



**Hort
Innovation**
Strategic levy investment

**TABLE GRAPE
FUND**



ATGA
Australian
Table Grape
Association Inc.

Improving Consumer Satisfaction To Increase Table Grape Sales

Table Grape Stakeholder
Alignment Workshop

23rd October 2018

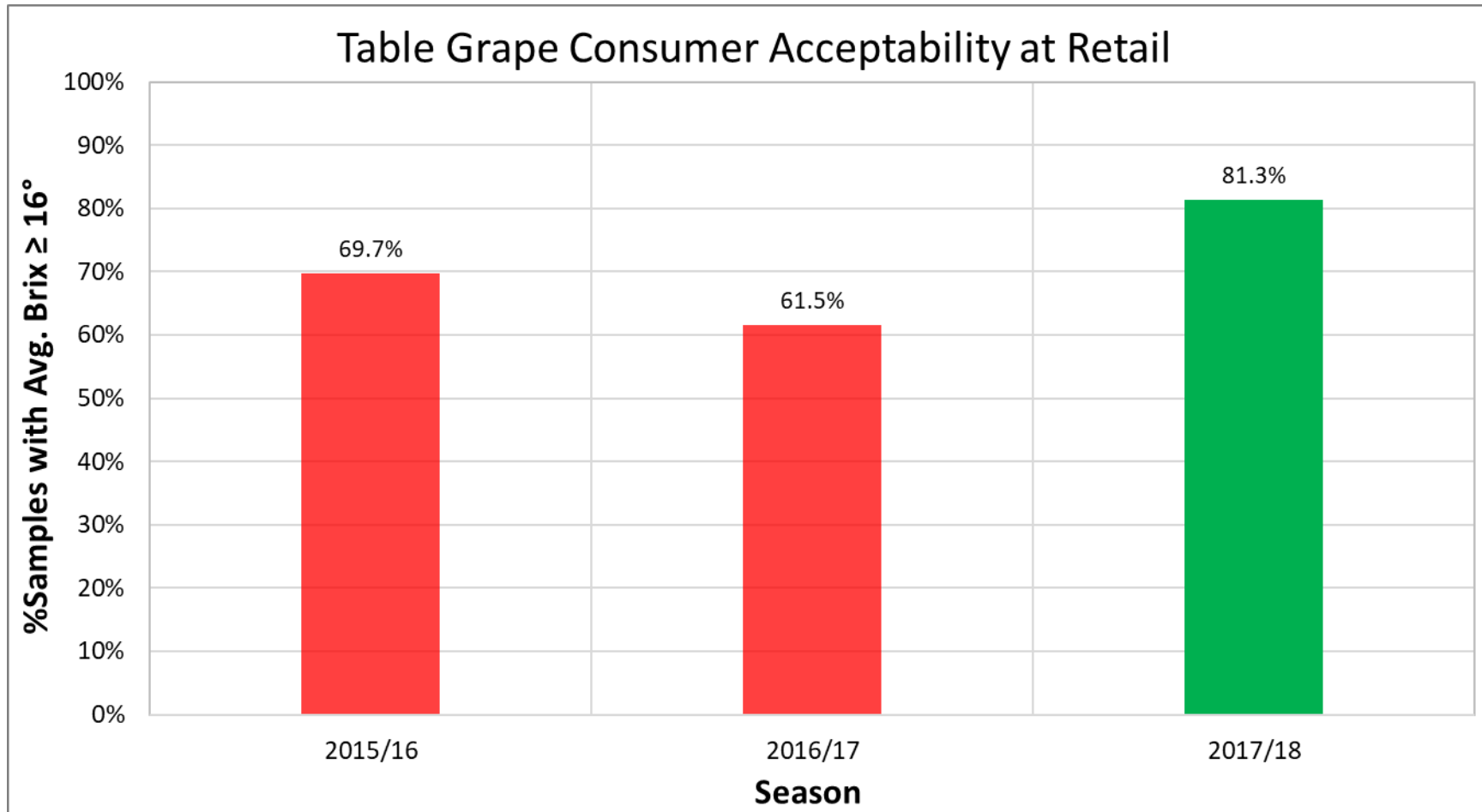
Overview

- Situation analysis
- Overview of testing methodologies
- Current testing and results
- Industry Case Studies
 - Greatly improved liking of Navel Oranges in New Zealand
- Recommendations to move forward

Project Objective

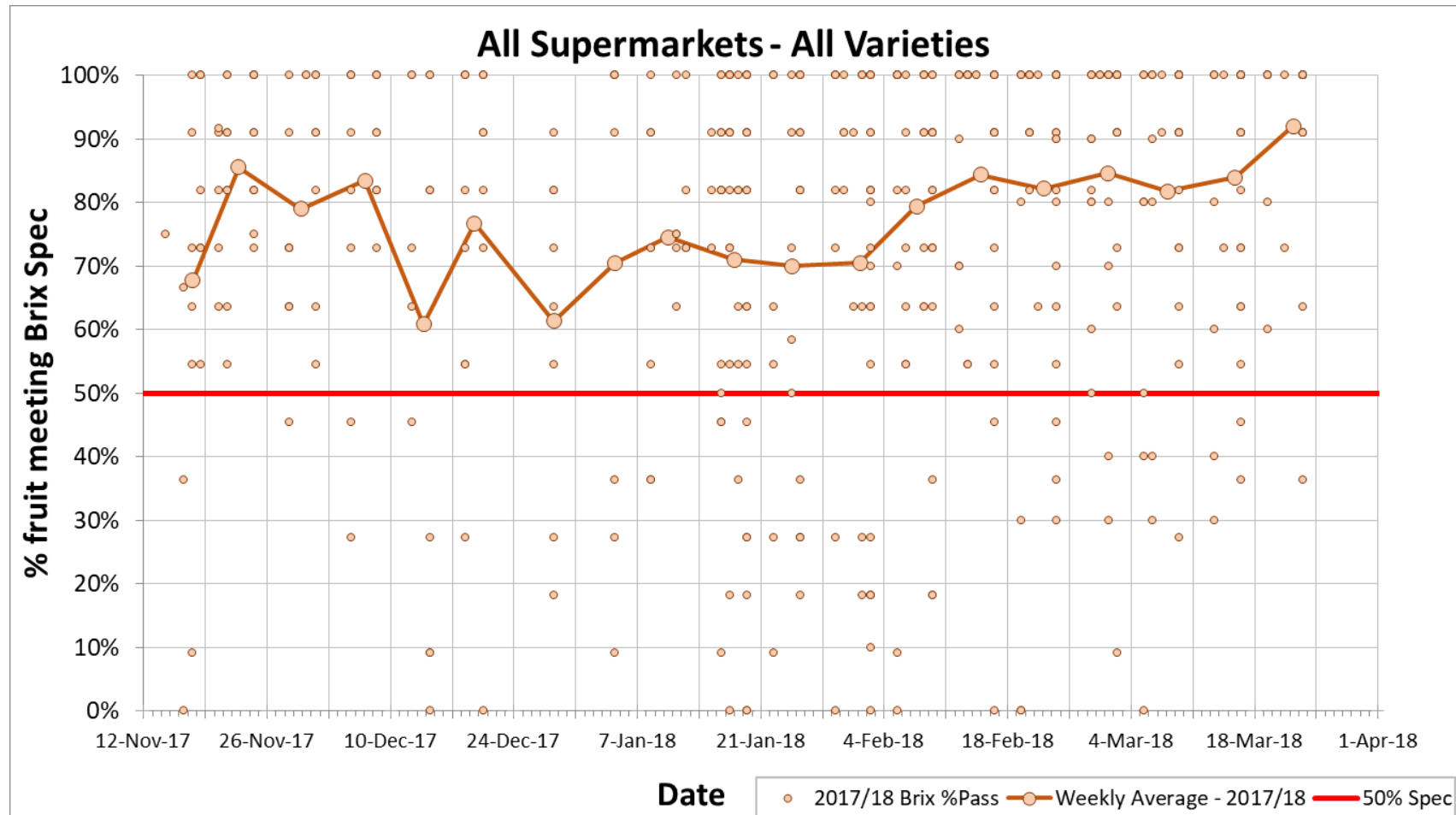
- Develop robust systems that will allow the Australian Table Grape industry to consistently supply fruit that satisfies consumer expectation in both domestic and export markets right from the start of the season
- This will lead to increased:
 - Purchase frequency
 - Average weight of purchase (AWOP)
 - Grower returns/profitability

The Issue is Immature Fruit @ Retail



Supermarket sample - 10 fruit selected from bunch bag. Average Brix measured 2016 & 2017, each fruit in 2018

Immature Fruit @ Retail last Season



Supermarket sample - 10 fruit selected from bunch bag. Brix measured on each fruit

Inconsistent eating quality is impacting sales

- Early Season Buying (Fresh Logic, May 2017):
 - 25% of grape buying households delay their grape buying until the end of the early season (March)
 - 33% of black grape buyers stopped purchasing after December
- After a negative eating experience, consumers:
 - Delay purchase for 6 weeks
 - Take another 2-3 purchases before loyalty is restored to original level

Testing to determine eating quality

Evidence-based maturity



Measurement Options

- Brix
 - Simple to perform on individual fruit with well known instruments
- Acid
 - Relatively simple to perform on individual fruit with new instruments (water + juice + instrument)
- Brix:Acid Ratio
 - Calculated from the above
 - Highly non-linear & inflexible
- BrimA
 - Calculated from the above
 - Highly linear & flexible

BrimA: Alternative to Brix:Acid Ratio

- BrimA (Brix minus Acid) Principle:
 - Sweet (Brix) and sour (Acid) are opposites
 - The tongue is more sensitive to acid than Brix
- $\text{BrimA} = (\text{Brix} - k * \text{Acid}) * 16.5$
 - Where k is typically between 3 and 5 (4 for Oranges)
- Has been applied to
 - Citrus, table grapes, plums, mangoes, blueberries

Taste Sensation

- Taste can be categorised as:
 - **Sweetness**
 - Pleasant (Brix, SSC, TSS)
 - **Sourness**
 - Unpleasant (TA, Acid)
 - **Bitterness**
 - Most sensitive of tastes (%)
 - **Saltiness**
 - Pleasant?
 - **Umami**
 - Pleasant savoury taste (e.g. ketchup, broth)



Measuring Consumer Liking: 9-point Hedonic scale

Dr David Peryam, 1950


Score	Description
9	Like extremely
8	Like very much
7	Like moderately
6	Like slightly
5	Neither Like nor Dislike
4	Dislike slightly
3	Dislike moderately
2	Dislike very much
1	Dislike extremely

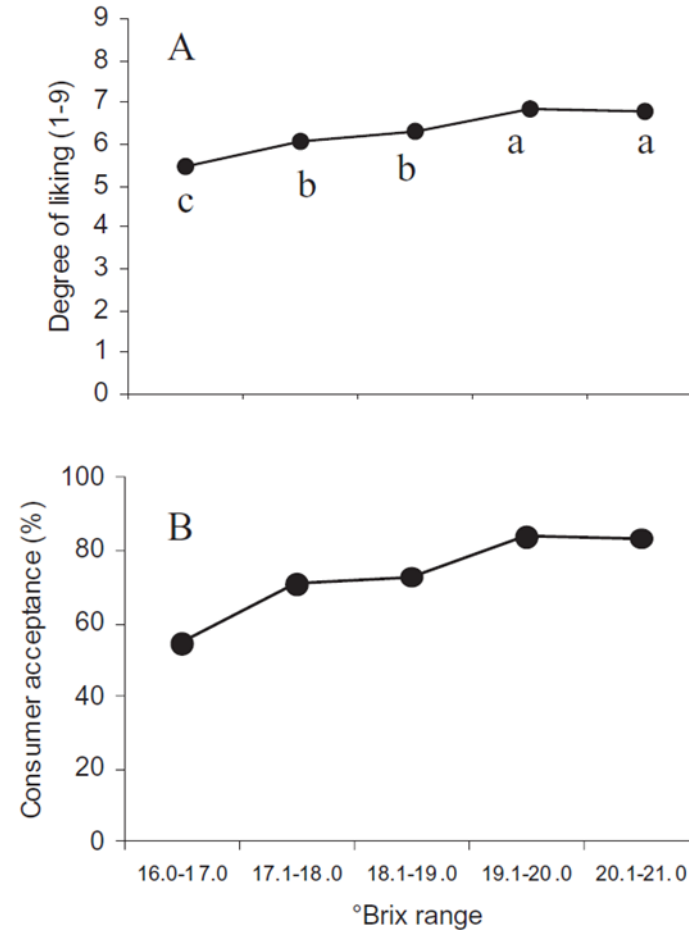
Matching objective measurement to liking

- Measure
 - Brix
 - Acid
 - Liking
- On individual berries!
- and lots of them across all major varieties.
- From taste score 1 many weeks before maturity to weeks after commercial maturity

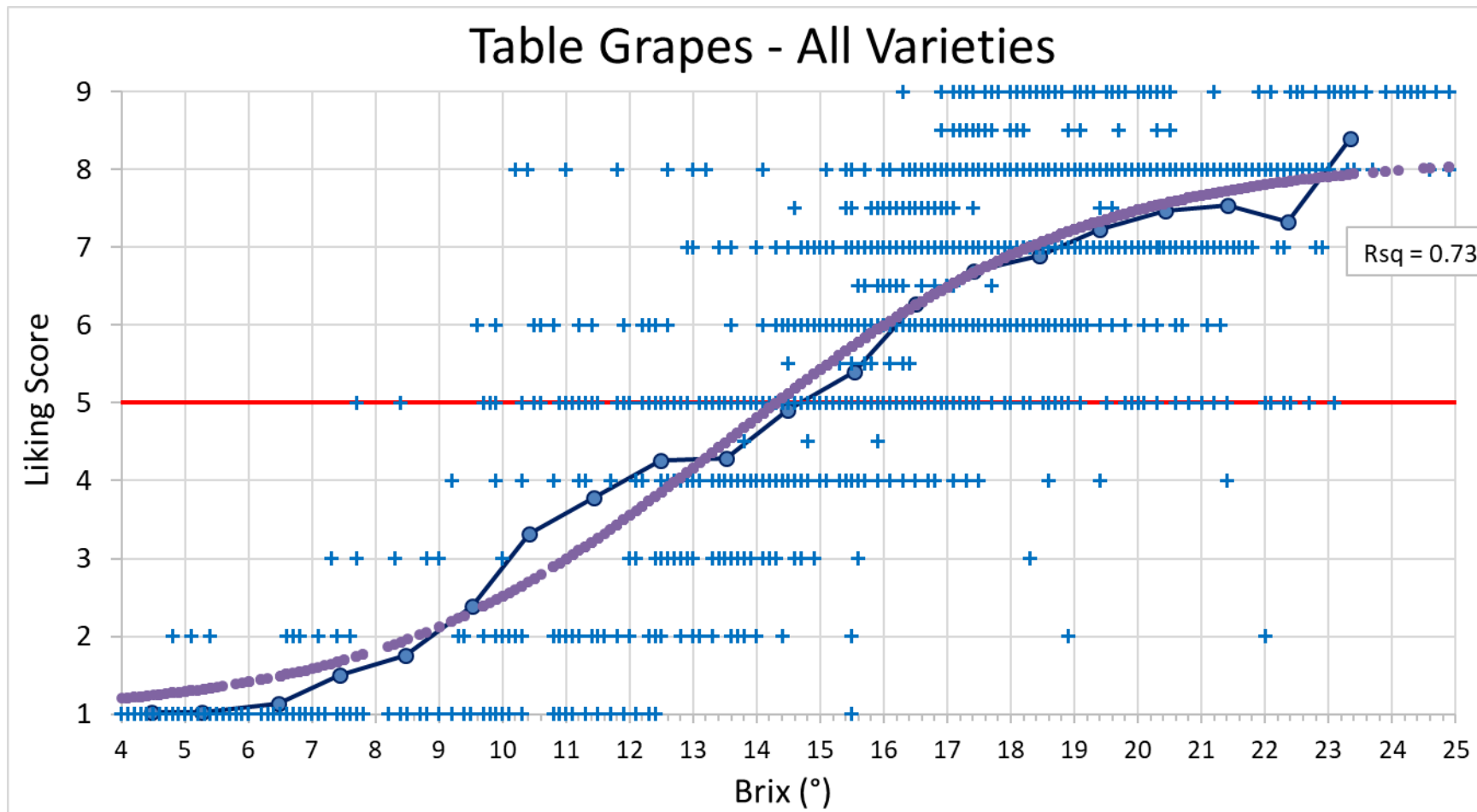


Why not test in a supermarket?

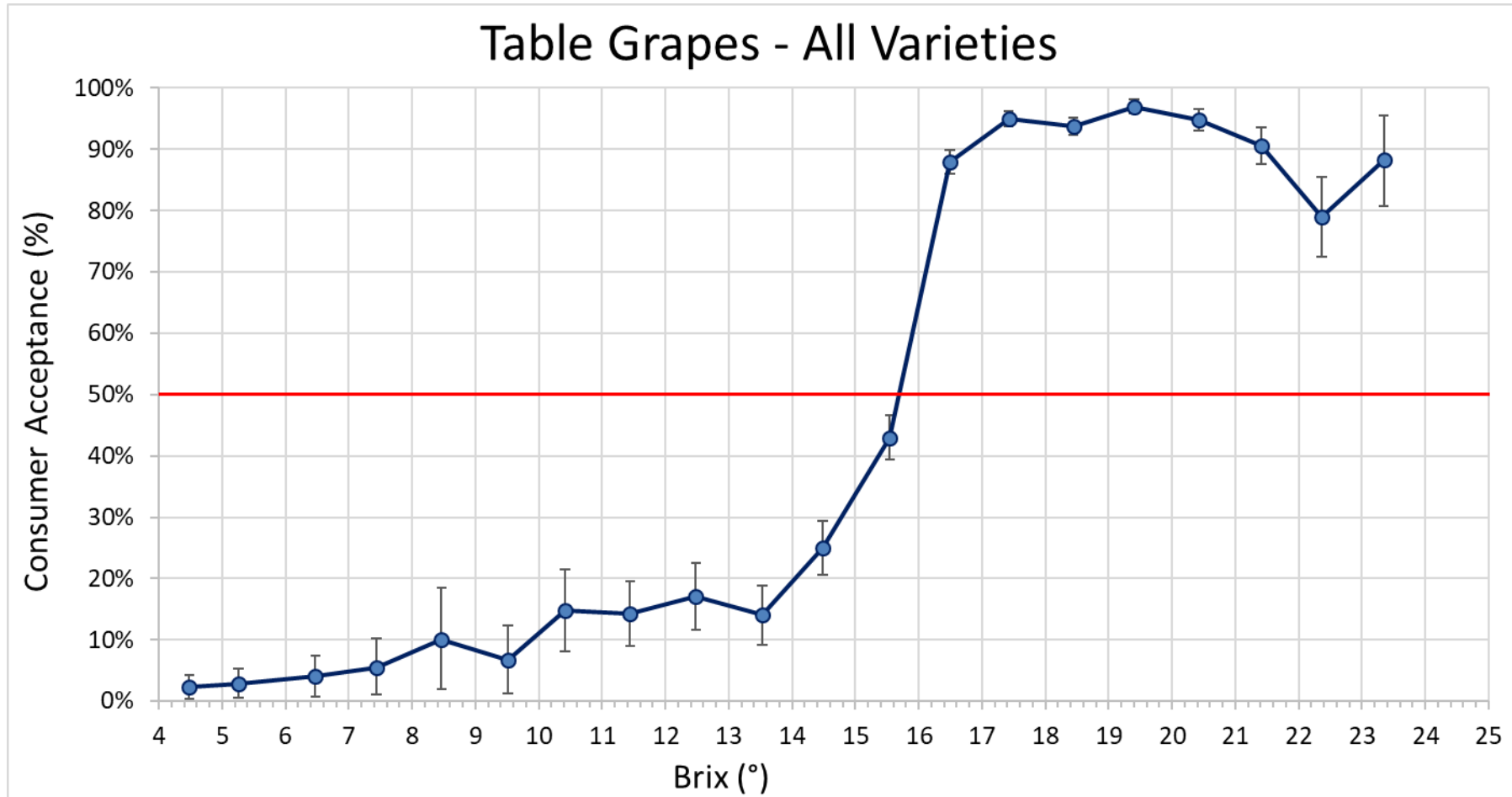
- Because the average liking scores generally don't go below 5 and only 100 tastes
- Data from WA 
- With no average score below 5, we cannot set a minimum maturity standard
- Our methodology based on research from USA with 3000 tastes



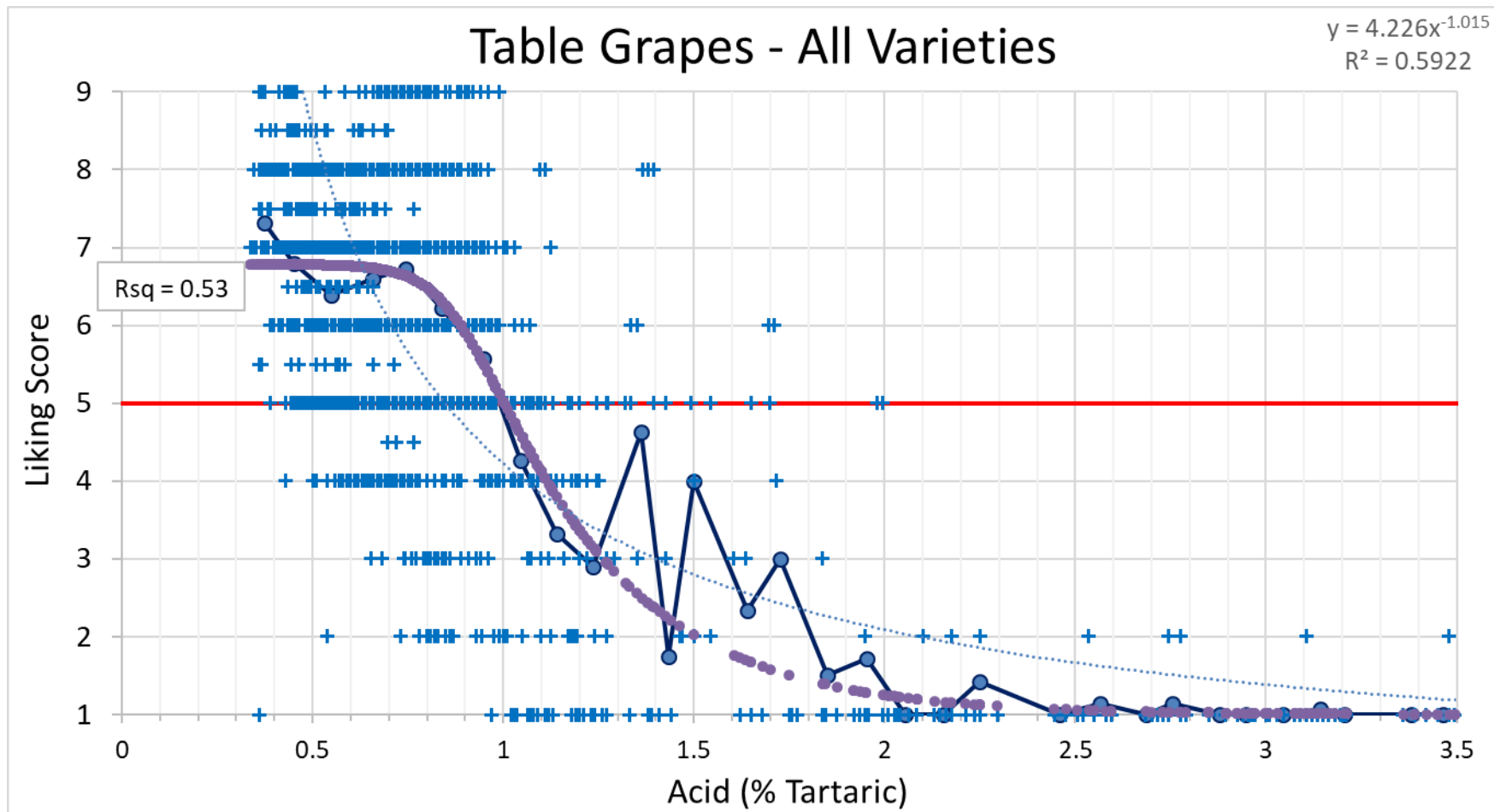
Liking increases with Brix



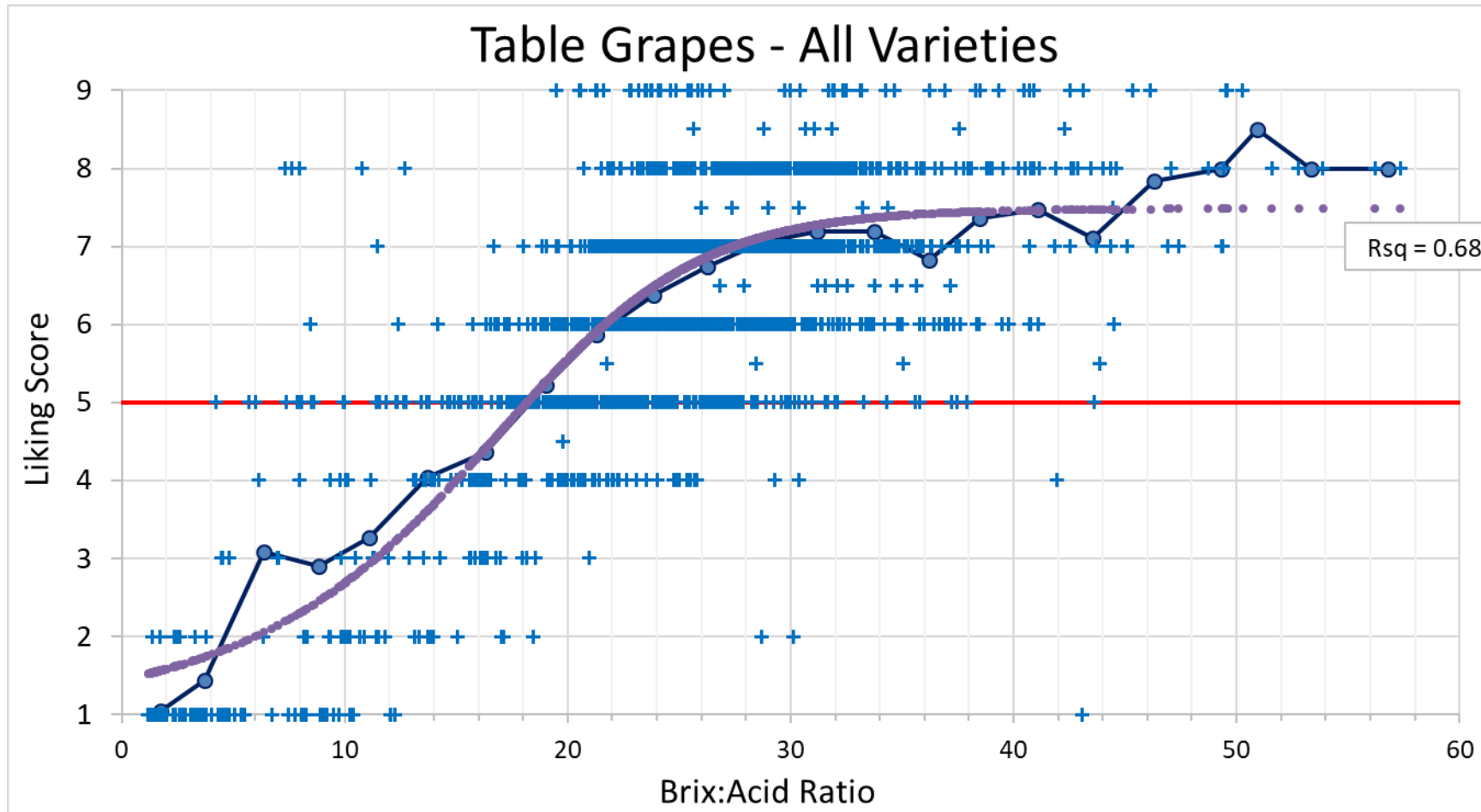
Acceptance increases with Brix



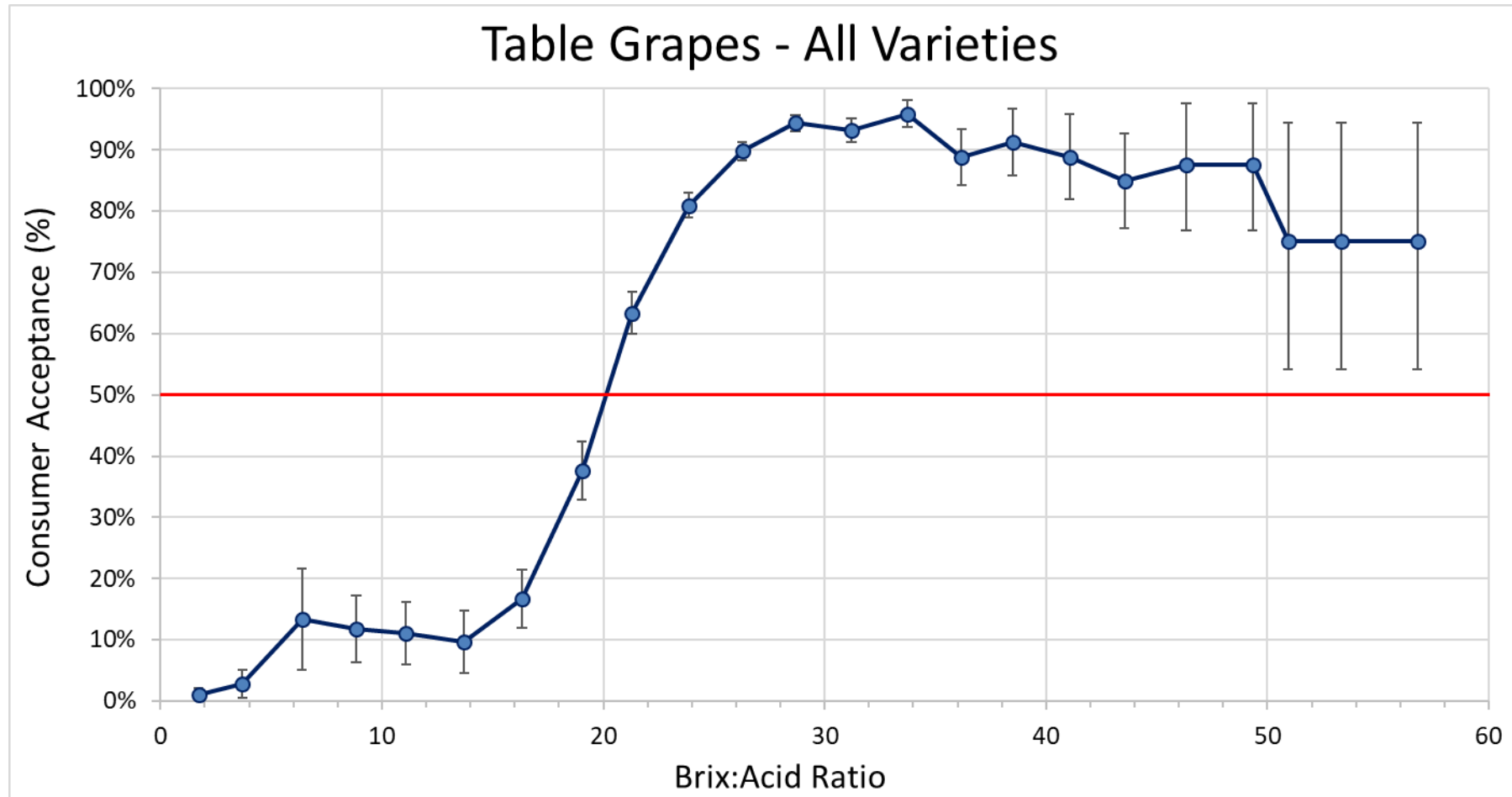
Liking decreases with Acid



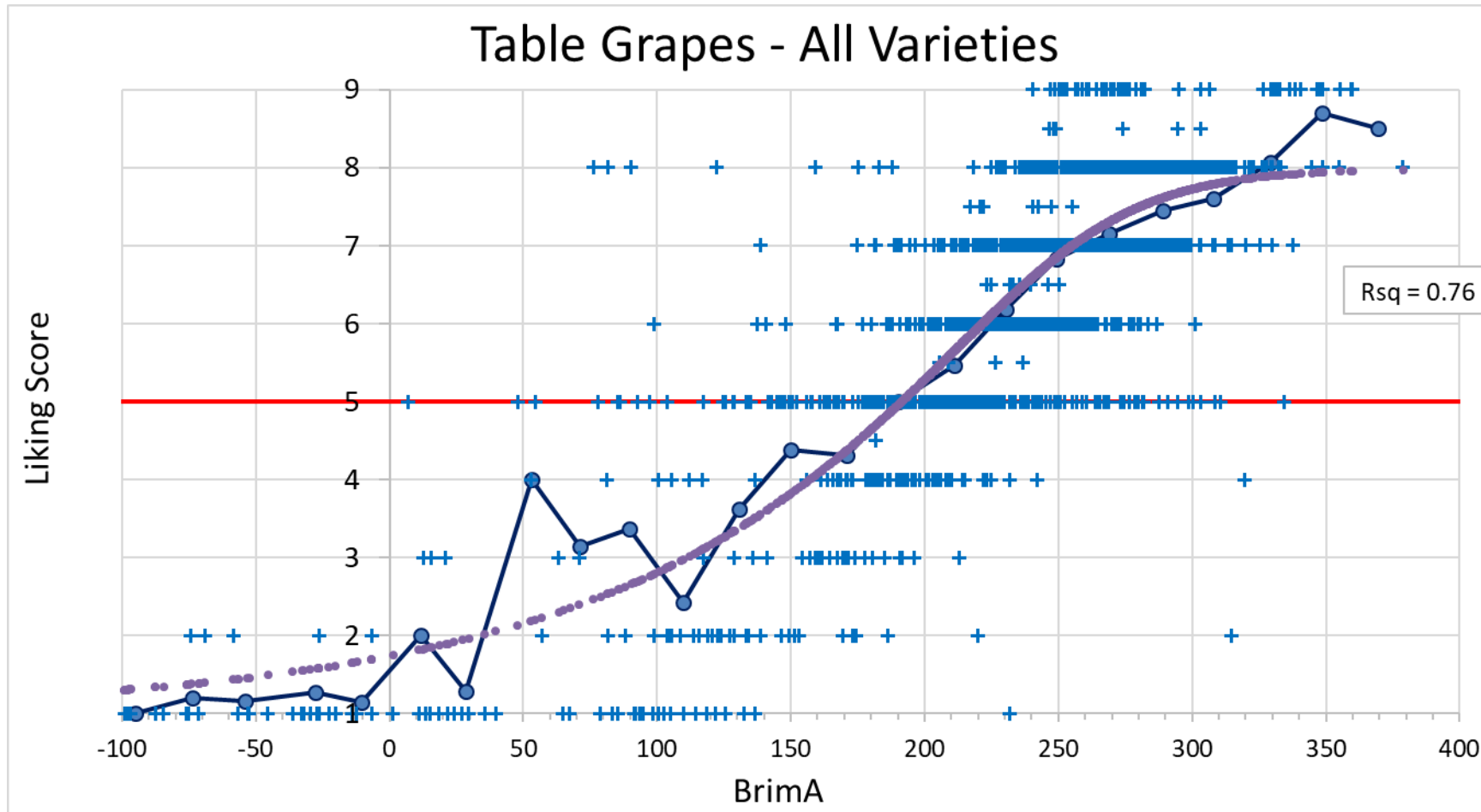
Liking increases with Brix:Acid Ratio



Acceptance increases with Ratio



Liking increases with BrimA (k=4)



Acceptance increases with BrimA

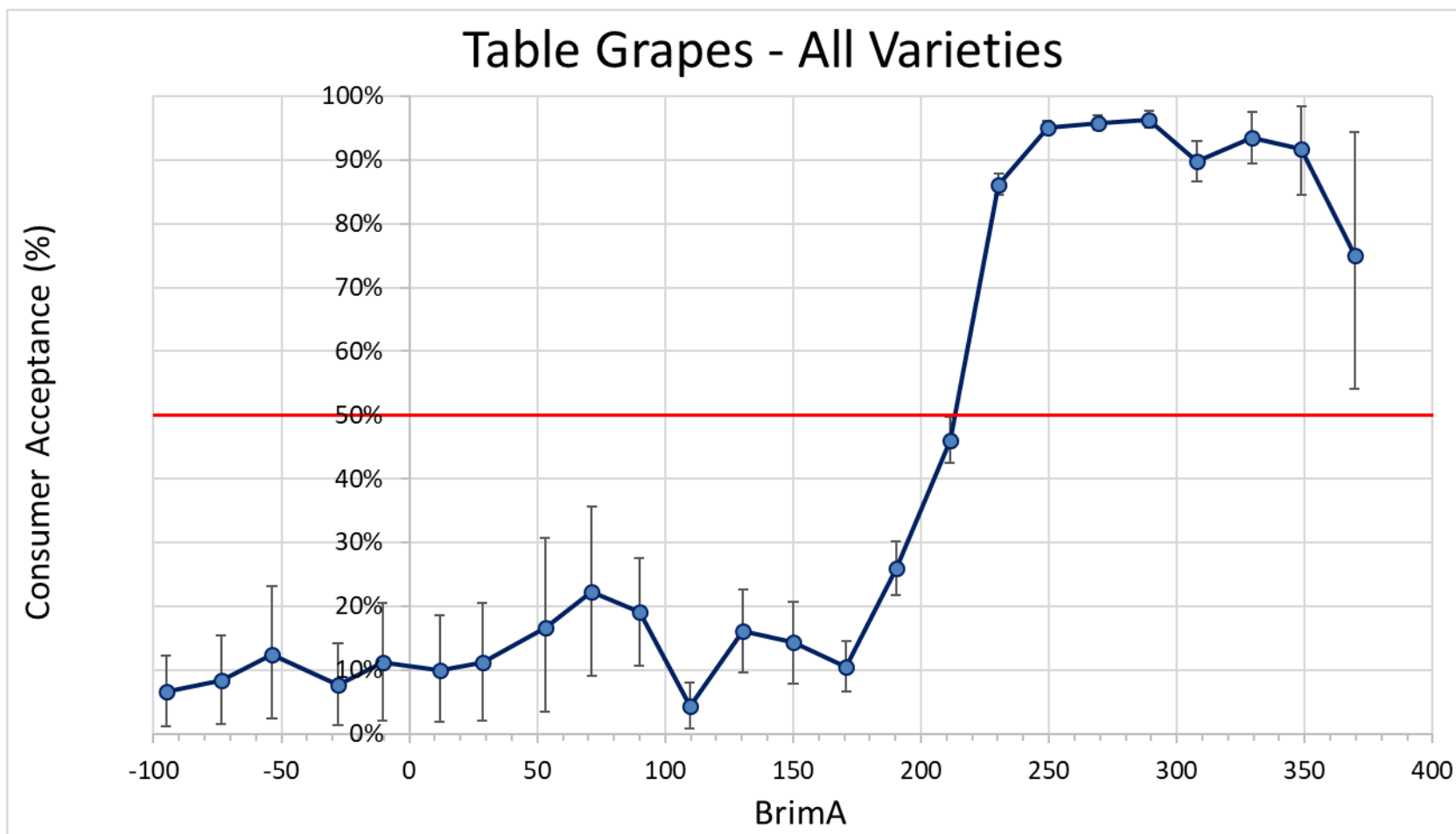


Table Grape Summary

- Brix and Acid measured on each fruit tasted
- Individual fruit liking scores from 1 – 9
- Model correlations with liking:
 - BrimA is highest with $R^2 = 0.755$
 - Brix is next with $R^2 = 0.726$
 - Ratio is next with $R^2 = 0.679$
 - Acid is lowest with $R^2 = 0.525$

Methodology

For the current project



Methodology - 1

- On-farm monitoring
 - Emerald & Sunraysia
 - Key commercial varieties
 - Proprietary varieties (by Costa)
- Supermarket Monitoring
 - Woolworth, Coles & Aldi
 - Samples of white, red and black grapes each week
- Export monitoring
 - Major export facilities

Methodology - 2

- On-farm sampling started approx. 2 months before maturity to after harvest
- Each berry measured for Brix, acid, size & liking
 - Important for predicting consumer liking
- Some bunches (200 berries) tested for 3D position of each berry, with Brix, acid, size & liking of each berry measured as well
- Data and models all available on-line 24/7 in real time

Methodology – Data Analysis

- Use Brix, acid and liking data to model and predict consumer liking
- Use on-farm time series data to model and predict maturity
- Analyse variability within a bunch, on-farm, at retail and export

Table Grape Maturity

Results to date



Project Overview 2017-18

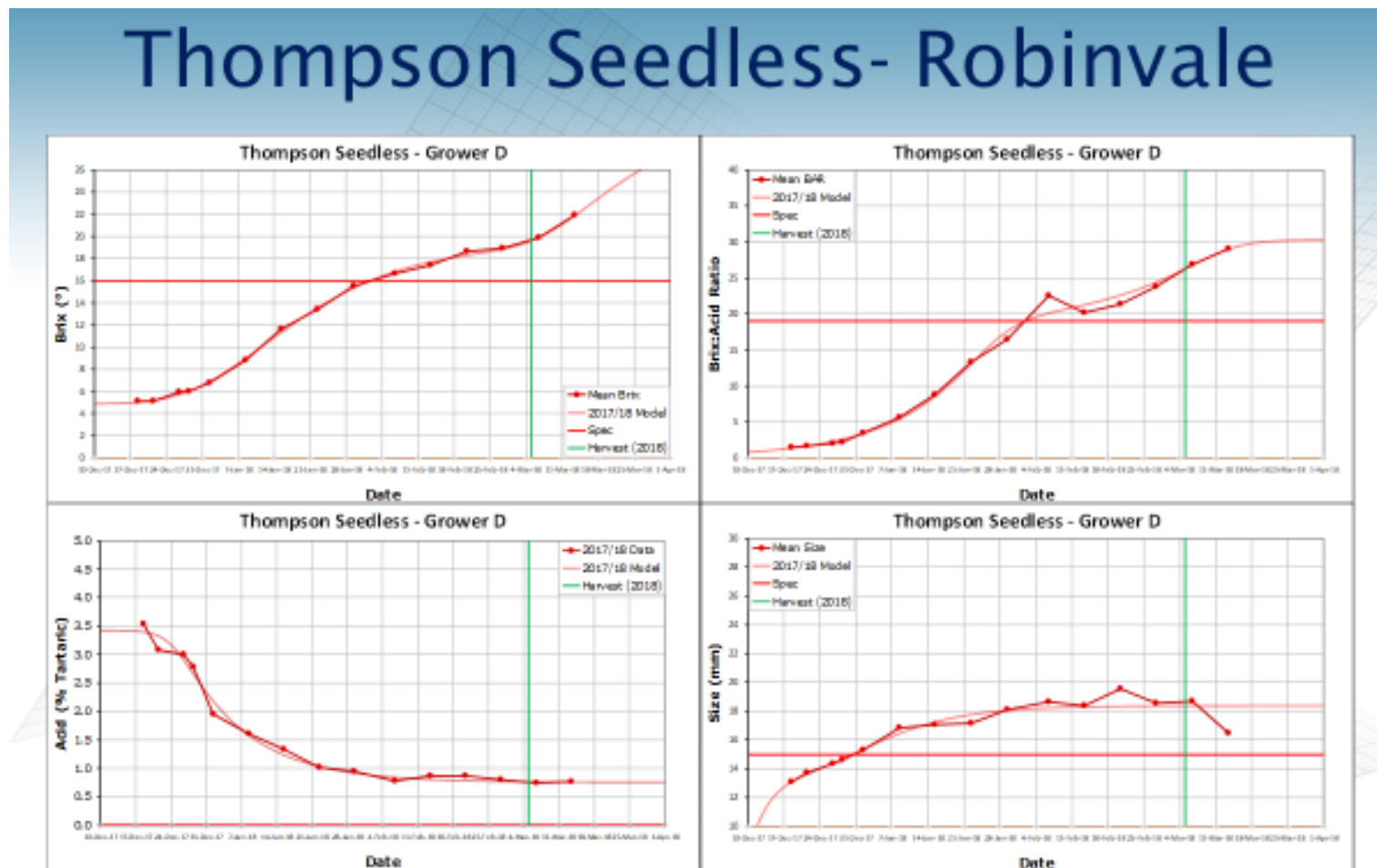
- Maturity Standards

- Conducted ~3,000 tastings (Brix, Acid & Liking) all major varieties
- Ready to assist industry to harmonise maturity specifications
 - Different specifications (ATGA, WA, Woolworths, Coles etc.)

- Monitoring

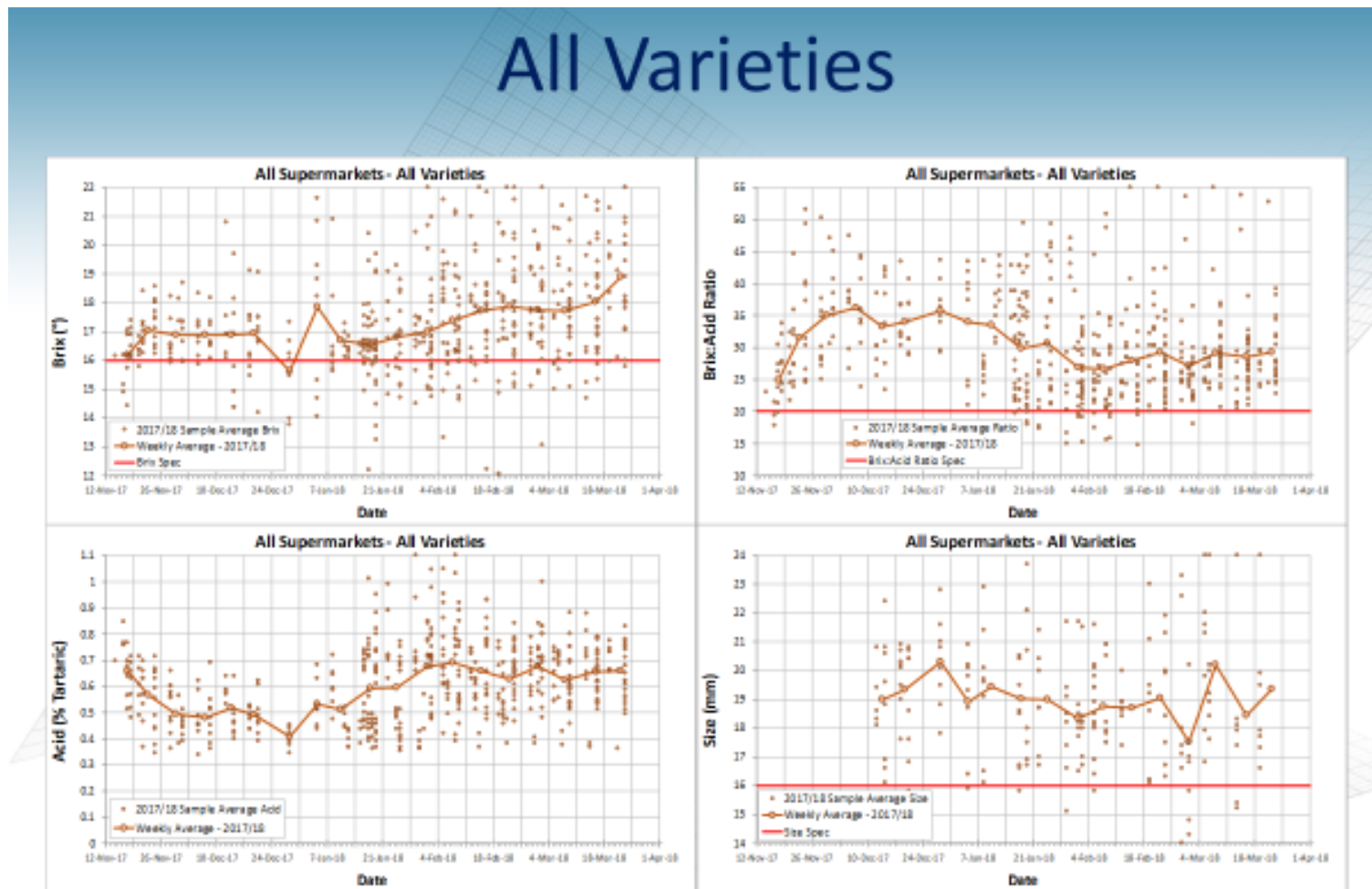
- Vineyard Monitoring (237 samples x 30 fruit)
- Supermarket Monitoring (550 samples x 10 fruit)
- Export Audits (65 samples x 10 fruit)
- Measure Variability in Maturity (869 samples)

On-line Results in Real Time – On-Farm



Updated weekly: Available to all growers & industry partners

On-line Results in Real Time – Supermarket



Updated weekly: Available to all growers & industry partners

Results 2017-18

- Understanding Consumer Liking
 - Models for predicting consumer liking based on Brix, acid, Brix:Acid Ratio and BrimA
- Variability
 - Good data on the variability in maturity within a bunch, in a block, at retail and export
- Maturity at retail & export
 - Good weekly data on maturity and variability in maturity at retail within and between seasons

Navel Orange Case Study



What happened?

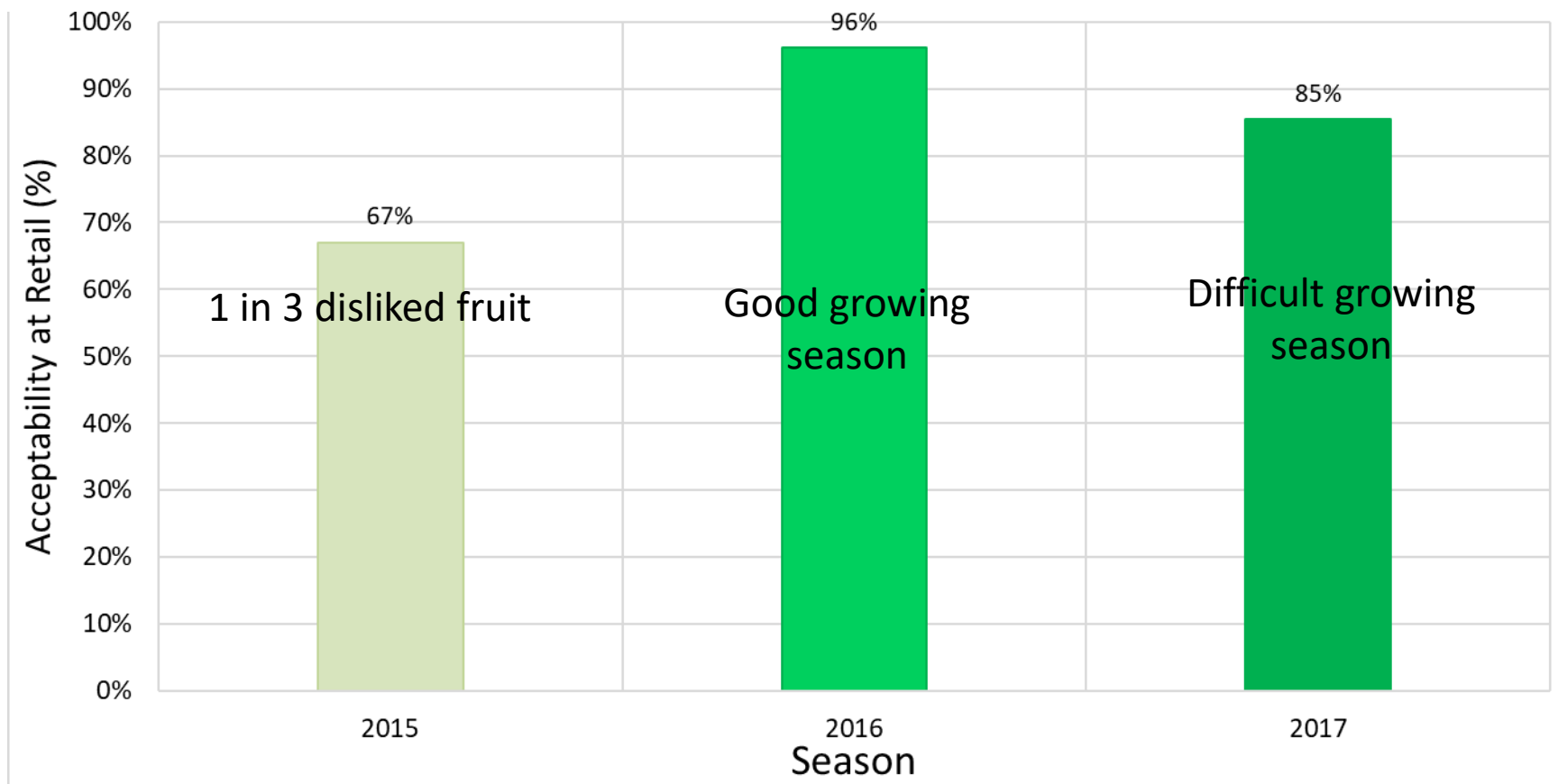
METHODOLOGY

- Robust maturity standards (agreed by industry)
- On-farm maturity monitoring and prediction to standard
- Independent clearance
- Supermarket monitoring
- Alignment within the whole supply chain

INDUSTRY ADOPTION

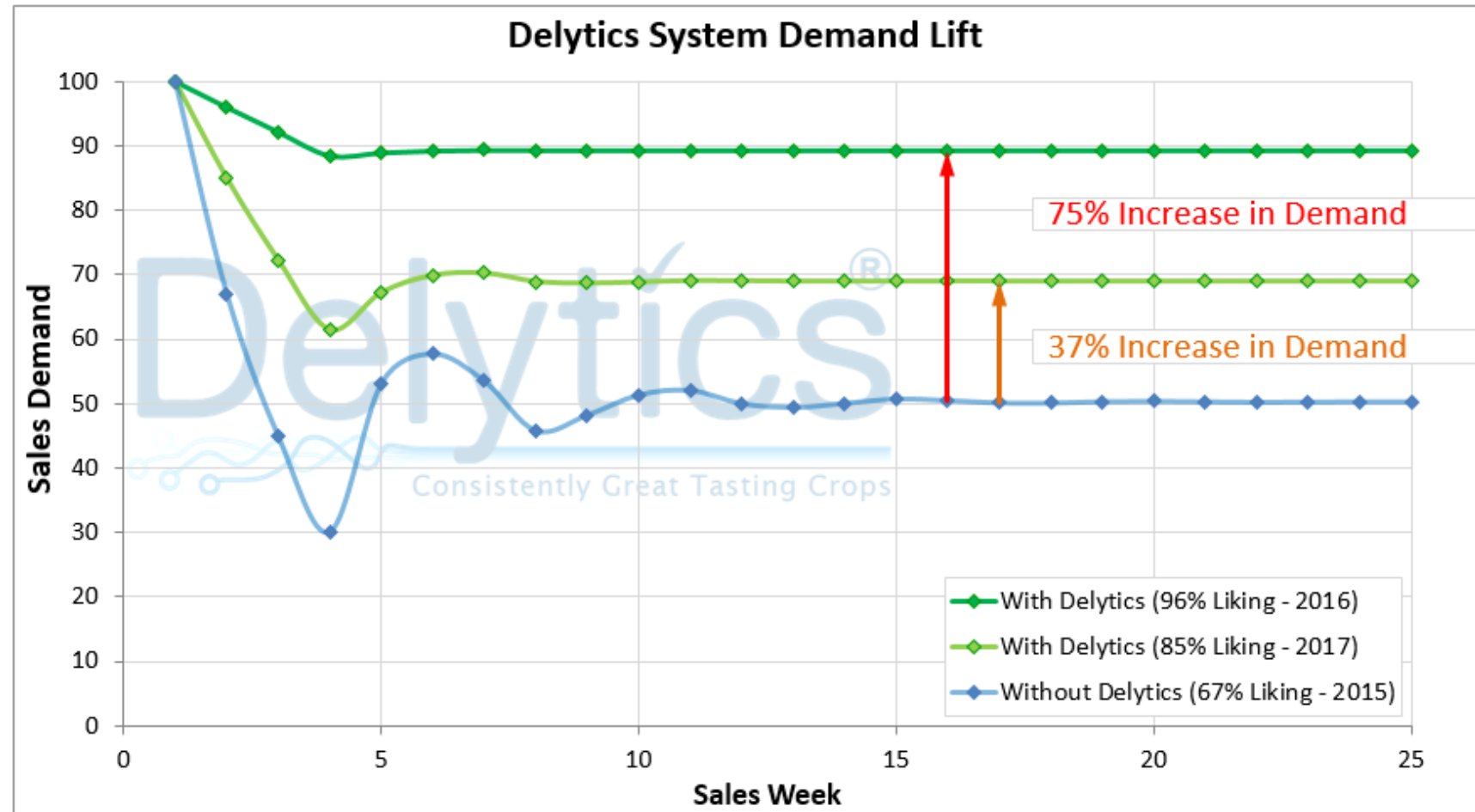
- Industry Board engaged key suppliers
- Education and understanding by all parts of the supply chain
- Packers and suppliers agreed to accept only independently cleared fruit
- 92% voluntary adoption this year (2018)

Increased Consumer Acceptance Of NZ Navels



Predicted Sales Increase

- Customers purchase once per week
- Previous week's eating experience influences next week's buying behaviour
 - Positive eating experience = repurchase same amount
 - Negative eating experience = delay 4 weeks before repurchase same amount



Navel Orange Feedback

- “The feedback we received from retailers is that the fruit has been well received and repeat purchases have been very good.”
 - Chair Orange & Tangelo Group
- “The eating experience of the NZ navels secured consistent consumer purchasing right from the outset this [2016] season.”
 - T&G Global
- “In my mind, this sort of quality monitoring should become mandatory across all facets of the fruit industry.”
 - Supermarket Produce Buyer
- “By the way, I have bought waaaay more NZ navel oranges this year than I normally do, because they’ve been so delicious!”
 - Consumer

Australian Industry Examples

- Citrus Australia
 - Delytics helped Citrus Australia adopt the BrimA standard for Navel Oranges and Mandarins
 - Supermarkets have also adopted these standards
- Australian Mango Industry
 - Delytics helped OneHarvest take the Calypso mango to the top selling mango in Australia
 - Adopted Dry Matter as the maturity measure
 - Minimum maturity standards have been set
 - NIR gun used to monitor maturity on-farm
- Both industries have seen excellent consumer support at retail

Table Grape Maturity Standards

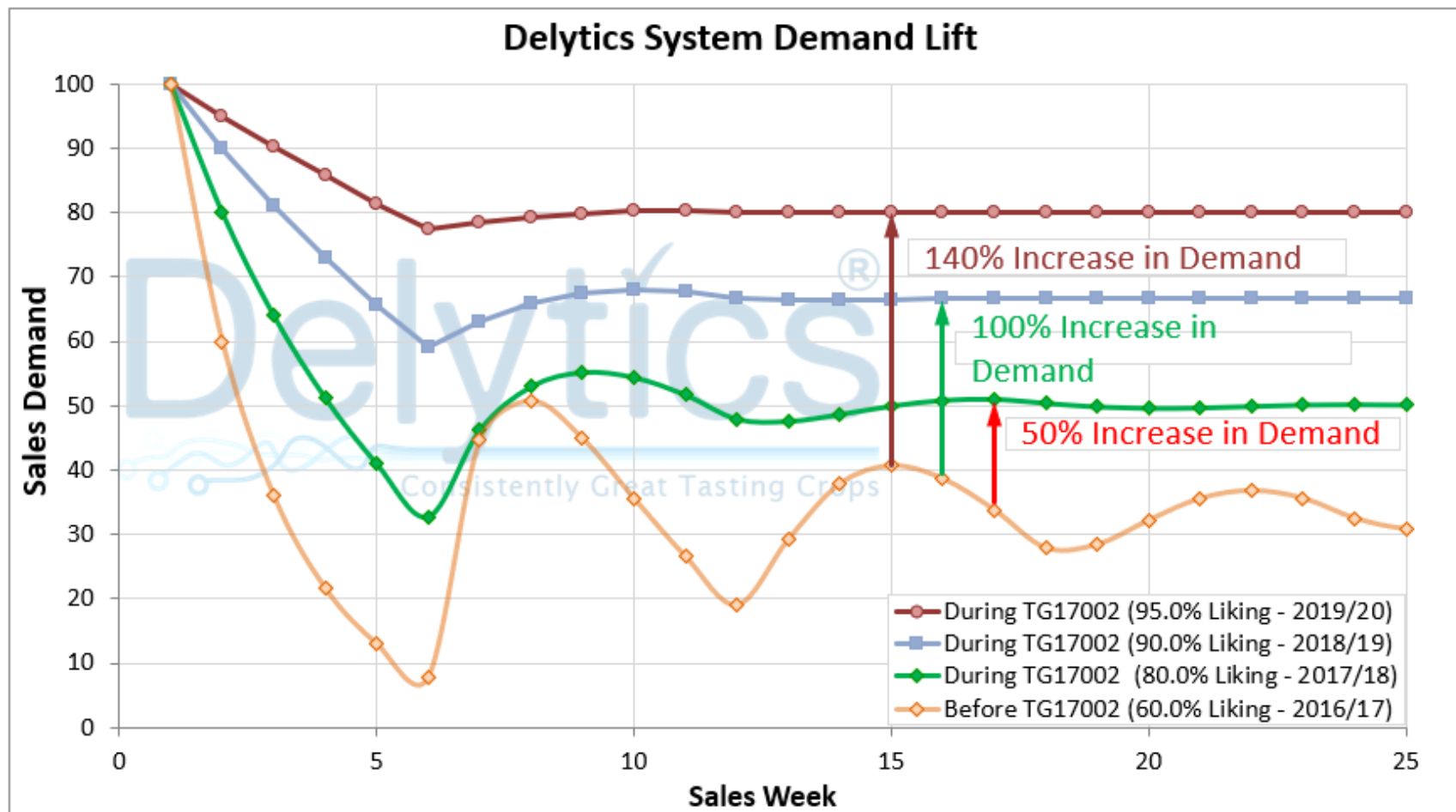
Recommendations moving forward



Target % of consumers enjoying Table Grapes?



Potential Demand Increases With Increased Liking



Current Maturity Standard

- Current minimum maturity standards based on sample average
 - Easy to take a single measurement on the combined juice from all grapes in the sample
- Typically 50% of fruit lie below the average
- Percentage of fruit not liked by consumers depends on:
 - Sample average,
 - Sample variability,
 - Maturity at which liking = 5.
- Sample variability strongly influences acceptability

A better option

- X% of fruit in sample above or below a value Y
 - $Y \geq$ Neither like nor dislike
 - Automatically deals with variability
- What measure?
- What is X?
- What is Y?
- Examples:
 - NZ Navel Orange
 $\geq 75\%$ of fruit with BrimA ≥ 90
 - Zespri Gold Kiwifruit
 $\geq 97.3\%$ of fruit with Dry Matter $\geq 17\%$

Key Questions

- Is acid important?
 - Short answer: Yes!
 - It is incorporated in both Brix:Acid Ratio and BrimA measures
- Brix:Acid Ratio or BrimA
 - Same or different?
 - Both calculated from Brix and Acid
 - Brix:Acid Ratio is highly nonlinear and difficult to manage
 - BrimA is highly linear and easy to manage

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This is the rub!

- Decide on a target % of consumers enjoying table grapes
- Match the maturity specification to the target



QUESTIONS & ANSWERS



Today's focus: Maturity Standards

“Collectively developing fact-based maturity standards that will improve eating quality and consistency”