

Behind the scenes

Hart trials

we share some of the how and why



What is this series about?

Throughout the 2022 growing season, we take you 'behind the scenes' of several Hart trials to explore the how and why.

A number of the trials featured are Hart-funded and have been developed after considering issues passed on to us from local growers and advisors. We'll tell you how these ideas progressed to trial stage and what growers can hope to learn from the research.

We've also included a GRDC project that involves the use of a controlled environment room (CER) and we'll tell you about how that works too.

Ultimately, we hope this provides an interesting look behind the scenes and that it inspires you to check back for the results after harvest.

Issue 1

Hart Beat and Yield Prophet® Simulations

by Rebekah Allen, Hart's Research & Extension Manager

Why do we release Hart Beat Newsletters?

Hart Beat newsletters are released monthly from June – October for 8 sites across the Mid-North region, including; Hart, Spalding, Condownie, Kybunga, Pinery, Eudunda, Tarlee and Farrell Flat. These reports provide simulated crop yield predictions for Scepter wheat in each location. To simulate yields, the online tool Yield Prophet® (a paid subscription) is used. This tool relies on accurate information including; current soil and water data, starting and in-crop nitrogen (N), historical climate data and current seasonal rainfall to predict crop yield potential for the given season.

Information we provide growers through Hart Beat newsletters includes;

- Predicted crop yield (t/ha) for May 1 and May 20 sowing
- Predicted wheat hay yield (t/ha)
- Starting soil N (kg N/ha)
- Plant available water (PAW, PAWC)
- Annual rainfall (mm)
- Growing season rainfall and current season decile
- French and Schultz prediction model at 80% and 100% WUE

HART BEAT

celebrating 40 YEARS of research & extension

Yield Prophet® simulations for 8 sites across the Mid-North of SA

Hart | Spalding | Condownie
Kybunga | Farrell Flat | Pinery
Eudunda | Tarlee

HART SA's premier cropping field site

CASE in 2020 FIVE AG

Flexi-coll

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How does Yield Prophet® simulate yield and what numbers do we report?

Yield Prophet® is a tool that provides crop yield estimates generated by a model called APSIM, developed by CSIRO. This model simulates the effects of both the environment and crop management, on yield. Yield Prophet® is able to simulate crop yield by using soil water and nitrogen data, while estimating crop growth. It also uses the past 100 years of climate data to determine our yield probabilities (Figure 1).

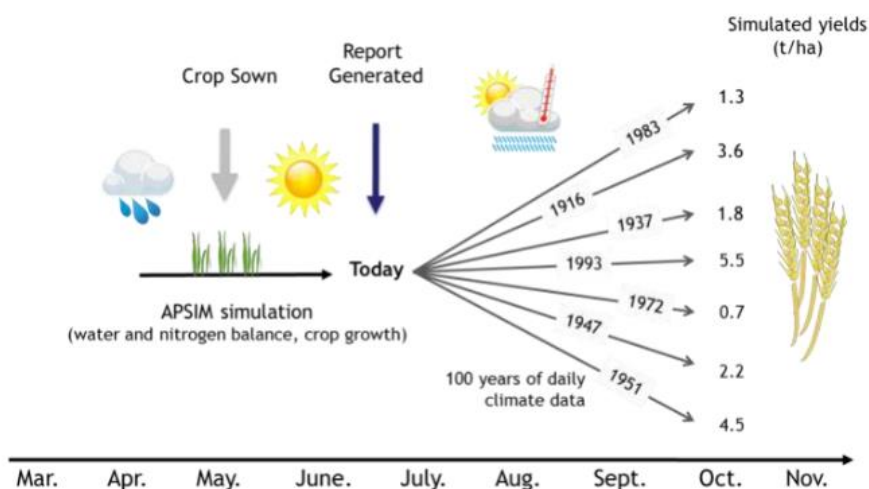


Figure 1. Yield Prophet® simulation using the APSIM model (Yield Prophet®, 2017).

Hart Beat newsletters report the average grain yield prediction for Scepter wheat sown on May 1 and May 20, representing an early and late sowing time. These reported yields are based on a 50% probability (or decile 5 season) for the remainder of the season. A graph is included for May 1 (Figure 2) showing crop yield (t/ha) at various probability levels. The small difference between these two lines indicates the current soil N level is adequate for the crop to reach its yield potential. If there was a large difference between the lines, it would indicate that we would require additional N fertiliser for the crop to reach its yield potential. The dashed green and blue lines show each scenario with seasonal frost and heat effects (shown for interest only). It is important to note that the yield reported is an average of both the limited and non-limited yield.

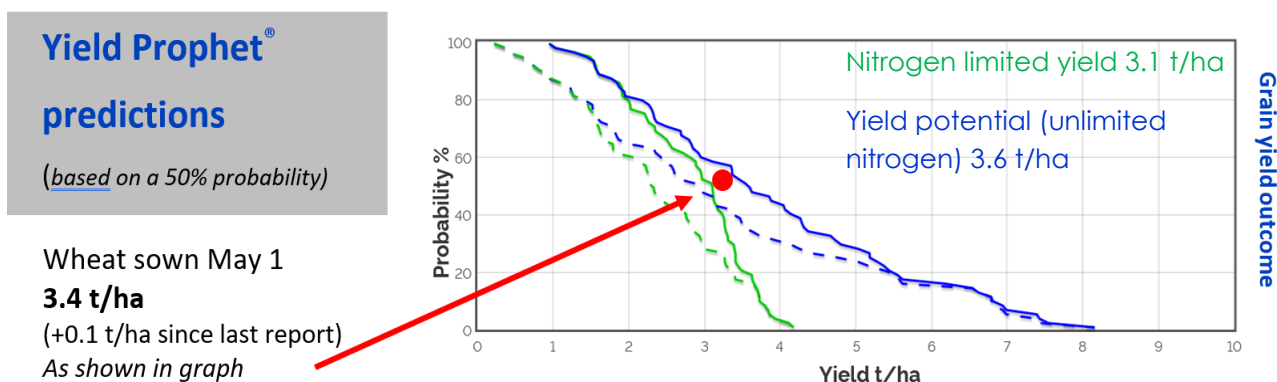


Figure 2. Wheat yield probability graph from Yield Prophet® reported in Hart Beat newsletters.

Yield Prophet® gives us a grain yield potential only and many things influence this after we have run the report. It's important to look at long-term weather forecasting to assist decision making.

Useful resources:

[The Very Fast Break - YouTube](#)

[Overview—Summary - Climate Outlooks \(bom.gov.au\)](#)

What soil measurements do we conduct?

Yield Prophet® uses APSOIL, a national soil data base to collect pre-characterised soil information from various locations. Soil data for sites includes; layer depth, EC (dS/m), pH (CaCl₂), Cl (mg/kg), ESP%, Boron and Aluminium. These soil characterisations exclude nitrogen and soil water.

Pre-seeding nitrogen and water content (%) values are input at the start of each season to determine accurate starting levels. It's important to note that only soil water content (%) is physically measured in the field for Hart Beat newsletters. This is to provide an estimate of soil water in each location pre-seeding. Soil water content generally varies as a result of soil type and summer rainfall.

Soil cores are taken in each paddock at each location in March – April each season. Soil layers are collected (Figure 3), weighed and dried in an oven for 48 hours at 60 degrees to determine water content (%) at each depth. Pre-seeding nitrogen is estimated as 60 – 70kg N/ha for each site (not measured) as a baseline. Seeding and in-crop nitrogen reported is also simulated as an estimate only.



Figure 3. Conducting soil sampling to measure pre-seeding water content (%). Dashed red lines indicate breakdown of characterised soil depths at Hart.

Why do we include the French & Schultz calculation?

The French and Schultz model was developed in 1984 to determine achievable wheat yield based on water-use (kg mm/ha). In 2006 Sadras and Angus updated this calculation to account for factors including; increased CO₂ levels, semi-dwarf wheats and crops grown on soils with lower evaporation rates. (Hunt & Kirkegaard, 2012).

French & Schultz Model (1984)

Yield potential (t/ha) = ((Stored Soil Water + Growing Season Rainfall) – Evaporation Coefficient (110)) * WUE (20 kg mm/ha)

Sadras & Angus (2006) – used in Yield Prophet® Lite

Yield potential (t/ha) = ((Stored Soil Water + Growing Season Rainfall) - Evaporation Coefficient (60)) * WUE (22 kg mm/ha)

The French & Schultz model reported in Hart Beat newsletters is displayed as a comparison to the Yield Prophet output. We have updated the model reported in Hart Beat newsletters to reflect the revised 22 kg mm/ha WUE with the original evaporation coefficient of 110.

Growing season deciles – how are they determined?

Growing season rainfall deciles provide an update on how our rainfall is tracking based on the previous 100 years of rainfall data. For example, if our GSR is decile 3, we are in the 30th percentile (or the lowest 30% of rainfall records). A decile 9 would mean that 90% of years had less than our current season.

Yield Prophet® Lite

A FREE online tool to predict yield potential and manage in-crop nitrogen

Yield Prophet® Lite is a free online tool for estimating potential yield values for your crop, taking into account various rainfall scenarios and application rates of nitrogen. It also provides the rainfall likelihood for the remainder of the growing season.

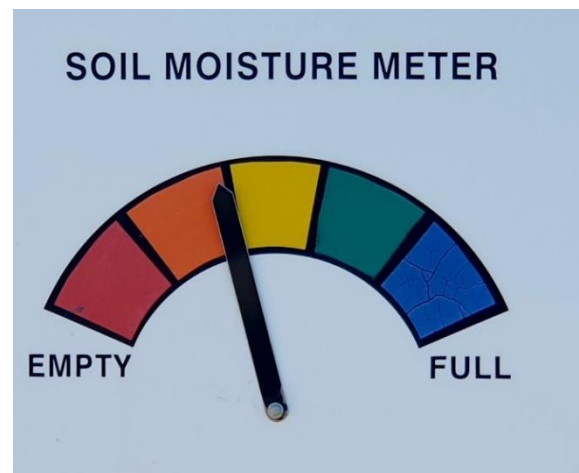
[Download the App or visit https://www.yieldprophet.com.au/yplite](https://www.yieldprophet.com.au/yplite)

What is PAWC and predicted PAW?

Plant available water values are reported in each newsletter to provide the soil PAWC for each location, providing updates on how full our soil profile (or bucket) currently is and how much water the crop currently has access to.

PAWC = Plant available water capacity. It is the maximum amount of water available to the crop from a particular soil type at each location. This is pre-determined from soil characterisation data (APSOIL).

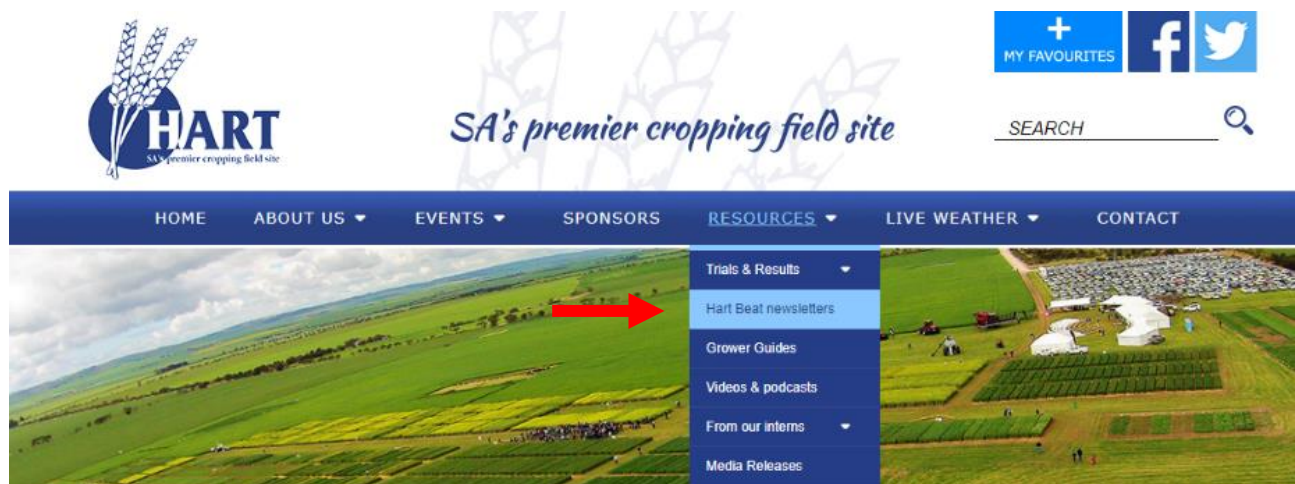
PAW = Plant available water. The current amount of water within the soil minus the crops lower limit (it's the amount of water the crop can access).



Where can you find our Hart Beat newsletters?

You can find our Hart Beat newsletters on our website under the resources tab:

<https://www.hartfieldsite.org.au/>



References

Yield Prophet 2017, 'How it works'.

Available online: <https://www.yieldprophet.com.au/yp/HowItWorks.aspx>

Hunt, J, Kirkegaard, J 2021 'A guide to consistent and meaningful benchmarking of yield and reporting of water-use efficiency'.

Available online: <https://publications.csiro.au/rpr/download?pid=csiro:EP156113&dsid=DS2>