Yield Prophet 2004
Summary of subscriber results

Introduction

In 2004, access to APSIM simulations were made available through the Yield Prophet web interface for the first time. Forty-seven individual growers, seven grower groups and three researchers subscribed to the Yield Prophet on-line simulation service. The regions represented included high rainfall WA, northern NSW, the Riverina, various regions of SA, and the Victorian Western District, Wimmera and Mallee. Service use varied among subscribers from those who generated a handful of reports, to Yield Prophet junkies who generated a few reports each week for the entire season! A big thankyou must go to all subscribers in 2004 for their enthusiasm, patience and interest.

Most subscribers to the Yield Prophet are in a 'evaluation' phase of use. This summary aims to inform subscribers in 2004, and potential subscribers for 2005 of how the Yield Prophet performed in all regions of Australia, where its strengths and weaknesses currently lie, and ways in which it will be improved for 2005.

Firstly, a word on the presentation of results. The accuracy with which the output from models fits observed data is often presented as a scatterplot of predicted results versus observed results (e.g. Figure 1). If a model is perfectly accurate, the data points will form a straight line that passes through the origin of the chart, and has a gradient of 1 (i.e. a linear function of the form y=x). The 'accuracy' of the model is often judged using an R^2 value calculated from simple linear regression of the data points. This value indicates how much the data points deviate from a straight line of best fit. The line is fitted to give the smallest amount of deviation possible. An R^2 value of 1 is a perfect fit, and values above 0.6 are usually considered to indicate a reasonable fit. Other statistical methods are sometimes used to determine how different the fitted function is to a straight line of the form y=x, which gives an indication of model precision. Using linear regression to assess model accuracy has several flaws. Firstly, it is easily biased by the location of data points - extremely high or low points will make the R^2 value high, even if most of the data points deviate from a straight line (e.g. Figure 2). Secondly, it's just not the best way of presenting the data! A table or graph showing how each simulated result differed from the observed result gives a much better indication of how the model is performing, and is easier to understand. The results from Yield Prophet 2004 have been presented using both methods so you can compare the two.

Results and Discussion

The nationwide performance of Yield Prophet in predicting crop yields was quite good, with a good relationship between predicted and observed yields (Figure 1). However, this relationship is principally strong due to the high yield results from Victoria (Table 1, Figure 2), and the low yield results from northern NSW (Table 2, Figure 3). This is not to say that the results aren't good! In northern NSW, good soil characterisation and a relatively orthodox growing season resulted in particularly accurate predictions. On the other hand, things were not so rosy in Victoria. After one of the driest summers on record, a late break and modest in-season rainfall meant that at the start of spring, most regions were expecting average crops at best. And then came October. Unseasonal heat, drought and frosts decimated crops that were already running low on water. These conditions had some rather strange physiological effects on the wheat crops subjected to them. Some appeared to die, only to sprout tillers after rains in November, which then did not ripen until late January. Many crops presented growth habits indicative of 1.5 to 3 t/ha yields prior to harvest, but yielded a depressing 0.5 -1 t/ha once the headers pulled in. Spikelets in these crops were fully formed on the outside, but often completely empty. The popular theory is that the hot weather in early October had sterilised the pollen. Yield Prophet predicted that most crops in the Wimmera and Mallee would yield

between 1-3 t/ha. However, as Table 2 shows, many crops yielded less than 1 t/ha, and most less than 1.5 t/ha.

So where did it go wrong for Yield Prophet in Victoria? Basically, the effect of high temperatures and frost on water stressed and flowering wheat crops is not well understood or quantified, and hence not incorporated into the APSIM model on which Yield Prophet is based. Also, APSIM will not perform as well when a crop is highly water stressed (as most were for all of October), as the effects of small errors and variation in soil water measurement and characterisation will be magnified. It is also worth pointing out that the regression in Figure 2 is quite misleading as a test of model accuracy, as it is made to look a lot better by the two highest yielding crops (4.8 and 8.0 t/ha) in the state. These crops were at Lake Bolac in the Western District and on irrigation at Serpentine respectively. Unfortunately, a good soil characterisation was not available for the soils at Lake Bolac, and Yield Prophet under-predicted yield by 1.2 t/ha with the rough guesstimation that was used. However, a good soil characterisation was available for Serpentine, and Yield Prophet responded with a pleasingly accurate prediction of 7.4 t/ha.

The lack of good soil characterisation data was also responsible for poor model performance in the Riverina (Table 3). In South Australia, some paddocks performed well, but others were subject to the same problems that affected Victoria (Table 4, Figure 4). In Western Australia, frost affected both paddocks to the extent indicated in Table 5.

Conclusions

So, lessons learned from this year's Yield Prophet? The results from 2004 show that Yield Prophet will work exceptionally well as long as it is provided with good soil characterisation data and a reasonably orthodox growing season. Unfortunately, we can't do much about the latter, but APSRU and BCG are doing their best to ensure that a good soil characterisation is available for all subscribers in 2005.

Yield Prophet 2005

A new version of Yield Prophet is currently under development for the coming season, and it will feature several interesting developments. The biggest difference will be that it has been expanded to include barley and sorghum as available crops, which has been a common request from subscribers in the past year. It will also feature a few new reports. The first of these will be a Sowing Date x Variety report, which will enable users to compare the effect of three different sowing date and variety scenarios on yield and flowering time probability outcomes. The second will be a report for calculating soil water and nitrogen balances under fallows. The third is aimed at irrigation farmers and will assist in irrigation scheduling. A nitrogen gross-margin report that calculates likely return based on urea and grain prices is also being developed. Further support for Yield Prophet will be provided through an on-line discussion forum, regional workshops and an interactive 'Ask the Prophet' page.

If you wish to improve the delivery of Yield Prophet in 2005, or have suggestion and ideas that you think will make Yield Prophet better, please take the time to complete the on-line survey at www.yieldprophet.com.au. You will have also received a copy of the survey with this report, which you can fill out in hard copy and return to the BCG office if you would prefer.

If you wish to subscribe to Yield Prophet in 2005, you can do so on-line at www.yieldprophet.com.au, or complete a registration form (downloadable from www.bcg.org.au) and return to the BCG office by 21 March. If you would like more information or have any questions regarding Yield Prophet, please contact;

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Table 1. Yield and protein of crops simulated by Yield Prophet in Victoria.

Grower	**Observed Yield**	**Yield Prophet Yield**	**Yield Difference** (Observed - Yield Prophet)	**Yield % Error** (Difference x 100/ Observed)	**Observed Protein**	**Yield Prophet Protein**	**Protein Difference** (Observed - Yield Prophet)	**Protein % Error** (Difference x 100/ Observed)	**Comment**
Barber	-	-	-	-	-	-	-	-	Crop sprayed out
Dunlop	1.4	1.9	0.5	36	11.8	12.3	0.5	4	Heat and Drought
Ferrier	0.3	1.2	0.9	93	16.5	13.7	-2.8	17	Heat and Drought
Flett	1.3	1.5	0.2	15	12.5	10.6	-1.9	15	Heat and Drought
Gellatly	1.6	1.5	-0.1	6	12.3	8.1	-4.2	34	Heat and Drought
Gregson	1.4	1.4	0.0	0	10.8	8.4	-2.4	22	Heat and Drought
Hedt	0.3	1.3	1.0	319	17.0	9.9	-7.1	42	Heat and Drought
Hunt	1.3	2.0	0.7	54	15.3	12.6	-2.7	18	Heat and Drought
James	8.0	7.4	-0.6	8	11.5		-11.5	100	
Kelly	1.8	1.4	-0.4	22	-	13.5	-	-	Heat and Drought
Knight	1.2	2.2	1.0	83	15.5	14.2	-1.3	8	Heat and Drought
Martin, B	0.9	1.5	0.7	77	13.9	11.5	-2.4	17	Heat and Drought
Martin, L	0.1	1.2	1.1	900	16.0	16.0	0.0	0	Heat and Drought
Martin, P	0.9	1.2	0.3	30	16.4	15.2	-1.2	7	Heat and Drought
McClelland	0.3	1.4	1.1	367	14.5	12.8	-1.7	12	Heat and Drought
McCrow	6.1	4.8	-1.3	21	11.5	9.6	-1.9	17	No soil characterisation
McQueen	1.3	1.6	0.3	23	14.0	14.1	0.1	1	Heat and Drought
Patton	0.4	1.7	1.3	325	12.7	11.2	-1.5	12	Heat and Drought
Postlethwaite	1.0	1.8	0.8	80	14.8	10.2	-4.6	31	Heat and Drought
Quick	0.1	0.8	0.7	700	16.0	9.2	-6.8	43	Heat and Drought
Sait	1.0	2.0	1.0	100	13.0	8.8	-4.2	32	Heat and Drought
Schlitz	1.2	2.1	0.9	72	11.3	14.3	3.0	27	Heat and Drought
Simpson	0.8	0.9	0.1	10	16.0	13.2	-2.8	18	Heat and Drought
Smith	0.7	1.0	0.4	54	14.0	10.0	-4.0	29	Heat and Drought
Taylor	2.5	1.9	-0.6	24	13.0	13.0	0.0	0	Heat and Drought
Walch	1.2	-	-	-	14.0	-	-14.0	100	
Warne	1.6	1.2	-0.4	25	12.0	13.2	1.2	10	Heat and Drought
Weidemann	0.9	2.8	1.9	211	15.5	10.9	-4.6	30	Frost, Heat and Drought
Whykes*	1.0	1.6	0.6	64	13.3	9.3	-4.0	30	Soil changed
Williamson	2.0	1.8	-0.2	10	11.0	7.6	-3.4	31	Heat and Drought

*simulation run using different soil characterisation to that used during the season

Table 2. Yield and protein of crops simulated by Yield Prophet in New South Wales.

Grower	**Observed Yield**	**Yield Prophet Yield**	**Yield Difference** (Observed - Yield Prophet)	**Yield % Error** (Difference x 100/ Observed)	**Observed Protein**	**Yield Prophet Protein**	**Protein Difference** (Observed - Yield Prophet)	**Protein % Error** (Difference x 100/ Observed)	**Comment**
Arnott (1)	4.3	4.8	0.5	12	10.6	12.1	1.5	14	Rain and wind ≈ - 0.5t/ha
Arnott (2)	4.1	3.5	-0.6	14	10.6	8.7	-1.9	18	Rain and wind ≈ - 0.5t/ha
Arnott (N test)	5.4	5.7	0.3	6	10.6	13.4	2.8	26	Rain and wind ≈ - 0.5t/ha
Ball	-	-	-	-	-	-	-	-	
Carter	7.8	8.2	0.4	4	-	14.5	-	-	5.2 t/ha plus 50% hail
Manchee	3.7	4.1	0.4	10	13.5	13.0	-0.5	4	Tipping of heads
McDonald	5.7	6.0	0.3	5	10.6	11.8	1.2	11	Wind damage ≈ - 0.1t/ha
Orchin	-	-	-	-	-	-	-	-	
Pegela Pastoral Co.	3.8	-	-	-	-	-	-	-	
Simson	-	-	-	-	-	-	-	-	
Wilson	3.8	4.0	0.3	7	12.9	14.2	1.3	10	
Walgett Sustainable Agriculture Group	3.4	Between 2.5 and 4.1	-	-	-	-	-	-	

Table 3. Yield and protein of crops simulated by Yield Prophet in the Riverine Plains.

Grower	**Observed Yield**	**Yield Prophet Yield**	**Yield Difference** (Observed - Yield Prophet)	**Yield % Error** (Difference x 100/ Observed)	**Observed Protein**	**Yield Prophet Protein**	**Protein Difference** (Observed - Yield Prophet)	**Protein % Error** (Difference x 100/ Observed)	**Comment**
Harmer	3.6	2.5	-1.1	30	12.7	13.7	1.0	8	
Matthews	2.6	4.0	1.4	56	14.0	12.4	-1.6	11	Heat

Table 4. Yield and protein of crops simulated by Yield Prophet in South Australia, difference between simulated and observed and percentage error.

Grower	Observed Yield	Yield Prophet Yield	Difference (Observed - Predicted)	% Error (Observed - Predicted / Observed)	Observed Protein	Yield Prophet Protein	Difference (Observed - Predicted)	% Error (Observed - Predicted / Observed)	Comment

Table 5. Yield and protein of crops simulated by Yield Prophet in Western Australia.

Grower	Observed Yield	Yield Prophet Yield	Yield Difference (Observed - Yield Prophet)	Yield % Error (Difference x 100/ Observed)	Observed Protein	Yield Prophet Protein	Protein Difference (Observed - Yield Prophet)	Protein % Error (Difference x 100/ Observed)	Comment
Appleyard	4.1	4.6	0.5	12	11.7	11.5	-0.2	2	Frost ≈ 0.3 t/ha
Michael	2.6	3.5	1.0	37	13.0	12.9	-0.1	1	Frost ≈ 1.1 t/ha

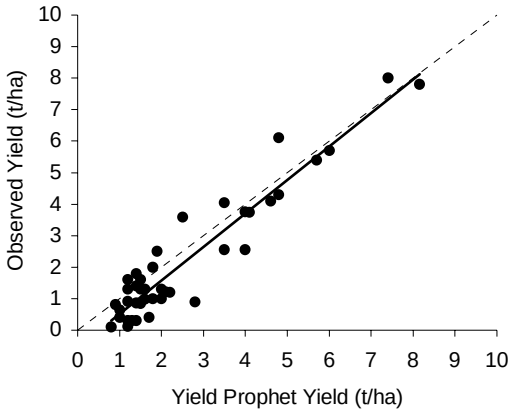

Figure 1. Observed yield vs. Yield Prophet simulated yield from across Australia (•). Fitted linear function (—) of form y=1.06x - 0.55 (R^2= 0.90). Linear function of form y=x (---).

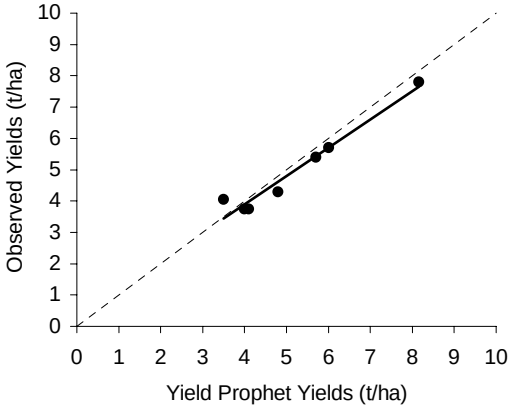

Figure 3. Observed yield vs. Yield Prophet simulated yield from northern New South Wales (•). Fitted linear function (—) of form y=0.90x - 0.29 (R^2= 0.96). Linear function of form y=x (---).

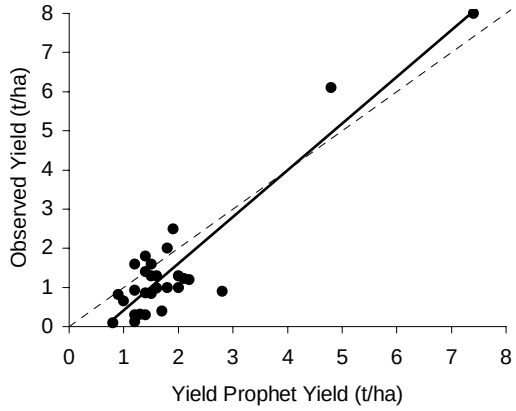

Figure 2. Observed yield vs. Yield Prophet simulated yield from all regions of Victoria (•). Fitted linear function (—) of form y=1.19x - 0.78 (R^2= 0.85). Linear function of form y=x (---).

Figure 4. Observed yield vs. Yield Prophet simulated yield from South Australia (•). Fitted linear function (—) of form y=?.??x - ?.?? (R^2= 0.??). Linear function of form y=x (---).