A European Canker (Nectria Canker) review

The effect on an industry striving to achieve $1 Billion by 2022

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Executive Summary

In 2013 the New Zealand Pipfruit industry produced 18m Tce (tray carton equivalent used as a standardised unit for quantity of apples) of export fruit generating $504m in revenue. As part of the pipfruit industries representative body Pipfruit New Zealand Inc strategic review a target of becoming a $1b industry by 2022 was issued thus indicating a requirement for growth of almost 100% over 9 years.

Since 2008 European Canker (Nectria Canker) infections have significantly increased due to weather events and lack of grower education of techniques to mitigate the infection.

To date there have been no official statistics quantifying the extent of the infection rate nationally, however anecdotal information provided through observation, contracted quantitative surveys on orchard and an industry leader survey suggests canopy infection could be as high as 15%. Best practice to date highlights the need to remove infection from the orchard in turn suggesting up to 15% of cropping potential could be lost.

In 2013 at a rate of an estimated 7.5% loss of production in Central Otago and Hawkes Bay combined with a 10% loss of production in Nelson and other pipfruit producing regions it could be estimated that up to 1.5m tce worth of production is currently being lost to European Canker. This translates to $42.2m in potential lost revenue through lowered hectare productivity.

After surveying a number of high level industry representatives (consultants, grower representative bodies, growers and industry body representatives) it cannot be said with confidence that the infection rate is being maintained but more than likely it could be increasing.

If this infection rate were to increase by 5% (13.5% and 15% respectively) across a $1b industry it can be estimated that growers would have the potential to lose an estimated 4.6m tce in production which translates to a staggering $143m.

For the pipfruit industry to realise its target of $1b by 2022 a combination of increases in productivity, new varieties and increased unit sales price are required along with significant development.

With EC potential to erode productivity and potentially increasing the industry is required to reassure corporate investors that New Zealand pipfruit production is a sensible investment option.

It has been identified through the survey that not only do we lack skilled researchers to better address this disease, but IP ownership coupled with market access sensitivities appear to be hindering free flow of knowledge with offshore specialists.

EC awareness is important to address and mitigate the infection further however knowledge of the disease within New Zealand pipfruit in market has serious ramifications on market access.

After evaluating the differing aspects of this disease, the primary objectives and functions of Pipfruit New Zealand and a better understanding how EC effects participants within the industry I am convinced management for the advancement in in field of EC mitigation is a function should be directed by PNZ under guidance of the industry participants.

Ideally a stepped assessment of the current infection levels of the disease and a quantified risk assessment of sensitive market access driven by industry body PNZ would be valuable.

This would derive the information needed to tactfully approach corporate investors and industry to form a research program sensitive to market access cautions but still providing growers and investors with reassurance that EC infection is a point of focus.

Funding could be leveraged between collaborative research bodies, corporate's and government allowing free access to findings.

Introduction to an Industry with a target to reach $1 Billion by 2022

New Zealand produces between 1% and 2% of global pipfruit with 50% of the New Zealand production controlled or owned by vertically integrated companies through consolidation. These figures were prior to T&G's purchase of Apollo or Freshmax purchasing Energie and Crasborn Bros in 2014 which consolidates up to a further 1,000 ha of producing land. This is an important aspect when considering specific market by market sensitivities coupled with producer territory sensitivities as a number of corporates are involved in global production and global IP management potentially broadening the view on a sensible resolution.

The New Zealand Pipfruit industry exported 324k tons from a planted area of 8,760 ha (average of 37 t/ha net). This crop is second only to New Zealand's 2004 record crop of 364k tons from a planted area of 12,846 ha (24 t/ha net). Interestingly this translates to 24% increase in productivity per planted ha over the past 9 years even with a reduction in planted area of 33%. 2013 volume was a 12% increase on 2012 – *PNZ 2013 Statistical Annual.* A proportion of this annual increase in productivity could be attributed to maturing canopy therefore should not be extrapolated year on year as it will depend on rate of development. Hectare productivity is an important aspect to consider when discussing effect of EC as a reduction in hectare productivity will mean a requirement for development of a greater volume of land to contribute to the required fruit volume to meet the industry target of $1b by 2022.

94% of New Zealand's pipfruit production is sourced from Hawkes Bay (61%), Nelson (29%) and Central Otago (4%). This total has been consistent for Nelson over the past 9 years however Hawkes Bay has seen a substantial increase of 7% which has been at the cost of "Other" producer regions which have reduced from 12% to 5% – *PNZ 2013 Statistical Annual.* This regional growth can be attributed to a number of factors including environmental suitability for pipfruit production, locality of corporate investors, varietal mix vs optimal market alignment and logistics to shipping ports. As Hawkes Bay, Central Otago and Nelson have differing infection rates of EC and a differing rate of pipfruit development within the industry this aspect is required when considering the landscape of the industry in the future.

Hawkes Bay is generally up to two weeks earlier than Nelson and 3 weeks earlier that Otago the latter two producing regions. This allows swift access to high paying spot price Asian markets.

The New Zealand Pipfruit industry had 370 export registered orchards in 2013 which is a reduction of 84 since 2009. This is of interest given that export marketers since 2001 (de regulation) increased from 1 in a regulated single desk environment to a high of 95 in 2009. This has since reduced to 84 – *PNZ 2013 Statistical Annual* with 9 commanding nearly 70% (12.7m tce) of the volume and hold more than 500,000 18kg tray carton equivalents (tce) each out of the 18m tce of finished product exported out of New Zealand in 2013. This depicts the change in an industry that would have previously needed a myriad of growers to have come together to represent themselves to build substantial strength, however now 70% of the industry is being handled by 9 key marketing representatives (mostly vertically integrated) each with substantial strength, financial backing and each relying on continued supply to sustain their business. Which is more important? The industry body or collaboration between these marketers?

A diversification to new varieties in higher customer demand, higher density plantings and improved efficiencies on orchard coupled with New Zealand continuing to command a premium for its product has meant financial performance has continued to sustain growth within an industry with less participants at a growing level.

Whilst nearly 60% of the countries volume is still Braeburn and Royal Gala there is a general trend towards varieties such as the Pacific series, Fuji, Jazz™, Envy™, Ambrosia™, Smitten™ and Pink Lady®. These new varieties are generally classed as restricted IP managed by licenced parties. This is of importance as the stakeholders of each of these IP managed varieties require performance of their own variety to be optimal to ensure a revenue stream. EC is understood to be effecting specific varieties more severely than others – *Vincent Bus 2014* therefore stakeholders with specific varietal interests will potentially focus narrowly on the key issues that challenge their investment instead of viewing it holistically as an industry and how their movements effect the industry not only their own investment.

54% of the total exported volume is marketed through 5 markets (UK, USA, Netherlands, Thailand and Belgium). Asian markets including the Middle East make up a further 36% of the market.

The New Zealand Pipfruit industry generated $504m in 2013 - *statistics NZ,* In the midst of a 20% increase in dollar value against the pound, 10% increase in dollar value against the Euro and around 40% increase in dollar value against the USD since January 2002. This shows 100% required growth to reach $1b by 2022.

To better understand what are considered "industry related" concerns as opposed to individual participant concerns and where the line can be drawn, we can review the formation of the industry body Pipfruit New Zealand by highlighting its objectives and strategy for supporting the industry and its participants.

In 2001 what then was known as the Apple and Pear Marketing Board (regulated pipfruit body) was deregulated. As part of this process the industry formed Pipfruit New Zealand Inc (PNZ) an industry funded representative body.

The PNZ establishment objectives were:

- *To provide New Zealand pipfruit growers with technical, economic and marketing information resources to enable them to be the world's best possible pipfruit producers*
- *To represent New Zealand growers nationally and internationally in a manner which ensures New Zealand growers have a competitive advantage in the market.*

The marketing, economic and policy parts of the objectives are the direct responsibility of Pipfruit NZ and the provision of technical information services is also Pipfruit NZ's responsibility

The objectives of Pipfruit NZ were expected to be provided through:

- *Encouraging and providing opportunities for New Zealand growers to discuss matters of commercial importance to their businesses.*
- *Providing New Zealand growers with the opportunity to have their commercial opinions presented in a united manner, at both a regional and national level.*
- *Providing growers with an economic, marketing and policy information services that will ensure they are able to make sound commercial decisions.*
- *Providing an industry information and policy advisory service to regional and national politicians, marketing and logistical companies, and international organisations to ensure New Zealand grower opinions are understood.*

– PNZ Website

In 2012 PNZ with the employment of a new CEO to PNZ it was announced to the industry that it wished to *"significantly improve its effectiveness in supporting the industry it serves"- PNZ strategic plan 2013*.

To build a detailed strategy a full review process took place in 2013 with results presented to industry during its 2013 industry conference Napier.

The PNZ strategic plan "A taste for the future" highlighted what the role industry participants required PNZ to take up within the industry and was summarised by 4 core role 1) Leadership 2) Representation 3) Collaboration 4) Communication. Cascading down from these 4 core roles PNZ identified 8 strategic priorities for focus so to support an industry targeting $1 Billion by 2022.

1. *Increased effectiveness at improving terms of Market access*
    - *Accessing prioritised new markets*
    - *Maintaining and improving prioritised existing markets*
    - *Responding cost effectively to crises*
    - *Future proofing the Industry*
2. *Increased focus on Asia for Market access and improvement. Helping the Industry best understand the requirements of doing business in Asia*
3. *Improved relationships with MPI, MFAT and Hort NZ*
4. *Defining, telling and helping Industry tell the NZ Apple story*
5. *Grow and improve the way PNZ generates and provides information of value to the Industry*
6. *RSE retained and enhanced*
7. *Working with Industry and related Horticultural groups in being better able to attract, grow and retain talent*
8. *Identify the most cost effective ways to access the commercialization of new varieties*

Introduction to European Canker (Nectria Canker EC)

Nectria Canker is a fungal disease caused by the fungus *Neonectria ditissima*. Commonly known globally by the name European Canker (EC). EC can be classified as one of the most aggressive and damaging diseases in commercial pipfruit production.

EC survives by developing perithecia and mycelium on infected material either live in the canopy or on debris on the orchard floor. Sporulation (conidia and ascospores) is common in wet conditions. Spores are then either transferred by wind or by splash a number of meters infecting trees in close proximity to the initial infection.

By definition a "canker" is an open wound caused by and infection or pest infestation within the plant material with a swelling within the bark surround the wound. Cankers can vary in severity, speed of spread and character.

What makes EC so difficult to identify and control is the fact that EC can lay dormant in plant material without expressing any symptoms for 2-3 years. This makes it especially difficult to identify latent infection within material used for propagating new trees, trees that are often used to replace trees already removed due to the disease. This is important when considering implications linked with the accountability/responsibility Nurserymen and propagators have in circulation of this disease. It also begs to question if it is even possible to hold a nurseryman responsible for providing infected material when in common practice it is the growers himself that provided the nurseryman in the first instance the material to produce the trees 18 months earlier.

EC moves very swiftly within the plants vascular system once infection expresses. Plant material removal is required until the wound shows now browning.

EC damage within the orchards can be summarised simply as 1) “spur or branch” infection, that is an infection that enters through bud scars, picking scars and pruning scars that can be pruned out by removing branches and 2) “Trunk” infection which is more dire as the canker eats into the main truck of the tree affecting its pipline for resources gradually strangling the tree and killing it. Removal of the tree is generally regarded “best practice”. This is what is considered as being loss of canopy and translates to loss of fruiting potential.

A trunk canker generally expresses due to a spur or branch canker not being removed soon enough and the infection reaching the trunk.

EC is not only found in New Zealand orchards but as the name hints it is found in continental Europe along with the UK, Australia, Canada, USA and South America. It can only be assumed that information dissemination between these territories is non-existent or heavily restricted due to concerns compromising market access. Sadly this will also likely mean R&D is being replicated in different territories

The severity of the disease however can be directly correlated to the environmental conditions in the growing regions. – *Robert Saville EMR*

EC through bud infection can display itself as eye rot on fruit within the orchard. This is not of great concern to New Zealand industry participants as eye rot can easily be sorted out during the grading process however it also expresses as fruit rot in storage. This is of concern regarding market access as if fruit is found to be harbouring the disease whilst being exported into countries where the disease is not present market access can potentially be revoked. This is the case for a number of Asia countries and Australia.

EC effects the commercial pipfruit industry from nursery through to customer, from loss of crop load due to removal of trees and canopy to reduced consumer supply and poor fruit quality.

Best Practice Control of European Canker (Nectria)

EC was until recently (est 2008) was not noted to be of significant concern in orchards throughout New Zealand. Infection was noted in warm wet producing areas similar to Riwaka Nelson and considered as non-existent in warmer dryer regions like Otago and Hawkes Bay. This is in contrast to other global pipfruit growing regions that have been battling EC for decades.

From 2008 it was noted that the more frequent occurrence of wetter autumns coupled with its temperate maritime climate fostered swift development of EC within the orchards. This coupled with a lack of focus in orchard management due to a lack of understanding allowed infection levels to escalate very quickly.

Once the disease was identified as being of significant concern along with growers adopting inappropriate and unacceptable orcharding practices Pipfruit New Zealand assisted in educating growers and developing a “best practice guide”.

The EC Management Strategy Ver 1.5 April 2013 published by Pipfruit New Zealand outlines a full supporting step by step best practice management guide to managing EC.

It can be broken down to three approaches 1) removal of inoculum, 2) maintaining the orchard and 3) managing the introduction of material.

1) Removal of inoculum – EC can be considered a disease that spreads within orchards as opposed to one that spreads from off orchard inoculum *(see introduction to canker)* therefore removal of infections within the orchard before it spreads to adjacent trees is most critical. This takes shape as

either canopy pruning or whole tree removal dependant on the specific infection level within the tree. As orchardists were relatively slow to adopt mitigation techniques of the disease on orchard infection levels for a number of orchards is high (10-20%).

This brings with it a range of challenges including the financial cost of removal, loss of potential income from removed fruiting canopy and the time required to do the job diligently.

This high level of infection coupled with an aging population of non-corporate third party growers has also seen a number of growers taking a "grow to extinction" approach. This approach allows a grower either contemplating medium term retirement (with no planned succession) or property sales to continue to generate income whilst not spending a great deal on control. This is a concern for neighbouring orchards that are endeavouring to retain sustainability.

2) Maintaining the orchard – primarily best practice in spraying, pruning, material removal from the orchard to prevent further inoculation.

This is where best practice becomes questioned particularly with regards to chemical usage, what is best practice for orchard vs what is best practice for industry? PNZ strategic priority points 1 regarding market access and future proofing of the industry.

Carbendazim is considered high risk chemistry for market access (in particular EU) however is very effective against EC. It will also likely be phased out entirely in years to come. Effective application during leaf fall is ideal however the level of risk with regards to summer rot resistance is high. In saying this If this is successful in controlling the disease and has the potential to lower infection to a sustainable level in the short term should it not be endorsed but used in caution particularly if it is likely to be banned outright.

Copper use is not endorsed or if endorsed it is endorsed as use with caution. This tact is taken due to the potential effects on worm life below the canopy and due to the grazing potential for sheep. Copper is the number one compound in the EU for control and mitigation of EC infection. Copper compounds are used that are more effective without heavy copper toxicity risk.

3) Managing the introduction of material – removal of infected material and the chemical reliance can both be applied sparingly if introduction of infected material can be blocked from entering the orcharding environment in the first instance. The challenge here is that IF material is infected but not showing infection (ie latent) it is nearly impossible to identify the risk during the planting or replanting of the orchard.

Nursery best practice is also available however what is not covered is how the industry could manage the supply of clean material to nurseries for propagation. This is an important aspect as commercial nurseries procure propagation material from the orchards it is supplying trees to. This means the risk is high that infected material is circulating between all participants.

Quantifying European Canker (Nectria) on Orchard

When discussing how EC directly impacts pipfruit orcharding it becomes clear that there are many opinions as to what accurately quantifies the extent of this disease on the industry, its corporate investors and most importantly the orchardists themselves (financially and operationally). It's is also clear that dependant on where within the industry a participant is active the observations differ.

Anecdotally figures of infection have in the past ranged from 2% to 20% within the orchard when EC is discussed with the orchardist effected and industry representatives. This is important as industry best practice recommends removal of infection and therefore for the basis of this project I have assumed the worst case scenario of each infection the orchardist will be removing significant

cropping potential and that this proportion of canopy removal is translated to loss in production. Ie 20% loss in canopy relates to a 20% loss of fruiting potential. This is an extreme assumption however for the modelling I will be using a lesser rate of infection from survey for calculations and conclusions.

Example of a heavily infected block showing trimmed and removed trees

To gauge the variance of opinion and source credible data a survey of respected industry participants was undertaken. All survey participants (10) were considered as being directly affected by this disease, spend significant time in orchard and or are participating in research to mitigate further infection of this disease and considered industry leaders.

Participating in the survey included employees from Plant and Food Research, Pipfruit New Zealand, Growers (grower group representatives), consultancy firms and researchers. This coupled with a 3 year quantitative survey of a corporate grower managing 800 ha of orchard in Hawkes Bay and Nelson make up the quantitative assumptions.

The survey was segregated into three sections (industry participation, the effects of EC on your business and EC a pathway to sustainability). This was structured to firstly have the participants describe their involvement in the industry and reflect on how they feature in achieving the target of $1b by 2022 along with their views on what the top factors are that are required to reach $1b and what they consider are the biggest threats to reach $1b. Secondly they were questioned as to the direct impact and quantitative understanding of the effect of EC on their business. Thirdly the participants were questioned as to what is currently being done to address the issue and what more they thought could be done.

The quantitative survey was commissioned – *Morgan Rogers* by engaging a consultant firm to walk 10% of the planted areas on orchard and record branch infection number along with removed trees.

This was conducted each year for three years to map the progression of EC within the orchard and measure the success of the management regime adopted by the specific orchard managers.

Questions pertaining to EC on Orchard (average of responses reported along with range if any):

1) What would you believe the average level/range of infection within an orchard could be expected in your region or grower base (ie Nelson, Central, Hawkes Bay or Nationwide depending on your role): ie 2% of trees infected?:

- 10% - 15% Nelson on average, actual survey on one orchard 28%.
- 2% - 15% Hawkes Bay and North on average (2% well controlled or semi intensive with 10% on normal orchards)
- Answers were very wide here from 1% to 50%.

2) Do you believe growers are generally sustaining this level of infection? Reducing it? Or do you believe it is increasing?:

- Consistently respondents believed the level is increasing with some growers adopting best practice sustaining

3) How much money do you believe is being spent on orchard for Canker related activities per ha?: (include walks, sprays, removals, replants, pruning)

- Between $1,200 and $2,500 per ha with the grower representative listing $3,000

4) Do you believe Canker levels on orchard or within the region is of consideration when committing to redevelopment/development?:

- Yes – this was consistent with most respondents.

5) Do you believe there are growers “growing to extinction”? If yes then why do you believe this approach is being adopted?:

- Yes or don’t know, respondents thought this was mainly due to financial pressure.

6) How wide do you think infection levels are within your respective region? For example 10% growers with 5% and 90% at 50%?:

- No consistent message however most suggest no blocks are clean however it’s was dependant on orchardist skill and vigilance

7) What do you believe to be the 5 most critical causes as to differing levels of infection on orchard?:

- Climate
- Management focus
- Variety susceptibility
- Identification
- Nursery supply
- Latent infection

All respondents had a combination of the above.

8) Is European Canker in your experience infecting specific varieties more aggressively than others?:

- Yes, up to 50% more was answered by one respondent that had studied the comparison.

Orchard Implications on Industry Strategic Goal

The surveyed participant’s listed 10 aspects that they considered highest consideration for an industry reaching $1b by 2022 the answers were very consistent between participants:

- Labour
- Market Access issues (pests and disease along with political powers)
- Resources for further development
- Nursery tree availability
- Lack of investment
- Exchange rate
- Slow to increase productivity
- Market competition
- New Varieties
- Climate

Interestingly in reviewing most literature EC can relate directly to a number of these 10 aspects, Market access (countries excluding our product), Resources (extra land required to make up the volume deficit), lack of investment (lower return per ha), nursery tree availability (too many replacements instead of new development), labour for managing more area for the same production, climate (higher infection rate).

Assumptions can be drawn to provide a high level forecast as to required development to meet the $1b target in 2022 along with cost to grower to continue EC management. These assumptions do not show the implications as to market access or grower/corporate confidence in development in an environment of high infection however can depict what extra requirements would be necessary on resources (ie development potential), heightened productivity per ha and money left on the table with regards to potential loss in production and revenue per ha. It must also be noted that the development must be undertaken prior to 2018 with trees ordered in 2017 at the latest.

New variety development to increase returns, better our position in a competitive market and select products less susceptible to the disease has exciting potential. However it is unlikely that within the timeframe required for planting to meet the 2022 target date (2018 last planting) a variety not currently in the ground producing significant volumes will make an impact given the risk involved in committing to significant development without seeing commercial performance.

2013 Production Stats						
Tce/ha	Hectares	Total NZ export Crop	Industry export $$	Tce Return		
2,041	8,820	18,000,000	$ 504,000,000.00	$ 28.00		
	Regional Production ha					
HB/OT	NSN	OTHER	TOTAL			
65%	29%	6%				
5733	2558	529	8,820			
			HB/OT	NSN	OTHER	TOTAL
Infection rate assumption based on survey summary			7.5%	10.0%	10.0%	
Cost per hectare to control			$1,850	$1,850	$1,850	
Cost per region in control			$10,606,050	$4,731,930	$979,020	$16,317,000
Loss of potential production base on canopy loss			877,500	522,000	108,000	1,507,500
Loss of potential returns			$24,570,000	$14,616,000	$3,024,000	$42,210,000

The 2013 production stats model replicates the PNZ pipfruit stats for 2013 to show what money has been spent on EC control (based on the average derived from the survey) of $1,850 per hectare which translates to pipfruit growers spending a potential $16.3m on EC control in 2013 alone.

The infection rate is based on the average reported figures derived from the survey. Given Central Otago's similarly low propensity to EC infection I have grouped these together to give an average of 7.5%. Nelson and "Other" have been grouped together as Hamilton would fill the bulk of "other" and is more similar in climatic condition to Nelson growing conditions.

I relate the potential loss in canopy to infection rate (as it should be removed as per industry best practice) which then in turn I relate to loss in potential production eg 7.5% trees or branches infected therefore 7.5% of trees or branches removed giving 7.5% less cropping potential. When this is applied to the volume of TCE produced in the region (ie additional 7.5%) I list this as loss of potential production. We can then apply tce return against this to work out the value or relate back to productivity per ha to work out un productive land potential.

2022 Assumptions	
Percentage increase to 2022	
Export Tce per ha	18% increase
Hectares	32% increase
Export crop	45% increase
Tce Return	10% increase

For the 2022 $1b industry modelling, I have predicted what I believe to be fair assumptions based on industry knowledge and market understanding.

Export TCE per ha, I have factored an 18% increase in production export TCE per ha which I believe is fair given the 24% increase stated earlier between 2004 and 2013 coupled with a greater proportion of young semi productive trees that will also be considered.

Increase in hectares (32%), this is derived from working back productivity, tce return and $1b.

Tce return is conservative however global apple production is on a significant rise which I believe will flatten the returns somewhat for commodity varieties like Braeburn and Gala. New plantings will be made up of new club varieties what will be commanding a premium of $35+ (which is currently correct) however this price will hold and not necessarily increase as I believe given the volume of fruit premium product price will be stagnant. This price may even drop slightly due to competition in the premium category. For example the Washington Apple crop is forecast for 154m tce in 2014. In 2013 is was only 133m and they have enough planted for a potential 180m. it will take time for the removal and re adjustment of the varietal mix to increase returns substantially which is unlikely to be realised prior to 2022. I predict increased returns to grower will be more substantial through gains in productivity.

2022 Production Stats							
Tce/ha	Hectares	Total NZ export Crop	Industry export $$	Tce Return			
2,500	12,987	32,467,532	$ 1,000,000,000.00	$ 30.80			
	Regional Production ha						
HB/OT	NSN	OTHER	TOTAL				
65%	31%	6%					
8,442	4,026	779	13,247				
				HB/OT	NSN	OTHER	TOTAL
Infection rate assumption based on survey summary with 5% increase				**13.5%**	**15.0%**	**15.0%**	
Cost per hectare to control				$1,943	$1,943	$1,943	
Cost per region in control				$16,401,948	$7,822,468	$1,514,026	$25,738,442
Loss of potential production base on canopy loss				2,849,026	1,509,740	292,208	4,650,974
Loss of potential returns				$87,750,000	$46,500,000	$9,000,000	$143,250,000

Tce/ha	Hectares	Total NZ export Crop	Industry export $$	Tce Return				
2,500	12,987	32,467,532	$ 1,000,000,000.00	$ 30.80				
	Regional Production ha							
HB/OT	NSN	OTHER	TOTAL					
65%	31%	6%						
8,442	4,026	779	13,247					
					HB/OT	NSN	OTHER	TOTAL
Infection rate assumption based on survey summary with a 5% sustainable level					**5.0%**	**5.0%**	**5.0%**	
Cost per hectare to control					$1,757	$1,757	$1,757	
Cost per region in control					$14,831,818	$7,073,636	$1,369,091	$23,274,545
Loss of potential production base on canopy loss					1,055,195	503,247	97,403	1,655,844
Loss of potential returns					$32,500,000	$15,500,000	$3,000,000	$51,000,000

This modelling depicts a reduction in EC levels within the industry if control costs stay static (but increase percentage with regards to infection rate). This is not necessarily accurate however a substantial increase in hectare control cost will swiftly erode profitability therefore a more effective spend of the money is ideally required.

What this model does depict is the potential for increased productivity, therefore a lesser reliance on resource for further development (increased production therefore less land required to produce apples to sell for 2022 benefit). Productivity can only increase so far as practical however tightens in the target.

The extra revenue generated in 2022 from reducing loss of potential returns from 15% to 5% of $90,000,000 would build confidence in corporates and investors to spend on development. Sizable corporate investment is required alongside third party growers to develop the significant volume of required orchard to meet that target.

The model forecasts a requirement of an additional 4,000 ha (9k to 13k), however even if price per tce in the assumption was increased to $35 per tce 2,000 ha's of expansion would still be required.

At a price of $35 per tce and an average productivity increased to 3,000 tce per ha more sensible increase of 500 ha would be required.

Corporate investors would need to spear head the significant investment required at $150,000 per ha newly acquired orchard.

Addressing the issue, Research ideas, cautions and differing opinions

To convince corporate bodies to invest in the New Zealand pipfruit industry along with current industry participants to better address the issue and avoid the "grow to extinction" path, the industry must position itself to give reassurance that EC is a disease that is being focussed on and a strategy is being built to mitigate the problem for the future.

In addressing the potential for progressing the understanding of this disease there have been contrasting views as to how the industry moves forward as one. The differences arise when growers with extremely high levels of infection are enticed to remove great volumes of canopy with little chemical support are compared with growers that have greatly reduced levels of infection, not reliant on chemical support but instead can feasibly prune out infection. This difference means focus and opinion on most effective research and investment is varied.

There is also differing views between IP owners with an invested interest for retention of the production levels (either producing solely in New Zealand or both New Zealand and offshore) vs Pipfruit New Zealand who as one of its strategic priorities views market access of utmost importance and prefer to keep the extent of the disease relatively low key.

Nursery tree producers also tend to distance themselves from the issue as acknowledging they are involved effectively highlights that their specific business may have a problem. This cautionary approach is taken to avoid customers moving to another nursery tree supplier.

The survey participants were questioned as to:

1) What projects or number of projects are you or your representative business participating in to greater understand European Canker and mitigate further infection of the disease?:

- Collectively the participants were involved in 5 different research projects on EC mitigation.

2) For each project what funding streams have you relied on proportionately (Gov, Private, and Industry) and what obligations are you under re dissemination of the information?:

- Generally funding for the projects balanced out roughly 25% private (grower or chemical company), 75% industry or government funding (SFF, PNZ)
- Only obligations were to PNZ and SFF that the information was to be disseminated to the industry BUT not externally.
- It was also noted that dissemination to growers was tricky and sensitive as open communication would jeopardise market access (Australia noted)

3) Do you believe more could be done to advance our knowledge of this disease? If so what do you believe are the constraints?:

- It was noted by all parties that more work should be done.
- A number of the participants endorsed increased offshore collaboration and more open communication
- All participants indicated that the key constraint is the lack of skilled pathologists

4) Do you believe the level of research and development along with the level of funding being undertaken in New Zealand fairly represents the potential financial impact of this disease on the growers and industry investment?:

- This question was interesting and had a varied response, the variation was linked to the lack of understanding of the quantitative ramifications of this disease.
- Most were of the opinion that more needed to be spent however skilled people would be the limiting factor.
- More funding spent on dissemination of the information
- 3 had no idea or comment

5) Should propagators and material supply be inclusive in industry grower research?:

- Yes

6) What 5 considerations should be given to sourcing support external from the New Zealand industry to mitigate further infection of this disease?:

- All agreed this was an exciting prospect
- Avoid duplication of investment
- Ensure relevance to NZ
- 365 day NH/SH research instead of single season
- Identify constraints to public funding and open dissemination
- Collaboration

7) What potential impact on market access does external knowledge of New Zealands European Canker infection have for the New Zealand pipfruit industry?: What potential do you believe this EC sensitive market access could contribute to the 2022 $1 billion target?:

- This question had a raft of differing answers however most respondents acknowledged they were not sure of the risk.
- Many responded that productivity outweighed the risk so the issue simply needs addressing
- Only Australia would block and the potential was insignificant in the $1b target
- Once further understanding of the risk involved in the rots on the fruit was understood by our markets the problem could become significant in the EU and Asia

8) How do you regard IP ownership to further research and development in this field?:

- Dependant on funding source and research contractor however most participants stated that it needed to be industry wide.

9) How do you believe IP ownership of either research understanding or PVR's will factor in the progress of knowledge in this field?:

- It was noted that this could be a hindrance but as per 8 should not be depending on funding

Conclusion, precautions and Areas for Address

European Canker is an aggressive fungal disease that is becoming more widespread throughout New Zealand. Industry understanding of the infections lifecycle is extensive with many documents available for reference into the microbiology of the disease.

New Zealand's climate is conducive to the spread of EC and is particularly bad in the growing sub region of Riwaka.

Industry participant quantitative understanding of the extent of which the disease has spread throughout producing orchards varies widely according to the participant's survey response from an average of 2% infection to 20% depending on region. Whereas actual quantitative surveys undertaken in Hawkes Bay and Riwaka Nelson show the disease could potentially be higher (15% and 29% respectively).

This coupled with a general lack of understanding surrounding the potential cost to the grower and potential cost to the industry in how this effects the $1b strategy can explain the lack of understanding of what could and/or should be spent to further mitigate the disease. Without an accurate quantitative assessment of the cost it is difficult to justify the expenditure.

Pipfruit New Zealand's strategic priority of protecting market access is very important however results from the participant survey clearly showed that there is no clear understanding of the potential financial impact of EC on our market access or what markets may be at risk if the disease levels become common knowledge in the market place.

The sensitivity surrounding the market access threat of this disease is hindering effective dissemination of the researched information and restricts the circulation of clear warnings regarding the severity of the disease if growers do not follow best practice.

According to the survey results it is unlikely funding should be considered a limiting factor in further research and advancement in industry knowledge of the disease, instead availability of skilled resource is more than likely the limiting factor.

Sourcing people with the specialised skill set required and bench marking our best practice against offshore industry best practice by participating in cooperative offshore research has been identified as being vital, but is identified as another factor that potentially alerts our market partners to our infection rates thus putting pressure on potential market access.

Cooperative research could be hindered by IP ownership depending on the source of funding. If government funding was not an option for cooperative research, corporate or private funding may also restrict dissemination of information by way of IP ownership and used as a competitive advantage.

The precautions above regarding market access maybe dismissed by corporates that need to ensure adequate returns on current IP investment. This coupled with many of the PVR varieties commercialised by corporates being classified as "sensitive" to EC like Kanzi, Jazz, Envy along with many Royal Gala sports may mean private research is instead funded with other complimentary PVR holders in other countries thus compromising PNZ's position with regards to market access.

What was also uncovered during the survey but not discussed in detail above, was the concern that growers land values could potentially plummet along with the potential for bank funding to become

uncertain if the extent of their infection was communicated widely. This is a major concern for growers borrowing to repair the damage the disease has caused and potentially expand (which is required for the PNZ $1b target).

Plant material transfer that potentially harbours latent infection is the likely cause of introduction of EC onto orchards. With very little discussion surrounding management of propagation material to ensure cleanliness of the trees growers are planting this further focus as the introduction of infected material will undermine the work orchardists are doing to mitigate the disease.

To achieve $1b by 2022 a considerable volume of development is required irrespective of sensible increases in tce value and production per ha. It was highlighted that EC is a serious concern when considering new development therefore it is important that an assurance can be given to potential investors in the industry that the industry is working effectively to further mitigate the disease with a target to reduce it to a commercially sustainable level.

To progress the New Zealand Pipfruit Industry towards a target of $1b, addressing what could be considered one of the key threats to this target there are a number of actions that could be considered.

As I believe the EC infection within the industry falls well within the objectives of the organisation and has a close relationship with a number of its strategic priorities Pipfruit New Zealand, the sole collective body within the industry I believe could drive progress in this area. as along with a close relationship with a number of the strategic priorities captured within its strategic plan

To truly quantify the actual infection rate of EC currently on orchard a full industry wide survey could be undertaken. As the industry is fragmented PNZ's annual development and statistical return would be an ideal format for this survey.

Running parallel to the statistical survey Pipfruit New Zealand would ideally give an accurate risk assessment (as part of their 1st strategic priority) regarding market access and the implications of information leakage to customer authorities.

This would give a fair understanding of outlook as to the best strategy for developing a mitigation plan.

Once an accurate survey is complete and a risk assessment is constructed Pipfruit New Zealand's involvement (as an industry wide body) is critical as to applying for and lobbying government for funding to support further research and development in this area. This funding stream will also ensure that the aspect of industry wide transparency and dissemination is managed fairly.

Dependant on the outcome of the proposed market risk assessment and the potential cost to the industry if the infection restricted market access, PNZ could negotiate establishment of a 365 day alternate hemisphere research program.

To address questions surrounding IP and PVR ownership PNZ could possibly sell rights for inclusion into the program on a reciprocated funding platform. Ie studies could be undertaken on varieties of corporate interest, funding could be shared with an reciprocate industry that could supply more specialist researchers (for example UK industry of which have up to 50% infection rate in selected varieties within their orchards).

Engaging constructively and transparently with corporate investors is also important to ensure an accurate untied message is conveyed. To address EC tactfully is important and best to be addressed by the most informed personnel.

Regardless of whether research communication leaks, to offshore customers without adequate management it will only be a matter of time before infection is found within fruit rots in market.

The establishment of a robust plan to advance industry knowledge and mitigate risk would provide growers and potential investors with reassurance for further development when considering EC as a limiting factor.

What is more important, fruit to sell or markets to sell it?

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