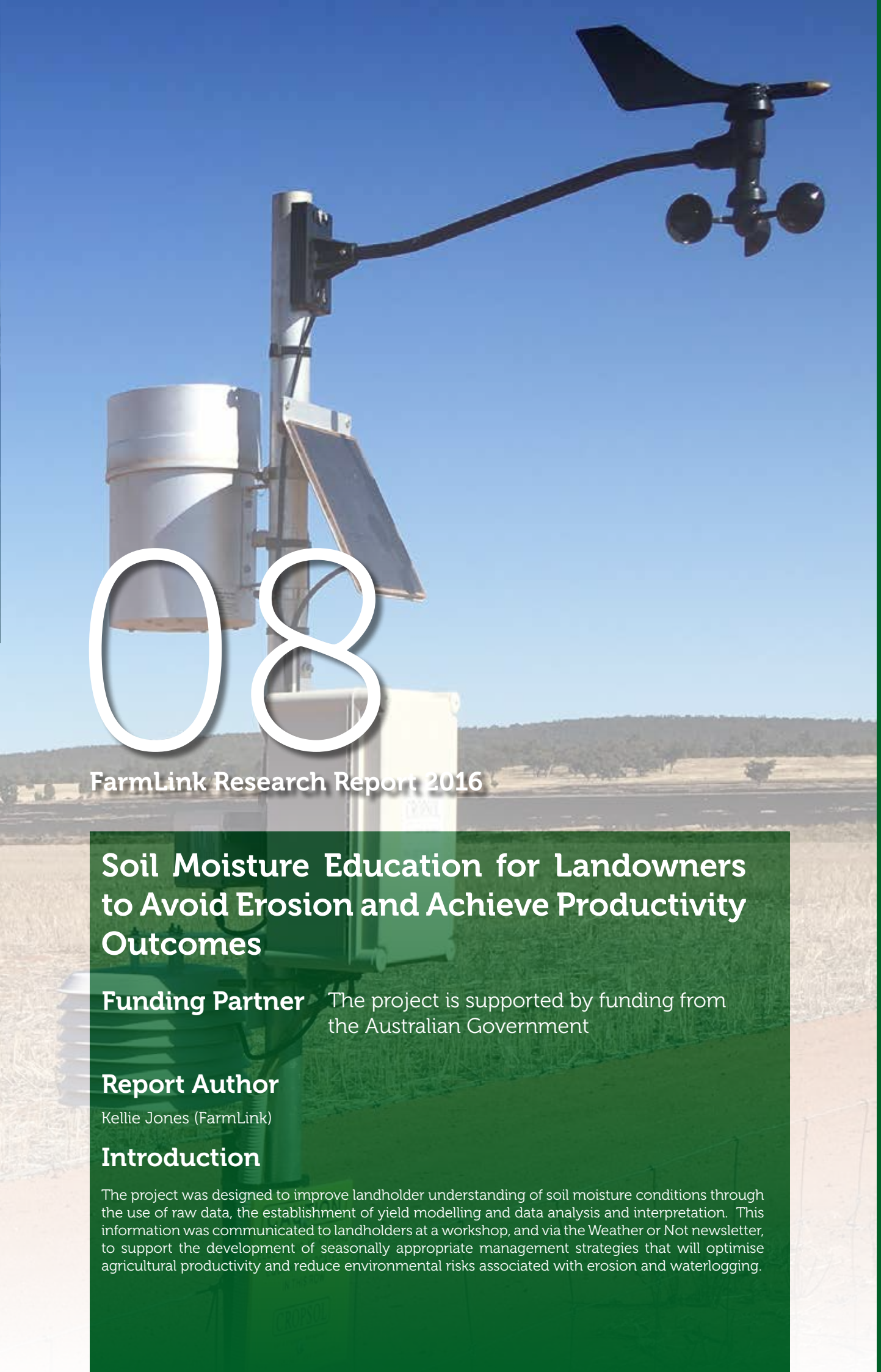

08

FarmLink Research Report 2016

Soil Moisture Education for Landowners to Avoid Erosion and Achieve Productivity Outcomes

Funding Partner

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Report Author

Kellie Jones (FarmLink)

Introduction

The project was designed to improve landholder understanding of soil moisture conditions through the use of raw data, the establishment of yield modelling and data analysis and interpretation. This information was communicated to landholders at a workshop, and via the Weather or Not newsletter, to support the development of seasonally appropriate management strategies that will optimise agricultural productivity and reduce environmental risks associated with erosion and waterlogging.

Method

1. FarmLink soil moisture probes network used to generate raw data
2. Subset of sites selected to implement automated weather stations and to establish yield modelling
3. Analyse and interpret the soil moisture, weather conditions and yield forecast data
4. Facilitate a workshop with landholders to educate them on data analysis & interpretation, strategies to maintain ground cover & optimise agricultural productivity/profitability.
5. Communicate key messages to landholders via monthly publications during the growing season

The project, conducted by FarmLink funded by a grant under the National Landcare Programme Sustainable Agriculture Small Grants Round 2015-16 had a focus on education in soil moisture management to reduce erosion risks across farming operations in Southern New South Wales.

The project used FarmLink's existing Weather or Not publication to deliver soil moisture information across the growing season to landholders across SNSW, paired with the inclusion of a workshop looking at soil moisture and seasonally appropriate management practices, at the annual FarmLink Open Day on September 2 at TAIC.

The 2016 season in itself presented challenges not experienced for some years in Southern New South Wales, with waterlogging and paddock inaccessibility seeing landholders faced with a different set of management issues than that of a 'typical' year.

The final report for the Weather or Not series summarised the year's activities.

To sum up 2016 it was dry, then wet, then underwater. It was a season that was frustrating, worrisome, and hard work, but, hopefully, rewarding for you all.

What did we learn?

In 2016, waterlogging 'threw a spanner into the works' disrupting what could have been a great production year. Waterlogging is difficult to overcome once it hits because it not only inhibits root growth but reduces nitrogen via denitrification when, in wet soils the oxygen concentration falls and microbes use nitrate instead of oxygen to support their growth, resulting in the production of nitrogen gasses that are lost to the atmosphere.

If you could go back in time and redo 2016, what would you do differently? What would you focus on?

Traditionally, Nitrogen (N) budgets call for how much to apply and when to apply it with a target yield and protein in mind. But to cope with a year where waterlogging is prevalent, how would you have altered the system? In hindsight, farmers may have started with a strong lead into the growing season by increased sowing rates, made sowing dates as early as possible and applied nitrogen early to promote growth.

Paddocks where waterlogging and flooding occurred can be a problem, but it also presents an opportunity to look at water diversion and soil structure strategies to better manage it in the future.

Yield Prophet - what if the yield wasn't accurate....

As previously indicated, Yield Prophet predictions don't take into account frost, disease, harvest loss and waterlogging.

Reviewing the Yield Prophet versus actual yield results can raise questions about the production of the paddock, factors affecting the accuracy of Yield Prophet and highlight future yield goals to aim for.

- What other factors could have contributed to yield loss?
- Is the soil and climate data in Yield Prophet accurate? (This can be adjusted in subsequent years)
- Is the observed paddock yield accurate?
- Was there weeds, pest pressure, storm damage or moisture stress at various times?
- And what can you do to manage these factors in the future?

The weather year that was

2016 was a dry and warm start to the growing season. Rainfall recorded at Temora Agricultural Innovation Centre showed 32 mm of rainfall for March and only 8.8mm for April. The break came in May with nearly 100mm of rainfall recorded and more across the district. Subsequently, all the paddocks in this newsletter were tracked at growing season rainfall of Decile 7 or higher.

The weather year that will be

Late summer and autumn is a difficult time to be make accurate climate predictions. The oceans surrounding Australia are 'resetting' from spring last year and are therefore generating patterns that are unreliable weather predictors. For this reason, models should not be given too much attention from now on until May. ENSO and IOD indicators are currently neutral but interestingly, the Southern Annular Mode (SAM) has been negative all summer. SAM's influence on NSW rainfall is complicated and the subject of current research, but it can influence summer rainfall. The NSW DPI Agriculture have produced an excellent clip about SAM called Climatedog: SAM. You can watch it on https://www.youtube.com/watch?v=G-S-YmE-Lkc

Looking ahead – storing soil moisture

The soil moisture probes in the featured paddocks have shown high moisture levels at the end of harvest giving confidence in good potential yields leading into sowing in 2017. One of the most effective ways to conserve your soil water is to manage your summer weeds early, so be vigilant with your monitoring and act early!

Acknowledgements

Thank you to all our paddock hosts who have willingly provided access and information when required – Paul and Linda Griffin, Sam and Matt Dart, Geoff, Liz and Adam Lane, Derek and Susan Ingold, Rob and Mandy Taylor, the Meier family and Purcell family. Thank you also to Geoff Minchin from the Riverina Local Land Services for providing local insight and information for the compilation of this newsletter.

INDIVIDUAL SITES

Ariah Park SW

In October, Yield Prophet predicted a 4.2 t/ha yield potential for this wheat crop, where actual yield was higher at 4.8 t/ha, of ASW (10.1% protein).

There were minimal external factors to influence yield apart from some waterlogging in September.

Table 1 below provides a summary of the 2016 water and nitrogen balances simulated by Yield Prophet. It highlights the high amount of moisture received during the growing season and the estimated amount lost through evaporation, run-off, drainage and transpiration.

Crop Water and Nitrogen Supply

Water		Nitrogen	
Starting Soil Water (PAW)	54.3 mm	Starting Soil Nitrogen	162 kg/ha
Rainfall (soil sampling [6-May] to Maturity)	559.2 mm	Plus applied Nitrogen	65 kg/ha
Less modelled Evaporation	177.4 mm	Plus modelled Mineralisation	15 kg/ha
Less modelled Run-off	18.3 mm	Less modelled Denitrification	12 kg/ha
Less modelled Drainage	229.1 mm	Less modelled Leaching	68 kg/ha
Less modelled Transpiration	162 mm	Crop Nitrogen Supply	162 kg/ha
Crop Water Remaining	26.6 mm	Nitrogen Remaining	24 kg/ha

Table 1. Predicted crop water and nitrogen starting levels, inputs and remaining levels.

When this site was initially soil cored at the beginning of the 2016 season (Table 2), nitrogen levels were very high, approximately 155 kg/ha. The crop was top-dressed with urea twice throughout the year with 23 kg N/ha in June and 37 kg N/ha in August. Reaching ear emergence in late September, the crop had a predicted 90 kg N/ha in reserve, considering predicted losses through mineralisation, denitrification and leaching that left the paddock with 24 kg/ha of predicted nitrogen. The final soil tests show there is approximately 50 kg N/ha. Soil nutrient levels throughout a season can be a very hard value to predict, especially after such a rare wet season like 2016.

Soil water had an increase of 3% in the top 10cm of soil, the top soil seems to be holding its moisture well even after the hot weeks in late January and February 2017. There was no difference in soil moisture between 70 to 100cm.

Depth	Analysis	Initial Sample	Final Sample	Change
0-10cm	Nitrogen kg/ha	120	20	-100
	Soil Moisture (%)	7	10	3
10-40cm	Nitrogen kg/ha	18	13	-5
	Soil Moisture (%)	9	10	1
40-70cm	Nitrogen kg/ha	10	8	-2
	Soil Moisture (%)	14	16	2
70-100cm	Nitrogen kg/ha	7	8	2
	Soil Moisture (%)	14	14	0
Total	**Nitrogen kg/ha**	**155**	**50**	**-105**

Table 2. Actual soil moisture (%) and nitrogen starting levels, remaining levels and the difference.

Greenethorpe

This wheat crop yielded 5.7 t/ha which is lower than the Yield Prophet predicted yield potential of 7.1 t/ha.

This was likely partly due to waterlogging and Yield Prophet also recorded three mild frost events which simulated a 1 t/ha loss. The grower reported "about 10% of the paddock was waterlogged in September with very low to zero yield in the wet areas which would have affected the final yield." Yield Prophet doesn't simulate the yield effect of waterlogging but in September, it did predict a 60% probability of 5 consecutive days of waterlogging.

The crop made H1 classification which is excellent considering opportunities to apply N were limited due to high rainfall. The crop received a total 95 kg N/ha with 31 kg N/ha at sowing and then a 64 kg N/ha in-crop application.

Crop Water and Nitrogen Supply

Water		Nitrogen	
Starting Soil Water (PAW)	45.1 mm	Starting Soil Nitrogen	105 kg/ha
Rainfall (soil sampling [7-Apr] to Maturity)	577 mm	Plus applied Nitrogen	95 kg/ha
Less modelled Evaporation	132.2 mm	Plus modelled Mineralisation	10 kg/ha
Less modelled Run-off	38.8 mm	Less modelled Denitrification	10 kg/ha
Less modelled Drainage	179.5 mm	Less modelled Leaching	3 kg/ha
Less modelled Transpiration	222.6 mm	Crop Nitrogen Supply	196 kg/ha
Crop Water Remaining	48.9 mm	Nitrogen Remaining	14 kg/ha

Table 3. Predicted crop water and nitrogen starting levels, inputs and remaining levels.

Table 4 shows the top 10cm of soil had a 3% increase in soil moisture, but at both 10-40cm and 40-70cm there was a reduction of 5%. The paddock started the season with approximately 99 kg/ha of nitrogen, it received 95 kg/ha during the season. Through modelled mineralisation, denitrification, leaching and removal by harvest, Yield Prophet predicted 14 kg/ha of nitrogen remaining (Table 3). The final soil analysis (Table 4) showed that there was 57kg/ha of nitrogen in the soil after the season was finished. It was predicted that 196 kg N/ha was removed from the paddock during harvest, but this was when a 7.1 t/ha yield was predicted. The paddock yielded less than that, therefore less nitrogen was removed in plant matter and more remained in the soil.

Canola is planned for this paddock in 2017.

Depth	Analysis	Initial Sample	Final Sample	Change
0-10cm	Nitrogen kg/ha	57	24	-33
	Soil Moisture (%)	4	7	3
10-40cm	Nitrogen kg/ha	27	22	-5
	Soil Moisture (%)	10	5	-5
40-70cm	Nitrogen kg/ha	15	11	-4
	Soil Moisture (%)	17	12	-5
Total	**Nitrogen kg/ha**	**99**	**57**	**-42**

Table 4. Actual soil moisture (%) and nitrogen starting levels, remaining levels and the difference.

Lockhart

This Suntop wheat crop yielded 4 t/ha and had a predicted yield of 5.1 t/ha. Yield Prophet didn't detect any frost or heat shock events so this difference could be attributed to rust disease infection detected at ear emergence and waterlogging in some parts of the paddock in September.

Table 5 provides a summary of the 2016 water and nitrogen balances simulated by Yield Prophet. It highlights the high amount of moisture received during the growing season and the estimated amount lost through evaporation, run-off, drainage and transpiration.


Crop Water and Nitrogen Supply

Water		Nitrogen	
Starting Soil Water (PAW)	134.3 mm	Starting Soil Nitrogen	23.1 kg/ha
Rainfall (soil sampling 1st-May) to Maturity	552.6 mm	Plus applied Nitrogen	62 kg/ha
Less modelled Evaporation	198.7 mm	Plus modelled Mineralisation	21 kg/ha
Less modelled Run-off	58.9 mm	Less modelled Denitrification	17 kg/ha
Less modelled Drainage	177.3 mm	Less modelled Leaching	5 kg/ha
Less modelled Transpiration	387.7 mm	Crop Nitrogen Supply	214 kg/ha
Crop Water Remaining	58 mm	Nitrogen Remaining	26 kg/ha

Table 5. Predicted crop water and nitrogen starting levels, inputs and remaining levels.

This site started the season with approximately 155 kg N/ha and it received 62 kg N/ha during the season. Yield Prophet predicted 26 kg/ha of nitrogen remaining in the soil, and the final soil analysis shows 42 kg N/ha left in the soil.

Depth	Analysis	Initial Sample	Final Sample	Change
0-10cm	Nitrogen kg/ha	50	12	-34
	Soil Moisture (%)	23	7	-16
10-40cm	Nitrogen kg/ha	63	15	-52
	Soil Moisture (%)	27	15	-12
40-70cm	Nitrogen kg/ha	25	9	-20
	Soil Moisture (%)	25	18	-7
70-100cm	Nitrogen kg/ha	17	6	8
	Soil Moisture (%)	21	20	-1
Total	**Nitrogen kg/ha**	**155**	**42**	**-98**

Table 6. Actual soil moisture (%) and nitrogen starting levels, remaining levels and the difference.

The Lockhart moisture probe site was soil cored in May 2016, the site had received a light shower of rain a few days prior to coring, the soil was very moist at all depths. There has been a large reduction in soil moisture percentage between 2016 and 2017, a 16% decrease for depths 0-10cm and 12% decrease for 10-40cm. No other paddocks in this project had a decrease in soil moisture as high as this.

This paddock has predicted 56 mm crop water and 26 kg N/ha remaining at the end of 2016. These will be excellent for LaTrobe barley crop planned for 2017.

Grong Grong

This Bonito canola crop yielded 2.2 t/ha canola with 46 to 47% oil content and had a predicted nitrogen limited yield of 2.2 t/ha. This yield is consistent with the nitrogen limited yield prediction (Image 1), it is 0.8 t/ha lower than the nitrogen unlimited prediction.

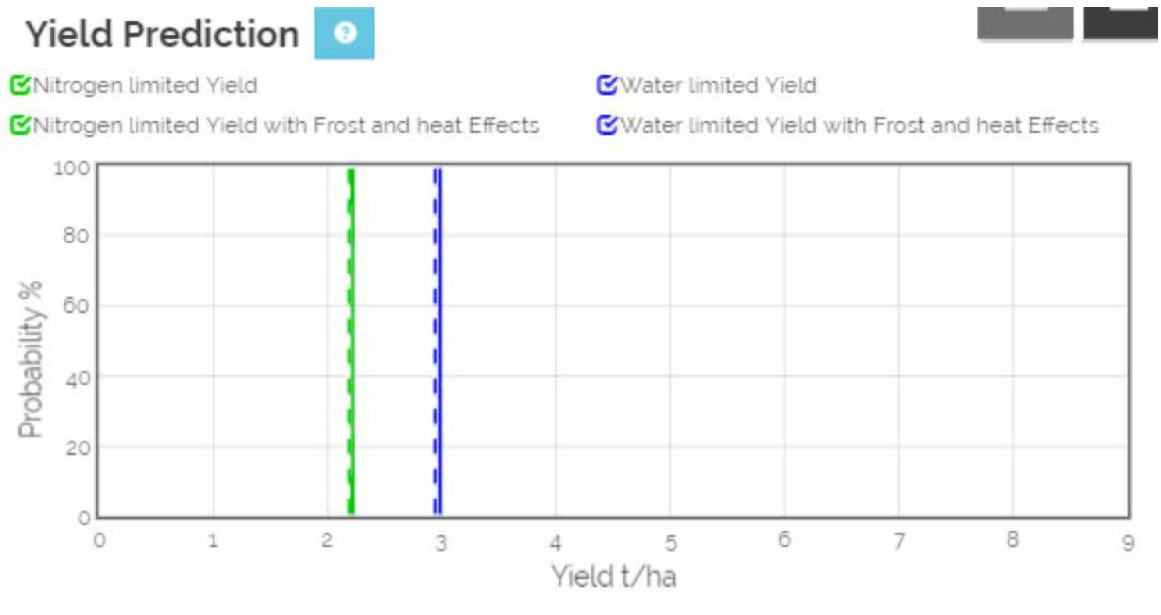

Image 1. Yield Prophet nitrogen and water limited yield prediction under frost and heat stress.

This canola crop received one in-crop application of 87 kg N/ha in early June however the grower reported excessive rainfall in September which contributed to waterlogging in the paddock and reduced access and potential yield loss. This rainfall has contributed to the estimated 70 mm water left in the soil after harvest. When comparing the initial soil moisture and actual final soil moisture, it is evident that a total of 18% of soil moisture has been lost between 0-70cm, while there was a 2% increase in moisture at 70-100cm.

There is an estimated 25 kg N/ha remaining in the soil, the final soil sample shows there is 89 kg N/ha remaining in the soil. This difference may be due to the unusual climate we experienced in the 2016 season. A wheat or oats crop is planned for this paddock in 2017.

Crop Water and Nitrogen Supply

Water		Nitrogen	
Starting Soil Water (PAW)	68.1 mm	Starting Soil Nitrogen	136 kg/ha
Rainfall (soil sampling [6-May] to Maturity)	570 mm	Plus applied Nitrogen	92 kg/ha
Less modelled Evaporation	157 mm	Plus modelled Mineralisation	23 kg/ha
Less modelled Run-off	37.1 mm	Less modelled Denitrification	12 kg/ha
Less modelled Drainage	258.2 mm	Less modelled Leaching	48 kg/ha
Less modelled Transpiration	115.5 mm	Crop Nitrogen Supply	191 kg/ha
Crop Water Remaining	70.3 mm	Nitrogen Remaining	25 kg/ha

Table 7. Predicted crop water and nitrogen starting levels, inputs and remaining levels

Depth	Analysis	Initial Sample	Final Sample	Change
0-10cm	Nitrogen kg/ha	68	34	-34
	Soil Moisture (%)	9	7	-2
10-40cm	Nitrogen kg/ha	20	20	0
	Soil Moisture (%)	12	7	-5
40-70cm	Nitrogen kg/ha	27	16	-11
	Soil Moisture (%)	24	18	-6
70-100cm	Nitrogen kg/ha	19	20	0
	Soil Moisture (%)	23	25	2
Total	**Nitrogen kg/ha**	**134**	**89**	**-45**

Table 8. Actual soil moisture (%) and nitrogen starting levels, remaining levels and the difference.

Beckom

This Condo wheat crop finished with a 4.4 t/ha yield prediction after a total 102 kg N/ha applied during the year. The actual yield was slightly higher at 4.8 t/ha and protein was 9.4%, the grower indicated there was waterlogging in some areas of the paddock.

The table below summarises the 2016 water and nitrogen balances simulated by Yield Prophet. The crop received 564 mm during the growing season and there was a good amount of water with 58 mm crop water remaining in the soil at the end of harvest.

Crop Water and Nitrogen Supply

Water		Nitrogen	
Starting Soil Water (PAW)	61.8 mm	Starting Soil Nitrogen	87 kg/ha
Rainfall (soil sampling [6-May] to Maturity)	564.7 mm	Plus applied Nitrogen	102 kg/ha
Less modelled Evaporation	188.2 mm	Plus modelled Mineralisation	29 kg/ha
Less modelled Run-off	17.8 mm	Less modelled Denitrification	14 kg/ha
Less modelled Drainage	177 mm	Less modelled Leaching	6 kg/ha
Less modelled Transpiration	185.6 mm	Crop Nitrogen Supply	198 kg/ha
Crop Water Remaining	57.8 mm	Nitrogen Remaining	34 kg/ha

Table 9. Predicted crop water and nitrogen starting levels, inputs and remaining levels.

There was an estimate 34 kg N/ha remaining in (Table 9) the soil at the end of harvest (Table 9), the final soil analysis (Table 10) showed there was in fact 81 kg N/ha remaining in the soil. The 81 kg N/ha will be beneficial for the canola crop planned for 2017.

Temora Agricultural Innovation Centre

This Suntop wheat crop received 675mm of rainfall during the 2016 growing season and yielded 1.9t/ha compared to the predicted 3 t/ha nitrogen limited yield potential. This difference is likely to be due to waterlogging and the fact that only nitrogen it received was at sowing (25kg N/ha). The FarmLink team reported machinery was unable to enter the paddock through the whole growing season. "An attempt was made with a four-wheeler and urea spreader, but it was unsuccessful."

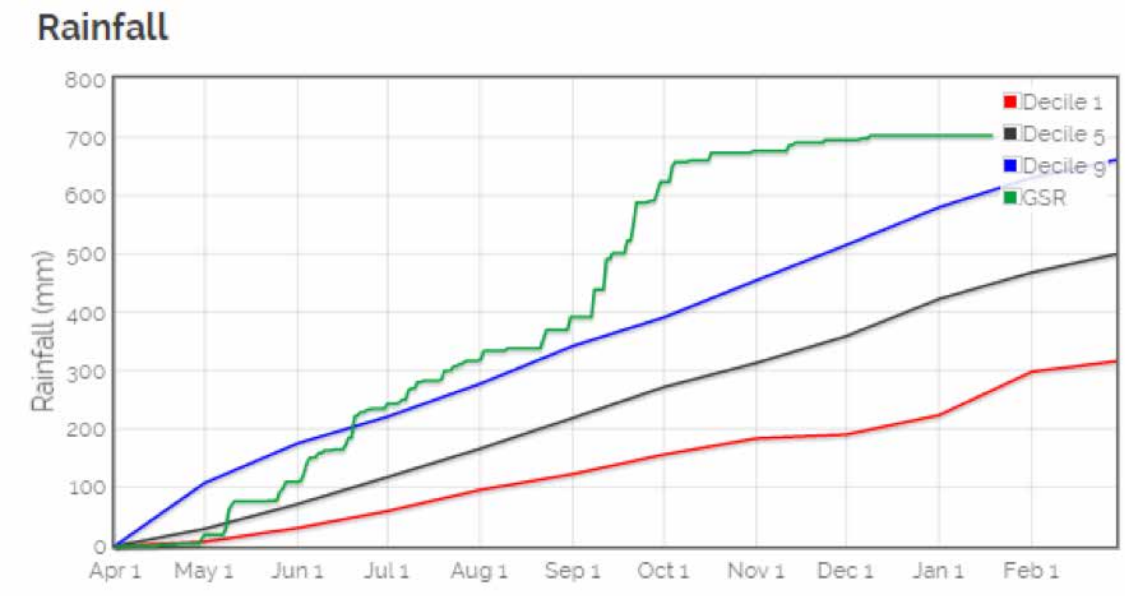

Image 2. Yield Prophet rainfall decile chart, April 2016 – February 2017

Crop Water and Nitrogen Supply

Water		Nitrogen	
Starting Soil Water (PAW)	21.2 mm	Starting Soil Nitrogen	113 kg/ha
Rainfall (soil sampling [6-May] to Maturity)	701.7 mm	Plus applied Nitrogen	40 kg/ha
Less modelled Evaporation	191.1 mm	Plus modelled Mineralisation	10 kg/ha
Less modelled Run-off	34.2 mm	Less modelled Denitrification	5 kg/ha
Less modelled Drainage	288.3 mm	Less modelled Leaching	26 kg/ha
Less modelled Transpiration	156.5 mm	Crop Nitrogen Supply	132 kg/ha
Crop Water Remaining	52.8 mm	Nitrogen Remaining	7 kg/ha

Table 11. Predicted crop water and nitrogen starting levels, inputs and remaining levels.

Table 11 provides a summary of the 2016 water and nitrogen balances simulated by Yield Prophet. It highlights the high amount of moisture received during the growing season and the estimated amount lost through evaporation, run-off, drainage and transpiration. This paddock has predicted 52.8mm of crop water. The final soil analysis shows that there is 3% less moisture in the top 10cm of soil, but there is an increase of 9% moisture from 20-100cm depths. Yield Prophet predicted 7kg N/ha remaining at the end of 2016, soil tests (Table 12) show that there is 81 kg N/ha remaining in the soil. Yield Prophet predicted a 1.1 t/ha higher yield than the actual yield, actual crop nitrogen supply would not have been as high as the predicted 132 kg N/ha. This would be partly the reason for the difference in remaining nitrogen.

Depth	Analysis	Initial Sample	Final Sample	Change
0-10cm	Nitrogen kg/ha	78	32	-45
	Soil Moisture (%)	8	5	-3
10-40cm	Nitrogen kg/ha	15	20	5
	Soil Moisture (%)	6	7	1
40-70cm	Nitrogen kg/ha	6	15	9
	Soil Moisture (%)	14	18	4
70-100cm	Nitrogen kg/ha	6	13	8
	Soil Moisture (%)	15	19	4
Total		**104**	**81**	**-24**

Table 12. Actual soil moisture (%) and nitrogen starting levels, remaining levels and the difference.

Dirnaseer

This Bonito canola crop had a predicted yield potential above 4 t/ha due to excellent growing season conditions including exceptional levels of soil nitrogen (405 kg/ha total) and moisture (731mm growing season rainfall which was a Decile 10 season). The crops actual yield was 2.7 t/ha with 47% oil content.

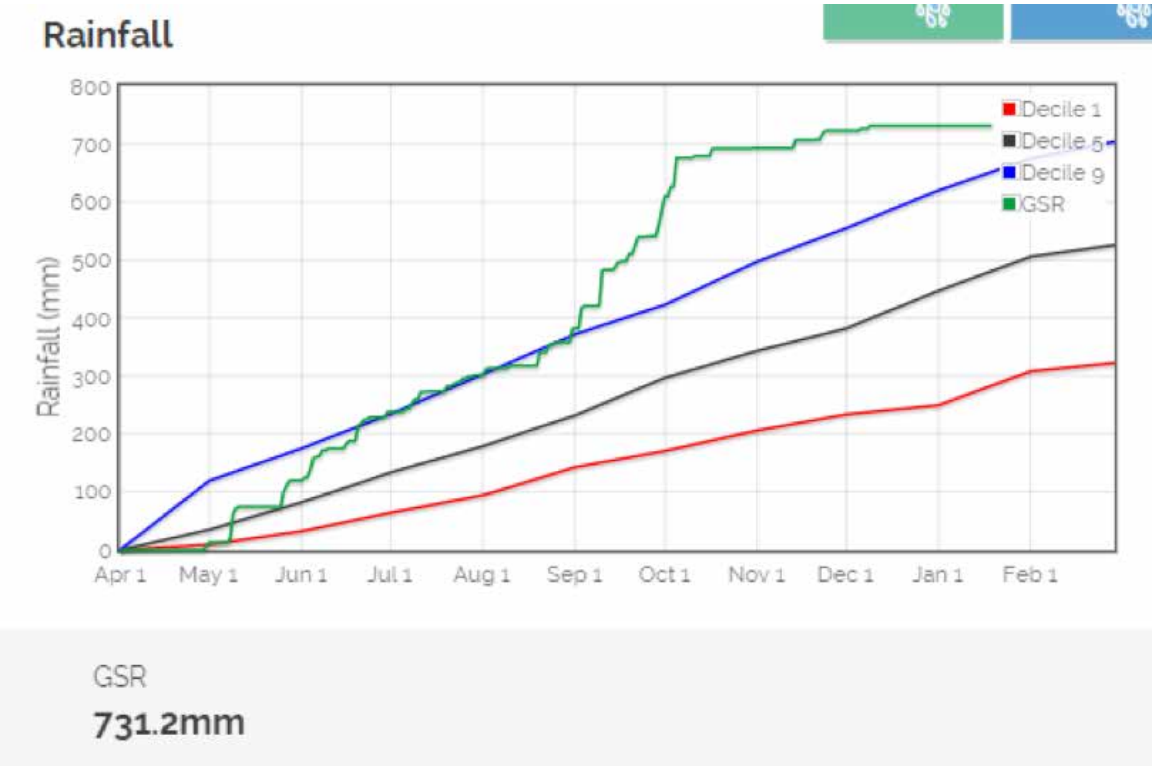

Image 3. Yield Prophet rainfall decile chart, April 2016 – February 2017

Table 13 summarises the 2016 water and nitrogen balances simulated by Yield Prophet at the end of harvest, there was 40mm of crop water and 8 kg N/ha remaining in the paddock and it is planned for a wheat crop in 2017.

Crop Water and Nitrogen Supply

Water		Nitrogen	
Starting Soil Water (PAW)	74.4 mm	Starting Soil Nitrogen	255 kg/ha
Rainfall (soil sampling [29-Apr] to Maturity)	731.2 mm	Plus applied Nitrogen	166 kg/ha
Less modelled Evaporation	228.1 mm	Plus modelled Mineralisation	44 kg/ha
Less modelled Run-off	50.7 mm	Less modelled Denitrification	35 kg/ha
Less modelled Drainage	217 mm	Less modelled Leaching	23 kg/ha
Less modelled Transpiration	269.6 mm	Crop Nitrogen Supply	406 kg/ha
Crop Water Remaining	40.2 mm	Nitrogen Remaining	8 kg/ha

Table 13. Predicted crop water and nitrogen starting levels, inputs and remaining levels.

The paddock started out with approximately 249 kg/ha of nitrogen, after the season had ended, Yield Prophet predicted there was 8 kg/ha of nitrogen remaining in the soil. Table 14 shows there was 112 kg N/ha in the soil when the final soil results were taken. However, the paddock yielded 1.3 t/ha less that what Yield Prophet predicted. Therefore, less nitrogen was removed from the paddock (grain) during harvest, leaving more in the soil.

Depth	Analysis	Initial Sample	Final Sample	Change
0-10cm	Nitrogen kg/ha	123	52	-71
	Soil Moisture (%)	11	10	-1
10-40cm	Nitrogen kg/ha	52	22	-30
	Soil Moisture (%)	12	12	0
40-70cm	Nitrogen kg/ha	36	12	-24
	Soil Moisture (%)	16	16	0
70-100cm	Nitrogen kg/ha	38	27	-12
	Soil Moisture (%)	16	16	0
Total	**Nitrogen kg/ha**	**249**	**112**	**-137**

Table 14. Actual soil moisture (%) and nitrogen starting levels, remaining levels and the difference.

This paddock had very little change in soil moisture. Throughout the season the paddock received 731mm of rain. Between May, 2016, and February, 2017, only the top 10cm had a decline of 1% in soil moisture, the other depths down to 100cm had no change, even after such a wet season.

Mirrool

Yield Prophet predicted 5.2t/ha for this paddock, the paddocks actual yield was 5.3t/ha and a protein content of 10.7%. With a difference of only 0.1 t/ha, this was a very accurate prediction from Yield Prophet.

Crop Water and Nitrogen Supply

Water		Nitrogen	
Starting Soil Water (PAW)	75.9 mm	Starting Soil Nitrogen	128 kg/ha
Rainfall (soil sampling [5-May] to Maturity)	597.5 mm	Plus applied Nitrogen	134 kg/ha
Less modelled Evaporation	181.6 mm	Plus modelled Mineralisation	16 kg/ha
Less modelled Run-off	21.7 mm	Less modelled Denitrification	11 kg/ha
Less modelled Drainage	239.5 mm	Less modelled Leaching	68 kg/ha
Less modelled Transpiration	193.5 mm	Crop Nitrogen Supply	199 kg/ha
Crop Water Remaining	37.2 mm	Nitrogen Remaining	23 kg/ha

Table 15. Predicted crop water and nitrogen starting levels, inputs and remaining levels.

The paddock started the season with approximately 123 kg/ha of nitrogen. Throughout the season the paddock received 134 kg N/ha, plus predicted mineralisation and minus predicted denitrification, leaching and removal through grain, the paddock was left with a predicted nitrogen level of 23kg/ha. The final soil test (Table 16) shows that there was a little more nitrogen left in the soil than first expected. Once again, this just shows how difficult it is to calculate inputs and outputs of a factor such as nitrogen.

Depth	Analysis	Initial Sample	Final Sample	Change
0-10cm	Nitrogen kg/ha	32	42	11
	Soil Moisture (%)	9	4	-5
10-40cm				
	Nitrogen kg/ha	45	9	-36
	Soil Moisture (%)	11	7	-4
40-70cm				
	Nitrogen kg/ha	27	7	-20
	Soil Moisture (%)	16	11	-5
70-100cm				
	Nitrogen kg/ha	19	12	-8
	Soil Moisture (%)	14	13	-1
Total	**Nitrogen kg/ha**	**123**	**69**	**-53**

Table 16. Actual soil moisture (%) and nitrogen starting levels, remaining levels and the difference.

Table 16 shows a decrease in soil moisture of approximately 5% between the 0-10cm, 10-40cm and 40-70cm layers. However, there was only a 1% decrease in soil moisture down at 70-100cm. Because this layer is so far down in the soil profile it is less effected by factors such as run off, evaporation, drainage and transpiration when compared to the other layers closer to the surface.

Ariah Park South

This crop had a 4.4 t/ha nitrogen limited yield prediction, and a 5.2 t/ha yield prediction if nitrogen was unlimited. The paddocks actual yield was 6.1 t/ha with 10.5% protein. This 1.7 t/ha yield difference may be due to incorrect soil characterisation. Soil moisture was not tested in the initial soil analysis for this paddock. This is required when choosing an accurate soil characterisation for the yield prophet site. Instead a soil characterisation was chosen using the PSA (particle size analysis) and the starting soil water was estimated. Estimating soil water in this way could introduce a high level of inaccuracy into the Yield Prophet modelling. This just shows how important it is to test for soil moisture when setting up a paddock.

Crop Water and Nitrogen Supply

Water		Nitrogen	
Starting Soil Water (PAW)	46.2 mm	Starting Soil Nitrogen	44 kg/ha
Rainfall (soil sampling [1-Jan] to Maturity)	630 mm	Plus applied Nitrogen	138 kg/ha
Less modelled Evaporation	252.5 mm	Plus modelled Mineralisation	41 kg/ha
Less modelled Run-off	3 mm	Less modelled Denitrification	1 kg/ha
Less modelled Drainage	222.5 mm	Less modelled Leaching	6 kg/ha
Less modelled Transpiration	167.2 mm	Crop Nitrogen Supply	216 kg/ha
Crop Water Remaining	31 mm	Nitrogen Remaining	33 kg/ha

Table 17. Predicted crop water and nitrogen starting levels, inputs and remaining levels.

Not having the starting soil moisture makes it hard to compare predicted (Table 17) and actual (Table 18) moisture results. Actual nitrogen results show a 5kg/ha increase and the predicted shows an 11 kg/ha decrease in nitrogen by the end of the season. This difference could also be due to poor soil characterisation. The simulation program relies greatly on accurate data being entered at the beginning and throughout the season to get accurate data at the end of the season. Please consider this when setting up a paddock in Yield Prophet in 2017.

Depth	Analysis	Initial Sample	Final Sample	Change
0-10cm	Nitrogen kg/ha	3	19	16
	Soil Moisture (%)	**NA	5	**NA
10-40cm	Nitrogen kg/ha	23	14	-9
	Soil Moisture (%)	**NA	11	**NA
40-70cm	Nitrogen kg/ha	9	5	-4
	Soil Moisture (%)	**NA	11	**NA
70-100cm	Nitrogen kg/ha	8	10	2
	Soil Moisture (%)	**NA	13	**NA
Total	**Nitrogen kg/ha**	**43**	**48**	**5**

Table 18. Actual soil moisture (%) and nitrogen starting levels, remaining levels and the difference.

Although the initial moisture levels were unknown, we can see that the top soil has 5% moisture. The moisture follows through to lower in the profile, there is 11% moisture between 10-70cm and 13% down between 70-100cm. This moisture will be useful for this year's crop.

* Please note that the actual total starting nitrogen levels are slightly different due to bulk densities used to calculate soil results from mg/kg to kg/ha. Also, the final soil samples were taken early February, 2017. Yield Prophet's predictions ended after harvest, nitrogen and soil moisture levels may differ slightly due to this time interval.

Conclusion

Although there were a few variances in predicted and actual yields, nitrogen and moisture levels, most of the predictions were within range of the actual values. Reasons for some of these discrepancies may be due to the unusually wet season we encountered in 2016. Other reasons may include spatial variability throughout the paddock. Soil test results should be interpreted as approximate values rather than exact values.

Input of accurate data is the most important point when using programs such as Yield Prophet. This includes selecting the best soil type for your paddock.