Soil Moisture Probes in Dryland Cropping Systems

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Background

- In May 2009 Rural Directions in partnership with SANTFA won a Farm Ready Industry Development Grant to run a soil moisture probe project

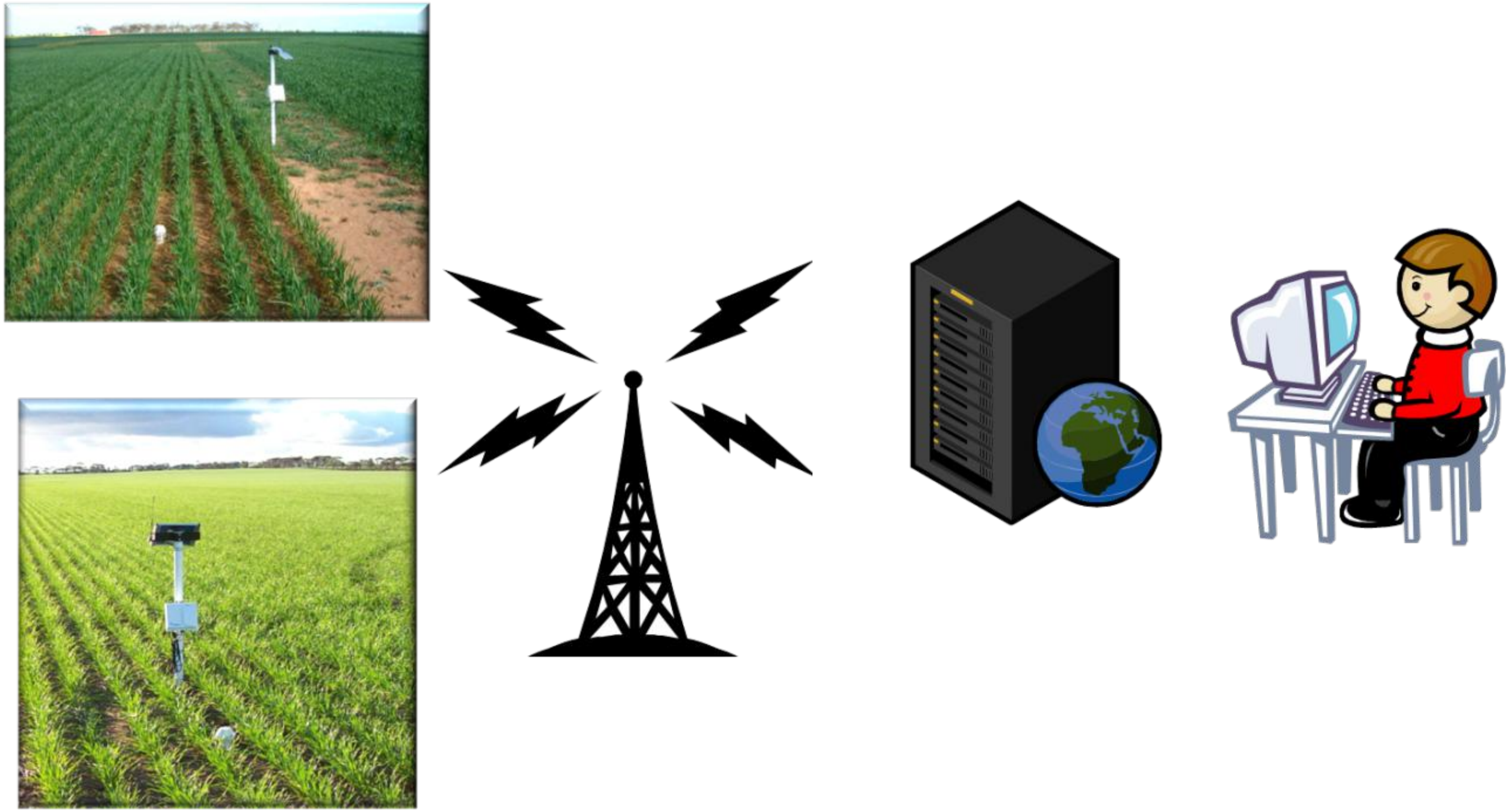
- After gaining sponsorship from 3 NRM Boards, 10 probes were purchased and installed in focus paddocks (8 Lower-Mid North, 2 Coomy-Coonalpyn

- Group workshops were conducted with 5 grower groups over a 2 year period

Our System

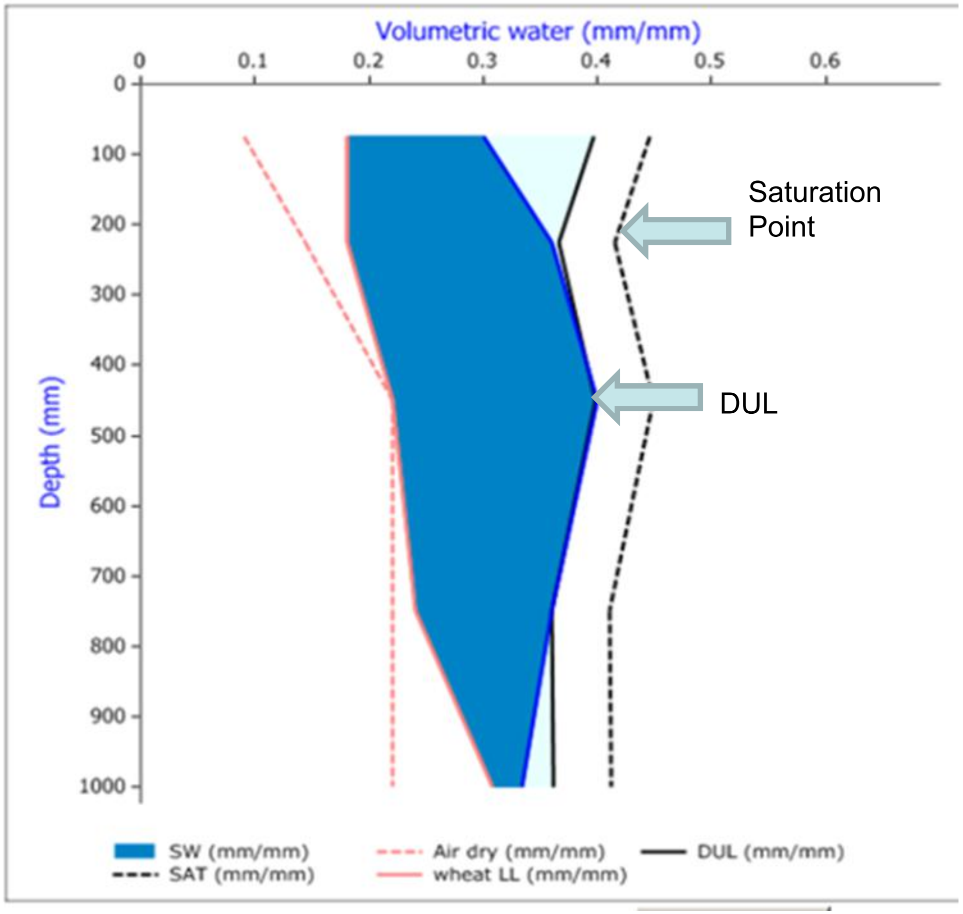
- Subsurface probes
- Automatic rain gauges
- Remote data hosting - Adcon
- Next G telemetry

Our System



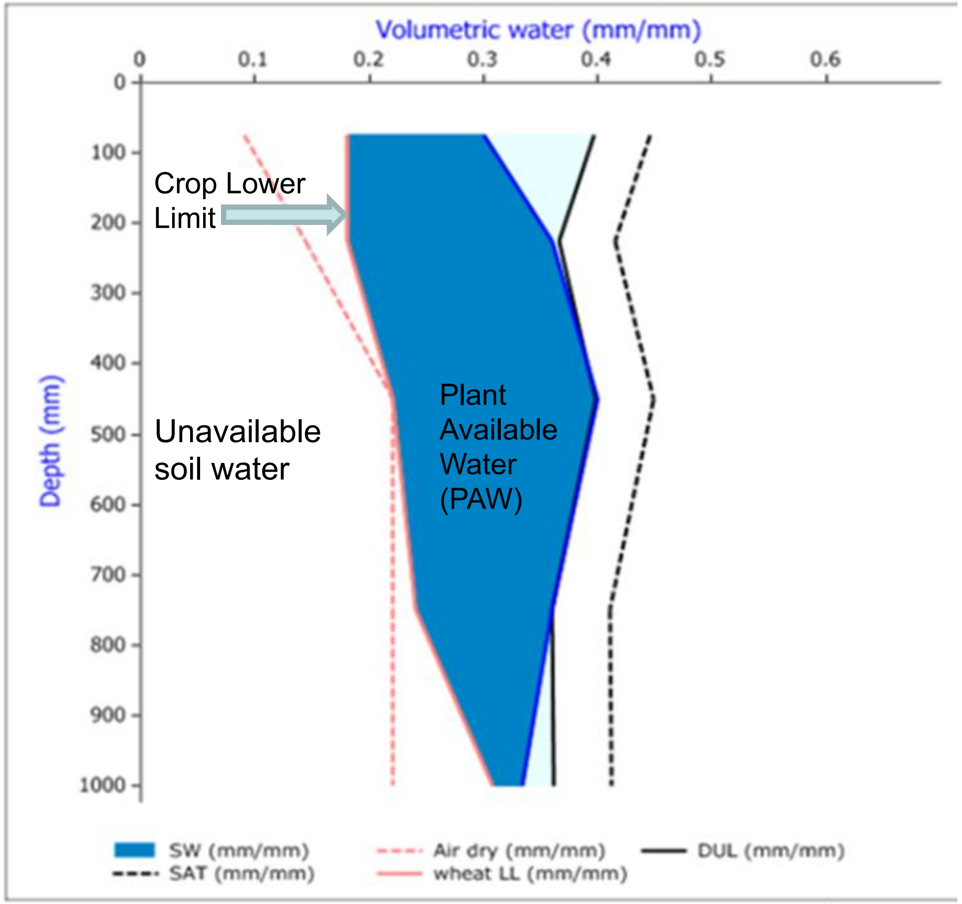
Plant Available Water

- Not all water present in soils is available to plants
- When a soil is saturated some water drains away and is unavailable to plants
- The point at which it drains away is referred to as ‘Drained Upper Limit’ or DUL.

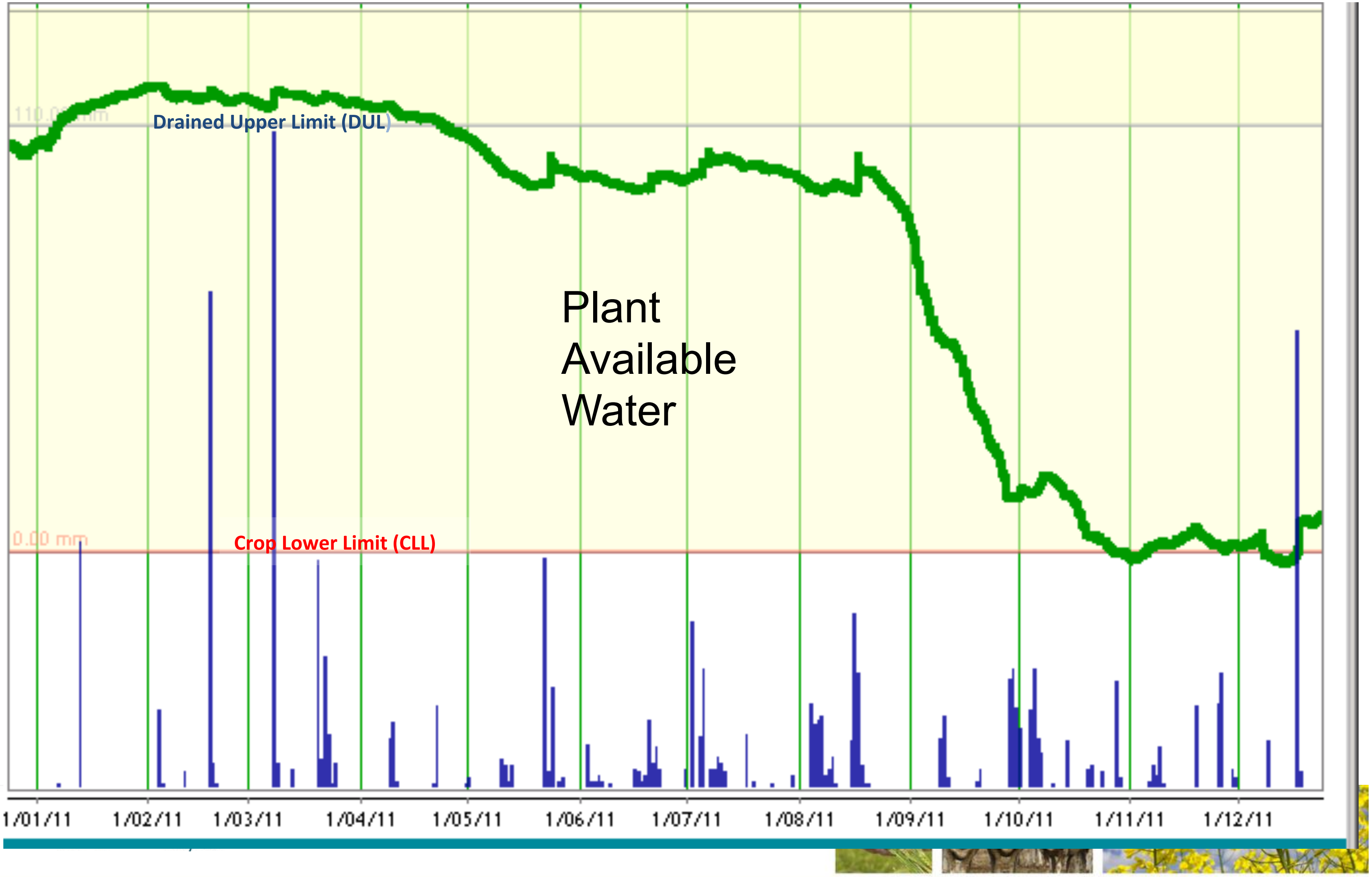


Plant Available Water

- Some is held tightly to soil particles and can't be accessed by plants
- When a soil water reduces to a point where plants wilt it is referred to as at "wilting point" or at "crop lower limit" (CLL)
- The difference between DUL and CLL is Plant Available Water or PAW



Sum Graph

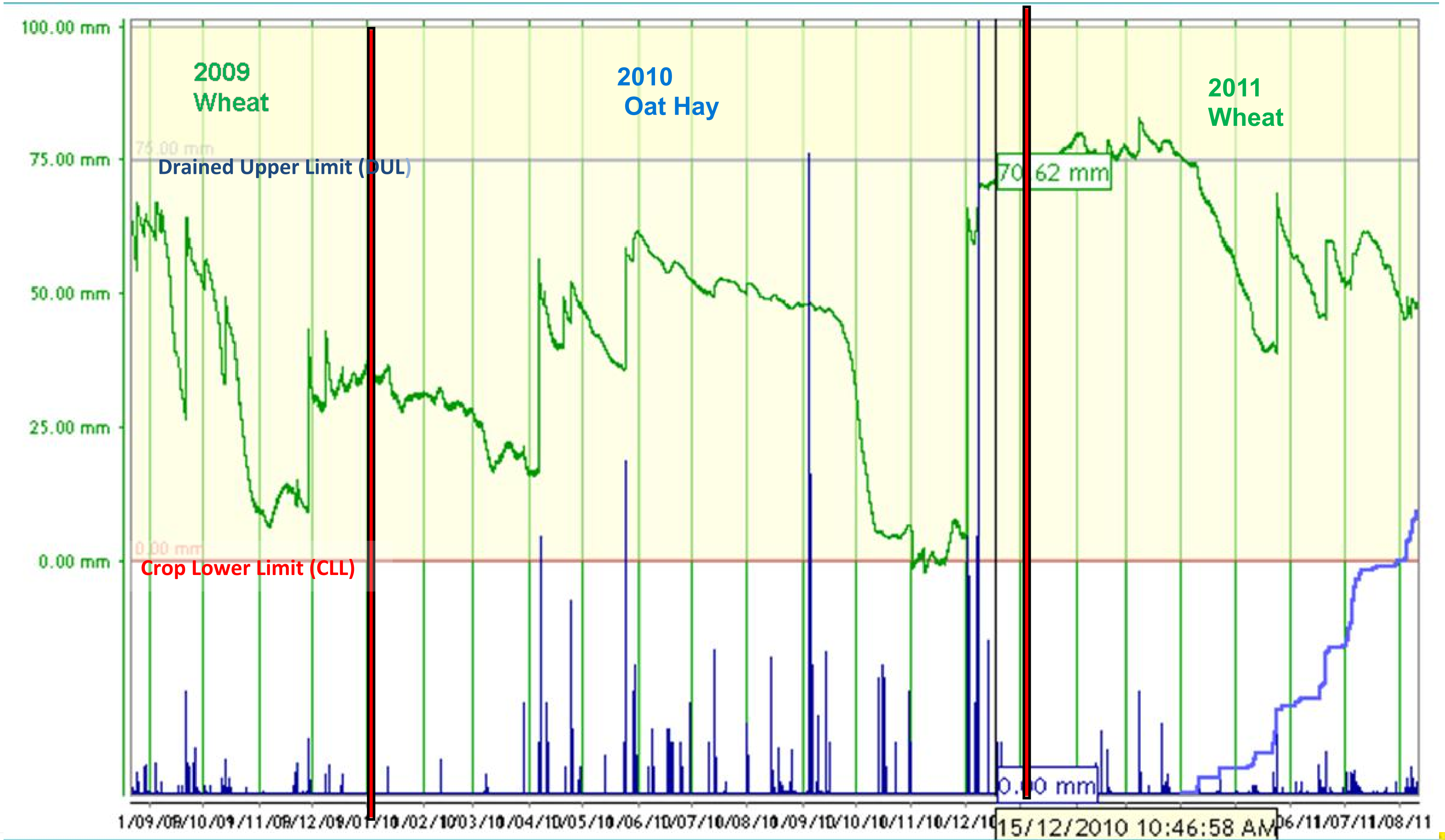


Drained Upper Limit (DUL)
Plant Available Water
Crop Lower Limit (CLL)
1/01/11
1/02/11
1/03/11
1/04/11
1/05/11
1/06/11
1/07/11
1/08/11
1/09/11
1/10/11
1/11/11
1/12/11

It Takes Time!

- It took us two seasons to get an accurate idea of Drained Upper Limit and Crop Lower Limit
- Dry finish in 2009
- Very wet summer in 2010-11

Soil Moisture Sum Graph – Tarlee



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Soil Moisture Probe Sum Graph – Salter Springs

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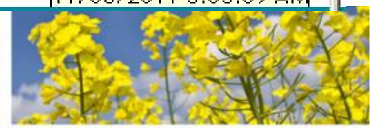
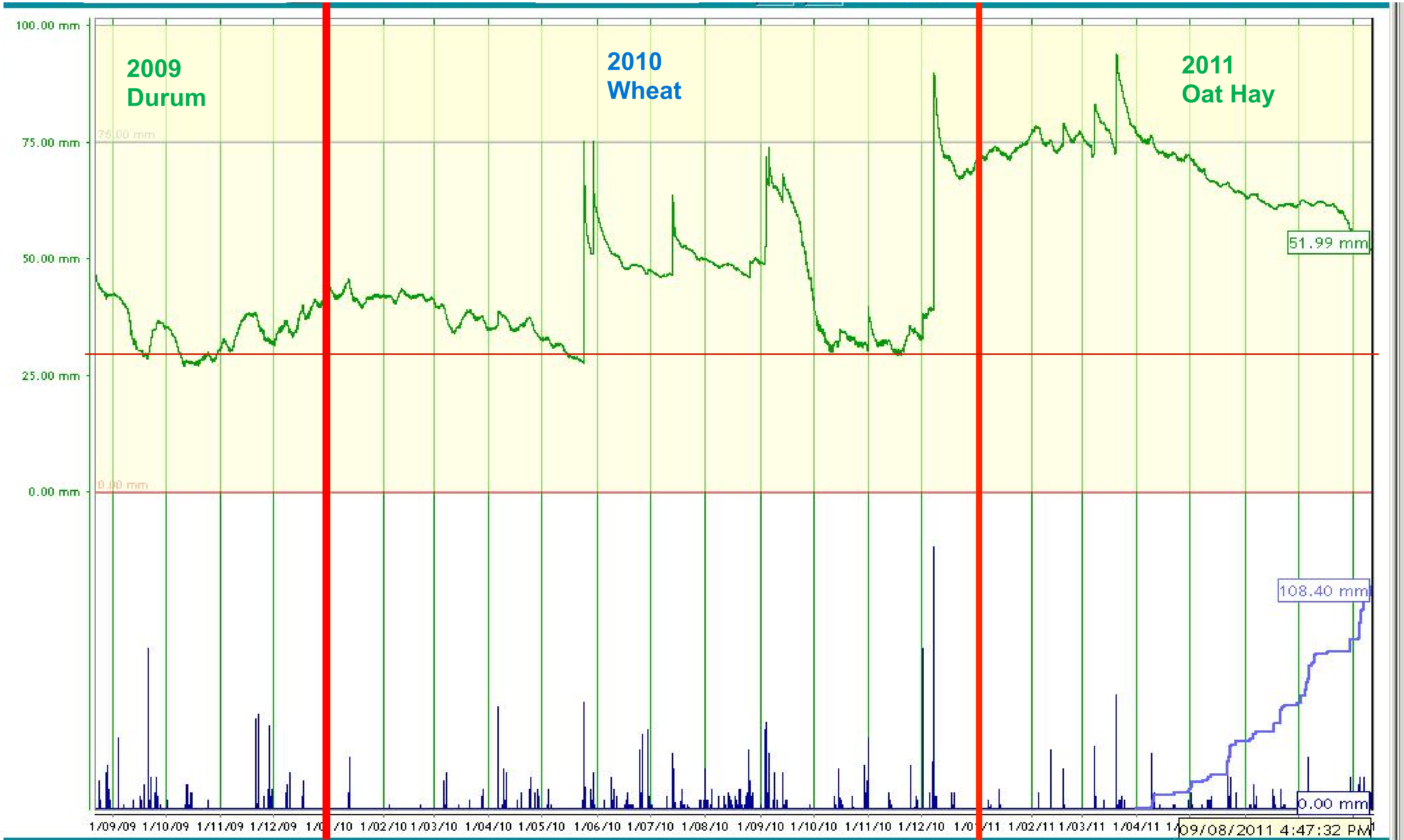


Soil Moisture Probe Sum Graph – Pinery



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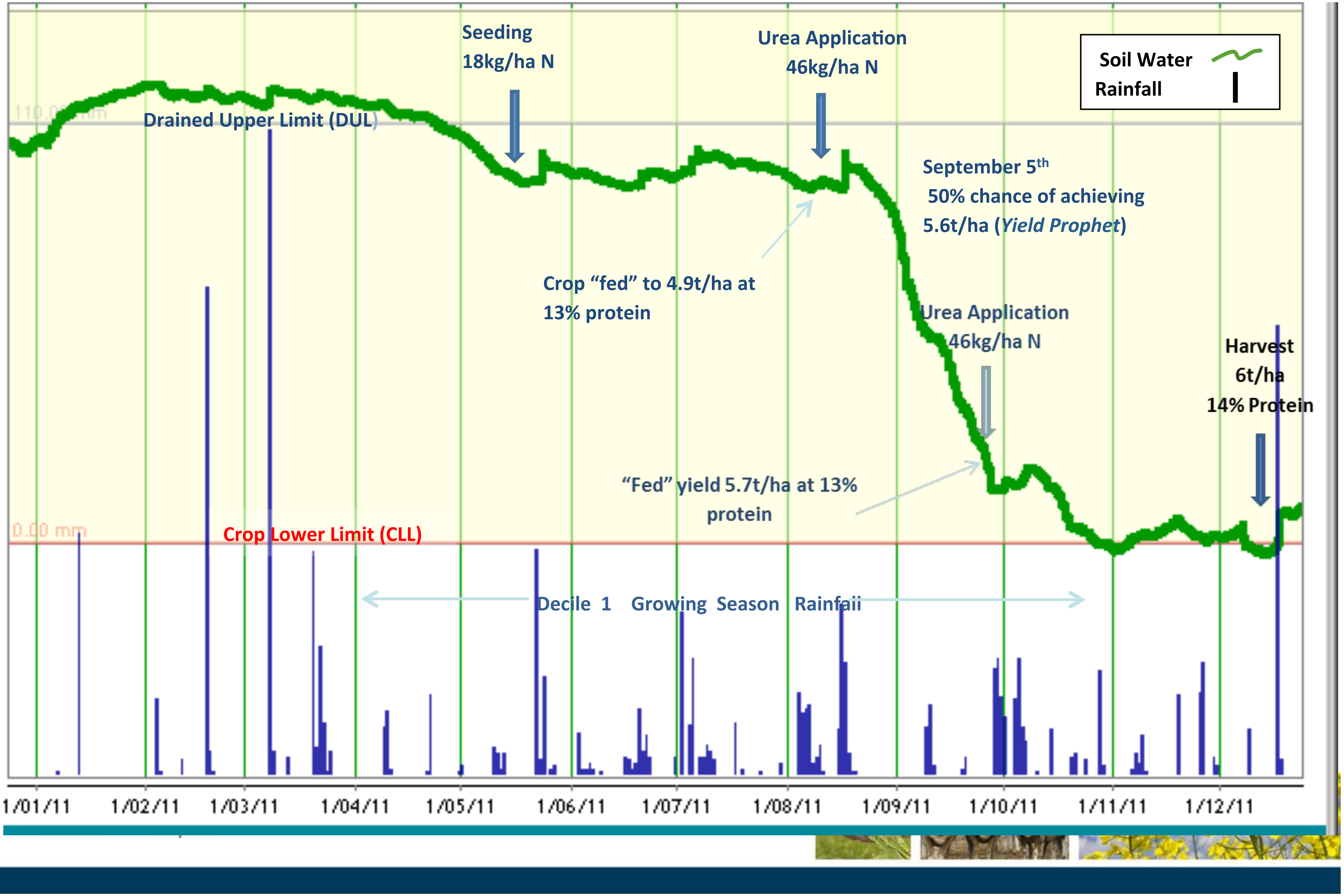
Using the Information

Once we knew where Drained Upper Limit (DUL) and Crop Lower Limit (CLL) was on the Sum Graph we were able to use the readings to guide understanding of:-

- How close to “full” is the soil water bucket?
- Is the crop likely to suffer waterlogging with the next rain? *(can guide fertiliser topdressing decisions)*
- How quickly is soil moisture being used?
- How many days of soil moisture have we got left? *(can guide late fertiliser, fungicide and grain marketing decisions)*

Salter Springs 2011 – A Case Study

- Well structured clay-loam
- Moisture probe installed August 2009
- Grew canola in 2010
- Durum sown in 2011
- 129kg/ha stored soil N


Seeding
18kg/ha N
Urea Application
46kg/ha N
Soil Water
Rainfall
Drained Upper Limit (DUL)
September 5th
50% chance of achieving
5.6t/ha (Yield Prophet)
Crop "fed" to 4.9t/ha at
13% protein
Urea Application
46kg/ha N
Harvest
6t/ha
14% Protein
"Fed" yield 5.7t/ha at 13%
protein
Crop Lower Limit (CLL)
Decile 1 Growing Season Rainfall
1/01/11
1/02/11
1/03/11
1/04/11
1/05/11
1/06/11
1/07/11
1/08/11
1/09/11
1/10/11
1/11/11
1/12/11

Grower Quotes

- “Without the information behind me I would have not have the confidence to apply the amount of urea in September as I did”

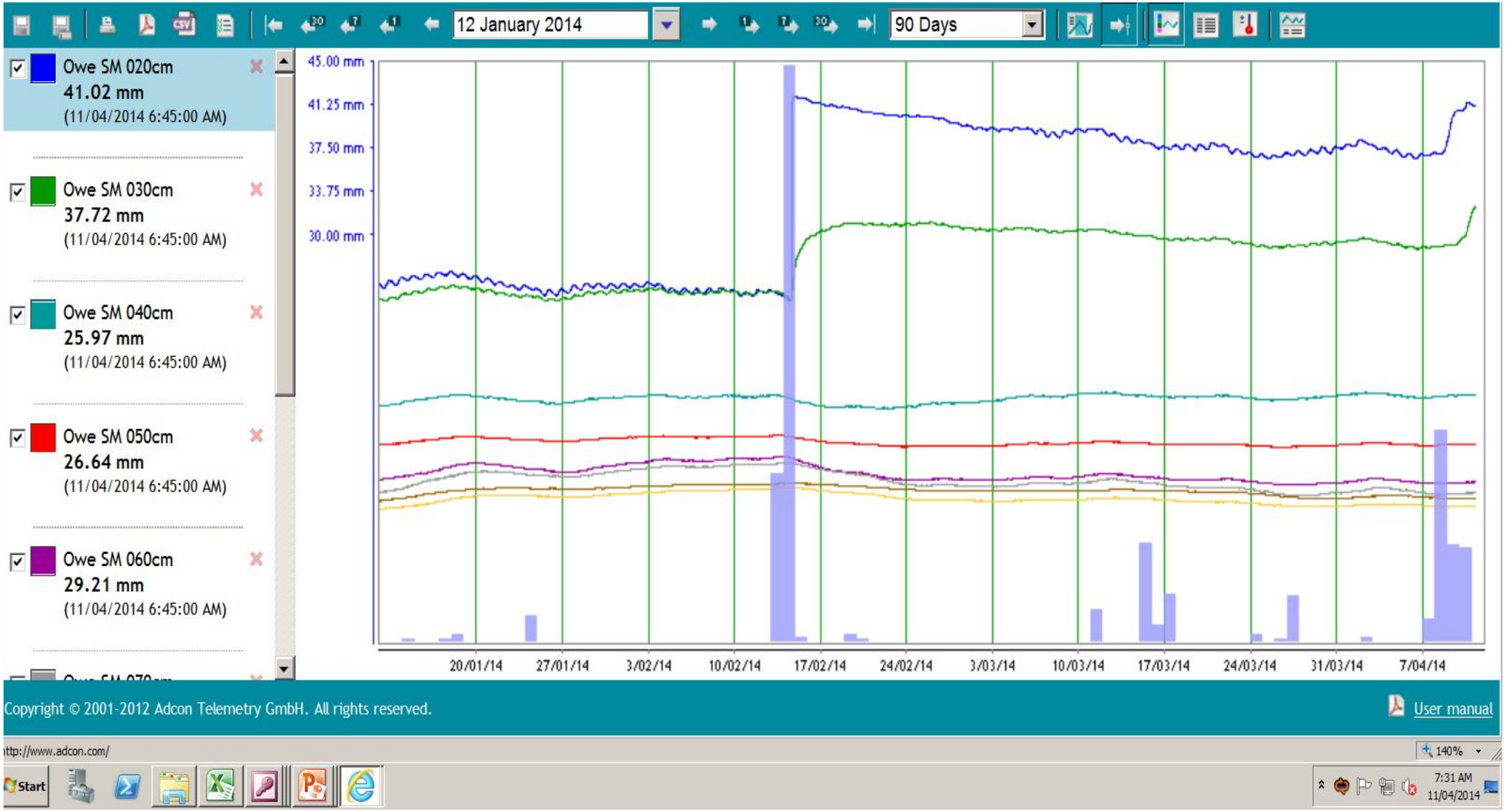
- “Yield Prophet was telling me that I still had available soil moisture for at least two weeks. The soil moisture probe was saying the same thing and the CSIRO Nitrogen Calculator was telling me I was underdone on N if yield was going to be greater than 5 t/ha”.

- “With a strong rainfall forecast for late September, I thought I had to go for it, with the end result of 6t/ha of DR1 quality grain and a gross margin of over $1500 per hectare”.

- “I believe they (moisture probes and Yield Prophet) are a valuable tool and certainly helped manage crops in 2011, as our moisture receded and finally crashed at the end of September. – I’m glad I kept the last of the urea in the shed !”.



Stacked Graph – *What Depth Has Rainfall Penetrated?*



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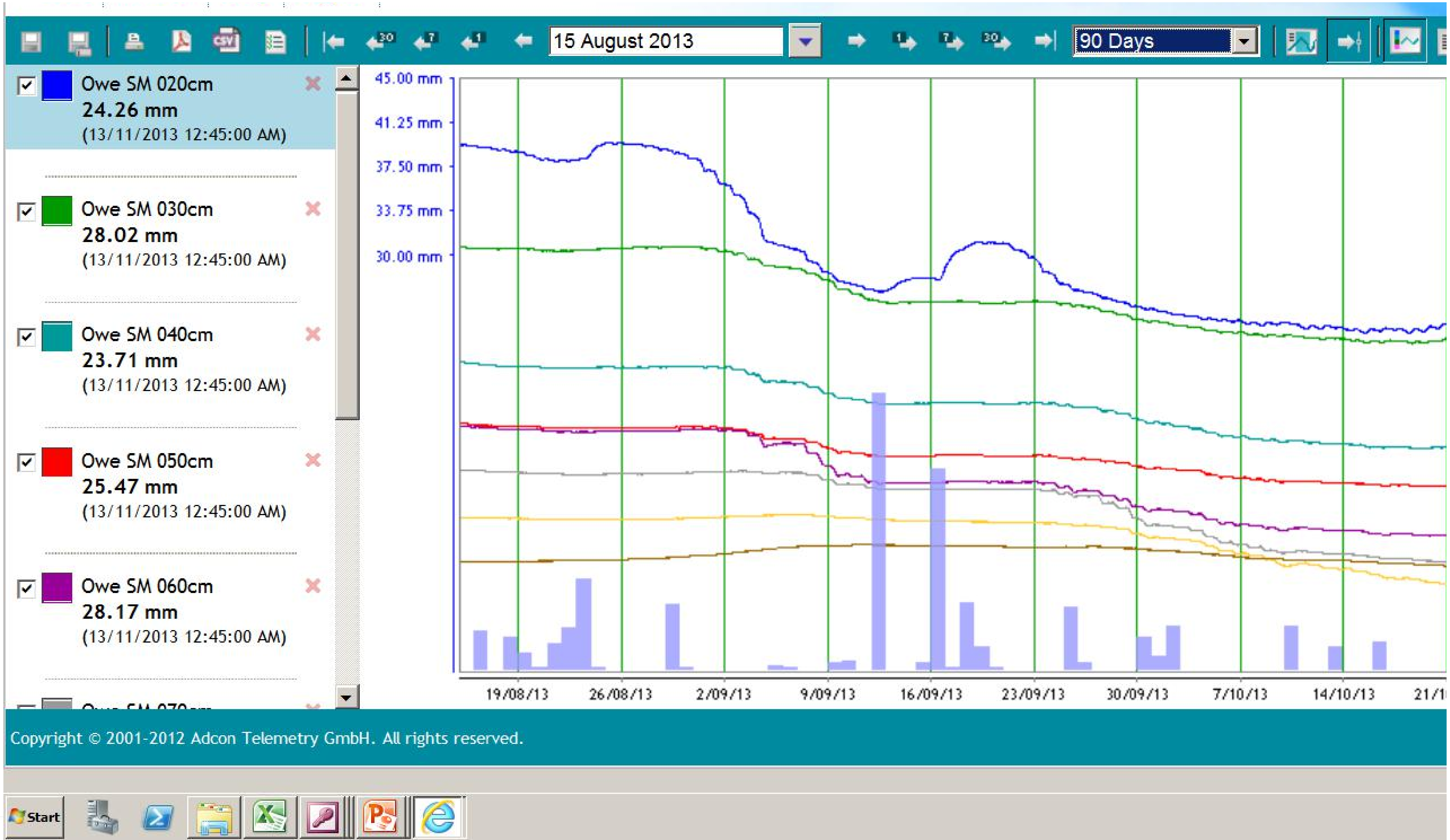
Stacked Graph – *What Depth is Moisture Being Used?*



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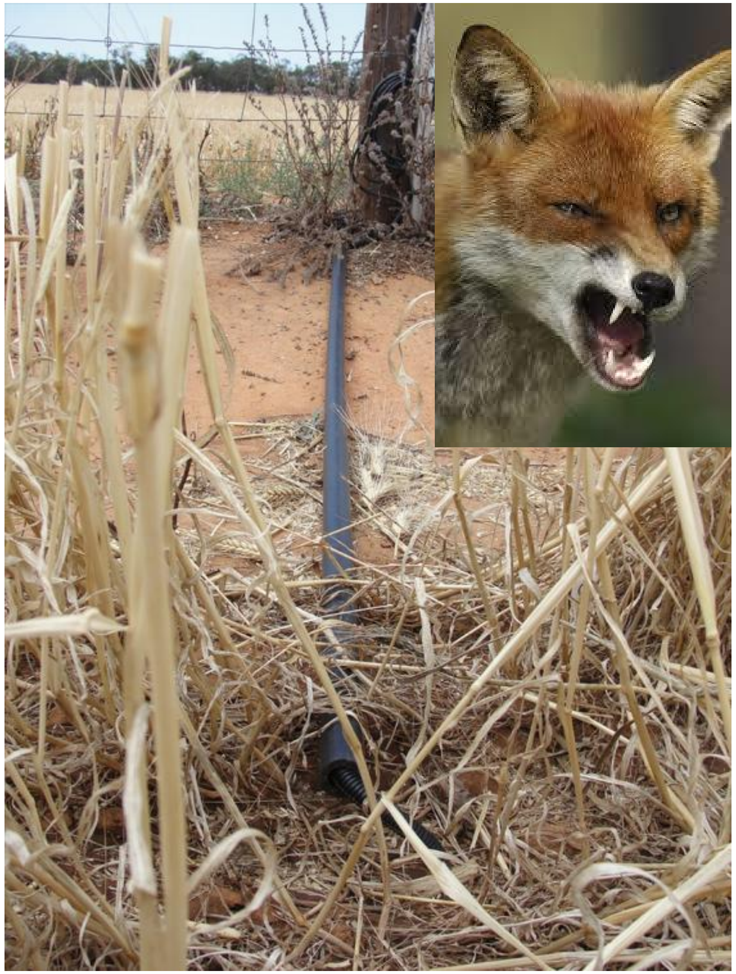
Maintenance



Soil Moisture Probes – Pros and Cons

Pros	Cons
• Direct measurement of soil moisture (and rainfall) in "real time" • Technology is a "hook" – attractive to growers • Ability to have growers accessing a network of probes across districts	• No linked N or yield prediction model • Cost - $4000-$5000 per unit • Site specific data • Outputs very dependent on soil type, paddock, crop management • May not have relevance to neighbouring paddocks/growers

Conclusions

- Soil Moisture Probes can be adapted for use in dryland farming situations
- Direct measurement of soil moisture (and rainfall) in "real time" has proved very powerful in guiding management decisions
- Choosing a representative soil type/paddock to locate probes is important
- The information generated from the probes improves in usefulness over time as more is learnt about the "soil water bucket"
- Development of production models that can be linked with soil moisture probe outputs will be extremely valuable