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Beyond the Borders of Nelson:
The opportunity for growth of the New Zealand Hop Industry

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I wish to thank the Kellogg Programme Investing Partners for their continued support:

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Executive Summary

The report titled; Beyond the borders of Nelson - The opportunity for growth of the New Zealand hop industry sets out to establish the following key aims:

- To investigate the key dynamics influencing the New Zealand hop industry and understand the key drivers encouraging growth within the sector.
- To understand the key growing requirements for hops and determine if opportunity exists for hop production in alternative regions to Nelson, New Zealand.

To seek a balanced point of view a multi-faceted approach was taken including:

- Reviewing national and global literature on hop production, marketing and selling methods
- Undertaking a higher-level overview of the global craft beer market and more in-depth review of the US craft beer market to appreciate the drivers of hop demand
- Informal discussions and in person meetings with various people from within and around the New Zealand hop industry to determine the dynamics of the market, approaches to selling product and how they aim to maximise returns for New Zealand hop growers
- Speaking with local and international brewers to understand market dynamics, and key decisions around sourcing hops when determining a 'brew'.
- Review and present a case study on a soon to be released market investment opportunity to understand the capital requirements and forecast returns for this investment

The key findings from the report show:

- The global craft beer dynamics will support continued growth of the New Zealand hop sector
- Hops can grow in other regions of New Zealand with some regions exhibiting remarkably similar growing conditions to the larger international hop growing areas of Yakima and Hallertau
- New Zealand grown hops have several redeeming features to make more attractive to brewers
- Capital cost of entry is considerable
- Forecast returns support continued investment in this sector

The conclusions and recommendations in this report are targeted at any party wanting a greater understanding of the New Zealand hop sector.

Acknowledgements

I would like to acknowledge the many people who assisted me in completing this project. This project and the time taken to complete the Kellogg's course would not have been possible without the support of my family. A big thank you to Gracie, Ella and Fynn for your patience in my absence as this report came together. To my wife Jo for her support, understanding and listening as I worked through the many challenges during the projects journey.

Without the support and advice of various people this report would have met an early demise. Of special note, I would like to thank:

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- Freestyle Farms Dave Dunbar, a wealth of information and someone willing to share this information to see the market grow
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- Plant and Food Research, Dr Ron Beatson and Wendy Cashmore
- NZ Hops Ltd, Doug Donelan
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And last but certainly not least, to the late Terry McCashin. You wet my thirst for this project with your youthful enthusiasm and for that I say; Cheers! RIP Terry.

Introduction

New Zealand has long been regarded globally as a producer of high quality primary goods. Born from our country's need to be self-sufficient due to being isolated from anywhere else in the world, early New Zealand settlers had to adapt to survive. Settlers did not have the luxury of mass trade for many years until shipping routes became established and New Zealand had products to trade in return. The gold rush period in the 1860s saw European settlers flock to New Zealand and with this rapid population growth came increased expertise in fields such as horticultural propagation and production. Commercial hop growing was one such primary sector that developed in response to early settler demand and early settler expertise.

The New Zealand hop sector has gone through several economic cycles and with the most recent boom of the craft beer sector hop demand has soared. This has seen the first expansion of hop plantings in the Nelson region in many years, although interestingly the industry is only now entering a phase where it will start to produce more hops than ever before.

The total area of hectares planted in hops has been relatively static in growth due to the historically volatile nature of the hop industry.

The scale of major hop producers such as the United States dwarfs the New Zealand hop industry. These growers are well known to create boom and bust cycles as they increase or decrease their plantings, flooding or starving a market. This volatility has a flow-on effect to all global hop producers, as markets navigate supply and demand imbalances. Most interestingly is how New Zealand is negotiating these market forces and is considered by many market participants as artisan producers of a high-quality product.

Through my research it was not uncommon to be told how buyers and consumers of the end product are noting subtle flavour and aromas not found in hops sourced from anywhere else in the world. With a bulging craft beer market brewers and consumers are looking for a point of difference to make their product stand out from the masses.

New Zealand with its temperate climate and isolated growing environment is finding market favour globally as the market literally 'tastes' the difference to what is grown elsewhere in the world. Just like Marlborough Sauvignon Blanc, New Zealand hop growers are producing a range of varieties that all exhibit a unique 'terroir.' The word 'terroir' conjures images of wine-swilling aristocrats comparing the subtle hues of a new wine. The fact this term is now used in hop and beer drinking circles indicates the evolving sophistication of this market. New Zealand stands to exploit this point of difference further by offering new and exciting flavours to meet the ever-changing palate of the modern beer drinker.

There is no denying the link between the craft beer boom and the current demand for New Zealand hops - the growth of both industries is intrinsically linked. New Zealand has a unique advantage due to its isolation from other hop-growing nations and free of the hop growing pests and diseases that challenge their growth. This along with world class research allows New Zealand to produce quality spray free hops with flavours and aromas not replicated in any other part of the world. Like many primary sector cousins, New Zealand hop growers have an opportunity to target high-value markets.

Through continued innovation, research and development of hop styles the global craft beer market presents the opportunity for the New Zealand hop sector to flourish.

This report will outline and discuss the potential for New Zealand hop industry expansion to meet global demand.

Aims and objectives

The purpose of this study is to take a high-level overview of the industry and the dynamics which exist creating a general increase in national and global hop demand. It will also compare the characteristics of the Nelson region with other regions throughout New Zealand and the world, to identify the opportunity to grow hops in beyond the borders of the Nelson district. To support my research, a case study on a new hop garden being established in the Tapawera region, Nelson is included to gain a greater appreciation for the capital required and the potential returns forecasted.

A key objective for this study is to provide an introduction for anyone considering the opportunity to enter this market, to appreciate the cost of entry and the future possibilities New Zealand hop growing presents.

Literature review

What are hops?

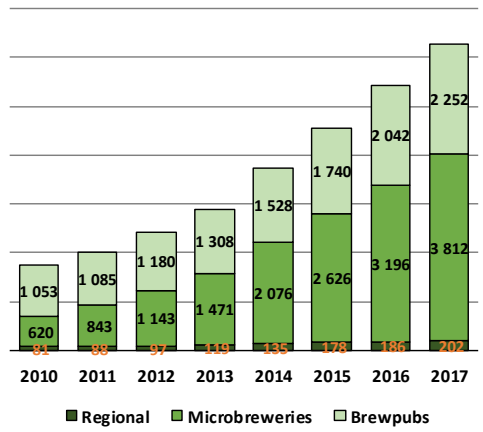
Hops (*Humulus lupulus)* are a perennial plant which originated from Europe and West Africa and consists of a crown of rhizomes below ground with annual climbing bines growing above ground. The rhizome is the perennial storage organ of the plant and ensures the plants survival from one season to the next. The hop cone, or strobile, is the mature female flower containing lupulin glands that produce alpha and beta acids as well as the essential oils that create the flavours, aroma and bitterness in beers (Hops – a guide for new growers, 2017).

Originally introduced to New Zealand by immigrants from Southern England and Germany in the mid-19th century, they found hops flourished in the Nelson climate of warm days, regular rainfall and lack of wind (Aitken et. el, 2005). There are no other commercial plantings of scale in any other area of New Zealand.

The hop market and the rise of the craft beer sector

Since 2012, the global craft beer market has seen a significant increase in craft breweries using considerably more hops than the traditional lager-style beers. Quantifying this period of growth, the American Brewers Association (ABA) statistics (Figure 1) indicate the US market alone has seen an increase in craft breweries of 160% between 2012 - 2017 (The New Brewer, 2018).

Figure 1 - Number of US Craft Breweries 2008-2017



Source: Brewers Association - New Brewer (2018)

Over the corresponding period world hop production has also increased by approximately 10,000ha and is now at a similar level last to the 2008-2009 production.

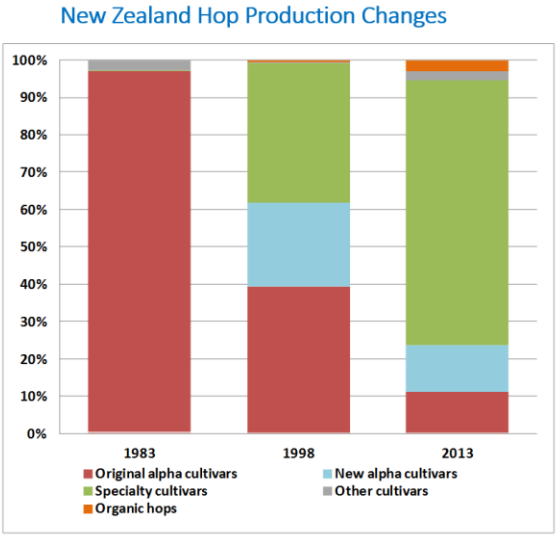
Figure 2: World Hop Area (Ha)

Source: THE BARTH REPORT – 140 years Barth Report (July 2017).

What does appear to have changed over this period is the style of hop grown. There has been a sharp increase in aroma hop production, at the expense of alpha hops in the New Zealand market. As a general rule the higher the alpha acid content of the hop, the more bitter the variety. This has been challenged in recent times with the advent of a category of hops also known as 'dual' or 'specialty' hops which have strong aroma/flavours while also having high alpha acid. One of New Zealand's leading examples in respect of market demand and value which demonstrates these characteristics is Nelson Sauvin.

The graph below (Figure 3) highlights the considerable shift since 1983 for the New Zealand hop sector from one supplying alpha hops to one supplying specialty cultivars. This sector has transitioned its strategy towards one of growing crops the craft beer market wants (Donelan, 2018).

Figure 3: New Zealand Hop Production Changes



Source Dr. R Beatson Plant & Food Research

Of the total world hop production, New Zealand (at less than 1%) is negligible when compared to the production of USA and Germany which produce approximately 42% and 36% respectively (IHGC).

Figure 4: New Zealand, USA and Germany hop 2017 production – Aroma and Alpha

	Aroma	Alpha	Total (T)	% of Total
New Zealand	620	140	760	0.7%
UK	1281	500	1781	1.6%
US	35008	13059	48067	41.9%
Germany	20250	21050	41300	36.0%
Total global	**69878**	**44938**	**114816**	

Source: IHGC – Economic Commission Summary Reports (2017)

Doug Donelan - CEO of New Zealand Hops Ltd (NZHL) states that approximately 80-85% of the New Zealand hop production is exported (Pers. Comms. 2018). Total export values are scarce although it is noted in a December 2016 interview with Donelan, the New Zealand hop sector had an annual turnover of about $20m.

Assuming the export figure of 80-85%, this means New Zealand hops generates a modest $16-17m in export dollars. In the same article, third generation grower Colin Oldham is noted as saying the

global craft brewers were snapping up all of the co-operative production and that the key to this success was the continued development of new varieties under a programme lead by Dr Ron Beatson of Plant and Food Research.

Research and Development

Following the introduction of newer, higher yielding material in the 1920s the hop industry sought the assistance of DSIR to combat the onslaught of the debilitating root rot disease (phytopthera) which established during the 1940's. DSIR was tasked with establishing a breeding and development programme for hops. Plant and Food Research stemmed from this and has gone on to develop several varieties that have gained international recognition from this breeding program, and are now seen as the new 'aroma centre' of hop breeding in the Southern Hemisphere (Aitken et. al. 2005).

Key outcomes of this breeding programme have been identified in 'Growing Futures' as:

- Hop varieties bred with root rot resistance.
- The world's first triploid varieties (seedless) which also had 50% more alpha acid (the bittering precursor in beer) than the varieties during the first half of the 20th century.
- A significant shift from commoditised alpha hops to those with flavour and aroma profiles to differentiate New Zealand from the world.

Regional overview

Key aspects a hop plant requires to grow successfully are described by Dodds (2017) as:

- **Latitude** – The generally accepted latitude range for commercial production is 35^{o}and 55^{o} north or south of the equator.

- **Photoperiodism** - A function of latitude. The hop plant is a photo-period-sensitive plant which is most productive when day length ensures good vegetative growth and canopy development, then timely flower induction.

- **Winter cold** - According to Williams et al. (1961), dormancy occurs in hops in two stages, the onset of dormancy and break of dormancy. Without adequate chilling, the break of dormancy can be insufficient, resulting in weak and erratic spring growth.

- **Terrain** - Level or undulating sites are said to simplify the establishment and operation costs of the garden.

- **Soil type** - Hops are noted to grow successfully on a range of soil types from light sandy soil to clay. A light textured, deep soil, well supplied with moisture and free of water logging is considered optimum.

- **Fertility** - A naturally fertile soil is preferable however deficits can be corrected prior to planting with fertiliser. pH is important with the optimum range being 6.0-6.5. Hops are also noted to be a very nitrogen hungry plant and the best time for applying this is during the rapid vegetative growth stage around mid to late spring (October to December).

- **Shelter from wind** - Exposure to strong wind can cause leaf damage and loss of cone bearing laterals. The preference is for a site that is sheltered and relatively free of excessive wind.

- **Water availability** - Hops have two roots systems – shallow feeder roots and deep penetrating roots. While natural rain is an advantage all literature (and personal comms, 2018) recommended an adequate irrigation system to support the natural elements. Hops have a high requirement for water to support the needs of a growing plant. Hop gardens have two predominant irrigation methods. Overhead sprinklers and drip-line irrigation.

- **Variety** - The greatest challenge for a hop grower is identifying what variety to plant. Hops have very short harvest windows and therefore all hop gardens will require a mix of varieties be planted to maximise the efficient use of the picking and drying facilities required within all gardens. Hops can be classified into early, mid and late varieties with respective harvest windows accordingly.

- **Plant virus status** -The hop plant is susceptible to a number of viruses and viroids and in the USA growers are able to source certified virus-free hops planting material. It is unclear from my research if such material exists in New Zealand, but should be a question asked by any new prospective grower. Common hop viruses are known to significantly affect plant growth and yield.

- **Ideal season to plant -** Hops are planted in spring as either rhizome cuttings or rooted cuttings from the previous spring. It is noted in Dodds (2017) report it will take 2-3 seasons for a plant to produce a full commercial canopy.

- **Support structures -** Hop garden design and trellis varies from country to country. In New Zealand, the common structure is the V-trellis where the top height is around 5 metres and row spacing of 2.5m with 1.2m between plants within rows.

Pests and Disease

New Zealand's isolation and temperate climate has allowed the New Zealand hop industry in the to prosper in the modern era free of the pests and diseases which challenge international growers. This allows New Zealand to grow hops free of spray residues, providing a significant point of difference to any other commercial hop in the global market (NZHL).

Terroir

Terroir, a term often associated with wine, is increasingly being used in the hop scene. Just as subtle differences are being noted in the provenance of Sauvignon Blanc, so too is the belief that hops produce different flavour and aroma profiles unique to a site or region.

A commodity hop such as Cascade, which is grown throughout the hop producing world, is proving to have flavour profiles uniquely different to any other part of the world when grown in New Zealand. Donelan (2016), in an article written for punchdrink.com notes that due to environmental factors and dissimilar growing conditions, hops reflect a terroir divergent from those same varieties grown elsewhere. As a result, NZHL have rebranded Cascade calling it Taiheke, realising a premium to the market. Evidence of this can be seen on the recently established secondary hop trading platform, *The Lupulin Exchange* where 2017 Taiheke is listed at a premium of approximately 30% above that of 2017 Cascade (Appendix 1).

Garden Establishment and Running Costs

Little to no formal New Zealand budget data exists to guide new growers on aspects such as establishment, growing and processing costs. Considerable data exists from the international market where it appears hop gardens are typically established of considerable scale. With over 40% of the world hop production grown in USA, it comes as no surprise to find considerable information coming from this market. There are several international sources which provide detailed breakdowns of cost such as website source: https://www.usahops.org/growers/cost-of-production.html. NZHL CEO, Doug Donelan (pers. Comms 2018) indicated they would share such information with any grower looking to join NZHL.

Of the data available publicly on New Zealand production and establishment costs, Brent McGlashin (Macs Hops, Motueka) is quoted (November, 2015) as stating it demands "huge capital expenditure" and references between $35-40,000/ha for posts, wires and plants and excluding the cost of land, kilns and boilers.

Freestyle Farms CEO, Dave Dunbar (Pers. Comms, 2018) indicated the establishment cost for a new hop garden to be approximately $45-55,000/ha, unless someone is putting in huge amounts of 'sweat equity,' which is often the case in an owner-operator model. Dunbar suggests operating costs once a garden is fully established are $17-$20k/ha for a 50ha garden and bigger. Information reviewed from USA Hops and confirmed by Dunbar both point to considerable economies of scale associated with a hop garden. Dunbar indicates a ratio of approximately 40% fixed costs to 60% variable highlighting the financial benefit in larger scale gardens.

Operating costs will likely vary from country to country and site to site. However, as a check it is noted in feedback from Donelan (Pers. Comms. 2018) "hops have to achieve $35,000 gross per hectare for land to remain in hops".

Sourcing plant material

Considering the introduction of change in the hop sector in the form of new growers, processors and exporters, there are few options available to any new grower from where and how to source suitable hop material. Plant and Food Research are presently working with all industry participants to find a model which makes suitable plant material available to anyone wanting to enter the market through a license and/or royalty agreement.

At the current time however, all modern high value commercial material is effectively under protection through Plant Variety Rights (PVR) or license linked to NZHL. Hop Revolution (HRL) a new grower entering the market, currently have an agreement which allows them to access and sublicense existing varieties to any grower (Cashmore, Pers. Comms. 2018)

Sales

All parties spoken to and all literature reviewed confirmed the art of growing hops is complex and requires careful attention to detail. Once grown the next challenge for any potential grower is to determine the route to market. While historically this has been a simple decision with all hops supplied to New Zealand Hops Ltd (NZHL), new businesses have recently entered the market providing options for any potential grower to consider. All current exporters of New Zealand hops appear to have the common goal of growing the market and increasing the supply of quality New Zealand aroma hops to the domestic and international market.

Methodology

Following the literature review, it became obvious that there is a distinct lack of written information on the New Zealand hop sector outside articles written for media publications or from the NZHL website. Outside information gathered from these sources and the need to engage with people from across the sector was critical to the findings gathered in this report.

Almost all information gathered has come about through personal conversations (email, phone) and meetings with key industry participants. Few structured questions were posed as most discussions flowed from one topic of discussion to the next.

Perhaps the theory of "you don't know what you don't know" is pertinent to use in this situation as it became clear through discussions that the hop market both domestically and internationally is both traditional and yet complex with the status quo being challenged on many fronts. Industry spread was an important part of this research to reach a balanced point of view on the industry. For that reason the information presented has come about from personal communications with the following people:

- Doug Donelan – CEO – New Zealand Hops Ltd
- Dr Susan Wheeler and Jono Trolove – Hop Revolution
- The late Terry McCashin – Hop Revolution and long-term craft beer advocate/expert
- Dave Dunbar – CEO – Freestyle Farms
- Various rural specialists – ANZ Bank
- Dr Ron Beatson – Principle Scientist - Plant and Food Research
- Wendy Cashmore – Head of PVR – Plant and Food Research
- Jason Franson – Brewer, Brew Union
- Ben Adams – Technical sales – Charles Faram, UK
- Simon Turner – Brewery owner – Bluestone Brewing, UK
- Robbie Reynolds – Accountant and ex grower – Nelson, New Zealand
- Greg Dryden, Fruition consulting, Nelson, New Zealand
- Brian Cloughley, MyFarm

Findings and discussion

The opportunity for New Zealand hop expansion – a market assessment

Craft brewing and the rapid growth of this market globally has seen an increased demand for the raw ingredient of hops. The two products are intrinsically linked with the growth of one supporting the growth of the other.

According to the ANZ and the New Zealand Craft Beer Industry Insights Report, Edition four 2017, there are 194 craft breweries in New Zealand. An increase of 102% over the three-year period from 2014.

Over the corresponding period and through to the 2017 harvest New Zealand saw a 36% increase in area harvested of 141ha, with a further 89ha harvested in 2018 (NZHL Harvest Info. 2013-2018).

Figure 6: Annual Hop Area (Ha) 2013-2018

Year	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*
Est. area planted	350	370	390	412	442	531

Figure 5: Source - NZHL Harvest Info 2013-2018

New Zealand hop area has been growing in area consistently for the last 5 years and as returns have risen it has encouraged new investment into the sector from both new and existing growers.

The likelihood of demand for New Zealand produced hops to lose its popularity is low with the global craft beer markets continued to growth. USA leads the charge on the growth of the craft beer market and as noted in (Figure 7) below this market now consists of over 6,200 craft breweries and growing. An increase of approximately 4,000 breweries between 2012 and 2017.

Unlike New Zealand, the United States market is a haven for readily accessible data. With a more established industry body in the American Brewers Association, and on the back of significant annual growth of craft breweries, New Zealand hops are finding a strong following throughout the USA. In fact, one of the few criticisms received about the New Zealand hop market was centred around brewers (both domestic and international) expressing frustration around the fact they could not secure enough (or any) of selected New Zealand products to support long term commitment to their beer brands.

Figure 7. The US Craft Beer market

U.S. Brewery Count

	2012	2013	2014	2015	2016	2017	'16 to '17 % Change
CRAFT	2,420	2,898	3,739	4,544	5,424	6,266	+ 15.5
Regional Craft Breweries	97	119	135	178	186	202	+ 8.6
Microbreweries	1,143	1,471	2,076	2,626	3,196	3,812	+ 19.3
Brewpubs	1,180	1,308	1,528	1,740	2,042	2,252	+ 10.3
LARGE NON-CRAFT	23	23	26	30	51	71	
OTHER NON-CRAFT	32	31	20	14	16	35	
Total U.S. Breweries	**2,475**	**2,952**	**3,785**	**4,588**	**5,491**	**6,372**	**+ 16.0**

Source; https://www.brewersassociation.org/statistics/number-of-breweries/

The growth of the US market has seen an unheralded demand for hops, in particular 'specialty hops' (aroma/flavour hops) to suit the demands of beers styles such as Indian Pale Ale (IPA) and American Pale Ale (APA). Two beer styles that are brewed at higher hop rates than traditional lager beers.

Feedback from various sources also suggest new markets are starting to emerge and grow through the likes of Europe and Asia.

In reaction to this increased demand, global hop producers have responded by increasing the area grown by approximately 3,000 additional hectares across 19 countries (IHGC,2017). The USA alone accounted for 48% of this growth with 1,487ha of additional hop are planted in 2017 compared to 2016 (IHGC, 2017).

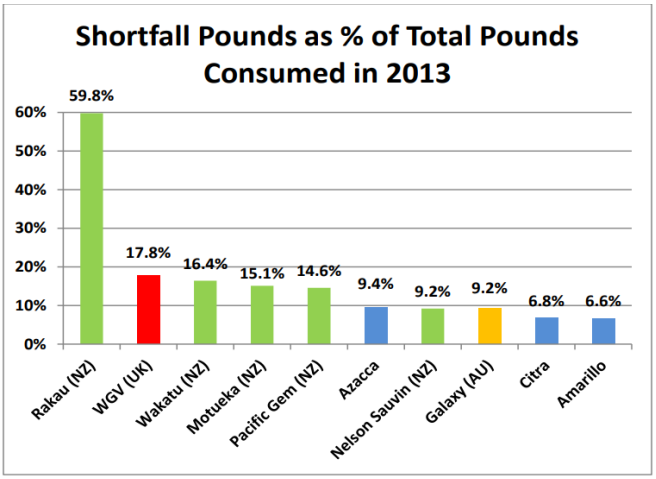
Donelan (2016) is quoted "Gone were the days when big breweries set the price, where once we could have sold 200 tonnes to one brewer we are now distributing 200 tonnes to 1000 brewers." This indicates the change in the global beer market positively affecting all hop growers as craft brewery numbers have rapidly expanded. Over the same period, prices are reported to have risen on the back of a global shortage of aroma hops. This has encouraged growth, albeit slowly in the New Zealand hop sector for the first time in 20 years as brewers seek the hop styles New Zealand grows.

Currently 80-85% of NZHL product is exported with approximately 30% sold to the US where Donelan (2016) expects the percentage to remain steady with increased production destined for new markets. Donelan (2016) sites a significant market opportunity to the new generation of Japan's beer drinkers who are increasingly choosing craft beer. According to Donelan, the story is similar in Taiwan, Korea and China.

With the increase in demand the market is reporting shortages of highly desirable hops. Both at home and abroad certain New Zealand hops are simply not available in quantities brewers require.
New Zealand brewer, Jason Franssen, Brew Union Brewing Company, Palmerston North, noted some varieties such as *Riwaka* are hard to source, making it difficult to produce a beer with this hop as a base ingredient. As a result, other hops are substituted to provide continuity of beer styles throughout the craft beer market.

This theme was supported in research conducted by the American Brewers Association (2013) where it was observed New Zealand varieties made up 5 of the 10 varieties reported to be in short supply.

Figure 8 – Reported shortfalls of hops in the US market (2013)



Source: http://msue.anr.msu.edu/uploads/236/71505/Craft_brewing_and_hop_usage.pdf

Donelan (2018) provided words of caution to such reports indicating "the Brewers Association reports aren't an accurate resource, they continue to report shortages of hop varieties that are available through our wholesalers". However, market response does support such findings with Chris Swersey, Supply Chain Specialist, Brewers Association (America) noting (Pers. Comms. 2018) in discussion of New Zealand hop availability "I'm aware of at least 3 larger craft brewers who have reformulated or killed at least 100,000 US barrels of beer away from New Zealand varieties in the past 3 years". Given each barrel represent 117L and approximately 0.8kg hops/barrel this indicates a significant opportunity to the New Zealand hop sector to support expansion.

Dave Dunbar, Freestyle Farms also made mention (Pers. Comms. 2018) that they too are finding the demand for New Zealand grown hops is significantly greater than growers are able to produce in the immediate future. Uncertainty of supply becomes a market risk for the brewer who is looking for consistency in flavour and aroma profiles of their beer brands.

Bluestone Brewing owner Simon Turner, Wales, made the following observation when quizzed on the opportunity for expansion of New Zealand hops to the UK Market. "I would say that in the UK, New Zealand hops are, in general, highly sought after and in short supply. The craft beer boom is also gathering momentum in Europe all be it slowly by comparison with UK and USA, so the market is growing" (Pers. Comms. 2018)

To further support the potential for growth of New Zealand hop production, market feedback from Ben Adams, Charles Faram technical sales specialist, when posed with the simple question, "If more New Zealand hops such as Nelson Sauvin could be grown, how much could the market tolerate"? met with the response: "You could double current production and this would not have an impact" (Pers. Comms. 2018).

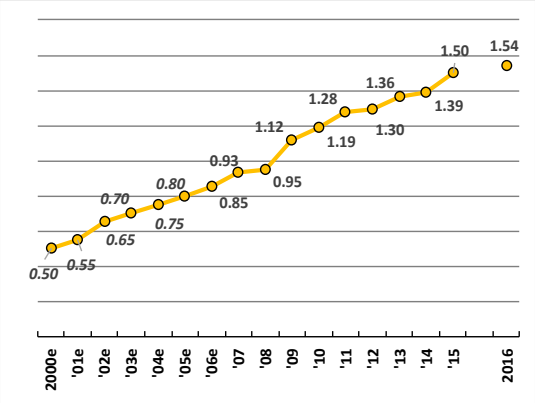
While encouraging to hear from someone in the international brokering sector, there is a risk to this statement in the underlying knowledge that the protection through Plant Variety Rights for Nelson Sauvin is due to expire in the next 3-4 years. There is some speculation among industry participants that this successful and highly sought-after variety will not grow as well internationally as it does in New Zealand, producing lower crop yields than growers are prepared to accept. It is also speculated New Zealand plant material will be susceptible to the pests and diseases not found in the New Zealand growing environment (Dunbar, Pers. Comms 2018).

How has the craft beer market increased hop demand?

US Market data shows an average increase of approximately 66% in the average hopping rates used in craft beers between 2007 and 2016 (Brewers Association - The Brewer, 2018).

Figure 9 below shows the movement in hopping rates from 2007-2016 measured as pounds per barrel (one barrel is the equivalent of 117L). This is perhaps not surprising to anyone who has followed the growth of this market as brewers have sought to push the boundaries, making beers bolder and 'hoppier' to meet a growing market interest in these styles. In comparison mass lager beers are reported to use 0.3-0.4lbs/bbl.

Figure 9: Hopping Rates for US Craft Beer 2000-16 (lbs per barrel)



Source: Brewers Association. The New Brewer, 2018

Terroir

Perhaps the greatest opportunity to support growth outside the greater Nelson region is linked to terroir. A word commonly associated with wine and used to explain the effect that geography and climate have on grapes.

Mikkeller (2017) in a blog to launch their terroir series states "in the same way that people in the wine world talk about terroir – that is to say the effects that geography and climate have on grapes – we can also talk about the terroir of hops and beer. A hop variety can taste markedly different depending on the country in which it is grown and the processes involved in its production"

To support this theory and provide an example of the opportunity for New Zealand regional diversification, several US brewers have completed a series of SMaSH (single malt and single hop) beers (Schimke, 2018). In this trial, they created four identical beers with the one change being the location of where the common hop, Cascade, came from. The purpose of this trial was to determine if the end consumer tasted the difference between brews indicating terroir differences.

J.E. Paino, owner of Ruhstaller who conducted the trial noted "Everyone, 100%, says there is a difference. Most folks, 90%, discuss which one they like better. The remaining 10% talk about characteristics" (Schimke, 2018).

While not scientific, the feedback noted in the article suggested drinkers do taste the difference and indicates an opportunity for growers to partner with brewers to explore this difference and market for mutual benefit.

Closer to home, there is no better evidence of this than with Marlborough Sauvignon Blanc. This wine style is noted to be uniquely different to Sauvignon Blanc from other regions in New Zealand and throughout the world and realising a premium return for Marlborough grape growers.

At this time, the difference noted in the hop sector is country specific and subject to the knowledge of the taster. In time and with expansion of the New Zealand hop market, who is to say this will not became region specific such as Marlborough Sauvignon Blanc, Central Otago Pinot Noir and Gisborne Chardonnay? Each region is identified and respected for the style of wine produced and linked to the distinct terroir of the region. The question remains, why should hops be any different and what opportunity does this open for the New Zealand hop sector?

There is no evidence of such research being carried out in the New Zealand market which is perhaps not surprising given all hops are currently grown in a small geographic area among well-established growers. With a growing craft beer scene both domestically and internationally there is no immediate evidence to suggest the market demand for New Zealand hops will disappear any time soon. As a result, New Zealand has an opportunity to expand on the opportunity terroir presents by conducting in-field trials and work with brewers to launch new and existing hop products to the market.

What regions of New Zealand appear suitable to hop production?

Three key growing regions have been analysed and assessed on the basic requirements for hops to grow successfully. From the literature reviewed and the various discussions held the key attributes that commonly came through were:

1. Latitude
2. Temperature (winter chill)
3. Day length
4. Water
5. Wind

Taking these further and narrowing the field to focus the research it was determined to concentrate on three common fruit growing areas of New Zealand being Clyde, Hawkes Bay and Gisborne. To give greater confidence in the findings and to add a point of international and national comparison all regions have also been compared to existing hop growing areas of Nelson, Yakima Valley (USA), Hallertau (Germany) and Worcester (UK).

1. Latitude

All chosen locations fall within the recommended latitude range of 35-55^{o} north or south of the equator.

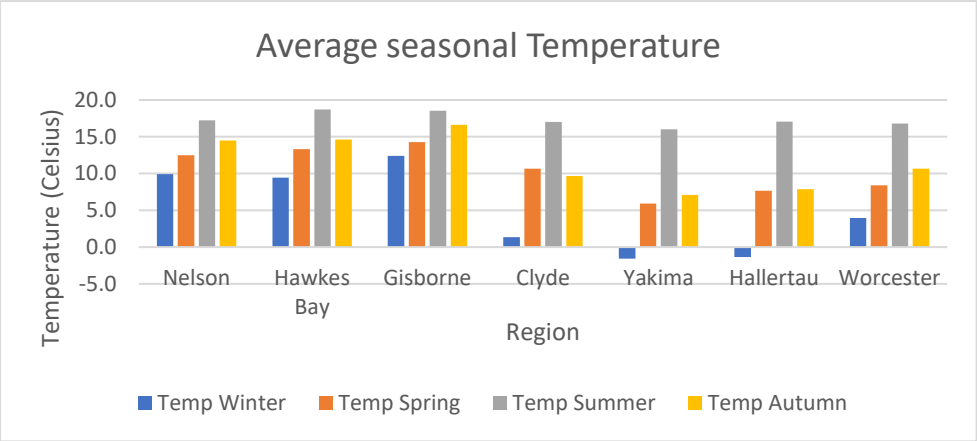
South	Latitude	North	Latitude
Nelson	41	Yakima	46
Gisborne	38	Hallertau	48
Hastings	39	UK - Worcester	52
Clyde	45		

2. Temperature

Temperature plays a major consideration in the successful establishment of a hop garden. While some reports and findings speculate on the importance of summer temperature, they all commonly agree on the need for an adequate winter chill period. Figure 10 illustrates the similarities for some regions and highlights potential risk for other regions to meet (or not) the winter chill requirements. Dodds (2017), notes – In the USA, hops extension sources suggest a threshold temperature of around 4.4-6^{o}C for a minimum cumulative period of 30-60 days for successful winter chill.

When looking at the various New Zealand locations, Clyde clearly meets the winter chill threshold while the other three sites indicate they may not. This would be of concern if not for the fact the Nelson region is New Zealand's only hop growing region and hops already grow well in this region. Hawkes Bay, based on the numbers presented has a slightly cooler winter and almost identical range of temperatures to Nelson for all other seasons.

Figure 10 – Average regional seasonal temperature

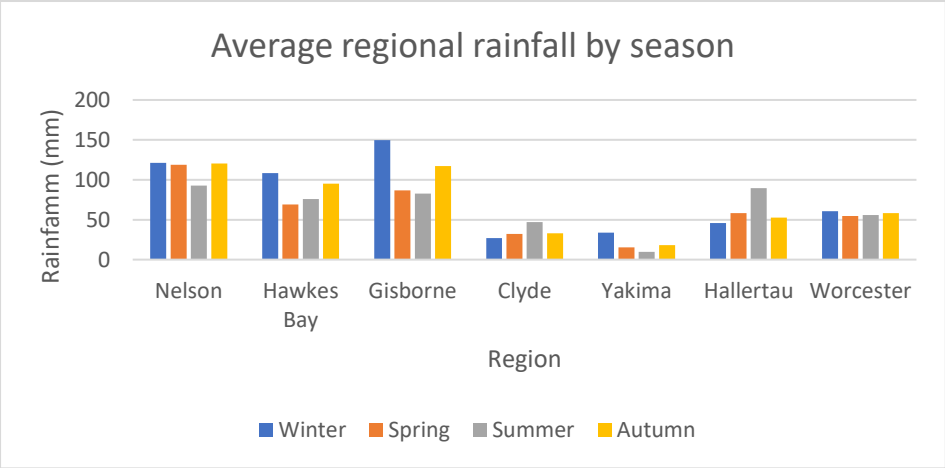


Source: NIWA/NASA

3. Rainfall/irrigation need

Rainfall plays a considerable part in the success of a hop garden in the respect it reduces the reliance on irrigation. The table below identifies the need for all regions to have suitable irrigation over the key growing months of spring and summer until the garden is harvested. Compared to the Northern Hemisphere regions, all NZ regions with the exception of Clyde show good summer rain fall. Irrigation will be particularly relevant for areas where summer rain is unpredictable as all New Zealand regions studied can prove to be. Clearly soil type will also play a major role in the site selection and need for a suitable water source to compliment the seasonal rainfall with free draining soils having a higher requirement for irrigation.

Figure 11 – Average seasonal rainfall



Source: NIWA/NASA

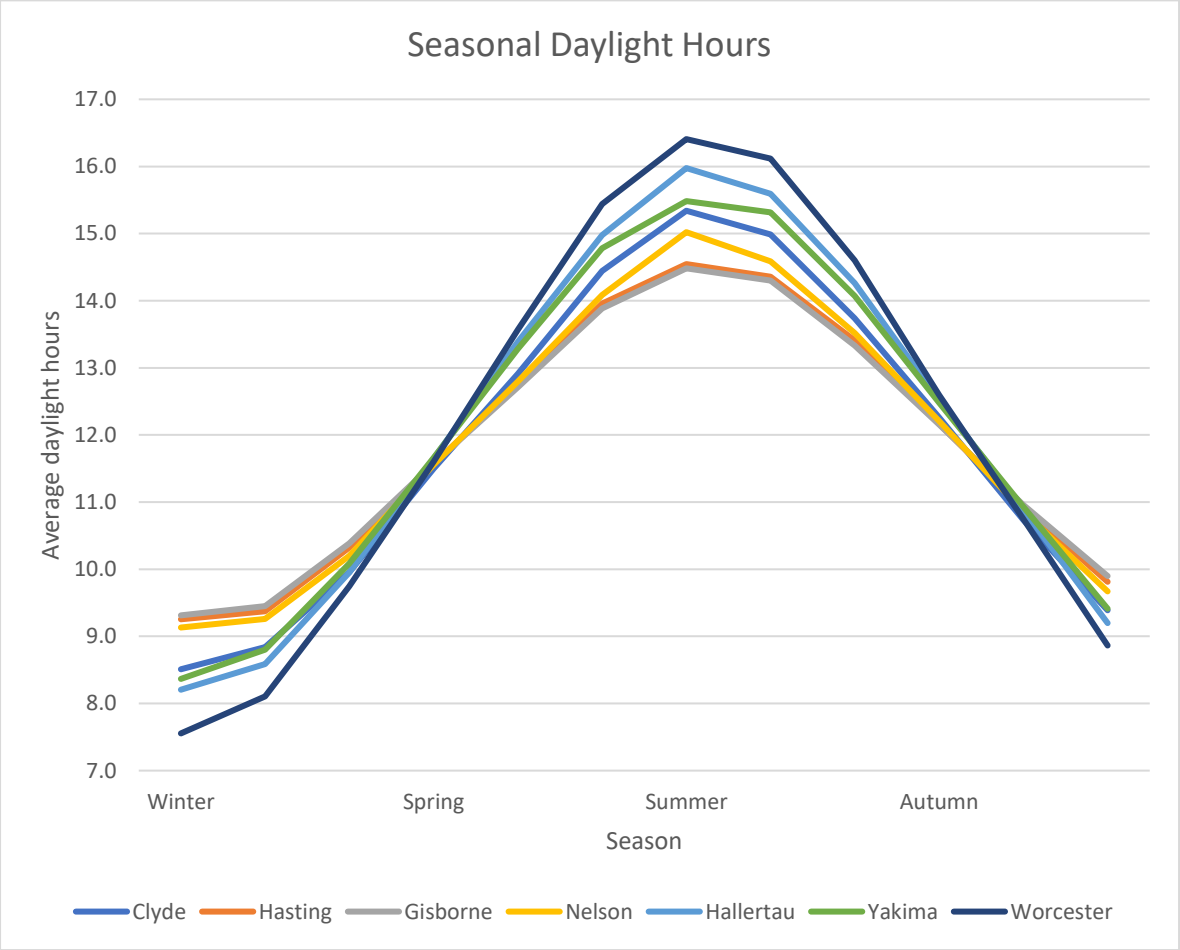
4. Day length

Day length is believed to trigger a hops response to key growing characteristics such as flowering and dormancy. From the various literature reviewed the length of daylight suggests greater yields are achieved in those locations with the longest summer daylength. The further you move out of the optimum latitude range, the more likely that canopy growth and/or flowering will be reduced diminishing the commercial viability. This is an observation also made by Dr Ron Beatson (Pers.

Comms, 2018). In breeding trials conducted in the three sites of Clyde (Central Otago), Motueka (Nelson) and Kerikeri (Northland), he noted a reduction in yield for varieties grown in Kerikeri where the day length is significantly shorter than Motueka or Clyde.

All New Zealand locations meet the day length requirement based on latitude.

Figure 12 – Average Seasonal Daylength

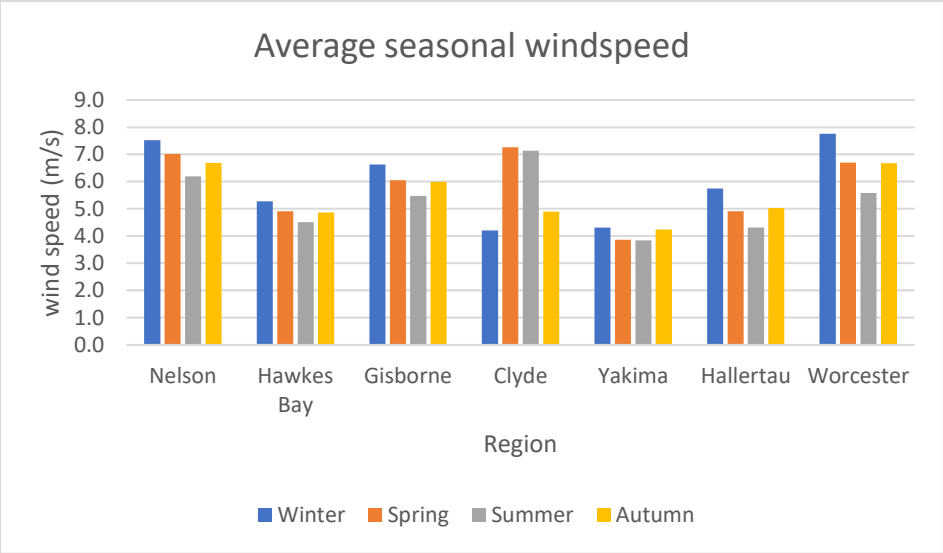


Source: US Navy, 2018

5. Wind

Dodds (2017), indicates wind can cause the scorching of hop flowers and cones and for cone bearing laterals to be torn from the bind reducing yield. All New Zealand regions when presented in the generalised form of comparing averages appear to have suitable wind conditions for the growing of hops. Clyde does exhibit the highest average seasonal wind for spring and summer which are the two critical seasons for hops. Careful site section would be required for anyone considering their options to grow hops in the Clyde region as a result. This can be mitigated through the erection of artificial or natural shelter noting the latter will take some time to establish, offering little protection over the initial years. This is not uncommon in other horticultural industries such as kiwifruit, apples and cherries where both artificial and natural shelter are used.

Figure 13 – Average seasonal wind speed



Source: NIWA/NASA

When reviewing the tables as a collective group it is clear there are opportunities and risks associated with establishing a hop garden outside the known quantum of the Nelson region. All sites have their opportunities and risks. Clyde displays remarkably similar characteristics to Yakima and Hallertau with good winter chill and long summer daylength. However; Clyde is not without its risks which appears to be the spring and summer winds and need for a reliable source of irrigation. These higher winds are at a time when the hop plant is at its most vulnerable and having previously lived in the Otago region for 20 years, the hot, dry summer winds of Central Otago are well known. However, within each region there will be locations which go against the trend and will offer natural shelter or if inclined and it is feasible to do so, artificial shelter can be erected to provide the protection required.

Hawkes Bay, Gisborne and Nelson share many similarities and on the face of it Hawkes Bay appears to meet all requirements to successfully establish a hop garden exhibiting almost identical attributes to Nelson. Again, considered site selection will be key to ensuring risks are mitigated.

The greatest risk noted for Gisborne based on the evidence presented is in the warmer winter months this region exhibits. With an average winter temperature in excess of 10^{o}C, this region runs the risk of insufficient winter chill. Dodds (2017), reports factors such as plant response to day length and winter chill requirement, are partly determined by genetics. This means that some hop varieties will grow where others might not. Continued field trials and working closely with key research teams such as Plant and Food Research will identify suitable material for use in each region and build a greater knowledge of the opportunity for growth in these new regions. It should also be noted kiwifruit grows successfully in the Gisborne region and there have been considerable plantings of this fruit in recent years throughout the Gisborne region. Kiwifruit, like hops, also requires a sufficient winter chill period to encourage maximum productivity giving further confidence of the ability to grow hops in this region.

Where and how are hop plants sourced?

One of the principle barriers to expansion of the hop sector at this point in time appears to be the availability of plant material for any grower wishing to set up outside the NZHL network. Through

an historical agreement, NZHL have secured the right to all current PVR varieties and it also seems non-PVR varieties. This gives NZHL intellectual property rights to all current PVR and non-PVR varieties and effectively seeks to stop any grower from propagating plant material for resale. Until recently this has not been problematic as all growers were suppliers to NZHL. Only since new hop businesses have entered the market has the issue of access to plant material become evident. According to Wendy Cashmore, Head of PVR, Plant and Food Research, this is an area of ongoing negotiation with NZHL and new growers. In the interim Plant and Food Research is looking to continue to breed new material which will, in time, be licensed and available to all growers through a royalty based model.

Proprietary breeding has proven to be a successful model for New Zealand agriculture as is evidenced in the success of companies such as Zespri with its Gold kiwifruit and the apple sector with brands such as Dazzle, Jazz, Envy and Rockit. Having control of a variety and the ability to focus on sales and marketing of unique and specific differences in the market gives growers the ability to leverage brand and maximise income.

To understand the development of the breeding programme, Dr Ron Beatson was interviewed (Pers. Comms. 2018) to gain a greater insight not only in where the industry has come from but more importantly what breeding/research techniques are being implemented to meet brewer and consumer needs.

From this interview, it was gleaned that historical breeding has centred on agronomic characteristics of maximising yield as historically and currently, growers are best able to maximise income through increasing productivity. While this driver is unlikely to significantly change in the years to come, greater emphasis in the breeding cycle has been placed on understanding the brewing ability of a hop and small batch brews are now undertaken as part of the breeding cycle as a result. In time, this will allow growers to gain a greater understanding on the likely market appeal for a hop before they plant it. A win-win situation for growers and brewers.

Once bred and released to market there are two registered nurseries for hops, Waimea Nursery and Macs Hops. Wendy Cashmore, Manager Plant Varieties, Plant and Food Research (Pers. Comms, 2018) comments that both have a history of providing quality plant material. Cashmore also notes the following means for a new grower to secure plant material for a hop garden:

1. Public domain access through informal supply networks e.g. nurseries, garden centres, on-line trading sites
    - This channel provides access to established, named varieties e.g. Smoothcone; no contractual terms are applicable, sales terms are as per the vendor, there are no royalties or licence fees applicable
    - Aspects to be alert to include uncertainty about plant health status (e.g. virus infection), trueness to type to the variety name and expected character, and provenance i.e. are the plants genuinely public domain varieties with no duty of care owed to any holder of PVR or other IP rights?
2. New Zealand Hops Limited (NZHL) – a proprietary portfolio of the most up to date varieties reflecting the current commercial production and New Zealand export offering
    - The IP rights in the proprietary portfolio of varieties offered by NZHL results from a very recent agreement between NZHL and Plant & Food Research; the parties have had a long standing R&D relationship, including investment together in breeding new hops varieties adapted to the NEW ZEALAND environment and commercial objectives. The parties have brought their former R&D arrangement to an end in favour of a new and diversified model for R&D engagement across the hops sector;

the transfer of the rights in the current portfolio of varieties to NZHL was a natural consideration in that outcome.
    - NZHL is continuing all contracts in place at the effective date of that IP Transfer (20 April 2018) and is developing its commercial engagement model for further development of the portfolio of varieties
    - Existing and new parties interested in production of these varieties should approach NZHL directly; certain licence terms including fees and royalties will apply
    - NZHL does not propagate and sell plants themselves but has capable nursery sub-licensees available for that component of the supply chain.
3. Importation of hops varieties
    - There are a range of public and private programmes internationally that could be approached for access to hop varieties
    - MPI manages the systems and processes for importation of plant material to New Zealand; the critical component of that system is an Import Health Standard (IHS) – essentially the regulatory framework that establishes risk/mitigations for plant pest and disease status and the milestones/assurances any party wishing to import plant material would need to meet
    - The MPI systems is user pays; there is no current IHS for hops – it is likely that if a party was considering importing hop material MPI would expect them to pay for development and sign-off of a new IHS.

(Source: Cashmore, W. Pers. Comms. 2018)

Of the three options indicated by Cashmore, Option 2 presents the only viable option for a commercial grower to access high value proprietary products until Plant and Food Research is in a position to supply directly to the open market.

Selling hops

Tom Frankcomb, Nuffield Scholar (2009) identified the key to successful trading for fresh produce was not dependent on the business structure, but rather a combination of factors such as:

- Supply what the customer wants and needs
- Always look to minimise cost structures in the chain
- Facilitate a smooth transfer and flow of information through the chain from customer to producer and vice versa
- Provide the producer and customer with something unique such as access to profitable varieties that will give them a competitive advantage

These key successful trading dynamics are relevant to hops if not all New Zealand primary export products as New Zealand look to supply the higher value markets willing to pay more for quality products.

Traditionally all New Zealand grown hops have been sold through NZHL via brokers and direct to brewers domestically and internationally.

According to the NZHL website, New Zealand hops are sold in over 50 countries making servicing this market, as a small global producer, a logistical challenge and logically necessitates the need for third party providers (brokers) of such services. The strategy taken by NZHL is one offering both an advantage and disadvantage. Advantage is seen in the ability to spread the market risk by reducing the reliance on any one market/customer. Disadvantage is in having somewhat scarce products spread too far and wide to be meaningful to any one larger craft brewer looking for a commitment of greater volumes.

Freestyle Farms in comparison has some similarities to NZHL although it has a greater emphasis on supplying direct to brewers through personal networks. It is this type of structure new entrants such as Hop Revolution are also looking to adopt. The direct marketing approach between growers/suppliers and brewer is seeing several international craft brewers express interest in committing to long term contracts with this business. Most importantly these buyers are indicating a willingness to pay a premium to secure their long-term supply of quality New Zealand hops (Dunbar and Wheeler, Pers. Comms. 2018).

With the growth of the craft beer market innovation in distribution models is starting to appear. One such example is the recently established on-line trading platform, The Lupulin Exchange. This platform is providing the means for brewers and brokers with surplus quantities of hops to sell in a transparent manner.

As noted by Donelan (Pers. Comms. 2018), "it's not really an alternative to the grower marketing model, they simply supply a platform for re-selling" therefore offering little competition to the existing sales channels for New Zealand hops.

Given the increase in global trade for most products via E-commerce, such platforms may well prove to become a mainstream path to market in the future. This will not replace the need for third party providers of such services as brewing is a technical industry which appears to seek expertise and knowledge to assist in the understanding of hop varieties. New Zealand hop producers are also going to need market support from established providers of services such as promotion and distribution. Such relationships prove their worth in periods of a depressed market where brewers have the flexibility to be selective on price and product. Being left alone to the mercy of the market when remote to the market could leave a business vulnerable without such networks to call on for support. Any new business would be wise to invest time and resources in building a strong network to provide flexibility in moving stock at crucial times.

An area of common agreement among the parties researched was the need to spend time in the market. All spent considerable time attending industry trade shows and key events to mix with brewers, brokers and other industry supporting businesses.

Dunbar (2018), Freestyle Farms stated they invite brewers to New Zealand to have them involved in the harvest and allowing them to effectively have a say in what hops are harvested and when. This is a smart means of creating a customer centric model, build relationship and ultimately trust with the customer. In the modern era of social media, these brewers also share the story to their followers and help to build knowledge of New Zealand grown hops and Freestyle Farms creating brand value for all.

What is the cost to establish and operate a hop garden?

Dunbar (Pers. Comms. 2018) indicates it is forecast to cost approximately $55,000/ha to establish a hop garden (excluding land) starting from a base of bare land.

This will likely vary according to site and availability of labour and skilled expertise to establish as well as the level of 'sweat equity' an owner operator is prepared to commit to establishing a hop garden.

According to cost estimates again provided from Dunbar (2018), total annual operational costs are forecast at approximately $17,000-$20,000/ha which he qualifies is for gardens of 50ha and above. With approximately 40% of these costs seen as fixed costs, economies of scale will exist.

Other factors which may influence the cost to operate a hop garden are:

Availability of labour, contour, automation of tasks (noting this will have a corresponding capital cost to purchase relevant machinery, R&M etc) and seasonal variation. The one common comment made by all people spoken to was the complexity involved with managing a hop garden. For this reason, it would be prudent for any new grower to seek a suitably qualified manager or consultant who can assist in developing and managing the garden pre and post-harvest; at least over the initial establishment season(s) as knowledge is gained.

Access to such skilled management will be particularly pertinent for any grower considering establishing outside the Nelson region where other grower support may not exist.

An agreed theme identified throughout the investigation into the hop sector was the quality of the end product was greatly influenced by the quality of the harvest and drying of the hop cone (Dunbar and Wheeler, 2018). With a limited harvest window, gardens need to be established with a range of varieties and associated maturity dates. Appendix 1 and 2 provides an insight into the varieties available and their respective harvest windows. Once harvested, hops need to be processed (picked) and dried within a short period of time.

The temptation for a grower to plant a monoculture of a high value proprietary variety such as Nelson Sauvin is high. However, Nelson Sauvin typically matures within a 7-10 day period meaning a garden of any scale would need to be able to harvest, pick and dry the cones within this short time frame. This also assumes a problem free harvest with perfect weather conditions, staffing and no mechanical breakdowns. As anyone from within or associated with the primary sector knows, such conditions are extremely rare.

Picking machines (pick the hop cone off the bine) range in size, associated speed and cost and are a necessity for all gardens. To determine the most appropriate picker to purchase will require an understanding of the harvest requirements and length of harvest window. Dodds (2017) notes the harvest is the most intense period of activity in both the hop yard and processing shed. Mature cones must be harvested, cleaned and dried in the shortest time possible to ensure optimum quality and storability.

Taking short cuts in this critical area will be detrimental to establishing a successful hop business.

How are hops processed ready for market?

Once the hops are dried and in a baled state, hops are typically pelletised and kept in airtight foil packaging of various weights. This puts them in a form that is easier to distribute and is the most common way for hops to be traded.

NZHL pelletises all hops on behalf of its grower shareholders, while Freestyle Farms completes this process in-house.

Labour

Over the course of writing this project the NZ horticulture sector was experiencing an unprecedented shortage of labour placing pressure on many fronts and throughout the industry. All parties related to growing hops commented on the intensive management a hop garden and the need for periods of high labour numbers to complete tasks. As a result, any new grower will need to study and understand the labour implications when determining the suitability of hop garden location, access to labour and suitable accommodation.

Financial returns – a case study

With the absence of detailed financial information from within the existing New Zealand hop industry, a case study was completed for a garden being established with MyFarm in Tapawera, Nelson. For the purpose of this case study, it has been modelled to include a 115ha (effective) hop garden with all resulting product processed (pelletised), marketed and sold by a third party. For the sake of clarity and to present a 'grower owned' model, all investment fees and establishment costs (legal fees, due diligence costs) have been removed. All costs are believed to be conservative.

This model has also assumed a bare land purchase price of $50,000/ha (total area), based on local market feedback and a land utilisation of 90%, leaving 10% as headlands, tracks and buildings.

An assumption has been included in figure 13 below for an investment into an associated third party such as New Zealand Hops Ltd. It is assumed shares are purchased in this business, however no allowance has been made for any potential profit share from this business. It is noted this could be done in-house, however there would then be the need for investment in a pelletising machine and packaging equipment as well as an allowance for sales, marketing and market support.

Other assumptions used include:

- Equity of 70% and all debt servicing based on interest only at 5.2% p.a
- Gross income to the grower after agency fees, royalties etc of $25/kg
- Average per hectare production fully established 1,660kg/ha
- All first-year operating losses capitalised (FY19)
- Income not realised until the second year of operation (FY20)
- No allowance has been made for a staggered draw down of funds associated with timing of development over the first year of operation
- Returns are pre-tax. No allowance has been made for depreciation or tax losses associated with development which are significant

Figure 13 – Total capital budget 115ha garden

	$ Total	$/Ha(effective)
Property Purchase	6,500,000	56,522
Estimated investment in NZ Hops Ltd	920,000	8,000
Buildings and Harvest Machinery	8,627,544	75,022
Garden machinery	1,190,000	10,348
Development Costs	6,347,795	55,198
First year operating losses	2,800,000	24,348
Total Establishment Cost	**26,385,339**	**229,438**
Funded by Equity	18,469,738	70%
Funded by Debt	7,915,602	30%

Source: MyFarm Limited

Figure 14: Forecast operating returns

	FY20	FY21	FY22	FY23
Average kg/ha yield	1,328	1,660	1,660	1,660
Garden Gate Return	3,818,000	4,772,500	4,772,500	4,772,500
Total Revenue	**3,818,000**	**4,772,500**	**4,772,500**	**4,772,500**
Garden Working Expenses	2,085,713	2,085,713	2,085,713	2,085,713
Total Operating Expenditue	**2,085,713**	**2,085,713**	**2,085,713**	**2,085,713**
EBITDA	1,732,288	2,686,788	2,686,788	2,686,788
EBIT	**1,732,288**	**2,686,788**	**2,686,788**	**2,686,788**
Interest	411,611	411,611	411,611	411,611
Net Profit Before Tax	**1,320,676**	**2,275,176**	**2,275,176**	**2,275,176**
ROE	**7%**	**12%**	**12%**	**12%**

Source: MyFarm Limited

The numbers presented in figure 13 and 14 above indicate the considerable capital investment required to establish and operate a hop garden. Seeing such costs also provides insight into why the existing hop industry has remained relatively static over the last 20 years during periods of volatile commodity cycles and lower hop prices. Until New Zealand growers broke away from the commodity market and into the higher value specialty hop market on the back of craft beer boom, there would likely have been little surplus capital or appetite for increasing investment in this sector.

Like all primary sectors and in particular horticulture, the hops sector is one which is typically high risk, high return. The forecast yields presented above support this dynamic and indicate favourable returns are possible for those willing and able to invest the capital and seek maximum market returns for the product. Investment at the front end in high quality, efficient processing machinery will allow a new grower to maximise the area planted into high yielding, higher value products such as Nelson Sauvin and Motueka as well as possible new varieties still in the breeding pipeline.

Scenario matrix for established garden

A scenario budget is presented below looking at the impact on returns +/- 20% of the forecast income and production presented in Figure 14

Figure 15 – ROE Scenario matrix +/- 20% yield and $/kg

		1,345	1,494	1,660	1,826	2,009
	20	3%	5%	7%	10%	12%
$/kg	**23**	5%	7%	10%	12%	15%
	25	7%	10%	12%	15%	18%
	28	10%	12%	15%	18%	21%
	30	12%	15%	18%	21%	24%

Source: MyFarm Limited

Figure 15 matrix should give confidence to any new party looking to enter the market. The qualifying statement to this is that the case study has been modelled on a garden of considerable scale (115ha) compared to the average New Zealand hop garden (c.25ha). Dunbar's (2018) comments that there are strong economies of scale in the hop sector due to approximately 40% of costs being fixed suggests gardens smaller than this would likely have lower returns on investment and the need to have an adjusted set of decision criteria.

Recommendations

As the market expands there is an underlying need for the New Zealand hop market to collaborate. This will maximise the opportunity expansion offers and have the potential to drive down costs, increasing margin to the grower. The prospect to collaborate will enhance growth opportunities for all, not only beyond New Zealand's borders but also within the garden gate through increased margins encouraging continued investment.

There can be no denying the wealth of knowledge that has been built up over several generations within the existing grower pool. The opportunity exists for these parties to participate in sharing their knowledge. This will assist new growers to supply high quality product to the market and avoid possible flow-on implications to the greater New Zealand hop industry reputation if hop quality is poor.

An alternative approach is for existing growers to establish a consulting and/or management service which it contracts out to the greater industry as new players enter this market.

Contract management/consulting is a particularly popular model within the kiwifruit and grape sector with contract management fees ranging from $800-$1,000/ha/yr as an example.

The market opportunity in front of the New Zealand hop industry appears too large for New Zealand growers to compete with one another internally. Increased supply offers the opportunity for New Zealand to service the market more consistently and drive up demand. This has the potential flow on benefit of maintaining higher price points for New Zealand hop growers.

Understanding the terroir of hops in other regions of New Zealand needs to be better understood and with that it is hoped further trials are completed to provide greater certainty for new growers looking to enter the market in new regions and offer the brewer market greater diversity of flavours.

Of note for any new grower, the labour market in the horticultural sector is currently facing challenges and growers/owners of future hop gardens will need to account for this in their investigation when considering where and if they enter this market. At this time, there appears to be little ability to mechanise many aspects of the hop garden management meaning a ready source of labour is a key factor in the decision matrix for any new grower.

Continued investment in R&D is crucial for the New Zealand hop sector. Plant and Food Research has served the industry well in its breeding to date. With increased competition in the sector it would be expected to see an increase in the rate of innovation competition creates. Key areas innovation is likely to occur and warrants continued efforts is in breeding and agronomy as well as the research into alternative hop products (oils, powders, nutraceutical's).

While the market pool of New Zealand varieties remains small, the ability for New Zealand growers and their respective supply entities to work collaboratively to promote the common good has to be explored further. Several primary sector businesses are seeing success in a structured approach to the market such as Zespri. In return, such businesses are feeding back to the grower what it is the market is seeking. This is allowing the industry to target management practices and research into areas which will maximise the return on their investment and the investment of the industry.

Conclusion

The opportunity to grow hops outside the nelson region exists.

Nelson has been New Zealand's home of hops since the mid-1800s and today remains a relatively small industry with approximately 23 growers and 500ha planted. Until recently this industry has seen little growth after many years of average returns discouraging investment in growth. However, the opportunity for the New Zealand hop sector to expand has developed on the back of:

- The global craft beer growth
- New Zealand plant breeding offering flavour and aroma profiles brewers want
- Proprietary products
- Limited supply of product to a growing market
- Clean green image and disease/spray free growing environment

With a growing craft beer scene both domestically and internationally there is no immediate evidence to suggest the demand for New Zealand hops will disappear any time soon.

While tightly held for many years the industry is opening up and facing the challenge of internal competition for the first time in the modern hop era. This is creating growing pains in the first instance as participants jostle for position and in time there will be the opportunity for all industry participants to work collaboratively to advantage all growers.

The cost of entry to this market is significant and the key barriers will not be lack of market opportunity. The key barriers to further expansion will be:

- Capital
- Skilled labour
- Sourcing plant material

The industry has been confined to the Nelson region since the mid-19th century and this region will continue to be the major centre for the hop industry. However, based on the basic growth requirements of latitude, day length, temperature (winter chill), access to water and wind other regions of New Zealand exhibit the potential for this crop to be a commercially viable option.

The growth of the craft beer sector has presented a significant opportunity for the New Zealand hop sector to grow.

From what I can determine through the international information available, the New Zealand hop industry has an opportunity to realise a premium position in a vast market looking for unique products. New Zealand's unique position lies in the fact we are a small producer (1%) of high value proprietary hops not grown anywhere else in the world.

Project review

This section looks at what has been learnt in completing a review of the hop sector.

The first challenge was finding the sources to give an unbiased view to the opportunity the growth of the craft beer market really does offer New Zealand hop growers. Discussion with the late Terry McCashin ignited a spark in me that inspired the 'want' to know more about this sector and challenge the popular belief hops could only be grown in the Nelson region. Time and again when seeking information those linked to the industry were cautious to divulge too much from what appears on the outside to be a fear of competition.

This was certainly not helped by the fact my employer, MyFarm, was in the process of setting up a new hops opportunity in the established backyard of Nelson with business from outside the existing ranks.

Personal dialogue through face to face meetings and phone calls broke down many barriers and in time people engaged and shared considerable information for which I am thankful.

The opportunity exists for hops to be grown in other regional locations of New Zealand and next steps will be to set up trials or find someone bold enough to establish a garden and have a go.

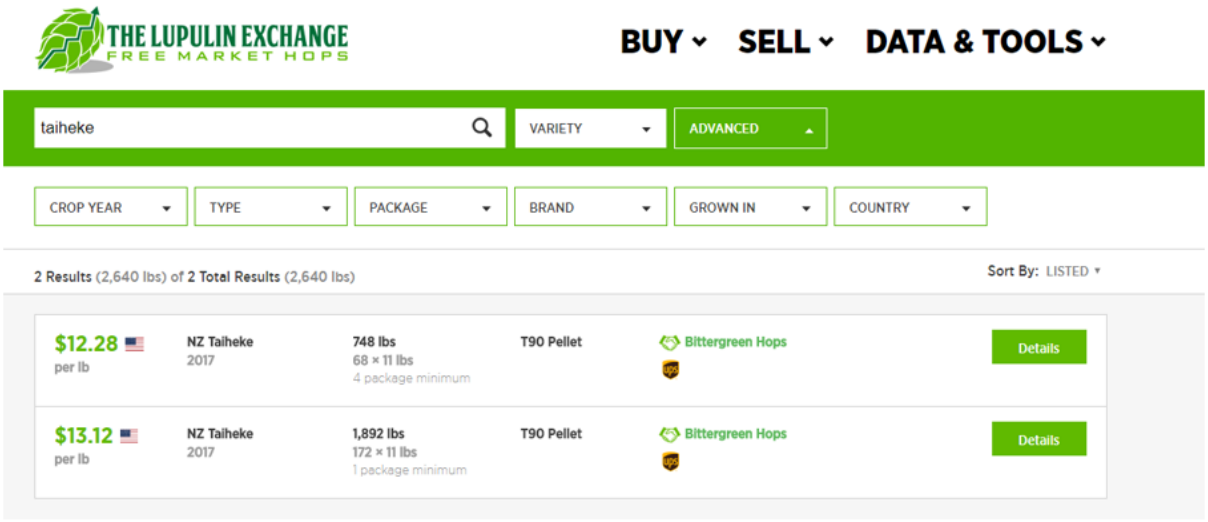
The second challenge was seeking and sourcing credible financial information for which a detailed financial assessment could be completed. It was interesting to note how many people from within the existing industry were nervous to share such information. Other than indicative numbers based on returns per hectare or estimated returns/kg this information proved a challenge to accumulate in any great detail. The siting of 'Intellectual property' was a consistent theme throughout the study limiting the hard data available to support the study.

Thankfully MyFarm was willing to allow the use of information gathered for its Tapawera investment property allowing a case study to be added in the late stages of this project. While based on a reasonable level of assumptions, this model will provide a high-level assessment for anyone looking to enter the industry. In time, it is hoped a more complete and detailed set of numbers will be available.

There exists untapped opportunity to explore this market further and in time I look forward to hearing of and seeing hops being grown in other areas of New Zealand.

Appendices

Appendix 1 – Taiheke Lupulin Exchange Results



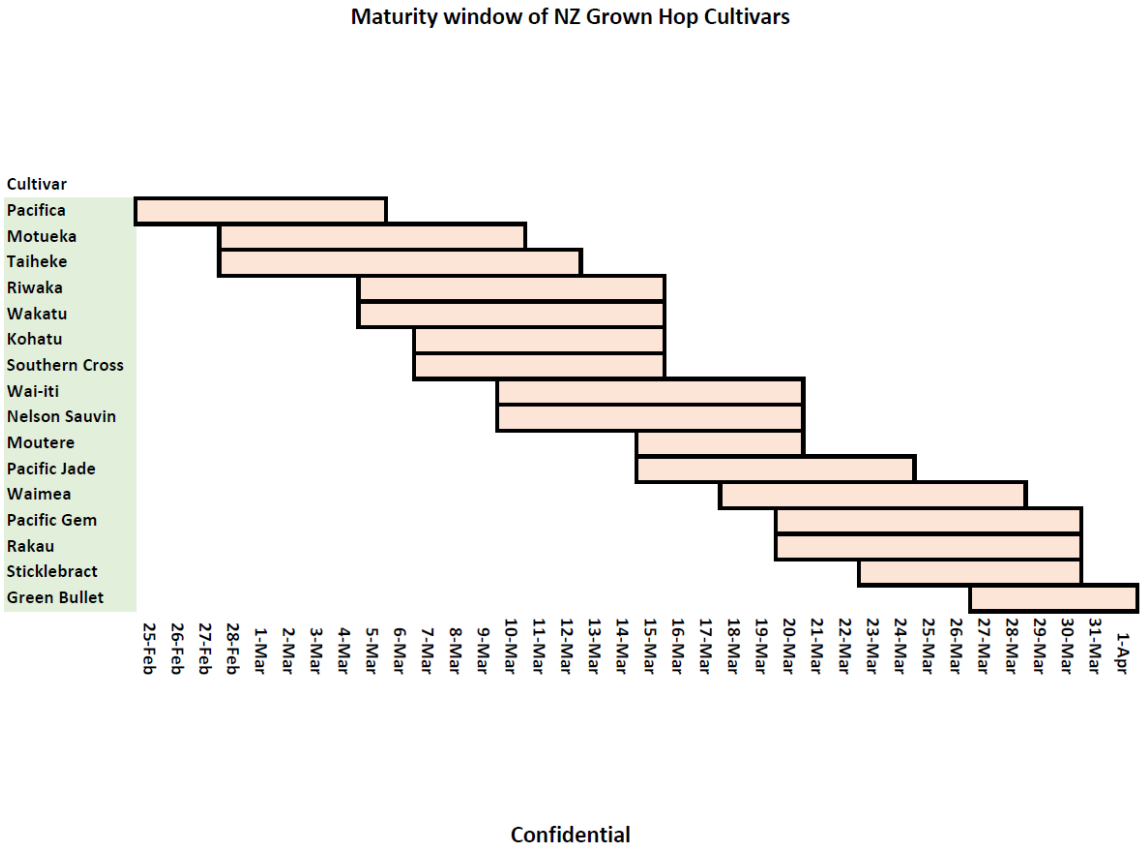
Source: www.lupulinexchange.com
Downloaded 29/4/18

Appendix 2 – NZ Variety chart

Name	Year of release	Type	Characteristics	Suitable uses
Pacific Gem	1987	Alpha (bittering)	Oaken flavours and blackberry aromas	European lagers
Wakatu	1988	Aroma	Freshly-zested lime and floral aromas	International premium lagers
Pacifica	1993	Aroma	Citrus notes	Traditional German lagers and pale ales
Southern Cross	1994	Dual purpose	Lemon peel and pine needle aroma with clean spiciness	Mainstream and craft styles
Motueka	1996	Aroma	Lemon and lime aroma with tropical background	Pilsners, traditional European and English ales
Riwaka	1996	Aroma	Grapefruit citrus aromas	New-world pale ale and pilsners
Nelson Sauvin	2000	Dual purpose	Crushed gooseberry aromas similar to Sauvignon blanc	American pale ales and super premiums
Pacific Jade	2004	Alpha	Fresh citrus and crushed black pepper aromas	Full ales and dryer lagers
Kohatu	2011	Aroma	Fruity flavours	Pale ales and pilsners
Wai-iti	2011	Aroma	Spicy, tropical flavours	Pale ales and pilsners
Waimea	2012	Alpha	Some citrus, herbaceous characteristics	Ales (including IPA's) and lagers

Source: Plant and Food Research - Growing Futures - 2012

Appendix 3 – New Zealand variety maturity table



Source: Ron Beatson, Pers. Comms. 2018

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