UNFS Yield Prophet in 2015

Author: Barry Mudge
Funded By: GRDC Stubble Initiative, Emerald Grain and participating land owners
Project Title: UNFS Yield Prophet
Project Duration: 2015 cropping season
Project Delivery Organisation: Barry Mudge Consulting

Key Points:
- **The UNFS delivered the Yield Prophet program on 10 sites throughout the Upper North in 2015**
- **In the majority of cases, Yield Prophet provided a good indication of yield prospects during the season. On some sites, yield predictions were compromised by the hot finish to the season**
- **The information provided by Yield Prophet can be useful in adjusting inputs (mainly Nitrogen) as the season evolves**

Project Report:

Background
Thanks to on-going sponsorship from Emerald Grain, Yield Prophet was run across the Upper North again in 2015. A total of 10 sites were selected with deep soil sampling undertaken at the start of May. Soils were analysed for moisture content and nitrogen along with other parameters to enable the appropriate soil to be selected for the Yield Prophet program. The program was then set up for each of the sites. Outputs were regularly updated throughout the season, with results e-mailed to members.

How Does Yield Prophet Work
Yield Prophet is the web-based interface which allows users to access outputs from the crop production model, APSIM. Inputs include detailed soil characterisation information along with measurements of soil water and deep nitrogen status at the start of the season. Specific crop information (sowing date, variety, fertiliser applications etc.) along with daily rainfall data are then entered for each site to provide updated estimates of yield expectations if historical rainfall patterns are repeated (see Figure 1). So it is important to recognise that the results are very specifically location based- these can then be extrapolated to other locations based on knowledge of the particular characteristics of each location.

Yield Prophet can provide an estimate of yield expectations as we move through the season, which can be used to aid management decisions (e.g. value of fungicide applications) and possibly giving more confidence in forward marketing of grain. YP also provides an ongoing estimate of the Nitrogen status of the crop and can be used to assess the value or otherwise of applying additional N.

The cost to run Yield Prophet in 2015 was an annual subscription of $180 ($120 if a member of BCG Cropping Group) plus the cost of the soil sampling. Once the subscription has been made, there is no limit on the number of times the information can be updated throughout the year. In 2015, the UNFS Yield Prophet program was funded through generous sponsorship from Emerald Grain, plus a $200 contribution from growers whose paddocks were included in the program.
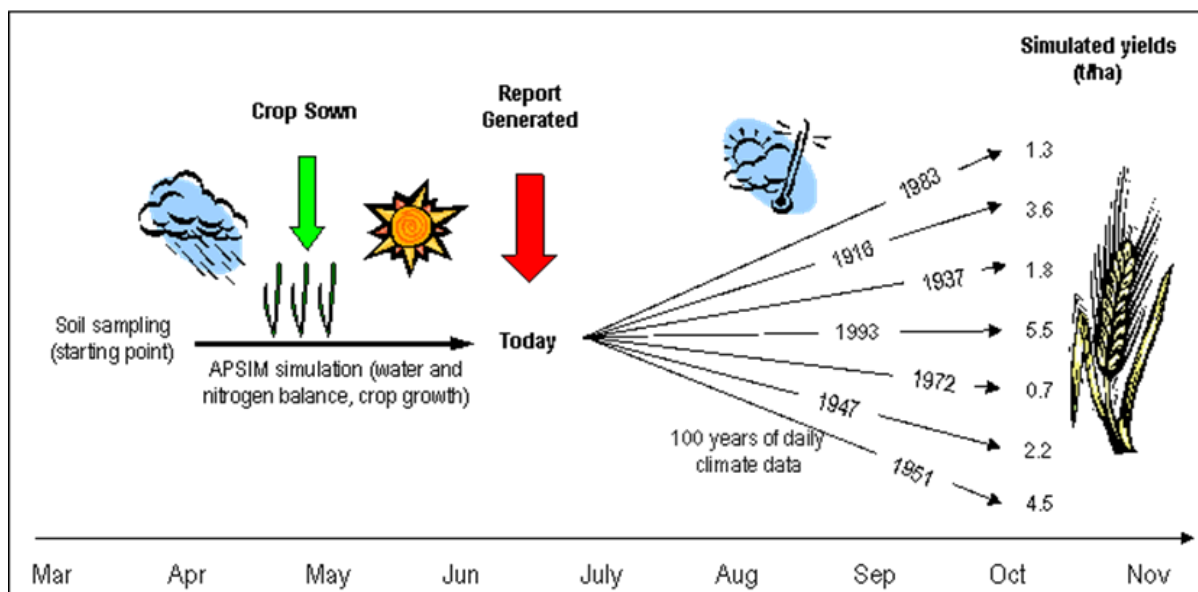
Figure 1. Diagrammatic representation of Yield Prophet

How did Yield Prophet perform in 2015

In previous seasons, Yield Prophet has been shown to be quite good at predicting crop yields in a range of seasons.

In 2015, starting soil moisture levels varied considerably across the region. Some properties had experienced excellent falls in April which had followed on some big rains (in parts) in January. Rainfall early in the growing season in all locations being tested was at least Decile 5 and in many instances (particularly in the north east) was well above average. Generally early sowing saw advanced crop stages. All this added up to the Yield Prophet model showing some impressive potential yields if good seasonal conditions were received for the rest of the season. However, there were two potential sleepers- The first was that on most sites, nitrogen levels were modest or low and the model showed that this would restrict crop yields in average or better seasons. In several cases, the N levels were so low that the model predicted that even a below average season would see yields restricted by N supply. The other sleeper was the potential impact that the El- nino weather pattern would have on winter and spring rainfall.

Seasonal conditions remained favourable through winter. By late August, all sites showed above average seasonal rainfall to date with some sites well above average. Then a dryish September followed by a very hot period early in October severely affected any crops which were not well advanced into grain fill. Generally, crops east of the ranges were most affected with crops west of the ranges sufficiently advanced prior to the hot spell to protect yield potential.

UNFS Yield Prophet site locations in 2015 are shown in Figure 12. Individual comments plus a review of the performance of YP at each site now follows- also included is a summary of the output from the model over the course of the season. Each figure shows the 10th, 50th and 90th percentile of predicted yield (for each date that the model was run) along with the actual yield obtained at each site. To interpret these results, and as an example, the 90th percentile yield shows that yield which is expected to be equalled or exceeded in 90 years out of 100. This changes as the season evolves with inclusion of more seasonal information- the three lines eventually converge at the completion of the season with the convergent point being the final yield prediction.

McCallum (7km south east of Morchard)- This was a paddock just east of Richards house. Emu Rock wheat back on pasture from last year. The paddock had good yield potential but model showed early on that additional Nitrogen would be required if the season was favourable. Additional 23kg/Ha of N was applied in early July which saw yield potential improve. The model suggested the final yield would be around 2.4 tonne/Ha- actual final yield of 1.64 tonne/Ha (AGP Quality- 6.9% screenings) was clearly affected by the poor finish to the season.
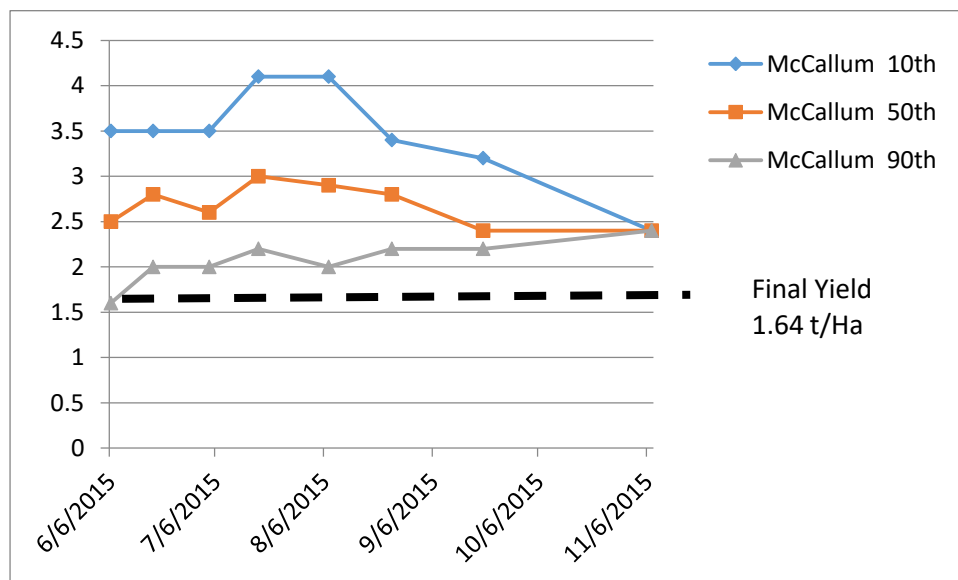

Figure 2. Yield potential (as measured by the 10th, 50th and 90th percentile) over the season and final yield for the McCallum site 7 km south east of Morchard

Barrie (2 km north Willowie)- Katana wheat back on canola stubble. This is a highly variable paddock with soil constraints at depth which impact crop yields. Final crop yield in the area sampled for Yield Prophet was estimated by Peter at around 2.0 tonne /Ha which was in line with model predictions.
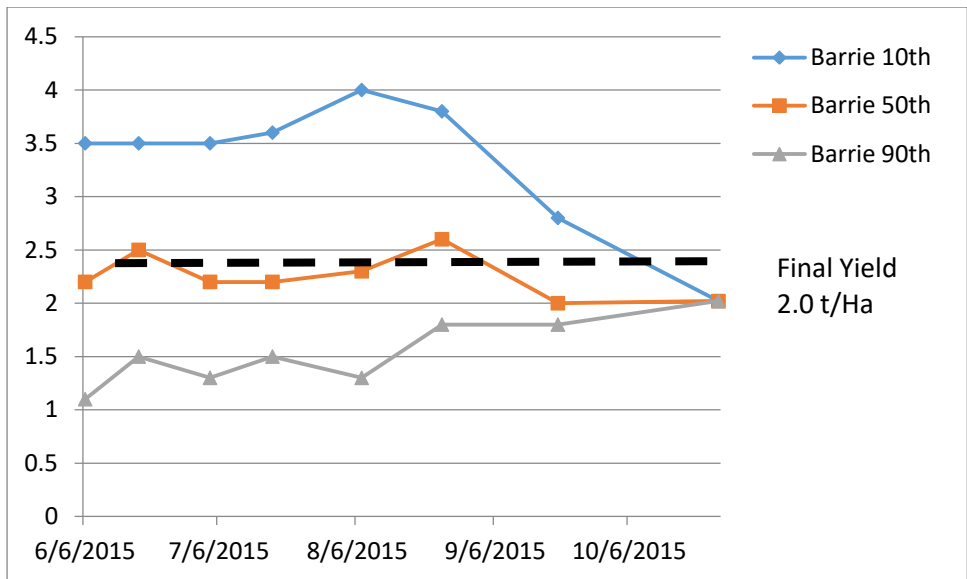
Figure 3. Yield potential (as measured by the 10ᵗʰ, 50ᵗʰ and 90ᵗʰ percentile) over the season and final yield for the Barrie site 2 km north of Willowie

Catford (10 km north of Morchard at Poverty Corner)- Katana wheat back on wheat stubble. This site showed very good levels of Plant Available Water (PAW) early in the season following very good January rains. Additional N was applied early in July which saw yield predictions improve. The model indicated that the final yield prediction of 1.89 t/Ha was still compromised by a lack of N. The actual final yield was 2.5 tonne/Ha of ASW quality which also suggests some yield compromise due to inadequate nutrition.
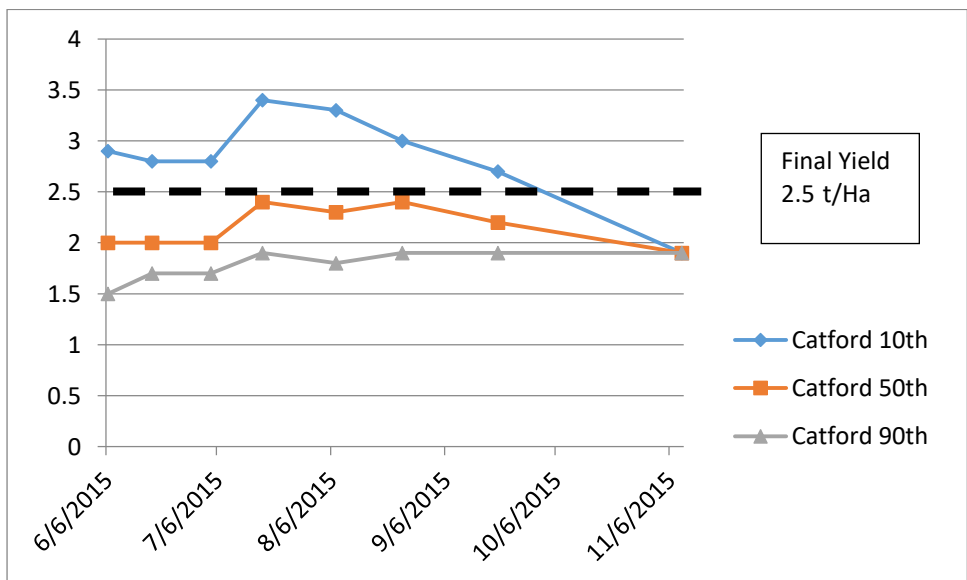

Figure 4. Yield potential (as measured by the 10ᵗʰ, 50ᵗʰ and 90ᵗʰ percentile) over the season and final yield for the Catford site 10 km north of Morchard

Crouch (25 km south of Port Pirie at Wandearah)- Kord wheat back on chickpea stubble. This area struggled for early season rainfall but had quite reasonable winter rains. Final growing season rainfall still was only around Decile 5. Chris and Graeme applied two applications of in-season N and predicted yield climbed steadily. The paddock showed a lot of variability in the final yield result- paddock average was 2.3 tonne/Ha but Chris indicated

that the area sampled would have yielded much better- perhaps 3.0 to 3.2 tonne/Ha which is close to predictions.
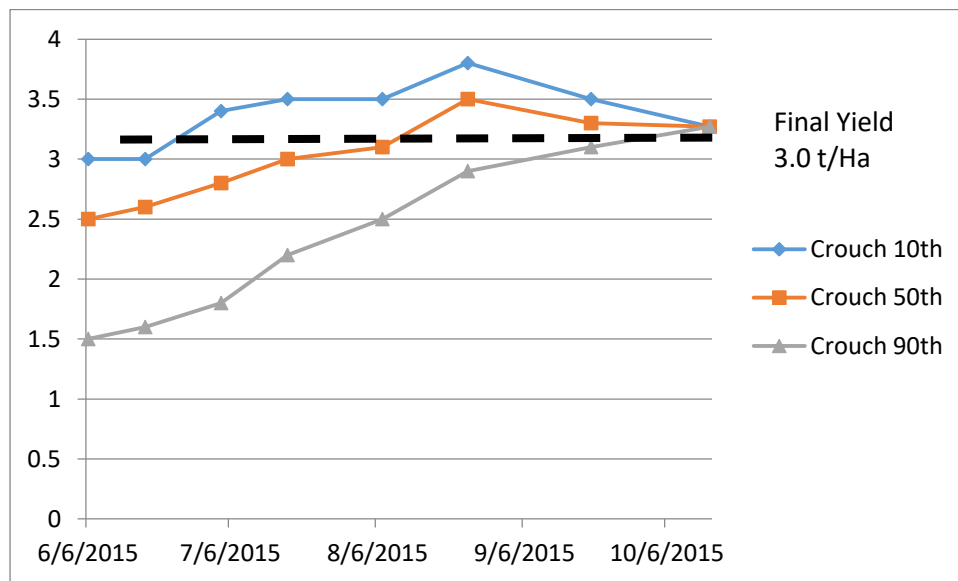

Figure 5. Yield potential (as measured by the 10th, 50th and 90th percentile) over the season and final yield for the Crouch site 25 Km south of Port Pirie

Heaslip (2 km north east of Appila on main Booleroo road)- Paddock showed good yield potential early but appeared to be lacking in N. Jim applied two additional N applications in July which lifted yield predictions considerably. However, yield predictions later in the season began to decline as the season closed off. The paddock final yield was 2.3 tonne/Ha of mainly ASW but with some AGP due to high screenings.
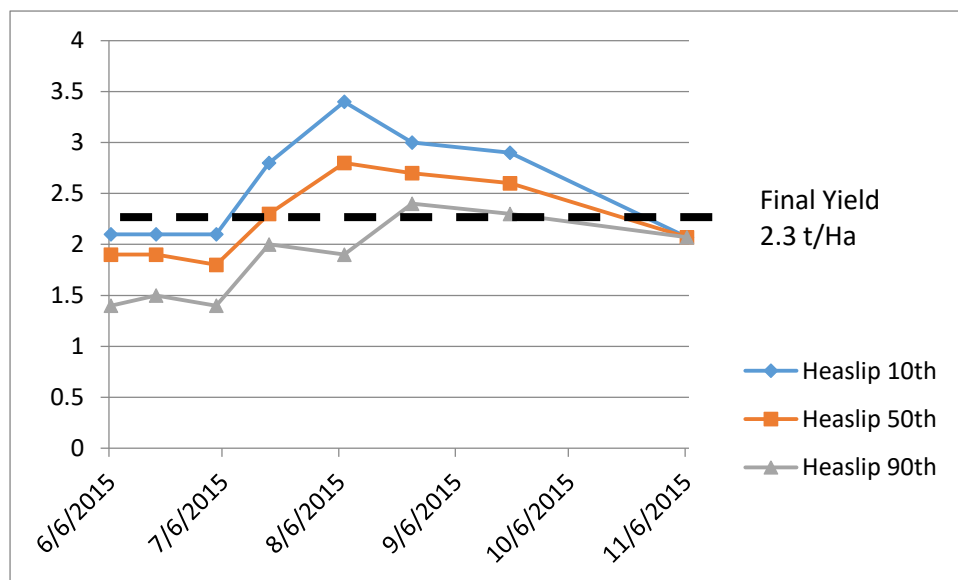

Figure 6. Yield potential (as measured by the 10th, 50th and 90th percentile) over the season and final yield for the Heaslip site 2 Km north-east of Appila

Mudge (9 km north of Port Germein)- Mace wheat back on a spray fallowed medic crop in 2014. This was a paddock on the west side of the main highway which was reasonably favoured by early season rains and showed good PAW. It also showed reasonable good levels of available N, although the high yield potential indicated that additional N would be

beneficial. No additional N was applied. Final crop yield of 4.2 tonne/Ha was close to the predicted yield of 4.3 tonne/Ha. Interestingly, the model predicted a final yield of 4.9 tonne/Ha if additional N had been applied.
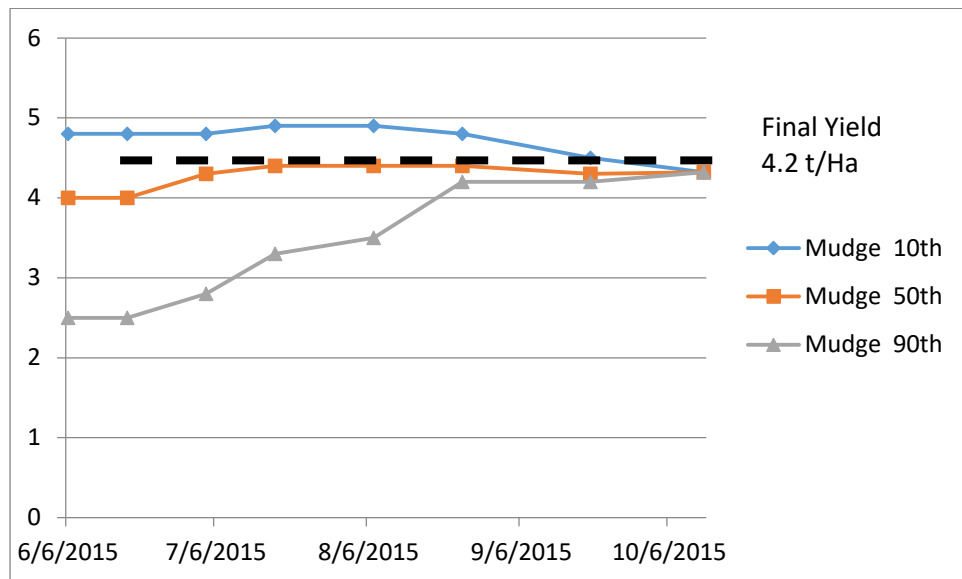

Figure 7. Yield potential (as measured by the 10th, 50th and 90th percentile) over the season and final yield for the Mudge site 9 Km north of Port Germein

Pole (5 km south east of Port Germein)- Mace wheat back on a grassy medic pasture in 2014. This was the site of the UNFS Barley Grass trial looking at the influence of crop competition on barley grass suppression. The site had reasonable growing season rainfall but showed quite low initial N which was not fully covered by additional applications. Final predicted yield based on N as applied was around 2.7 tonne/Ha- this was significantly lower than the prediction of 3.1 tonne/Ha if additional N had been applied. Actual final yield for wheat at this site was 2.1 tonne/Ha which may have been compromised due to possible presence of root disease (final yield of Fathom barley at the same site was 3.5 tonne/Ha).
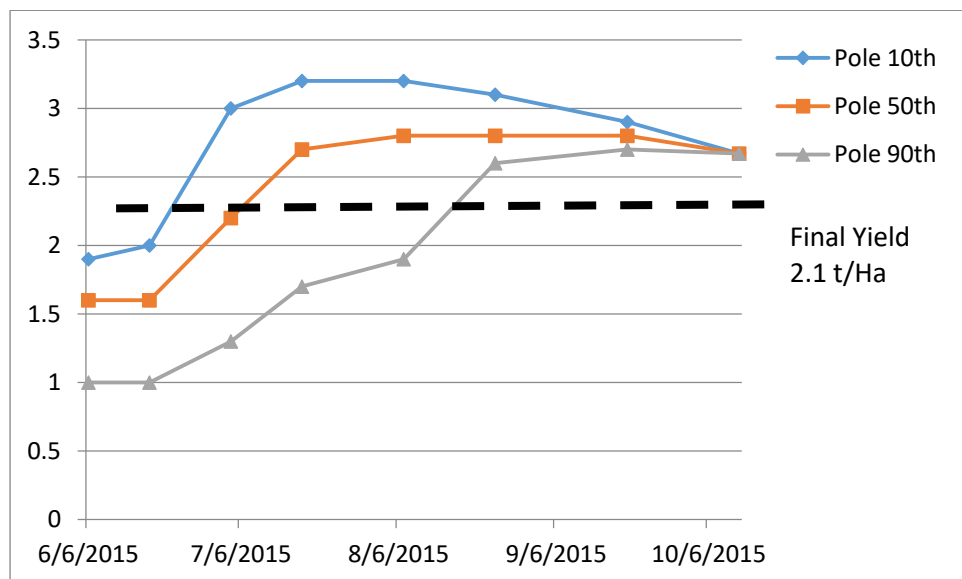

Figure 8. Yield potential (as measured by the 10th, 50th and 90th percentile) over the season and final yield for the Pole site 5 Km south-east of Port Germein

Berryman (7 km north east of Wirrabara)- Scout wheat on canola. This is high rainfall country which showed good yield potential during the season, but with the model showing a significant drop off in yield as the season finished poorly. The final predicted yield was (only) around 3.1 tonne/Ha- and while the paddock was quite variable, Dustin suggested that the predicted yield was 0.5-1.0 t/Ha below actual. This may have been due in part to the fact that the model used Booleroo Centre's (a drier location?) rainfall records for its calculations.
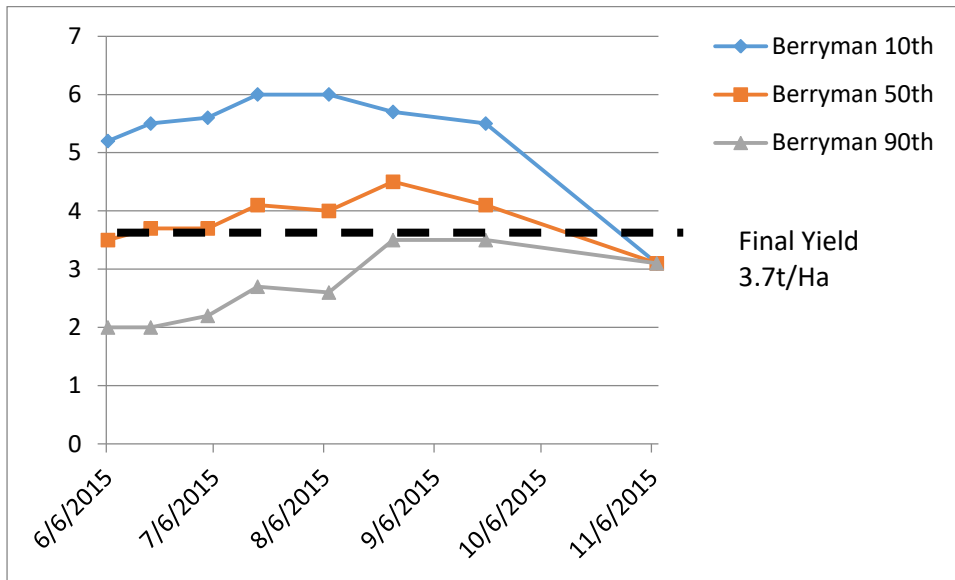

Figure 9. Yield potential (as measured by the 10th, 50th and 90th percentile) over the season and final yield for the Berryman site 7 Km north-east of Wirrabara

Foulis (3 km north of Wilmington)- Mace wheat back on wheat. This site had very good early and mid-season rainfall and showed high yield potential. Matt backed this up with some good levels of urea applications with yield predictions continuing to improve through the season. Unfortunately, the final yield was compromised by the hot and dry finish- final crop yield was 2.85 tonne/Ha of AGP against a predicted yield of 4.0 tonne/Ha. Interestingly, an adjoining wheat crop which had less urea applied went 1.0 tonne/Ha better.
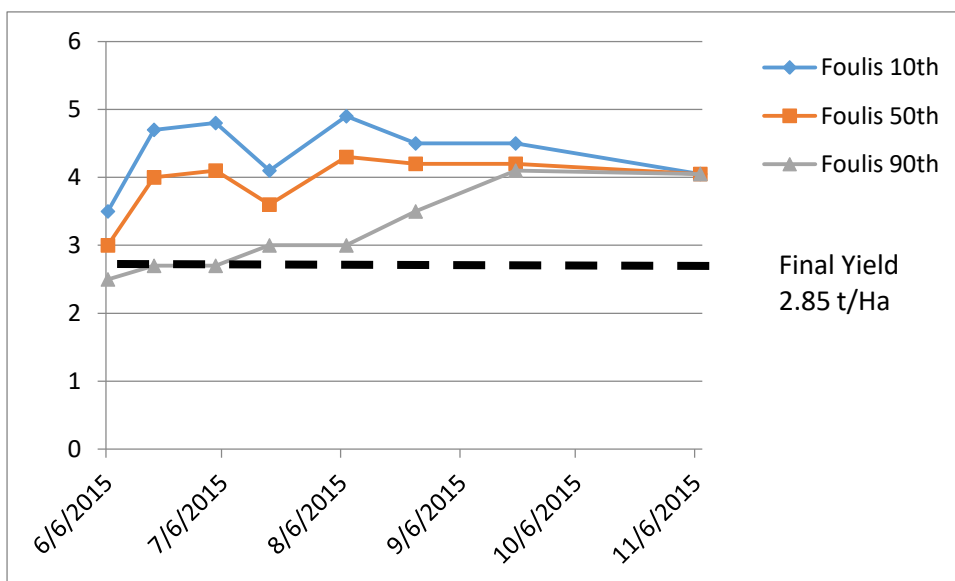
Figure 10. Yield potential (as measured by the 10th, 50th and 90th percentile) over the season and final yield for the Foulis site 3 Km north of Wilmington

Kuerschner (just east of Black Rock)- Katana wheat back on wheat stubble. Site received about 100 mm of rainfall in an April event and should have shown high levels of PAW when tested. However, the soil tests only showed wet soil down to about 40 cm, which was a mystery but may reflect variability across the paddock. In any event, predicted yields remained at moderate levels through the season, with additional N applied in late July lifting predicted yields considerably. Final predicted yield of 1.8 tonne/Ha was significantly lower than the actual achieved of 2.6 tonne/Ha which may have reflected the issue raised with the initial soil testing.
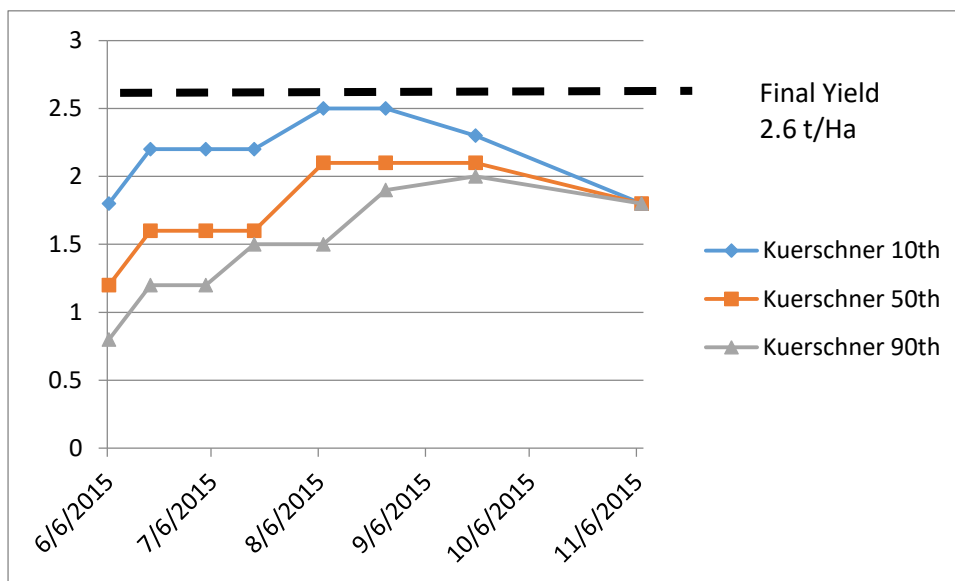

Figure 11. Yield potential (as measured by the 10th, 50th and 90th percentile) over the season and final yield for the Kuerschner site at Black Rock

Summary and Conclusions
In most cases in 2015, on the 10 sites used in the Upper North, Yield Prophet provided a reasonable estimate of yield potential as the season evolved. The less than favourable finish to the season compromised some sites, particularly those at a vulnerable crop stage during the extreme heat event in early October. However, Yield Prophet remains a useful tool to assist with in-crop input decision making particularly in-season Nitrogen applications.

Barrie (2 km N of Willowie)

Catford (10 km N Morchard)

Foulis (3 km N of Wilmington)

McCallum (7 km S/E Morchard)

Mudge (9 Km N Pt Germein)

Kuerschner (Black Rock)

Pole (5 km S/E Port Germein)

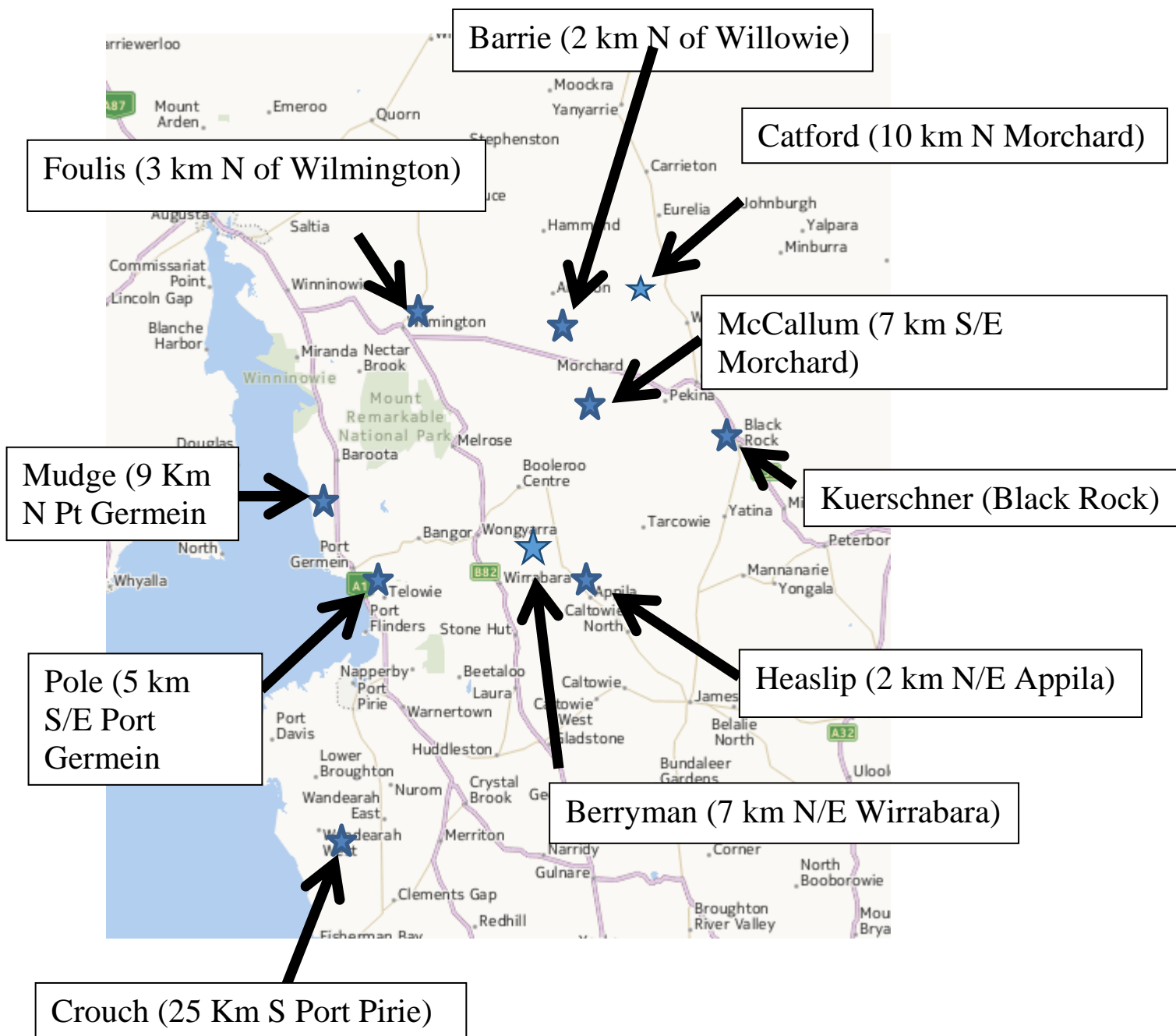Heaslip (2 km N/E Appila)

Berryman (7 km N/E Wirrabara)

Crouch (25 Km S Port Pirie)

Figure 12. Yield Prophet- Site locations in 2015