17. Fresh Onions: a 5,000 year history – and New Zealand exports 200,000 tonnes each year

Onions, for centuries the most used flavouring vegetable in the world, are grown in over 175 countries and the volume in international trade is estimated to be about 3.8 million tonnes.

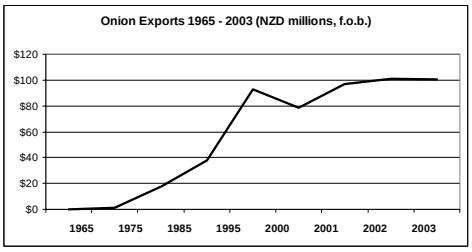
New Zealand's onion exports commenced in the 1960s but remained at small volumes (less than 15,000 tonnes) until the mid 1970s. Exports increased to around 70,000 tonnes by 1984 with 50,000 tonnes to Japan, however with the loss of much of the Japanese market to local competition, New Zealand's onion exports fell away sharply in 1987 to just 28,000 tonnes. At that point the New Zealand industry had to refocus upon exports to Europe.

The UK market was very quality focused with demand for high quality product for 12 months of the year. To ship that far the product had to be of excellent quality. With market innovations, innovative breeding and selection, and improved handling methods such as shipping in ventilated containers, growers and exporters increased export volumes to over 210,000 tonnes (Europe 41%, Japan 22%, UK 17%, other countries 21%) by 2000.

The main variety grown in New Zealand originated in the 1920s and became known as *'Pukekohe Longkeeper',* a good storage onion that could be exported around the world. In opening up markets, 90% of New Zealand's export onions came from Pukekohe where the Patumahoe clay loam soils and humid climate made it especially suitable for growing onions - characteristics not easily duplicated in other locations. Growers and exporters shared the risks in developing our export markets. To quote an industry supplier, *"the growers and exporters 'fall and die' on what you deliver in the market place".*

Progressively the New Zealand onion industry refined the qualities of onions in terms of: * yield, * skin quality and appearance, * robustness and * greater consistency. Fresh onions are now New Zealand's highest value export vegetable at around $100 million (f.o.b.) and 200,000 tonnes since 1999/2000. Onions are New Zealand's fourth highest value horticultural export and was ranked third until overtaken by wine exports in 1997.

New Zealand represents only 5% of global onions trade, and is the largest exporter to the European Community. If the Chinese become the largest onion exporter – as they might, New Zealand will need to specialise and to recognise the strength of competing exporters from South America, South Africa and Australia.



The industry acknowledges the need to support and fund R & D to enable continued growth. Onion white rot disease is a global problem that is compounded by intensive production systems. A second hazard, the pest onion thrip, is very hard to detect, hard to control and resistant to approved chemicals, and may only become apparent on an onion bulb on arrival in a distant export market.

New Zealand's *Crop & Food Research* and also *HortResearch* are world leaders in this type of research as only two other locations, in Wisconsin, USA and Holland, have acknowledged capability. Breeding for genetic improvement in onions is a 10 to 15 year project which means that plants initially selected in 1999 are not likely to be in the market until 2013 as each cycle takes two years to breed.

Crop & Food Research have been working for 15 years to understand the flavours and characteristics of onions. John McCallum, a researcher with Crop & Food Research says *"There is a huge wave of information that has become available. The challenge is to find ways of making practicable applications."* Already, they have patented a unique way of putting the genes in onions and new cultivars are being developed with better colour, uniformity and storage life to meet market requirements.

1. Background

Onions are the most used flavouring vegetable in the world and references to their history go back 5,000 years or more with Chinese cultivation, 3,500 BC for the Egyptians, the sixth century BC in India, the first century AD in Greece, and many references through the Middle Ages of European development.

Onions may be one of the earliest cultivated crops because they were less perishable than other foods of the time, were transportable, were easy to grow in a variety of soils and climates. Onions had health conferring properties, prevented thirst and could be dried and preserved for later consumption when food became scarce.

World Onion Production
At least 175 countries grow onions. According to the United Nations Food and Agriculture Organisation, there are an estimated 2.7 million hectares of onions in the world, producing 48 million tonnes each year. Approximately 8 percent of this global onion production is traded internationally. Leading onion production countries are China, India, United States, Turkey and Pakistan. Onions come in three colours - yellow, red, and white. Approximately 88 percent of the crop is devoted to yellow onion production, with about 7 percent red onions and 5 percent white onions.

Onion Nutrition
Onions are low in calories yet add abundant flavour to a wide variety of foods. With only 30 calories per serving, onions have sodium, fat, are cholesterol free, and provide dietary fibre, vitamin C, vitamin B6, potassium, and other key nutrients.

In addition, onions contain a variety of other naturally occurring chemicals known as organosulphur compounds that have been linked to lowering blood pressure and cholesterol levels. Onions supply some vitamin C, folate and fibre and small amounts of a range of other vitamins and minerals.

Research indicate that phytochemicals in onions, including antioxidants and sulphur compounds may result in a number of health benefits from cancer protection and heart disease protection through to a reduction in symptoms of osteoporosis, asthma and diabetes.

2. NZ Production

The main variety now grown in New Zealand originated in the 1920's when John Turbot, a Pukekohe grower, produced a crop of onions using two imported seed lines: the brown Spanish (or Australian brown) and the straw Spanish. When they were mature he took a selection from the straw Spanish crop and sold his first seeds to fellow growers in 1929 which became the well-known *'Pukekohe Longkeeper'* (PLK). A variant, *'Pukekohe Early Longkeeper'* also has excellent keeping qualities.

PLK is an open pollinated variety (can't be easily protected), whereas most other onions are hybrids (mostly sterile and therefore can not be readily re-seeded). The PLK does however have a wide spectrum / gene base and has allowed growers of onions for seed to progressively improve the variety.

Rapid growth of the onion industry has resulted in increased production in major onion producing regions such as Pukekohe / Waikato (68%) and Canterbury (16%) with Hawkes Bay and Manawatu also being important areas. The onion industry has grown from one

having few small producers with relatively small quantities produced, to now about 150 growers averaging 37 hectares and 1,400 tonnes each.

The Patumahoe clay loam soils and climate (temperature, rainfall and humidity) near Pukekohe made this region especially suitable for growing onions for export markets. These characteristics are not easily duplicated in other locations as light quality and soil type can affect flavour – possibly more so than genetic differences.

New Zealand has a 10-week window for exports and has the largest market share in competition with onions exported from Tasmania, South Africa and Argentina.

Exports of onions commenced in the 1960s but remained at small volumes (less than 15,000 tonnes) up to the mid 1970s, then increase to around 70,000 tonnes in 1984 with 50,000 tonnes to Japan. With the development in Japan of a Hokkaido long storage onion crop, and increased competition ofrm cheaper Mexican onions, New Zealand's onion exports fell away sharply in 1987 to just 28,000 tonnes (11,000 t. to Japan, 5,000 t. to UK and 11,000 t. to other countries). At that point the New Zealand industry had to refocus upon exports to Europe. New Zealand onion exports to Europe commenced in 1989 with just 5,000 tonnes.

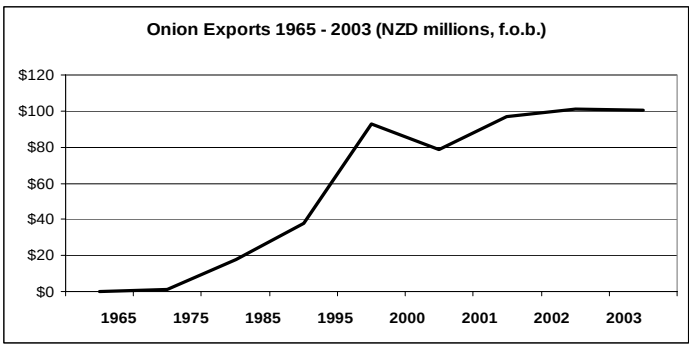
The UK market was very quality focused, whereas many other markets are discount or price focussed. The UK was therefore a good opportunity market for New Zealand to supply during the Northern Hemisphere off-season. . However major quality challenges had to be overcome because of the distance of NZ from this market. The potential for quality deterioration to occur on the long (6 to 8 week) sea journey through fluctuating temperature and humidity conditions from New Zealand's temperate climate, through the tropics into the cool northern hemisphere are conditions that provided an ideal environment for the development of fungal rots and sprouting.

With market innovations, improved breeding and selection, and improved handling methods, growers and exporters increased export volumes significantly to the point that by year 2000 exports had reached over 210,000 tonnes (Europe 41%, Japan 22%, UK 17%, other countries 21%).

The main export markets for New Zealand onions today are United Kingdom, Germany and Japan.
The volume in international trade is estimated to be about 3.8 million tonnes of which New Zealand's exports represent about 5 percent.

3. Science and innovation features

Onions exports have plateaued in the past four years and decline unless more R&D is undertaken to further enhance quality and reduce losses in fruit destined for exported to distant markets.



With the change of focus to Europe, many changes were required. The Japanese market required large bulbs, whereas markets in Europe required small bulbs. The industry has responded to these market needs and has a reputation for supplying a high quality product. New cultivars are being developed with better colour, uniformity and storage life to meet market requirements.

Whilst the Pukekohe Longkeeper (PLK) variety has remained the main stay of New Zealand's onion exports, continuous breeding and genetic improvements are essential to future market success.

Particularly important has been the industry's ability to achieve
- a more consistent quality of product , and
- re-examine harvesting methods. Currently it is estimated that up to half of the export onion crop is hand clipped at harvesting as this has proved to be important in achieving a superior skin finish and overall higher quality product.

Progressively the industry refined the qualities of onions in terms of:
- yield
- skin quality and appearance
- robustness
- more consistency
- resistance to disease
- longer storage life characteristics.

In onions, sulphur compounds affect flavour and dry matter affects storage. The challenge for researchers was to find out how the two might be linked. Crop & Food Research have spent 15 years attempting to understand the flavours and characteristics of onions and have now identified key genetic characteristics – to be able to use molecular diagnostics to identify traits from small samples. As a result future breeding should be more focussed than in the past and the potential exists to achieve a marked improvement in targeted onion quality attributes.

The PLK variety had long keeping qualities from the outset, but this was dependent upon having suitable carriage and storage conditions. Improvements in shipping methods at a viable cost was achieved by the development of ventilated shipping containers that allowed good airflow over the harvested onions whilst in transit to distant markets. This was especially important as most of New Zealand's export crop crosses the equator and can be on board ship for several weeks.

The industry has acknowledged the importance of vertical integration. There is acknowledgment from the industry of the need to support and fund R & D to enable continued growth of the industry. The disease onion white rot and the pest onion thrip have received industry funding and remain priorities.

4. Benefits

Fresh onions are New Zealand's highest value export vegetable at over $100 million since 1999/2000 and production in excess of 200,000 tonnes.

5. R&D investment

Through a voluntary levy paid by growers and on each tonne of exports, and a Vegetable Commodity Levy, the industry contributes to research investment. In 2000/2001 research funding was over $600,000 with two thirds being met by the MAF Sustainable Farming Fund.

Research Priorities

The industry lists the following as their research priorities with the majority of recent research funding having been directed to developing technologies to control onion white rot and onion thrips.

- Disease control particularly for onion white rot. White rot remains an economic threat, but its incidence fluctuates between seasons. In some areas, whole paddocks can be destroyed by white rot. On-farm hygiene programmes and other practices such as the selective use of fungicides has improved control.
- Pest management particularly for thrips.
- Post-harvest handling of product from farm to the kitchen
- Improving shelf life capabilities for transit. Examples are the extensive work done in trialling door-off and ventilated or 'fantainers'
- Breeding and plant improvement programmes for higher yield and quality, consistent shape, better skin quality and enhanced keeping quality.
- Satisfying market requirements for evolving consumer tastes. New cultivars are being developed with better colour, uniformity and storage life to meet market requirements.

6. Strengths

- The onion industry is a well established export industry
- Growers are committed to investment in production, grading, packing and storage.
- Grower's control the production right through to packing, for majority of the export production.
- Industry has a good reputation for high quality standards and reliable supply and a "can do" attitude of having to make it happen.
- An industry based on the world's best brown storage onion types.
- Production techniques are based on more then 20 years of local research and 30 years of experience in Pukekohe.
- Good reputation and proven commitment to quality.
- More stable volumes consumed in each market.
- Onions are considered a key food ingredient.
- Co-ordinated grower and exporter funded research.
- Co-ordinated grower and exporter's collaboration on access to markets and on transport/shipping issues.

7. Outlook

- Past research has shown a high level of adoption by industry – including both growers and exporters e.g. thrips control and use of ventilated containers. Some exporters have been shipping by chill container and achieving outturns that offset increased costs.
- Research is well directed and focussed on industry needs as a result of having a mechanism to identify priorities and evaluate proposals.

- Research is vital to develop better techniques and varieties which will meet higher standards expected by importing countries.
- Canterbury is becoming a major area of production.
- Recent years has seen less volatility in production volumes.
- Funding from industry has improved.
- It is estimated that about 40 to 50% of crop is hand clipped. Total machine harvesting does not achieve same consistency in quality.
- Greater coordination within the sector is expected

8. Statistics (2003)

- Number of Growers - 150
- Number of Exporters - 19
- Planted Area (ha) - 5,488
- Production: 210,000 tonnes
- Sales values: ($ million)
  - Fresh domestic $25m
  - Fresh Export $ 100.5m FOB

9. Information sources

- Colin Eady and John McCallum, Crop & Food Research, Lincoln (interviews)
- NZ Vegetable & Potato Growers Federation (Inc) www.vegfed.co.nz
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- New Zealand Horticultural Facts & Figures, 2003 (HortResearch)
- Kevin Wilcox, Managing Director, A S Wilcox, Pukekohe (interview) (onion growers and exporters)
- Grant Ryan, principal, May & Ryan, Pukekohe (interview) (produce and supply the largest volume of onion seed to the New Zealand industry).
- Webber, D., Buchan, D.J., Cosslet, C.B., Santorum, A., Wood. R.J., Fullerton, R.A., 1999 *'High Stakes in Pukekohe: An economic and social assessment of the onion industry with special reference to the impact of onion white rot disease in the Pukekohe area.'* HortResearch Technical Report No 1999/224, 53pps.

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 growing**futures** 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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