

GRDC Regional Cropping Solutions Network Research
Project 1 of 4: Soil and water relationships during variable seasons
Project code: SDI00003

Introduction

The Albany Zone RCSN discussed project opportunities in March 2012. One of the main issues for the zone was making the most out of stored water and matching crop inputs appropriately, N in particular. Growers want the ability to better understand soils. Introducing more Yield Prophet sites into the zone will enable farmers and consultants to simulate the probability range of yield potential and the risk of frost and heat shock for a range of sowing dates.

Yield Prophet is not well-known in the Albany Zone. In 2011 there were some Yield Prophet sites established in the more northern parts of the zone (Lake Grace & Nyabing) with local agronomists. In 2012, gaps in the zone were targeted with more sites being located in the mid and southern parts.

Objectives

Objectives of the project are to increase grower and adviser understanding of;

- tools available for better crop management decisions
- soil water relationships and Plant Available Water Capacity (PAWC)
- influence of seasonal conditions and PAWC on crop yield potential

Methodology

Three grower groups were approached to participate in the project, Stirlings to Coast Farmers (SCF) (3 growers 5 sites), North Stirlings Pallinup (NSP) (2 growers 3 sites) and Gillamii (2 growers 3 sites). Two SCF sites were located near soil water probes which were installed as part of sponsorship with that group. A total of 11 sites were established with three paddocks having two sites to examine paddock variation. Grower group staff selected participants and assisted with soil sampling, farmer communication, field day organisation and evaluation.

Two sites at NSP were in partnership with the DAFWA statewide project. The remaining 9 sites were hand sampled by Jeremy Lemon and group staff on two or three occasions during the season including the initial characterisation and further sampling timed to estimate both Drained Upper Limit (DUL) and Crop Lower limit (CLL). CSBP assisted with many analyses as part of support for grower groups. Most growers were coached to enter their own data for rainfall and paddock management and run reports but only three actively used the site, two of whom had YP sites the previous season.

Support for YP through Tim McClelland of BCG established view only access to all sites and getting the sites operating by end of June in time for nitrogen decisions. Each grower's agronomists were given website access to their client's YP paddocks to view and generate reports and discuss results with them.

Results

Table 1 summarises the characteristics of the sites in the project. The two PAWC columns are the PAWC of the soil selected from the YP web interface and the PAWC measured or estimated from soil cores collected during the season.

Table 1: Soils of 2012 southern Yield Prophet sites, PAWC, and season rainfall. PAWC (YP) is the PAWC of the soil selected for the YP simulation. Measured PAWC is the value from soil profile observations and cores. Values with (*) are from soil water sampling.

location	soil	crop	sow date	PAWC (YP) mm	measured PAWC mm	approximate root depth m	May-Oct rain
Tenterden	deep loamy duplex	Mace	28-May	107	120*	1.0	284
Tenterden	deep sandy duplex	Mace	28-May	74	67*	1.0	284
S Stirling	sandy duplex	Baudin	25-May	85	104*	1.0	227
S Stirling	sand/gravel	Bass	23-May	47	56	0.8	227
Woogenellup	loamy duplex	Oxford	4-Jun	82	90	1.0	326
S Frankland	clay loam	Mace	1-Jun	135	86*	1.0	385
E Frankland	gravel loam duplex	Mace	25-May	168	120	1.0	380
E Frankland	sandy duplex	Mace	25-May	91	98	1.0	380
Gnowangerup	shallow loamy duplex	Gairdner	16-May	85	122*	1.0	186
Amelup	shallow sandy duplex	Buloke	18-May	49	50*	0.6	225
Amelup	clay loam	Yitpi	12-Jun	70	111*	1.0	225

Table 2: Actual paddock yields compared to estimated yields. Yield Prophet is end of season simulated yield, PYCAL estimates are based on rainfall and allowances for evaporation (110mm or 1/3 growing season rainfall and water use efficiency of 20 kg/ha/mm for the balance of rainfall).

location	soil	Total N applied kgN/ha	paddock yield t/ha	protein %	Yield Prophet t/ha	PYCAL 110/20 t/ha	PYCAL 33%/20 t/ha
Tenterden	deep loamy duplex	7+23	3.9	8.7	4.7	3.7	3.9
Tenterden	deep sandy duplex	7+23	3.76	8.7	4.5	3.7	3.9
S Stirling	sandy duplex	28+21+21	4.36	11.1	4.0	2.6	3.2
S Stirling	sand/gravel	27+21+10+13	2.87		3.0	2.6	3.2
Woogenellup	loamy duplex	9	4.2	12.2	5.2	4.4	4.4
S Frankland	clay loam	17	5.3	10	4.9	6.2	5.6
E Frankland	gravel loam duplex	10+28+28	4.8	9.3	4.1	6.1	5.5
E Frankland	sandy duplex	10+28+28	4.8	9.3	4.1	6.1	5.5
Gnowangerup	shallow loamy duplex	30			3.2	2.1	2.8
Amelup	shallow sandy duplex	10+28	2.9		1.9	2.4	3.1
Amelup	clay loam	10+28	2.8		1.9	2.4	3.1

Yield Prophet was acceptably close to final yields at 5 sites and PYCAL at 9 sites.

Nitrogen fertiliser requirement predictions are compared in table 3 from both YP and Select Your Nitrogen (SYN) were compared for all sites at the end of the season.

Four growers examined nitrogen rate comparisons near their sites to test the YP information that post sowing N would not be required. In two cases, S Frankland and Woogenellup, additional N didn't improve yield as predicted. In the other two cases additional N was needed with yield losses of about 0.5 t/ha where 46 kgN/ha was not applied at Tenterden and 0.3 t/ha where a second N application of 28 kgN/ha was not applied at E Frankland.

Table 3: Comparison of nitrogen decision ability for 2012 southern Yield Prophet sites compared to estimated nitrogen requirement assessed from crop performance, N test strips and grain protein.

site	SYN predicted N requirement	Yield Prophet predicted N requirement	comment
Tenterden loam	too low	too low	they agree on N response but more N could have been used to lift protein and yield
Tenterden sand	too low	too low	
S Stirling duplex	good	good	they agree on N and rates about right
S Stirling sand/gravel	good	good	they agree on N with rates about right
Woogenellup loam	much too high	good	SYN way off, no N required confirmed by N test strips
S Frankland loam	good	good	they agree on N with both right saying no more needed
E Frankland gravel	good	much too low	could be problems with sampling error and sample site in relation to test strips or soil selection may not be appropriate
E Frankland sand	good	too low	
Gnowangerup loam	good	good	they agree on N with both right on no more needed for this site
Amelup duplex	good	good	they agree for responsiveness but no N strips to check site response
Amelup clay	good	too high	unexpected low N analyses for this green manure paddock

Discussion of Results

Careful sampling and soil selection from the web interface is required for Yield Prophet to generate useful information for decision making. For this set of sites, PYCAL using stored soil water, and deducting 33% of growing season rainfall has given the most reliable reflection of yield. While simpler tools seem just as accurate for estimating yields in unconstrained situations, YP has the potential to reflect soil conditions, PAWC, subsoil chemical constraints, and more if they are well characterised.

YP has the advantage of putting a lot of information together in single reports and analyses nitrogen scenarios. YP presents N analyses as a set of cumulative probability curves on fixed

scenarios, quite different from the fertiliser rate and return sensitivity analysis that is commonly used for fertiliser decision support.

Communication and extension

Deliver monthly email newsletters June to October discussing season progress, outlook and implications for crop management. Comparisons of outputs from Yield Prophet, PYCAL, and soil moisture probes.

Four email newsletters were prepared and delivered to members of participating grower groups. Points in the proposal (above) were addressed except the PYCAL comparisons during the season were not kept up to date and included in updates emailed to growers. Time is required to collect individual rainfall data and run PYCAL reports. Soil water probe information was only available for the Stirlings to Coast Farmers as these were part of a Landmark sponsorship agreement with this group only.

A half day Yield Prophet presentation was made by Tim McClelland at Borden to 5 growers, 4 consultants and one undergrad agriculture student.

Incorporate site visits and soil pits in Spring Field day program.

Presentations were made at field days in spring with SCF (70 participants), NSP(12) and Gillamii (30). A July presentation was also made with SCF (30) and also the SCF Crop Updates with 60 attending.

Interview participants for perceptions of value, and improved decision making.

Participants were interviewed for their perceptions of value and their use of YP in decision making. All growers with sites thought Yield Prophet was a valuable learning experience. They gained a better understanding of PAWC, soil water and root growth and understood the concept of cumulative probability of the yield range. The nitrogen information was valuable to most participants. Most sites had abundant mineral nitrogen after a wet summer period and little leaching losses until June. Two growers reduced nitrogen rates over large parts of their cereal program making savings while maintaining yield and protein.

One grower learned that much less N should be applied at sowing. It should be applied later according to seasonal conditions. Another grower saw early applied nitrogen leach beyond the expected root zone and applied further N to compensate.

Two further growers had paddocks where YP suggested no more N was required after sowing. They continued with their usual N fertiliser programs but could have used even more N. Nitrogen rate strips confirmed that following YP in these situations at would have been costly.

All growers with YP sites would be interested in having further sites if offered as continued group learning. Only three growers would be prepared to pay for further sites with support. The acceptable cost for these growers was about \$300 per site. Those not prepared to pay were disappointed with the accuracy of either the yield or N forecasts or want more experience for confidence in the system before purchasing the service.

Field days, and outcomes of the learnings will be extended to farmers through a number of routes including North Stirlings Pallinup Group, DAFWA, Gillamii group, Stirlings to Coast Farmers, and Albany Zone Regional Cropping Solutions group.

In addition to activities detailed above, an end of season summary of results is being prepared for inclusion in the SCF Crop Updates and email delivery to members of the 3 groups.

Implications

Yield Prophet is not simple but does have payoffs for sophistication. As a more complex Decision Support System (DSS), continued demonstration, evaluation and promotion is required. Alternative DSSs are available to deal with components that YP covers and these too should be used in projects exploring better cropping decisions.

Crop management decision tools or (DSSs) are being developed and updated constantly. Growers and consultants often see only marginal gains over their current decision making processes. When time is limited, the effort of learning and implementing new DSSs is perceived to outweigh the marginal benefit. Success in using a DSS might be defined as having a better outcome as a result of implementing a different decision based on that tool compared to management based on normal processes. Often new DSSs confirm current practices and growers see no advantage except an increased confidence that they are making good decisions.

All decision processes only have a probability of being successful - good decisions are not guaranteed. If a poor decision eventuates in the early stages of assessing a new DSS through seasonal conditions, weaknesses in the DSS itself or poor sampling procedure, growers are reluctant to adopt the new tool.

Growers and consultants use their established decision support systems in which they have experience and confidence over many seasons. New decision support systems need to establish their benefits in this context. When assessing new DDSs growers ask for 'functionality and useability, something that is simple and reliable'. A lot of skill is required to construct a DSS with these features.

There are other DSSs to support the range of decisions supported with Yield Prophet. Potential Yield Calculator, Select Your Nitrogen, Flower Power, soil water probes and a range of fertiliser decision tools can help with many cropping decisions. However, these are not automatically linked to weather data and integrated in one system and need to be used separately with data transferred between them.

Recommendations

Yield Prophet and other decision support tools need continuing demonstration, promotion and support to gain wider acceptance by both growers and advisers. Consultants should be engaged in the process to ensure tools are used widely to maximum advantage. Like many complex decision support systems, using them over several seasons builds confidence, expertise and an appreciation of potential and limitations. Yield Prophet is a moderately complex program that needs support for new users and probably consultant support for growers to get best value from it.

The objectives of the project were not to sell Yield Prophet but to demonstrate it as one of the potential tools for making better cropping decisions. Growers and consultants were exposed to a range of information sources including the DAFWA Statistical Seasonal Forecasting. Season outlook is an important part of the crop management decisions toolbox and needs to be incorporated into other systems for making better cropping decisions.

Appendices

Extension activities

26 June	Yield Prophet workshop, Borden	3 consultants 6 growers
5 July	SCF post seeding field walk,	50 attending
July	Presentation to Landmark agronomists	15 agronomists from across WA
25 July	4 Farmers WA tour, South Stirling & Woogenellup	6 local farmers, 16 NSW/Vic farmers, 1 WA consultant
13 Sept	GRDC spring tour, Borden site	4 GRDC panel and staff, 2 growers
20 Sept	SCF Spring field day, Tenterden sand site	60 at site
19 Oct	Gillamii/Landmark field day Frankland	30 including agribusiness and grower group staff
23 Oct	NSP trials tour	5 growers 6 agribusiness
14 Mar 13	SCF Crop Updates – summary of results	25 growers 25 agribusiness

Field day handouts

Different soils, different management (SCF field walk, 2 South Stirling sites.)

SCF Spring field day - Tenterden, 2 sites described, 1 visited.

NSP Field day handout, 3 sites described, 2 visited.

Gillamii/Landmark Frankland field day, 2 sites described, 1 visited.

Newsletters by group email

Season soil water and profit (3 July)

Yield Prophet suggests no nitrogen is required (3 July)

Season soil water and profit update July (3 August)

Season soil water and profit update September (14 September)

Season soil water and profit update October (5 October)

Season soil water and profit end of season report (planned for March 2013)

SCF group newsletter

Spring edition. - Season, Soil Water and Profit - Welcome rains add soil water

Plain English Summary

Project Title:	GRDC Regional Cropping Solutions Network Research Project 1 of 4: Soil and water relationships during variable seasons
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Objectives	Objectives of the project are to increase grower understanding of; <ul style="list-style-type: none">• tools available for better crop management decisions• soil water relationships and Plant Available Water Capacity (PAWC)• influence of seasonal conditions and PAWC on crop yield potential.
Background	<p>A high priority for the RCSN of the Albany zone is making the most out of stored water and matching inputs appropriately (N in particular). The ability to better understand soils, nitrogen fertility, soil water relationships and seasonal conditions will help growers make better cropping decisions.</p> <p>Establishing more Yield Prophet sites in the zone will help farmers learn to simulate the probability range of yield potential and the risk of frost and heat shock for various sowing dates.</p> <p>Yield Prophet is not well-known in the Albany Zone. In 2011 there were some Yield Prophet sites established in the more northern parts of the zone (Lake Grace & Nyabing) with local agronomists, there have been very few sites in southern areas.</p>
Research	<p>In 2012 eleven Yield Prophet sites were set up in the southern areas of the Albany port (and RCSN) zone. These sites were located to complement sites being established through DAFWA and Consultag. Locations of all known sites were mapped. Nine sites were sampled several times during the growing season for soil water profiles, five for N profiles with CSBP support to match in-season sampling with simulated water and N profiles.</p>
Outcomes	<p>Growers and consultants in the southern cropping areas of the zone have a greater awareness of Yield Prophet and its potential for supporting better decisions. Some consultants are likely to offer Yield Prophet support to clients after many were involved with the project through clients and attending the Borden training session. There is greater awareness of the importance of PAWC in describing yield potential and the value of deferring nitrogen applications to better assess yield potential and likely returns to N topdressing.</p>
Implications	<p>Growers and their advisers in the area are more familiar with soil water relations, N dynamics and variation of yield potential in relation to soil types and season. Their integration into Yield Prophet reports has been demonstrated. This should lead to some commercial adoption of Yield Prophet and other crop decision support systems for better management of crops leading to increased profitability through management of seasonal risk.</p>
Publications	<p>No formal publications resulted from this project. five newsletters were sent to all members of the three participating groups during the growing season and an end of season summary. These explained the project, location of sites and cropping details for each site, followed seasonal progress of the simulation reports for the sites and discussed management implications of the reports.</p>