# IRRIPASTURE USER GUIDE

Australian Government
Department of Agriculture, Fisheries and Forestry

UNIVERSITY OF SOUTHERN QUEENSLAND

Dairy Australia

# ACKNOWLEDGEMENT

IrriPasture is brought to you by the Centre for Agricultural Engineering (USQ), Dairy Australia and has been developed by Rua Peak Tech.

This project is supported through funding from the Australian Government Department of Agriculture, Fisheries and Forestry as part of its Rural R&D for Profit program and Dairy Australia.



**Acknowledgement**

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# INTRODUCTION TO IRRIPASTURE, A FREE IRRIGATION SCHEDULING TOOL

IrriPasture is an online, smartphone accessible, water budget and irrigation scheduling tool especially developed for the irrigated dairy systems of Australia. The tool is FREE to access and use.

IrriPasture uses predetermined soil characteristic and pasture/crop data, together with daily weather data from the Bureau of Meteorology (BOM) and appropriate local weather stations (where available) to determine a water balance for your selected irrigated site/s. The graphs, tables and figures of IrriPasture are presented in an easy-to-read dashboard to assist in irrigation scheduling decisions. Using IrriPasture in conjunction with soil moisture monitoring (SMM) and field observations can increase precision application of irrigation at the right time and right rate for optimal pasture and crop growth.

IrriPasture was first prototyped through the Smarter Irrigation for Profit Phase 1 project, and further developed in the Smarter Irrigation for Profit Phase 2 project (SIP2). The SIP2 project was a cross-industry initiative that aims to improve the profit of irrigation farmers in the sugar, cotton, grains, dairy, and rice industries.

The Smarter Irrigation for Profit 2 project was supported by funding from the Australian Government Department of Agriculture Fisheries and Forestry as part of its Rural R&D for Profit program, and Dairy Australia.

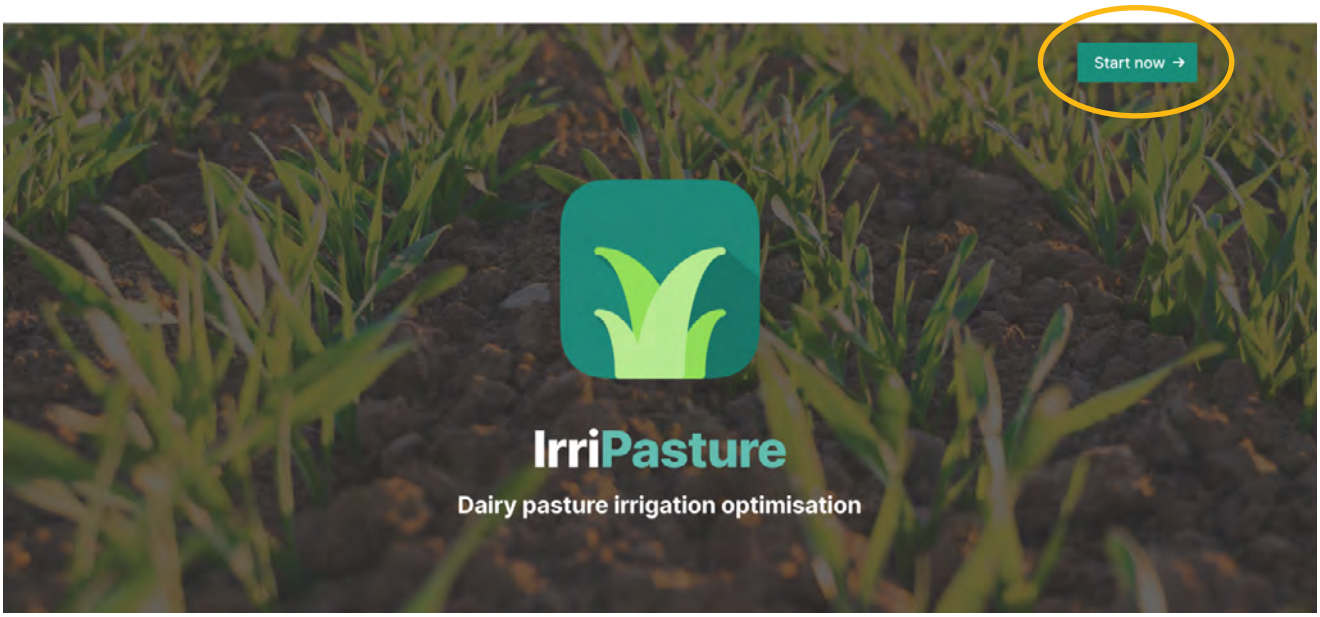
# GLOSSARY

| | |
|---|---|
| RAW | Readily Available water |
| BOM | Bureau of Meteorology |
| SIP2 | Smarter Irrigation for Profit 2 |
| FAQ | Frequently asked questions |
| mm | Millimeters |
| ET | Evapotranspiration |
| SMM | Soil Moisture Monitoring |

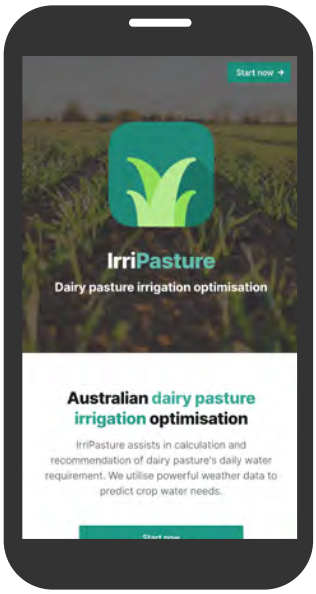
# ACCESSING AND SIGNING UP TO IRRIPASTURE

Visit **irripasture.com** or scan the QR code below to get started.

Click on ***START NOW*** to create a new login.




**Note:** If you are using a smartphone, the following instructions will remain the same, however what you see may look slightly different than the screenshots included in this guide.



# CREATING AN IRRIPASTURE LOGIN

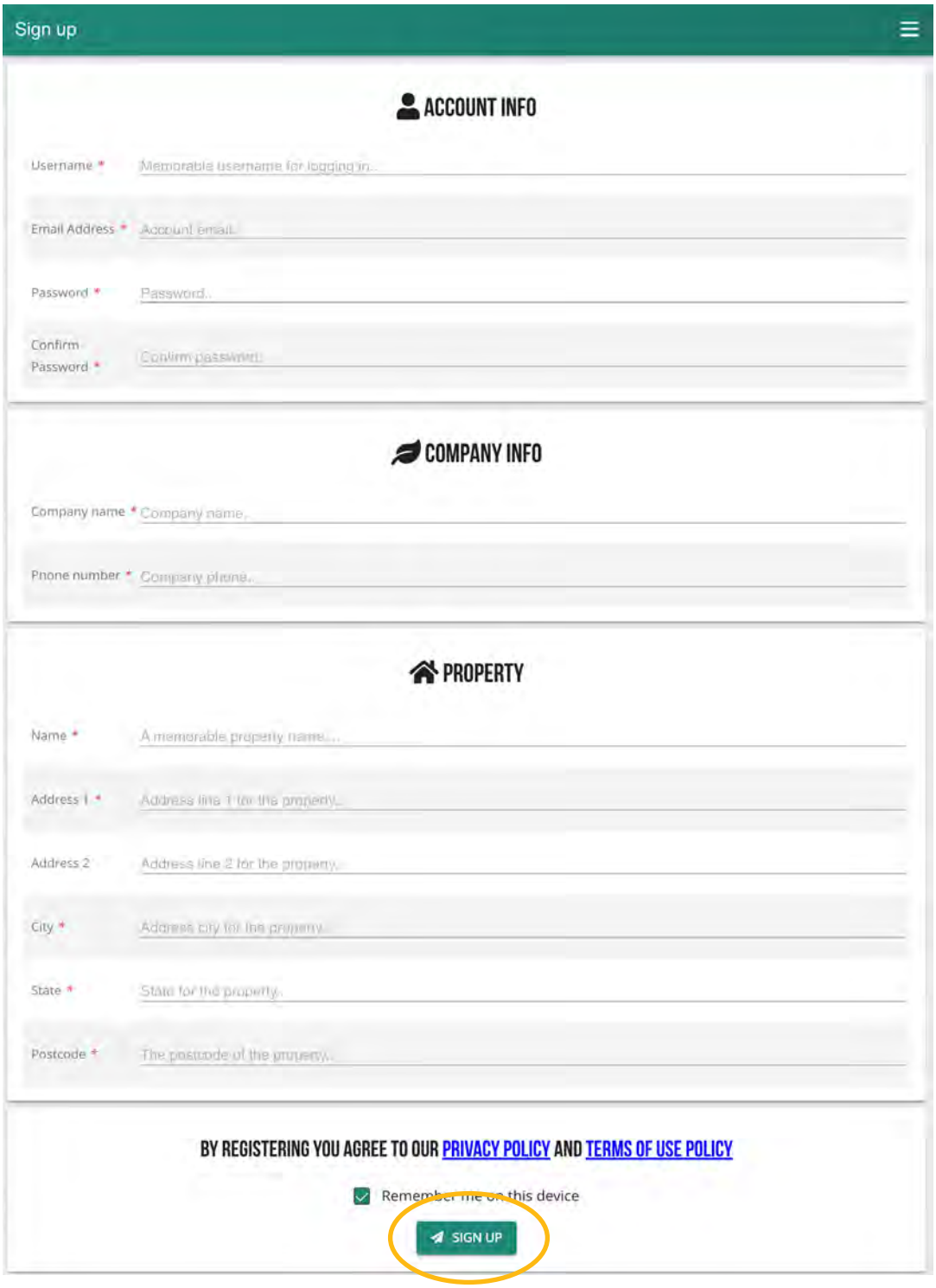
A sign-up screen will be displayed to enter your new login details and property information.

Fill in the required details to create your IrriPasture account.

Click on the ***SIGN UP*** button at the bottom of the page.

**Tip 1:** The username will need to be all one word to be accepted.

**Tip 2:** The password will need to be at least six characters long and consist of both letters (a-z) and numbers (0-9).

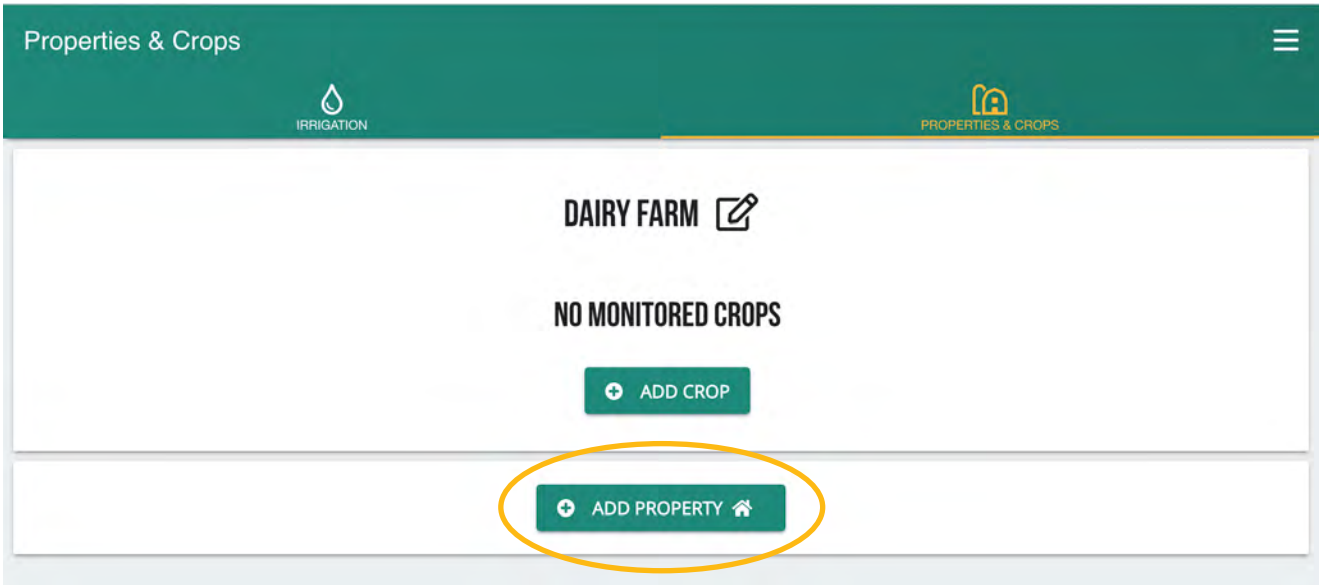


# ADDING AN ADDITIONAL PROPERTY

To add another property after you have already set up a property and crop you need to go to the ***PROPERTIES & CROPS*** option on the irrigation dashboard and scroll down to the bottom to find the ***ADD PROPERTY***.

Click on the ***ADD PROPERTY*** button.

Fill in the required details for your desired property, then click ***SAVE***.

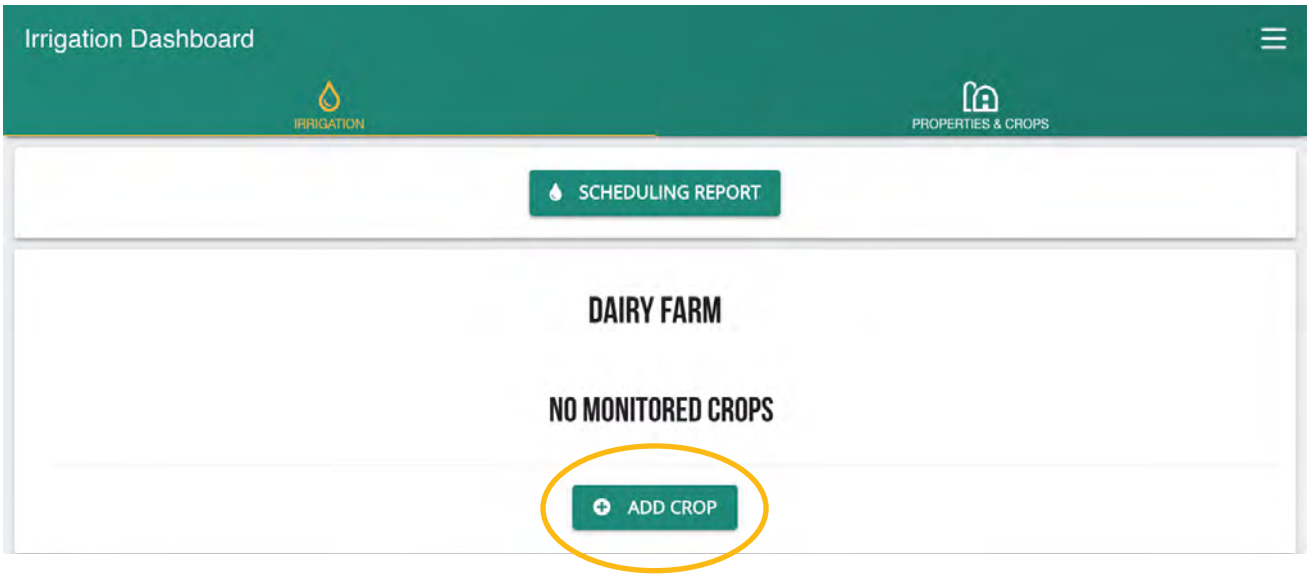


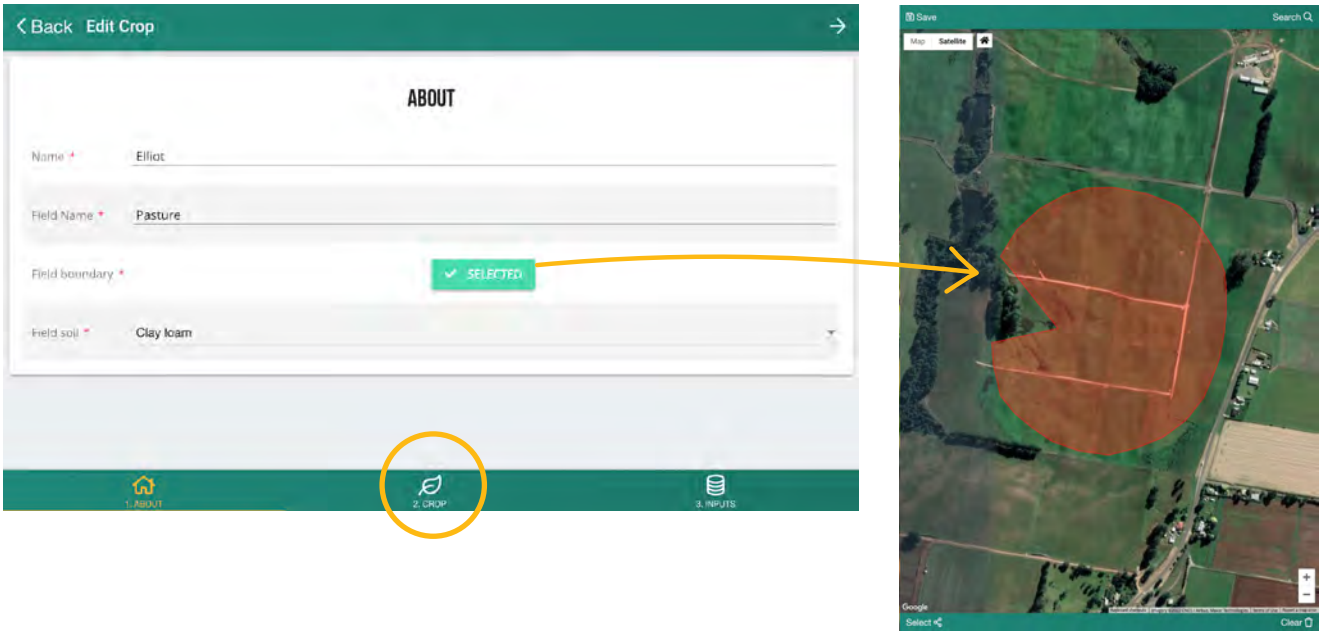
# ADDING CROPS

IrriPasture allows you to set-up different management areas across your property using the ***+ ADD CROP*** button. These management areas may be based on the different irrigation types, pasture or crop type and/or soil types.

Different irrigation systems apply water at different rates and will typically need to be monitored separately. Different management areas should be set-up as separate 'crops'.

To start defining your separate irrigation management areas – click ***+ ADD CROP***.

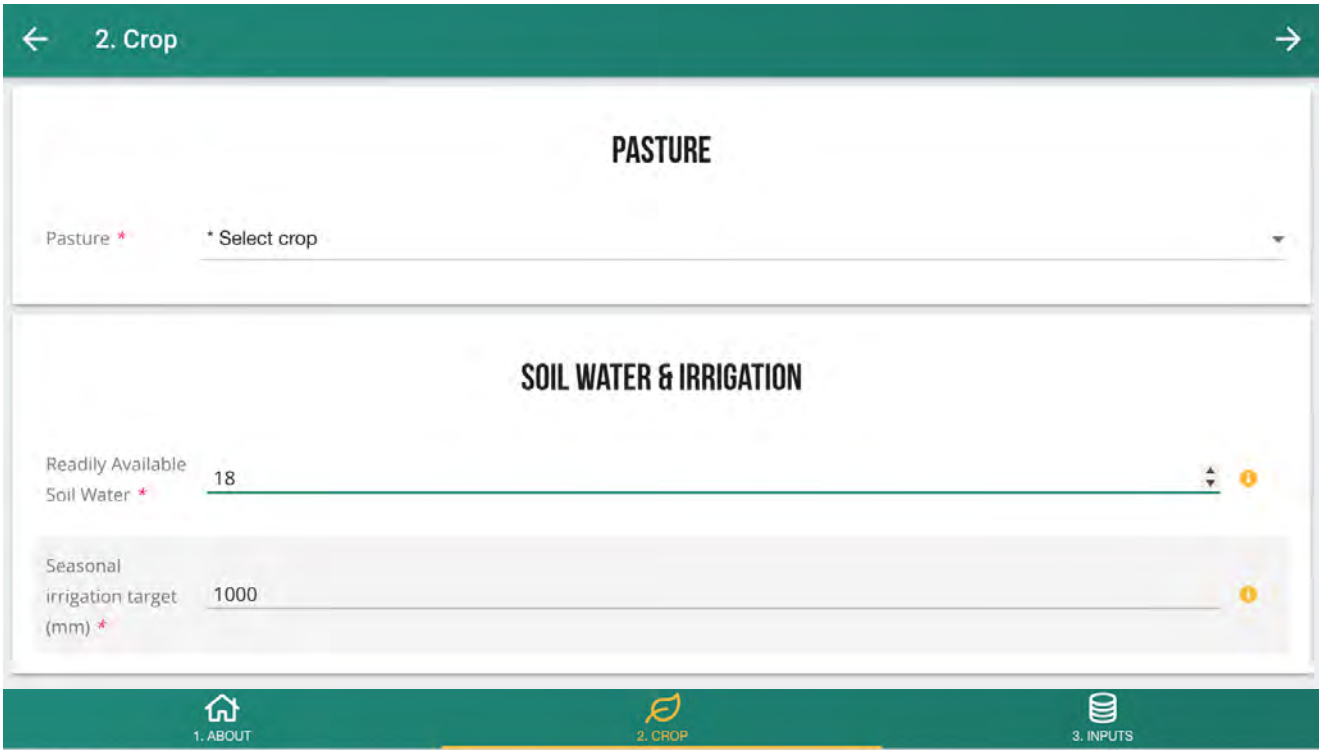





The screen above will appear. Complete it using the following information.

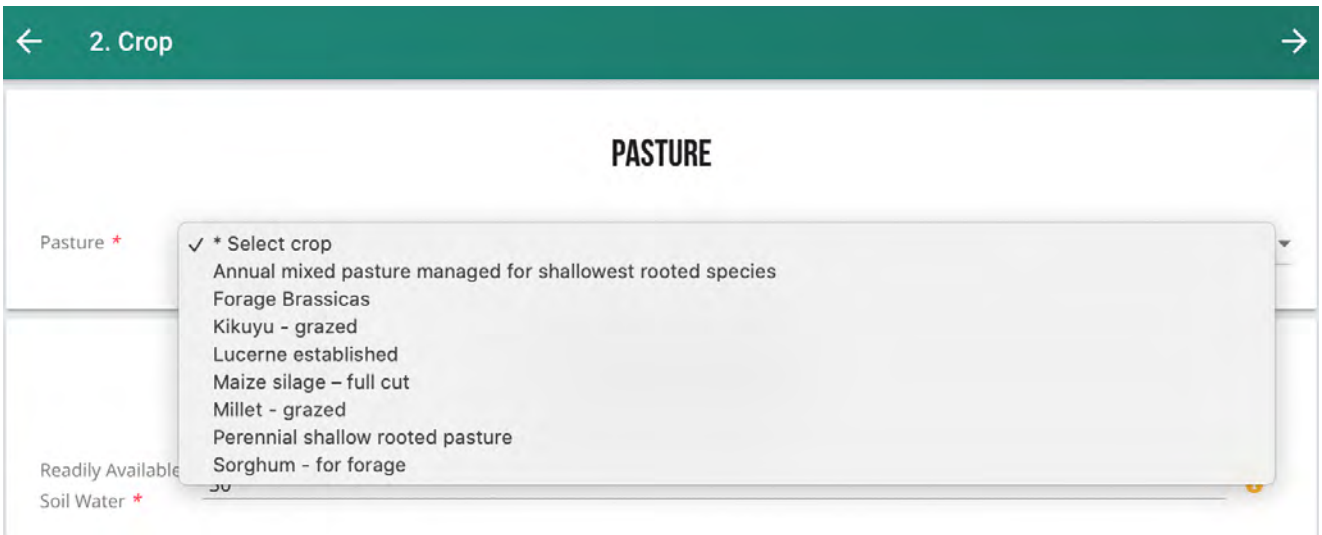
- ***NAME*** - Name the irrigation management area that will best communicate the location of the site.
- ***FIELD NAME*** - name of the specific paddock or pasture/ crop of the irrigation management area for which you are establishing the water balance.
- Draw an irrigation management area in ***FIELD BOUNDARY*** by clicking on ***SELECT*** (bottom left of screen) and then on each corner of the management area until you return to the first point and click to complete. If you make an error click ***CLEAR*** (bottom right of screen) to undo and start again.
- Select a soil type from the ***FIELD SOIL*** drop-down menu
  - If you don't know what your soil type is, check a soil test report, or ask your agronomist. You can also do a simple field test to estimate soil type. Click **here** to find out how to do this or head to the FAQ section if you are reading offline.

When this is complete, click on the **2. CROP** (leaf icon) at the bottom of the page to continue on to the following page.



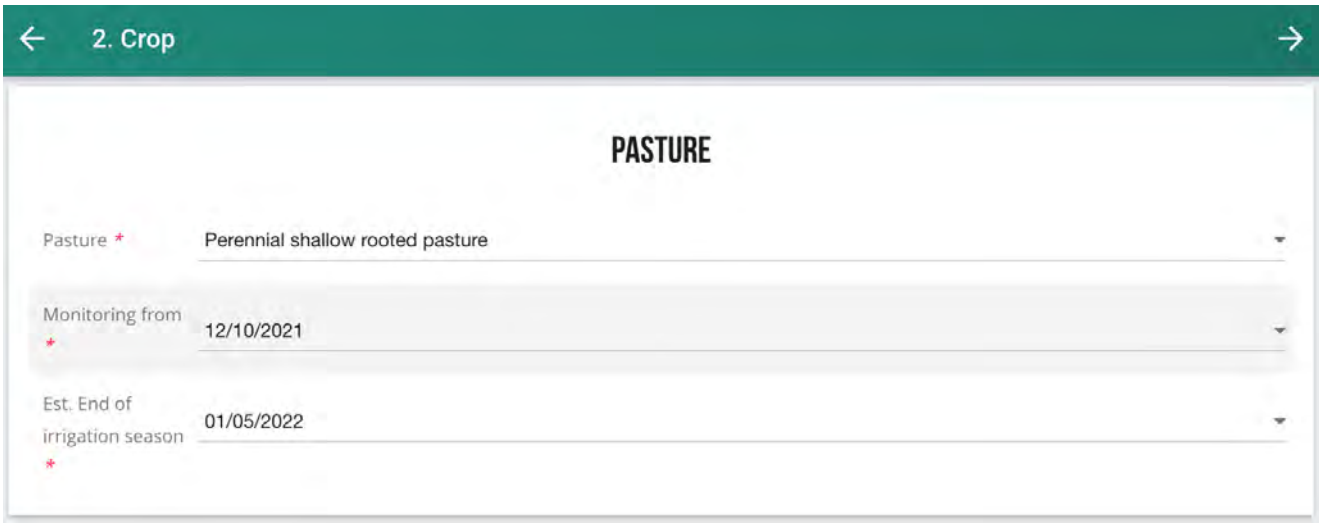

To complete this screen:

- Select a crop/pasture type from the ***PASTURE/ * SELECT CROP*** drop-down menu. You need to make an agronomic decision if this management area is a mixed pasture. Decide whether you will irrigate according to the most dominant pasture or the shallowest rooting depth pasture type.

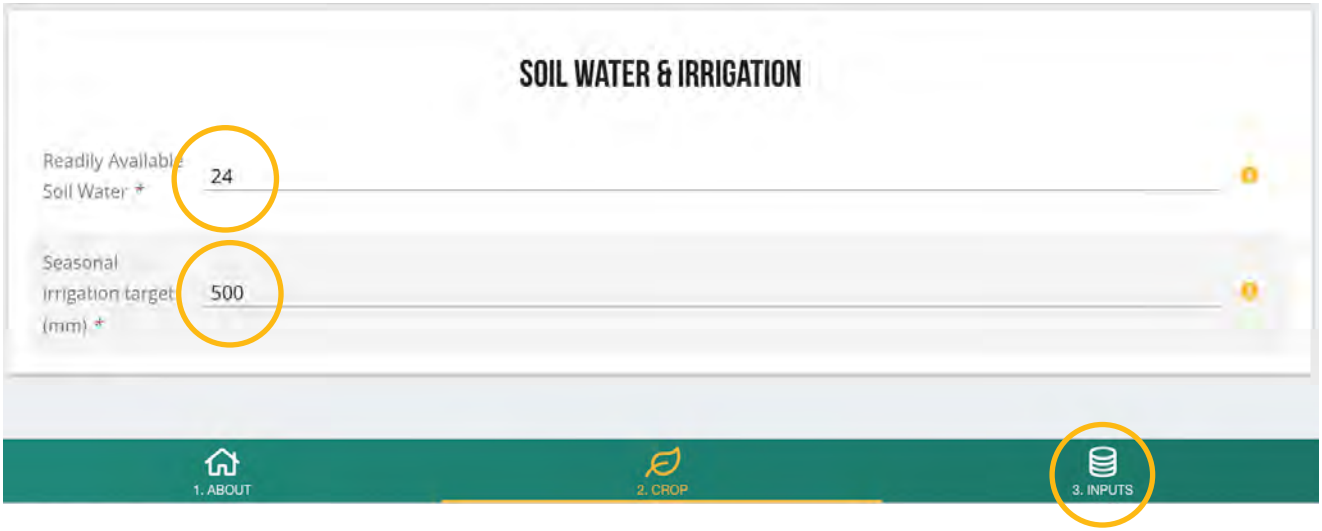



- Once pasture/crop type has been selected - enter the planting date and expected days to full crop cover (if required). If the crop is established or a perennial, then set days to full crop cover at 1 day.

For a perennial shallow rooted pasture you are able to select an irrigation start and end date.




**Tip:** It is a good idea to start monitoring crops from when you believe the soil was last at field capacity or from when the last significant rainfall was.




Enter your readily available water (RAW) value. To find out how to determine your RAW visit **dairyaustralia.com.au/DeterminingRAW**

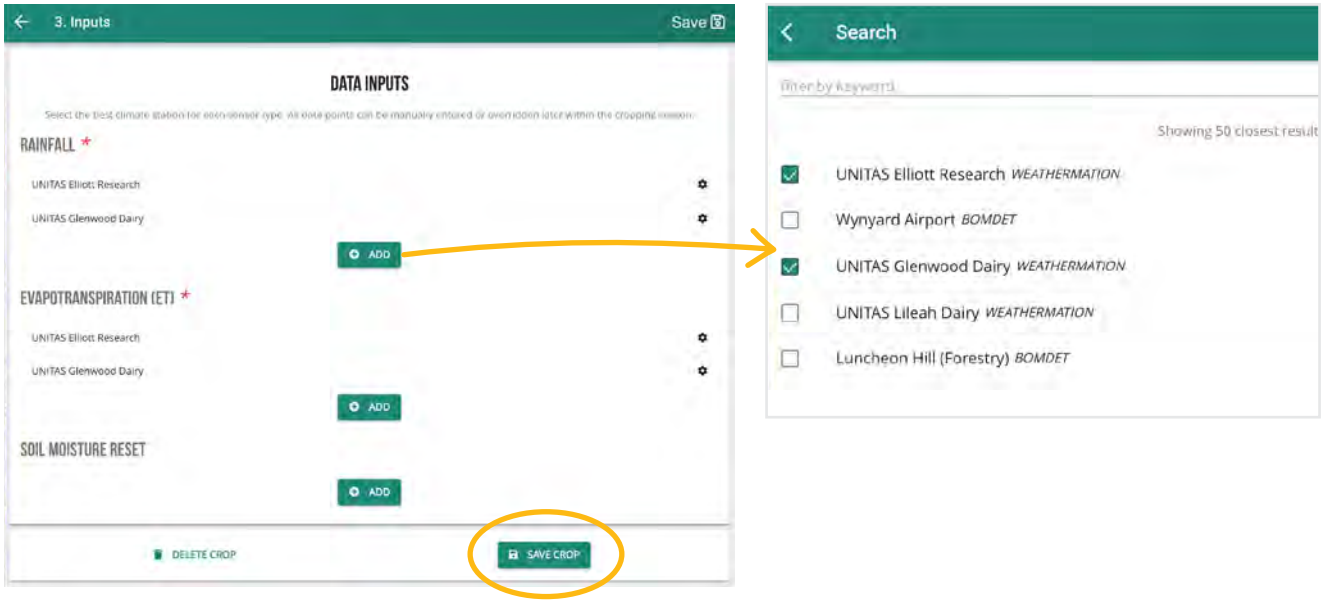
Enter your seasonal irrigation target in mm.
(**Note:** 1 ML = 100 mm on 1 ha)

**Tip:** The seasonal target is your estimate of the amount of irrigation you might apply to the crop. It is usually dependent on the rainfall and evapotranspiration for your area. Targets should be set if there is a limit to water access. Sometimes farmers will set this as the water allocation that they have per hectare (i.e. 5ML/ha you would use 500mm).

**IMPORTANT**

Different soil types and the crop/pasture rooting depth affect the size of the Readily Available Water (RAW) 'bucket', which is what IrriPasture uses to determine when irrigation will be required. Without an accurate RAW value IrriPasture will be highly inaccurate in its soil moisture reporting. For more information on how to determine RAW head to the FAQ section of this guide.

Once all ***2. CROP*** details are entered click ***3. INPUTS*** to continue on to the following page.




Click on the ***+ ADD*** button next to ***RAINFALL*** and ***EVAPOTRANSPIRATION*** (ETo) to select the nearest or most appropriate weather station for your farm - as in the screenshot above, the nearest weather station is UNITAS Elliott Research which is 11.4 km from the field boundary selected earlier.

Your local knowledge may determine that the nearest weather station is not necessarily the most appropriate because rainfall and ETo may be affected by topography, or the weather station is located at a highly exposed airport.

It is always a good idea to add backup weather stations, in case of any technical issues with your selected first-choice weather station. These will then show up below your first weather station selection on the data input page. You can change the order the weather stations are called on for data, by clicking either ***PROMOTE*** or ***DEMOTE*** on the configuration icon showing on the right as a 'cog' or 'gear'.

***SOIL MOISTURE RESET*** is optional and would typically be left as it is (no need to select this). An explanation of the soil moisture reset function is included in the **FAQ** section of this guide.

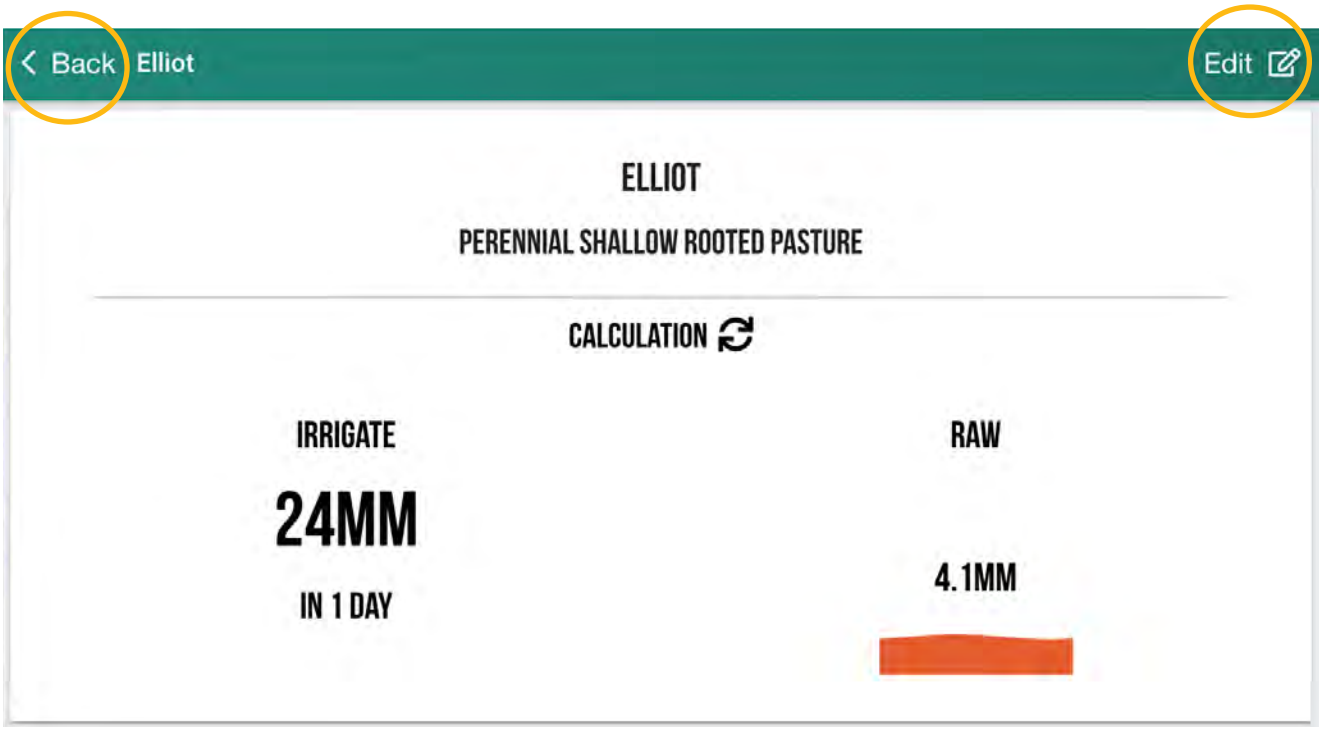
When the weather stations have been selected – click on ***SAVE CROP***

**IMPORTANT**

Always select more than one weather station. The closest will be top of the list, increasing in proximity as you go down the list. If possible, avoid using weather stations that are located at airports as they do not provide representative evapotranspiration data for pastures and crops which will result in incorrect calculation and reporting.

# ADDING MORE CROPS

When all the information has been entered and saved, IrriPasture will save the 'Crop' (irrigation management area) and the following Crop Dashboard will be established:



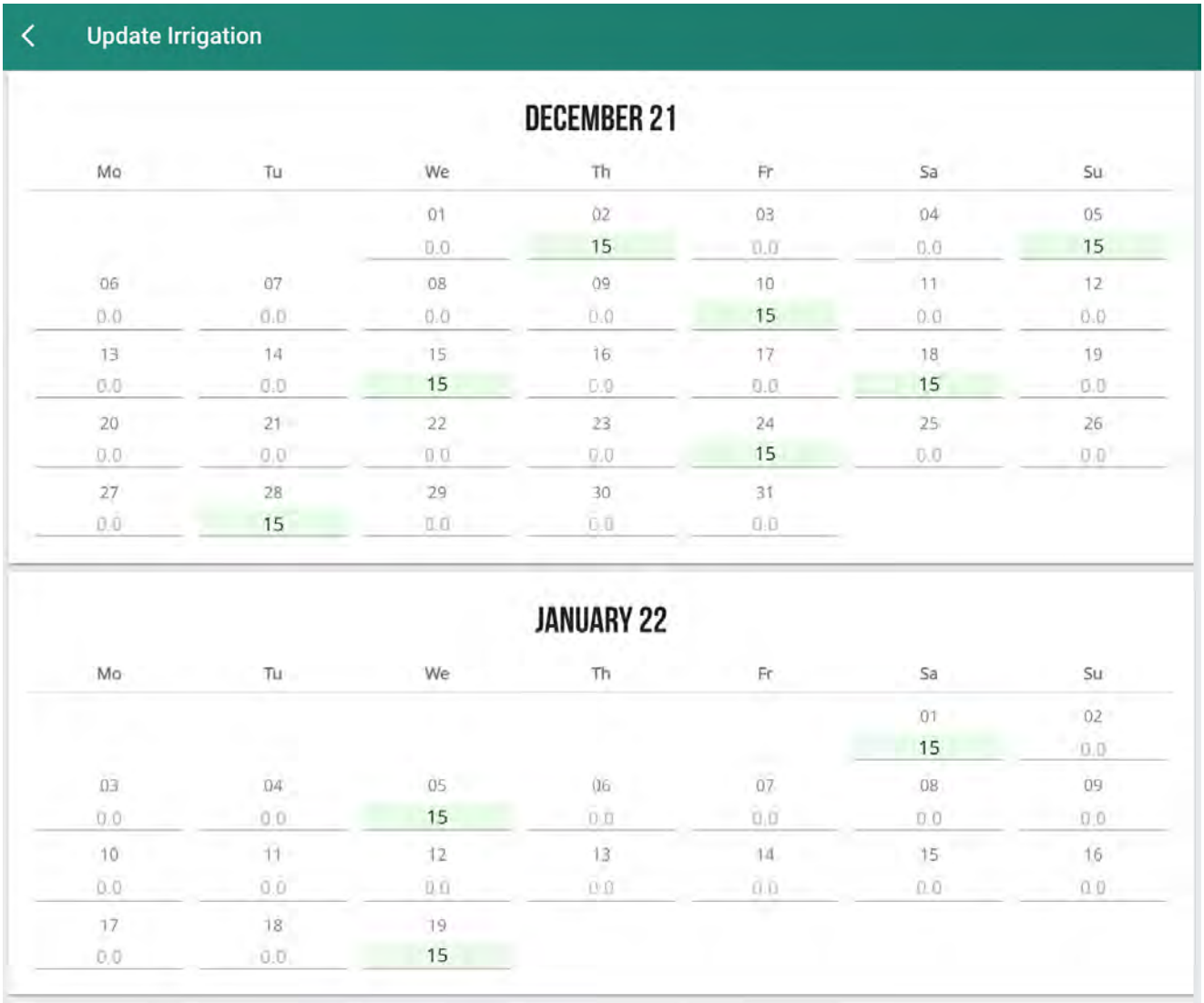

To enter the next 'Crop' (irrigation management area), click on the ***< BACK*** button and you will return to your property dashboard. Select ***+ ADD CROP*** and enter details for another 'Crop' (in a similar way to how you have just done it – but for a different irrigation management area).

You can make changes to your 'Crop' at any time by selecting the ***EDIT*** icon shown in the top right corner of this page.

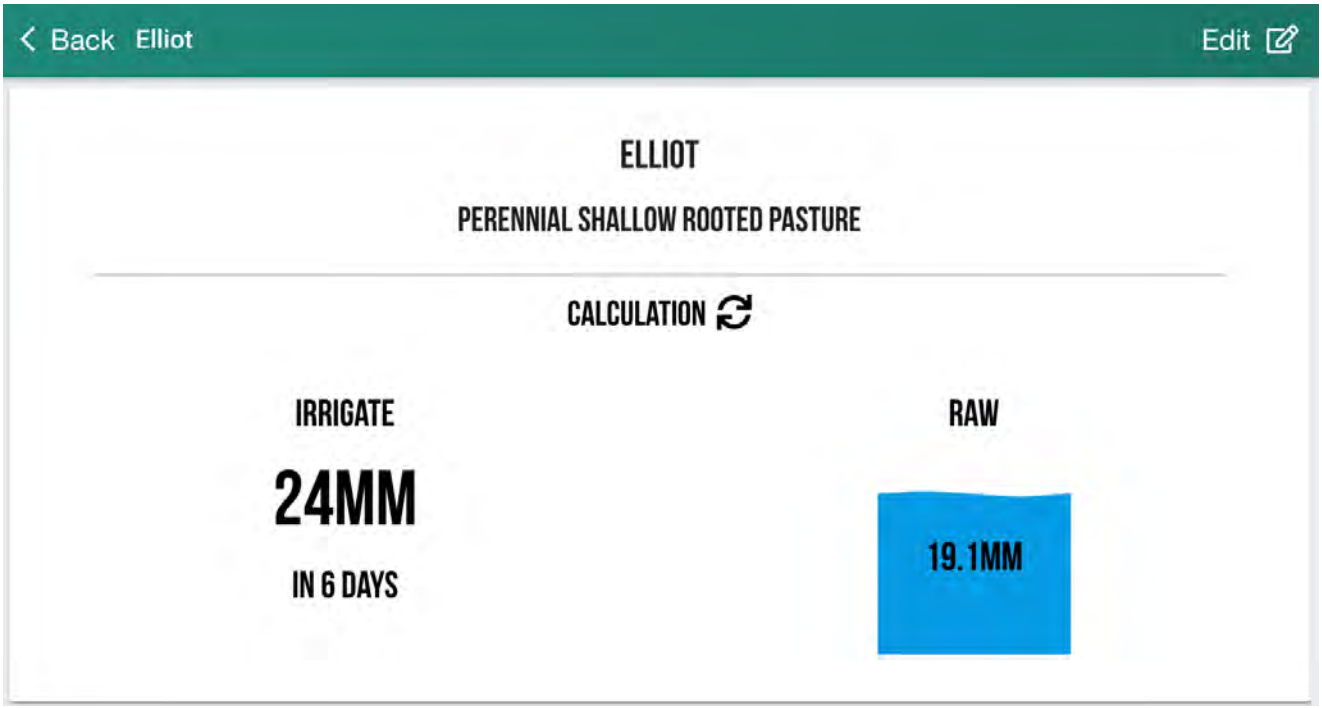
# UPDATING RAINFALL AND ADDING IRRIGATION

Rainfall data is collected from the previously selected weather station, but if rainfall is significantly different at your farm, then you should manually enter rainfall depths on these days using the ***UPDATE RAINFALL*** button and following the same steps as updating irrigation mentioned below.

Any irrigation you undertake in the irrigation management area ('Crop') will need to be manually entered using the ***UPDATE IRRIGATION*** button.




Update irrigation applications in mm (in this case it was 15 mm) on the days when it was applied, and then click on ***< UPDATE IRRIGATION*** when you've finished to go back to summary page for that 'Crop'. IrriPasture will highlight any value that has been changed in green, so you know what values you have updated.

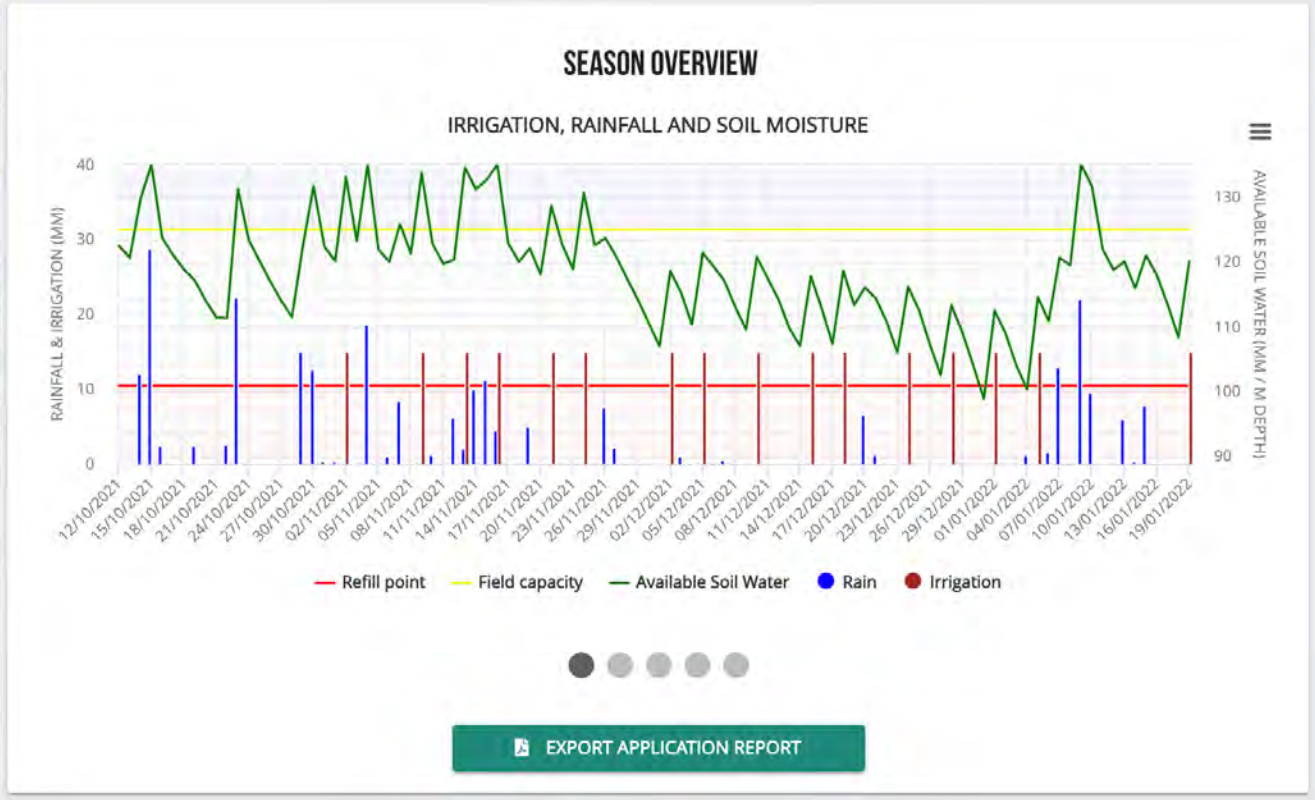



With the irrigation applications entered as updates, IrriPasture now shows that there is 19.1 mm of RAW left available to this crop in this soil. If no water enters the soil profile through either rainfall or irrigation the refill point will be reached in 6 days and 24 mm of water will need to be applied through irrigation or rainfall to return the soil to field capacity.

**IMPORTANT**

IrriPasture can only function properly and report accurately if the irrigated amount is added after each irrigation. Regularly check the rainfall data is accurate and update your irrigations as you apply - you can simply use your smartphone in the paddock to do this.

Keep scrolling down below the dashboard and **PASTURE MANAGEMENT** section to find the season overview graphs with the soil moisture (green line) displayed with rainfall (blue bars) and irrigations (maroon bars) beneath it.




## Grazing/cutting function

An option has been provided to enter dates that grazing or silage cutting has occurred. This function is only useful if the area being grazed/cut corresponds with the total area being monitored. For the dates selected, the Kc value used to calculate ETc is lower to account for reduced ET due to less leaf area.

## Stop monitoring function

The 'stop monitoring' function can be used to archive a paddock when it is no longer being monitored. To stop monitoring, click on the orange ***STOP MONITORING*** and select the end date from the drop-down calendar and click ***SAVE***. This will provide you with a season overview screen. In the top left corner, you can click the back arrow to take you back to the Irrigation Dashboard. You will notice that this crop/site is no longer listed. If you click on the ***PROPERTIES AND CROPS*** option in the top right of the screen you will notice that this crop is still listed here and selecting this crop will take you to the season overview chart for this crop.

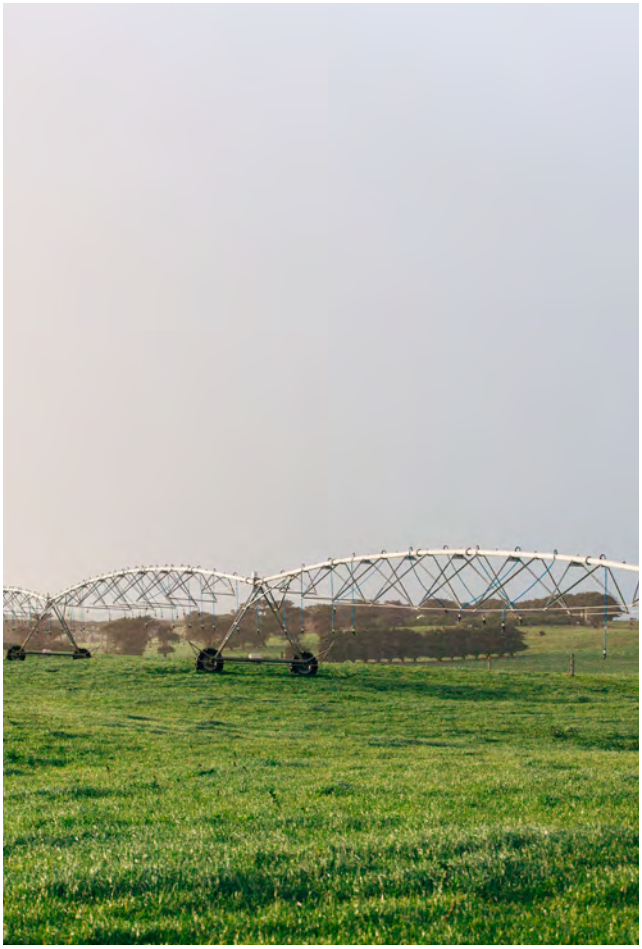
If after archiving the crop you decide you want it to be active again, the following process will return the crop to the Irrigation dashboard

Click on ***EDIT*** in the top right-hand corner.
Click on ***2. CROP*** at the bottom centre of the screen.
Click on the down arrow for monitoring end. Click on ***CLEAR*** at the bottom centre of the calendar.
Click on ***3. INPUTS*** in the bottom left-hand corner of the screen.
Click on ***SAVE CROP***.

This will bring you back to the active season overview screen for this crop and if you click the back arrow in the top left-hand corner and then click ***IRRIGATION*** with the water droplet in the top left you will see that this crop is listed again as an active crop on the irrigation

### Soil moisture reset function

If IrriPasture says that irrigation is required but the soil appears to be at or above field capacity, the soil moisture reset function should be used. For a full explanation of the underlying reason why this is the case please refer to the FAQ section (when and why should I use the soil moisture reset function). To use the soil moisture reset option, scroll down below the SEASON OVERVIEW water budget graph to the SOIL MOISTURE RESETS section and click on the RESET EVENTS button. Click the ADD RESET button and select the date in the dropdown calendar that relates to the date you identified the soil as being at or above field capacity. Click the SAVE button and then click on the Soil Moisture Resets arrow in the top left hand corner of the screen. This will reset the RAW to field capacity on that day.  If you want to cancel this change and remove the RESET you need to return to the soil moisture resets section and click on the On/Off toggle in the top righthand corner for the reset event you want to cancel.



# SEASON OVERVIEW GRAPHS

Optimal irrigation can be achieved by maintaining the green (available soil water) line within the optimal zone on the graph - between the yellow field capacity or (full-point) and red (refill) lines. This zone has been determined by the soil type and RAW information you added when establishing the 'management area'. If rainfall is forecast, you may decide not to irrigate, which will mean the green line will trend more closely to the red line, allowing more capacity in the RAW bucket for rainfall capture. If a dry-spell is forecast in coming days, you will most likely want to irrigate to refill the RAW bucket.

To edit what is shown on the graph, you can click on the labels at the bottom of the graph above the five grey dots to turn elements on and off. To focus in on certain areas on the graph you can **'pinch and expand'** on your smartphone or tablet and **'click and drag'** on your computer. When you have finished looking at a specific time simply hit **'reset zoom'** to return to the original view.

In addition to the SEASON OVERVIEW graph that shows **Irrigation, Rainfall and Available Soil Moisture**, there are four other graphs that can be viewed by clicking the grey shaded circles below this SEASON OVERVIEW graph.

These are:

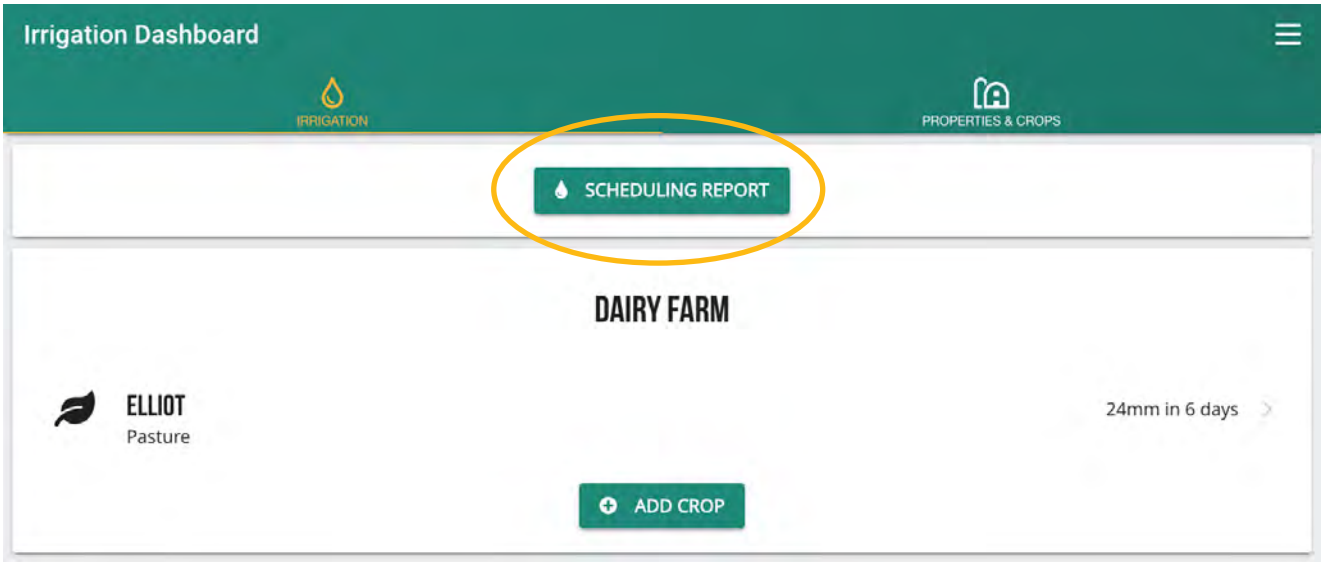
- **Daily crop water requirement**
  This graph assists you to understand the water demands of the crop or pasture you are growing based upon the daily conditions.
- **Cumulative crop ET, rainfall, and irrigation**
  This graph assists you to see how well your irrigation management is supplementing the gap between crop demand and rainfall over the period.
- **Rain, Irrigation and Total adjusted amount**
  This graph assists you to determine how efficiently you are using irrigation to supplement rainfall.
- **Crop factor coefficient graph**
  This graph shows how the crop/pasture demands change over a season.

You can also download and print these graphs by clicking the three horizontal lines in the top right corner of the graph.

**Additional:** Enter your different irrigation management areas as 'Crops' and each zone or 'Crop' will be displayed like the examples above.

# PRODUCING A SCHEDULING REPORT

To produce an irrigation scheduling report, you will need to navigate back to the ***IRRIGATION DASHBOARD*** by clicking on the top left ***< Back*** button. Above the pasture/ crop that you added will be the ***SCHEDULING REPORT*** button. By clicking this, a scheduling report will be produced for all of the crops (management areas) in the list.




IRRIPASTURE

USQ Dairy Australia

Scheduling Report 20 January 2022

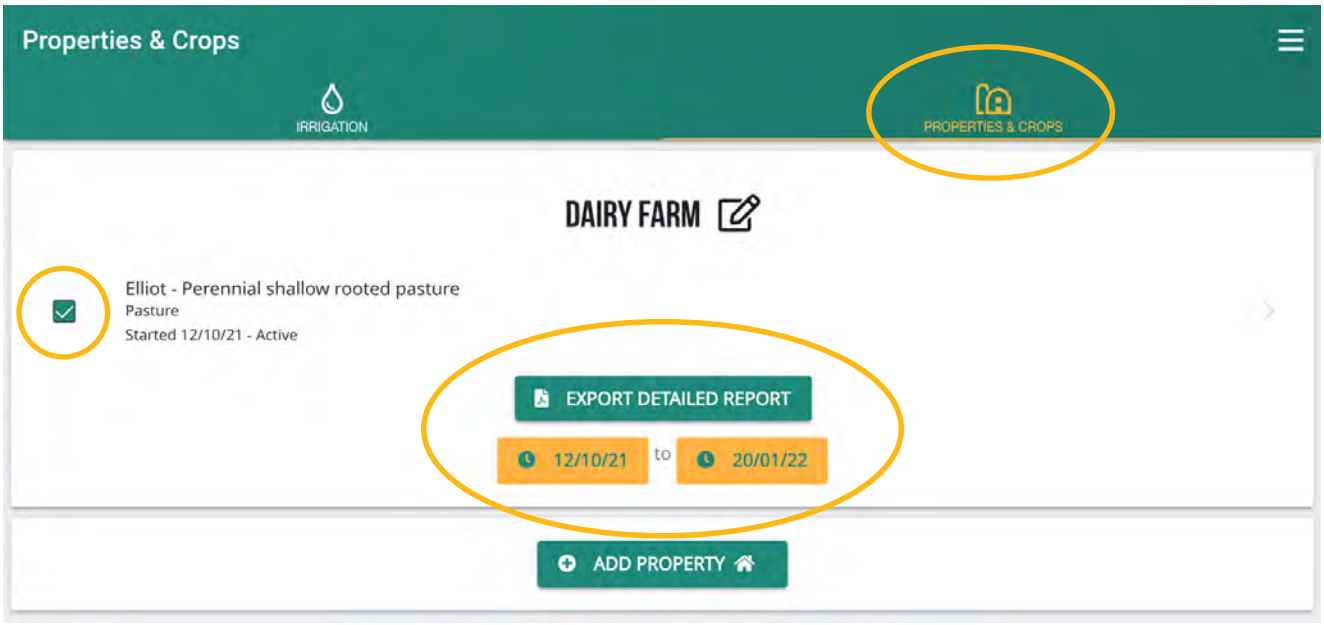
This report provides a summary of irrigation due information across all properties.

| Property | Name | Field | Crop | Last Irrigation | Readily Available Water (RAW) | Days to next irrigation | Amount to apply |
|---|---|---|---|---|---|---|---|
| Dairy Farm | Elliot | Pasture | Perennial shallow rooted pasture | 19/01/2022 | 19mm | 6 (~26/01/2022) | 24mm |

The above table is the report output detailing the amount of irrigation water needing to be applied to get the soil moisture back to field capacity.

# PRODUCING A DETAILED REPORT

Detailed reports can also be produced by navigating to the properties and crops page from the IRRIGATION DASHBOARD. An extended report can be produced for a specific period. You may use this if you want to learn more about the volume of irrigation and rainfall needed to grow a certain crop/pasture or determine the water use efficiency of growing your crop/pasture over a season. When in properties and crops the following page will be displayed:




To produce a report, you will need to:

- tick the box of the crop you would like to produce a report for
- define a period of time that you want to look at by selecting a ***START*** and ***END*** date
- click ***EXPORT DETAILED REPORT.***

The detailed report includes (See example below):

- a yield and irrigation summary
- irrigation, rainfall, and soil moisture graph
- daily crop water requirement
- cumulative crop ET, rainfall, and irrigation
- crop factor coefficient graph.

IRRIPASTURE

USQ Dairy Australia

Dairy Farm | Detailed Report | 20 January 2022

This report provides a summary of data inputs and results for selected crops in Dairy Farm (Test Road, 7325).

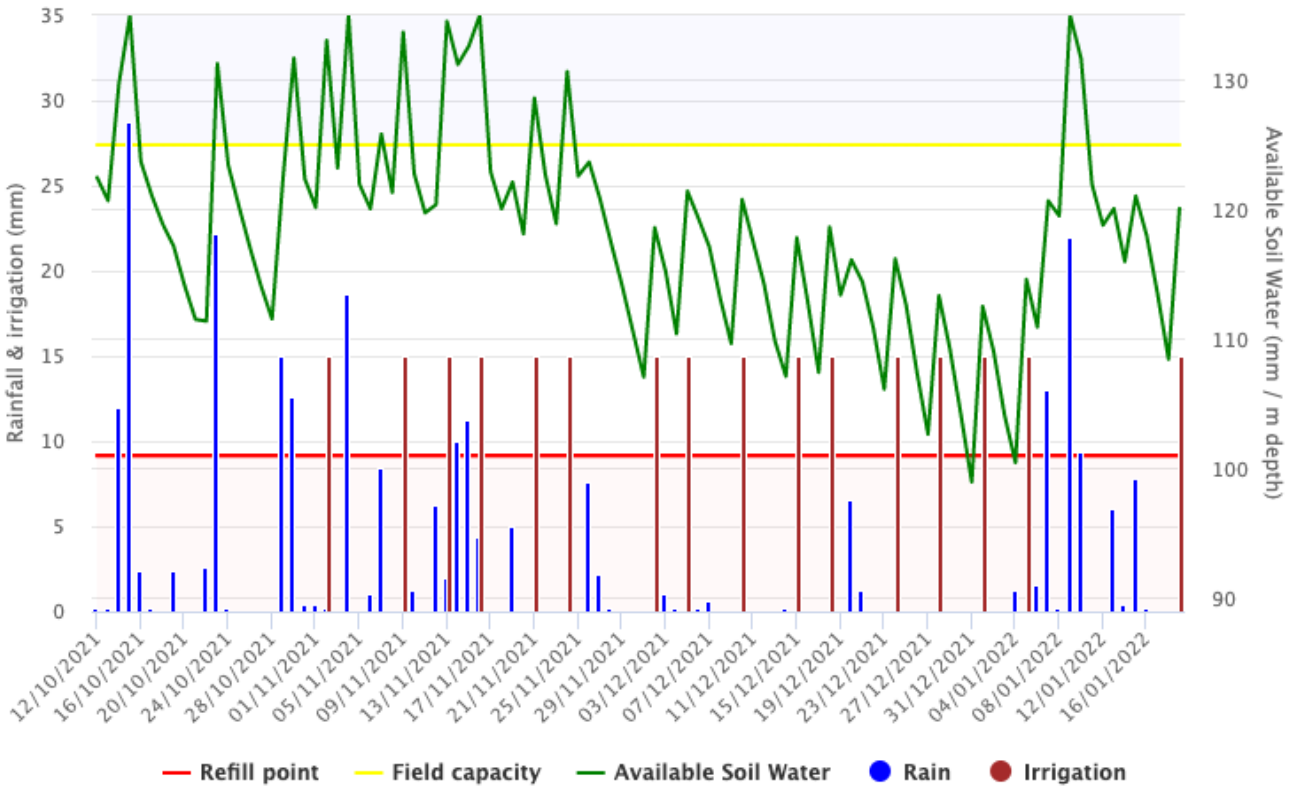
**Yield and Irrigation Summary (12/10/2021 to 20/01/2022)**

| Field | Crop | Soil | Field Capacity (mm) | Readily Available Water (mm) | Available Soil Water (mm) | Refill Point | Start Date | End Date | Total In-season Rain (mm) | Effective Rain (mm) | Total Irrigation Applied (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pasture | Perennial shallow rooted pasture | Clay loam | 125 | 19 | 120 | 101 | 12/10/2021 | 02/05/2022 (est) | 251 | 190 | 240 |

**Notes**

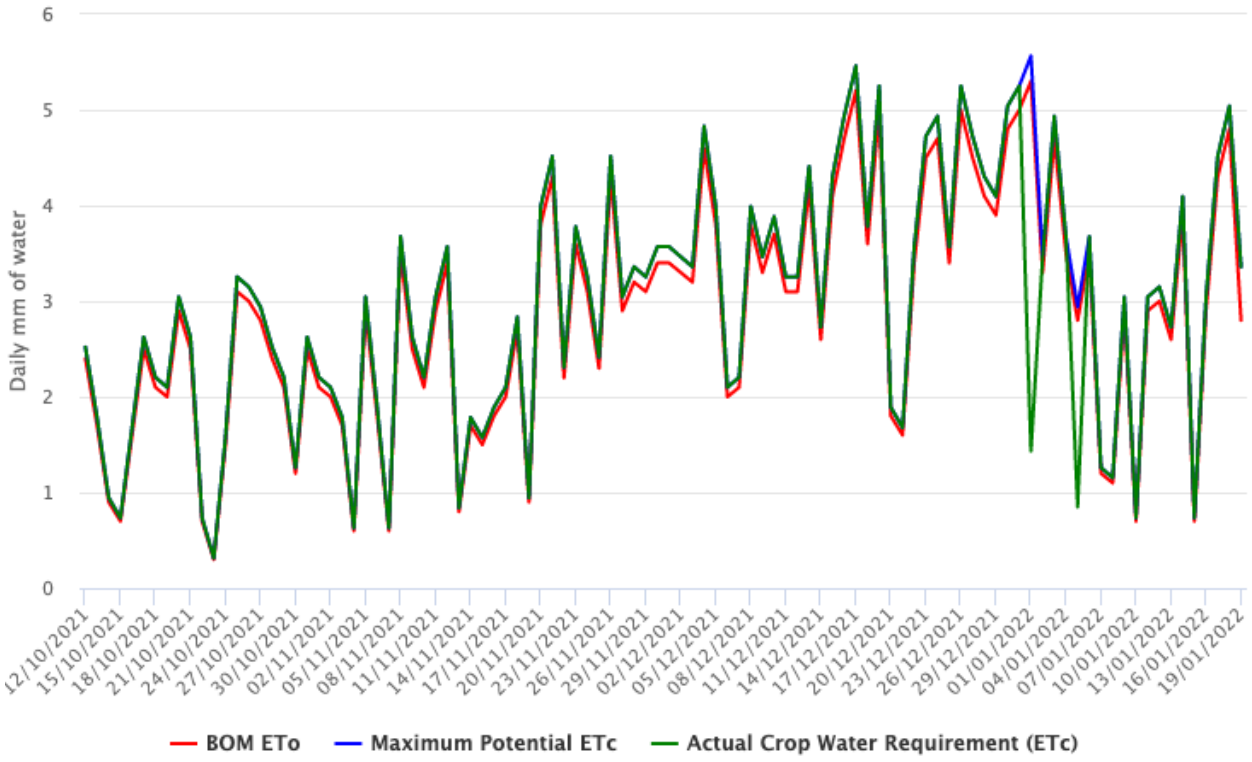
- Results shown are filtered from 12/10/2021 to 20/01/2022
- Available Soil Water - the amount of water (mm) in the soil.
- Readily Available Water - the amount of water (mm) that is available in the plant root zone.
- Refill point - defined point at which irrigation should be applied i.e. the soil moisture to be removed before applying irrigation.
- Total In-season rainfall - cumulative total of all rainfall between plant and harvest dates.
- Effective rainfall - the amount of rainfall that enters the root zone and is available for the plant to use.

## Irrigation, rainfall and soil moisture




On this irrigation, rainfall and soil moisture graph, ideally the green line for available soil moisture should be maintained between the yellow field capacity and the red refill point lines.

### Daily crop water requirements




On the daily crop water requirements:

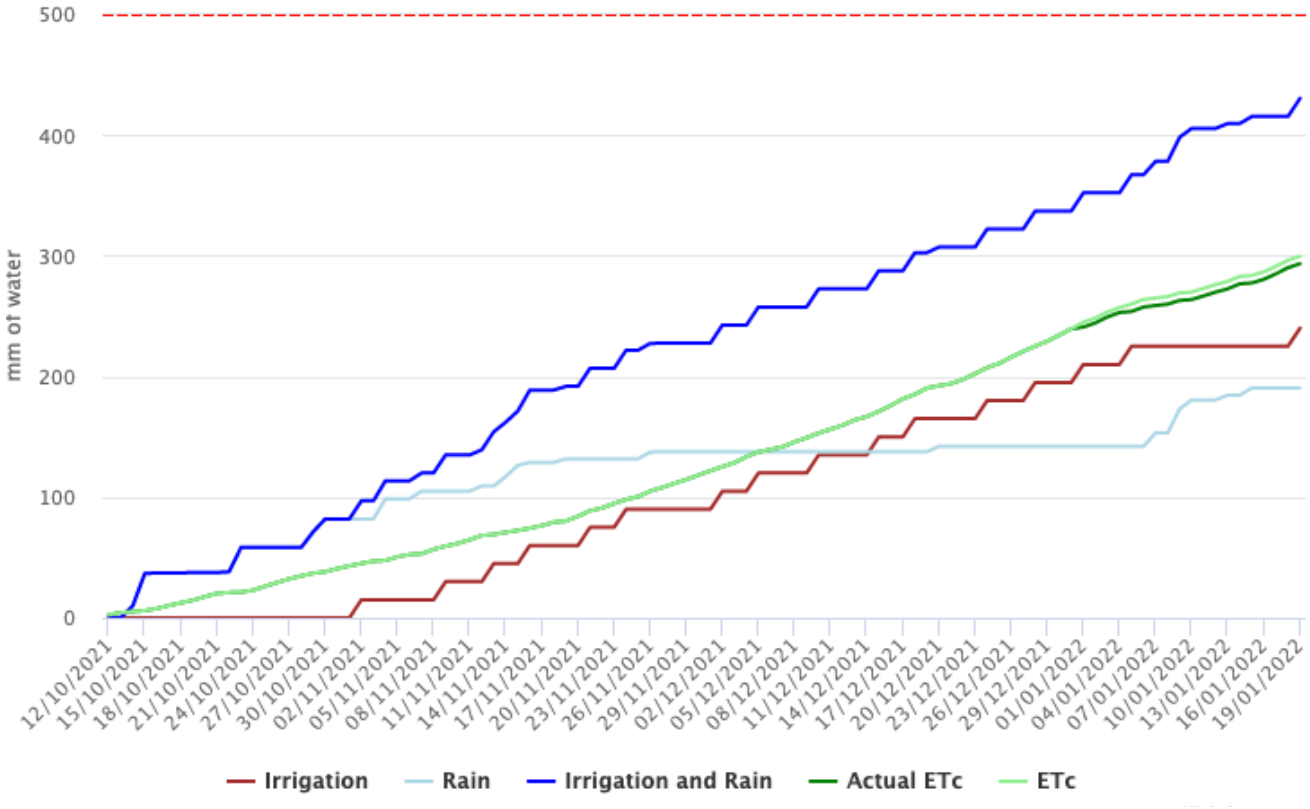
BOM ETo - is the reference evapotranspiration (FAO56 Reference Evapotranspiration)

Max ETc - Crop Factor (Kc) × BOM ETo; i.e. this could be 1.1 × 8 mm/d = 8.8 mm for the day. Kc is the crop factor and is different for different crop types and stages of growth.

Actual ETc - is the actual evapotranspiration of the selected crop/pasture. There could be situations where this is not equal to the Max ETc. For example if the available soil water level falls below refill point, the crop will not use soil water at Max ETc, and this stressed crop will have an actual ETc below MAX ETc for the day.

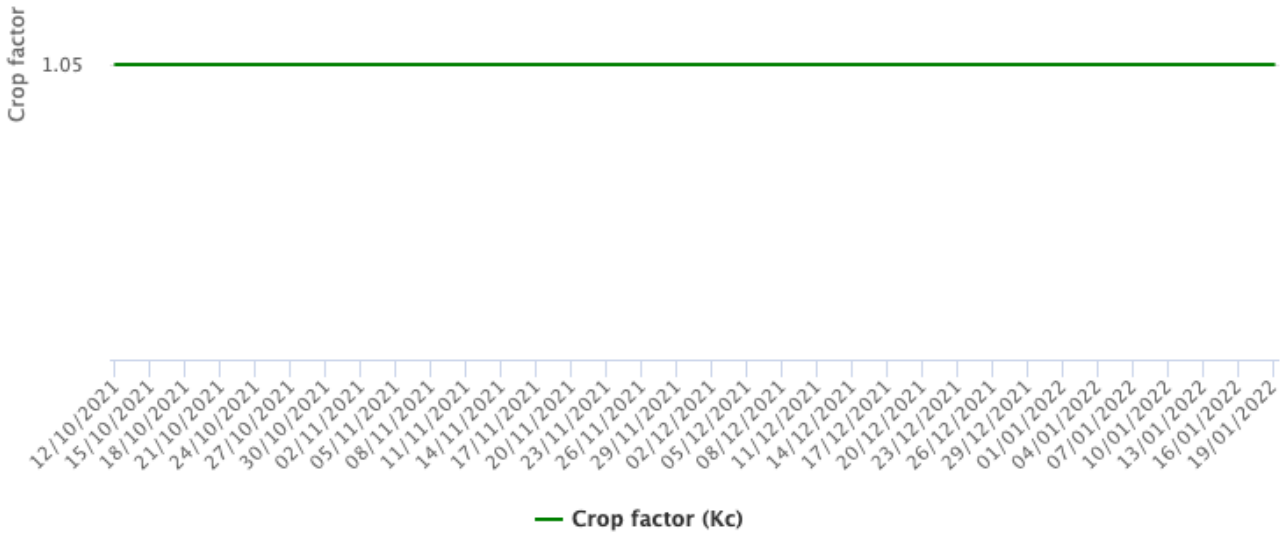
Where the Actual crop water requirement - ETc (green line) is below the Maximum potential ETc (blue line) the plant is stressed and not growing at its potential. On this well irrigated example, this only occurs to a small degree in the January period.

### Cumulative Crop ET, rainfall and irrigation




This graph depicts the cumulative crop ETc, rainfall and irrigation. Where the ETc (light green line) does not match the Actual ETc (dark green line) there has been crop stress with the crop not growing to its potential.

### Crop factor coefficients




The crop factor co-efficient changes according to crop type and crop stage of growth. The crop co-efficient depicted here is determined from the crop information you have provided.

# FREQUENTLY ASKED QUESTIONS

## When and why should I use the soil moisture reset function?

IrriPasture only measures the water entering the soil profile from rainfall and irrigation and exiting the via evapotranspiration.

However, IrriPasture does not account for water that enters the soil profile through lateral flow (movement of water from higher areas to lower areas) and through capillary rise (where water rises into the root zone from below i.e. saturated subsoils).

This often occurs after an extended wet period and usually corresponds with winter in temperate regions of Australia.

However, this may result in the incorrect reporting of RAW in IrriPasture early in the season before subsoils have drained or water tables have lowered.

By utilising the soil moisture reset function; you can reset the soil moisture to field capacity and "restart" the water budget from that date. Irripasture has two options for resetting soil moisture to field capacity.

1 The first option can be found below the season overview chart. This is a manual option for resetting soil moisture to field capacity at a date that the user chooses and is more useful for most users. Details of how to use this feature can be found on page 15 of this manual.

2 The second option can be found on the Inputs page when setting up or editing a crop. You can select a soil moisture probe that can automatically reset the soil moisture back to field capacity when it records soil moisture above field capacity at the probe. This is only possible for specially configured probes that have been installed on the site. This is an advanced feature with options to override reset events if the user determines that this reset is not appropriate.

## IrriPasture says that I have to irrigate my total RAW amount today, but my system can't manage that?

If this is the case, you have not been irrigating to maintain RAW and replace the water used by the crop. This amount is what would be required to lift the soil back to field capacity which most systems aren't designed to do all at once. If designed properly they should however be able to apply more than the daily plant requirements. To build your RAW back up irrigate more than the forecast ETo if possible. This will depend on system capacity, water availability and upcoming rainfall to supplement irrigation.

## Can I get a weather station on my farm to link up to IrriPasture?

Because IrriPasture needs high quality data to accurately calculate soil moisture, high end weather stations are needed which cost a lot of money and need maintenance. Research has found that ETo from high end weather stations is generally representative of a significant area around these weather stations.

## Why does IrriPasture show AVAILABLE SOIL WATER in mm/m depth when my pasture only goes down to 30 cm?

The AVAILABLE SOIL WATER axis on the right-hand side of the graph for season overview, represents the soil water content available in an entire metre depth of the soil that you have selected. This will not match any other soil moisture probe readings as each are calibrated differently. Your RAW (Readily Available Water) amount available to your pasture's 30 cm rooting depth, is represented as the 'bucket' graphic on the top right of the main screen, and is the amount that the green line is above the red refill point line on the main SEASON OVERVIEW graph.

## How do I determine my RAW and soil texture?

To determine your RAW download the Determining readily available water from soil texture information fact sheet at **dairyaustralia.com.au/DeterminingRAW**. Information on soil texture can be found at **qld.gov.au/environment/land/management/soil/soil-properties/texture**

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