New Zealand Avocado

NZ Avocado Growers' Association Inc.
NZ Avocado Industry Ltd

# Webinar

## Welcome!

Your video will be turned off and your microphone will be muted upon joining the meeting

This meeting will be recorded

Use the **Q & A** function to ask the hosts and panelists questions

**We will start soon...**

Contact: **Communications@NZAvocado.co.nz**

# Soil moisture management webinar

Phillip West, Research Manager, NZ Avocado
Miguel Tapia-Gatica, Research Engineer, NZ Avocado
Brad Siebert, Acting CEO, NZ Avocado

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# Hello & welcome

Thank you for joining us today

Introduction & agenda

Phillip West, Research Manager

- Seasonal outlook
- Soil moisture management
- How to set up a soil moisture balance on orchard

Miguel Tapia, Research Engineer

- How to measure water in and water out

Brad Siebert, Acting CEO

Regional plan changes

- Upcoming water regulations

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# Webinar technology

## Questions

During the event, please use the **Q&A** function on zoom to ask questions and we will respond during designated Q&A breaks.

If you have a technology issue or question during the event, please use the ‘chat’ function and the host will assist you.

We suggest you move your Zoom toolbar to the bottom of the screen in order to view the slides fully.

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# Webinar poll

Where in New Zealand are you located?

How many hectares is your avocado orchard?

How long have you been growing avocados?

Do you have an irrigation system on your orchard?

If you do have an irrigation system do you have a water meter?

Are you thinking about installing an irrigation system?

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# Soil moisture management

Phillip West, Research Manager, NZ Avocado

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# Overview

- Seasonal outlook
- How much water can your soil hold
- How much water is coming in
- How much water is going out
- Soil moisture monitoring

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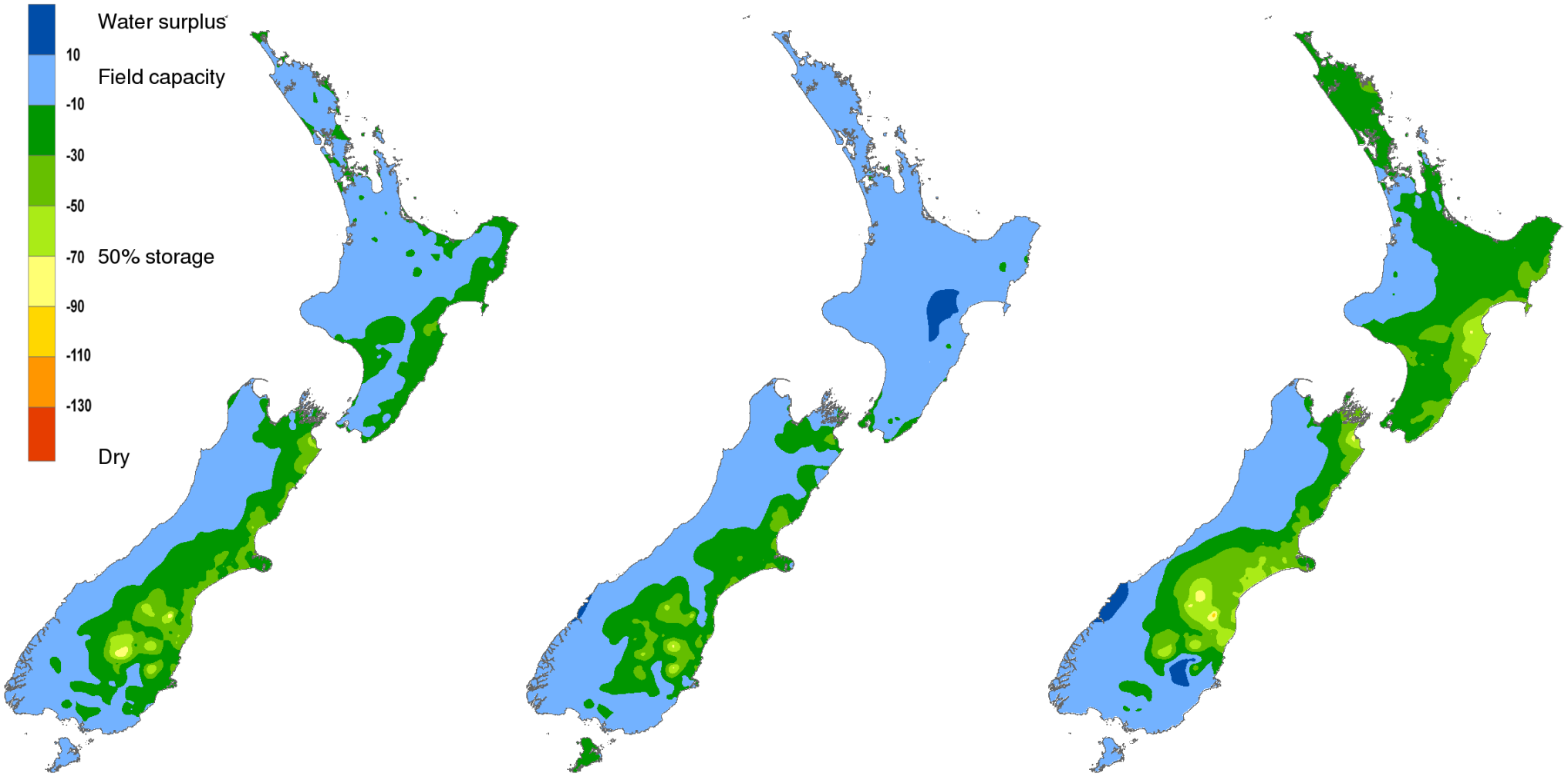
# Current soil moisture

Soil moisture deficit (mm) at 9am on 20/09/2023

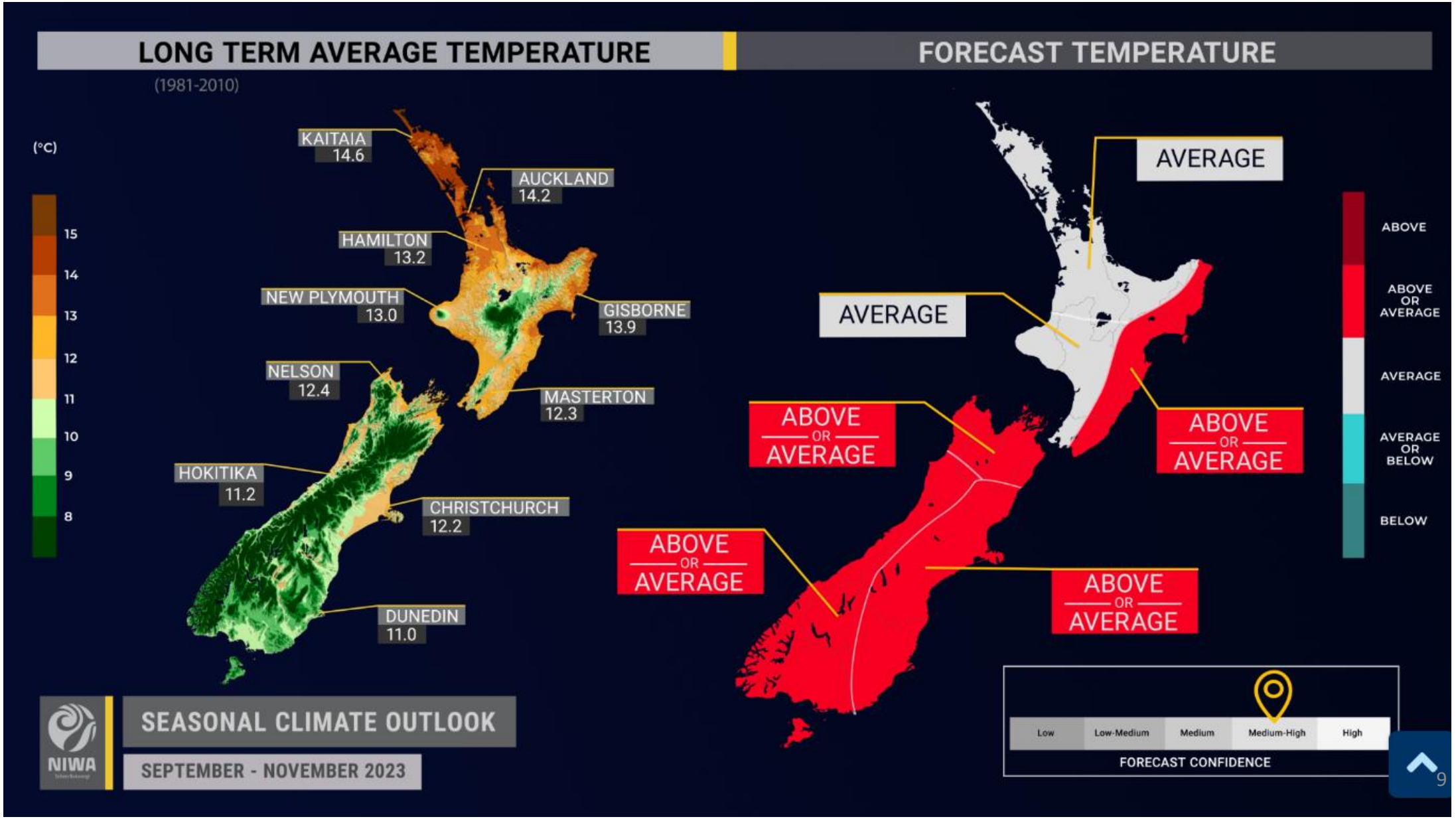



Historical average deficit at 9am on 20 Sep

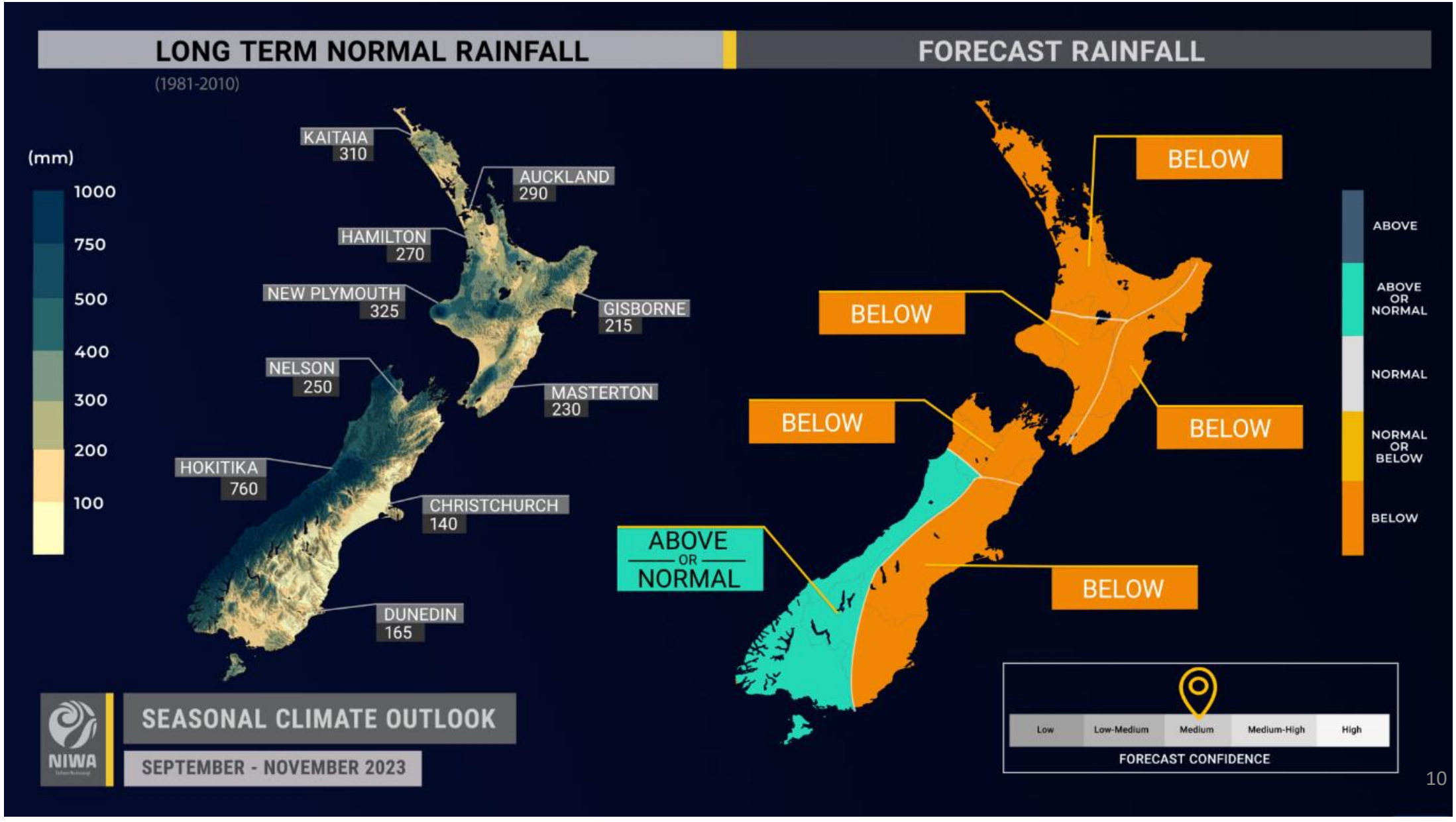
Deficit at 9am on 20/09/2022

Deficit at 9am on 20/09/2023

# Seasonal outlook

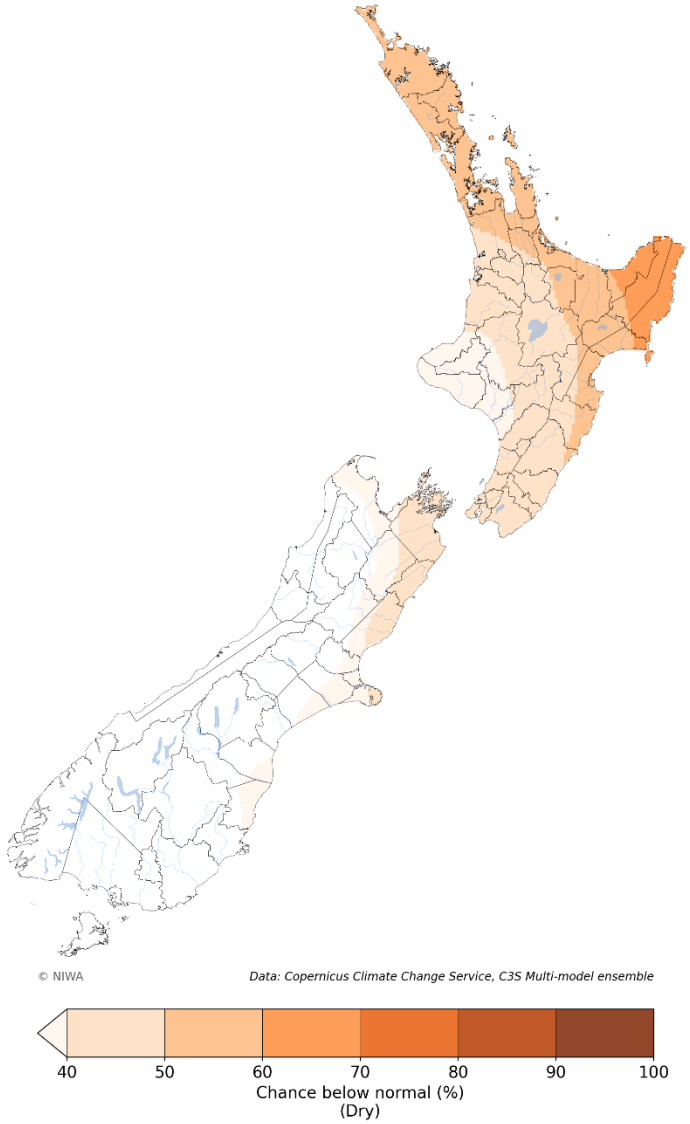


# Seasonal outlook

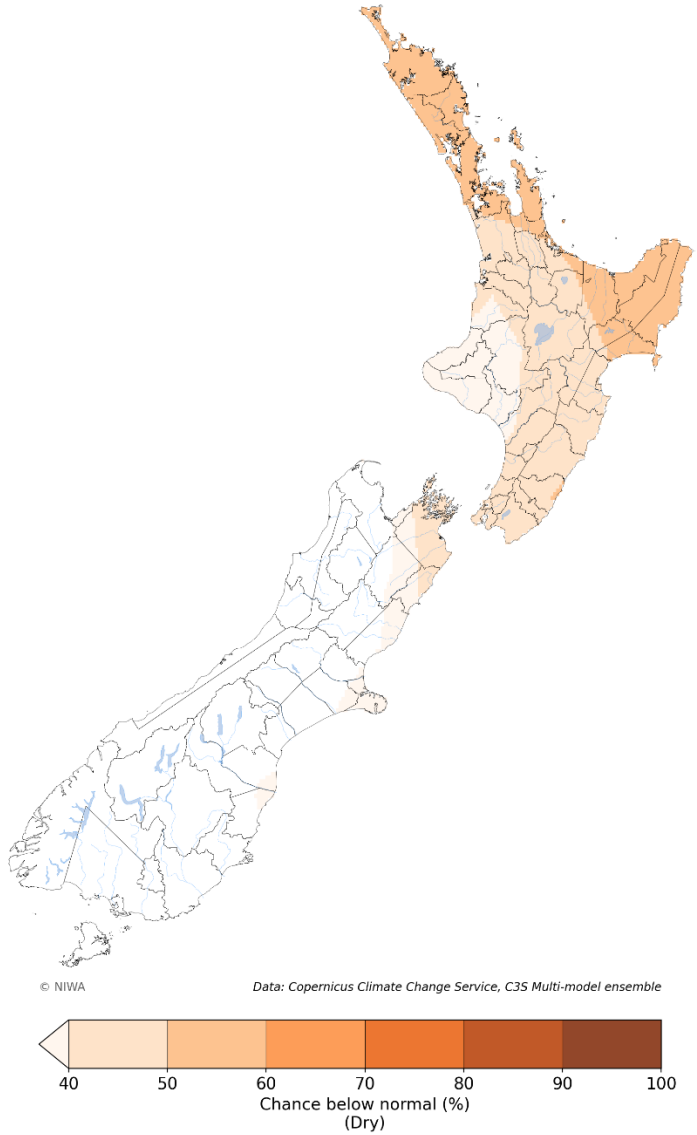


# Seasonal outlook

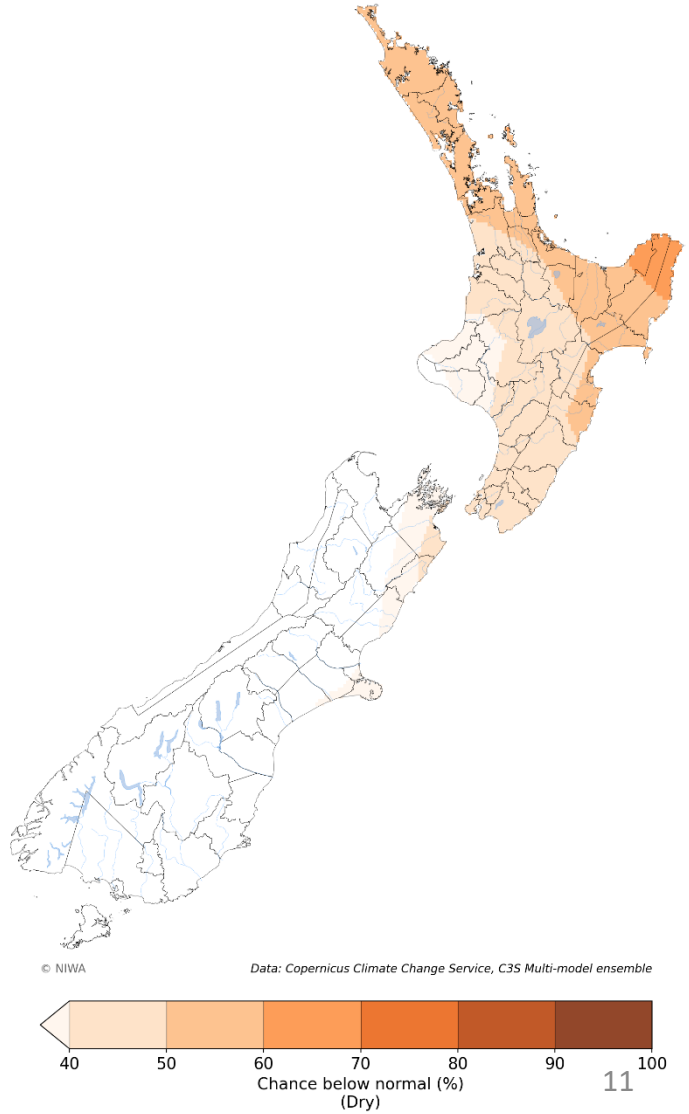
**Probabilistic Precipitation Tercile Forecast**
**October - December 2023**



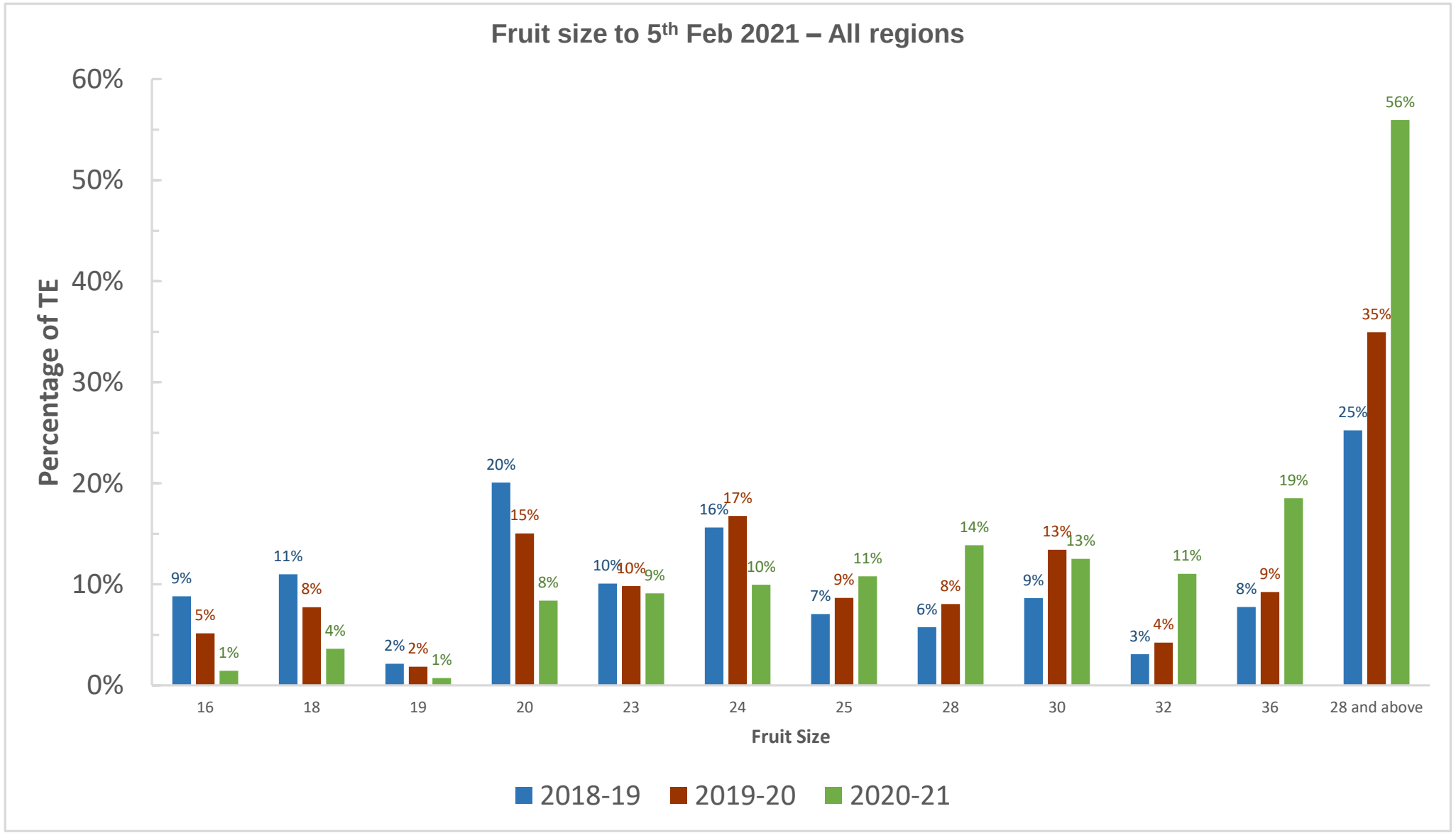

**Probabilistic Precipitation Tercile Forecast**
**November 2023 - January 2024**



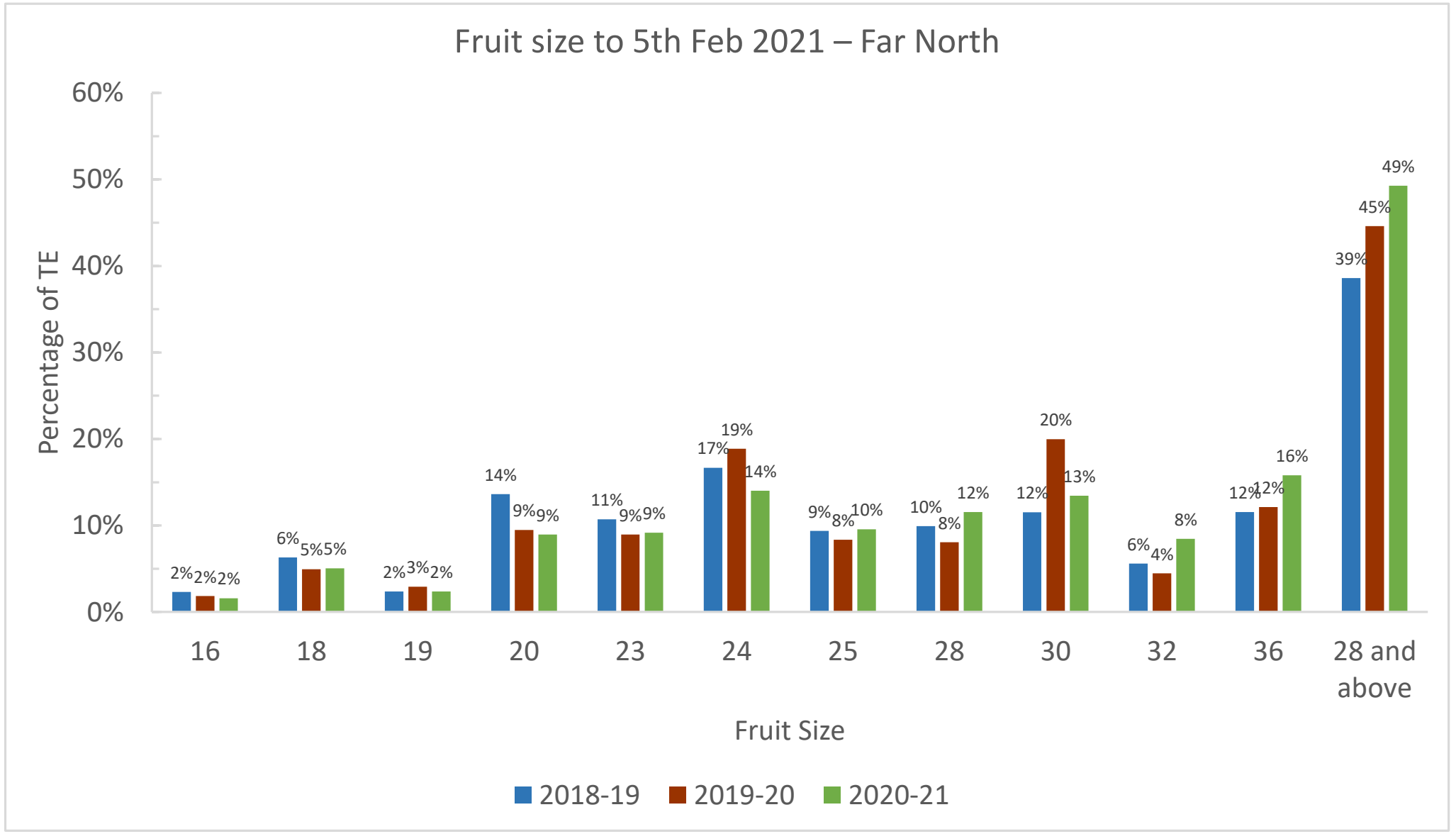

**Probabilistic Precipitation Tercile Forecast**
**December 2023 - February 2024**



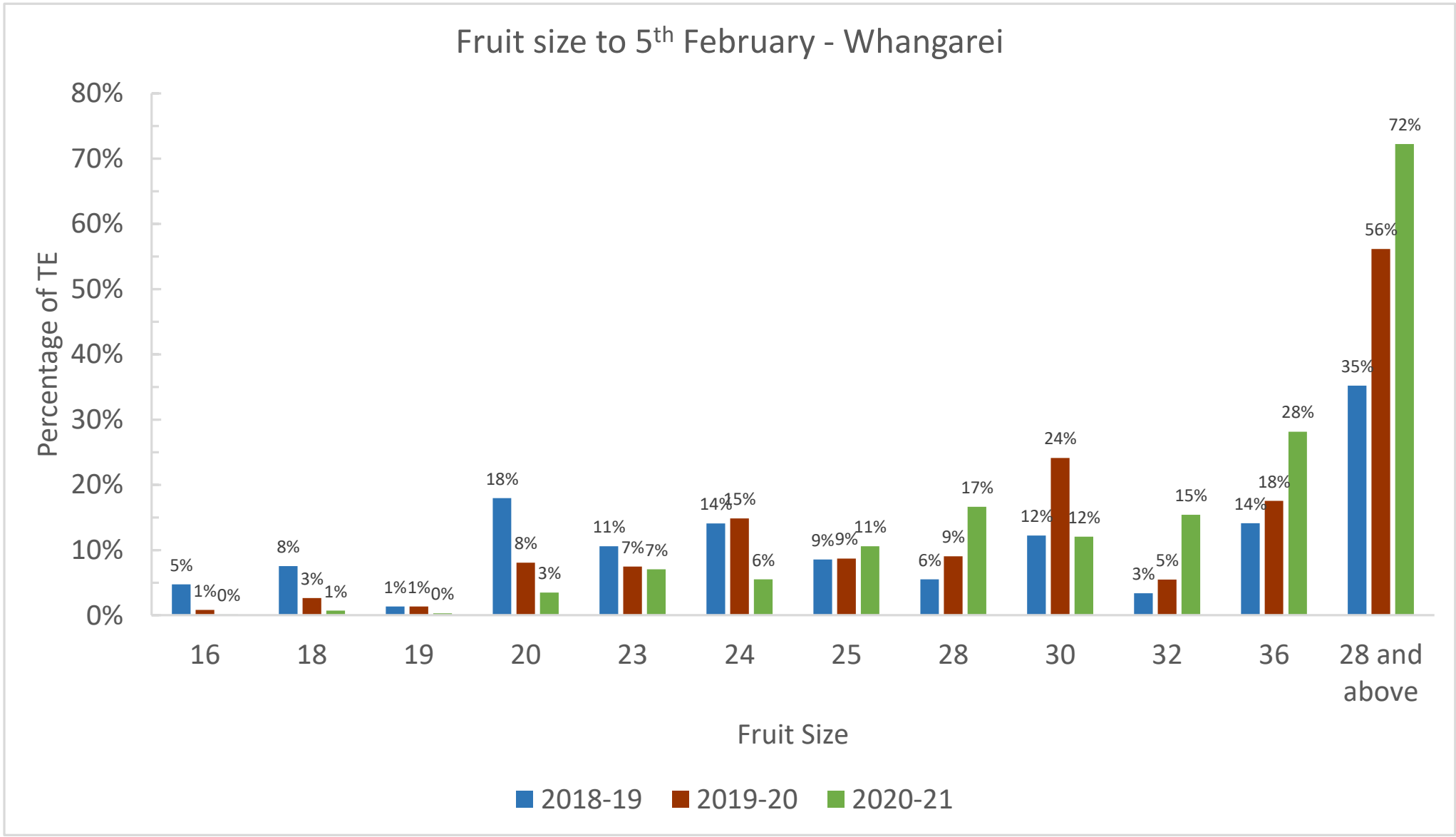
# Fruit size


Fruit size to 5th Feb 2021 – All regions
Percentage of TE
60%
50%
40%
30%
20%
10%
0%
9%
5%
1%
11%
8%
4%
2%
2%
1%
20%
15%
8%
10%
10%
9%
16%
17%
10%
7%
9%
11%
6%
8%
14%
9%
13%
13%
3%
4%
11%
8%
9%
19%
25%
35%
56%
16
18
19
20
23
24
25
28
30
32
36
28 and above
Fruit Size
2018-19
2019-20
2020-21

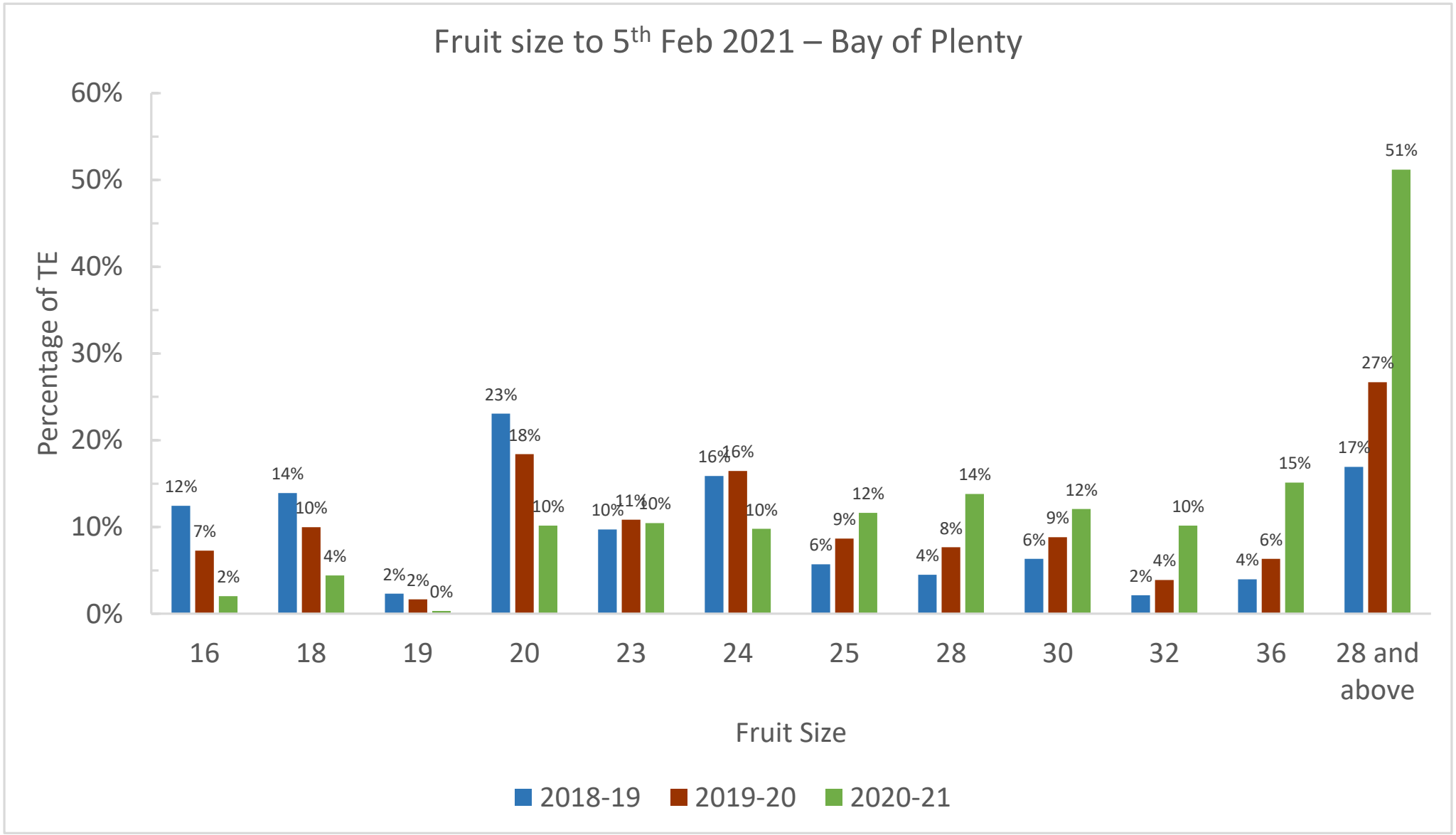
# Fruit size


Fruit size to 5th Feb 2021 – Far North
Percentage of TE
60%
50%
40%
30%
20%
10%
0%
2% 2% 2%
6% 5% 5%
2% 3% 2%
14% 9% 9%
11% 9% 9%
17% 19% 14%
9% 8% 10%
10% 8% 12%
12% 20% 13%
6% 4% 8%
12% 12% 16%
39% 45% 49%
16
18
19
20
23
24
25
28
30
32
36
28 and above
Fruit Size
2018-19
2019-20
2020-21

# Fruit size

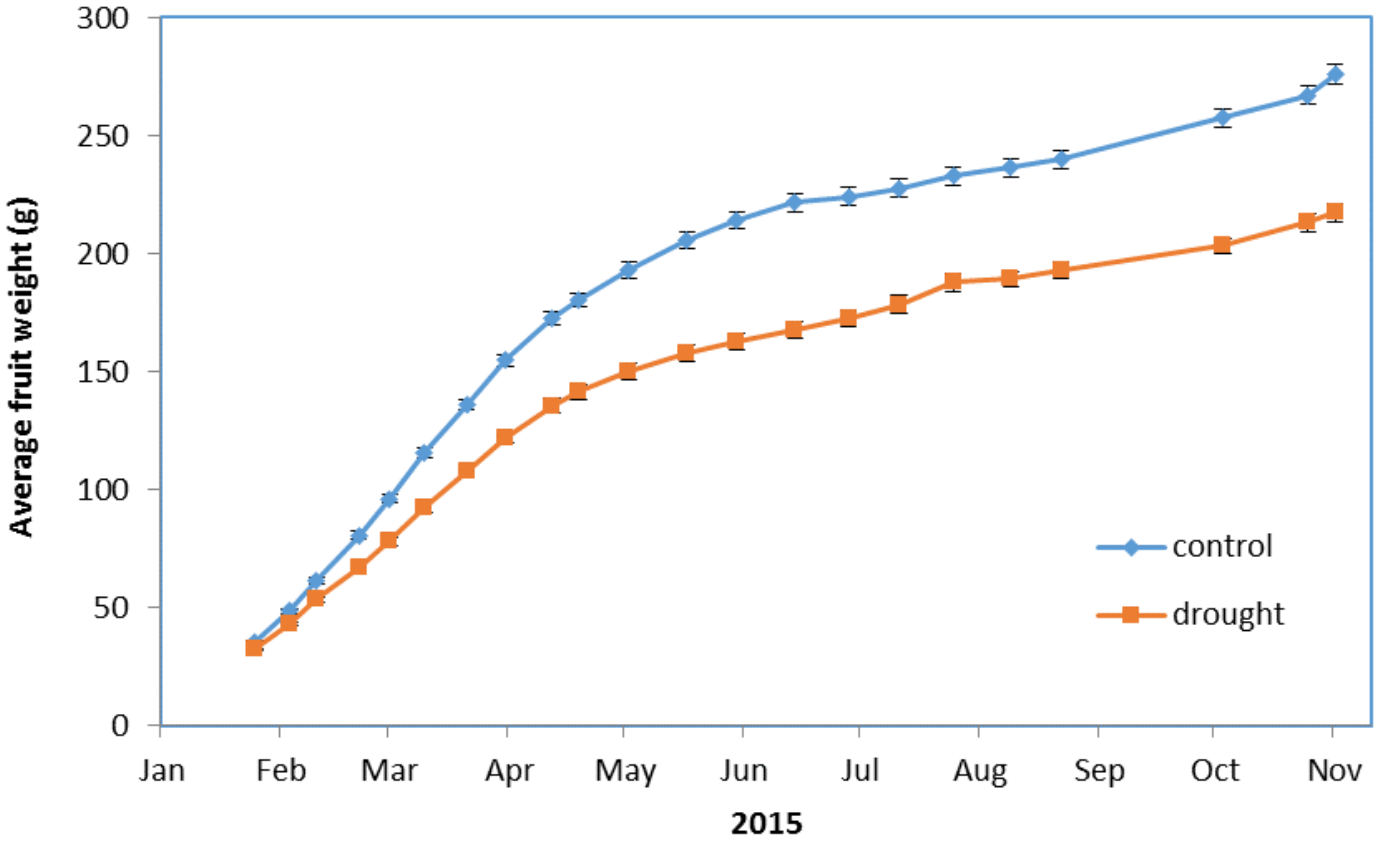

Fruit size to 5th February - Whangarei
Percentage of TE
80%
70%
60%
50%
40%
30%
20%
10%
0%
5%
1%
0%
8%
3%
1%
1%
1%
0%
18%
8%
3%
11%
7%
7%
14%
15%
6%
9%
9%
11%
6%
9%
17%
12%
24%
12%
3%
5%
15%
14%
18%
28%
35%
56%
72%
16
18
19
20
23
24
25
28
30
32
36
28 and above
Fruit Size
2018-19
2019-20
2020-21

# Fruit size


Fruit size to 5th Feb 2021 – Bay of Plenty
Percentage of TE
60%
50%
40%
30%
20%
10%
0%
12%
7%
2%
14%
10%
4%
2%
2%
0%
23%
18%
10%
10%
11%
10%
16%
16%
10%
6%
9%
12%
4%
8%
14%
6%
9%
12%
2%
4%
10%
4%
6%
15%
17%
27%
51%
16
18
19
20
23
24
25
28
30
32
36
28 and above
Fruit Size
2018-19
2019-20
2020-21

# Soil moisture management

## What happens if the soil is too dry?




Size 20


Size 25

# Soil moisture management

## What happens if dry soil is rewet?

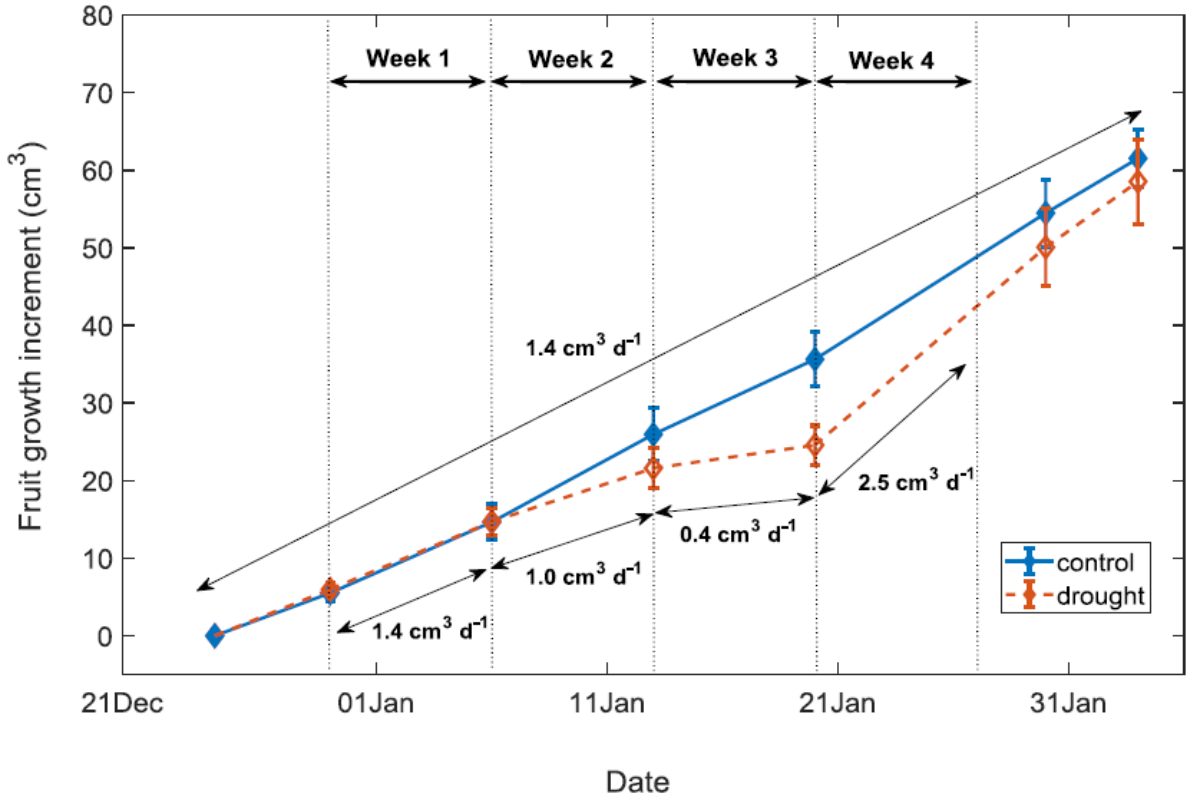
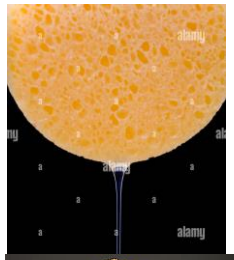



**Figure 4.6:** Mean fruit growth increment (±1S.E.) ($cm^3$) estimated from non-destructive fruit growth measurements using callipers. The first date of measurement was 24 December 2018, when mean fruit volume was 29.8 ± 8.4 $cm^3$, and the final date of measurement was 4 February 2019 (n = 16 control fruit on three plants, and 19 drought fruit of three plants) (P>0.05).

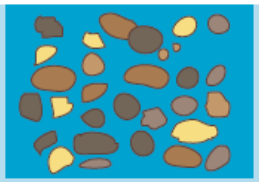
## Potted trees:

- Fruit size may recover in early rapid fruit growth phase.
- Not sure if happens in orchard.
- Observations from March onwards is little can be done to influence fruit sizing rate.

# Role of soil in soil moisture management



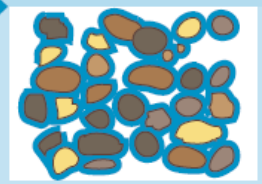
**SATURATED SOIL**
All pores filled with water. Plant roots short of air for oxygen and gas exchange.



Larger macro-pores drain by gravity, air enters soil.

DRAINAGE WATER (UNAVAILABLE)

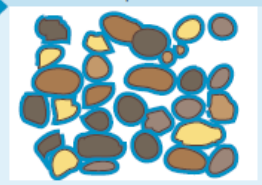
**FIELD CAPACITY**
Macro-pores provide air spaces and oxygen.
Micro-pores filled with water held by capillary forces.
Plant roots easily take up water.



Plants and soil surface evaporation remove soil water from micro-pore reservoir.

READILY AVAILABLE WATER (RAW)

**STRESS POINT (TRIGGER POINT)**
Finest pores retain water held by strong capillary forces. Plant roots take up water with increasing difficulty. May wilt during the day, recover at night. Soil well aerated.

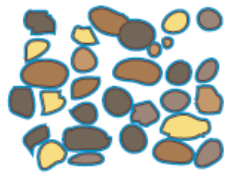


Plants and surface evaporation continue to remove water from smallest micro-pores.

SURVIVAL WATER

PLANT AVAILABLE WATER

**PERMANENT WILTING POINT**
Only 'hygroscopic' water remains in soil, bound very strongly to the soil particles. Plant roots unable to take up water, plants wilt and do not recover.



HYGROSCOPIC WATER (UNAVAILABLE)

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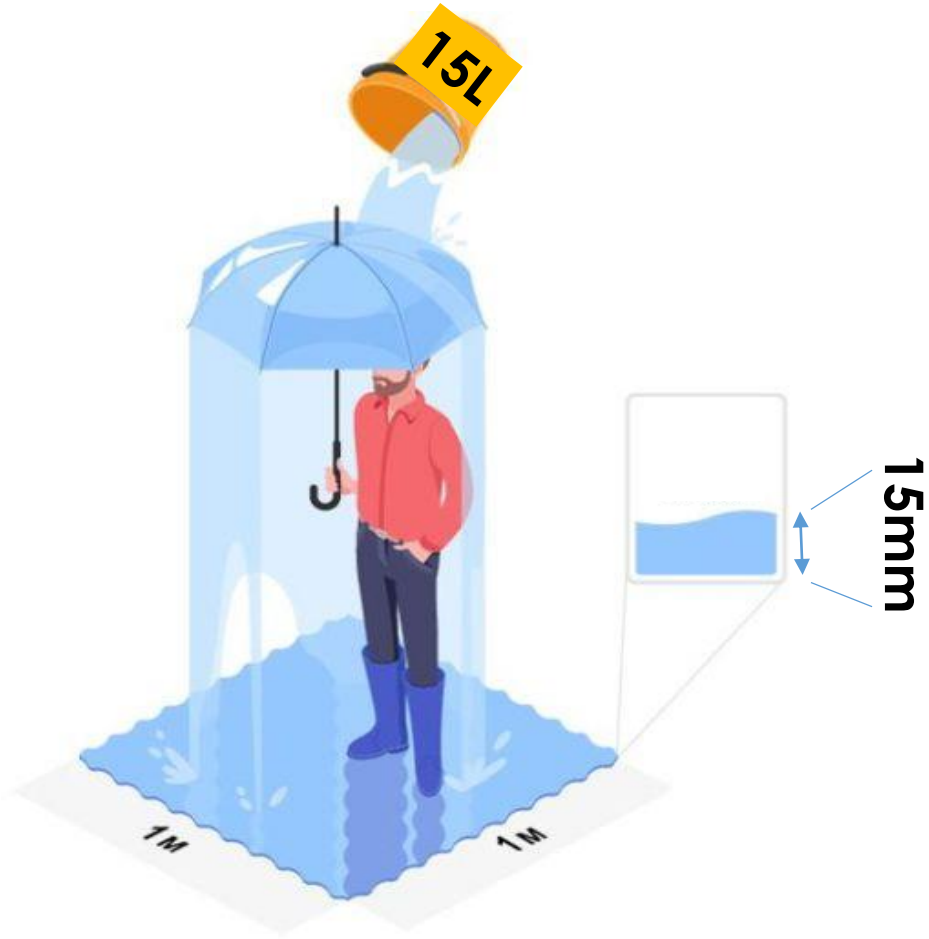
# What is 1mm of water?

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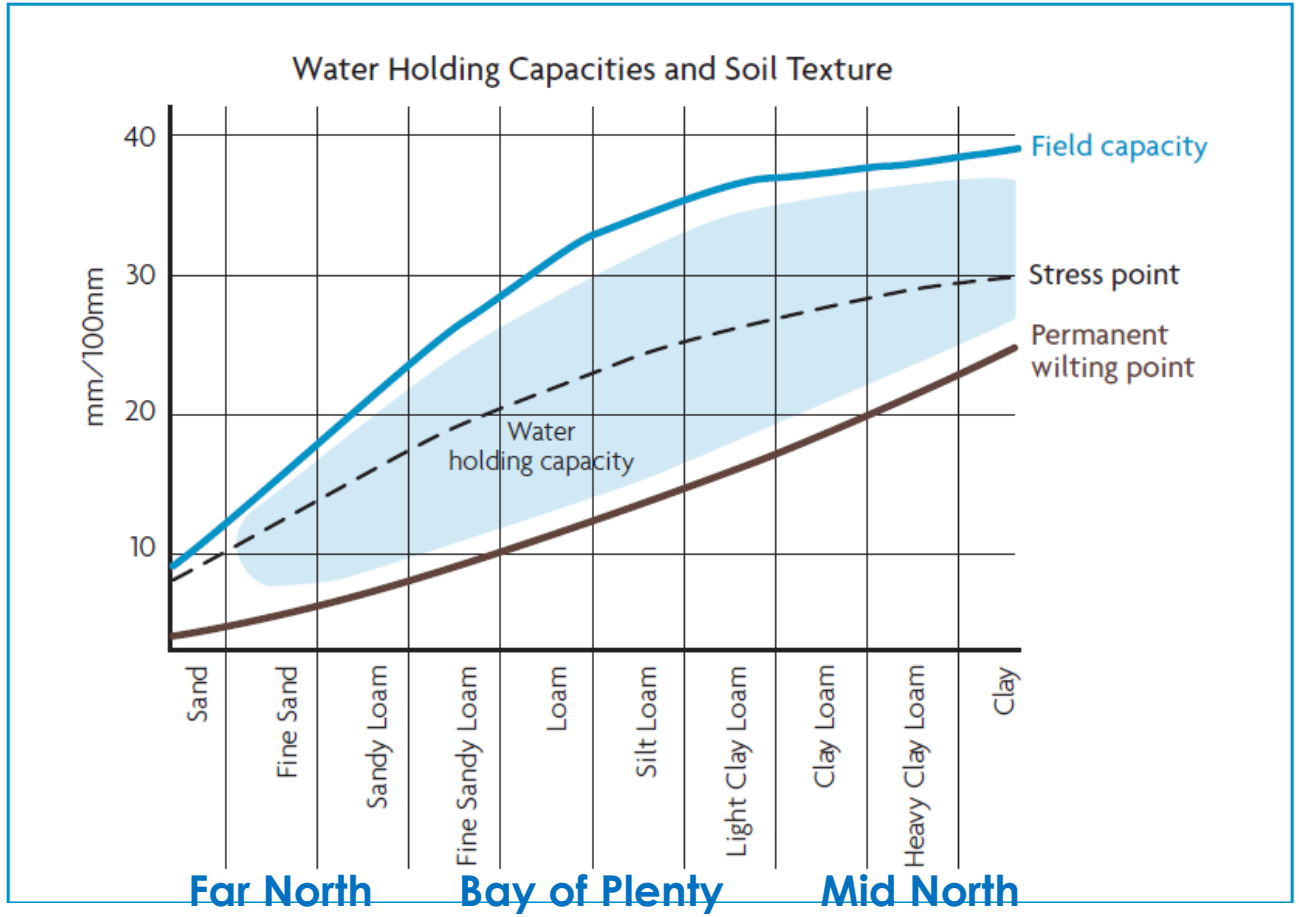
# Different soils hold different amounts of water

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# Role of soil in soil moisture management

## Available Water Holding Capacity

**Why – This is a fundamental piece of information needed to design an irrigation system and manage irrigation.**

To determine AWHC four pieces of information are required;

1. A soil profile split into each horizon.
2. The depth of each horizon.
3. The soil texture of each horizon.
4. Information on WHC for each texture.

To obtain the information for 1, 2 and 3. . . find a spade, a ruler and dig a hole!

Soil WHC information for 4, can be obtained from regional council websites and Landcare Research online data base 'S-Map Online'. Site specific AWHC can be determined on-site using soil moisture measuring tools such as neutron probes.

Table 1 gives an indication of Available Water Holding Capacity for the various soil classes.

**STONES**

If stones are present, the WHC value should be reduced by the same percentage, i.e. if stones make up 30% of the soil volume, reduce the soil WHC by 30%.

Table 1: Typical total available water capacities.

| Class | Millimetres per 100 mm of soil depth | |
|---|---|---|
| | Down to 300 mm | Below 300 mm |
| Sand | 15 | 5 |
| Loamy sand | 18 | 11 |
| Sandy loam | 23 | 15 |
| Fine sandy loam | 22 | 15 |
| Silt loam | 22 | 15 |
| Clay loam | 18 | 11 |
| Clay | 17.5 | 11 |
| Peat | 20–25 | > 20–25 |

Source: Adapted from NZS5103:1973



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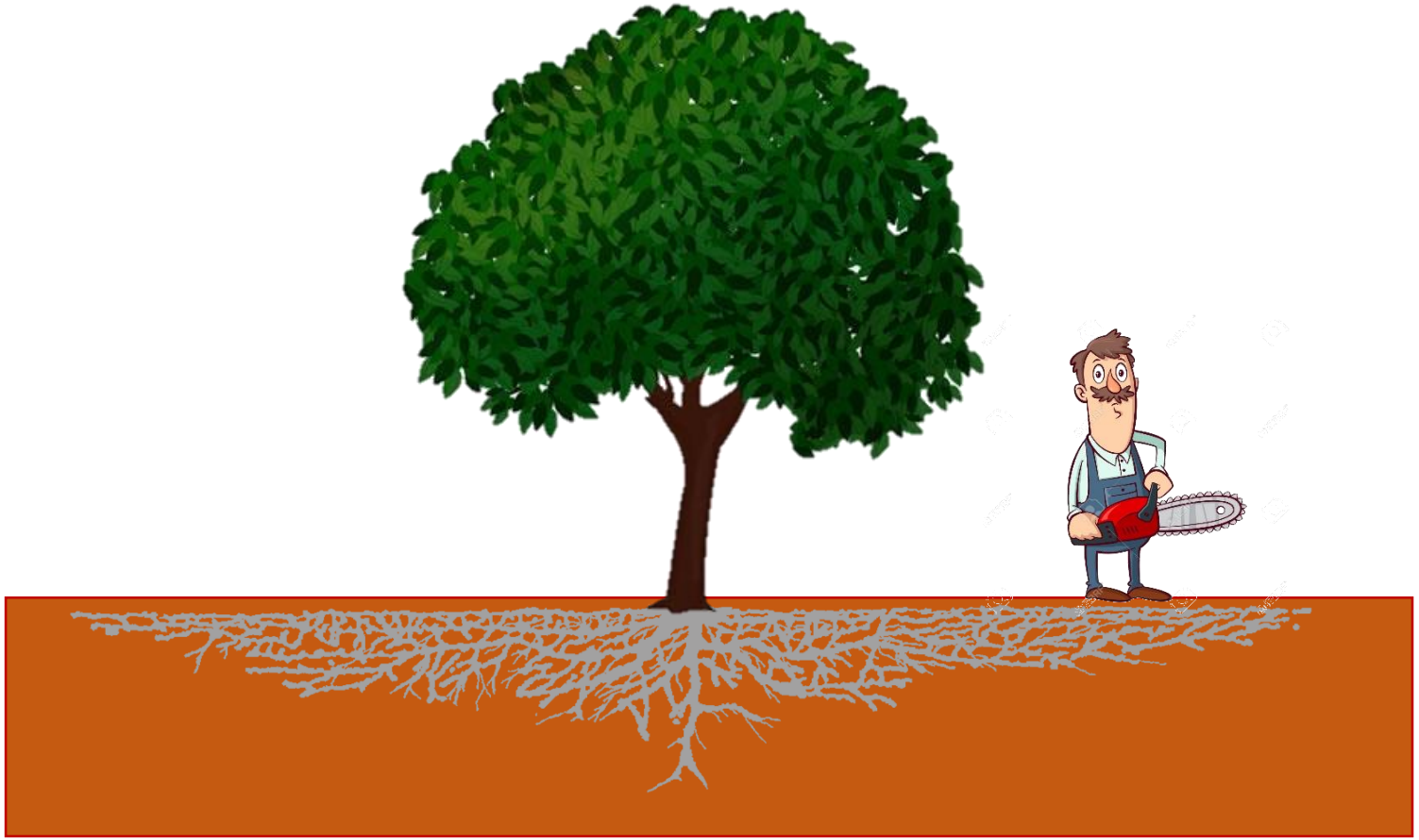
# Role of soil in soil moisture management



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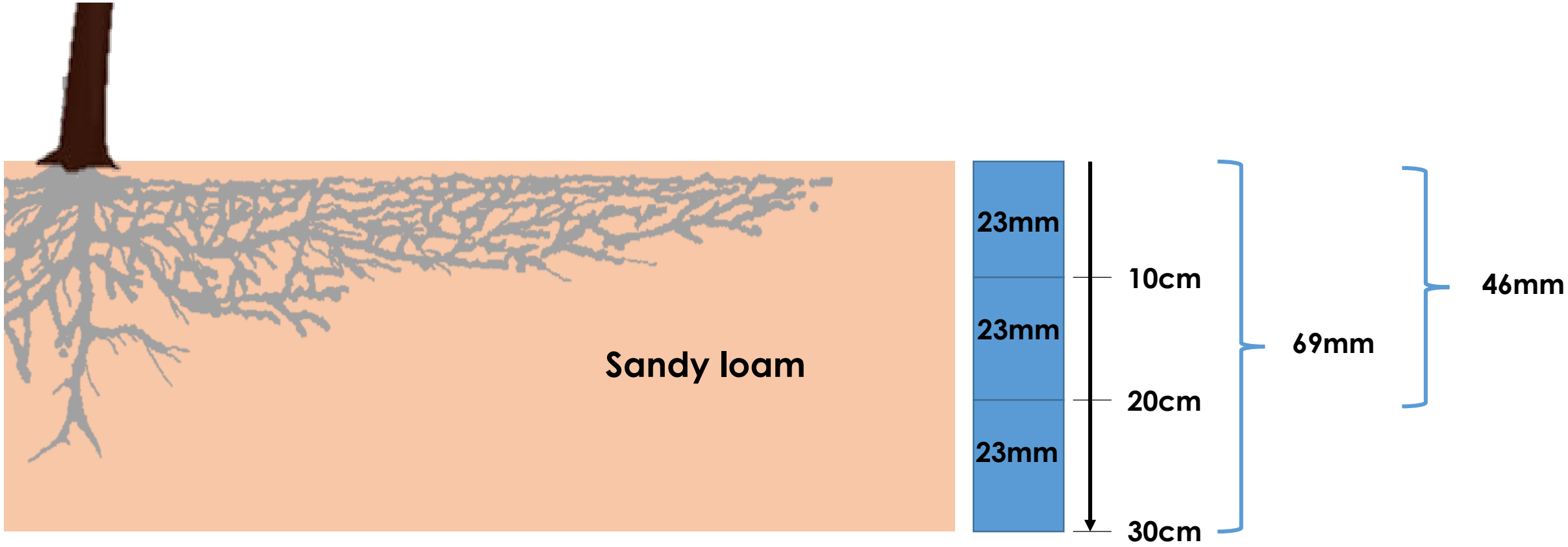
# How much water can your soil hold?

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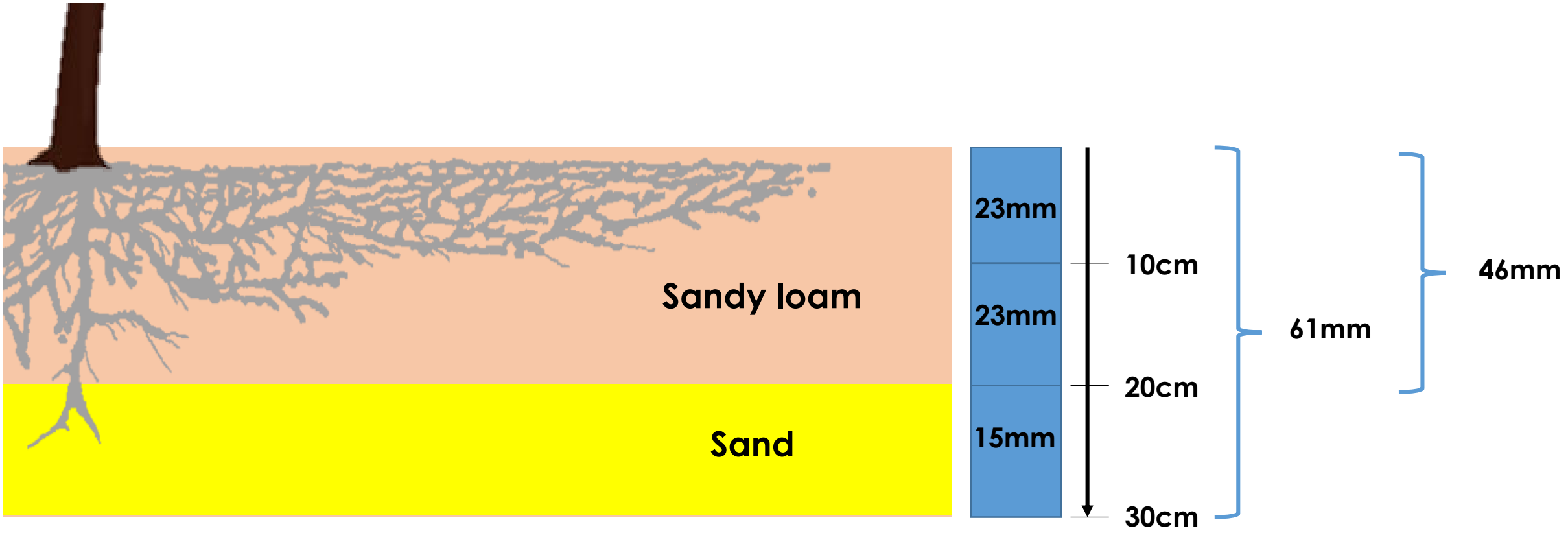
# How much water can your soil hold?

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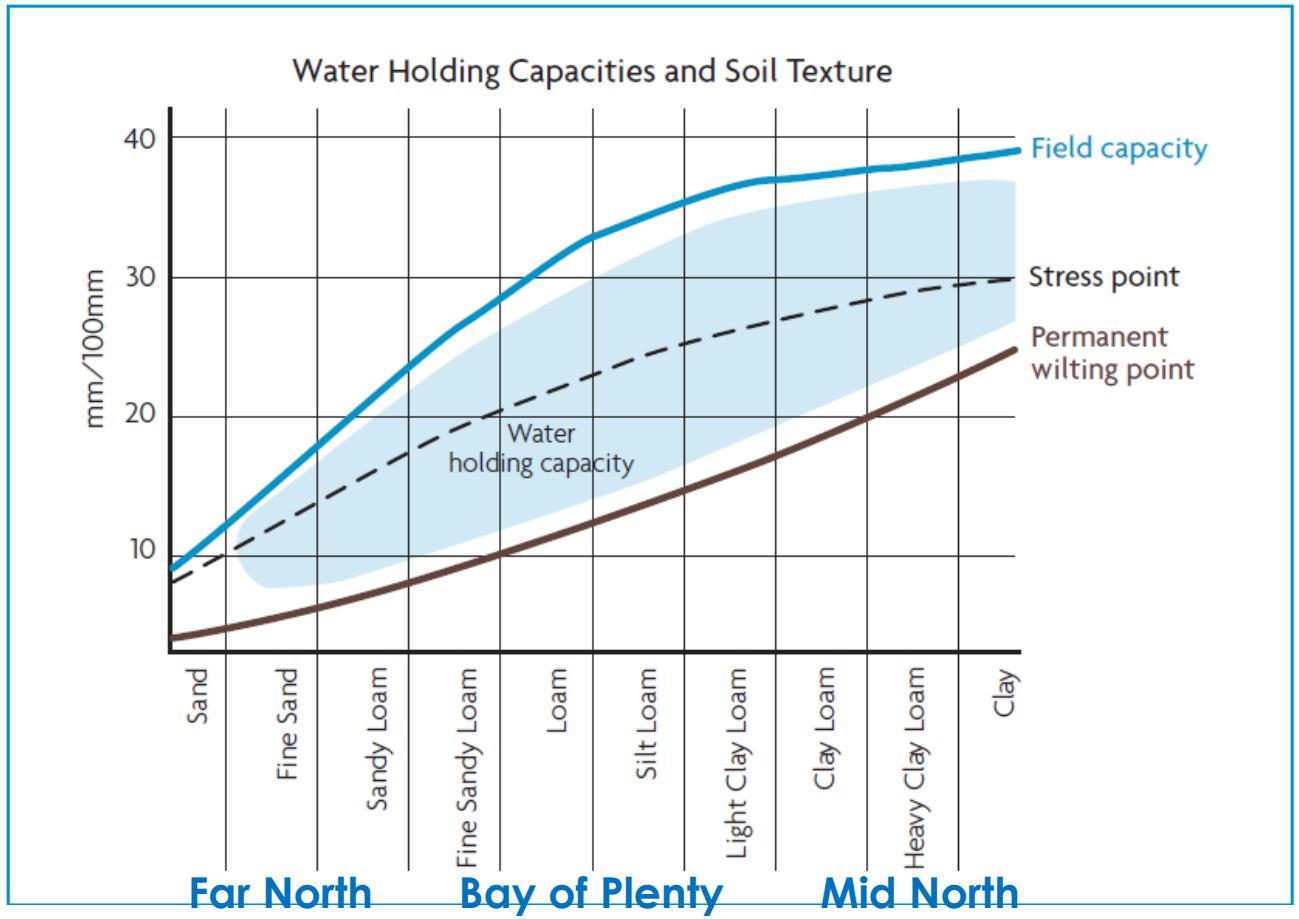
# Different soils release water differently

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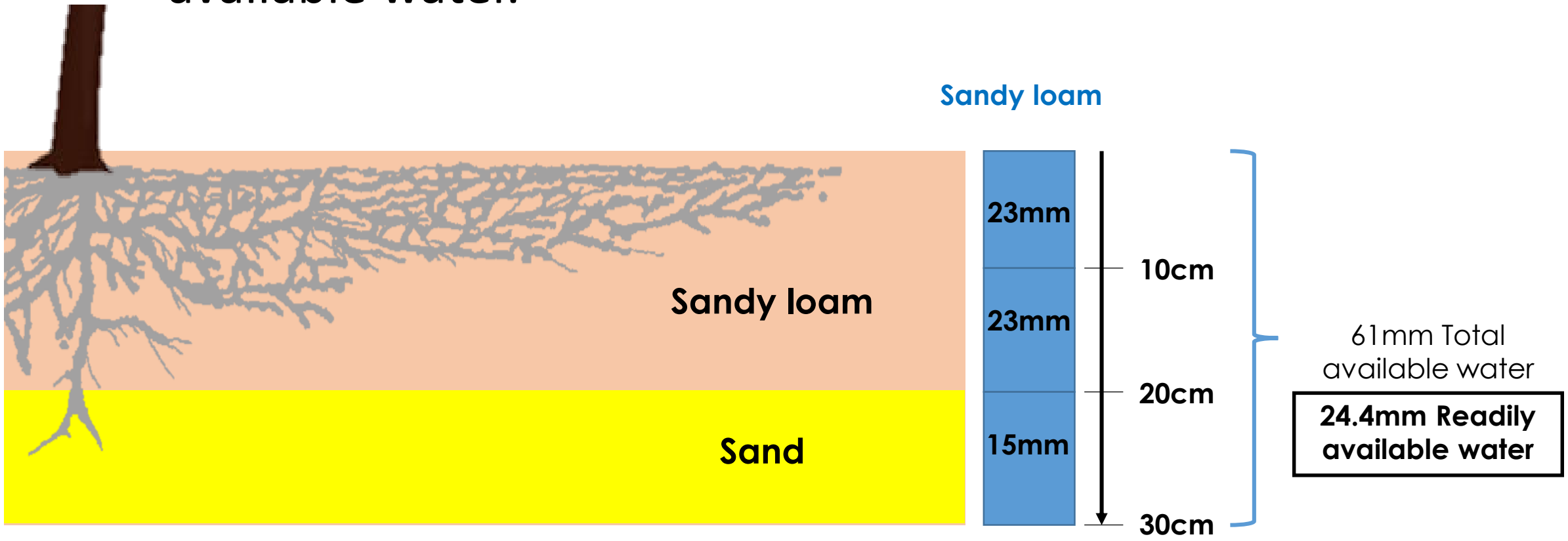
# How much water can your tree access easily?

- Stress point for sandy loam is about 40% of total available water.

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# How do we measure how much water is coming in?

- Sprinkler radius for the wet area ($m^2$).
- Flow or volume of water per hour (L/hour).
- How long you irrigate for.

- Sprinkler radius: 4m
- Sprinkler flow: 50L/hour
- Irrigation time: 8hours

4m

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# How do we measure how much water is coming in?

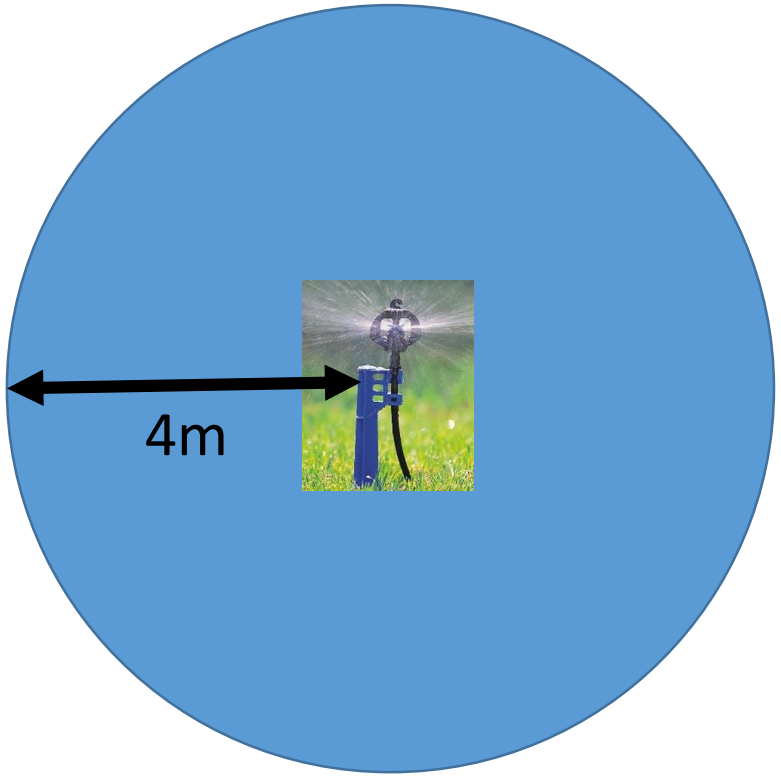
Area = $\pi$ x radius$^2$

Area = $\pi$ x (4m x 4m)

Area = 3.14 x (4m x 4m)

Area = 3.14 x 16m$^2$

Area = 50.24m$^2$ ≈ 50m$^2$

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# How do we measure how much water is coming in?

Flow = Sprinkler flow / Area

Flow = (50L/hour) / 50m$^2$

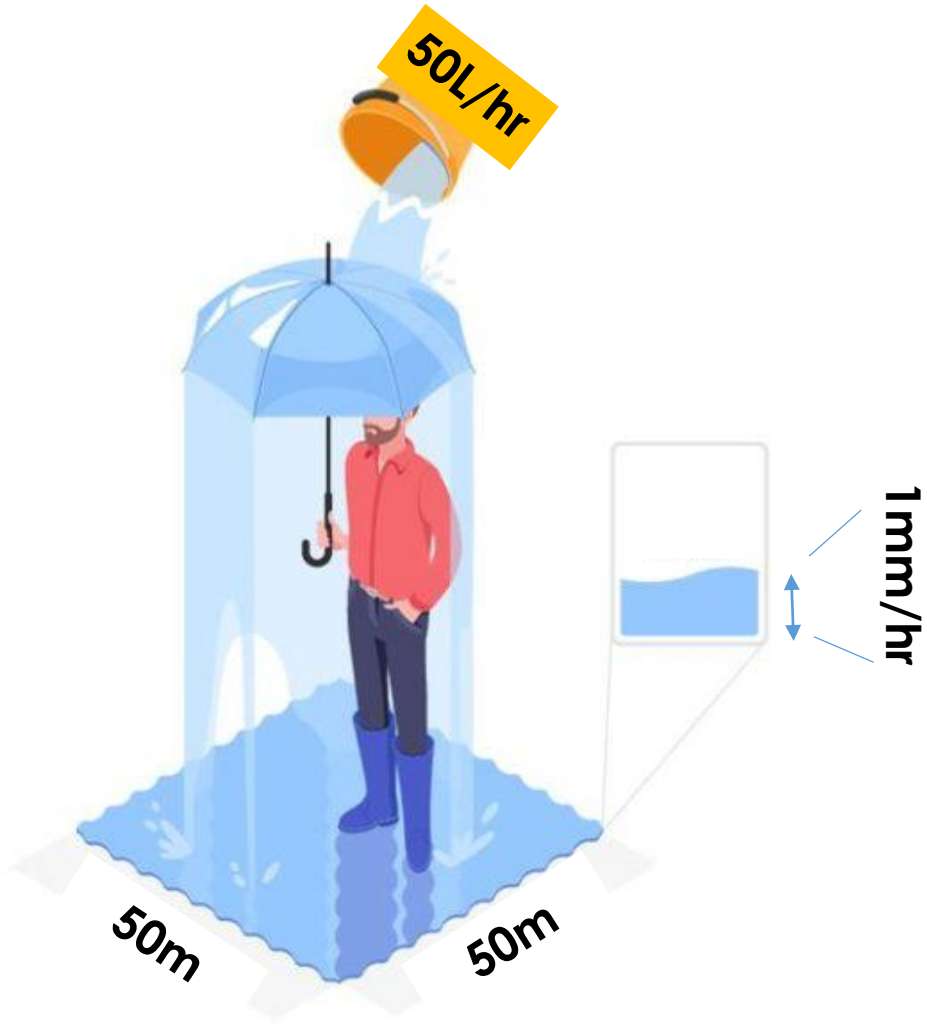
Flow = 1L/m$^2$/hour

Flow = 1mm/hour

Volume = Flow x Irrigation time

Volume = 1mm/hour x 8hours

Volume = 8mm per irrigation




**1L/1m$^2$= 1mm**

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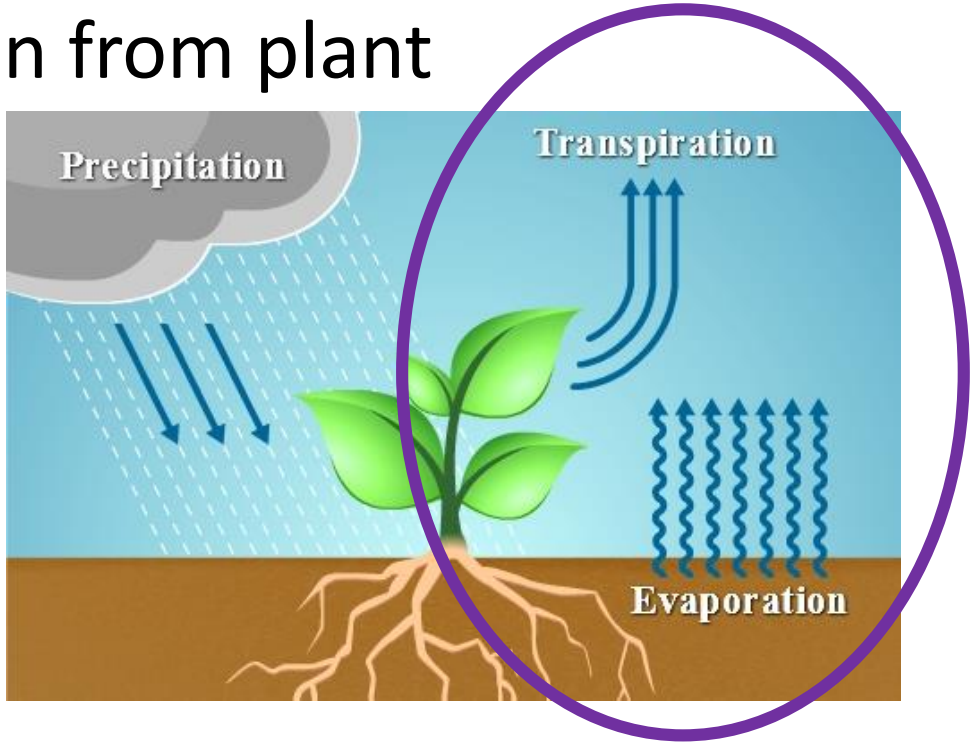
# How do we measure how much water is coming out?

- Evapotranspiration
  - Combination of evaporation from soil and transpiration from plant

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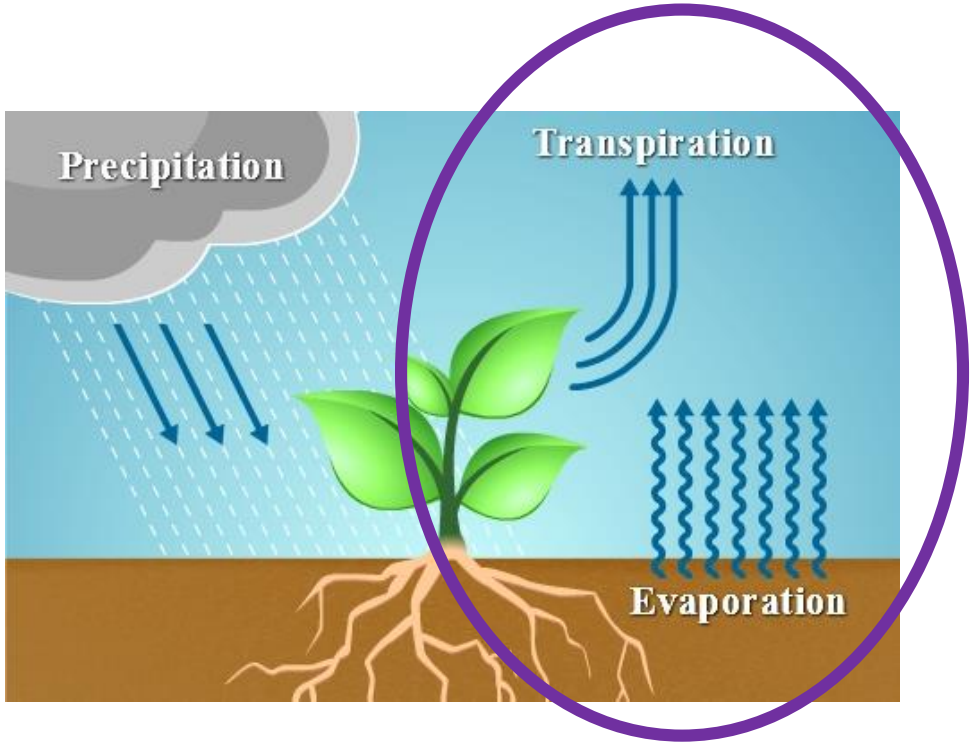
# How do we measure how much water is coming out?

- Evapotranspiration factors
  - Temperature
  - Sunshine
  - Humidity
  - Windspeed
  - Tree state

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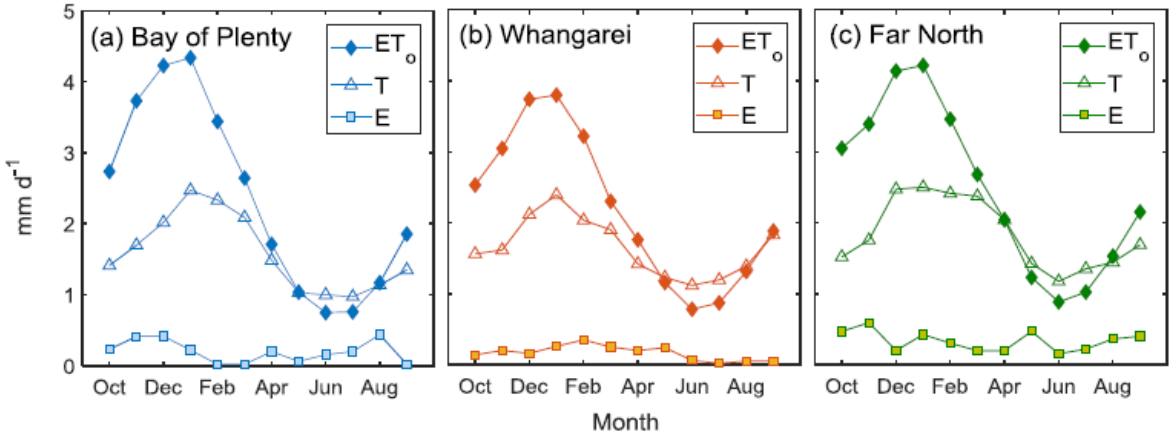
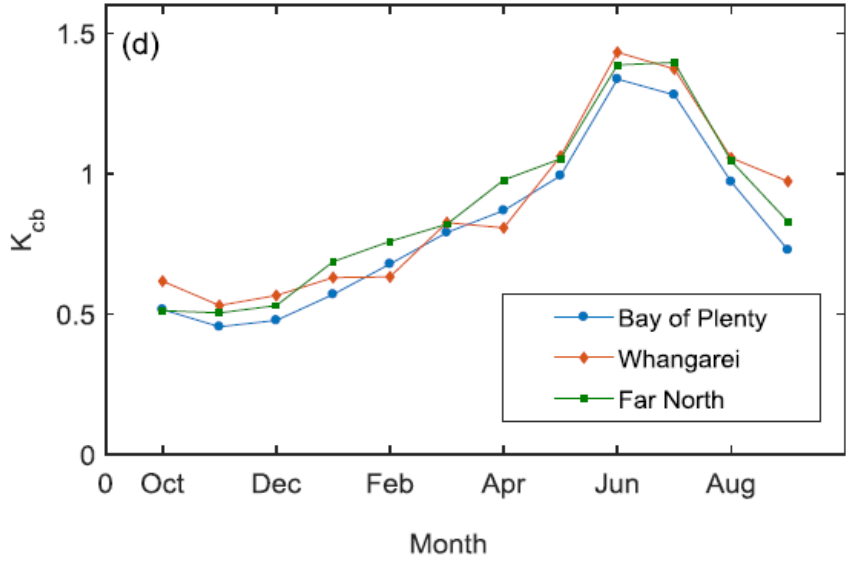
# How much water do trees use?

- Crop factors allow estimation of water use from weather conditions.
- ETo: ET of grass (reference)
- ETc: ET of crop (avocado trees)

- Water use is a little different between regions but Crop Factors (Kc) are very similar.




(Kaneko, 2020)

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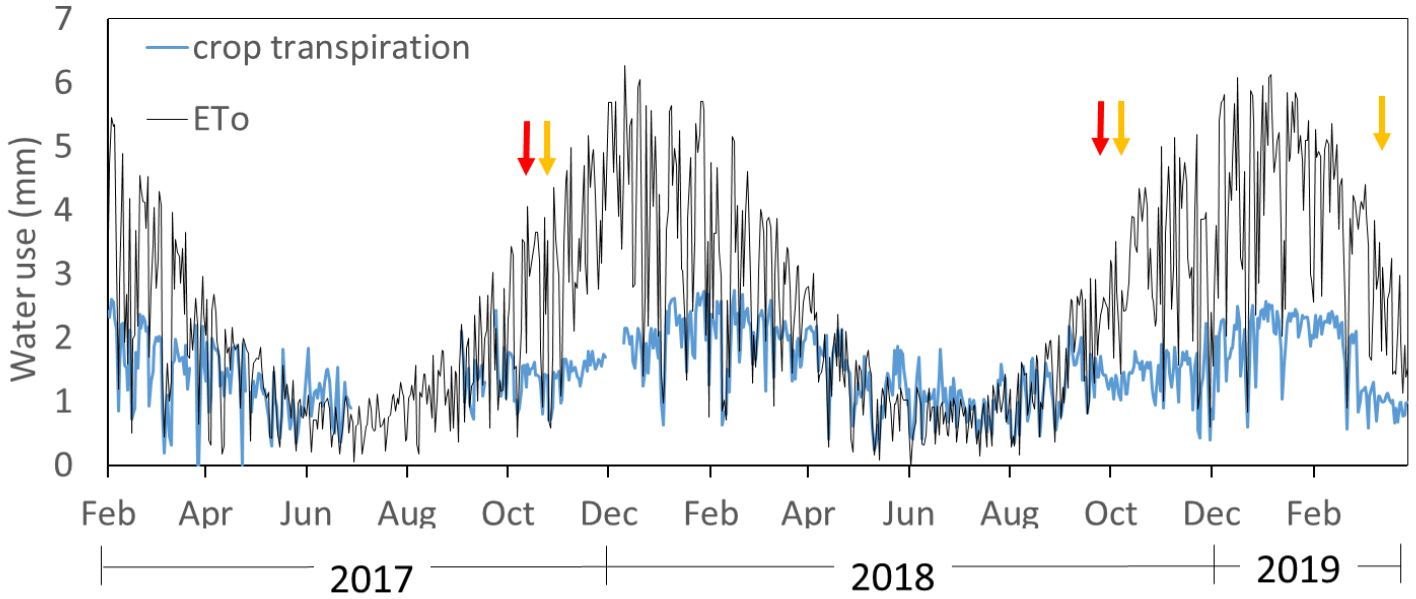
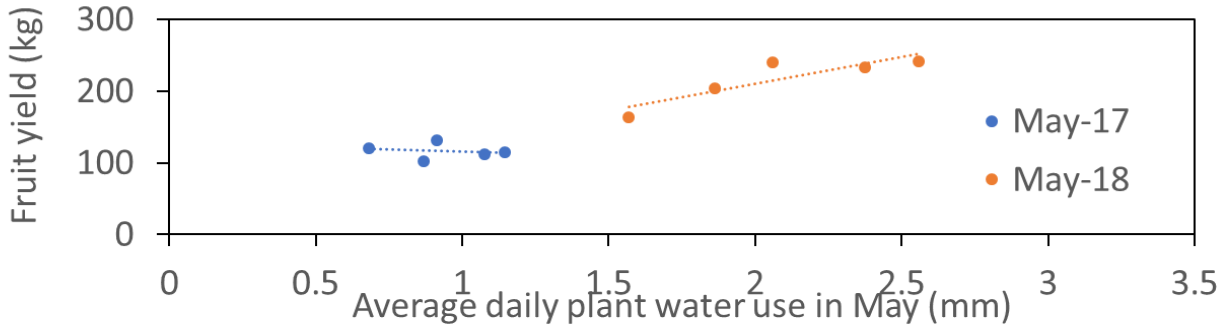
# How much water do trees use in the Bay of Plenty?




= Harvest

= Prune




- Harvesting and pruning reduce water demand by the tree.
- A sick tree will also use less water.

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| Month | Far North | | Mid North | | Bay of Plenty | |
|---|---|---|---|---|---|---|
| | Daily ETo (mm/d) | Daily ETc Avocado (mm/d) | Daily ETo (mm/d) | Daily ETc Avocado (mm/d) | Daily ETo (mm/d) | Daily ETc Avocado (mm/d) |
| October | 3.0 | 1.8 | 2.5 | 1.6 | 2.7 | 1.6 |
| November | 3.4 | 2.2 | 3.1 | 1.8 | 3.7 | 2.2 |
| December | 4.1 | 2.6 | 3.7 | 2.3 | 4.2 | 2.4 |
| January | 4.2 | **2.7** | 3.8 | **2.7** | 4.3 | **2.7** |
| February | 3.5 | 2.5 | 3.3 | 2.5 | 3.4 | 2.3 |
| March | 2.7 | 2.4 | 2.3 | 2.2 | 2.6 | 2.0 |
| April | 2.0 | 2.1 | 1.8 | 1.8 | 1.7 | 1.7 |
| May | 1.2 | 1.5 | 1.2 | 1.5 | 1.0 | **1.1** |
| June | 0.8 | **1.4** | 0.8 | **1.2** | 0.7 | 1.2 |
| July | 1.0 | 1.7 | 0.9 | **1.2** | 0.7 | 1.2 |
| August | 1.5 | 1.5 | 1.3 | 1.4 | 1.1 | 1.6 |
| September | 2.1 | 2.1 | 1.9 | 1.9 | 1.8 | 1.3 |

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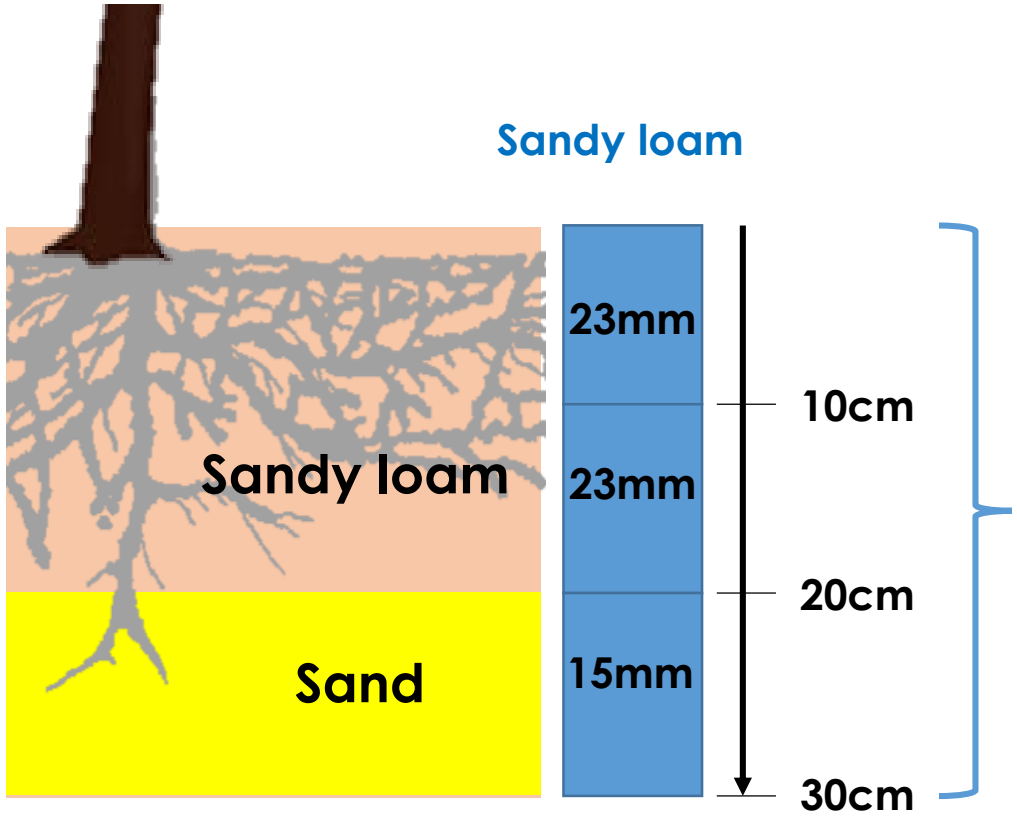
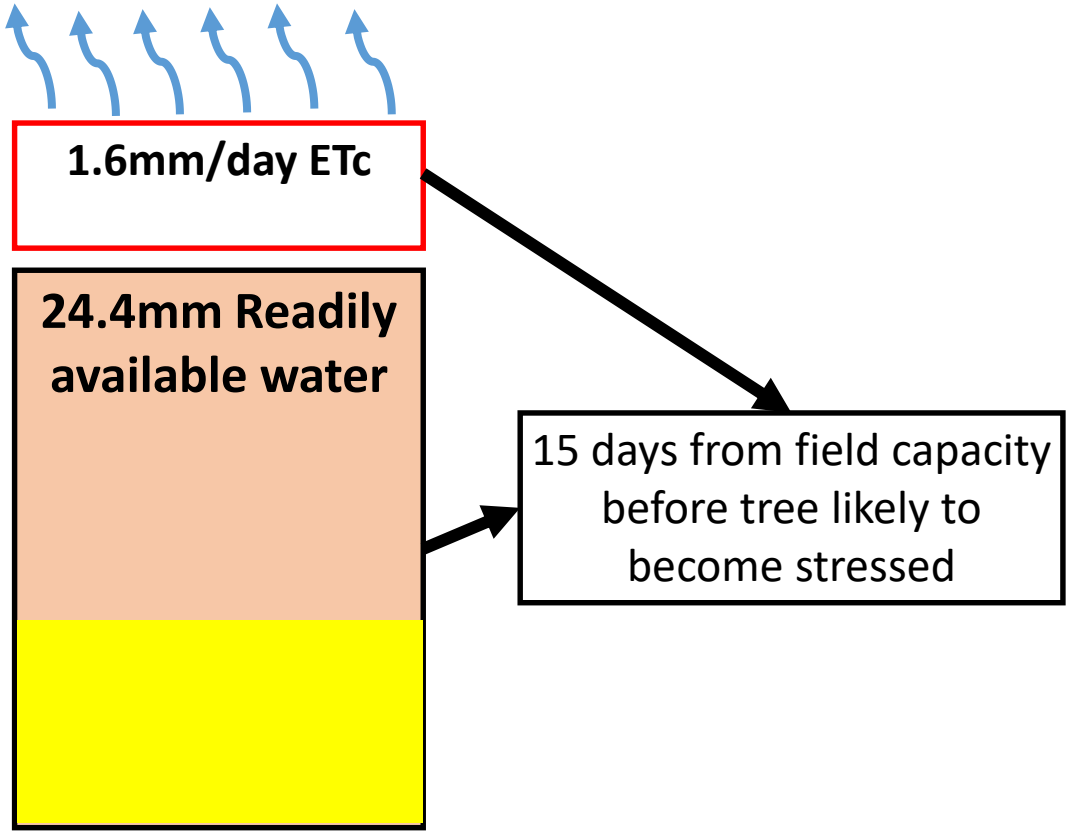
# How can I use this information?

- Calculate the water balance in October.




61mm Total available water




If we get 3.2mm of rain this will mean it will take 2 more days to reach stress point

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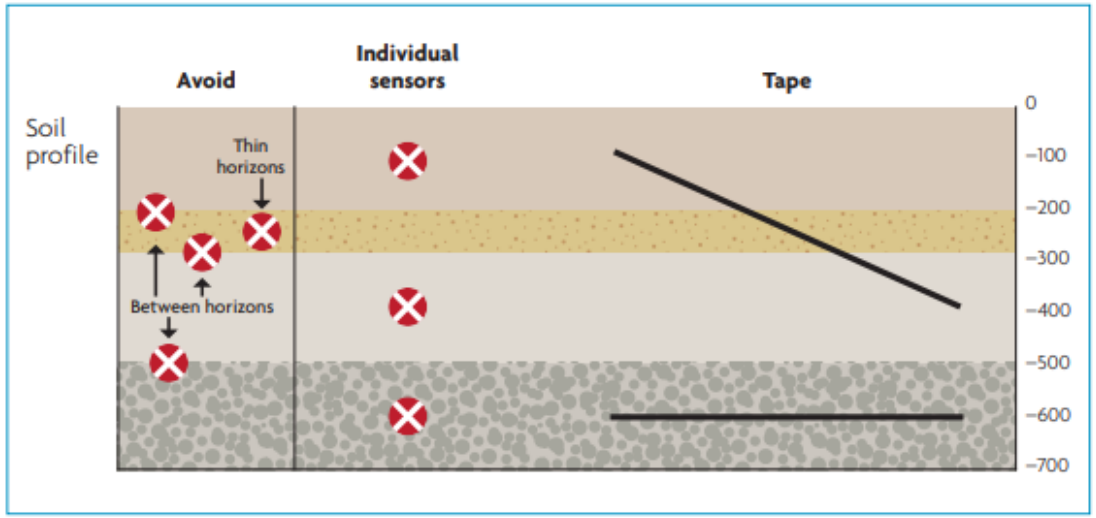
# Role of soil moisture monitoring

- Locate soil moisture probes under representative trees.
- Locate on northern aspect of tree, half way between drip line and trunk of tree. This are will dry out the most quickly and be representative of where roots are.
- Ensure monitoring probes are in an area that gets irrigation if you have it as need to measure impact of irrigation events. Ensure leave, branches, twigs, weeds don't prevent irrigation reaching probe area.
- Maintain probes and sense check reading based on experience and other data if possible.

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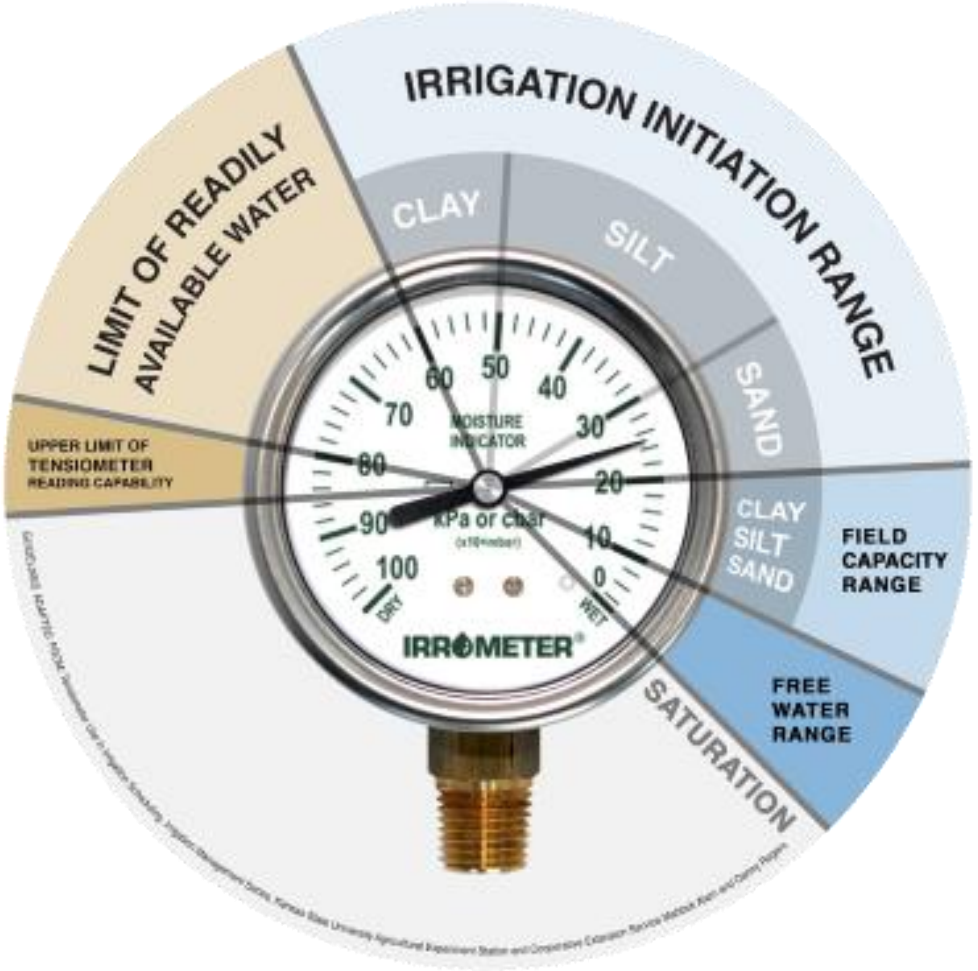
# Role of soil moisture monitoring

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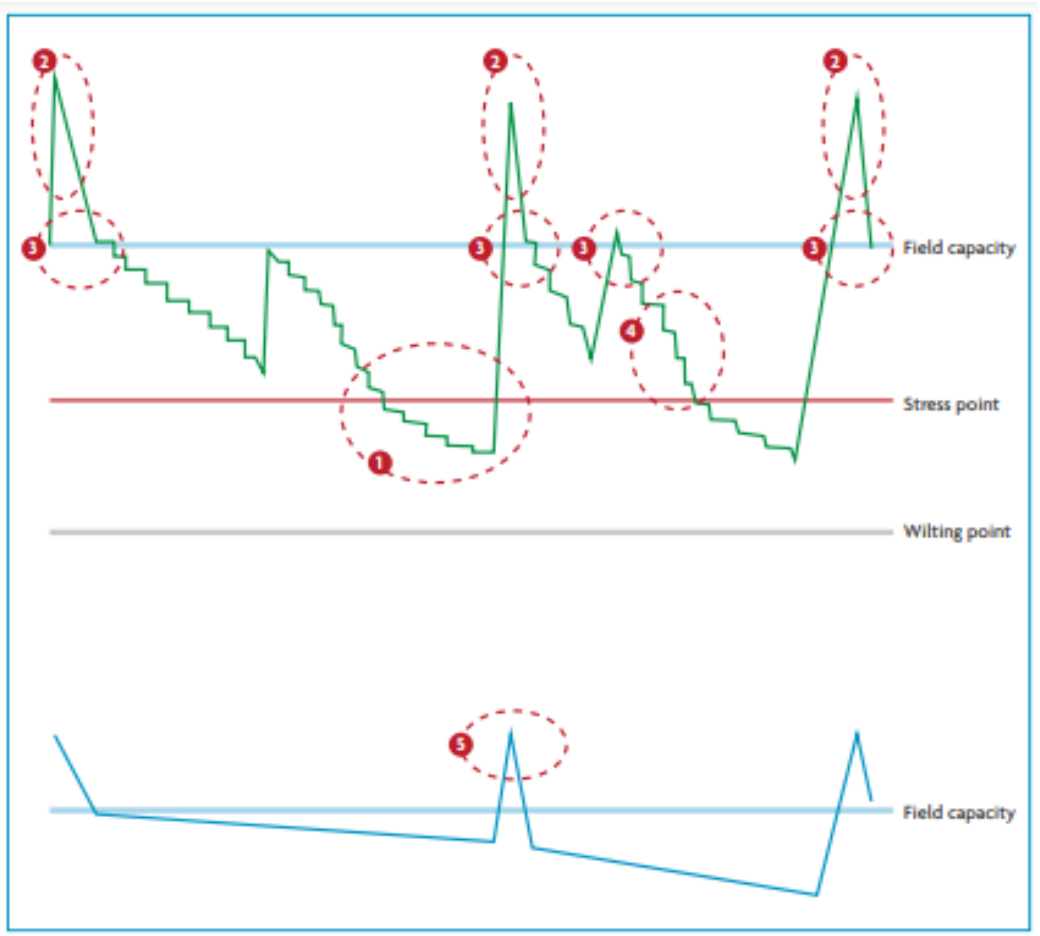
# Role of soil moisture monitoring

Root zone sensor




Below root zone sensor

Excess water leading to drainage events

Trees stressed and not using energy efficiently

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# Role of soil moisture monitoring

- Soil moisture monitoring to confirm assumptions
  - Field capacity about 24 hours after heavy rain
  - Stress point as irrigation trigger
    - -25 kPa sand, -30kPa loam, -40 to -50kPa clay
  - Two depths of sensors helpful to fine tune
    - 10-15cm sensor drying before 30 – 40cm
      - Increase frequency of irrigation (or increase mulch)
    - 30 – 40cm drying  before 10-15cm
      - Increase irrigation duration

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# Summary

- How much water your soil holds
- How much water is coming in
- How much water is going out
- Soil moisture monitoring to confirm assumptions

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# Question break – via poll function

- What does soil type influence when thinking about soil moisture?
  - A. How much water the soil can hold
  - B. How much water is easily available to the tree.
  - C. All of the above
- What is the equivalent of 1mm of rain?
  - A. 1L/10$m^2$
  - B. 10L/$m^2$
  - C. 1L/$m^2$
- Where should you locate a soil moisture probe?
  - A. A representative tree, half way between the trunk and the drip line on the South side of the tree.
  - B. A representative tree, close to the trunk on the North side of the tree.
  - C. A representative tree, half way between the trunk and the drip line on the North side of the tree.

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# Information relating to regional plan changes and regulation

Brad Siebert, CEO, NZ Avocado

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# Question break – via poll function

- Do you think you the new fresh water farm plans relate to your orchard?
  - A. Yes
  - B. No
  - C. Not sure
- Do you think Global GAP will fufill fresh water farm planning requirements?
  - A. Yes
  - B. No
  - C. Not sure

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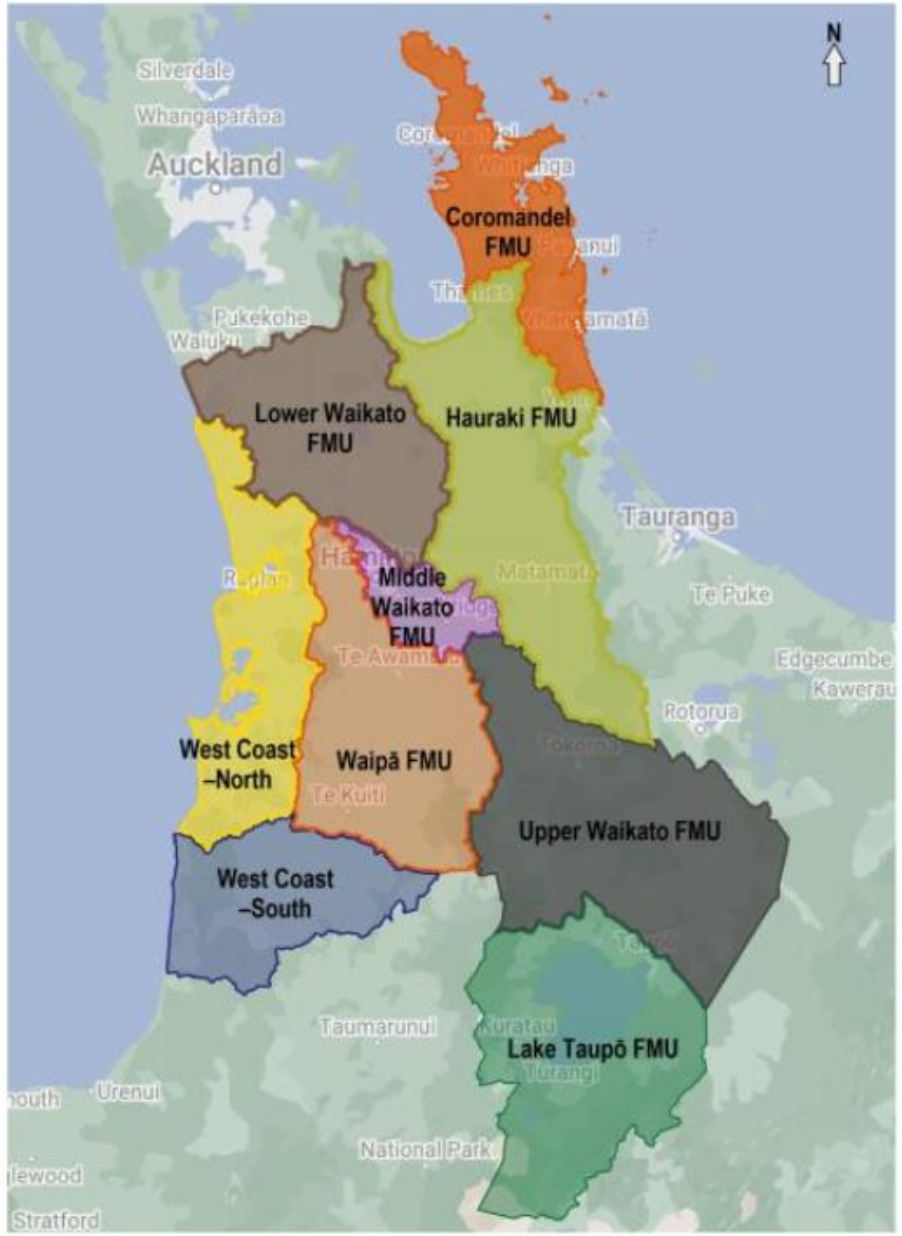
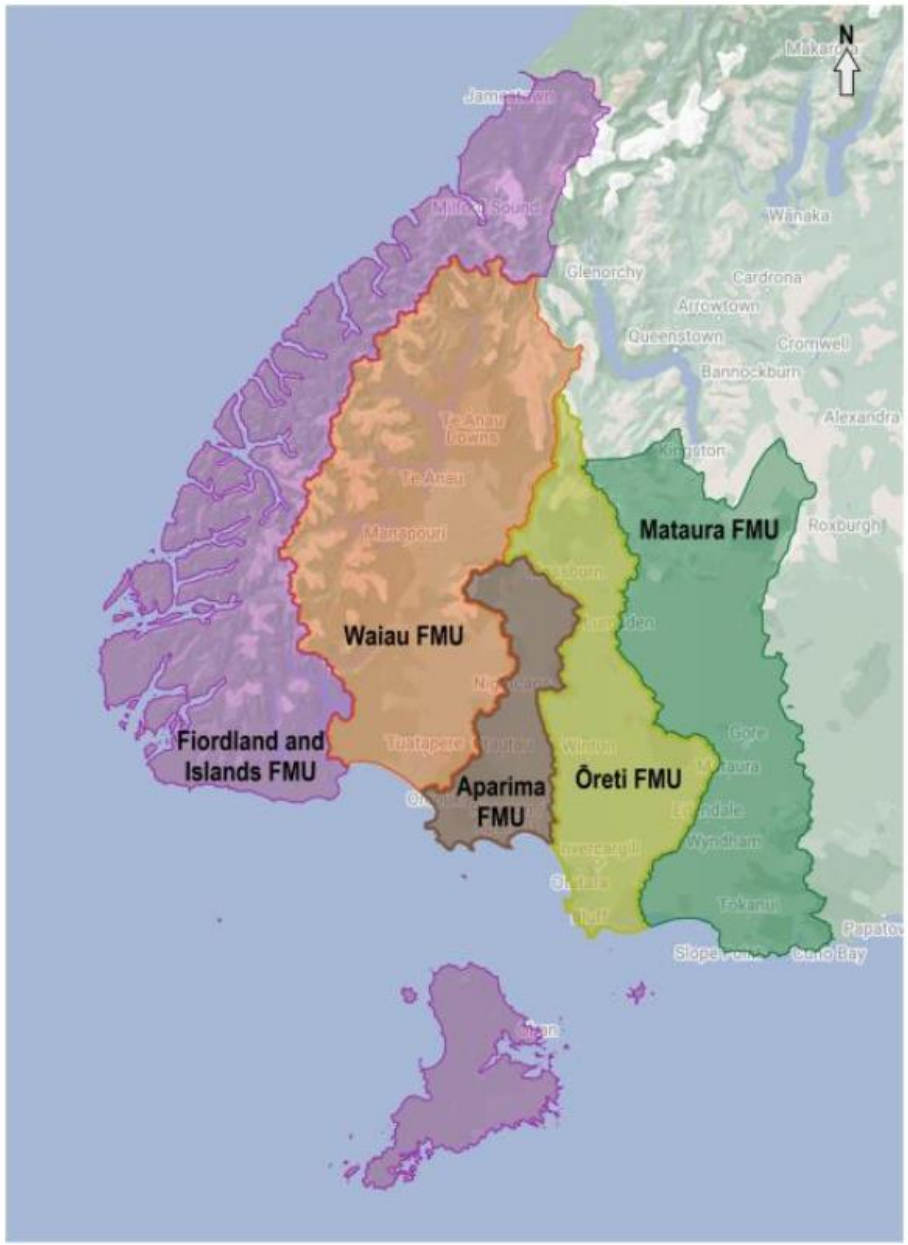
# Freshwater farm plans

- Freshwater farm plans will be phased in region by region, starting in parts of the Waikato and Southland on 1 August
- Growers will have 18 months to prepare their first plan after the regulations take effect in their region
- Over time farmers and growers will need a freshwater farm plan if they have 20 hectares or more in arable or pastoral use, five hectares or more in horticultural use, or 20 hectares or more in combined use
- The rollout period for the remaining regions will be outlined before the end of this year.
- The Government is investing $22.5 million from the Essential Freshwater fund to help farmers, growers and advisors develop the plans.
- Regional Councils are responsible for accrediting regional certifiers and auditors
- AsureQuality has been selected to be responsible for developing the certifier and auditor competencies and approval process for Freshwater Farm Plans
- The BoPRC has stated that at a governance level at least they expect that industry assurance programmes will be acceptable once modified to meet the FWFP requirements (and certifiers and auditors being approved) – yet this is quite a big job to get done in the next 2+ years.

## Waikato region




## Southland region



# Future compliance requirements

- An operator must submit a freshwater farm plan to a certifier within 18 months from the date an Order is made under the Act.
- An operator must undergo an audit for compliance with the plan not later than 12 months after the initial certification.
- Fresh Water Farm Plans must be re-certified every 5 years (or after any significant changes to land use or risks)
- ***Certifying and auditing***
- Fresh Water Farm Plan Certifiers and auditors must be appointed by the regional council for the region in which the farm is situated.
- A farm operator must choose a certifier and auditor appointed by the regional council for the region in which the farm is situated.
- The farm operator must engage and pay for the services of the certifier and auditor directly

# Fresh Water Farm Plans must:

- Hold the identifying and contact details of the farm operator(s), legal title and address
- Identify and describe the land unit and land use
- Identify any relevant resource consents
- Illustrate on a **map** the:
  - Farm and land unit boundaries and access ways
  - Natural and artificial freshwater bodies
  - Soil types
  - Typography
  - Critical Source Areas (i.e. gully's that accumulates runoff or could contribute to the delivery of contaminates to water ways)
  - Drainage systems
  - Irrigation and frost protection systems
  - Water-take bores or surface water abstraction points
  - Any cultural matters of importance to tangata whenua or the community
- Identify and assess any inherent vulnerabilities or risks from growing activities
- Set out an **action plan** with:
  - 5-year timeline of actions
  - The land area and risks the actions are intended to address
  - Actions categorised into a catchment or regulatory context
  - The existing and new actions to avoid, remedy, or mitigate any identified risks
  - A time frame within which each action must be implemented
  - An account of any further activities or actions required under regional or national regulations/legislation relating to the catchment
- Names, dates and declarations relating to certification and auditing

# BOP Regional Council

BOPRC are considering:

- Key changes is Nitrogen Caps for all land uses,
- Permeant sediment controls for horticulture, controls for cultivation and applying stock exclusion setbacks to horticulture.
- A possible reduction in the 5Ha threshold in high risk catchments

| **Maintain/small change**<br>*Region-wide rules* | **Moderate change**<br>*FMU (or part of FMU) specific rules where needed* | **Large change**<br>*FMU or (part of FMU) specific rules where needed* |
|---|---|---|
| Prescribe **additional regional Farm Plan requirements** – minimum performance standards for specific practices, risk reduction from current to at least good management practice, continual improvement. | Reduce regional size threshold for FWFPs (e.g., for high-risk land uses or catchments).<br>Add minimum standards, with consent required if not met.<br>Additional risk reduction requirements.<br>More frequent auditing. | |
| • **N fertiliser cap limit** for all land uses (to hold the line on high use).<br>• **Require accounting of N input** from other sources (e.g., feed and compost).<br>• **P fertiliser limit** relative to optimum Olsen P levels.<br>• **Stocking rate limits** (to "hold the line").<br>• **Purchased N surplus** limit | Reduce limits on **fertiliser**, **purchased N surplus**, and **stocking rates** - to reduce N contaminant loads as per catchment/FMU needs. | |

# Question break – via poll function

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# Questions

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