Where is the Profitability in the Manuka Honey Production in Northland?

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Photograph on the cover page, taken by Keegan Blignaut in January 2020, Taupo. The person photographed is James Schmidt and has given written permission to use this photograph.

1. Executive Summary

The Manuka honey industry in New Zealand underwent a massive change in December 2017 with the new definition for Manuka honey released by the Ministry for Primary Industries (MPI). The new definition of Manuka honey was released in response to the growing concerns of fraudulent honey being sold as Manuka honey and damaging the brand's integrity. The change in definition caused many Northland beekeepers to have their business become unprofitable due to old fashioned beekeeping practices, which caused the Manuka honey produced to fail when tested.

The change to the Manuka honey definition and the significant challenges Northland beekeepers face in terms of unfavourable spring weather, early Manuka flowering times, swarming, and access to early honey flows has caused many small beekeepers to close their business since 2017.

There is a general belief that beekeeping in Northland is too risky and that there is no profitability remaining in the Manuka honey in the region. This project sets out to determine if the Northland Manuka honey industry is profitable and, if so, how to unlock it. A comparison is made between Northland and Waikato to highlight the risks of beekeeping in Northland and determine the key focus areas that can reduce these risks and deliver profitability.

Using the data provided in MPI's Apiculture Monitoring Reports from June 2008 to June 2018, it is clear that a ~12% net profit before tax was achieved during these ten years in Northland. At ~12%, this profitability is exposed to significant downward pressure due to overstocking of beehives in the region and unsettled weather.

The findings from this study suggest that Northland beekeepers can improve this profitability to greater than 20% consistently over the long term by doing the following:

- Reducing beehive stocking rate in the region to one beehive per one and a half hectares of Manuka resource.
- Stop boundary stacking beehives to reduce poaching of Manuka nectar from neighbouring properties and so reduce the overall land royalty payment per beekeeper.
- Securing good wintering apiary sites to protect beehives from Karaka and Kowhai poisoning will ensure the healthiest bee colonies are placed into Manuka honey production.
- As Northland beekeepers experience an increase in operational cost related to the extended honey season, caused by warmer weather conditions year-round, producing the highest $/Kg Manuka honey is critical.
- An average of 18 kg of honey per beehive is the **NEW** expected yield per beehive in Northland, and of this 18 kg, only 9 kg would pass as mono-floral Manuka honey. Therefore, the beekeeper must ensure this Manuka honey has a minimum dollar value of $50/kg to ensure profitability year on year.
- The Northland beekeeper requires a mobile beekeeping operation that allows for beehives to be moved to Central North Island to make a second Manuka honey crop to increase profitability to over 30% in an average honey season.

There is profitability in Northland beekeeping; however, it requires the beekeeper to change from the old methods of beekeeping and ensuring all mono-floral Manuka honey is isolated to capture all the dollar value available. In doing so, the profitability of greater than 20% is achievable for a Northland commercial beekeeping business.

2. Introduction

The purpose of this report is to explore the profitability of the Northland based commercial beekeeping business, focused on Manuka honey production as its primary source of income generation.

Over the past ten years, consumers have become more informed and have required a higher level of scrutiny of products, especially for the products they eat or products that claim to have health benefits. This social scrutiny has placed the spotlight on the integrity of Manuka honey and the New Zealand beekeeping industry as a whole.

The 3 - 1 Manuka honey test established by Analytica Laboratories was the primary test used to define Manuka honey pre-December 2017. However, it is a broad definition for Manuka honey as it only determines the MGO and DHA rating of Manuka Honey and not its plant of origin. This broad definition of Manuka honey gave rise to many honey packers selling honey that did not pass as Manuka honey when tested after being packaged.[1]

The 3-1 Manuka honey test forms part of Manuka honey's testing as it is a critical component in authenticating Manuka honey's growth potential. However, it does not cover all areas of authentication required by MPI.

MPI was concerned that without a robust Manuka honey definition, Manuka honey as a brand would lose its integrity due to fraudulent Manuka honey sold on the international market. Therefore in 2014, MPI undertook research and set a new Manuka honey definition and honey testing process. The research into a new definition for Manuka honey was completed in April 2017 and released for public comment; in December 2017, the final draft of the new Manuka honey definition was released. (Criteria for Identifying Manuka honey, MPI. Technical Paper 2017/18, Pg. 1)

The pace of the growth in the Manuka honey industry began to slow within the six months before the release of the new Manuka honey definition in April 2017. This slow down was due to nervous commercial beekeeping businesses, honey buyers, and commercial honey packers concerned that particular Manuka honey grades or blends would not pass the new definition and experience a drop in market value.

Post the new Manuka honey definition release in December 2017, when coupled with three poor honey crops in Northland in 2016, 2017, and 2018, the face of the Manuka honey industry changed dramatically in Northland. Concerns emerged that commercial beekeeping in Northland was no longer profitable.

This project aims to determine if any profitability remains in Manuka honey production in Northland and how to unlock it.

[1] Source: https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12114712

3. Aims and Objectives:

1. Understanding the Manuka honey industry and the impact the new Manuka honey definition has had on Northland beekeeping.
2. Determine the factors that make beekeeping different in Northland to other regions of New Zealand.
3. Review the current state of Northland commercial beekeeping business and profitability.
4. Determine the best course of action to return, and increase the profitability of commercial beekeeping in Northland.

4. Methodology

The following resources and methods were used to compile this report:

1. To understand the Manuka plant and its history in New Zealand, a review of published Manuka plant's research was conducted.
2. To provide an overview of the Manuka honey industry, by analysing MPI and Stats NZ data on the Manuka honey industry to determine any trends that existed and to determine industry norms.
3. To determine export volumes and total dollar values of honey exports from New Zealand, a review of MPI's Apiculture reports from June 2008 to June 2018 was completed.
4. Used the NIWA climate reports for the Northland and Waikato to determine the similarities and differences between regions. The same NIWA report was used for both regions as the information in both reports was structured in the same fashion allowing for ease of comparison.
5. Explored personal industry experience required for success in commercial beekeeping in Northland. This experience was acquired through managing two of the three largest commercial beekeeping businesses in Northland with >~5000 beehives. This industry experience helped explore and understand the topics of volatile weather impact in the region, availability of bee forage, and Manuka flowering periods experienced in Northland.
6. Used the financial data provided in the MPI Apiculture reports to build a financial review of the Northland region for the period June 2008 to June 2018. The information in these reports was used to create all the tables, graphs, and charts to determine the Northland commercial beekeeping businesses' current profitability and potential profitability.

5. Overview of the Manuka plant and the honey it produces:

Manuka honey is produced from a plant named *Leptospermum scoparium* and is commonly known as Manuka or tea tree in New Zealand. The Manuka plant is a shrub of variable height ranging from 4-8 metres. Individual plants vary depending on the habitat it grows in. (New Zealand Garden Journal, Pg 4. 2008 Vol. 11(2) José G. B. Derraik). Contrary to common knowledge, *Leptospermum scoparium* may not be endemic to New Zealand. *Leptospermum scoparium* may be native to south-east Australia. (Thompson, J. (1989). Manuka thrives in extreme environments where the marginal growth of woody plants is common. For this reason, Manuka is used as a nurse plant for other native forest plants in New Zealand. Maori used the manuka wood for manufacturing weapons and tools, and the leaves were used to reduce fever and as a sedative. The Maori used Manuka oil for diarrhoea, colds, and inflammation (Lis-Balchin, M.; Hart, S.L.; Deans, S.G. 2000).

The growth of human settlements and deforestation for agriculture led to many forest areas being cleared, leading to a low nutrient status of soils in these areas, which became suitable for the Manuka plant to take hold (Harris et al., 1992) Manuka is the most widespread, abundant, and environmentally-tolerant woody species in New Zealand (Ronghua et al., 1984). Manuka is a pioneer plant which has a rapid growth rate and excellent seed production to colonise open areas if left to do so aggressively (New Zealand Garden Journal, Pg 4. 2008 Vol. 11(2) José G. B. Derraik).

All through the 1900's Manuka was eradicated by any method possible to make way for pastures and was viewed by many farms as the most invasive weed in New Zealand. In the 1970s and 1980s, research led to an opinion change, as Manuka was found to help slow soil erosion and help with water conservation (Williams, P.A. (1981).

In the early 1980s, Dr Peter Molan discovered Manuka honey's active properties, which led to a whole new understanding of the manuka plant and its potential value. In the early and mid-2000s, there was extensive research done on Manuka honey to determine the secret behind the antimicrobial activity.[2]

6. Understanding the Manuka Honey Industry:

[2] Source: https://www.mgs.org.nz/dr-peter-molan

6.1 (MGO) Methylglyoxal

Thomas Henle from the Dresden University in Germany discovered the chemical Marker (MGO) Methylglyoxal in Manuka honey in 2009. [3] MGO is the property in manuka honey that gives the honey its antimicrobial activity. It originates from (DHA) Dihydroxyacetone, which is present in the manuka nectar.[4] There is a relationship between DHA and MGO in a ratio of 3 to 1. DHA from the nectar converts into MGO. MGO is linked numerically to the UMF standard set out by the UMF Association. UMF stands for the Unique Manuka Factor. The higher the MGO or UMF, the greater the antimicrobial activity and hence an increase in economic value. Grades of between 1200 to 1800 MGO have been produced, however, these exceptionally high grades of Manuka honey are not common. It is common for commercial beekeeping businesses to produce honey in all the MGO bands, as seen in Figure 1[5].

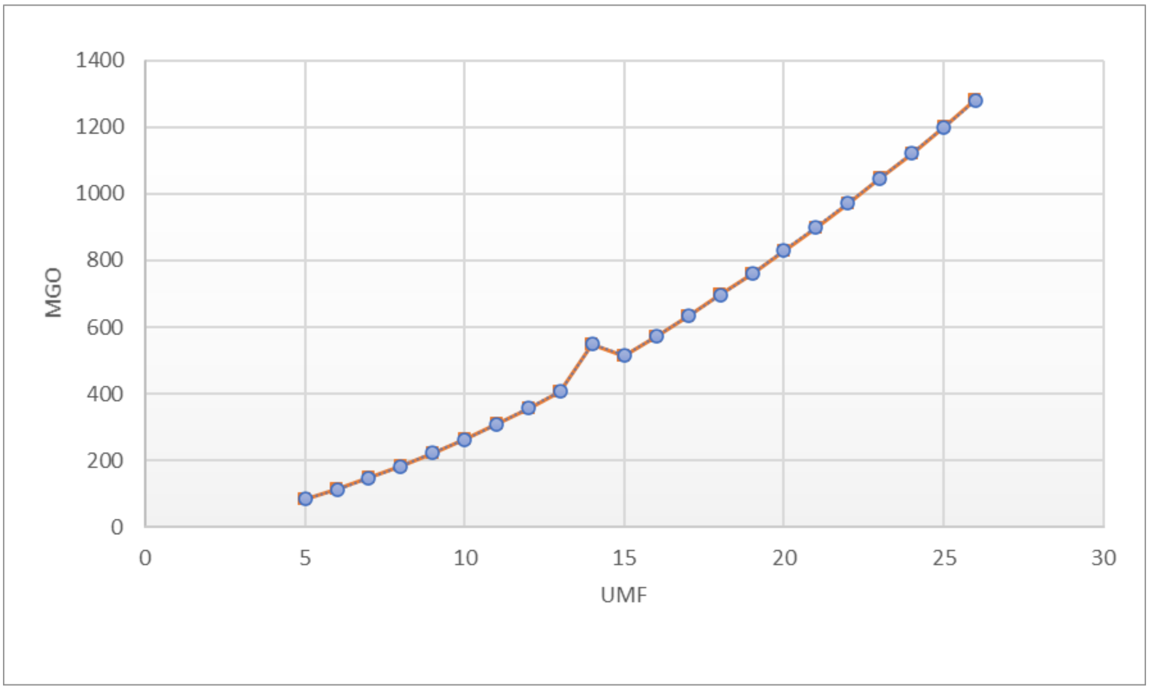

Figure 1: MGO to UMF

Source: https://export-x.com/manuka-honey-umf-to-mgo-calculator/

6.2 Production and Export of Manuka Honey:

Over the past ~10 years, the Manuka honey industry has experienced exceptional growth in the number of commercial beekeeping businesses producing Manuka honey and the number of Manuka honey distributors within New Zealand and internationally.

From June 2008 to June 2018, there was an increase in beehives from ~360 000 to ~880 000 beehives, an increase of ~ 520 000 beehives in New Zealand. The majority of the growth in beehive numbers has been on the North Island, where the largest proportion of Manuka plantation exists in New Zealand. From June 2008 to June 2018, the number of beehives has increased from ~227000 to ~670 000 beehives in the North Island. A growth rate of~ 66% over these ten years. Total capital expenditure over these ten years equals ~$171 million.[6] See Table 1.

The production and export of both bottled and bulk packaged Manuka honey have experienced a similar growth rate from June 2008 to June 2018. As of June 2008, the total of all types honey exported from New Zealand was 7384 tonnes at an estimated total revenue of ~ $94 million.[7] As of June 2018, the total of all types of honey exported from New Zealand was 8692 tonnes at an estimated total revenue of ~ $354 million[8] , a total growth of 73.38% over ten years. This 73.38% increase in export dollar value has not come from a substantial increase in tonnage exported but from an increase in the dollar value per kg of honey exported.

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[3] Source: https://www.mgs.org.nz/manuka-honey#:~:text=In%202009%20Thomas%20Henle%20from,Manuka%20flowers%20to%20varying%20degrees.

[4] Source:https://www.mgs.co.nz/manuka-honey

[5] Source: https://export-x.com/manuka-honey-umf-to-mgo-calculator/

[6] Source: MAF & MPI Apiculture Reports 2008 to 2018 -See:Table 1 in appendices

[7] Source: https://figure.nz/chart/kX4EHvK0MDmkZh4x-dkxXV5DkkLR54jQh

[8] Source: https://figure.nz/chart/kX4EHvK0MDmkZh4x-dkxXV5DkkLR54jQh

From June 2008 to June 2018, there has also been a clear move away from bulk honey to retail packaged honey to ensure the most significant dollar value gain per kg. In 2008, more than half of all exported honey was in bulk packaging, whereas in 2018, less than 1000 tonnes of the ~8700 tonnes exported was in bulk packaging.[9]

It is not easy to determine what types of honey make up the total New Zealand export tonnage as MPI does not currently collect this data. When comparing the ten-year average $/kg of honey exported for June 2008 to June 2018, Non-Manuka honey averaged $7.65/kg, and Mono-floral Manuka honey averaged $49.88/kg. Therefore there is a $42.88/kg difference between Non-Manuka and Manuka honey or a ~84.66% difference in price. From June 2008 to June 2018, the total tonnage exported increased by 15%, whereas the export revenue grew by 73.38%. The 73.38% increase indicates the export growth is related to a dollar value increase in Manuka honey rather than an increase in tonnage exported. The 73.38% increase also indicates that Manuka honey makes up a large portion of exports due to its higher dollar value. See Table 2[10] and Table 3[11] .

Before MPI released the new Manuka honey definition in December 2017, New Zealand had experienced a higher price per KG for non-manuka honey locally. Non-Manuka honey was blended into high-grade Manuka honey to "stretch" its intrinsic value beyond its actual market value when compared to international honey prices. International honey prices averaged out to .77 cent USD or NZD 1.25 per kg for bulk honey at a conversion rate of USD 1 to NZD 1.63[12]. The average $/kg for non-manuka honey between June 2008 and June 2018 was $7.65, which is $6 above the international honey price. This price difference would make it extremely difficult for non-Manuka honey to compete internationally both in bulk or retail package markets. Therefore it is reasonable to assume that a large part of the exported honey from New Zealand is Manuka honey.

Since MPI released the new Manuka honey definition in December 2017, there has been a reported increase of ~20% of honey being exported in bulk packaging to other countries from late 2018. This exported honey is supposedly being sent to countries with less stringent product labelling requirements for retail products and packaged as Manuka honey overseas. This is because these honey types would not pass the Manuka honey definition when packaged in New Zealand for the retail market both locally and internationally. This supposed increase in bulk honey exports has no current data to support it.

Like with most industries throughout the world, it is critical to keep a brand's integrity intact to ensure the product's value is protected. Manuka honey is no different because it has potential health benefits; hence it demands a high dollar value. As the Manuka honey industry grew, more and more customers wanted reassurance that the Manuka honey they were purchasing was actually "Pure Manuka Honey."

Under the current MPI Manuka honey definition released in December 2017, "Pure Manuka Honey" is broken into monofloral Manuka honey and multifloral Manuka honey[13]. To be defined as Manuka Honey, five chemical markers must be present in the honey. All other types of honey produced in New Zealand are referred to as non-Manuka honey by most commercial beekeeping businesses focusing on Manuka honey production as their primary income source.

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9 Source: MAF & MPI Apiculture Reports 2008 to 2018

10 Source: MAF & MPI Apiculture Reports 2008 to 2018

11 Source: https://figure.nz/chart/kX4EHvK0MDmkZh4x-dkxXV5DkkLR54jQh

12 Source:https://www.xe.com/currencyconverter/convert/?Amount=.77&From=USD&To=NZD

13 Criteria for Identifying Manuka honey, ISBN No: 978-1-77665-542-7, MPI Technical Paper 2017/18 Page 2

6.3 The New Definition of Manuka Honey released in December 2017[14]

Before releasing the New Manuka honey definition, many reports emerged in the media of fraudulent Manuka honey sold internationally. When tested, the honey in the jar did not match the label under the 3-1 Manuka Honey test used as the standard at the time. The 3-1 Manuka honey test definition honey was too broad and allowed a large amount of honey blending to occur in the packing process. Commercial beekeeping businesses and honey packers often blended non-Manuka honey with mono-floral or multi-floral manuka honey to "stretch" the dollar value of the Manuka and non- Manuka honey.

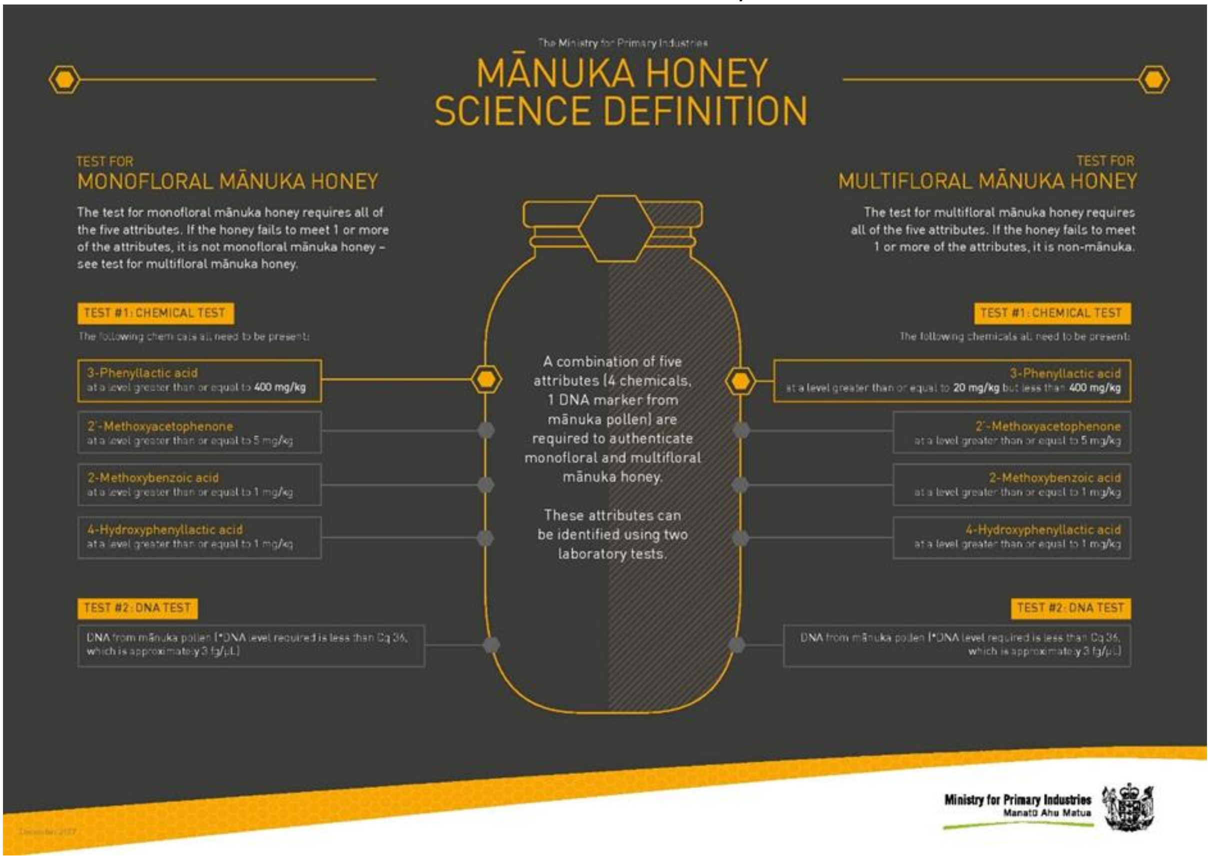

Figure 2: MPI's Definition of Manuka Honey released in December 2017
Source: https://www.mpi.govt.nz/dmsdocument/17374-manuka-honey-science-definition-infographic

6.4 Fraudulent Manuka honey exposed:

Articles 1 and 2 in the appendix are media reports raising the issue of fraudulent Manuka honey before the release of the new Manuka honey definition in December 2017.

The following vital issues emerged from the two articles:

- *Minerva Scientific tested seven leading Manuka Honey products widely available in UK stores or online and found six of the seven products had potential discrepancies between what was stated on the label and what the lab results showed. Five of the jars had total activity (TA) levels that conflicted with the figure printed on the label*[15]
- *According to New Zealand's leading Manuka association, 1,800 tonnes a year of the Manuka honey are now consumed in the UK each year, out of an estimated 10,000 tonnes sold globally. Yet Manuka honey production at the time of the publishing of this article was 1,700 tonnes or the equivalent. Therefore there is a large discrepancy in what the definition of as genuine Manuka honey.*[16]
- *Many customers do not understand the complexity of Manuka honey to determine if what is purchased is fake or genuine Manuka honey.*[17]

In conclusion, the Manuka honey industry has seen immense growth, and with it, significant changes to beekeeping practices and honey standards. Any significate growth in a niche food industry, in which Manuka

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14 Source: https://www.mpi.govt.nz/dmsdocument/17374-manuka-honey-science-definition-infographic

15 Source:https://www.comvita.co.uk/blog-article/press-release-manuka-honey-investigation/UKA300005

16 Source: https://www.independent.co.uk/life-style/food-and-drink/features/the-manuka-honey-scandal-9577344.html

17 Source: https://www.independent.co.uk/life-style/food-and-drink/features/the-manuka-honey-scandal-9577344.html

honey exists, will result in Government regulations to protect the brand, the customer, and those who choose to adhere to regulations.

MPI's release of the new Manuka honey definition in December 2017 killed the goose that laid the golden egg. Many beekeepers and retail packers came up short due to "dishonest" practices when blending and labelling Manuka honey incorrectly or dishonestly. The new Manuka honey definition, coupled with three poor honey crops in 2016, 2017, and 2018 changed the Manuka honey industry from a money-making machine to a risky business model.

The new Manuka honey definition has had the most significant impact on the commercial beekeepers in the Upper North Island, especially north of Kaiwaka, through to the Far North. The impact is due to lower yields of Mono- floral Manuka honey produced per beehive due to the Manuka flowering in late Spring and early Summer when the predominately unsettled weather occurs in Northland. Due to poor beekeeping practices, where beekeepers do not isolate mono-floral Manuka honey from other honey produced, results in a large proportion of high MGO honey failing to pass the new Manuka honey definition test. These two factors have resulted in many smaller commercial beekeepers closing or selling their businesses to large, more progressive beekeeping businesses.

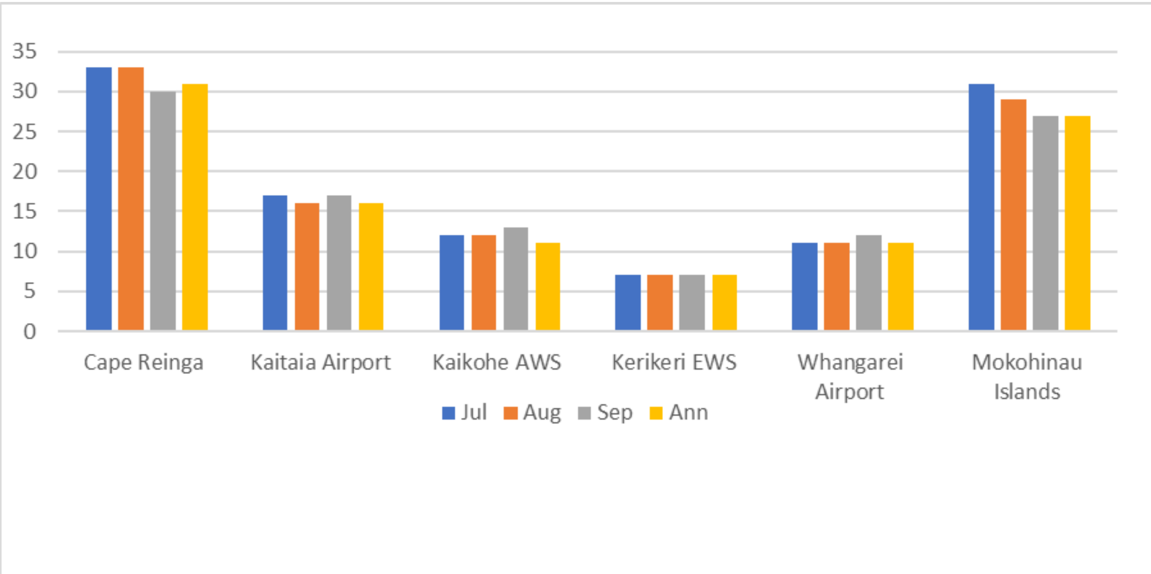
7.Beekeeping in the Far North:

The following dynamics that exist in the Northland need to be examined, variable weather conditions in Spring, availability of bee forage, Manuka flowering times, and land-ownership to understand why the new Manuka honey definition caused significant changes to commercial beekeeping in the region. A comparison is made between Northland and Waikato due to proximity geographically and experience managing a commercial beekeeping business in both these regions for the last three years.

7.1 Spring weather and colony build-up:

Wind: Many consider the Northland as a summer playground, calling it the "Winterless North," but Northland experiences very changeable weather patterns, which are not conducive to good honey crops. Spring is a critical period for most agri-businesses, and beekeeping is no different. In Spring, bee colonies start developing brood to raise new bees required for honey production. Bee colonies come out of winter mid-August with ~15000 bees and require ~60000 bees by October 10th to be production-ready for the main manuka crop in Northland. This increase of ~45000 bees is equivalent to a growth rate of 75% in 8 weeks or ~5600 new bees a week.

Northland experiences a predominantly southwest airflow through Winter and Spring. Spring is generally the windiest season for Northland, and winds can vary significantly in different geographical areas. Figure 3 shows the



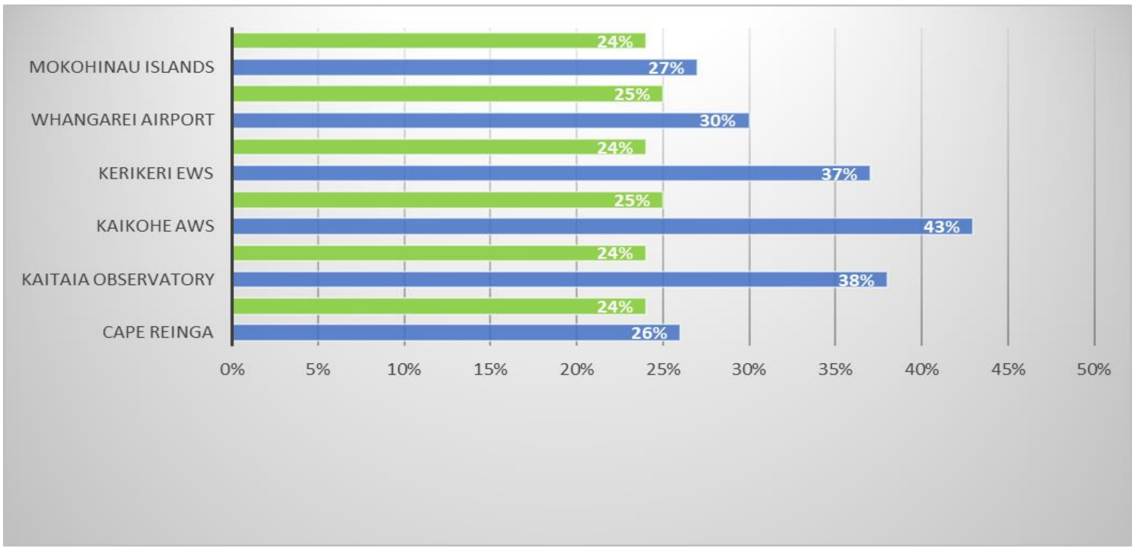
average wind speed in Northland through late Winter and early Spring, and Figure 4 shows the proportion of winds strength compared to total winds throughout the year

Figure 3: Mean Monthly and Annual Wind Speed (km/hr) in Northland (July to September)

Source: The Climate and weather Northland 3rd Edition,2013, #59 ISSN 1173-0382 (Online), P.R. Chappell[18]

Beekeepers in Northland refer to this as a "Southerly," it dramatically slows the bee colonies' Spring build-up. The "Southerly" wind is associated with cooler temperatures. Cooler temperatures that drop below ~13-degree Celsius cause the bees to eat more honey storage, slow brood development and increase labour costs as beekeepers must feed supplementary sugar syrup and do more beehive manipulation to achieve production-ready colonies. These Spring winds also impact Northland beekeepers more than in other regions in New Zealand as Northland beekeepers are required to have their beehives up to honey production strength by the 10th of October, forcing the beekeepers to work in unfavourable weather due to time constraints.

Figure 4: Northland-Spring Proportion of Strong (blue) and Light(green) Winds as a Percentage of the Annual



Totals of Northland

Source: The Climate and weather Northland 3rd Edition,2013, #59 ISSN 1173-0382 (Online), P.R. Chappell[19]

Even though beekeepers in the Waikato experience similar Spring wind patterns as Northland, as seen in Figures 5 and 6, the Waikato still offers the beekeepers some advantages. Many beekeepers south of Auckland require beehives to be up to honey production strength between the 10th and 30th of November as the Manuka flowers 4 to 6 weeks later in central New Zealand. In contrast, most of Northland's Manuka is 50% open, excepting the Pouto peninsula and the high grounds of the Waipoua forest. These extra 4 to 6 weeks enable colonies to build up more naturally than in Northland.

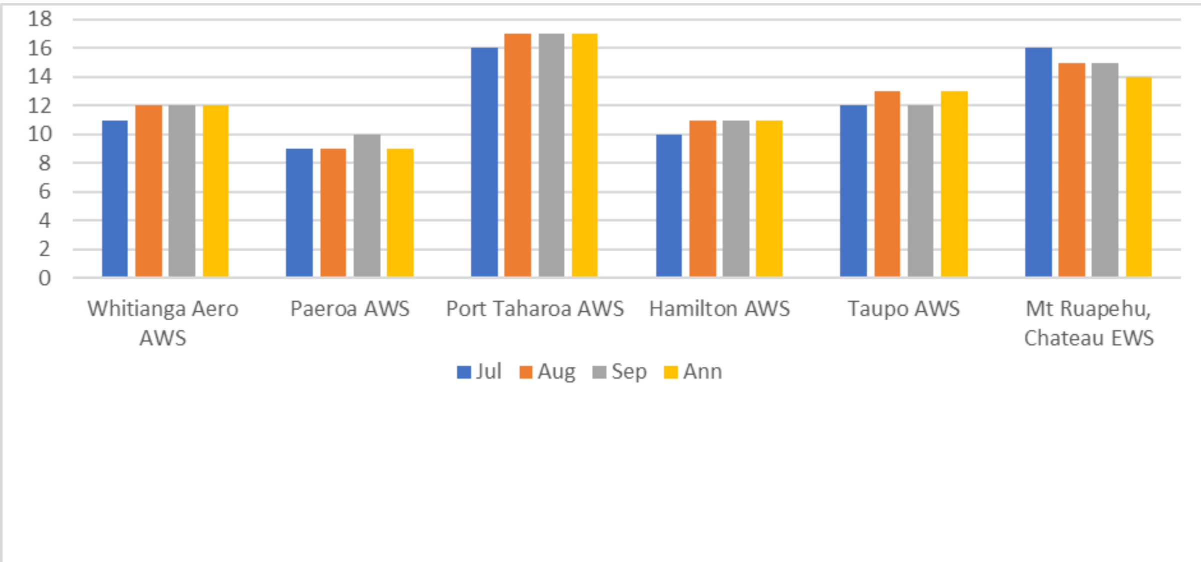


Figure 5: Mean Monthly and Annual Wind Speed (km/hr) in Waikato (July to September)

Source: The Climate and weather Waikato 2nd Edition, (No publishing date is given) #61 ISSN 1173-0382 (Online) P.R.Chappell[20]

18 Source: https://www.nrc.govt.nz/media/11212/climateandweatherofnorthlandniwa.pdf

19 Source: https://www.nrc.govt.nz/media/11212/climateandweatherofnorthlandniwa.pdf

20 Source: https://niwa.co.nz/static/Waikato%20ClimateWEB.pdf

When considering poor weather days between August to October across New Zealand and generally that the weather tends to be more settled moving into November, the extra 4-6 weeks available for bee colony build-up result in the more significant bee population in Waikato.

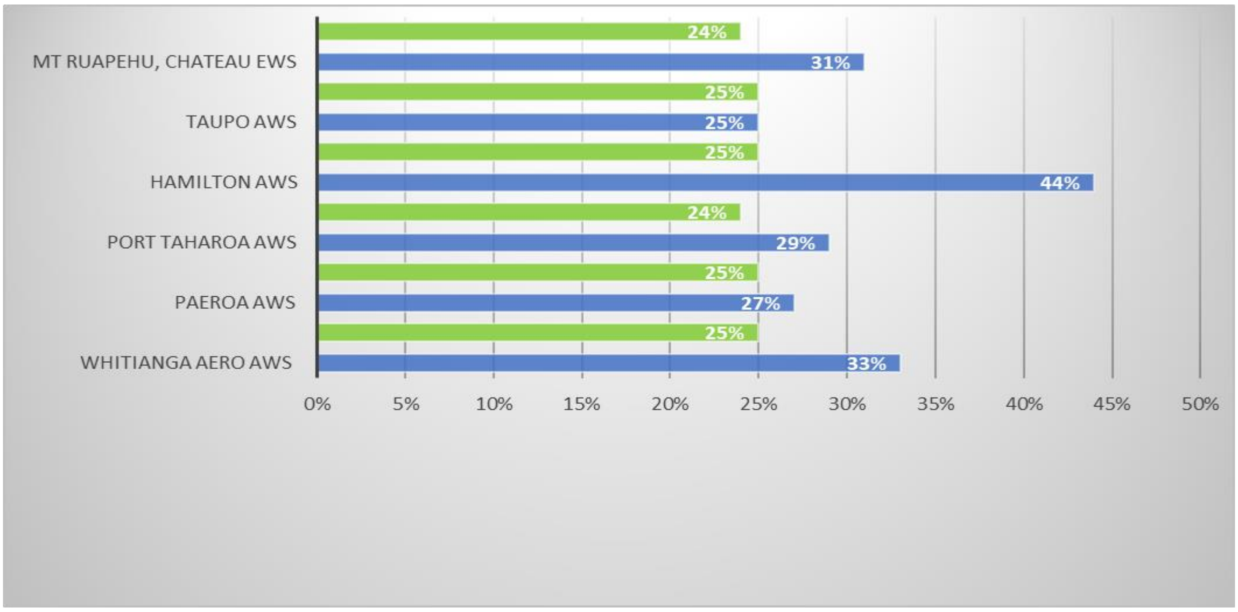


Figure 6: Waikato-Spring Proportion of Strong (blue) and Light(green) Winds as a Percentage of the Annual Totals of Waikato

Source: The Climate and weather Waikato 2nd Edition, (No publishing date is given) #61 ISSN 1173-0382 (Online) P.R. Chappell [21]

Rain: Average hours of rainfall during the day time is another area that affects beekeeping across New Zealand. Rainfall in most agri-businesses is a blessing. In contrast, rain for a commercial beekeeping business usually leads to increased workload on beekeepers. It can result in a significantly reduced honey crop being produced like in 2016 when New Zealand experienced one of its worst beekeeping seasons in ten years. The 2016/17 season produced an estimated honey crop of 14,855 tonnes, the lowest crop since the 2011/12 season when there was 47% (372,850) fewer hives. The average hive yield in 2016/17 of 18.7 kilograms was less than two-thirds of the ten-year average.[22] Poor weather was the most significant contributing factor to the low yield, which affected Northland beekeepers the greatest with an average yield of 15.2 kgs per beehive. Northland is unique because it is a narrow peninsula with no part more than 50 Kilometers from the Sea. This short distance between coastlines causes winds to be moist and results in abundant rainfall in the region[23]. The median rainfall across Northland varies from ~1000 mm on the coast to ~2000 mm across the mountain ranges. Due to this narrow peninsula, Northland experiences 150 to 200 rain days a year.[24]

[21] Source: https://niwa.co.nz/static/Waikato%20ClimateWEB.pdf

[22] MPI Apiculture report 2017, ISBN No. 978-1-77665-779-7 (Online), www.mpi.govt.nz

[23] The Climate and weather Northland 3rd Edition 2013, P.R. Chappell

[24] The Climate and weather Northland 3rd Edition 2013, P.R. Chappell

Beekeeping best practice is to not work inside the beehives when there is rainy weather. The challenge for Northland beekeepers is that Spring is generally wet. Rainy/wet weather or showery weather is associated with colder winds, and opening beehives in such weather reduces the bee colony's temperature. A reduction in beehives' brood cluster temperature is detrimental to the colony as bees need to keep the brood nest at 35 degrees Celsius to ensure the healthiest young bees emerge. Figures 7 and 8 show the regional differences in rain days between Northland and Waikato.

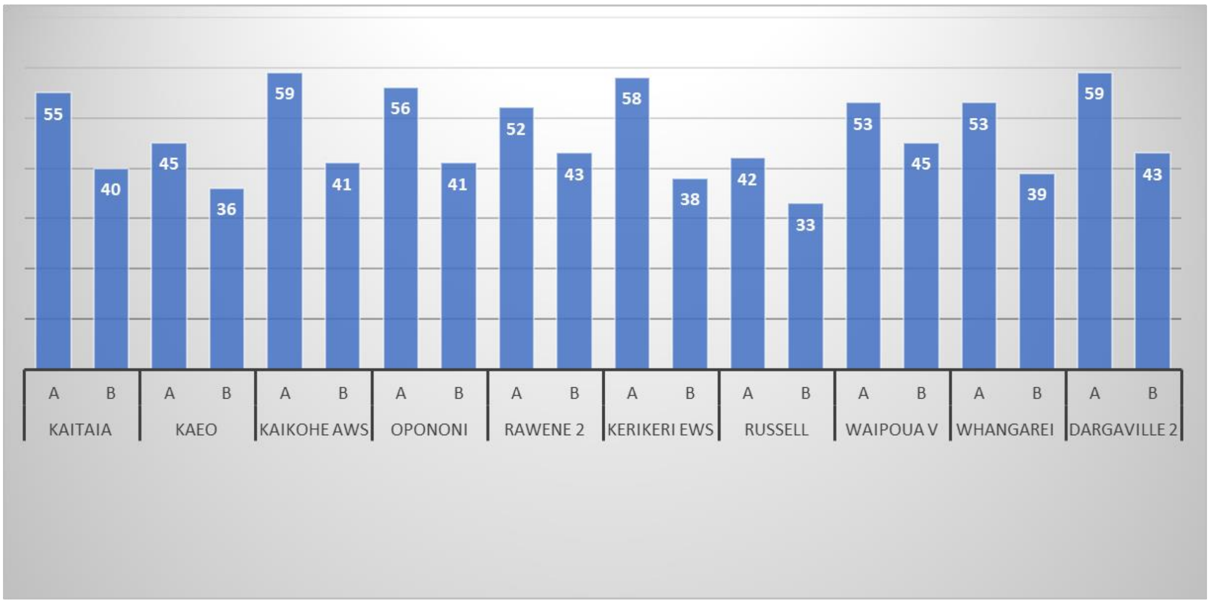


Figure 7: Northland-Average Aug. to Oct. rain days and wet days for the Northland region. A: 0.1 mm rain day; B: 1 mm wet day

Source: The Climate and weather Northland 3rd Edition,2013, #59 ISSN 1173-0382 (Online), P.R. Chappell[25]

The Waikato experiences ~ ten days less of showery weather between August to October compared to Northland. These extra ten days of fine weather can equal up to~10000 news bees emerging from the brood, contributing to improved bee health and population growth. Compared to Northland, ~ ten days of adverse weather can translate to an 11% increase in Northland beekeepers' workload. This increase is due to lost work time and reduced good bee foraging weather, causing reduced bee colony health and population growth and resulting in increased bee colony manipulation by the beekeeper.

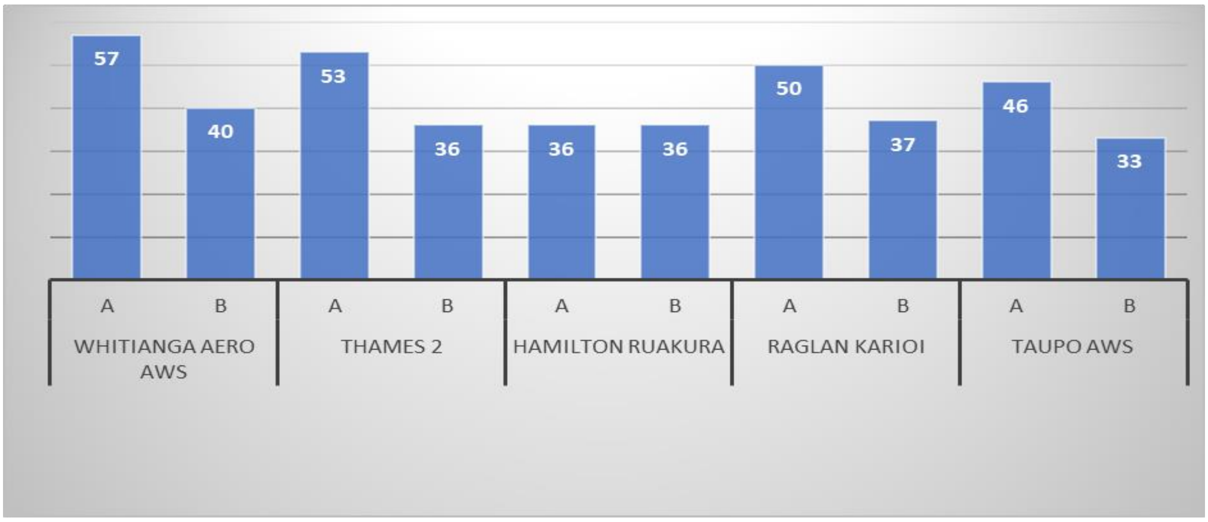


Figure 8: Waikato-Average Aug. to Oct. rain days and wet days. A: 0.1 mm rain day; B: 1 mm wet day

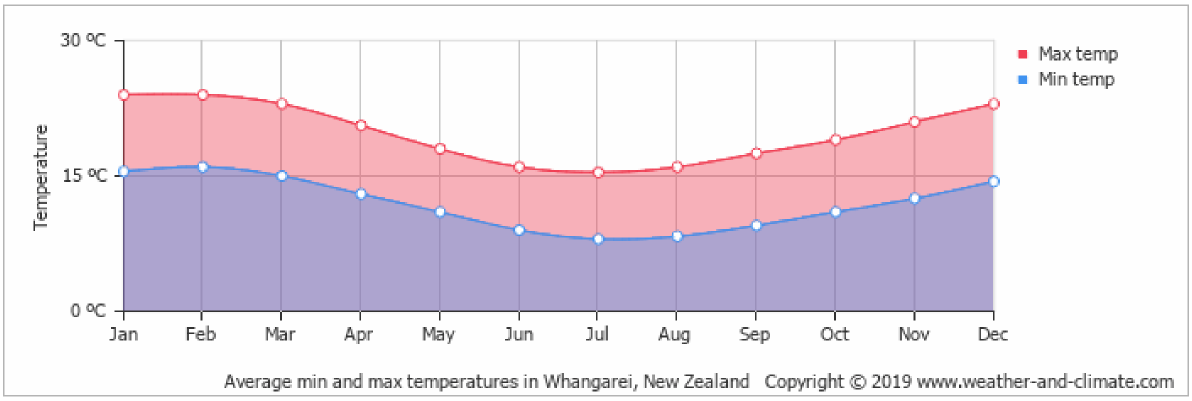
[25] Source: https://niwa.co.nz/static/Waikato%20ClimateWEB.pdf

Source: The Climate and weather Waikato 2nd Edition, (No publishing date is given) #61 ISSN 1173-0382 (Online) P.R. Chappell

Temperature: The difference in day time temperatures between Northland and Waikato does not affect bee colonies build up as dramatically as the windy or rainy weather. In a healthy colony of ~15000 bees in Mid-August, any temperature above ~13 degrees Celsius and the bees will be able to forage during settled weather.

Figure 9: Monthly Minimum and max temperatures for Kerikeri

Source:



https://weather-and-climate.com/average-monthly-min-max-Temperature,kerikeri,New-Zealand

The significant difference between Northland and Waikato as depicted in figure 9 and 10 related to temperature is a higher labour cost due to warmer average temperatures in Northland, which allow colonies to build up strength from early August and maintain brood until late April. In the Waikato, the beekeeping season is 6 to 8 weeks shorter as September is when colonies start to build up strength and colonies become broodless near the end of March due to much cooler night temperatures

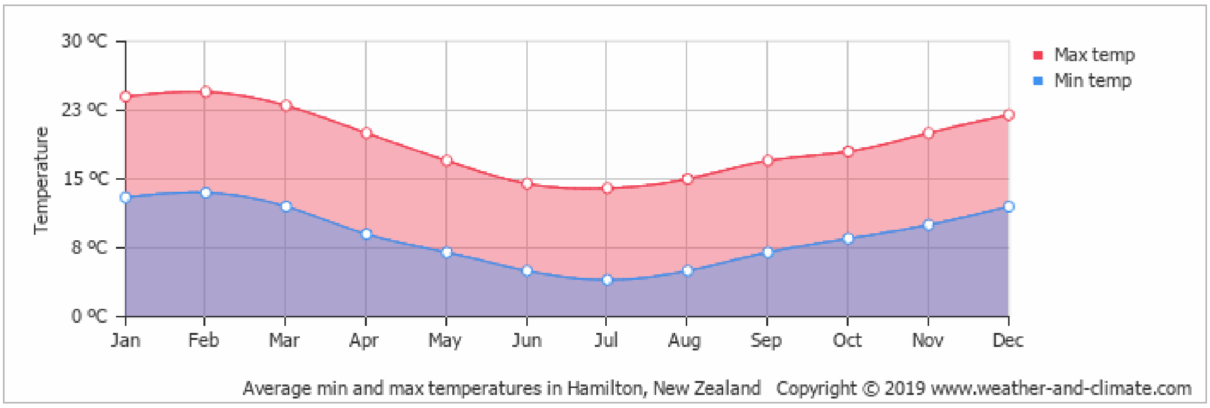


Figure 10: Monthly Minimum and Maximum temperatures for Hamilton

Source: https://weather-and-climate.com/average-monthly-min-max-Temperature,hamilton,New-Zealand

7.2 Availability of Bee Forage:

The availability of bee forage varies significantly across all regions of New Zealand. In most regions south of Auckland and throughout the lower North Island, most beekeepers winter the beehives near bush blocks, which offer great nectar and pollen sources for colony build-up in Spring. The natural nectar and pollen sources provide essential nutrients compared with human-made feed supplements. These beekeepers will produce ~10 Kg to ~30 kg from mid-September to early December before the beehives are moved into Manuka honey production. The availability of nectar and pollen allows bee colonies to build a large bee population and improve the bee colony's general health.

In Northland, there are a handful of challenges that commercial beekeepers face to access good bee forage for bee colony build-up in Spring, such as poisoning from karaka and kowhai trees. Bee colonies develop rapidly through August due to warmer day and night temperatures in Northland. These colonies require large volumes of nectar (3 to 4 liters/day) and pollen (~100 to 250 grams/day) to maintain the bee population growth from September onwards.

Most bush blocks in Northland contain large amounts of kowhai and karaka trees, and the nectar from both these trees poison bees. The kowhai and karaka trees flowering period moves with the warmer temperature from the east coast through mid-September to late October on the West Coast.

Karaka trees' nectar is poisonous for bees. Any bee colonies that forage from its nectar will have a considerable reduction in bee population and most likely not build up to honey production strength. The karaka tree nectar is taken back to the colony by foraging bees and fed to the queen, and this results in poor egg-laying, and a large number of queens will not recover from exposure to karaka tree nectar.[26]

Kowhai trees produce large quantities of nectar and bees forage the kowhai flowers profusely in early Spring before any other honey flow in most areas starts. Many beekeepers have experienced high bee mortality and thought the nectar was fermenting due to rainy weather in Spring, causing the nectar to turn to alcohol; however, there is no scientific evidence to support this.[27]

Research completed by P. G. Clinch, T. Palmer-Jones & I. W. Forster found that the kowhai nectar itself is poisonous to bees, often causing high bee mortality and the only method to avoid is this by moving the beehives from the area. They found that moving from the South Island and heading north into the North Island of New Zealand, the greater the kowhai poisoning's toxicity.[28] Bee colonies experience 30% to 50% losses of worker bees, mainly bees of foraging age, resulting in no honey crop being made from these colonies.

Due to karaka and kowhai trees' large geographical spread within the native bush in Northland, most commercial beekeeping businesses tender for forestry blocks, containing little or no native bush in them. The average cost of ~$10 to ~$15 per beehive is paid yearly to forest owners as a fee to winter beehives in the forestry block until the beehives are moved into manuka honey production. The cost to tender for forestry blocks increases the running cost per beehive for Northland beekeeping businesses compared to the Waikato, where most landowners are not paid for wintering sites, instead are given on average ~12 kg of honey per year as payment for the usage of the land.

This ~12kg of honey usually comes from the honey crop made from Waikato's beehives when on the wintering sites, therefore the wintering sites' cost is less per beehive. There are areas in Waikato where beekeepers pay for wintering, yet these sites tend to be excellent bush honey blocks that provide all-weather access and large bush honey crops.

The other challenge for Northland beekeepers is that not having a natural nectar source in Spring slows bee population growth as colonies instinctively increase bee population comparably to nectar availability. Northland beekeepers feed liquid sugar syrup as a replacement for nectar sources, yet it does not provide bee colonies with the essential nutrients for natural bee population growth. Liquid sugar syrup tends to make bees "excited" or hyper-active. This hyper-active behaviour results in increased brood generation in the bee colonies requiring large volumes of liquid sugar syrup to prevent the colonies from starving and can cause a

[26] T. Palmer-Jones & L. J. S. Line (1962) Poisoning of honey bees by nectar from the karaka tree (PG 433)

[27] P. G. Clinch , T. Palmer-Jones & I. W. Forster (1972) Effect on honey bees of nectar from the yellow kowhai (PG200)

[28] P. G. Clinch , T. Palmer-Jones & I. W. Forster (1972) Effect on honey bees of nectar from the yellow kowhai (PG200)

bee colony to want to swarm—both the swarming and rapid brood development results in an increased labour cost for a Northland beekeeper.

The increased bee population resulting from hyper-active brood generation requires large volumes of liquid sugar syrup feeding, which increases the costs to maintain the bee colonies and often results in high C4 levels in any Manuka honey produced. It is a challenge not to overfeed syrup to bee colonies while waiting for the Manuka nectar to start coming into the beehive at sufficient enough volumes to maintain colonies early in the Manuka honey production period.

C4 Sugar Levels in Honey: C4 naturally occurs in honey as part of the sugar content of honey; levels of >7% indicate human-made syrup was overfed when feeding the bee colony close to the honey flow. Any C4 levels greater than >7% will reduce the price for honey, especially for Manuka honey. C4 sugar levels tend to be higher in Manuka honey produced in Northland. The high C4 level is due to the beekeeper feeding bee colonies close to the nectar flow because the Manuka nectar availability is inconstant due to unsettled weather during the early flowering period. There are methods to reduce sugar syrup feeding in this critical period before Manuka honey production starts, yet it requires significate labour and beehive manipulation.

In the Waikato, most beekeepers will remove all the bush honey before the later Manuka honey flow, which starts after the bush honey. Removing the bush honey ensures any C4 sugar is separated from the Manuka honey and protects the honey's dollar value. Compared to Northland, which does not have a bush honey flow before the Manuka crop, this is a significant advantage to reduce the C4 levels in the Manuka honey crop.

Swarming: Swarming is the method whereby bee colonies naturally multiply without man's intervention. The bee colony increase in the bee population to the point where there is no more available space for population growth, resulting in the development of a new queen and the part of the bee colony swarming off. The old queen and ~50% to 70% of the bee population fly away to develop a new bee colony. A swarmed off bee colony will not build up to production strength in time for Manuka honey production as it loses all its available forager bees due to swarming.

The methods used to stop bee colonies swarming in Northland are labour-intensive. The swarming occurs from late September to late October, which coincides with moving beehives into the Manuka honey blocks for honey production. As beehives require to be moved at night to ensure all the bees are in the beehive and general beekeeping work is required to manage swarming during the day time, a labour unit will average 60+ hours of work during this period of the season. In contrast, Waikato beekeepers are not required to move any beehives into Manuka honey production during September and October due to the Manuka plant's later flowering time south of Auckland, allowing the beekeeper to focus all their effort on swarm control.

In the Waikato, beekeepers tend to reduce the bee colony size through beekeeping manipulation, reducing the bee population, and almost eliminate swarming when done correctly. This type of swarm control is not achievable in Northland because the beekeeper can not reduce the bee population enough to stop swarming completely as the bee colony will not produce any Manuka honey due to reduce bee population.

In the Waikato, the clover and Spring bush honey flow helps reduce the bee colonies' tendency to want to swarm off and reduces the C4 level as this early honey crop is harvested before moving the beehives into Manuka honey production. In contrast, very few early honey flows are available to produce honey before the Manuka honey production in Northland; therefore, the beekeeper must add extra beekeeping tasks to simulate a honey flow and reduce the C4 levels.

Any bee colonies that swarm off before being moved into Manuka honey production will not produce a Manuka honey crop as the flowering period is too short for the bee colonies to return to production strength. Likewise, any bee colonies already placed into Manuka honey production, which then swarm off, will not make a honey crop due to the loss of its foraging bees. Therefore the Northland beekeeper usually does intensive swarm control during the Manuka honey production, which increases labour cost and risk of disrupting the bee colonies when working with the bees, reducing the amount of Manuka Honey produced.

Best practice beekeeping can and will reduce bee colonies' swarming tendency and reduce C4 levels in honey. Still, these practices are labour-intensive compared to beekeeping practices that can be used in areas south of Auckland to manage these same risks.

7.3 Manuka flowering period:

The Manuka plant flowers at different times of the year between early September through to the end of February, dependent on the plantation's geographical area.[29] In Northland, the Manuka starts to flower on the east coast of the Cape Reinga from late-August and moves down the coast through Kaitaia in September, Mangonui, and Kaeo from mid-October to November. The Manuka flowering then crosses over the Puketi ranges and moves south from Herekino, the Hokianga, and through the Mangamuka's from later October to mid-December. Areas such as Waipoua, Dargaville, and Pouto Peninsula experience later flowering from November to early January. The Manuka flowering time frame experienced in Northland makes it challenging to maximise Manuka honey production while trying to stop bee colonies from swarming off and try to prevent the overfeeding, which results in increased C4 levels in the Manuka honey.

Compared to areas south of Auckland, the Manuka plant will not start flowering until late November through early January. By mid-November across New Zealand, bee colonies tendency to swarm off is over, and bee colonies have usually built up to production strength on the early honey flow, providing acceptable beekeeping practices have been followed. When coupled with the Manuka plant's later flowering time south of Auckland, these two factors offer the Waikato beekeepers a far greater opportunity to produce a larger Manuka honey crop. Waikato beekeepers commonly experience reduced labour costs, increase honey production due to fewer swarmed off bee colonies, and a reduced risk of high C4 levels compared to Northland beekeepers.

The final area of comparison when discussing Northland and Waikato's Manuka plant flowering times is tied to more settled weather experienced through Mid-November to February across New Zealand. Northland tends to experience more unsettled weather from September through to Mid-November, which can result in no Manuka honey crop in some years. The difference in the flowering times has resulted in an average of ~ 9 kg to 12 kg of monofloral Manuka honey produced per beehive per year in Northland, whereas areas south of Auckland average ~19 kg to ~23kg of Manuka honey.

7.3 Land Ownership:

All three of the topics as mentioned earlier, spring weather variability, forage availability, and Manuka flowering period are packaged within a unique land ownership structure in Northland that, in many cases, acts as a multiplier and increases the risk of a reduced Manuka honey crop.

The general rule for Manuka honey production is a ratio of 1 beehive per hectare of Manuka resource to ensure an economic return when generally settled weather patterns are experienced in any given region in New Zealand. To achieve this stocking rate in Northland is challenging due to the size of landholding and the number of landowners in areas where Manuka grows.

Figure 11 shows an area in Northland with ~130 different land titles surrounded by ~950 hectares of Manuka (blue areas represent Manuka/kanuka). Many landowners in this area live under financial distress and depend on the income commercial beekeeping businesses pay to place beehives on their properties for Manuka honey production.

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[29] The Manuka & Kanuka Plantation Guide, April 2017. https://www.trc.govt.nz/assets/Documents/Guidelines/Land-infosheets/Manuka-plantation-guide-landcare-April2017.pdf

A commonly seen beehive lease agreement would be 20 beehives at $50 per hive paid yearly. From the area depicted in the image, we can estimate there could be as many as ~2500 beehives accessing the ~950 hectares of Manuka resource available at a ratio of 3.8 hives per hectare. This overstocking of beehives dramatically reduces the potential to produce an economically sustainable Manuka honey crop in such areas. High stocking rates impact bee colony health due to high competition for natural nectar and pollen source and increases disease/pest control cost for the beekeeping business in Northland

Figure 11: Northland Area- Mangamuka GPS -35.234453, 173.53273
Source: http://mhnz.maps.arcgis.com/home/webmap/viewer.html?webmap=e045645a68964ace9d66efa32d9c40aa

Compared with the figure 12 from the border of Waikato and Bay of Plenty, there are ~30 land titles accessing ~9100 hectares of Manuka/kanuka resource. This is equivalent to ~300 hectares per land title, and this ensures that commercial beekeepers can achieve one beehive per hectare for Manuka honey production. Both the landowners and commercial beekeepers who place beehives in this area will produce a higher economic return than that seen in Northland due to the beehive stocking rate being correct.

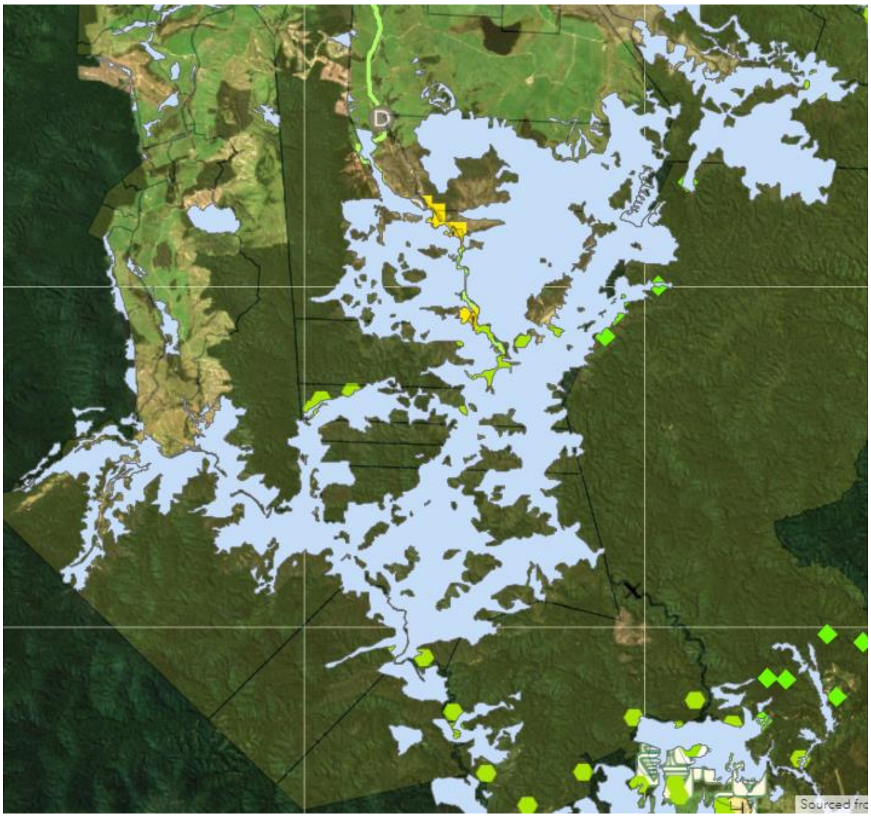

Figure 12: Waikato/Bay of Plenty- South of Taupo GPS -39.0677, 176.382809
Source: http://mhnz.maps.arcgis.com/home/webmap/viewer.html?webmap=e045645a68964ace9d66efa32d9c40aa

8. The financial position of most Northland based commercial beekeeping businesses:
Using financial data provided in the MPI's Apiculture Monitoring Reports released between June 2008 to June 2018, I compiled an indicative income statement for a Northland-based commercial beekeeping business. The data provided in these reports lead to indicative profitability of a Northland-based commercial beekeeping business over the ten years represented. The sample size of a commercial beekeeping business was defined as a business operating ~2000 beehives with five staff and a sole owner-operator.

8.1 Operational Expenditure:
Table 4[30] represents the indicative operational expenditure for the ten years from June 2008to June 2018. The peak in operational expenditure seen in 2010/2011 is due to the highest honey crop yield for the ten years of 34.14 Kg per hive. The indicative ten year average for operational expenditure is $391.21 per year. Therefore the total operational expenditure for a 2000 beehive operation would be ~$782,428.00 per year. Figure 13 presents the cost include to determine the average running cost per year for a beehive.[31]

Labour	Building rental	Sugar
Protein	Varroa Treatment	Repairs and maintenance
Compliance costs	Vehicle maintenance	Fuel
Queen Replacement	PPE	Drum Cost

Figure 13:Expenditures included in the average running cost per year
Source: MAF & MPI Apiculture Reports 2008 to 2018

8.2 Land royalty fee:
Manuka honey increased in dollar value due to further research into its health benefits, and the demand for it grew from health-conscious customers. As a result of this increase in dollar value, many landowners, where beekeepers placed the beehives, started to demand payment for the usage of their land to produce Manuka honey. In the beekeeping industry, this cost to use the land is referred to as land royalty fees.

There are three kinds of land royalty fees: a percentage of the crop value, usually up to 30%, a per beehive fee placement between $30 to $100 or for more favourable land opportunities, 50/50 profit share agreements.

[30] Source: MAF & MPI Apiculture Reports 2008 to 2018
[31] Source: MAF & MPI Apiculture Reports 2008 to 2018

Land royalty fees form part of the financial expenditure for a commercial beekeeping business. Table 5[32] shows that the ten-year average of $87 per beehive for Manuka honey production, a Northland commercial beekeeping business operating with 2000 beehives, will have an indicative land royalty fee of ~$174 000.00 per annum.

8.3 Understanding the Honey crop produced:

Table 6[33] shows that the total dollar value of honey crop produced for any commercial beekeeper focused on Manuka honey production consists of three parts. Part one - The Manuka honey produced represents ~50% of the honey crop produced in Northland (This ratio will be between ~60% to 80% south of Auckland depending on how an individual beekeeping business operates). Part two - The remaining ~50% of the honey crop is all other honey types that do not pass as monofloral Manuka honey. Part three - The combined average value of the total honey crop produced indicates the business's net sales per kg if the total crop was sold. If a Northland commercial beekeeping business were to use the average honey produced per beehive of 24.78 kg and the average $/kg of honey of $28.76 for the period 2008/2009 to June 2017/2018, it would have a net sales value of ~$1,425,345.00 per annum.

8.4 Net Profit average from June 2008 to 2018:

Table 8[34] indicates a total net profit of ~32% for using the averages provided, which is a positive result by most business's standards. However, these averages do not provide a realistic picture of the Northland commercial beekeeping business's financial returns due to overstocking of beehives on available Manuka honey resource and unsettled weather from September to December.

8.5 Why we cannot trust the averages:

Figure 14[35] and Table 7[36] shows how, over the ten years, June 2008 to June 2018, the number of beehives in Northland has increased by ~66% from ~ 53000 to ~159000, whereas the honey crop harvested has not increased proportionally. The average yearly increase in the honey crop over the ten years was ~10%, while there was an increase of ~100 000 beehives in Northland

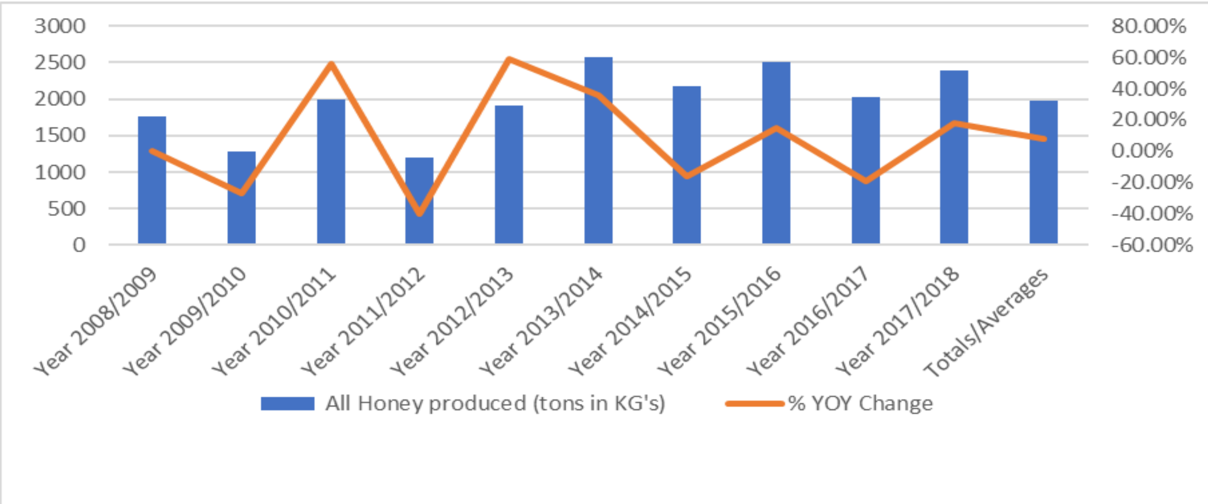

Figure 14: Year on Year change in Northland Honey Crop

Source: MAF & MPI Apiculture Reports 2008 to 2018

The realistic average kgs of honey produced per beehive is better determined by using the four-year average from June 2014/2015 to June 2017/2018, of 18.8 kgs. The average of 18.8 kgs takes into account the rapid increase in beehives and overstocking occurring and accounts for the unsettled weather experienced in Northland over this period. ~43% of the ~66% growth in beehives experienced in Northland from June 2008/2009 to June 2017/2018 occurred from 2014 to 2018. This ~43% increase in beehives resulted in an average decrease of ~38% in honey produced per beehive (June 2015 - 24.11 kgs to June 2018 - 15.00 Kgs). Table 9[37] represents a realistic net sales for a Northland commercial business that would be ~$1,081,376.00 per annum using the average honey production from June 2014/2015 to June 2017/2018. This net sale

[32] Source: MAF & MPI Apiculture Reports 2008 to 2018

[33] Source: MAF & MPI Apiculture Reports 2008 to 2018

[34] Source: MAF & MPI Apiculture Reports 2008 to 2018

[35] Source: MAF & MPI Apiculture Reports 2008 to 2018

[36] Source: MAF & MPI Apiculture Reports 2008 to 2018

[37] Source: MAF & MPI Apiculture Reports 2008 to 2018

generates a ~12% net profit, a realistic indication of profitability for a Northland beekeeping business with good Manuka honey apiary sites. This average ~12% net profit does not take into account that only a handful of Northland beekeepers will average ~ 18 kg of Manuka honey per beehive due to poor beekeeping practices and poor apiary site selection that do not produce high-grade Manuka honey consistently. This ~12% net profit is supported by Table 10[38] showing from June 2008 to June 2018, the average profitability for a Northland commercial beekeeping business is ~12%.

A Northland beekeeping business that achieved a consistent net profit before tax of ~12% would accept this as a positive financial return if the beekeeper eliminated all the risks discussed regarding beekeeping in Northland. However, due to the riskier nature of agri-business and especially that beekeeping and honey crop yields are tied so closely to settled warm weather, ~12% NPBT is not a comfortable return on investment. There is, however, a handful of reasons why beekeepers chose to start a business in Northland as listed below, which increases their business's net profit:

1. Generally, most of the Manuka honey produced is of a high grade due to the access to predominantly Manuka nectar during flowering time, reducing the potential for diluting the Manuka honey by other honey types.
2. Access to generally higher-grade Manuka honey due to Manuka plants' cultivars found in Northland producing higher DHA nectar.
3. The beekeeper's opportunity to produce a Manuka honey crop in Northland and harvest this Manuka honey crop in early December and then moves these same beehives south to Taupo, Taranaki, or Whanganui to continue producing honey.

9. Conclusion: Profitability is Achievable in Manuka Honey Production in Northland.

~12% net profit return on investment is not a sustainable return due to the risks a Northland beekeeper faces to achieve this profitability; therefore, achieving a minimum of 20% net profit is critical to ensure a stable business model over the long term. Achieving a minimum of 20% net profit year on year will require the business to produce over 20% net profit in the better honey seasons to achieve an average of 20% in the long term.

9.1 How to obtain better than a 20% profitability target:

- **Manuka Resource isolation and stocking rate:**
  - Due to the nature of small landholdings in Northland surrounding most Manuka resources, securing land isolated from other beekeeping operations is paramount. A stocking rate of one and a half hectares of Manuka per beehive is advisable, whereas, for the rest of New Zealand, the advisable stocking rate is one beehive per hectare of Manuka resource.
  - The accuracy of harvesting, batching, and testing of harvested honey will allow the beekeeper to focus on finding Manuka plantations that produce the highest grade MGO honey as this will ensure the highest dollar value per kg for the honey produced.
- **Local knowledge of areas affected by karaka and kowhai poisoning:**
  - Karaka and kowhai poisoning has been the demise of many beekeeping ventures, which have brought beehives into Northland from other regions without local knowledge of the bee forage. Knowledge of these poison "hot spots" is vital. Only moving beehives into Manuka honey production as late as possible, even once 50% of the Manuka has flowered, will increase the Manuka honey crop regardless of the weather.
  - Placing the beehives once the karaka and kowhai have flowered will ensure the bee colonies are in better condition after the Manuka honey crop is harvested and allow the beekeeper to take advantage of any second honey crop available either in Northland or other regions of New Zealand.
  - Tender to win forestry blocks on the east coast of Northland, which tends to have less karaka and kowhai trees in the surrounding bush. The East Coast tends to be two to three degrees warmer than the west coast helping the bee colonies develop faster in Spring.

[38] Source: MAF & MPI Apiculture Reports 2008 to 2018

- **Stringent control of operational expenditure when compared to land royalty fees:**
  - Northland's beekeeper standard practice is to pay landowners a fixed rate per beehive placed for Manuka honey production each year. This fee can range from $50 to over $100 depending on the Manuka honey quality produced in any given area.
  - The issue with this model is when beekeeper A has access to the Manuka resource on Landowner A's property of 50 hectares and places 32 beehives for Manuka honey production per year at $70.00 per beehive. Landowner B (direct neighbour of Landowner A), who does not have any Manuka resource on his property, allows beekeeper B to place 32 beehives for Manuka honey production, and the bees fly over the fence to Landowner A to obtain the nectar.
  - Beekeeper B also pays $70.00 per beehive land royalty fee. This situation results in 64 beehives foraging 50 hectares of Manuka resource, and neither beekeeper A or B makes enough Manuka honey unless it's an outstanding honey season. Both beekeepers have an operational expenditure of ~$12500 and a land royalty fee of $2240.00 per year; if both beekeepers harvested 9 kg of Manuka honey at ~$45 per kg (~400 to ~450 MGO), the net result for both beekeepers is **a loss** of ~$1800. See Table 11.
  - A better method is for beekeeper A to place 32 beehives on landowner A and pay both Landowner A and B $2000 per year land royalty. Securing full access to the Manuka resource will increase the Manuka honey crop yield to ~12 Kgs. There will most likely be a slight increase in MGO as the Manuka honey crop would be less diluted due to the bees not having to compete for the Manuka nectar resulting in $49 per Kg (~450 to~470 MGO, which is the ten year average from June 2008 to June 2018). Table 12 indicates a Net Profit of ~$1800 per year for beekeeper A, ~23% profitability increase compared to Table 11.

    Therefore securing exclusive access to the Manuka resource from both landowners A and B and reducing the beehive stocking rates per hectare of Manuka resource will improve profitability.
  - In Northland, most landowners have become accustomed to a per beehive rate for the land royalty fee. This payment structure where the number of beehives placed increases the land royalty paid to the landowner has resulted in beekeepers competing for Manuka resources, and an increased price being paid per beehive to the landowner. Generally, beekeepers do not understand the relationship of operational expenditure per beehive compared to land royalty fees and how it affects net profit. Beekeepers carry a higher operational cost and risk of no financial returns for every beehive placed at ~$392 of operational expenditure than the $89 land royalty fee per beehive per annum. Therefore it is more cost-effective to reduce the number of beehives placed than the overall land royalty paid.
  - Below is the comparison of 20 beehives' operational expenditure on a per beehive rate for land royalty compared to 16 beehives' operational expenditure on a fixed land royalty fee using the ten-year averages June 2008 to June 2018. Assuming that by reducing the stocking rate by four beehives, there would be an indicative increase of 1 kg per beehive over the remaining 16 beehives on site, which is low compared to the 48 kgs of honey that could potentially be made by these four beehives removed. See Table 13.
  - The Northland beekeeper will see a ~13% decrease in income but reduces the operational expenditure risk by 20%. This 20% reduction in operational cost should result in a minimum of a 3% increase in NPBT by using a conservative estimate of only 1 Kg increase in manuka honey crop produced due to the reduction in beehives.
  - Therefore, Northland beekeepers should reduce the number of beehives per landowner without changing the total land royalty paid to the landowner. Taking this action, the beekeeper reduces the exposure to the risk of financial losses by the greatest portion when compared to reducing the land royalty fee.

  - Not changing the land royalty fee paid per annum also protects against the unfortunate situation where the landowner does not agree to reduce the land royalty fee, and the beekeeper loses the apiary site.

- **Forecast Income on producing ~18Kg's of honey per season in Northland:**
  - The $/kg of all honey produced for June 2014 to June 2018 was $41.75; however, this is not the reality in June 2020 as the prices of both Manuka honey and all other honey have adjusted downwards. The Manuka honey price fell by ~9%, and all other types of honey fell by ~60% in June 2020. Table 14 indicates the combined honey price to be $35.00 per kg, and the Northland beekeeper must use this $/Kg to build all the financial models for forecasting cost and profitability.

  - Northland beekeepers must use the four-years June 2014 to June 2018 average kgs produced per beehive of ~18 kgs. ~50% of this ~18 Kgs will be monofloral Manuka if the correct apiary sites are chosen. The beekeeper must ensure the ~9 kg's mono-floral Manuka honey produced has a minimum $ value of ~$50 to cover the $450 of operational cost per beehive to protect the business' bottom line in poor seasons.

  - Northland beekeepers must ensure the majority of the remaining ~9 kg's of honey produced is multi-foral Manuka honey by harvesting the first Manuka honey crop with still 15% of Manuka flower remaining. In most seasons, there will be a second crop of ~6 kgs that should pass as a multifloral Manuka with an MGO grade of ~80 MGO to ~120 MGO. Most beehives will produce a further 3 kg of bush Honey, which will top up net sales once harvested. Using the business model, an indicative NPBT % of ~ 16% is achievable. See Table 15 – **NOTE:** No change to the land royalty was required to achieve this profitability.

  - To achieve greater than 20% profitability, a Northland beekeeper needs only to increase the Mono-floral Manuka crop by only ~1 kg per beehive. This increase of 1 kg per beehive is achievable by following the recommendations regarding stocking rates of beehives and exclusive access to the Manuka resource. The beekeeper's sole focus should be on reducing beehive numbers in overstocked areas and being prepared to increase the business's total land royalty fee per annum to secure exclusive access to the Manuka resource. By increasing the Mono-floral Manuka crop by 1 kg will increase profitability by ~8%. See Table 16

  - As a large volume of the Manuka flower finishes flowering by the 15th of December in Northland, a Northland beekeeper with the correct beehive equipment to allow for ease of transport of beehives can take advantage of the later flowering Manuka in central New Zealand. A Northland Beekeeper can move beehives to other regions south of Auckland, increasing profitability to ~30% in a settled weather season.

  - Most regions in central New Zealand, moving from East Cape across to Taupo and down into Taranaki and ending in Whanganui, experience a much later Manuka flowering period from the 15th of December to the 15th of February. This later flowering allows a Northland beekeeper to increase profitability or recover from a poor honey season in Northland.

  - The average kgs produced per beehive in the regions mentioned above is ~20 kgs of Manuka honey per season. For every 200 beehives, a Northland beekeeper can move into these regions; there is a potential upswing of ~15% if a Mono-floral Manuka honey greater than a 400 MGO is produced at an average of ~15 kgs per beehive. See Table 17

  - The beekeeping industry's general consensus is that the operational expenditure to produce a second monofloral Manuka honey crop is half the yearly operational expenditure. As the beehives are already at production strength during the first Manuka honey crop, they require fewer cost inputs to send into the second Manuka crop. This practice of sending beehives into a second Manuka crop is referred to as "double running." Double running is labour-intensive and can reduce colony health due to stress on bees; therefore, no more than 20% of all beehives should be double run.

9.2 Sustainable profitability is achievable by Northland beekeepers:

The evidence provided in Tables 13, 15, 16, and 17 reflects a realistic picture of the future state of Northland commercial beekeeping businesses financial situation if run correctly. The evidence provided also proves that Northland Manuka honey production is profitable at a >20% profitability year on year.

If Northland beekeepers that do not change their beekeeping practices and isolate the Mono-floral Manuka honey and reduce overstocking of beehives in the region, they will continue to experience unstainable financial loses.

10. Recommendations:

- Secure exclusive access to Manuka plantations to increase Manuka honey crop and improve the grade of the Manuka honey
- Reduce beehive stocking rate in Northland to one beehive per one and a half hectares of Manuka resource.
- Educate landowners regarding land royalty fees based on the total honey crop produced instead of a per beehive fee to reduce overstocking.
- Northland beekeepers must stop poaching Manuka honey from neighbouring land as this reduces the financial returns for the landowners and beekeeper
- Reduce the number of beehives per landowner as this is the best way to reduce financial exposure to financial loss rather than reducing the land royalty fee.
- Harvesting of the Manuka honey crop at the correct time during the season can result in a 6% to 8% increase in revenue; therefore, the beekeeper must ensure harvesting is completed correctly.
- Northland beekeepers must double-run a portion of their beehives to increase profitability and reduce the exposure of a failed honey crop in Northland.
- Northland Beekeepers must partner with landowners to plant Manuka plantations to increase the Manuka resource in the region.

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12.Appendices:

The article 1 below is taken from Comvita's UK webpage:

"Industry sources estimate over 8,000 tonnes of New Zealand honey is sold globally. Research by UMFHA, the Manuka honey producers" organisation in New Zealand, states approximately 2,500-3,000 tonnes of this is Manuka honey. Approximately 2,500** tonnes of this New Zealand Honey is exported to the UK annually, although due to commercial sensitivities, it is unknown exactly what percentage is Manuka. The Grocer Magazine suggests that this means that much of the Manuka honey industry is based on fraudulent claims.*

As part of their investigation, The Grocer commissioned Minerva Scientific, one of Europe's leading independent honey test laboratories, to test seven leading Manuka Honey products widely available in UK stores or online. They say; "Six had potential discrepancies between what was stated on the label and what the lab results showed. Five of the jars had total activity (TA) levels that conflicted with the figure printed on the label." Comvita's Medi-Bee Manuka Honey was the only honey that "…contained significant levels of the unique Non-Peroxide Activity, or NPA, that sets Manuka honey apart from other honey types and is the stuff in the honey that supposedly provides the acclaimed health effects."[39]
(Comvita UK, 2014)

The article 2 below is taken from Independent's UK webpage:

"It is a concern for a small yet growing proportion of the nation's shoppers: is the "liquid gold" in my jar worth all the buzz – and the £30 I paid for it? Because a scandal is sweeping the world's most rarefied beehives and the supply chain that connects them to its most extravagant buyers of honey.

Manuka has for years been touted by celebrities and health-food fans as a sweet elixir. Derived from the nectar of a New Zealand shrub of the same name, it has antibacterial properties and a range of reported health benefits. Yet rampant demand has led to antipodean turf wars, hive sabotage, the mass murder of bees, shoplifting and – now – a flood of fakes.

At the heart of the scandal: basic maths. According to New Zealand's leading Manuka association, 1,800 tonnes a year of the honey are now consumed in the UK each year, out of an estimated 10,000 tonnes globally. Yet production of the genuine stuff is set at just 1,700 tonnes, or the equivalent to more than three million small jars. Unless Britain has somehow managed to secure all of it, there's a lot of fake Manuka on our shelves.

The Grocer magazine has been on the trail of the dodgy honey for a while and reports this week an email it received from a whistleblower who would only agree to be quoted as "Manuka Man." "There is significant mislabelling and disingenuous claims across the UK," he wrote. "From high street shops to online retailers, counterfeit manuka honey is on sale across the UK and the UK consumer is being misled."

There is widespread evidence of a honey crimewave triggered by Manuka mania, which started in the early 1990s (only the Maori population swore by the unassuming plant's health properties before tests at Waikato University in Hamilton, New Zealand, caught global attention). For beekeepers, proximity to the plants is key. They deploy helicopters to prospect for new sites and land grabs are common. In 2012, The New Zealand Herald reported that two bee owners were offering big rewards for tip-offs about the theft of dozens of hives and the fatal poisoning of thousands of bees in a further 90 hives. The bees themselves are not special – the nectar contains all the value. In Britain, some retailers began limiting the number of jars on shelves and encasing them in security-tagged boxes after shoplifters began targeting the honey.

Waitrose sells various manuka brands at up to £10 per 100g, or almost £33 for a jar of Steens raw 20+ manuka honey. New Zealand-based Steens employs more than half a billion bees and says its most potent honey can be used to help heal burns and sores, as well as to aid digestion and rehydrate skin when used as a face mask.

Laboratory tests have questioned some of the health claims put forward by Manuka advocates but the honey's popularity will not be dimmed. Katherine Jenkins, the singer, has said it helps soothe her throat. Novak Djokovic revealed in his book "Serve to Win" that he starts each day with two spoonfuls of the honey mixed in warm water. Scarlett Johansson has promoted the use of Manuka in beauty products.

[39] Source:https://www.comvita.co.uk/blog-article/press-release-manuka-honey-investigation/UKA300005

Steens and other large producers, including the British company Rowse, assure consumers that their product is rigorously tested. "We're proud to say that Rowse N.P.A. (Non Peroxide Activity) Manuka honey comes exclusively from New Zealand," Rowse says. "We test each and every delivery at source before purchase in New Zealand and on receipt at Rowse Honey in Wallingford Oxfordshire, to guarantee its NPA rating."

NPA denotes the antibacterial profile that is unique to Manuka, but as Manuka Man said, "a lot of the industry does not understand the complexity of Manuka enough to understand that what they are buying is fake Manuka."

When Manuka isn't Manuka, it can be Kanuka, a cheaper honey derived from a plant with pollen that is fiendishly difficult to distinguish even under a microscope. No farmer has yet trained bees only to target the most lucrative plants and testing regimes can be limited. As part of its investigation, Grocer commissioned Minerva, "one of Europe's leading independent honey testing labs," to examine seven randomly selected jars of Manuka on sale in the UK, all but one showed discrepancies between what was on the label and what was in the jar, although not to the extent that they would bother the law. According to the Food Standards Agency (FSA), there is no legal definition of the "activity" or "total activity" of Manuka honey. Moreover, "activity" can fade between the time of testing by producers and use by consumers.

The FSA is working with other bodies to create a solution to eliminate the confusion now challenging a huge market. In the meantime, those who would not do without healing honey may look closer to home for a cheaper alternative. Last October, a Scottish study of the antibacterial properties of 29 kinds of honey published in The Veterinary Journal produced a possible rival to Manuka: herb honey from Inverness."[40](Simon Usborne, July 2014)

[40] Source: https://www.independent.co.uk/life-style/food-and-drink/features/the-manuka-honey-scandal-9577344.html

Table 1: 10-Year Average Capital Expenditure on Bee hives:	
Year	Capital Expenditure
Year 2008/2009	$ 200.00
Year 2009/2010	$ 282.50
Year 2010/2011	$ 292.50
Year 2011/2012	$ 325.00
Year 2012/2013	$ 375.00
Year 2013/2014	$ 405.00
Year 2014/2015	$ 350.00
Year 2015/2016	$ 680.00
Year 2016/2017	$ 500.00
Year 2017/2018	$ 450.00
10 Year Average:	$ 386.00
Note: Hive growth over 10 years: 670 000 - 227000= 44300 Hives	
$386-00 capital expenditure * 443000 bee hives = ~ $ 171, 000, 000	

Table 2-Honey Price/KG		
Year	Manuka honey Price/KG	All other honeys Prices/KG
Year 2008/2009	$ 34.38	$ 4.25
Year 2009/2010	$ 24.25	$ 4.50
Year 2010/2011	$ 44.00	$ 4.55
Year 2011/2012	$ 29.00	$ 5.00
Year 2012/2013	$ 35.23	$ 6.50
Year 2013/2014	$ 46.50	$ 6.90
Year 2014/2015	$ 63.00	$ 9.75
Year 2015/2016	$ 80.00	$ 12.00
Year 2016/2017	$ 68.90	$ 13.00
Year 2017/2018	$ 73.50	$ 10.00
10 Year Average:	$ 49.88	$ 7.65

Table 3: 10-Year Honey Export $ Value			
Year	Total Export $ value per year	Honey Exported in Kg's Y.O.Y	$/KG of Honey Y.O.Y
Year 2008/2009	$ 94,362,105.00	7384000	$ 12.78
Year 2009/2010	$ 98,395,600.00	7147000	$ 13.77
Year 2010/2011	$ 110,512,974.00	6721000	$ 16.44
Year 2011/2012	$ 128,284,417.00	7675000	$ 16.71
Year 2012/2013	$ 170,731,819.00	8054000	$ 21.20
Year 2013/2014	$ 202,307,982.00	8702000	$ 23.25
Year 2014/2015	$ 285,647,592.00	9046000	$ 31.58
Year 2015/2016	$ 295,019,238.00	8831000	$ 33.41
Year 2016/2017	$ 377,663,134.00	8450000	$ 44.69
Year 2017/2018	$ 354,528,831.00	8692000	$ 40.79
Growth rate	73.38%	8070200	68.67%

Table 4: 10 -Year Average running cost per bee hive per year in Northland:	
Year	Ave. Running cost/hive/year
Year 2008/2009	$ 328.31
Year 2009/2010	$ 337.14
Year 2010/2011	$ 390.00
Year 2011/2012	$ 360.38
Year 2012/2013	$ 385.15
Year 2013/2014	$ 410.44
Year 2014/2015	$ 422.88
Year 2015/2016	$ 424.32
Year 2016/2017	$ 422.37
Year 2017/2018	$ 431.16
Totals/Averages	$ 391.21

Table 5: Northland's average land royalty fee:	
Year	Land Royalty Fee per year
Year 2008/2009	$ 67.50
Year 2009/2010	$ 34.63
Year 2010/2011	$ 89.37
Year 2011/2012	$ 32.16
Year 2012/2013	$ 72.51
Year 2013/2014	$ 123.73
Year 2014/2015	$ 123.95
Year 2015/2016	$ 153.02
Year 2016/2017	$ 79.42
Year 2017/2018	$ 93.71
Average over 10 years:	$ 87.00

Table 6: Three parts that make up the total $ value of honey crop				
Year	Part 1- Manuka Honey $/KG	Part 2-All Other Honey $/KG	Part 3-Combine Honey $/KG	Ave. KGs of honey per hive
Year 2008/2009	$34.38	$4.25	$19.31	33
Year 2009/2010	$24.25	$4.50	$14.38	24
Year 2010/2011	$44.00	$4.55	$24.28	34.14
Year 2011/2012	$29.00	$5.00	$17.00	18.64
Year 2012/2013	$35.23	$6.50	$20.86	30.27
Year 2013/2014	$46.50	$6.90	$26.70	32.61
Year 2014/2015	$63.00	$9.75	$36.38	24.11
Year 2015/2016	$80.00	$12.00	$46.00	22.5
Year 2016/2017	$68.90	$13.00	$40.95	13.56
Year 2017/2018	$73.50	$10.00	$41.75	15
Totals/Averages	$49.88	$7.65	$28.76	24.78 KGs

Table 7: Growth in the number of beehives and honey produced-Northland			
Year	# Hives (In thousand)	All Honey produced (Tons in KGs)	% YOY Change in Honey produced
Year 2008/2009	53	1756	0.00%
Year 2009/2010	53.5	1285	-26.82%
Year 2010/2011	58.5	2000	55.64%
Year 2011/2012	64.4	1200	-40.00%
Year 2012/2013	62.9	1905	58.75%
Year 2013/2014	79.1	2580	35.43%
Year 2014/2015	90.2	2175	-15.70%
Year 2015/2016	111	2500	14.94%
Year 2016/2017	149.3	2025	-19.00%
Year 2017/2018	158.9	2383	17.68%
Totals/Averages	88.08	1980.9	8.09%

Table 8: Income Statement- 2000 beehives operation- Northland (24.78 Kgs/beehive@$28.76)	
Net Sales of Honey crop	$ 1,425,345.60
Operational expenditure	-$ 782,420.00
Land Royalty Fee	-$ 174,000.00
Net Profit	$ 468,925.60
Net Profit %	32.90%

Table 9: Income Statement- 2000 beehives operation- Northland (18.8 Kgs/beehive@$28.76)	
Net Sales of Honey crop	$ 1,081,376.00
Operational expenditure	-$ 782,420.00
Land Royalty Fee	-$ 174,000.00
Net Profit	$ 124,956.00
Net Profit %	11.56%

Table 10: Net Profitability June 2008 to June 2018	
Northland	Net Profitability
Year 2008/2009	43.29%
Year 2009/2010	-24.92%
Year 2010/2011	30.93%
Year 2011/2012	-44.24%
Year 2012/2013	15.96%
Year 2013/2014	27.96%
Year 2014/2015	26.96%
Year 2015/2016	34.55%
Year 2016/2017	-4.65%
Year 2017/2018	14.82%
10-year Average	12.07%

Table 11: Beekeeper A and B Income statement (9 Kgs@ $45/kg)	
Income from honey Crop	$ 12,960.00
Land Royalty	-$ 2,240.00
Operational expenditure	-$ 12,518.85
Net Lose	-$ 1,798.85
Net Loss %	-13.88%

Table 12: Beekeeper A ONLY income statement (12 Kgs@$49/Kg)	
Income from honey Crop	$ 18,816.00
Land Royalty landowner A and B	-$ 4,480.00
Operational expenditure	-$ 12,518.85
Net Profit	$ 1,817.15
Net Loss %	9.66%
Increase in Profitability for Beekeeper A of 23.54%	

Table 13: Risk profile - 20 beehives at $89/beehives (12kgs@$45/ kg)			
Income from honey Crop	$	10,800.00	
Land Royalty	-$	1,780.00	
Operational expenditure	-$	7,824.28	
Net Profit before Tax	$	1,195.72	
Net Profit %		11.07%	
Risk profile - 16 beehives at fixed and unchanged land royalty (13Kgs@$45/kg)			
Income from honey Crop	$	9,360.00	
Land Royalty	-$	1,780.00	
Operational expenditure	-$	6,259.42	
Net Profit before Tax	$	1,320.58	
Net Profit %		14.11%	
Change in exposure to risk			
Income from honey Crop %		13.33%	Decrease income by 13.33%
Land Royalty %		0.00%	No change
Operational expenditure %		20.00%	Decrease operational expenditure by 20%
Net Profit before Tax %		3.04%	Increase NPBT by 3.04%

Table 14: Combine Honey Price June 2020			
Northland	Part 1- Manuka Honey $/Kg	Part 2-All Other Honey $/Kg	Part 3-Combine Honey $/Kg
Year 2014/2015	$63.00	$9.75	$36.38
Year 2015/2016	$80.00	$12.00	$46.00
Year 2016/2017	$68.90	$13.00	$40.95
Year 2017/2018	$73.50	$10.00	$41.75
Year 2018/2019	$71.29	$6.00	$38.65
Year 2019/2020	$67.00	$3.00	$35.00

Table 15: Income Statement- 2000 beehives operation- Northland (18 Kgs/beehive)	
Sales of Monofloral Manuka Honey MGO band 420 to 460~ $50/ Kg @ 9 Kgs/beehive	$ 900,000.00
Sales of Multifloral Manuka Honey > 83 MGO to 120 MGO ~$15/ Kg @ 6 Kgs/beehive	$ 180,000.00
Sales of all other types of honey ~$3/Kg @ 3 Kgs/beehive	$ 18,000.00
Net Sales of Honey Crop	$ 1,098,000.00
Average $ return per beehive	$ 549.00
Average $/ Kg of honey	$ 30.50
Operational expenditure	-$ 782,420.00
Land Royalty Fee	-$ 174,000.00
Net Profit before Tax	$ 141,580.00
Net Profit before Tax %	15.73%

Table 16: Income Statement- 2000 beehives operation- Northland (18 Kgs/beehive)		
Sales of Monofloral Manuka Honey MGO band 420 to 460~ $50/ Kg @ 10 Kgs/beehive	$	1,000,000.00
Sales of Multifloral Manuka Honey > 83 MGO to 120 MGO ~$15/ Kg @ 6 Kgs/beehive	$	180,000.00
Sales of all other types of honey ~$3/Kg @ 3 Kgs/beehive	$	18,000.00
Net Sales of Honey Crop	$	1,198,000.00
Average $ return per beehive	$	599.00
Average $/ Kg of honey	$	33.28
Operational expenditure	-$	782,420.00
Land Royalty Fee	-$	174,000.00
Net Profit before Tax	$	241,580.00
Net Profit before Tax %		24.16%

Table 17: Income Statement- 2000 beehives operation- Northland (18 Kgs/beehive) plus 200 Double run beehives		
Sales of Monofloral Manuka Honey > 460 MGO~ $50/ Kg @ 10 Kgs/beehive	$	1,000,000.00
Sales of Multifloral Manuka Honey >83 MGO to 120 MGO ~$15/ Kg @ 6 Kgs/beehive	$	162,000.00
Sales of all other types of honey ~$3/Kg @ 3 Kgs/beehive	$	16,200.00
Sale of Monofloral Manuka Honey from 200 Double run Beehives > 400 MGO ~$40/ KG @ 15 Kgs/beehive	$	120,000.00
Net Sales of Honey Crop	$	1,298,200.00
Average $ return per beehive	$	649.10
Average $/ Kg of honey	$	36.06
Operational expenditure + 200 hives double run @ ~$195.61/beehive	-$	743,298.00
Land Royalty Fee	-$	174,000.00
Net Profit before Tax	$	380,902.00
Net Profit before Tax %		38.09%