

## TECHNICAL SUMMARY

# C4 sugar and moisture results from last season

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Laboratories like Analytica test a lot of samples each year, providing a snapshot of the honey which has been produced across the industry.

A review of test results can give interesting insights into how honey produced in one season compares with other seasons. In this article we compare the results of two common tests that are important indicators of honey quality—C4 sugars and moisture—over the past two years.

We filtered our database of results from the past two years to focus on samples of recently extracted honey tested in 2019/20 and 2020/21 (the most recent season). Many more C4 sugar results were below 3% in 2020/21, which was a big improvement on the prior year. Perhaps this indicates a positive effect of changes in the way sugar syrup is used by beekeepers to feed hives in the winter and spring. Moisture content above 18% represents an increasing risk of honey fermenting, and there were more samples with a higher moisture content in the 2020/21 season.

Labs have only limited information about the samples they receive for testing. To try and ‘compare apples with apples’ for this article, we have compared freshly extracted honey from 2019/20 (the extraction season before last) and 2020/21 (the most recent harvest). We identified this honey by choosing results from samples received between November and May (the period when most extraction of fresh honey is taking place) with a low HMF (of 5 mg/kg or less). Most samples had some mānuka content.

## C4 SUGARS

This test has gone from being very uncommon five or six years ago, to being one of the most common tests carried out in mānuka honey today. It is used to check whether the honey will meet the import regulations of some countries, and a limit of 7% C4 sugars is usually applied. It is a published testing method, originally developed in the

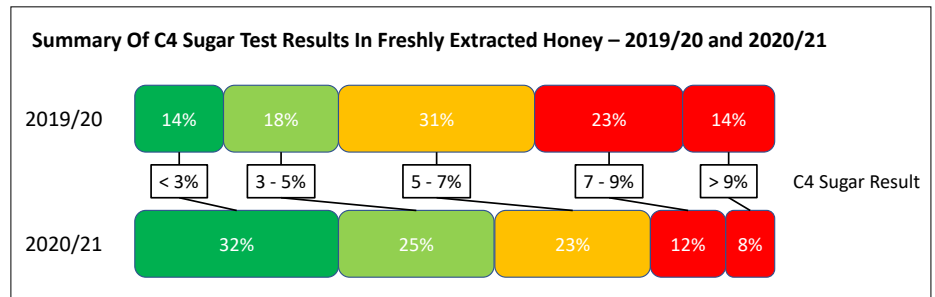


Figure 1: Summary of C4 sugar test results in freshly extracted honey, 2019/20 and 2020/21.

1980s (AOAC 998.12), to detect honey that had been adulterated by adding cane sugar syrup or high-fructose corn syrup. *The New Zealand BeeKeeper* has published numerous articles about C4 sugar testing for those wanting to learn more about the test and how it works (Chernyshev, 2017; Rogers & Braggins, 2018; Chernyshev, 2018).

The issue with C4 sugar testing in mānuka honey is that test results do tend to increase over time, especially in higher-grade honeys. So low test results (ideally less than 3%) at extraction are important if honey is to test below 7% C4 sugars when mature (12–24 months later).

Figure 1 compares the percentage of samples in different ‘bands’ of results in the two extraction seasons. Colour coding has been used to highlight the risk of the honey having a C4 sugar test result greater than 7% when mature, based on the increase commonly seen in mānuka honey over time.

The good news is that a much higher percentage of honey had a low C4 sugar result at extraction in the most recent season when compared with 2019/20—about twice as much, in fact. Beekeepers have been developing practices that aim to reduce the amount of sugar syrup from early season feeding that makes its way into honey. These results may be showing a positive impact of these practices.

There is still some honey produced with very high C4 sugar results. In both seasons the highest sample was over 50% C4 sugar using this test, and the average of the 20 highest samples was 29% (2019/20) and 20% (2020/21). These could be from hives used in pollination, where a lot of sugar syrup can be fed.

Some people question the value of the C4 sugar test, especially given the way results change in mānuka honey. Unfortunately, while our overseas markets are using the test as part of their regulations, we will be stuck with it. There are a range of other sugar adulteration tests used around the world, using instruments with acronyms like NMR, HRMS, LC-MS/MS, and LC-IRMS. These tests are very expensive (they can be hundreds of dollars a sample) and at this point there has not been enough testing of New Zealand honey using these to provide any comparisons like the ones above.

## MOISTURE

While C4 sugar testing is quite complex, moisture testing is one of the simpler tests carried out on honey. It is important for a couple of reasons:

1. honey with high moisture content is at increased risk of fermenting. Fermented honey is a problem for both safe handling of the honey as well as spoilage in its quality. Honey

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with moisture levels less than 18% tend to be regarded as having little or no immediate risk of fermenting, but that risk rises as moisture levels increase above 18% (Howse, 2019).

- the internationally recognised Codex Alimentarius Commission standard for honey includes a definition that honey should have a moisture content of “... not more than 20%”, and based on this definition, some countries include it as a requirement for honey they are importing (Codex Alimentarius Commission, 2001).

Capped honey will usually have moisture content at or below 18%. It is quite common for beekeepers focusing on producing monofloral mānuka to have higher moisture content in their honey, as they will actively harvest honey during mānuka nectar flow to avoid dilution with other floral types. This honey can be uncapped at the time.

Figure 2 compares moisture results in freshly extracted honey from 2019/20 and 2020/21, divided into colour-coded

bands according to the fermentation risk of the honey based on moisture content.

These data suggest that overall, more honey was harvested with a high moisture content in the most recent season than in the prior one. Only a small minority of samples had results above 20% (3% and 10% in the two seasons). However, 40–50% of samples had results between 18% and 20%, suggesting some risk of fermentation if storage conditions and osmophilic yeast content of the honey encouraged that.

In both seasons, the lowest 20 samples tested had an average moisture content of just over 15%, and the highest 20 samples averaged 21.2% and 21.9% in the two seasons, respectively.

Moisture testing is something that many people do for themselves in the extraction facility, using portable devices. A range of these devices are available, and many of them work well if they are well maintained and used carefully as per manufacturer instructions. If you are using one of these devices, it can be wise to do a

regular comparison with moisture results from a lab running an accredited testing method. This tells you how your results compare with those produced in well-controlled lab conditions.

**REFERENCES AND FURTHER READING**

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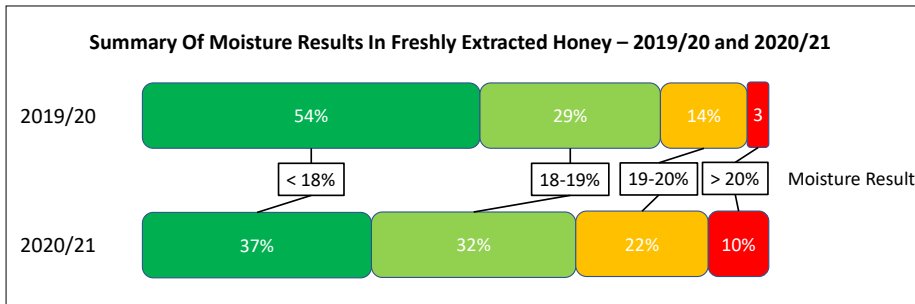
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*These articles are available to members in the BeeInformed section of the online BeeSmart Toolkit at www.apinz.org.nz*

Figure 2: Summary of moisture results in freshly extracted honey, 2019/20 and 2020/21.



# REMINDER TO TEST FOR TUTIN

Tutin, a neurotoxin found in the tutu plant, represents a real risk to the honey industry.

All beekeepers, honey packers and exporters need to comply with food safety standards set for tutin. The main risk period for tutin is between January and April with this risk increasing in hot, dry weather.

To comply with the standard, beekeepers have five options

including harvesting honey before 31 December, if this honey is from supers put into hives on or after 1 July.

Other options include sending samples to a certified laboratory for testing before sale, running hives in low-risk geographical zones (below 42 degrees south), demonstrating

that tutu is not significant within a predictable range of bee foraging in your area or demonstrating that you operate in a low-risk area with a targeted testing regime. More information can be found on the ApiNZ website [www.apinz.org.nz/standards-compliance-regulatory](http://www.apinz.org.nz/standards-compliance-regulatory)