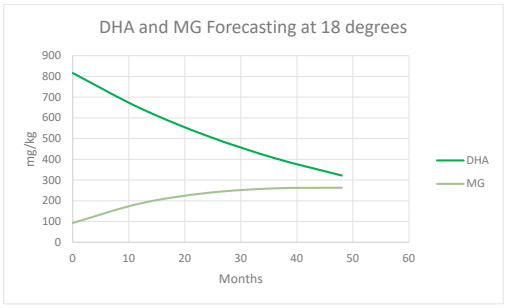
TECHNICAL SUMMARY

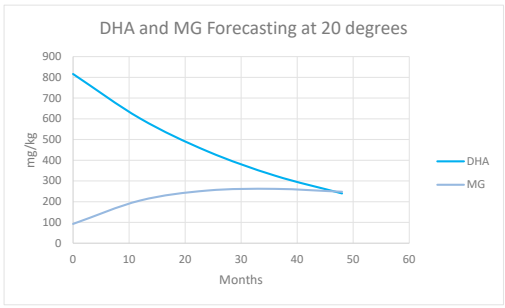
What happens to your honey as it ages?

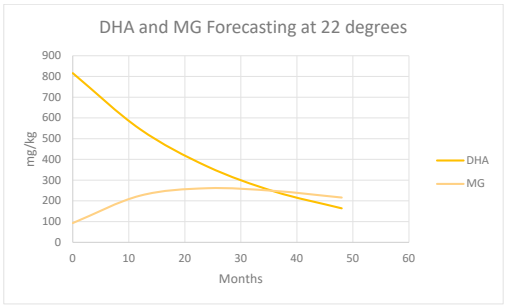
Matthew Lewis, Analytica Laboratories

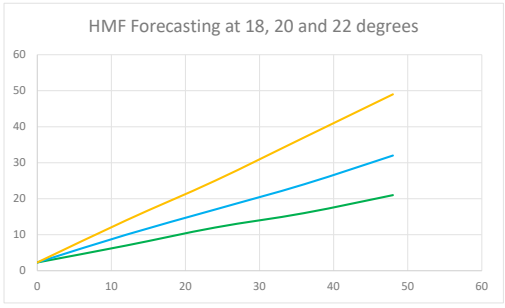
The inspiration for this article has come from a honey sample that has been stored at ambient temperature for almost eight years. This honey's test results showed an HMF of almost 4000mg/kg and, if you're curious, it had an almost barbecue sauce scent to it!

As many in the honey industry know, honey changes over time. Using scientific methodology, we can forecast these changes, allowing honey producers to make informed decisions about their product. In this article I am going to discuss analytes found in honey and explain how we notice them change over time.









Temperatures refer to degrees Celsius.

DIHYDROXYACETONE (DHA) AND METHYLGLYOXAL (MG)

DHA is a chemical compound found in the nectar of the mānuka flower. After the nectar has been turned into honey, DHA will start to convert into MG. MG is the compound in mānuka honey that gives it its unique antimicrobial properties that are yet to be found in any other honey. Mānuka honey's value is based on its MG levels, so it is common to mature mānuka honey for a year or two prior to packing and exporting the honey overseas.

Why can't you mature mānuka honey indefinitely?

As DHA converts into MG, MG also starts to convert into other unknown compounds so once the levels of DHA get close to or drop below the levels of MG, you will start to see your MG levels plateau and drop. This is important to keep in mind when you are packing mānuka honey because you need to make sure your honey stays true to label prior to its best before date.

Honey with an HMF of 4000mg/kg. Photo supplied.

5-HYDROXYMETHYLFURFURAL (HMF)

HMF is an organic compound that develops in most food by the dehydration of reducing sugars (for honey, these sugars are mainly glucose and fructose). You may have noticed that the older a honey gets, the darker it becomes, and this is caused by the increasing levels of HMF. HMF levels will continue to increase in honey over time, and this is accelerated by heat. Because of this, CODEX has stated that the maximum level of HMF in honey is 40mg/kg unless you come from a tropical country where ambient temperatures are consistently very hot (Codex Alimentarius Commission, 2019). Bear this in mind when processing and storing your honey!

3-IN-1 FORECAST

After developing the Mānuka 3-in-1 Test, Analytica embarked on an incubation study which enabled us to create the Mānuka 3-in-1 Forecasting Tool. Check out our article in *The New Zealand BeeKeeper*, April 2016 edition, for a rundown on how to use this forecast for trading honey (Howse, 2016). This tool provides you with a good indication of how your mānuka honey will mature over time under specific and controlled storage conditions. If you look at the graphs above, you will notice how the increase in storage temperature speeds up the rates of change for DHA, MG and HMF.

C4 SUGARS

C4 sugars in non-mānuka honey have not been known to change over time, however "apparent" C4 sugars in mānuka honey have been seen to shift for (currently) unknown reasons. An earlier article written by Dr Anatoly Chernyshev in *The New Zealand BeeKeeper* indicates that the reason for this change may be due to an unknown analyte in mānuka, although more research needs to be

done to confirm what this could be (Chernyshev, 2018). The problem New Zealand honey producers have with this apparent C4 sugar shift is that it causes unadulterated high-grade mānuka honey to fail the internationally recognised C4 sugar test, of which there is no viable alternative in New Zealand.

ENZYME ACTIVITY

Enzymes like diastase are used by bees to turn nectar into honey. These enzymes continue to be active in the honey and degrade and become inactive over time and with heat. This is why CODEX uses diastase activity as an indication of honey freshness and heat treatment. Invertase is another enzyme in honey that is more commonly tested for overseas but this test may make its way to New Zealand.

FERMENTATION

Fermentation can happen over time to honey that has yeast in it—this is actually how mead is made using honey! High moisture levels can give yeast a more favourable environment to grow, which is why moisture levels of honey are checked at extraction. It is internationally recognised that good-quality honey should not have a moisture level of higher than 20 per cent but to prevent fermentation, you want to aim to pack or mature honey at a moisture level of less than 18 per cent.

REFERENCES

Chernyshev, A. (2018, November). Apparent C4 sugars in mānuka honeys. *The New Zealand BeeKeeper, 26*(10), 17–19.

Codex Alimentarius Standard 12-1982 for Honey. Retrieved from http://www.codexalimentarius.org/download/standards/310/cxs_012e.pdf

Howse, S., (2016, April). Using mānuka honey forecasts for trading honey. *The New Zealand BeeKeeper, 24*(3), 21–25.

Howse, S. (2016, November). Managing the risk of fermenting honey. *The New Zealand BeeKeeper, 26*(10), 13–15.

Bee biosecurity in Fiji

Dr Oliver Quinn, Ministry for Primary Industries

With the growing honey industry in Fiji, the Biosecurity Authority of Fiji (BAF) is interested in developing honey bee husbandry skills and clinical hive assessment training. This summer they invited Biosecurity New Zealand to visit as part of the Pacific Partnership programme.

Dr Oliver Quinn from Biosecurity New Zealand and Dr Cooper Schouten from Southern Cross University ran workshops in Nadi and Suva covering surveillance, pests and diseases and monitoring. These skills will help BAF officers identify exotic diseases such as American foulbrood (AFB) and pests like the mite *Varroa jacobsoni.*

Field training included building general beekeeping skills in novice biosecurity officers and enhancing the skills of expert officers. This involved full brood clinical inspections, identification of suspect AFB-infected hives and various AFB sampling techniques and varroa assessments. These used soap shake and sticky mat tests sourced locally in Fiji. For varroa treatment, a chemical rotation and non-chemical control option was also introduced to reduce varroa mite load.

BAF was also keen to develop an in-house PCR testing capability to increase sensitivity for earlier AFB detection and increased opportunity to monitor AFB. This could assist with decision making around effective long-term approaches to AFB control in Fiji. This training also provided generic support in general use of PCR tests that could be applied to other transboundary animal diseases.

A diagnostic workshop with Dr Quinn and Biosecurity New Zealand's Dr

Dr Malan Bandara, Dr Chaminda Dissanayak, Dr Oliver Quinn and Dr Jonathan Foxwell debriefing after the diagnostic workshop. Photos supplied.

Jonathan Foxwell took BAF officers through honey bee sample processing methods for both culture and DNA extraction.

BAF will use these critical skills towards implementing a national AFB feasibility eradication programme. Utilising conventional and real-time PCR techniques, the BAF diagnostic team is able to perform confirmatory testing if required and sequence AFB typing.

The work is part of the New Zealand and Pacific Communities partnership to strengthen animal health in the Pacific, developing resilient biosecurity systems and supporting our primary industries. Next steps will be for Biosecurity New Zealand to support BAF's implementation of the AFB national survey in 2023.

The biosecurity team at the end of a hot day of training in beekeeping suits!