ABOUT PROJECT

Smarter Irrigation for Profit Phase 2 (SIP2) is a partnership between the irrigation industries of sugar, cotton, grains, dairy and rice, research organisations and farmer groups. The objective of SIP2 is to improve the profit of over 4,000 irrigators. It has 14 sub-projects covering three main components:

- Development of new irrigation technologies including new sensors, advanced analytics to improve irrigation scheduling and strategies to reduce water storage evaporation.
- Cost effective, practical automated irrigation systems for cotton, rice, sugar and dairy.
- Closing the irrigation productivity yield gap for cotton, rice, dairy, sugar and grains irrigators through a network of 46 farmer led optimised irrigation sites and key learning sites located on commercial farms across Australia.

Visit Project Website

Irrigated Cropping Council
Promoting irrigated agriculture

IRRIGATION TIMING DEMONSTRATION

The demonstration was established to test the yield and grain quality of wheat to various irrigation scenarios. While some differences were noted, the demonstration was compromised by drought in late winter prior to the opening of the irrigation season. Yield potential was reduced through tiller death and the plants were unable to compensate once irrigation was applied.

Objective

Demonstrate the effect of timing and quantity of irrigation water on wheat yield and grain quality.

Method

Table 1. Method summary

Sowing Date	15th May
Target Plant Population	160 plants/m_2
Seeding Rate	78 kg/ha based on TGW*
Irrigation	
17th August	1.1 Ml/ha All treatments
15th September	0.8 Ml/ha Booting Timing
21st September	1.0 Ml/ha Timing based on SMM@
4th October	0.5/1.1 Ml/ha Flowering Timing@
14th October	1.0 Ml/ha Timing based on SMM*
Rain fall	250.1mm GSR (April – October)
N application	August 17th - 55 kg N/ha
Harvest	3rd December
Average Yield	5.5 t/ha

* Thousand Grain Weight. @ Soil Moisture Monitoring equipment reading 60-70 kPa

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METHODOLOGY

The wheat variety Scout was selected as a high yielding variety under irrigated conditions. Demonstration design and randomisations were produced via DiGGer software. Plot size was 5m by 20m^2. The sowing rate was 78 kg/ha targeting 160 plants/m. Seed was treated with Gaucho seed dressing (200 ml/100 kg) 24 hours prior to sowing on May 15th. Seed was sown using Shearer drill, fitted with knife points and press wheels. Soil moisture was excellent at sowing following 88mm in April and showers through May.

Weed control consisted of a broadleaf spray on July 23rd (Triathlon 1.0 l/ha).

Irrigation treatments were planned as per Table 2. Due to poor rainfall in the months of June and July, the demonstration site was affected by drought stress from the last week of July until August 17th, when irrigation was available with the opening of the 2020/21 season.

The soil moisture monitoring equipment installed in the plots showed moisture stress in excess of 240 kPa. Visually the plants had lost their lower leaves and tiller death was evident. The decision was made to irrigate all plots in order to keep the trial alive on August 17th, and then the planned treatments were applied. Shoot counts at this time averaged 517 shoots/m^2 across the demonstration site.

Following the first spring irrigation, irrigation water was applied via surface dripper tape (Netafim Streamline X 16080) which was capable of delivering 100mm or 1.0 Ml/ha of water in six hours, mimicking a flood irrigation event.

Where treatments were applied at a growth stage rather than based on soil moisture, an estimate was made on how much water would be required to refill the soil moisture profile.

IRRIGATION TREATMENTS

Table 2: Planned and actual irrigation strategies

	Planned Treatments	Actual Treatments
1	No spring irrigation	Irrigated on August 17th only
2	1 irrigation at booting	Irrigated on 17/8 and 15/9
3	1 spring irrigation at flowering	Irrigated on 17/8 and 4/10
4	2 spring irrigations based on SMM	Irrigated on 17/8 and 21/9
5	Irrigation at booting + flowering	Irrigated on 17/8, 15/9 and 4/10
6	Full irrigation based on SMM	Irrigated on 17/8, 21/9 and 14/10

Table 3: Summary of irrigation water applied (Ml/ha)

	Treatment	17-Aug	15-Sep	24-Sep	4-Oct	14-Oct	Total
1	1 spring irrigation	1.1					1.1
2	1 + 1 irrigation at booting	1.1	0.8				1.9
3	1 + 1 irrigation at flowering	1.1			1.1		2.2
4	2 spring irrigations based on SMM	1.1		1.0			2.1
5	1 + irrigation at booting + flowering	1.1	0.8		0.5		2.4
6	Full irrigation based on SMM	1.1		1.0		1.0	3.1

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METHODOLOGY

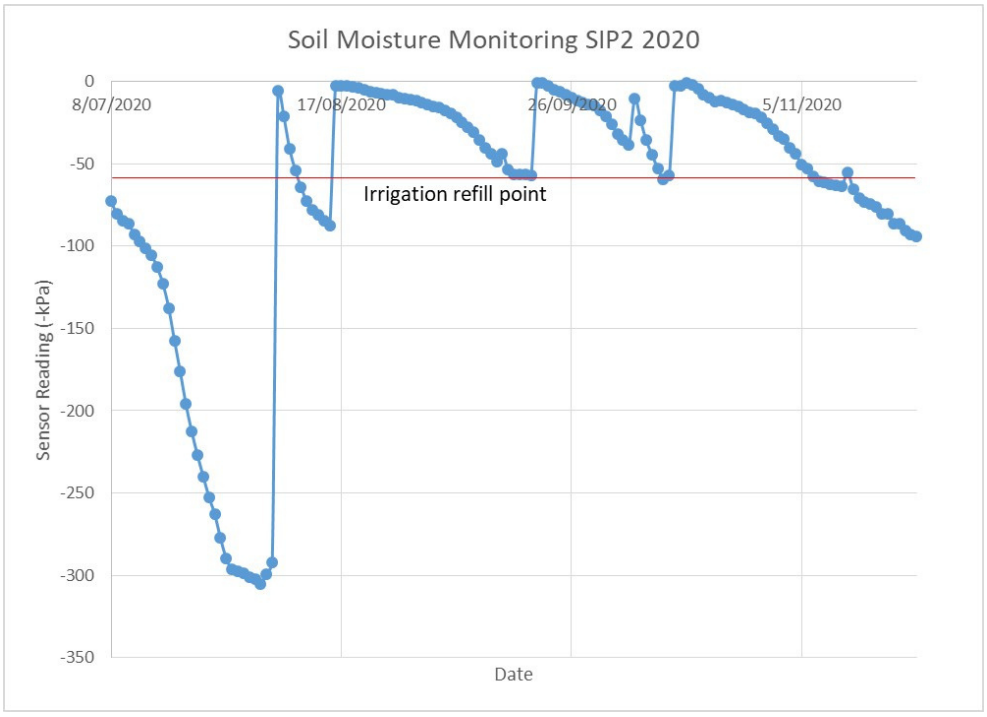

Figure 1: Soil Moisture Monitoring data from Treatment 6

The trial was harvested on December 3rd. Grain samples were taken and analysed for protein and moisture content, grain size and test weight.

2020 RESULTS

Harvest results show a yield response to irrigation. Most of this yield response can be attributed to increased grain size. Treatment 2 (irrigation at booting) had a slightly higher yield than explained simply by grain size (5.8 t/ha compared with 5.5 t/ha expected based on grain size) but this may be an anomaly due to site variability.

Water use efficiency (WUE) was highest in the treatment that received the lowest irrigation and generally followed the trend of higher irrigation inputs resulting in lower WUE.

Table 4: Yield and Grain Quality

	Irrigation Treatment	Yield	TGW*	Protein	Screenings	Test	WUE@
		t/ha	g	%	%	kg/hl	kg/mm
1	1 Spring	4.7	36.0	9.8	2.4%	82.6	18.9
2	1 + 1 at Booting	5.8	42.0	9.7	2.1%	82.2	17.7
3	1 + 1 at Flowering	5.1	40.3	10.1	2.4%	82.8	14.3
4	2 Spring SMM	5.8	43.7	9.7	1.3%	83.1	16.7
5	1 + Booting + Flower	5.7	44.7	9.5	2.5%	82.4	15.1
6	Full (3 Spring SMM)	5.8	45.3	9.9	2.0%	81.6	13.0

*TGW - Thousand Grain Weight. WUE@- Water Use Efficiency

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Table 5: Gross margin analysis

	Irrigation Treatment	Gross Margin $60/Ml		Gross Margin $250/Ml	
		$/ha	$/Ml	$/ha	$/Ml
1	1 Spring	725	659	516	469
2	1 + 1 at Booting	957	503	596	313
3	1 + 1 at Flowering	761	346	343	156
4	2 Spring SMM	945	450	546	260
5	1 + Booting + Flower	901	375	445	185
6	Full (3 Spring SMM)	885	285	296	95

Gross margins were calculated using the cost of irrigation water at $60/Ml (the approximate cost of water using an irrigator's allocation) and $250/Ml (the approximate price of temporary water in spring 2020).

The best return per Ml was the single early irrigation in mid-August. Best return per hectare was from 2 spring irrigations where the crop had a full soil moisture profile at booting.

CONCULSIONS

The winter drought had two major impacts on the demonstration. Moisture stress in late July and early August, which could not be addressed due to the irrigation season being closed, resulted in tiller death and the loss of yield potential. Irrigation on August 17th was too late for the crop to be able to compensate by initiating more tillers as the plants were too far advanced in its growth cycle.

Irrigating on August 17th also ensured that the crop had adequate moisture at booting, assumed to be a key growth stage in the development of the florets and thus yield. The demonstration was intended to have drought stress treatments at this stage to test this assumption, but by being forced to irrigate to keep the demonstration alive, the assumption was not tested.

Later spring irrigations did result in higher yields, but this was predominantly driven by increased grain size. In the 2020 spring, having a full soil moisture profile at booting followed by 52.6mm of rain until the end of October was sufficient to achieve the highest yield.

Gross margin analysis indicated that the best return per megalitre was from the single irrigation in mid-August. The best return per hectare was from having the soil moisture profile full at booting.

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