
13. Blueberries – a 20th Century fruit is part of New Zealand's expanding horticulture industry

The potential for a New Zealand blueberry industry was seen as one of many diversification options for the agricultural sector, during the 1970s. The initial issue was to identify suitable blueberry cultivars for New Zealand soils and climates.



During the latter 1970s MAF began an innovative blueberry development programme that aimed to produce blueberry cultivars that could add value to the industry.

- Blueberry cultivars were imported from USA. DSIR scientists developed micro-propagation technology that enabled the limited number of imported plants to be rapidly increased so that the best cultivars for New Zealand growing conditions could be identified in MAF field trials. The micro-propagation technology enabled the trials to be advanced by up to three years. The most promising cultivars were released to industry.
- The next step was to begin a breeding and selection programme to produce cultivars that lengthened the harvest season by up to 6 weeks; and improved the size, taste, colour and postharvest storage qualities of the fruit. NZ bred cultivars from this programme were released to the industry during the late 1980s and 1990s.
- During the 1990s these NZ bred cultivars were released to nurseries in Europe, Japan and USA under licence.

The release of NZ bred cultivars into the Northern Hemisphere is expected to increase the year round demand for these superior blueberries. This will be to the advantage of New Zealand growers as they become active participants in the global market. Royalties from plant sales flow back to New Zealand.

Failure to find blueberry cultivars that produced quality fruit with appeal to overseas consumers would have placed the fledgling industry as a commodity producer with limited market opportunities. This situation would probably have led to the industry's early demise.

The growth in exports of fresh blueberries during the 1990s was based on innovative development during the preceding decades. Almost 50% of the fresh blueberries for export are harvested outside the midseason December - January period, with some 2/3 from NZ bred cultivars.

Fresh blueberry exports have expanded from \$2.1 million in 1990 to \$7.5 million in 2003. Frozen blueberry exports are around \$1.0 million annually. The flow back of royalties to New Zealand makes a significant contribution to the ongoing research programmes within HortResearch.

The internal rate of return on the R&D investment that led to the NZ bred cultivars is estimated to be 19%, with a net present value of \$0.5 million, 2004. The equivalent 2009 values are projected to be 21% and \$2.7 million, respectively.

Blueberries rank very high in antioxidant activity when compared to most other fresh fruits and vegetables. Consequently, the consumer demand for the product is increasing. Science and technology innovation will continue to be an essential component to ensure that quality products enter the world markets.

The case study illustrates how science and industry partners assembled and improved the plant resources for a new industry. The New Zealand team of scientists and industry partners decided that they could produce blueberry cultivars with better attributes than those imported from USA

1. Background:

Some 430 ha of blueberries are grown in New Zealand (Agriculture Census 2002), with 80% of the crop being grown in the Waikato. There are about 75 growers. The cropping area is now expanding into Hawke's Bay and other regions. Fresh blueberry exports were worth \$7.5 million (fob) in 2003.



Blueberries have probably been collected by native people for thousands of years in North America, and later by European settlers, but it was not until the 20th century that the plant became domesticated. Prior to 1900, selection of bushes from the wild was known to have occurred. Plantsmen and plant breeders, notably Frederick Coville, selected and bred large-fruited cultivars after the turn of the 20th century, which formed the foundation of the modern industry. New Zealand is an active participant in developing blueberries as a global fruit following their domestication in the early 20th century. Today, 75-100 named cultivars exist, and new cultivars are being produced annually.

World area of blueberries reported by FAO is about 47,900 ha, with over 80% in USA and Canada. There are a few thousand hectares in Europe, particularly in Poland, Lithuania, Romania and the Netherlands. In Japan, native blueberries are collected from the wild and processed, and plantings are expected to expand. In North America, over 70% of the crop is processed. FAO estimated the world production of blueberries in 2003 to be 227,000 tonnes, with over 80% being produced in Canada and USA.

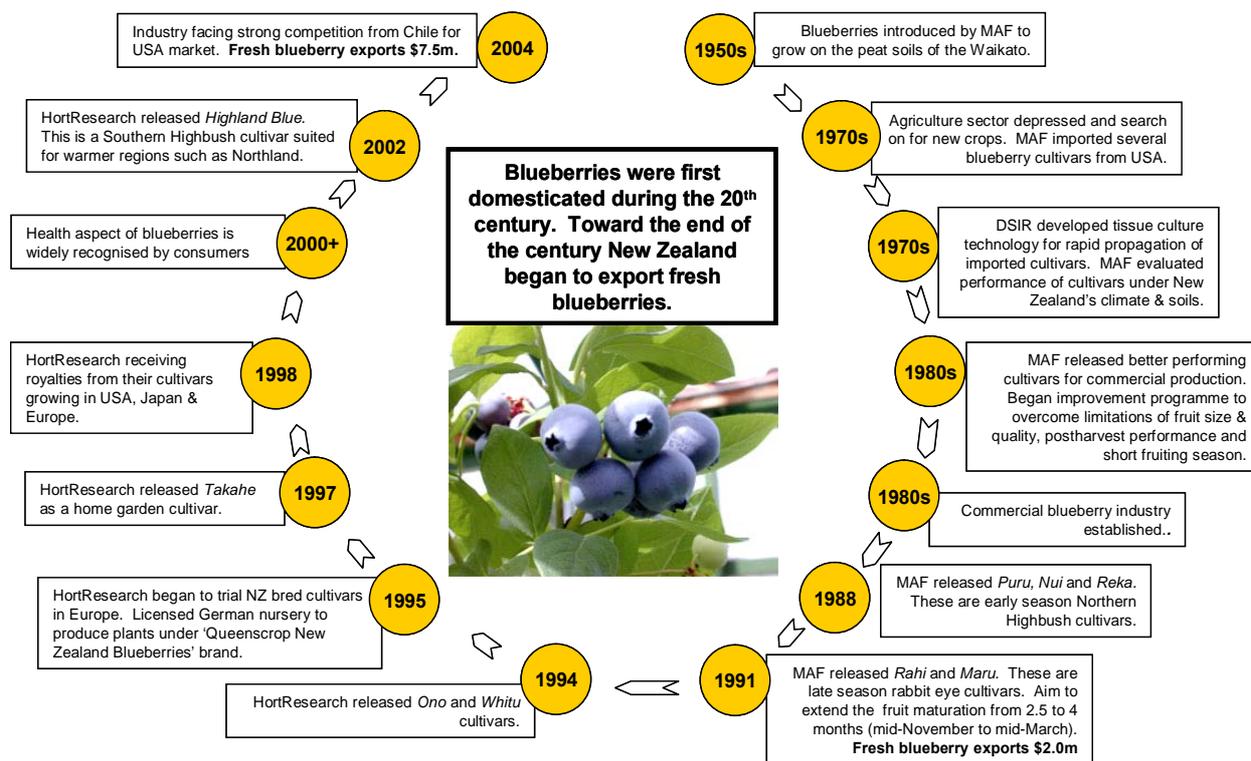
The foundations for New Zealand's fresh blueberry export industry were laid during the 1970s. Blueberry cultivars were imported from USA for field evaluation. The best performing cultivars were subsequently released for commercial production.

A New Zealand based cultivar development programme was commenced about 1979, with the aim of breeding cultivars with large fruit, high yields, an extended harvest season and postharvest qualities that enabled fruit to be shipped overseas using controlled atmosphere (CA) storage. Cultivars from this programme were released to the industry during the late 1980s and 1990s and now make a significant contribution to New Zealand fresh blueberry exports.

The value of the NZ bred cultivars has been recognised by growers in Europe, USA and Japan, and they are now grown under licence by nurseries in those countries. The plant royalties are fed back into the New Zealand programme.



2. Timeline



3. Science and innovation features:

- Blueberry cultivars were imported from USA in order to evaluate their productivity when grown in New Zealand soils and climates. Biosecurity regulations restricted the imports to only a few plants of each cultivar. Innovative techniques of plant micro-propagation were developed by DSIR scientists that enabled the rapid production of large numbers (>3000) of plants for MAF field trials. This technology advanced the evaluation trials by about three years.
- An innovative breeding and development programme was commenced that led to NZ bred blueberry cultivars with an extended harvest period (by up to 6 weeks) and large fruit with good eating and postharvest storage qualities.
- During the 1990s these New Zealand cultivars were introduced to nurseries and the blueberry sectors in Europe, Japan and USA. Northern Hemisphere production of these cultivars increased the demand for large size fruit and helped build a year round demand for these superior blueberries. All the cultivars introduced to the Northern Hemisphere are protected by Plant Variety Rights which means that a flow of plant royalties returns to the breeder in New Zealand.
- The current introduction of new production technologies for fresh blueberries within New Zealand means that the innovation is continuing. Meanwhile the cultivar development can expand its focus to cultivars suited to warmer winters and to processing. Increasing the diversity of the New Zealand blueberry gene pool is another priority.

Future innovation will continue to improve the taste, size, colour, health giving compounds and processing attributes of the fruit. Improved productivity will be sought, including the wider use of protected growing systems. Cultivars will be developed that better match the many different regional climates within New Zealand. Active promotion of NZ bred cultivars in Northern Hemisphere countries will continue.

4. Benefits:

- NZ bred cultivars have lengthened the harvest season by up to 6 weeks. This has helped New Zealand producers to obtain premiums for early and late season fruit in the fresh export markets.
- HortResearch, as the New Zealand breeder, receives significant royalties from offshore nurseries.
- The larger fruit produced by the NZ bred cultivars are attractive to consumers in the export markets. These fruit also have improved eating and postharvest storage qualities.
- The ability to transport fresh blueberries in CA storage has allowed container shipping to replace the more costly airfreight.

5. Return on R&D investment

The return on R&D investment was assessed by comparing the industry performance with the innovation in place to that of a counterfactual¹ situation which identifies a possible industry performance, had the innovation not happened.

Key Information used in the analysis:

1. The area of the blueberry crop is about 430 ha in 2004, having expanded from 300 ha in the early 1990s.
2. Exports of fresh fruit have expanded from \$680,000 in 1983 to \$2.1 million in 1990 and \$7.5 million in 2003.
3. Exports of frozen blueberries are approximately \$1 million. This sector is primarily based on USA cultivars.
4. Exports of early (Oct & Nov) season fresh blueberries have expanded since 1998/99 and are now about 17% of exports by value. Most of the fruit is produced on NZ bred cultivars.
5. Mid season (Dec & Jan) production is primarily harvested from USA cultivars and is about 50% of exports by value.
6. Late season (Feb, March & April) production is harvested from a 50:50 mix of NZ bred and USA cultivars and is about 33% of exports by value.
7. The sale of NZ bred cultivars in Europe, USA and Japan returns a significant royalty payment to HortResearch as the breeder.
8. It takes about 10 years to breed and select a new blueberry cultivar.

Counterfactual: (What would have happened if this innovation had not occurred?)

The key elements of the counterfactual are as follows:

1. The industry is based on USA cultivars, chosen on the basis of *ad hoc* evaluation by individual growers within New Zealand.
2. The industry does not earn any overseas royalties.
3. There is an additional industry cost to cover the evaluation of the imported cultivars.
4. All fresh blueberries for export are produced during the mid season when prices are usually lower. The industry does not receive early and late season premiums for the export of fresh blueberries.
5. The limited harvest season for fresh blueberries limits the development of the domestic market.

¹ Refer Appendix

6. New Zealand blueberries are a commodity product for which all R&D is done offshore. This is similar to the Chilean kiwifruit industry.
7. Blueberry cultivars are planted in land previously used for dairying. Assumed a gross margin of \$117.06/ha for dairying and 2.4 cows/ha.

Assessment results:

| | as at 2004 | as at 2009 |
|--------------------------------------|---------------|---------------|
| Internal Rate of Return ² | 19% | 21% |
| Net Present Value ³ | \$0.5 million | \$2.7 million |

The 2009 assessments are based on the assumptions that:

- Crop area will not increase between 2004 and 2009
- Fresh export will increase at 4% per year with same profile of early, mid and late season sales.
- HortResearch's forward projections of royalty income will be met.
- Processed exports and domestic sales will continue at present levels.

6. Quotes:

"HortResearch's range of new blueberry cultivars, with improved fruit size, firmness and flavour, is in demand in North America and in several European countries. They are rated amongst the best fresh cultivars available in the world." Orchardist, 1994.

"Now that NZ has a good selection of new cultivars which perform well under our conditions, and cover a long fruiting season, the emphasis of the breeding programme has changed. Its aim is to improve the fruit quality of all cultivars, giving less variability in quality, increased fruit size, reduced seed size, and improved storage characteristics. These attributes should enhance shelf life of the fruit, and enable sea-freighting. Other objectives in the breeding programme include developing low chill cultivars for northern regions." Orchardist, 1994

"In some instances, it can be advantageous to have New Zealand-bred cultivars grown in Northern Hemisphere countries which do not compete directly with us, creating off-season demand that growers here are able to fill. HortResearch blueberry cultivars, for example, have created a demand in the North American market for large-size fruit. Selling plants of these cultivars to North American growers increases the year-round demand for these superior blueberries. New Zealand growers then gain premium returns for their fruit during the North American winter." Source: HortNet 1994
HortResearch scientist, Narandra Patel, said, *"We expect 'Island Blue' will complement early season outdoor production, particularly in Northland, and also possibly become a useful machine harvest process cultivar in traditional production areas where mild winters are common"*.

" After more than ten years of growing and evaluating rabbiteyes, we are excited to offer growers what we feel are the best late ripening varieties for climates similar to Western Oregon. Maru, Powderblue and Rahi" . Fall Creek Farm & Nursery Inc, Oregon which has the exclusive license for these blueberry cultivars. www.fallcreekfarm.com

² Refer Appendix

³ Refer Appendix

7. Related activities:

BBC Technologies in the Waikato have developed a grading machine that is able to recognise different fruit qualities by colour and sort at high speed. This machine is of huge benefit to high volume packers and can be used with a range of fruit crops. See Case Study #11.

8. Information sources

Information supplied by:

- Narandra Patel, HortResearch, Ruakura. Leader of the blueberry breeding and development programme.
- Lynda Hawes, Consultant, Hamilton. Berryfruit specialist.
- Greg Furniss, BBC Technologies, Hamilton.
- Jan Bishell, Blueberries NZ Inc., Hamilton.

Other references:

- "New blueberry release prefers warm weather." HortResearch Media Release. November 2002.
- Berryfruit Variety Descriptions. Compiled by Geoff Langford. 1997
- Growing Blueberry. Annette Richardson, HortResearch. Pages 109 to 112.
- J.T.K. Poll, F.H. Wood. "Blueberries in New Zealand". ISHS Acta Horticulturae 165: [III International Symposium on Vaccinium Culture](#)
- N. Patel, J.P. George. "Progress with Breeding Blueberries in New Zealand." ISHS Acta Horticulturae 446: [VI International Symposium on Vaccinium Culture](#)
- Regulatory impact and compliance cost statement: final paper on application for a commodity levy order on blueberries. 2001. www.maf.govt.nz

¹**Counterfactual:** *Counterfactuals are the statement of what would have happened (or could happen) in the absence of a specific event, programme or action. Counterfactuals are the "what ifs", "thought experiments", "alternatives to actual history"; they imagine what would have happened to an economy, an industry or a business if, contrary to fact, some present conditions were changed, in this case, if a specific R&D advance had not occurred.*

²**Net Present Value (NPV):** *Net Present Value represents the stream of benefits, less the stream of costs, converted into equivalent values today, using an appropriate discount rate. In the case of R&D, we have summed the benefits of an identified R&D advance, taken away the stream of costs and used a 7% discount rate to calculate the NPV.*

³**Internal Rate of Return (IRR):** *The Internal Rate of Return calculates the interest rate received for an investment consisting of costs and income that occur over a specific period. By examining the costs, and when they occur, compared to the benefits over time, the IRR calculation estimates the return from the project as an interest rate calculation. It is the rate of interest at which the present value of future cash flows is exactly equal to the initial capital investment.*

This case study is one of a 21-part case study series aimed at demonstrating the value of science and innovation in New Zealand's leading edge bio-science industries... and their significance to New Zealand.

Martech Consulting Group is a strategic consultancy based in New Zealand. The growingfutures case study series was in part based upon Martech's extensive work with sector representative groups, science providers and organisations that interact with science providers to achieve consensus on co-ordinated actions, improve governance, develop sector-based strategies and improve innovation processes.

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