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FarmLink Research Report 2015

Mirrool Creek Landcare Project 2015

GRDC Project code – CRF00002

Project Partners

Funding Partners

Trial Site Location

Mirrool Creek

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Farm Host

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Introduction

Growers in the Ariah Park and Mirrool region of Southern New South Wales expressed an interest in developing knowledge and skills in improved soil moisture profile mangement to reduce yield loss and maximise profitability. In conjunction with the project partners three soil moisture probes and automatic rainfall gauges were installed at two sites. One on Felix Farm, North West of Ariah Park, and the other on Bellevue, South West of Ariah Park. The probes were installed twenty metres apart to allow a range of management options to be implemented over each probe. The probes were installed 18cm below the soil surface to allow normal machinery operations to occur without interuption. Each probe has six sensors at 28, 38, 58, 78, 98 and 118cm to measure the moisture levels at a range of depths. Temperature, daily rainfall, dew point, delta T and wind data was also recorded at both sites using weather stations.

The focus of the first site, Felix Farm, for 2015 was to evaluate the effect of different stubble treatments and varying nitrogen applications on soil moisture & yield over the growing season. The focus for the second site, Bellevue, was to compare nitrogen application rates & timings & view the impact it has on PAW use and rainfall infiltration between Lucerne/Clover pastures and wheat.

Moisture probes can be great decision making tool, as they can be used to track soil moisture use and remaining moisture levels at a range of depths throughout the growing season, allowing management decisions to be as informed as possible.

Method - Felix Farm

The trial site was sown with 45Y84 canola on 22 April at 2.5kg/ha and with 50kg/ha of MAP (Impact treated) on 300mm row spacing's with a (Ultisow) disc seeder. A stubble burn treatment was implemented on 15 May and nitrogen treatments were pre-drilled on 20 April, two days prior to sowing. All three blocks were top dressed with 100kg/ha of urea on the 15th of June.

Probe 1 canola sown into standing wheat stubble, Nitrogen rate of 50kg/ha of Urea pre-drilled (20/04/15) + additional 100kg/ha urea topdressed

Probe 2 canola sown into burned wheat stubble, Nitrogen rate of 50kg/ha of Urea pre-drilled (20/04/15) + additional 100kg/ha urea topdressed

Probe 3 canola sown into heavy standing wheat stubble load, Nitrogen rate of 200kg/ha of Urea pre-drilled (20/04/15) + additional 100kg/ha urea topdressed.

Results - Felix Farm

Probe number	2015 Harvest Index	2015 Estimated Hand Harvest Yield	SFU's 1st April 2015	SFU's 31st October 2015
1	0.33	1.60	65.37	63.87
2	0.31	1.55	71.37	69.67
3	0.34	2.39	61.89	-

Table 1. Yield and soil moisture data for Dart moisture probes, various stubble and urea treatments 2015. SFU = Soil fraction units

The results in Table 1 show Probe 3 had the highest yield for 2015. Probe 3 had 150kg/ha more urea compared to probes 1 and 2. Whilst probe 1 and 2 yield is quite respectable at approximately 1.6t/ha given the shorter spring experienced in 2015, the extra 790kg's achieved by probe 3 highlighted a strong response to additional nitrogen. At $500/t for canola, the increased yield of 790kg/ha would bring in an extra $395/ha, there was a profit of $295/ha. NB: that doesn't include all fixed or variable costs.

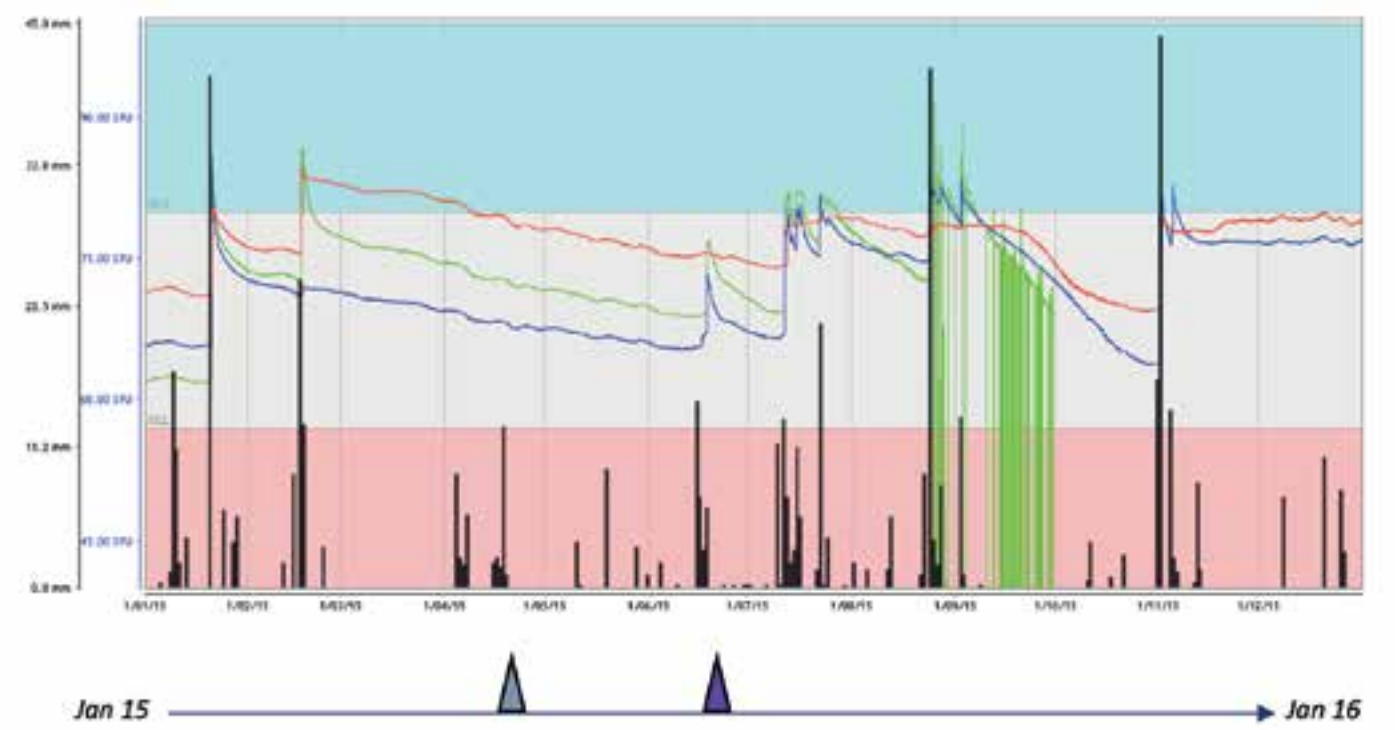

Figure 1. PAW levels for 3 Dart probes January – December 2015. Blue = probe 1, Red = probe 2, Green = probe 3, black bars = rainfall (mm).

Probe 3 began the season with the lowest PAW due to high moisture use and yield in 2014 from the preceding long fallow treatment in 2013. The moisture levels soon re-joined probes 1 and 2 (in the sum graph) after a major rain event in January. The three plots had an excellent start to the season with near perfect soil moisture conditions at sowing. From April 1st up until the day of sowing, the blocks received 38.8mm of rain. All probes show a steady decline in moisture levels from sowing onwards, indicating crop establishment and early growth. Despite the different nitrogen treatments and some differences in plant counts at each probe, all seem to be using moisture at an equivalent rate. Despite a lower plant count, probe 1 seems to be using up plenty of moisture.

Surprisingly during this period, probe 2, the burn treatment, has narrated high moisture levels. It might be expected that a bare cultivated surface would be prone to more evaporation than the other two treatments. It is also less influence by a rain event in mid -June which sees a small but sharp increase in probe 1 and 3.

A very wet winter sees all probes register DUL and field capacity, with probe 3 seeming to top out the graph readings. The site received 192mm of rainfall over winter, and a total of 530.4mm over 2015. Probe 3 has the highest stubble load out of all the treatments, this is aiding in increasing moisture infiltration as water movement over the plot is slowed giving more opportunity for it to enter the soil profile.

We can see during winter (early to mid-July) some small sharp falls in probe 3, indicating that the crop over that treatment has a well-developed root system and has started to access some of the 200kg/ha of nitrogen applied to that treatment. Consequently, from mid-August we see the green line dip below the blue and the red as the crop makes use of the moisture and nitrogen.

Rain events in late August and early September lift probe moisture levels back above DUL/field capacity. Probe 2 plateaus a little, indicating low moisture draw down. Probes 1 and 3 exhibit a moderate usage of soil moisture, especially probe 3 which now has a high biomass demand for moisture.

A short spring in 2015 saw little or no rainfall through September and October, but with well stocked profiles we see all treatments using up that stored moisture. Probe 3 unfortunately experienced some technical difficulties in late September and this has made for a dirty graph, but an underlying trend is still very evident and we can see this high nitrogen input treatment drawing down on the PAW moisture reserves. It ceases to function at the end of October, but the steepness of the graph indicates that moisture use is high and the yield achieved at that probe of 2.39t/ha would have used most if not all of the available moisture and converted it to yield.

By late October we can see that the two functioning probes have reached a CLL for the season, and these are similar to the preceding season.

Rain did eventually come at the start of November, but this was too late for any plant use and yield benefit. It did however quickly replenish the moisture levels back towards a DUL and they have remained relatively static into 2016.

Probe number	Emergence	2015 Estimated Hand Harvest Yield	SFU's 1st April 2015	SFU's 31st October 2015
1	47	76.89	0.33	1.60
2	78	78.95	0.31	1.55
3	72	-	0.34	2.39

Table 2. Treatment measurements for probes at Dart moisture probe site.

The results in table 5 show that there was a large difference in canola emergence counts between the probe treatments. Probe 1 had the lowest count with 47 plants/m2, while probe 2 had the highest emergence count with 78 plants/ m2. Probe 3 followed probe 2 closely with 72 plant/ m2. Even though probe 2 had the highest emergence count, it still yielded approximately the same as probe 1 which had 31 less plants per square metre.

Method - Bellevue

The focus for 2015 at this probe site was to compare nitrogen application rates and timings and view the impact it has on PAW use and rainfall infiltration between Lucerne/Clover pastures and wheat.

The probe site was sown with Stingray canola on the 20th of May at 3.5kg/ha with 60kg/ha MAP and 80kg/ha of Gran Am, with a knife point, press wheel seeder on 300mm spacing's. 100kg/ha of urea was applied on 31 July to probes 1 and 2 (Canola probes). The Lucerne/clover pasture crop is in its final year of pasture and will be sown to oats in 2016 in an attempt to open the ground up and will be sprayed out in the spring. It will be then put into a cropping rotation in 2017.

Probe 0 Pasture, lucerne and clover.

Probe 1 Stingray Canola, sown into roughly 2t/ha of standing barley stubble, targeted for 100kg urea topdressed to the area surrounding it.

Probe 2 Stingray Canola, sown into roughly 2t/ha of standing barley stubble, targeted for a split application of urea added to the area surrounding it. How ever, only the first application was applied due to the paddock being too wet for the second application. Therefore, both probe 1 and 2 had the same treatments.

Results - Bellevue

The probes at this site have experienced some data logging issues during the 3 years they have been collecting data and this affects the reliability of the data and interpretation of results. The probes have returned data but getting the 3 probes to conform to a common scale for interpretation has been an ongoing challenge. However individually it is still possible to track soil moisture levels and plot associated trends across the collection period despite this non standardized scale.

Probe number	Yield	Emergence (Plants/m2)	SFU's 1st April 15	SFU's 20th November 15
0	Pasture		22.26	28.34
1	1.3t/ha	44	30.33	35.80
2	1.3t/ha	44.47	69.67	85.34

Table 3. Yield and soil moisture data for Denyer moisture probe nitrogen treatments 2014. SFU = Soil fraction units

Discussion – Bellevue

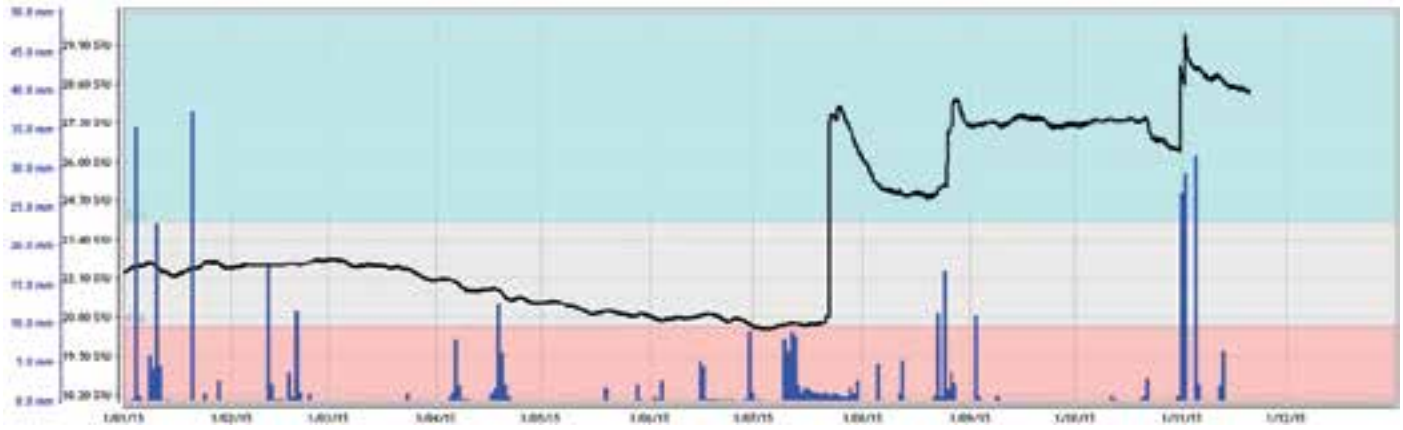

Figure 2. Denyer probe 0, Paw levels sum graph. Lucerne and clover pasture, January-December 2015. Blue bars = rainfall (mm).

Probe 0 at Denyer's gives us a good indication of the soil moisture variability and usage under a perennial dominated pasture over the three years of data logging. Large rainfall events are required to cause dramatic increases of moisture in the soil profile and fill it up towards its assumed DUL (light blue zone on graph). As we can see there was a major increase in moisture up to 27.58 SFU on 23 July, 2015. At first sight, this looks like an excessive amount to increase by with little rainfall. But the frequent small rainfall events received over a long period of time has allowed the water to infiltrate into the soil and not just wash away before having time to soak into the soil.

Figure 3. Denyer probe 1, Paw levels sum graph. Canola crop, January-December 2015. Blue bars = rainfall (mm).

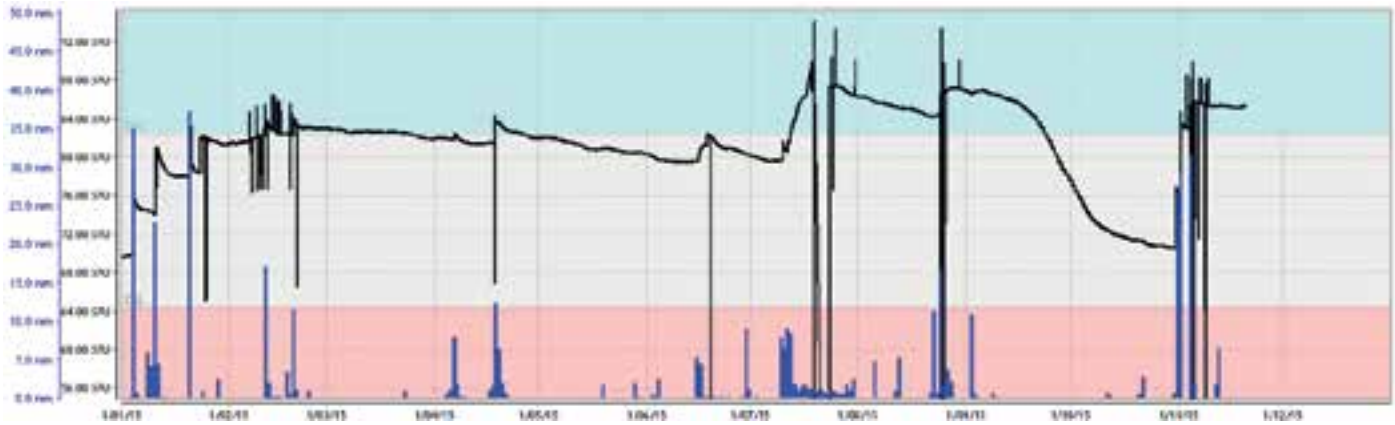

Figure 4. Denyer probe 2, Paw levels sum graph. Canola crop, January-December 2015. Blue bars = rainfall (mm).

While there have been issues with the three probes conforming to the same scale, probe 1 and 2 exhibit similar behaviour throughout the season. Both probes received the same urea treatments of 100kg/ha top-dressed, probe 2 never received the second top-dress application scheduled for later on in the season due to access to the paddock. Unfortunately, all three probes cut out on November 20, but most of the season's moisture data was captured.

Conclusion

Dart

Many factors could have contributed to the extra yield that probe 3 produced, the main factor was the high nitrogen rate of 200kg/ha pre-drilled prior to sowing. The high nitrogen ensured good root establishment in the early stages of growth, allowing the roots to access moisture located deeper in the soil profile. However, this means more moisture was utilized and removed from the soil during the season compared to the other two probes, this is the trade-off between soil moisture and yield. Another factor contributing to the high yield is the high stubble load over probe 3, the stubble slowed down the movement/run off of water increasing water infiltration into the soil.

Unfortunately, probe 3 went offline in late September. Despite these problems, we can see the trend continued to decline before it completely cut off. The last reading was 69.93 SFU, while the readings at the point in time for probe 1 was 73.31 SFU and 75.46 SFU for probe 2. From this we can gather that there was less plant available water left in the soil under the high urea treatment (probe 3). There is a chance that the moisture levels dropped below the CCL, but how far the moisture declined is unknown.

It was expected that probe 2 would have a lower moisture levels due to increased evaporation from the bare soil and high plant establishment counts, however this was not the case. Probe 2 had the highest moisture levels throughout most of the season. The probe had the lowest yield, once again demonstrating the trade-off between yield and moisture use.

The moisture probe network has been a great tool to teach growers in the region how to read moisture graphs and use this data to make informed management decisions. Growers can see how various urea application rates and stubble cover effects soil moisture throughout the season. The effects on the starting moisture for the next season is also demonstrated.

Denyer

The aim of the project at the Denyer's site was to compare moisture infiltration in pasture and cropping paddocks and the effect of varying nitrogen applications on moisture usage and yield. These probes have given growers in the region the opportunity to learn about water infiltration in various crop types. There was no difference in the urea application rates over probe 1 and 2 to compare.

Although the graphs could not be compared directly to each other due to scaling problems, individually these graphs are still useful. From this data we can see the moisture supply and demand is clearly dissimilar for the crop types. The PAW is held under constant pressure to the demands of the deep tap rooted Lucerne species, whereas the moisture demand in the canola crop fluctuates throughout the season.