the industry. For example, the selective breeding of dairy cow species to increase milk production has recently been linked to a genetic alteration that decreases the fertility of those highly productive cows[1], significantly reducing the capacity to breed dairy cows in the future.

Unlike selective breeding, the creation of a genetically modified organism must undergo rigorous safety experimentation and pass stringent safety checks before they are allowed to enter the market. This better control, and the related safety checks involved, can lead to fewer unexpected side-effects when compared to the blind application of selective breeding that is undertaken as part of common farming practice.

Genetic diversity in crops

Selective breeding generally results in a decrease in genetic diversity for those species. Lower genetic diversity can mean that a species is less capable of coping with and combatting diseases specific to the species. The most well-known example of this issue is the Irish Potato famine that began in 1845 and killed over 1 million people[2].

The great famine provides the most devastating example of the effects of monocultures and crops with low genetic diversity. The use of genetic modification in crops has the risk of decreasing genetic diversity and increasing reliance on monocultures. It is the use of monocultures that increases the risk of viral and parasitic outbreaks within crops[3].

However, genetically modified crops could also enhance the diversity of crops used in South Australia. Through the use of genetic modification techniques, it is possible to dramatically speed up the domestication process for some crops[4]. By increasing the range of crops suitable for domestication, some of the risks faced through monocultures and reduced genetic diversity can be mitigated.

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[1] "The ups and downs of genetic selection in dairy cows" International Milk Genomics Consortium, 2014
[2] "Monoculture and the Irish Potato Famine: cases of missing genetic variation" Berkley University, Accessed 2018
[3] "The diversity-generating benefits of a prokaryotic adaptive immune system" S. van Houte et. Al, Nature, 2016
[4] "Gene editing can speed up plant domestication" Science News, 2018

Pesticide use

Pesticide use in agriculture is of great concern when considering the survival of pollinating species, including bees. A number of countries in Europe and South America are implementing bans for pesticides such as glyphosate. Some GM crops and many non-GM crops rely heavily on other pesticides. Appropriate and thoughtful genetic modification can, however, increase the inherent resilience of crops to pests and thus decrease the need for pesticides[5].

In India a genetically modified strain of cotton was introduced in 2002 that was designed to be resistant to pests including bollworm. Recently the Indian Government announced that since its introduction, this cotton had increased the nation's cotton production from 308 kg/ha (2001-02) to 568 kg/ha (2016-17)[6]. This increased yield is due to a decrease in the damage caused by bollworm, and additionally led to a decrease in the use of pesticides on cotton crops. Ultimately the use of genetically modified crops, when undertaken responsibly, can reduce the use of pesticides on a large scale and lessen the resulting environmental impacts[7].

Human health

To date there has yet to be a single peer-reviewed study to indicate health risks associated with genetically modified crops. On the contrary, there is evidence of benefits to human health of genetic modification. A recent meta-analysis of research into the yield and health effects of genetically modified corn has actually shown that GM-crops could be beneficial for human health. These crops were shown to have decreased levels of mycotoxin (a toxin from fungi that is carcinogenic)[8]. Australia's CSIRO has produced a number of enhanced crops to benefit human health, including gluten-free barley, and is developing others such as wheat that lowers the risk of colon cancer. On an international scale the World Health Organisation has stated that:

"GM foods currently available on the international market have passed safety assessments and are not likely to present risks for human health, in addition, no effects on human health have been shown as a result of the consumption of such foods by the general population in the countries where they have been approved.[9]"

Given the requirements made of GM crops, such as mandatory safety examinations, it could easily be argued that these crops are safer, and more thoroughly tested than non-GM produce.

Crop drift/cross-contamination

Genetically modified crops are a contentious issue, and some farmers specialise in non-GM crops as a result. Cross-contamination from GM crops could be

[5] "Genetically Modified Crops: Risks and Promise" Ecology and Society, 2000
[6] "BT cotton doubled production, minimised harm by pest: Govt" The Times of India, 2018
[7] "Effect of genetically modified crops on the environment" VIB, 2016
[8] "Impact of genetically engineered maize on agronomic, environmental and toxicological traits: a meta-analysis of 21 years of field data" E. Pellegrino et. Al, Scientific Reports, 2018
[9] "Frequently asked questions on genetically modified foods" World Health Organisation, 2014

considered an issue if the moratorium on GM crops was lifted in South Australia. States that allow for genetically modified crops have already implemented a requirement that these crops come with safety measures that prevent cross fertilisation of neighbouring crops and the environment[10]. This technology and methodology already exist and can be used to mitigate concerns of non-GM farmers.

Concerns that have been raised include the potential for monopolisation of seeds with this type of technology[11]. The crops grown using GM seeds are often not fertile, requiring farmers to constantly return to the same supplier to purchase seeds for each year's crop. Legislation to protect farmers from this monopolistic behaviour would help mitigate these concerns[12].

Increased yield for fewer resources

Increased yield

Much of the focus of genetic modification research is centred around increasing yield for crops or producing a crop that has extra nutritional/disease resistance benefits. The results of these modifications differ little from the results of selective breeding, but the changes can be achieved in a shorter time frame (and with more controls).

Dwarf wheat is an example of a genetically modified strand of wheat that has resulted in an increased yield. This same aim was attempted using selective breeding, but due to the limited control, the grain became so heavy the stalks would bend, ruining the crop. Dwarf wheat allows for shorter and thicker stalks of wheat, addressing this issue[13].

There are also cases of crops being modified to contain higher levels of certain vitamins. The development of golden rice has allowed for an increased concentration of vitamin A in this strand of rice[14]. This is important for countries with diets that are low in meat, as the rice helps to balance the resulting vitamin A deficiency, which can lead to blindness amongst other negative health effects.

Water

In Australia one of the biggest threats to agriculture is drought and water scarcity. This is an issue for all states, including South Australia, and with the changes associated with climate change it will be of increasing concern. Genetically modified crops can be designed to be less water reliant, making them more suited to growing in drier Australian climates. The over-expression of a particular gene common in crop plants was shown to reduce water use in field

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[10] "Gene Technology Act 2006" Western Australian Legislation, 2006
[11] "Monopolisation and the Regulation of Genetically Modified Crops: An Economic Model" A. Munro, The economics of Managing Biotechnologies, 2002
[12] "Legal Liability, Intellectual Property and Genetically Modified Crops: Their Impact on World Agriculture" K. Kariyawasam, Pacific Rim Law & Policy Journal, 2010
[13] "Root:shoot ratios of old and modern, tall and semi-dwarf wheats in a Mediterranean environment" K. H. M. Siddique, et. Al, Plant and Soil, 1990
[14] "Improving the nutritional value if Golden Rice through increased pro-vitamin A content" J. Paine, et. Al, Nature Biotechnology, 2005

crops by up to 25%[15]. Genetically modified crops could help make significant progress towards relieving water scarcity.

Fertiliser

Fertiliser use in agriculture is a necessity, especially in Australian soils which are notoriously low in key minerals and nutrients, such as phosphorus[16]. Apart from the financial burden of using fertiliser, crop run-off can also be washed into local water ways resulting in toxic algal blooms[17]. Some crops are now being modified to include genes found in native Australian plants, which have evolved to thrive in nitrogen-poor soils.

STA recommends that the SA government consider lifting the moratorium on genetically modified crops, that includes appropriate legislation to protect non-GM farmers from cross pollination.

[15] "Photosystem II subunit S overexpression increases the efficiency of water use in a field-grown crop" K. Glowacka et. Al, Nature Communications, 2018
[16] "The incidence of low phosphorus soils in Australia" R. Kooyman, et. Al, Plant and Soil, 2016
[17] "Freshwater algal blooms and their control: Comparison of the European and Australian experience" G Herath, Journal of Environmental Management, 1997