Assessing the usability of Yield Prophet in the West Midlands region

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Purpose:	The demonstration undertaken at four on-farm sites seeks to test the Yield Prophet tool to determine its relevance and usefulness to growers of the West Midlands region in determining the most efficient and effective nitrogen strategy

BACKGROUND

Yield Prophet® does not generate recommendations or advice. Yield Prophet uses the computer simulation model APSIM together with paddock specific soil, crop and climate data to generate information about the likely outcomes of farming decisions. This tool has been widely trialled in the medium and low rainfall areas of the Northern Agricultural Region; however it has never been tested in the high-rainfall, West Midlands region.

In 2010 West Midlands Group through the Birchip Cropping Group's National Adaption & mitigation initiative tested yield prophet in a replicated trial scenario. This trial compared yield prophet nitrogen simulated N applications to farmer practise N strategy. The outcomes of this trial indicated that Yield Prophet (when correctly calibrated) does give a relatively accurate simulation of the site it was tested on. However farmers in the West Midlands remain sceptical of Yield Prophet's usability and relevance to a region where soil variation within paddock is the norm.

The aim of this demonstration was to test the usefulness of the Yield Prophet tool in the West Midlands environment by giving four growers the opportunity to use the tool for the 2011 growing season.

Each grower chose a paddock that was to be sown to wheat, farmers then identified the dominant soil type within that paddock. West Midlands Group arranged for this soil type to be fully characterised (see 'process' section below for more information). In April 2011 the four growers were given basic training in the web-based Yield Prophet program and were introduced to its nitrogen reporting functions. It should be noted that yield prophet has other reporting functions which focus on other production factors (such as time of sowing and variety comparison). The focus of this demonstration is the usefulness of Yield Prophet for the purpose of nitrogen application decision making.

Over the course of the year each grower utilised the nitrogen and crop reports from Yield Prophet to assist them in determining their in-season nitrogen applications for their paddock. Two of the growers chose to split their paddock, applying the Yield Prophet nitrogen regime to one-half and their nitrogen regime to the other to give a direct comparison.

This report details the nitrogen applied to each of the demonstration paddocks and the grower's experience of using the tool.

Process of setting up a Yield Prophet site from scratch

The following soil types within the West Midlands were selected, and were characterised so that they could be added to the Yield Prophet database:

- Badgingarra Research Station. Duplex sandy gravel Badgingarra (903)
- Rubicon .Yellow brown shallow loamy duplex (Badgingarra 902)
- Wathingarra: Brown Deep Sand (Badgingarra 904)

- Kerry Downs: Deep yellow sand, (Moora 901)
- Cooligee' Regans Ford: Red sandy earth (Dandaragan 905)

The Yield Prophet characterisation process included the following for each site: Soil water holding capacity and status, calculated as the difference between Crop Lower Limit (CLL) and Drained Upper Limit (DUL); physical analysis, soil type description (including bulk density) and chemical soil analysis.

Soil moisture

CLL or wilting point, measures the extent to which a particular crop can extract water from a particular soil type. Generally CLL has to be determined using a rain-out shelter. The shelter goes on at booting to early flowering. At maturing / harvest the tent is removed and soil cores are taken in the centre of the tent and assessed for gravimetric soil water content.

The dry finish to 2010 meant that in this case tents were not needed as there was no rain on the sites between early flowering to harvest. As such soil cores (to 100mm min) were taken from each site in December 2010 and CLL established.

DUL or field capacity- is the amount of water that a particular soil holds after drainage has practically ceased (Gardner 1984; Godwin et al. 1984; Ratliff et al. 1983). To establish this at each site approximately 4 sq metres was trickle irrigated daily and covered with black plastic over a period of 7-10 days until such time that the soil profile was fully wet up to depth.

A small excavator was hired and dug pits to a depth of 1.2 metres both in the irrigated and un-irrigated areas. Samples were taken and sent to the lab.

Physical analysis and soil type description

DAFWA staff were contracted to characterise the soil to 100-130mm at each site. To do this DAFWA staff take samples from the irrigated and non-irrigated parts of the pit to determine soil characteristics and bulk density at each soil type change.

Chemical analysis

Samples were taken from each soil layer in the un-irrigated area each soil pit and sent for chemical analysis using a standard soil test kit.

What happens with all the data?

The full data set for each site is sent to Birchip Cropping Group (the administrators of Yield Prophet) to be calibrated and added to the computer model. It is given a Yield Prophet soil name and is then available to all yield prophet subscribers to utilise.

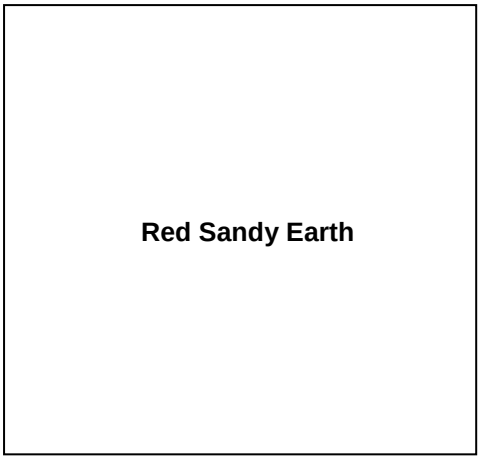
Cost of classifying a soil

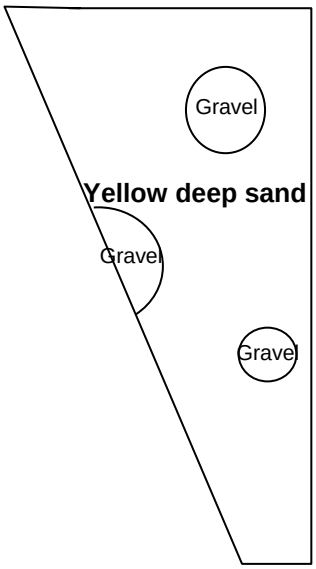
WMG's costs to set-up and fully characterised five Yield Prophet soils (exc GST):

Contractors for set-up of irrigation and DAFWA soil characterisation	$8,000
Contract of soil core machine	$3,300
Excavator hire	$1,215
Materials	$600
Soil test kits	$1,100
YP subscription ($155/ year/ site)	$775
Total to set-up five YP sites	**$14,990**

This is approximately $3,000 per site; however there was significant efficiencies gained by undertaking each activity at multiple sites.

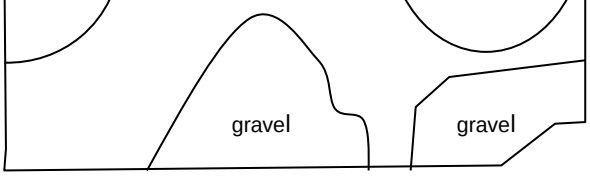
DEMONSTRATION DETAILS

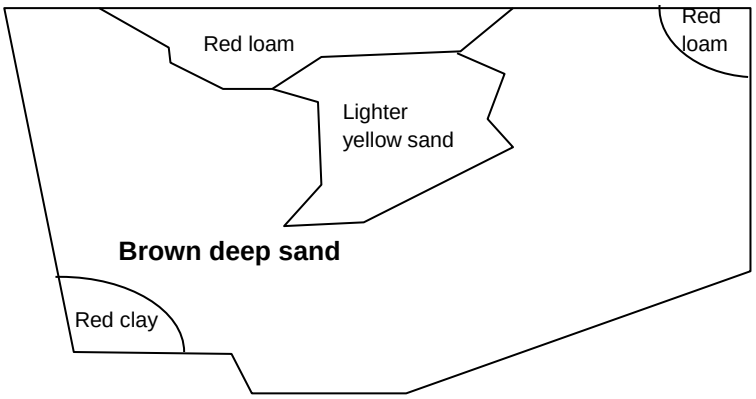




Location:	Regans Ford
Soil:	
WA soil group:	**Red sandy earth**
YP soil type:	Red sandy earth (Dandaragan No905)
The crop:	
Rotation:	Long-term pasture
Crop & Variety:	Wheat, Magenta
Seeding date:	2 June
Seeding rate	100kg
The season:	
GSR April- Oct:	556mm
Rainfall decile at 31 October	6

Location:	West Moora
Soil:	
WA soil group:	**Yellow deep sand**
YP soil type:	Yellow Deep Sand (Moora No901)
The crop:	
Rotation:	2010 pasture, 2009 wheat, 2008 canola
Crop & Variety:	Wheat, Calingiri
Seeding date:	8 June
Seeding rate	100kg
The season:	
GSR April- Oct:	330mm
Rainfall decile at 31 October	3





Location:	N/E Badgingarra
Soil:	
WA soil group:	**Yellow/brown shallow loamy duplex**
YP soil type:	Yellow brown shallow loamy duplex (Badgingarra 902)
The crop:	
Rotation:	2010 Canola; 2009 Wheat; 2008 Lupins
Crop & Variety:	Wheat. Calingiri
Seeding date:	31 May
Seeding rate	95kg
The season:	
GSR April- Oct:	497mm
Rainfall decile at 31 October	5

Location:	East Badgingarra
Soil:	
WA soil group:	**Brown deep sand**
YP soil type:	Brown deep sand (Badgingarra No904)
The crop:	
Rotation:	2010 Canola; 2009 Wheat; 2008 Pasture
Crop & Variety:	Wheat, Calingiri
Seeding date:	3 June
Seeding rate	85 kg
The season:	
GSR April- Oct:	433mm
Rainfall decile at 31 October	3

Nitrogen treatments

Table 1: *Nitrogen (N) status and in-season nitrogen application (as specified by Yield Prophet) in comparison with normal farmer nitrogen application for that paddock.*

	Red sandy earth	**Yellow deep sand**	**Shallow loamy duplex**	**Brown deep sand**
Initial N status at 11 April	85kg	35kg	99 kg	31 kg
YP N applied	82kg	77kg	113 kg	106 kg
Usual farmer N application for this soil type	*80kg*	*49 kg*	*96 kg*	*78 kg*

RESULTS

Yield

Table 2: *Comparison of Yield Prophet simulated yield (with applied nitrogen) and actual yields.*

	Red sandy earth	Yellow deep sand	Shallow loamy duplex	Brown deep sand
YP simulated yield for soil type	2.8 t/ha	2.2 t/ha	6.7 t/ha	4 t/ha
Actual yield for soil type	3 t/ha	1.2 t/ha	4.85 t/ha	3.67 t/ha
Paddock average- Yield across all soil types in paddock	3 t/ha	1.5 t/ha	4.85 t/ha	2.8 t/ ha

FARMER COMMENTS

Usability of Yield Prophet

- High input requirement to get detailed data out, but once it is setup the online format is easy to use and generates good reports.
- Easy to use once you are familiar with the program.

Usefulness of Yield Prophet set-up process

- Farmers commented that the exercise of opening up a deep soil pit was on one the most informative and useful aspects of the Yield Prophet process.
- Good training with a consultant on how to use the tool was vital as well.

Yield Prophet reports

- Farmers had mixed comments about the reports with each having their favorite report- one farmer chose to use only the crop report to make his decisions.
- One farmer found the profit comparison report the most useful where as another found it the least useful report commenting ‘it is pretty obvious through the comparison report if the is likely to be a financial response, the seasonal risk is too great to compare nitrogen profitability to the last dollar.’
- Farmers found the climate and weather aspects to the crop report of interest, specifically the breakdown of chances of certain weather characteristics influencing yield, however in reality this didn’t really clarify decision making.
- The reports reference the Southern Oscillation Index (SOI) which is generally considered irrelevant to the Western Australia.
- Growth stages of crops were very accurate for all sites.

Other aspects that limited yield

- Three of the four sites experienced a three week dry spell that was accompanied by warm, weather at the beginning of September. The yield prophet crop reports at all three sites did not indicate that crop was experiencing moisture stress or heat shock. The three farmers commented separately that this dry spell had impacted the crop yield.
- One of the potential issues is the assumption of root growth and rooting depth. If there is low soil nutrition at depth it is likely that the roots are "lazy" during the growing season and don't go as deep as the model suggests. This would then affect the modeling of water use down the profile and water stress on the plant.
- One farmer generated a report on 26 September which indicated the crop was under moisture stress, however this did not convert to yield penalty in the crop report.

Future of Yield Prophet in West Midlands region

The low water holding capacity of sands in the West Midlands region means that the effect of short term dry spells has greater significance than total rainfall on production- this seems to be difficult to simulate in Yield Prophet.

Simulated yield on two out of the four sites was far from what would be considered an acceptable level of variation (1 t/ha for yellow sand and 1.85 t/ha for shallow loamy duplex). However the other two sites simulated yield very well.

Typical farm paddock of 60-70ha within the West Midlands region has multiple soil types present. At this stage Yield Prophet only allows the user to simulate one soil type per paddock. There is the ability to separately log each soil type however this requires a great deal of information input and the user has to pay a 'paddock' subscription for each soil type.

Unfortunately, there are very few soils classified in the West Midlands region, to WMG's knowledge the five soils classified as part of this project are the only fully characterized soils in the West Midlands region. This project has estimated that the cost of fully classifying a soil is $3,000. When there is so few soil types classified in the West Midlands region coupled with farmers having multiple soil types (sometimes more than a dozen) on their farm this cost is the key barrier to adoption of this tool in the West Midlands region.

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