

Plant Available Water (PAW) Information and Tools for better crop management decisions for Albany and Esperance RCSN Zone consultants and farmers

GRDC Regional Cropping Solutions Network Research Report
Project ID RAI00003



Introduction

In August 2012, both the Albany and Esperance Port Zone Regional Cropping Solutions Network members ranked water use efficiency and soil knowledge highly as an issue in their respective zones. Consequently they allocated funds towards this combined project (more so from Esperance than Albany.)

Numerous soil tools and models exist but many of our complex soils are not covered by these systems – this is slowing adoption of new technologies in these areas. This project aims to address this underrepresentation by identifying gaps in soil descriptions for our regions. Yield Prophet sites will be implemented creating a forecasting model for the majority of the region's growers to utilise.

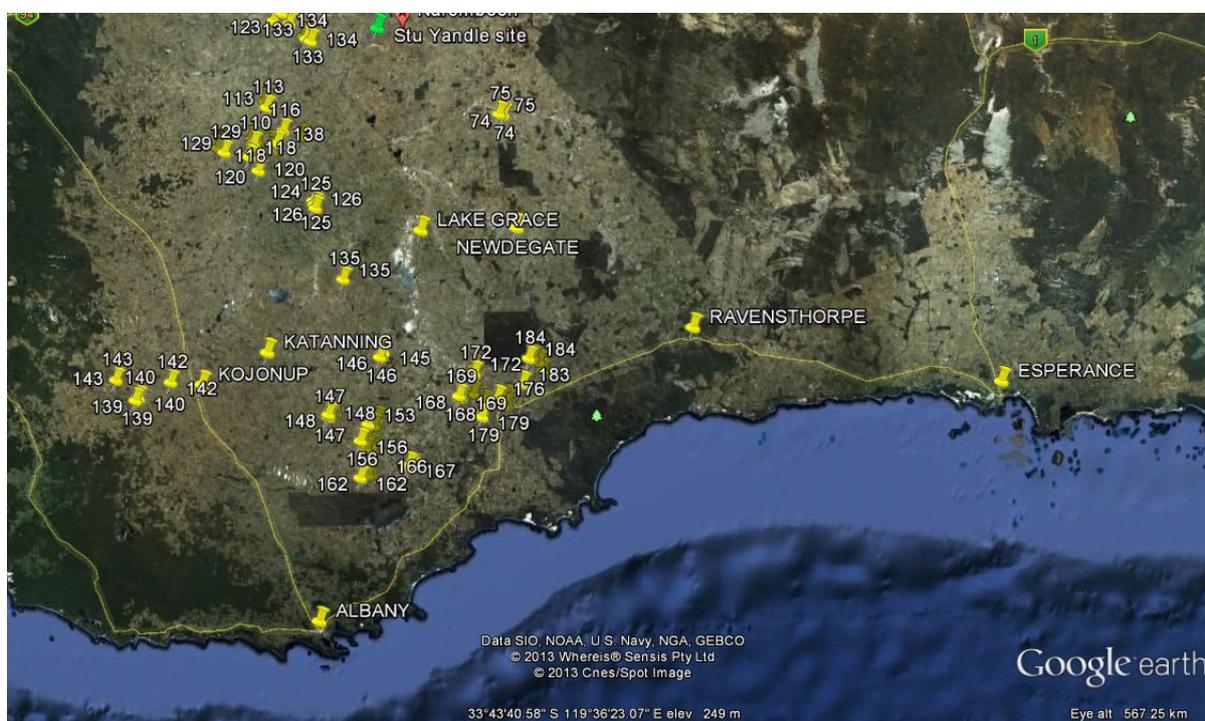


Figure 1: Numbered Yellow Pins above are current Focus Paddock sites which DAFWA plans to link (in the future) to Yield Prophet® - note the gaps in the eastern and southern areas.

Objectives

This project aims to identify gaps in soil descriptions for the Esperance and Albany Zones. Key focus sites representing these gaps will be identified and addressed with soil characterisations and installation of Yield Prophet sites (complete with rain gauge, telemetry, APSOIL characterisation and registered as Yield Prophet sites.) This project will assist growers to make better informed decisions when it comes to addressing their soil constraints and crop management decisions.

This project also aims to upskill growers and industry on the tools and models available to them and how to interpret the data generated from Soil Moisture probes. This will be achieved through extension activities and workshops.

Methodology

A group meeting lead by David Hall DAFWA was arranged in Ravensthorpe February 20th 2013. Key stakeholders and driving industry members were welcomed from both zones to discuss the project. The focus being what already exists and how can we close the system gaps best utilising what we already have.

Workshop Outcomes: Ravensthorpe 20th February 2012 – David Hall (DAFWA)

Meeting Objectives

- Identify where current Apsoil sites are and where there is information that has not been captured in the Apsoil database including research sites and weather stations with soil water probes..
- Identify where gaps are in terms of :
 - Spatial distribution
 - Sites reflecting key soil types
 - Quality of information
- Select sites that are representative of the Esperance /Albany soil types and climates for further investment (soil probes, weather stations).

Outcomes

- 1) Attached to this document is a spatial file that lists current Apsoil sites, existing weather stations with water probes and research sites that have crop upper and lower limits.
- 2) Suggested groups/soil types have been identified as requiring further soils or weather station/soil probe information for delivering YP. (high Priority) . The actual locations would be best determined by the grower groups based on access to mobile coverage and extension value of the site..
 - a. West Arthur group (West of Hwy) - loamy gravel
 - b. Nyabing farming group - duplexes
 - c. FBG - Jerramungup - gravelly or sandy duplex
 - d. LakeKing/Holt Rock Farming Group - alkaline sandy or loamy duplex
 - e. Rain (Nth Ravy –Burrell) - alkaline sandy duplex
 - f. Jerdacuttup Topcrop group (?) - deep sandy gravel duplex
 - g. Cascade (Carmody ?, Welke?) - alkaline sandy or loamy duplex
- 3) Suggested sites to fill gaps (lower priority) . Some of these sites may already have information that is currently not in the Apsoil database.
 - a. Kojonup (Webbs?) - sandy and gravelly duplexes (CSIRO)
 - b. West Arthur /Nyabing- sandy duplex (DAFWA,
 - c. Jerramungup - shallow sandy duplex
 - d. Jerramungup - Moort soils (Bakker and Hamilton)
 - e. Jerramungup - Red Loamy duplexes
 - f. Nt Ravensthorpe - Shallow domed clays
 - g. Salmons Gums - Deep circle valley loams
 - h. Beaumont - Alkaline sandy duplexes – calcareous (DAFWA Survey)

Recommendations

- 1) There is a need to harvest existing soils information not currently listed in Apsoil that has been collected by CSIRO , DAFWA and consultants (PAA , Farm and General) for the purpose of running APSIM or YP. This may be achieved within the project GRDC is currently funding with Neil Dalgliesh and Yvette Oliver. These organisations have significant soils databases which either have the relevant data or could be used to generate the soils parameters required to run YP using Soil Water Express (<http://www.apsim.info/swe/Default.aspx>).
- 2) Provide funding to grower groups (ie Rain, SEPWA) to provide web based access to climate and soil water data currently held by individual farmers. Registered members could view these sites for a fee.. The fee could be used to maintain, upgrade or develop new sites. SEPWA is currently exploring this idea.
- 3) Develop a “lucid” key to identify soil types that are similar to that at a YP site. The emphasis then becomes matching soils as opposed to assuming that the closest soil in the Apsoil database is the most appropriate..
- 4) GRDC would be better off investing in climate stations and water probes and harvesting existing soils information. Detailed characterising of further Apsoil sites is seen as a lower priority.
- 5) Co-investment with farmers in water probes with data made available through grower group sites.

Meeting attendees

| | | |
|------------------|------------------|------|
| Andy Duncan | | Rain |
| Jenny Chambers | Rain | |
| Elisa Spengler | | Rain |
| Quenten Knight | PAA, | |
| Andrew Heinrich | Farm & General | |
| Jeremy Lemon | DAFWA, Albany | |
| Brendan Nicholas | DAFWA, Esperance | |
| Steve Tunbridge | DAFWA, Katanning | |
| David Hall | DAFWA, Esperance | |

Input was also sought and provided by

Ben Whisson
Stuart Witham
Dennis van Gool
Paul Galloway
Greg Warren
Courtney Piesse
Yvette Oliver

From this meeting the following sites were identified for probes:

| Area | Host Name | Related Grower Group | Soil Type | Any existing data/ weather stations? |
|------------------------------|--|--------------------------|---|--|
| Gnowangerup | Richard House; ALBANY ZONE | North Stirlings Pallinup | duplex loam | Has CSBP probe, good records, hosted YP in 2012 weather station there already. Just coring and analysis required. CSBP Manager Albany is Wade Anning - 0429 207 226. ACTION REQUIRED: YP site registration & YP Database set up; Soil Coring & analysis |
| Lake Grace (Holt Rock Group) | Landon Bristow-Boahm; ALBANY ZONE | LIFT | Deep sand over gravel | ACTION REQUIRED: YP site registration & YP Database set up; Soil Coring & analysis, 80cm probe and weather station |
| Lake King/ Holt Rock | Anna-Lisa and Craig Newman; ESPERANCE ZONE | Lakes Grower Group/ RAIN | Alkaline sandy or loamy duplex | ACTION REQUIRED: YP site registration & YP Database set up; Soil Coring & analysis, 80cm probe and weather station |
| Ravensthorpe | Lloyd Burrell; ESPERANCE ZONE | RAIN | Gravelly sand over clay | Non-wetting Soil Trial Site, good yield mapper, has EM38's of some of farm. 10km from a DAFWA Weather Station - it's on the same east-west bearing. ACTION REQUIRED: YP site registration & YP Database set up; Soil Coring & analysis, 60cm probe and weather station |
| Jerdacuttup | Stott Redman; ESPERANCE ZONE | Jerdy Top Crop/ RAIN | Deep sandy gravel duplex | Good Yield Mapper, has done some EM work, has experience with YP. 15kms from Hopetoun North weather station but would like one at his site (even if he has to pay the extra) ACTION REQUIRED: YP site registration & YP Database set up; Soil Coring & analysis, 80cm probe and weather station |
| Munglinup | Doc Fetherstone-Haugh; ESPERANCE ZONE | Munglinup Grower Group? | sand over gravel/ clay at bottom | good yield mapper, already has a soil probe on site funded and managed through CSBP who are OK with us using the equipment and data and adding to it. ACTION REQUIRED: YP site registration & YP Database set up; Soil Coring & analysis |
| Cascade | Welke - 'Willost' property; ESPERANCE ZONE | SEPWA only | Loamy clay where DAFWA weather station is | Existing DAFWA Weather Station ACTION REQUIRED: YP site registration & YP Database set up; Soil Coring & analysis, 60cm probe |
| Salmon Gums - North East | Andrew Longmire; ESPERANCE ZONE | North Mallee | Heavy red soils | Hostile sub-soils at 60cm. COGGO probe going in with Andrew contributing some of his own costs. Has done EM38 mapping and header records. Soil Coring, Analysis & YP Registration Covered by DAFWA YP Project. ACTION REQUIRED: Soil Core & Characterisation only |
| Salmon Gums | Rory Graham; ESPERANCE ZONE | North Mallee | Duplex | Under Boron layer deeper than 60cm. Has done Yield Prophet work in the past. If we use Andrew Longmires setup as a site can we fully fund Rory's? Have asked for \$8000 for the 2 sites. ACTION REQUIRED: YP site registration & YP Database set up; Soil Coring & analysis, 60cm probe and weather station |
| Beaumont | Gavin & Elaine Egan; ESPERANCE ZONE | SEPWA only | Alkaline sandy duplexes - calcareous | EM maps, variable rates etc. Soil Coring, Analysis & YP Registration Covered by DAFWA YP Project. ACTION REQUIRED: 80cm probe and weather station |

Precision Agronomics Australia (PAA) cored the sites and installed the probes and weather stations in May 2013.

Results

Probes were installed at the following locations:



The data from these probes was loaded onto the PAA and SEPWA websites for all to view:

http://www.precisionag.com.au/probes_and_prophets.php

Rainfall, soil moisture, and temperature can all be viewed at these links.

Extension activities on Yield Prophet Sites and Soil Monitoring tools were undertaken at the following field days:

- 20/06/2013 – Munglinup Field Day visiting the Soil Moisture Probe at Doc Fetherstonehaugh's – 36 attendees
- 26/06/2013 – Soil Monitoring Workshop – North Ravensthorpe visiting the site at Bevan and Karyn Tuckett's Included a soil core demonstration – 41 attendees
- 10/09/2013 – Jerdy Top Crop Spring Field Day – Jerdacuttup – visiting the site at Stott Redman's (Hopetoun) – 40 attendees
- 17/09/2013 – RAIN West Ravensthorpe Spring Field Day – discussing the probes and undertaking a soil core demonstration. – 80 attendees
- 24/09/2013 – Lakes Grower Group Spring Field Day – Lake King – visiting the probe at Craig and Anna-Lisa Newman's – 40 attendees
- 20/03/2014 – North Mallee Farm Improvement Group Crop Updates – Salmon Gums – 50 attendees

Due to seasonal constraints the consultant workshops in this project were not delivered. They will, however, be delivered in another GRDC RCSN project run by Precision Agronomics Australia.

Discussion of Results

Key findings:

- Calibration of soil moisture sensors (especially 10cm) is key to get reliable measurements
- The 2013 growing season was too wet for most soils to reach the crop lower limit, larger data time series required
- The high 2013 rainfall diluted soil toxicity, causing deeper root growth than expected
- Care has to be taken with inserting fertiliser applications applied before/during seeding
- Data has to be filtered for errors and missing data
- Possible improvements:
 - o Localised weather, especially rain, but potentially radiation and temperature
 - o Adjust APSoils: Soil hydraulic characteristics, toxicity and texture from moisture probe and lab samples
 - o Adjust YieldProphet for non-wetting sands and waterlogging
- YieldProphet yield estimates (see table below) are generally not far off. Deviations are mainly caused by missing rainfall, non-wetting sands and waterlogging. Landon Bristow and Craig and Anna-Lisa Newman's yield prediction show unexplainable behaviour.

| Grower Name | Paddock Name | Yield | YieldProphet | Comments |
|----------------------------|--------------|-------|--------------|---------------------|
| Bevan Tuckett | Adelong/15 | 4.2 | 3.6 | (North) |
| | | 3.8 | 3.0 | (South) |
| Landon Bristow | East Hyden | 2.7 | 5.5 | ? |
| Doc Fetherstonhaugh | Munglinup | 2.4 | 3.2 | (Waterlogging) |
| Stott Redman | Hopetoun | 3.9 | 3.9 | |
| Lloyd Burrell | Mt Madden | 2.4 | 3.2 | (Non-wetting sands) |
| Craig and Anna-Lisa Newman | Varley | 3.4 | 5.6 | ? |
| Rory Graham | Salmon Gums | 2.4 | 2.0 | (Missing rainfall) |
| Scott Welke | Cascade | 4.0 | 1.3 | (Missing rainfall) |
| Gavin and Elaine Egan | Beaumont | 4.1 | 3.9 | |
| Andrew Longmire | Salmon Gums | 4.2 | 4.1 | |

Implications

This project has had a large impact on Albany and Esperance growers. The underrepresented soil types are now predominantly covered making the Yield Prophet project more relevant to the area. Growers can access the information in the paddock on smart phones and tablets. This enables them to make better informed decisions when it comes to soil inputs and management.

Recommendations

Precision Agronomics Australia are currently engaged in a complimentary project (also with the assistance of the GRDC Regional Cropping Solutions Network) whereby additional probes and Yield Prophet sites have been established. This is closing the last of the 'soil type' gaps. As outlined above, possible improvements include:

- o Localised weather, especially rain, but potentially radiation and temperature
- o Adjust APSoils: Soil hydraulic characteristics, toxicity and texture from moisture probe and lab samples
- o Adjust YieldProphet for non-wetting sands and waterlogging

Appendices

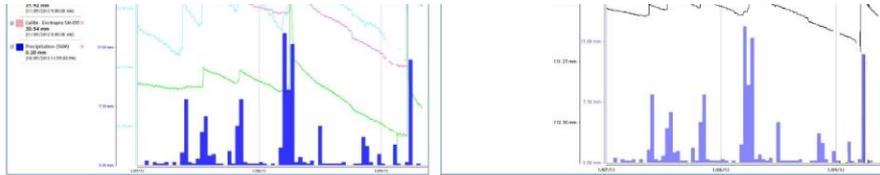
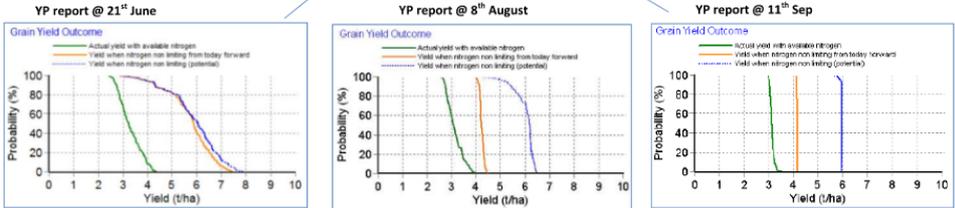
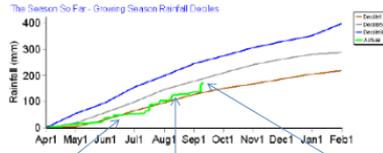
Below examples of information included in Field Day booklets and event handouts:

Probes and Prophets



| Depth | 0 - 10 | 10-20 | 20 - 40 | 40 - 60 |
|------------|--------|-------|---------|---------|
| NO3N | 18 | 2 | 3 | 2 |
| NH4N | < 1 | < 1 | < 1 | < 1 |
| Col P | 26 | | | |
| Col K | 55 | | | |
| KCl S | 19 | | | |
| O C | 1.2 | | | |
| Cond | 0.156 | 0.169 | 0.453 | 0.802 |
| p H Ca Cl2 | 5.3 | 6.2 | 8 | 8.4 |
| Cl | 91 | 66 | 257 | 563 |
| %Clay | 10 | 24 | 40 | 38 |

- Accurate soil characterisation required for reliable Yield Prophet® results
- Incomplete characterisation of soil water profiles for major soil types across the South Coast region
- Soil moisture probes enable accurate, cost effective soil water with additional, ongoing benefits
- Soil moisture probe data and YP reports available at: www.precisionag.com.au/probes_and_prophets.php



| Scenario1 | Scenario2 | Scenario3 |
|--------------------|--------------------|--------------------|
| Date: 30-Apr | Date: 30-Apr | Date: 30-Apr |
| Amount (kg/ha): 0 | Amount (kg/ha): 30 | Amount (kg/ha): 30 |
| Date: 15-Jun | Date: 15-Jun | Date: 15-Jun |
| Amount (kg/ha): 30 | Amount (kg/ha): 30 | Amount (kg/ha): 30 |
| Date: 1-Aug | Date: 1-Aug | Date: 1-Aug |
| Amount (kg/ha): 0 | Amount (kg/ha): 30 | Amount (kg/ha): 60 |

- 90% probability of doubling the return on investment in additional 30 units of N on 1st Aug
- **BUT** – is the bucket size correctly estimated?
- Analysis of soil moisture probe data will enable accurate estimation of bucket size
- Correct bucket size will enable more accurate results from Yield Prophet®



This project is funded by the GRDC Regional Cropping Solutions Network

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www.precisionag.com.au/probes_and_prophets.php

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Rain Ravensthorpe Agricultural Initiative Network

PRECISION AGRICULTURE AUSTRALIA



Image 1: Frank D'Emden (PAA) at Munglinup Field Day discussing the probe at Doc Fetherstonehaugh's



Image 2: Bevan Tuckett talking about the probe installed at his property – North Ravensthorpe



Image 3 – Frank D’Emden (PAA) soil coring at Tuckett’s – North Ravensthorpe



Image 4 – David Hall (DAFWA) discussing a soil core at West Ravensthorpe Spring Field Day

References

Example only

Plain English Summary

Project Title: Plant Available Water (PAW) Information and Tools for better crop management decisions for Albany and Esperance RCSN Zone consultants and farmers

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Objectives

To identify gaps in soil descriptions for the Esperance and Albany Zones. Key focus sites representing these gaps will be identified and addressed with soil characterisations and installation of Yield Prophet sites (complete with rain gauge, telemetry, APSOIL characterisation and registered as Yield Prophet sites.) This project will assist growers to make better informed decisions when it comes to addressing their soil constraints and crop management decisions.

Background

Numerous soil tools and models exist. DAFWA’s website mentions; NP Decide, PYCal, SYN, WA Wheat, MySoil – to name a few. There are many others apart from these, including Yield Prophet® (which pulls information from many of the models above). These tools are sound but are under-utilised.

Yield Prophet® is one tool that can assist farmers in making management decisions based on modelling soil water capacity, soil fertility status, and crop requirements, as well as giving indication of potential yield - however the system is based on APSOIL soil characterisations and there are many inconsistencies within that system that create issues. There is also an absence of soil descriptions for many types in the Albany and Esperance regions.

This project also strives to provide information and tools on soil water measurement to consultants and advisors who can then extend the information out to growers - Yield Prophet® being one focus for this to happen.

Other benefits of this project are more weather stations (unlikely to otherwise be funded by BOM), utilising existing on-farm research and value adding to existing soil moisture probes which have been installed privately.

Research

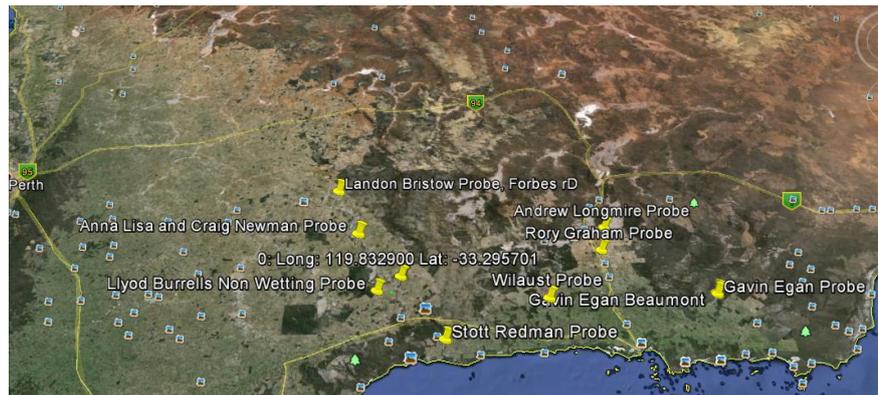


Figure 1: Esperance zone sites that have the full Yield Prophet suite installed

A planning meeting was held in Feb 2013 with industry and grower representation from the zones. Suitable sites were identified and Precision Agronomics Australia implemented Yield Prophet Sites in 8 Esperance and 2 Albany locations.

Outcomes

Probes were installed and the data generated from these probes was loaded onto the PAA and SEPWA websites for all to view:

http://www.precisionag.com.au/probes_and_prophets.php

Rainfall, soil moisture, and temperature can all be viewed at these links.

Extension activities were undertaken in Munglinup, North Ravensthorpe, Jerdacuttup/ Hopetoun, West Ravensthorpe, Lake King and Salmon Gums.

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Implications Publications

