Yield Prophet: 2013 Summary

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Key messages

- Yield Prophet formulates predictions based on historic climate information, rainfall to date, soil nitrogen and soil water.
- In 2013 the paddocks monitored achieved yields that were only a 20% probability when the calculations were first conducted in May.

Aim

1) To evaluate usefulness of the crop modeling tool Yield Prophet.
2) To improve understanding of how the tool works, its accuracies and limitations.

Background

Yield Prophet is a web based interface for the agricultural production simulation model (APSIM). It uses start of season information from the paddock (plant available water capacity, stored soil water and stored N) with real-time information from the paddock i.e. rainfall-to-date, sowing date and fertiliser management to simulate how the crop is growing. Using historical rainfall records it can predict how it may yield over a range of season finishes; this provides a forecast of the chance of achieving a certain yield at any point in time during the season. From this we can match inputs to these yield potentials. The accuracy of the forecasts depends highly on the soil type characterisation. The model does have limitations and will not take into account parameters such as weed burden and disease so the information presented is designed to only be used as a guide to help understand soil water and nitrogen dynamics.

In 2013 Yield Prophet was used in 5 paddocks across the Liebe area. Reports were sent through to all members via email throughout the year so that they could compare modeled paddocks to their own.

Results

Soil water

In 2013 all sites had rainfall at decile 1 (lowest 10% of rainfall totals on record) and our soils only filled to 30% of capacity (Figure 1). The red clay at Dalwallinu had the highest water holding capacity of the 5 sites with an ability to hold 164mm of water. On the 2nd July Yield Prophet predicted the soil was holding 37mm of water or 22% of capacity. The Sandy gravel at Wongan Hills is by comparison a very shallow soil and can only hold 66mm of water and on the 2nd July only held 5mm of water and thus putting the crop under stress.

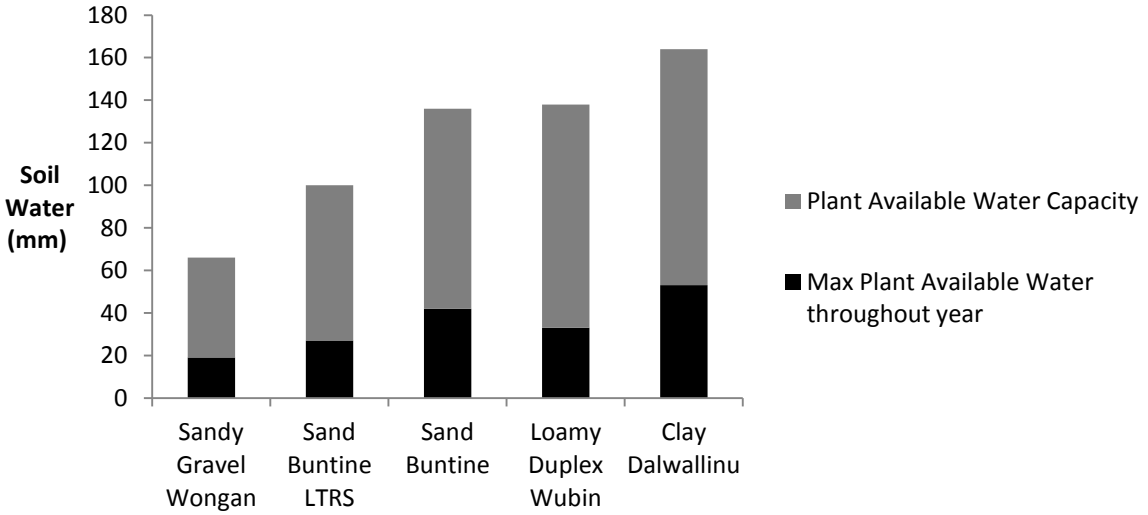

Figure 1: Plant available water capacity (PAWC) or size of the water bucket for each yield profit site in grey and the maximum volume of water that was achieved through any point in 2013.

Table 1: Yield outcomes and predictions for the five yield prophet sites in the Liebe area in 2013.

Site	Crop	Soil	Growing season rainfall April-October	Predicted yield 80% probability (July)	Predicted yield 80% probability (October)	Actual yield
Long Term Site, west Buntine	Barley	Yellow sandy earth	208	0.8	1.8	2
Dodd's, west Buntine	Wheat	Yellow deep sand	183	1	1.8	2.8
Carter's, east Wubin	Wheat	Red deep loamy duplex	137	1	1.2	1.6
Sewell's, Wongan Hills	Wheat	Duplex sandy gravel	232	1	2.2	2.5
Hyde's, Dalwallinu	Wheat	Red clay	242*	1.8	3.3	2.1

*Note rainfall amount taken from BOM Dalwallinu Comparison rain gauge.

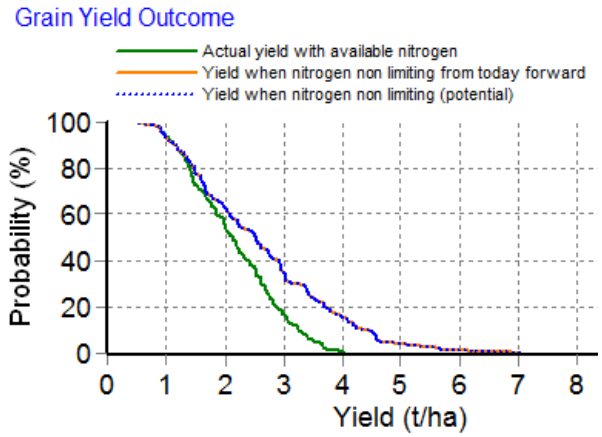

Figure 2: Yield probability curve for Carters loamy duplex on 17th July 2013.

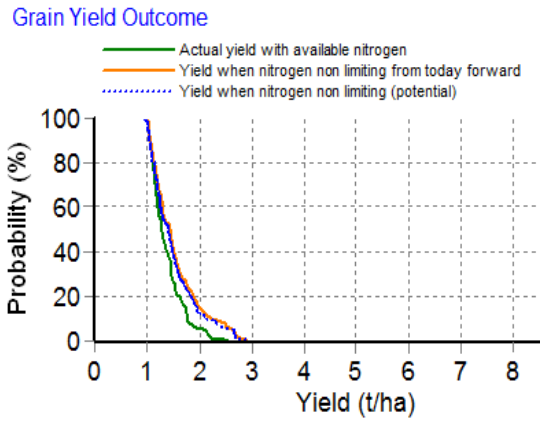

Figure 3: Yield probability curve for Carters on 2nd September 2013.

One of the factors influencing yield predictions in Yield Prophet is historic rainfall. At the beginning of a year a range of yield outcomes are possible because history shows rainfall could be anything from 70mm to 470mm. As the months pass the probability curve narrows because the plants possible yields become more certain as does the rainfall decile. In the case of Carter's site on the 17th July the yield (based on historic rainfall, soil type and seeding date) could have been anything from 0.5 t/ha to 4 t/ha depending on future rainfall (Figure 2). However, as the season progressed the range of possible yield outcomes decreases (Figure 3).

Nitrogen story

Large variability exists in the amount of nitrogen in each soil type. Baseline soil nutrient data is collected at the start of the season through soil testing. Then the model estimates the N usage by the plant as well as taking into account losses and gains through mineralisation. The red clay at Dalwallinu was predicted to be holding 265 kg/ha in July (Figure 4). The site received only 7 units of nitrogen at seeding and no follow up applications. In October the total soil N had reduced to 190 kg/ha (Figure 5). A large amount of this nitrogen was present below the rooting depth, the total plant available N is indicated as the 'current crop available N'. For this paddock the rooting depth was estimated by the farmer and the project officer and was entered into the model as 1800mm. At the Long Term Site at Buntine, 107 kg/ha of nitrogen was present in the soil in July (Figure 6), but by the end of October this had reduced to 57 kg/ha (Figure 7). This site did not have post emergent nitrogen application.

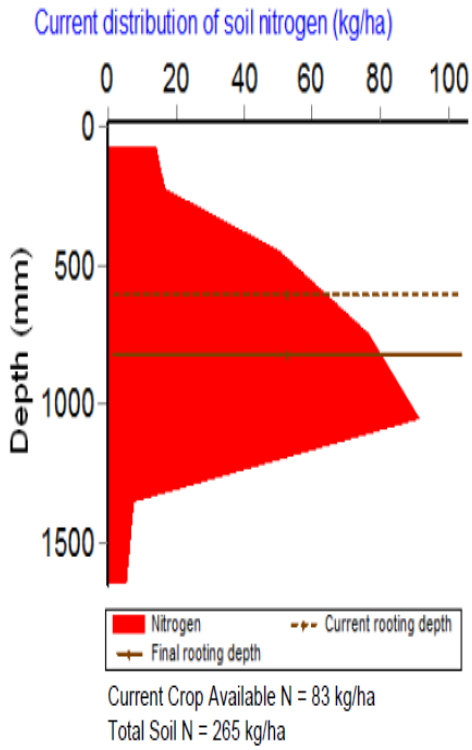

Figure 4: Soil nitrogen estimates generated by Yield Prophet for Hyde's, red clay at Dalwallinu in July 2013.

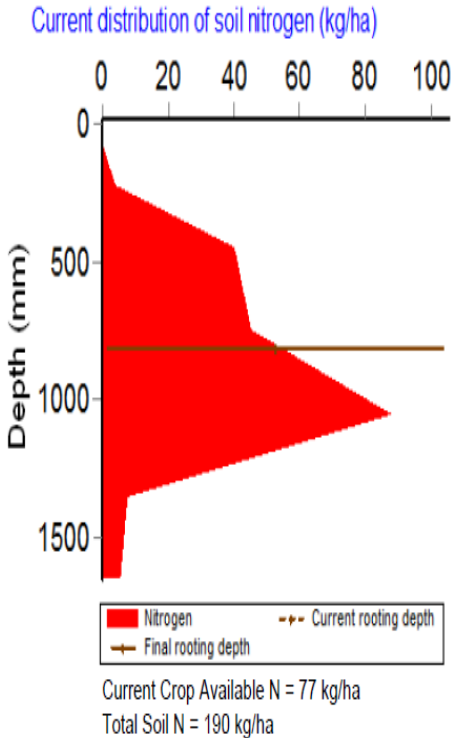

Figure 5: Soil nitrogen estimates generated by Yield Prophet for Hyde's, red clay at Dalwallinu in October 2013.

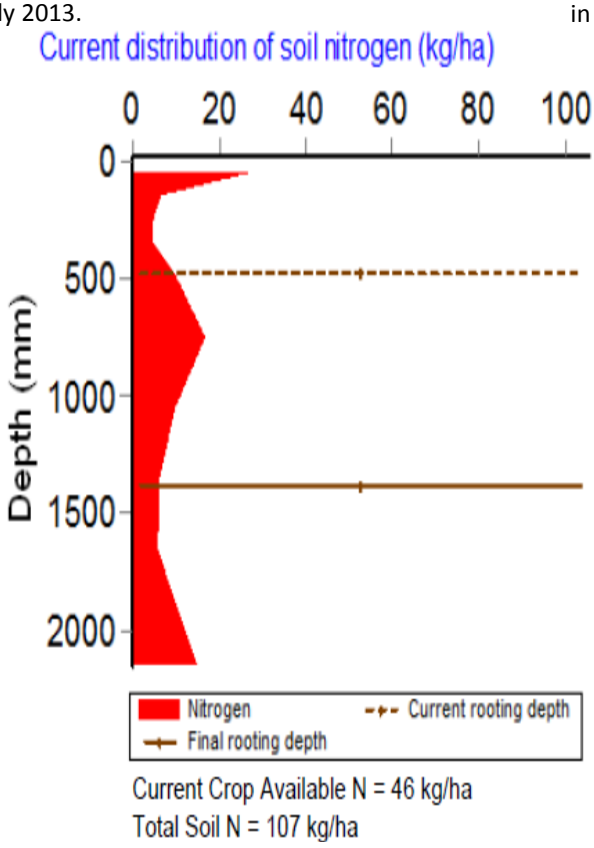

Figure 6: Soil nitrogen estimates generated by Yield Prophet for Dodd's yellow sand in Buntine in July 2013.

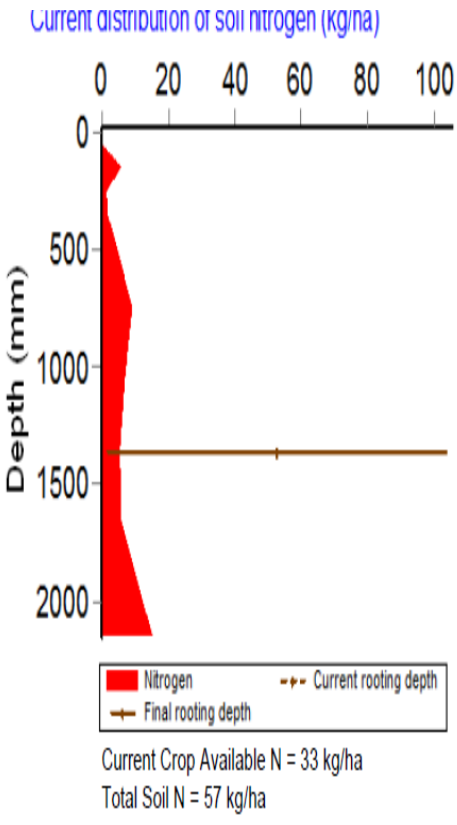

Figure 7: Soil nitrogen estimates generated by Yield Prophet for Dodd's yellow sand in Buntine in October 2013.

Comments

The Yield Prophet model contains a large amount of information and like any model, the information put out is only as good as the information that is put in and the interpretation that goes with it. In 2013, the final yields achieved, especially on the sandy sites, were within reason of the yield ranges given through the year. The soft finish certainly helped to push final yields over what the model estimated mid way through the year.

The model does have limitations and will not take into account agronomic issues such as weed burden, non wetting soils and disease incidence. It also models just one point in the paddock which makes it difficult to estimate whole paddock yields especially in duplex soils where the depth of soil can change rapidly across a large paddock.

As a tool, where its greatest value lies will be up to the individual growers and their specific farming operation and decision making processes. It can help to provide some more information to assist with a nitrogen decision through the year, it may also help to assist with planning sowing times and yield potentials and it potentially could provide reassurance around a marketing decision.

So at this end it has been important for the Liebe Group to provide as much information about how the tool works and what its limitations are, but where its final on-farm value is, is really up to the individual growers and their decision making.

Acknowledgements

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