Updated April 2012

Scion's Genetically Modified Tree Research

OUR RESEARCH HISTORY

Scion has been conducting genetically modified tree research since 1992. This research involved non-native, economically important forestry species both in the laboratory and in field trials. From 1996 to 1999 Scion undertook field trials with genetically modified radiata pine to establish that the science could be conducted in accordance with all regulatory, risk management and environmental standards.

In 1996 the Environmental Risk Management Authority (ERMA) was established, and in 2000 ERMA granted Scion approval for field trials for certain experiments over a 20-year period, starting in 2003. The species involved are radiata pine and spruce.

The experiments to date have been purely to assess environmental safety. These experiments were completed in June 2008 with the required destruction of the trees and subsequent publication in peer-reviewed scientific journals. These experiments found no evidence for environmental impacts of any kind resulting from genetic modification. The results showed "no evidence of the modified genes having transferred to other organisms; no evidence of detrimental impact on insect diversity by the genetically modified pines; no evidence of impacts on the micro-organism populations that live in close association with the pine roots" – NZ Herald 2 May 2008.

December 2010 approval

In December 2010 ERMA granted approval, with controls, for Scion to field test genetically modified radiata pine in outdoor containment. (Approval GMF 100001). The field trials will continue environmental impact assessments and at the same time assess commercially viable traits.

The trees to be tested in the field trials will initially be developed and grown in the laboratory using standard molecular biology techniques under Scion's ERMA development approvals. Then, the approved trees will be tested in the field, i.e. they will be planted outdoors and grown on a secure, contained 4 hectare site. Field trials like this are necessary to provide proof of concept for improvement of the wood quality trait of interest.

The introduced genes and other relevant DNA sequences will be obtained or synthesised as copies from naturally occurring organisms such as bacteria, fungi, and plants (including pine). No genetic elements from humans, or New Zealand indigenous flora and fauna, have been or will be used.

The field test will last for 25 years. However, each tree will only be grown for a few years. Some may grow to a maximum age of 8 years or until they begin to develop reproductive structures (whichever occurs first). The development of reproductive material (pollen or seeds) in the field trial is excluded.

Trees will be assessed for expression of the new genes, herbicide tolerance, improved growth rate and wood quality traits. Environmental impacts will also be assessed by monitoring the microorganisms and insects living in association with pines. Scion has had a long history of isolating and preventing the escape of germplasm through its breeding programmes and its past field tests.

Scion is in frequent communication with Mana Whenua, who support our research. We believe that the future benefits of this research programme will be sustainable products, manufacturing processes and energy supplies to meet the needs of future generations. The benefits will be an increase in our understanding of this technology.

Scion is responsible for the overall operation and management of this field test. For many years, Scion has been at the forefront of research in plantation forestry and conifer biotechnology. We want to maintain and develop this position so that New Zealand has the opportunity to make pragmatic decisions on the use of gene technology in the future as well as develop new knowledge that can be used extensively through non-GM methods of tree improvement.

In April 2012, during the long Easter weekend, a field trial of genetically modified radiata pine trees planted in a secure site at Scion's Rotorua campus was deliberately destroyed. The field trial which contained 375 young radiata pine trees was in full compliance with the containment controls.

13 April 2012 Press Release : Scion's Field Trial Deliberately Destroyed.

OUR RESEARCH PROGRAMME

Genetic modification is one of many techniques that can be used to improve the productivity and quality of commercially grown forestry species. Scientific opinion, based on years of research as well as commercial plantings world-wide, is that genetically modified products are safe. Our published research on environmental safety of genetically modified trees also indicates that they are safe.

Genetic modification techniques allow plant breeders to introduce a single, clearly identified desirable trait into a breeding population where it is not normally or readily available. For example, Scion's previous genetic modification research, in containment, on insect resistance showed that the Bt toxin gene (derived from the bacterium *Bacillus thuringiensis*), which is specifically poisonous to caterpillars, was effective in preventing damage to pine plants by caterpillar feeding. This same toxin is currently available in powder form, often used by gardeners and commercial organic growers. Currently caterpillar pests are not a problem for radiata pine in New Zealand, but they cause problems for pine growers in other parts of the world. Scion's technology allows New Zealand to be prepared for any future incursions of such insect pests. Modifications like this have already led to huge reductions of pesticide use in agricultural crops overseas and have shown environmental benefits and safety over a period of more than 10 years.

Scion's genetically modified tree research began in 1992. Initially, a genetic modification technology was developed for conifers such as radiata pine. In a second step, our first field trial provided proof of concept showing that genetically modified trees could grow normally and express the new gene. In a recent field trial (2003-08), genetically modified trees were assessed for their impacts on soil microbes and invertebrate organisms. No negative effects were detected.

GLOBAL BENEFITS OF GENETIC MODIFICATION SCIENCE

Environmental benefits

Research that allows production of more and better timber and timber products from plantation forests helps alleviate pressure to log native forests. Genetic modification can be used to improve specific traits in trees that could lead to environmental benefits such as drought tolerance, increased carbon sequestration, or better options for the production of biofuels.

Forestry benefits

On a commercial scale, genetic modification can improve individual tree characteristics, including traits such as: pulpability, wood quality (e.g. strength, stiffness and density), increased carbon sequestration, herbicide resistance, pest and disease resistance, environmental stress tolerance (e.g. cold, drought), and reproductive function.

The increased productivity of plantation forests can help meet rising global demand for fibre.

Internationally, genetically modified crops have enabled significant reduction in the use of pesticides and demonstrated increased productivity and increased sustainability. Uptake of the technology in agriculture continues globally at a fast pace because of the benefits to growers, processors and consumers.

Scientific benefits

The results from Scion's field trials will increase scientific understanding of the mechanisms of wood development and reproductive development, and how they can be modified to meet economic, social and environmental goals.

Results from Scion's trials will help the New Zealand public, the forest industry, and legislative and regulatory agencies to make decisions about the commercial use of genetic modification technology in forestry.

Economic benefits

New Zealand requires the development and application of science to remain competitive in the global marketplace, which is increasingly adopting genetic modification technologies. With an economy dependent on primary product exports, New Zealand relies on agricultural and forestry innovation to ensure its future economic competitiveness.

Scion has developed a bioenergy scenario that shows how New Zealand could gain a long-term sustainable alternative to imported transport fuels by establishing 1.8 million ha of energy forests on some of our marginal land. By 2035, Scion estimates that there will be a net gain to the New Zealand economy of $4.5 billion per year based on projected oil prices ($120-140/bbl). The scenario would reduce New Zealand's total reliance on imported oil for energy by 60%. Genetic modification of trees for bioenergy has the potential to introduce greater gain or process improvements that will make bioenergy production more sustainable and economic.

PUBLISHED PAPERS FROM SCION

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