#3. *Jazz*™ - a new New Zealand apple variety enters the global market

New Zealand has a proud history of developing novel apple varieties. The World Apple Review (2004) reports that apple varieties bred and selected in New Zealand after the 1950s account for 11.5% of the world's apple crop and this share is forecast to rise to 14.5% by 2010. *Royal Gala* and *Braeburn* are the pre-eminent New Zealand varieties grown in other countries. This capacity for innovation within the New Zealand apple industry continues with the exciting new variety *Jazz*™ that results from crossing of *Braeburn* with *Royal Gala*.

This innovative capacity is a strong reason why New Zealand retains a competitive position in the global trade of apples. Apple varieties from Europe and USA were brought to New Zealand during the 19th Century. Severe attacks of woolly aphids were experienced during the 1870s. The industry was saved when a local nurseryman found that the variety Northern Spy was resistant to these aphids. During the 20th Century, both private and public sector personnel contributed significantly to these innovations through their selection and breeding activities. *Royal Gala* and *Braeburn* were introductions from the private sector and *Jazz*™ came from a public sector breeding programme. The rootstocks on which these varieties are grown have been selected by both private and public sector organisations primarily on the basis of resistance to problem pests and diseases and tree vigour.

Jazz™ is the forerunner in a notable new marketing innovation. *Jazz*™ trees have been planted in commercial orchards in New Zealand (1996); Washington, USA (1999); and France (2000) by orchardists who have contracted to supply apples to ENZA, New Zealand. By producing apples on both Northern and Southern Hemisphere orchards, a continuous supply of quality *Jazz*™ apples to supermarket customers can be assured. The commercial development of *Jazz*™ is controlled by ENZA, and continuing economic benefits are expected to flow back to New Zealand from overseas orchards.

New Zealand has learnt a lesson from the development of *Royal Gala* and *Braeburn,* which were bred and selected in New Zealand, but not protected from development by competitors. The introduction of Plant Variety Rights now allows breeders to retain ownership of the variety as well as a royalty income stream. This has been an incentive for New Zealand to look innovatively at ways of doing business on a global scale and capturing the benefits of local innovation. Royalties are collected on the fruit sold from the orchard not on the trees sold to the orchard which is the usual practice with perennial plants.

In 2003, New Zealand exported 17 million cartons of fresh apples valued at $392 million (fob) to 66 countries. These exports included a very small entry of about 30,000 cartons of *Jazz*™*.*

Because the introduction of *Jazz*™ apples to market is very recent, the 2004 estimates of net present value are negative. The 2009 projected values of internal rate of return on R&D investment and net present value are 13% and $2.8 million, respectively.

This case study illustrates how science and industry can work together to develop a new apple variety and protect the intellectual property for global development, with benefits flowing back to New Zealand.

1. Background:

A well developed capacity for innovation is a strong reason why New Zealand retains a competitive position in the global trade of apples.

Apple varieties from Europe and USA were brought to New Zealand during the 19th Century and introduced to a land that was comparatively free of the pests and diseases experienced in the home country. However, entry of woolly aphids to New Zealand during the 1870s placed the apple industry at risk. The industry was saved when a local nurseryman found that the variety Northern Spy was resistant to these aphids. This was developed as a rootstock that became an important component of the industry during its formative years. During the 20th Century, both private and public sector personnel contributed significantly to innovation within the fledgling apple industry through their selection and breeding activities. Many rootstocks on which these varieties are grown have been selected by both private and public sector programmes on the basis of their resistance to problem pests and diseases and tree vigour.

The World Apple Review (2004) reports apple varieties bred and selected in New Zealand after the 1950s account for 11.5% of the world's apple crop and this share is forecast to rise to 14.5% by 2010. *Royal Gala* and *Braeburn,* which were introductions from the private sector, are the pre-eminent New Zealand varieties. This capacity for innovation within the New Zealand apple industry continues.

Origin of apple varieties prominent in New Zealand during the latter part of the 20th Century:

- *Cox's Orange Pippin* – chance seedling in UK, 1825.
- *Red Delicious* - chance seedling in Iowa, USA, 1881. Numerous red strains subsequently identified.
- *Golden Delicious* – chance seedling in West Virginia, USA in 1914.
- *Fuji* – Japanese breeding programme, introduced in 1962.
- *Splendour –a* chance seedling found in Napier, 1964.
- *Gala* – private NZ breeding programme (*Kidd's Orange x Golden Delicious* cross), introduced in 1965: red strains subsequently identified.
- *Royal Gala* – a red mutation from *Gala*, introduced out of a private selection programme, in 1973.
- *Granny Smith* – chance seedling in NSW, 1868.
- *Braeburn* – chance seedling in Nelson, introduced in 1970: Red skin strains were identified later.

The DSIR apple selection programme began in the 1950s when a large number of apple varieties were collected from overseas for evaluation. Very few were judged suitable for New Zealand conditions and consequently Dr Don McKenzie made the decision to begin an apple breeding programme. The programme placed emphasis on breeding and selection for excellent eating quality and texture, combined with attractive and distinctive appearance and long storage life.

During the 1970s DSIR initiated two apple breeding programmes, using the varieties *Red Dougherty* and *Golden Delicious*, *Gala* and *Splendour*. The *Gala x Splendour* crossing programme produced the Pacific series of apples, e.g. *Pacific Rose*, *Southern*

Snap which have a sweeter flavour and crunchier texture than the existing varieties. However, they are susceptible to russeting and best suited to drier climates such as Central Otago and Washington State, rather than Hawke's Bay and New York State.

During the 1980s DSIR started another programme based on crossing the *Braeburn* and *Royal Gala* varieties. The new variety *Jazz*™ is a selection from this programme. *Jazz*™ is a firmer apple than the Pacific series, which is crisp and crunchy with an attractive tangy effervescence. It is not susceptible to russet and shows a wide adaptation to climate.

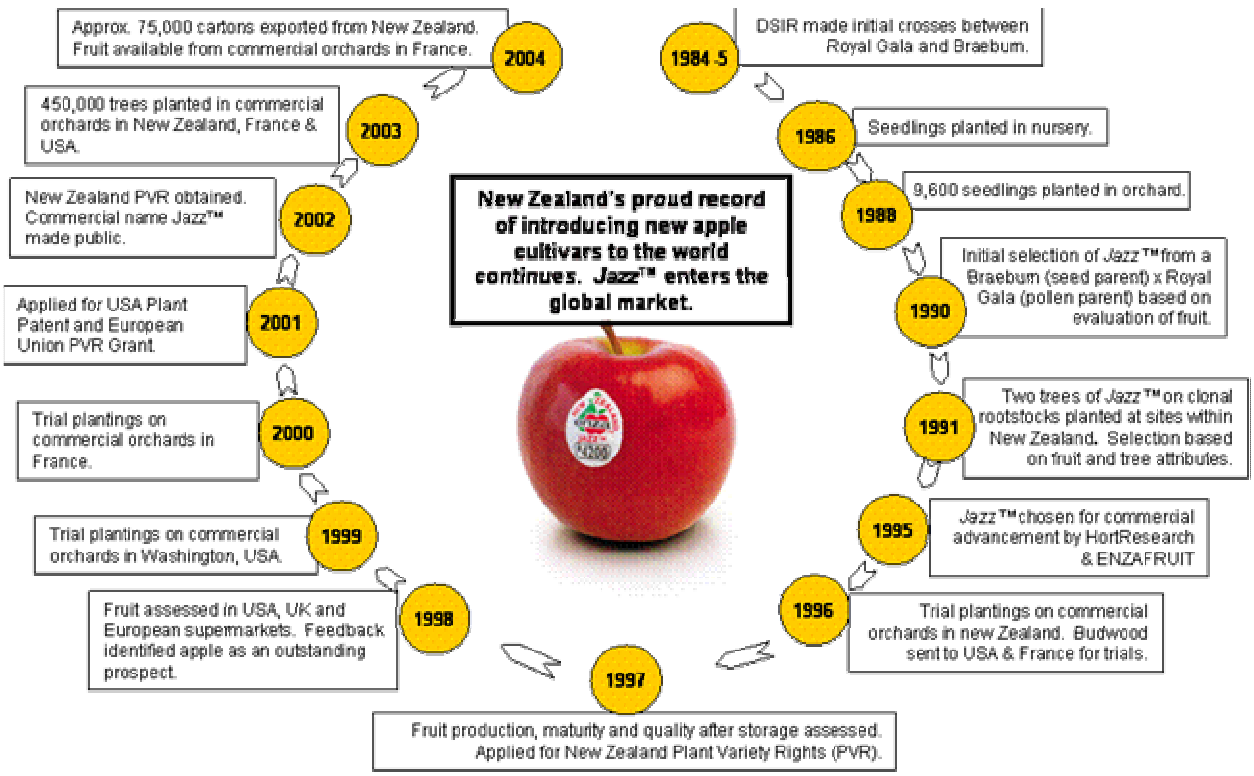
HortResearch continued the DSIR programme when it was formed in 1992. The present apple breeding programme involves a wide range of scientific skills and disciplines, such as breeding, molecular biology, physiology, pomology, entomology, pathology, postharvest physiology and sensory analysis.

Access to a wide set of multi-disciplinary skills is a unique aspect of this programme when measured against most other international apple breeding programmes.

New Zealand has seen that the inability to protect the intellectual property encapsulated in *Braeburn* and *Royal Gala* has allowed them to be developed by competitors. Plant Variety Rights (PVRs) were introduced to New Zealand after these varieties were release. However, PVRs now provide a vehicle that New Zealand can use to protect new apple varieties. This development has provided an incentive for New Zealand to look innovatively at ways of doing business on a global scale and capturing the benefits of local innovation.

In 2004, Pipfruit New Zealand Ltd. and HortResearch have entered a joint venture on apple breeding with Apple & Pear Australia and the Associated International Group of Nurseries (includes nurseries in Argentina, Australia, Belgium, Chile, France, South Africa and USA). HortResearch will provide its partners with exclusive access to existing trial varieties and the fruits of their ongoing research. This company will be responsible for developing, licensing and marketing the pipfruit varieties.

2. Timeline for innovation - New apple variety *Jazz*™

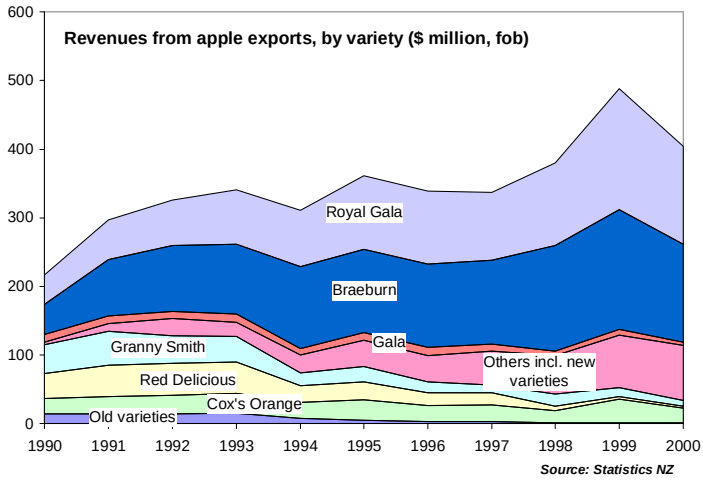


3. Science & Innovation Features:

- *Jazz*™ is a new apple variety selected and bred in New Zealand. *Jazz*™ continues the country's proud history of developing novel apple varieties. It was granted a New Zealand PVR in 2002 and applications have been made for a US Plant Patent and a European Union PVR grant.
- *Jazz*™ marks a significant change in New Zealand's apple breeding philosophy whereby the present and future focus is on breeding and developing apples for global production (not to be grown solely in New Zealand). This will allow New Zealand marketing organisations to source quality apples from both New Zealand and overseas producers and market these new varieties year round on a brand and/or variety basis.
- The New Zealand fruit sector is making innovative changes to market infrastructure and brand competition. The changes are reflected in the way in which *Jazz*™ has been released. The year round supply of fruit to market will be managed by sourcing apples successively from New Zealand's Southern Hemisphere orchards, and Northern Hemisphere orchards. This approach will provide a continuous and reliable supply of apples to supermarkets, rather than just another seasonal product.
- The commercial development of *Jazz*™ is occurring simultaneously in Northern and Southern Hemispheres. ENZA has global control of marketing *Jazz*™ because orchardists in New Zealand and overseas must have a contract with ENZA in order to obtain trees and the fruit must meet the ENZA specifications.
- Royalty fees from New Zealand and overseas producers come back to HortResearch where they are employed in the tree management and integrated fruit production programmes, as well as the ongoing breeding programme. Another innovative practice relates to the collection of the royalties. These are paid on the fruit sold from the orchard, not on the trees sold to the orchard, which is the usual method used by breeders to collect plant royalties.
- *Jazz*™ is protected by a PVR and trademark and has been released globally under control from New Zealand. *Jazz*™ illustrates how fruit produced by the next generation of New Zealand apple varieties can be placed on the global market, because the varieties can be protected by PVRs.

4. Benefits

- The variety profile of apples exported from New Zealand has changed continuously over the years. The changes during the 1990s are illustrated in this figure. *Jazz*™ is another variety that continues this tradition, enabling New Zealand to retain a competitive position within global markets.



- The apple variety *Jazz*™ has been granted a PVR. This protects the variety and allows worldwide production and marketing of the apple by New Zealand organisation(s) whereby some of the economic benefits can be

captured by New Zealand, and plant royalties returned to the New Zealand breeder.

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 counterfactual[1] situation, which identifies a possible industry performance, had the innovation not happened.

Key information used in the analysis:

1. *Jazz*™ was first planted on New Zealand commercial orchards in 1996, on commercial orchards in Washington State, USA in 1999, and on commercial orchards in France in 2000. By 2003, some 450,000 trees had been planted on commercial orchards worldwide.
2. *Jazz*™ apples were first exported from New Zealand in 2002 and placed on the domestic market in 2003. Approx 75,000 cartons of *Jazz*™ apples were exported from New Zealand in 2004.
3. The offshore production of apples lags behind New Zealand production by about three years. Ultimately, the New Zealand and offshore production will be similar.
4. Royalties on *Jazz*™ trees grown both in New Zealand and overseas are paid to HortResearch.
5. At present *Jazz*™ returns a significant premium over other varieties. This premium is expected to continue for the medium term.
6. There are significant legal and market development costs associated with the development of *Jazz*™. These development activities are critical to ensure that quality apples are produced from all orchards independent of the country of origin.

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

- Industry sources suggest that without *Jazz*™ the orchardists would probably choose to grow *Royal Gala*. The counterfactual assumes that orchardists replace older varieties about every 15 years. If *Jazz*™ had not been produced it was assumed that the orchardist would have planted *Royal Gala*.
- Assume that *Royal Gala* is not grown offshore by New Zealand entities. There would not be an opportunity to manage year round supply of apples into the Northern Hemisphere markets.
- *Royal Gala* does not attract royalties.
- Assume that the orchard management and post harvest technologies are similar for *Jazz*™ and *Royal Gala.*

Assessment results:

	as at 2004	as at 2009
Internal Rate of Return[2]		13%
Net Present Value[3]		$2.8 million

[1] *Refer Appendix*
[2] *Refer Appendix*
[3] *Refer Appendix*

The 2009 assessments are based on the assumptions that:

- Industry's forward projections of production and prices for *Jazz*™ and *Royal Gala* apples will be met.
- The price premium for *Jazz*™ over *Royal Gala* will decrease towards 2009.
- HortResearch's forward projections of royalties will be met.

6. Quotes:

"Innovation is a key factor in our success……..New Zealand presently leads the world in new (apple) varieties and we must maintain this momentum and commitment". NZAPMB Annual Report 1991.

"Competitors are marketing increasing volumes of our flagship varieties, Braeburn and Royal Gala. It is essential we develop new premium varieties to keep ahead of the competition". NZAPMB Annual Report 1994.

"Jazz™ begins with a sweet Gala rush that carries over to a tangy effervescence. Its crispness and crunch are unbeatable." www.nelsonapples.com

7. Related activities:

"*HortResearch's help has been instrumental in applying our collective experience of growing Pacific Rose™ in New Zealand to a successful growing programme in Washington, USA."* Steve Potbury, Variety Development Technical Manager, ENZA Ltd. HortResearch Research report 2000/01.

8. Information Sources:

Information supplied by:

- Allan White & Richard Voltz, HortResearch, Hawke's Bay. The apple breeding programme is based at HortResearch, Hawke's Bay, under the leadership of Allan White.
- Stuart Tustin, HortResearch, Hawke's Bay.
- Steve Potbury, ENZA, Hastings.

Other references

- Bollard, E.G., August 1996. *Further Prospects for Horticulture – the continuing importance of research*. 94 pages. New Zealand Fruitgrowers Charitable Trust.
- Wratt, G.S. and H.C.Smith. 1983. *Plant Breeding in New Zealand.* 309 pages. Published by Butterworths of New Zealand Ltd. in association with DSIR.
- *World Apple Review* – 2004 Edition. Belrose Inc. Pullman, Washington. USA.
- 122 pp.
- White, A G, P L Brookfield, R Weskett, S Legg, D S Tustin, J Hughes, M White. *Breeding and development of the new apple variety Jazz™.* [Poster]. HortResearch.
- *Pipfruit joint venture.* July 2004. Horticulture News. P 5.

Appendix

The working definitions used in this assessment were as follows:

[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.*