

## Invited Address

### Seed Quality in New Zealand – Historical and Current

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#### Abstract

The New Zealand seed industry developed from an awareness over 100 years ago that standards were required for sale and purchase of seed. This paper outlines twelve decades of growth, covering seminal moments and major contributors. It also covers important components of physical seed quality.

#### Introduction

The New Zealand Seed Industry has always upheld quality as a key driver for the industry moving forward. Key factors involved include the contributions and input of breeders, seed producers, the seed certification Bureau of AsureQuality Ltd, the New Zealand Ministry of Agriculture, seed cleaners, seed laboratory analysts and seed traders and marketers. Hence seed quality in the context of the New Zealand seed industry is not limited to just the physical quality of the seed lot.

Records show that prior to 1895 and indeed up to the year 1917, the terms and standards of sale and purchase of grain, seed and produce in New Zealand were in a chaotic state, both in domestic and international trade.

There was much debate within the New Zealand seed industry in 1917 and 1918 and at the end of that period, the New Zealand Grain, Seed and Produce Merchants Federation, was formed. The Federation learned very early on that quality standards were essential for orderly business and determined that industry, whatever it is, must be capable of delivering what the purchaser has ordered.

It was well recognised that it was standards of quality that lead to this formation and it was standards of quality and their maintenance that brought about the close association between the Federation, New Zealand farmers and the New Zealand Department of Agriculture.

#### Early Influences

New Zealand's early farmers soon realised that this country held some potential to be developed into an agricultural nation with the ability to export much of its produce.

A number of related factors and activities were happening simultaneously and it is now that when we look back over the past century that we can understand that these activities were all aimed at positioning New Zealand towards agricultural excellence in the seed industry. This had to be achieved by paying close attention to all aspects of quality.

In the first part of the 20<sup>th</sup> Century New Zealand was developing an active domestic grain trade and an active export seed trade. The New Zealand Department of Agriculture had a controlling interest in all manner of agricultural activities and so was both very supportive and demanding. The seed merchants in New Zealand had already started with governing their own industry. The botanists of the time also realised the potential and were influential in industry development. The comparisons of New Zealand were often with the United Kingdom, where many of the early settlers originated.

### Botany

Mr Reginald George Stapledon, an eminent Professor of Botany and the First Director of the Official Seed Testing Station, Cambridge in the United Kingdom, was to play a significant part in the seed quality standards of New Zealand's seed industry.

Early in the 1900s Stapledon aroused considerable interest by revealing the deplorable state of the grasslands of Great Britain. Most of the century-old pastures on the lowlands and nearly all of the uplands were dominated by weeds and inferior grasses, and contained practically no clovers. Only the farmers practising a rotational farming system had reasonably good pastures. Most pastures were short-lived as a result of sowing poor strains evolved through repeated sowing and reaping for seed under a largely arable farming system. Little attention was given to selection and breeding, and the system tended to encourage quick establishment of annual strains of pasture plants.

The same kind of deterioration was fast taking place at that time in New Zealand, caused by the saving of seed from the short-rotational farming systems of the South Island. Short-lived, more or less annual strains of ryegrass, and white and red clover were being evolved, which failed to make suitable permanent and long-rotation pastures, irrespective of the soil or management conditions.

Stapledon set out to improve the position in Britain. He established the Welsh Plant Breeding Station and developed it with a strong grassland bias, breeding and multiplying pedigree strains of more persistent indigenous ryegrasses, Kentish wild white clover, Montgomery red clover, leafy timothy and cocksfoot strains. He also used European strains and some of the permanent-pasture, leafy, and higher producing strains from New Zealand. His tests of pre-certification seeds at the Welsh Plant Breeding Station clearly showed that all was not well with the New Zealand grass

and clover seeds then being exported. Indeed, at that time there was an active industry in New Zealand of importing seed to try and overcome the shortcomings of New Zealand's indigenous strains of the time.

Around this period, Mr Alfred Hyde Cockayne, a biologist, was a director of the Fields Division and Plant Research Station, (and an eventual Director General of Agriculture) and was also the first president of the New Zealand Grassland Association, which was inaugurated in 1931. While much of his work was around pastoral agriculture, he was a strong advocate of the use of clean and viable seeds and of a seed control system.

Stapledon made a visit to New Zealand in 1926 and inspired the setting up of herbage strain testing in 1928. This led to the certification of high quality seed both for export and the renewal of our own pastures. At the request of Alfred Cockayne, Stapledon's understudy, Dr. William Davies, was seconded to New Zealand for two years and he helped materially with the strain testing work being vigorously pursued here.

### Seed Imports

The importation of pasture seed into New Zealand was a popular activity 90 years ago and in the 1924/1925 edition of Wright Stephenson & Co.'s 'New Zealand Pasture Grasses' catalogue and handbook, there are a number of insights into the New Zealand seed industry at the time. The opening statement is thus:

'Farmers in the Old Country have been educated into buying the best seeds. The British Government has taken this matter up very strongly in the past few years, and we only wish the New Zealand Government would move in the same direction. It would assist firms, like ourselves, who protect the farmers interests by retailing only the very best seeds.'

### **Seed Production**

Farmers and merchants soon discovered that New Zealand was an ideal country for seed production which was developed initially from the imported strains of a number of species.

### **Seed Merchants**

At the outset of the formation of the New Zealand Grain, Seed and Produce Merchants Federation in 1917/18, the merchants had clear aims of developing quality and orderliness to their business operations. Much of their deliberation as a federation was aimed at the government departments of the day along with their own internal governance. The National Federation was split into regional associations where at annual conferences they each had representation to form and develop the rules of the federation. There was much discussion and interpretation issues, especially between the North and South Islands.

In 1919, they had to impress on the Minister of Railways the importance of supplying accurate weights from rail wagons as these were the basis on which much produce was bought and sold.

In 1921 a remit was proposed (from Auckland) to allow rejection of grain that contained thistles. This proposal was lost but does demonstrate the thinking on quality issues of the time.

Underlying all of these activities in the 1920s was a proposal by the New Zealand government to introduce a Seed Bill into parliament as law. This was vigorously opposed by the Federation as it was thought that the already established careful methods of the seed trade generally and the wider seed community was sufficient to protect the New Zealand consumer. New Zealand today remains one of the few countries in the world without a seed act. This is testament to the work done by the Federation some 90 years ago.

By 1928 the terms, regulations and conditions for the trade in grain, seed and

produce in New Zealand were very extensive and in fact have pretty much remained untouched since that time.

In 2008 the New Zealand Grain, Seed and Trade Association (NZGSTA) began updating many of these terms purely for language modernisation and to reflect actual trade activities as they take place today.

### **Seed Certification**

From the earlier work of botanists in developing better pastures for New Zealand it was quickly realised that varietal or strain purity must be maintained to get the best out of these new varieties or strains.

From 1929 the New Zealand agronomist, Mr J. Hadfield, inaugurated a pasture seeds certification scheme which was successfully operated for many years by Mr J. Claridge.

Later our certified strains were improved by outstanding plant breeders such as Sir Bruce Levy and others and for many years New Zealand lead the world as far as seed certification and plant breeding was concerned.

The OECD seed certification scheme was started in the EU shortly after Second World War. In 1961 Canada and the United States of America joined followed by New Zealand in 1967.

The New Zealand Seed Certification system as we know it today has been successfully operated for many years. The Palmerston North Seed Testing Station was involved in plot testing seed lots for strain purity from an early stage of the seed certification programme in New Zealand.

### **Seed Testing**

With increasing seed activity in New Zealand, the Department of Agriculture became involved as early as 1895 with advisory and experimental seed testing work under the direction of Mr T.W. Kirk.

Some early seed testing analysis in New Zealand was undertaken initially within the offices of various firms that traded in seed.

During 1909-1914, seed testing was carried

out as a regular service for farmers and merchants by the Department of Agriculture seed laboratory based in Wellington.

From 1914, Mr E.B. Levy (later, Sir Bruce Levy) was in charge of, and responsible for, development of the Seed Testing Station. Early reports were in the form of letters which stated:

I have the pleasure to inform you that your sample of ..... germinated 99%.'

This was later changed to a simple report form with other information relating to the seed lot on the reverse. The seed laboratory changed locations a number of times and was finally located at Palmerston North in 1928, where it was titled 'Official Seed Testing Station for New Zealand.'

### **Plant Breeding**

The importation of seed in the early part of New Zealand's colonisation is well documented and the subsequent seed production from these imports is also well known as this has been fundamental to the origins of the New Zealand Seed Industry. However, these practises gave variable results and in some cases disappointment to the purchaser, both domestically and in export markets. The recognition of this lead industry and the Department of Agriculture to introduce the seed certification scheme.

This means of identifying seed types and areas of seed harvest gave encouragement to breeders to develop these varieties further. Initial breeding objectives were probably aimed at the purification of seed lines and strains but this soon developed in pasture seed species to looking at productivity gains. Along with this was the need to match pasture production with the best growth season. These activities were driven by a number of eminent grasslands scientists, and the associated Grasslands Division of Department of Scientific and Industrial Research, subsequently AgResearch.

In the 1970s private breeders started in

earnest in New Zealand to adapt further our eminence in pasture seed breeding. This has been very successful as their aims towards animal productivity have outstripped their northern hemisphere colleagues who have long been targeting dry matter production as a principle attribute from pasture species.

### **Physical Seed Quality**

#### ***Seed moisture content***

Seed moisture content is often taken as accepted, but this is probably the most important quality aspect of seed because it has a major effect on the medium and long-term storage life of the seed. It also has a major effect on plant performance and has to be at appropriate levels for seed to survive global transport conditions, often through extremes of temperature in short periods.

The regions on the east coast of the South Island give us an excellent environment for seed production and in many summers, natural safe seed moisture levels are achieved easily. Following on from this, the region's low levels of humidity aid safe seed storage for long periods.

Artificial drying is undertaken by growers of ryegrass seed following the tried and true principles developed by New Zealand industry specialists such as Mr Clem Crosby. This has the benefit of minimising seed losses at harvest.

Today, we are getting demands from some global customers to aim for levels of seed moisture in some seed products that are around 6%. This can be achieved only with artificial drying after harvest. The aim is to provide low moisture so that inventory can be carried over from one year to the next through climates that have high temperatures and high humidity, without any deterioration in seed germination.

#### ***Seed Purity***

Seed purity includes both agronomic purity and physical purity. Agronomic purity starts with the breeders pure seed lots. From this seed, for certified seed, agronomic purity

can be maintained through the generations until we get to commercial seed lots, through the seed certification system. This is a well-proven system and as already stated was developed very early on in New Zealand. Today, the production of genetically-modified seed in some countries relies heavily on the systems developed with seed certification.

The seedsman's training in seed certification has meant that these same sound principles are applied equally as well to some species of not certified seeds, e.g., the production in New Zealand of many species of vegetable seed.

The end result is that the customer has some assurances that the seed being purchased is true to type, having been produced within a sound seed quality system.

Physical purity involves cleaning the seed lot harvested from the production field over a series of mechanical separation devices that aim to distinguish between the crop seeds and the weed seeds through physical differences (e.g., shape, length, weight, colour or specific gravity). The goal is to remove the undesirable weed seeds from the seed lot. This needs to be undertaken to meet normal quality for domestic sales within New Zealand and to meet importing country border standards in the global seed markets.

### ***Germination***

There are well-recognised global quality standards for germination for different species of seed with some tolerance allowances to a set minimum germination level. The tolerance value forms a measure to calculate the discount value of the price of the seed.

### ***Endophytes***

Novel endophytes have been recent additions to the quality parameters of seed, especially for ryegrass and tall fescue. There is much to say about this subject; briefly, the care and storage of novel endophytes has raised a whole new set of issues. Cool storage and even freezing of seed lots to retain the quality levels of novel endophytes is common place, and there are other well-known protocols in the handling of such seeds.

### ***Seed Counts***

Seed counts are common in larger seed species such as cereals, corn, beans and garden peas. It is common practice to package some of these species in seed counts of say 100,000 seeds and occasionally the packing weights are adjusted to give 100% germinable seeds or pure live seeds. This is often calculated within sowing rates so that desired plant populations are achieved in the production field.

### ***Summary***

There has been much development in both the science and commercial arms of the New Zealand Seed Industry all aimed at excellence. Nevertheless, the essential elements and principles of seed quality remain today as they were established here 100 years ago.

The role of the seed merchant today is not simply that of a seller of seed. Merchants have to manage the various key quality parameters that are found in the analysis of seed lots, fulfilling the role that seed industry forbears knew was essential: delivery of sound, quality seed to customers.