Final Technical Results Report

2024

NGN Winter wheat agronomy for grain growers in the Western Region

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REPORT SENSITIVITY

Does the report have any of the following sensitivities?

Intended for journal publication	YES ☐ NO ☒
Results are incomplete	YES ☐ NO ☒
Commercial/IP concerns	YES ☐ NO ☒
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Contents

ABSTRACT

This trial was conducted to help grain growers in Western Australia make better decisions about which cereal crops to sow and when, especially in seasons with early rainfall. With new winter wheat varieties like Mowhawk offering the potential for early sowing and grazing, the trial compared its performance across three sowing times (March, April, May) against spring wheat (Rockstar) and oats (Bannister). The trial found that Mowhawk performed best when sown in late March, but its yield advantage was likely reduced by grazing and weed pressure. Spring wheat yielded better than winter wheat when sown later in May, while oats outperformed both wheat types in early sowing, offering higher yields, better weed suppression, and greater income. These results show that while winter wheat can be a valuable option for early sowing, oats may be a more profitable and lower-risk choice in many situations. The findings will help growers plan more flexible and profitable cropping programs based on seasonal conditions and market opportunities.

EXECUTIVE SUMMARY

Why the Work Was Done

Recent advances in winter wheat breeding have introduced varieties like *Mowhawk*, which offer potential for early sowing and dual-purpose use in mixed farming systems. With increasing interest from growers in capturing early sowing opportunities—especially following early autumn rainfall—this trial aimed to assess the performance of *Mowhawk* winter wheat across three sowing times and compare it with spring wheat (*Rockstar*) and oats (*Bannister*). The goal was to provide growers with practical insights into crop selection, timing, and management strategies to improve profitability and resilience in variable seasons.

What Was Achieved

- **Winter Wheat (Mowhawk):**
  Performed best when sown on **27 March**, achieving the highest yield (2.90 t/ha) and grain quality (APW2). However, grazing reduced its competitive ability against ryegrass, limiting its yield advantage.

- **Spring Wheat (Rockstar):**
  Sown on **25 May**, it yielded **3.21 t/ha**, outperforming Mowhawk in both yield and income under late sowing conditions, confirming its suitability for traditional sowing windows.

- **Oats (Bannister):**
  Outperformed both wheat varieties in early sowing, with yields of **5.75 t/ha** (TOS1) and **5.12 t/ha** (TOS2). Oats showed superior weed suppression, grazing recovery, and economic return, generating up to **$2,501/ha**.

- **Weed Management:**
  Ryegrass competition significantly impacted wheat performance, especially in grazed plots. The inclusion of oats limited herbicide options, highlighting the importance of **clean paddock selection** and **post-emergent grass control** for winter wheat.

When and How Industry Can Benefit

- **Early Sowing Opportunities:**
  In years with early rainfall, growers can confidently sow *Mowhawk* or *Bannister* in late March to capture early moisture and extend the cropping program.

- **Dual-Purpose Systems:**
  Both *Mowhawk* and *Bannister* offer grazing potential, but oats recovered better post-grazing, had higher biomass and maintained higher yield.
- **Weed Control Planning:**
  Effective ryegrass management is essential for winter wheat success. Clean paddocks and flexible herbicide strategies are critical.

Who Can Benefit

- **Grain Growers** in the Great Southern and similar regions seeking to expand sowing windows and improve profitability.
- **Mixed Farming Enterprises** looking for dual-purpose crops with grazing and grain potential.
- **Agronomists and Advisors** supporting growers with crop planning, weed control, and grazing strategies.
- **Breeders and Researchers** developing winter cereals suited to early sowing and integrated systems.

Recommendations for Future Action

1. **Further trials** focussing more on other species such as oats and long spring/winter barley as a comparison against winter wheat.

BACKGROUND

Winter wheat varieties have had genetic advancements in recent years resulting in them becoming more suitable to mixed cropping systems. The variety Mowhawk for example, is a new winter wheat variety that is suited to planting in an early sowing window (late March – mid April). The vernalisation requirement provides an extended period of vegetative growth well suited to grazing and can achieve an Australian Hard classification at harvest. Varieties like Mowhawk are well suited to the Great Southern cropping zone as it allows 100% cropping enterprises an early sowing opportunity in wet years and for an established crop to be developed before waterlogging may occur.

Capturing an Early Sowing Opportunity

Bullaring experienced above average March rainfall (60mm) in 2024 (Appendix 9.1). This provided growers with an opportunity to sow long season cereals very early to utilise this soil moisture. Winter wheat has been popular with growers looking to capture early seeding opportunities and for grain and graze. With recent high oat prices and the natural strong frost tolerance of oats it was decided to evaluate how very early sown oats compared to winter wheat.

The site received an early break followed by average winter rainfall and then above average spring. This set the potential for very high grain yields.

The trial site in Bullaring will help to evaluate how wide the sowing window for Mohawk and similar varieties can be extended, as well as determine when it may be more beneficial to opt for a standard spring variety or an alternative species such as oats. This trial builds on findings from previous research within the project, which indicated that early-sown oats tend to yield higher and can provide a greater economic advantage over winter wheat when market conditions are favourable.

This research aims to allow growers to have greater knowledge on how to profitably grow winter wheat crops in response to timing of nitrogen applications and the suitability of winter wheat sown in the upper Great Southern cropping region.

PROJECT OBJECTIVES

1. To compare the yield of three times of sowing (March, April, May) for Mowhawk winter wheat.
2. Compare the performance of oats vs winter wheat in early sowing windows.
3. To compare the yield of early sown winter wheat against spring wheat sown during its ideal sowing window.

METHODOLOGY

The trial was set up as a large-scale randomised block design sown with the farmers machinery. A hydraulic tine Bourgault air seeder on 25cm spacings with a stiletto paired row seeding boot was used.

The first time of sowing (TOS1) was opportunistic, taking advantage of early March rainfall and an ideal scenario where growers could utilise early moisture by planting winter wheat. Moisture was becoming marginal, however, germination of the crop could still be achieved with deeper seeding, so they were sown 40-50mm deep.

Following TOS1, there was roughly a 1-month gap between the next two seeding times, to evenly represent the seeding window in southern Western Australia. There was adequate moisture for germination at the later two seeding dates, which were both sown at 30mm seed depth.

- TOS 1 27th March
- TOS 2 30th April
- TOS 3 25th May

Due to the trial layout, the pre-emergent herbicide application could only be applied prior to the first seeding time. This compromised weed control for TOS 2 and 3 compared to the standard practice.

On the 10th of June a mob of 200 ewes accessed the paddock that the trial was in. This was unplanned and the trial was grazed for two days. The trial was uniformly grazed. TOS 1 & 2 were significantly impacted but TOS 3 was only at the 2-leaf stage and therefore the impact was minimal.

Trial Layout

	Rep 1					
Plot #	101	102	103	104	105	106
Variety	Mowhawk	Bannister	Rockstar	Mowhawk	Bannister	Mowhawk
Time of Sowing	1	1	3	2	2	3

	Rep 2					
Plot #	201	202	203	204	205	206
Variety	Bannister	Mowhawk	Mowhawk	Bannister	Mowhawk	RockStar
Time of Sowing	1	2	1	2	3	3

	Rep 3					
Plot #	301	302	303	304	305	306
Variety	Bannister	Rockstar	Bannister	Mowhawk	Mowhawk	Mowhawk
Time of Sowing	2	3	1	3	1	2

Experimental design

Trial design type	Randomised complete block design (RCBD)
Replicates	3
Plot size (width x length)	12m x 100m

Crop Agronomy Management

Activity	Description (Active ingredients listed as grams ai/ha)
Autumn Knockdown Weed Control	500g Paraquat + 238g 2,4-D Ester + 3g Metsulfuron methyl + 0.2% v/V Wetter 1000
Pre-emergent Weed Control	50g Saflufenacil + 25g Trifludamoxazin (200ml Voraxor) + 2000g Prosulfocarb + 300g S-Metalochlor (2.5L Boxer Gold) + 450g Glyphosate + 1% v/V MSO
Broadleaf Weed Control	75g Clopyralid 200g MCPA Ester + 20g Diflufenican (800ml Tigrex) 120g Bromoxynil + 120g MCPA Ester (0.6L Bromicide MA)
Fungicide	60g Azoxystrobin + 87g Propiconazole
Nutrition (at seeding)	75kg Crop Builder:MOP 75:25 (11P, 11K) 60L UAN (25N)
Nutrition (3-leaf)	120kg NK 2:1 (38N, 18K)
Nutrition (1st Node)	100L UAN (48N)

Treatment list

Seeding Date	Treatment	Seeding rate (kg/ha)
27/03	TOS 1 Mowhawk	50
27/03	TOS 1 Bannister	50
30/04	TOS 2 Mowhawk	60
30/04	TOS 2 Bannister	90
25/05	TOS 3 Mowhawk	60
25/05	TOS 3 Rockstar	70

Assessment details

Date	Timing	Assessment
27/03 & 25/05	At Seeding	Soil Moisture Cores
13/06	3 weeks after final TOS 3	Establishment Counts
30/09	Anthesis	Crop Biomass
30/09	Anthesis	Soil Moisture Cores
16/10	Panicle emergence-Harvest	Panicle Counts
4/12	Harvest	Yield and Grain Quality

LOCATION

Site #	Latitude (decimal degrees)	Longitude (decimal degrees)	Nearest town
Trial Site #1	-32.5970	117.5039	Bullaring, WA

RESULTS

Wheat

The first time of sowing (TOS1), on the 27th of March resulted in a yield of 2.9t/ha for Mowhawk. This was an increase of 270kg/ha compared to TOS 2 (not significantly different) and a 430kg/ha increase compared to TOS 3. Late March is within the optimal sowing window for Mowhawk, therefore a significant improvement to TOS 2 (later than ideal for Mowhawk) was expected. The trial being grazed on the 10th of June probably decreased this advantage of the earlier time of sowing by setting back the crop's growth and allowing more light penetration to the lower canopy, thus reducing crop competition with weeds (Figure 1). A nearby paddock of Mowhawk was ungrazed and shows a comparison to the grazed trial plot (Figure 2). TOS 3 was not affected by the grazing (Figure 3).

Figure 1 Mowhawk TOS1 after grazing by sheep.

Figure 2 Ungrazed Mowhawk from a nearby paddock as a comparison.

Figure 3 Mowhawk in TOS3 which was not affected by grazing.

Spring wheat sown of the 25th of May (Rockstar), yielded 3.2 t/ha, which was 300kg/ha more than Mowhawk at TOS 1. However, the grazing also needs to be considered when comparing this result and it is likely that the winter wheat would have done better, relative to spring wheat if the crop had not been grazed. Grazing opened the canopy and allowed he ryegrass to proliferate and reduce wheat yield. The oats in TOS1 and TOS2 were also grazed heavily, however, they recovered quicker than the wheat and were able to compete more strongly with the ryegrass. Without the oats in the trial stronger, early post-emergent herbicides such as Mateno Complete could have been used on the wheat to slow or control the ryegrass

Quality

Hectolitre weight was significantly higher for TOS1 Mowhawk, compared to TOS3 and was part of the reason for the quality downgrade. There was no difference between TOS1 and 2, however, there was a trend towards higher weight in TOS1. While statistically there were no significant differences in screenings between the times of sowing, as delivered to CBH only Mowhawk in TOS1 achieved a milling grade due to the screenings measuring below 5%. All other wheat treatments were downgraded due to high levels of screenings. TOS3 Mowhawk had higher protein (12.3%) than TOS1 and 2 due to it being lower yielding. This resulted in a grade improvement over TOS2 (from AWW2 to AUH2).

Oats

Oats significantly out-yielded wheat in this trial, with TOS1 and 2 yielding above 5t/ha. The yield from TOS1 of 5.75t/ha was particularly impressive and a key learning outcome on the phenology of Bannister oats. Despite being sown on the 27th of March, the crop maintained vegetative growth and did not rush to head, which gives growers more confidence to sow Bannister early.

Figure 4 shows a heavy ryegrass weed burden across the trial site. The oats appeared to compete against the ryegrass far better than the wheat, a major reason for the yield gap between the two crops.

Figure 4 The grass weed burden of the trial near maturity.

Quality

The delay in sowing between TOS1 and TOS2 for oats resulted in a quality downgrade from OAT2 to OAT3 due to the lower hectolitre weight (Table 2). This also resulted in a decrease in grain price.

Crop Emergence and Panicle Counts

Mowhawk sown at 50kg in TOS1 produced 52 plants/m^2 and was significantly lower than all other treatments. This may have been due to deeper seeding into marginal moisture. The crop did compensate for low plant emergence by tillering, with no difference in final tiller number of Mowhawk at TOS2 and 3, despite nearly double the plant emergence in TOS3. There was no significant difference between Rockstar and Mowhawk in TOS3 with regards to emergence or final tiller number.

The same trend was observed in oats, with no difference in final tiller number between TOS1 Bannister at 50kg/ha and TOS2 Bannister sown at 90kg/ha.

Table 1- Crop emergence and panicle counts.

Trt	Time of Sowing	Variety	Seeding Rate (kg/ha)	Crop Emergence (plants/m2)		Crop Panicle Counts (panicles/m2)	
1	1	Mowhawk	50	52	d	305	ab
2		Bannister	50	77	c	295	abc
4	2	Mowhawk	60	82	c	283	bc
5		Bannister	90	122	a	266	c
6	3	Mowhawk	60	99	b	308	ab
3		Rockstar	70	111	ab	327	a
	P Value			<0.01		0.022	
	LSD			16.4		35.6	
	CV			22.19604		14.68795	

Table 2- Yield, grain quality and economics.

Time of Sowing	Variety	Yield (t/ha)		Hectolitre Weight (kg/HL)		Screenings (%)	Protein (%)		Grade	Price ($/t)	Income ($/ha)
1	Mowhawk	2.90	d	80	a	4.0	10.0	cd	APW2	$373	$1,082
	Bannister	5.75	a	49	c	6.8	9.2	d	OAT2	$435	$2,501
2	Mowhawk	2.63	de	74	ab	7.8	10.7	bc	AWW2	$350	$921
	Bannister	5.12	b	48	c	9.0	9.5	d	OAT3	$372	$1,905
3	Mowhawk	2.47	e	73	b	8.2	12.3	a	AUH2	$372	$919
	Rockstar	3.21	c	72	b	5.7	11.2	b	AWW2	$350	$1,124
P Value		<0.01		<0.01		0.0941	<0.01				
LSD		0.3		6.06		3.6	0.86				
CV		4.53		5.17		29.29	4.59				

Note: Grain pricing is based on the average top FIS price in Kwinana during November 2024 for each grain grade.

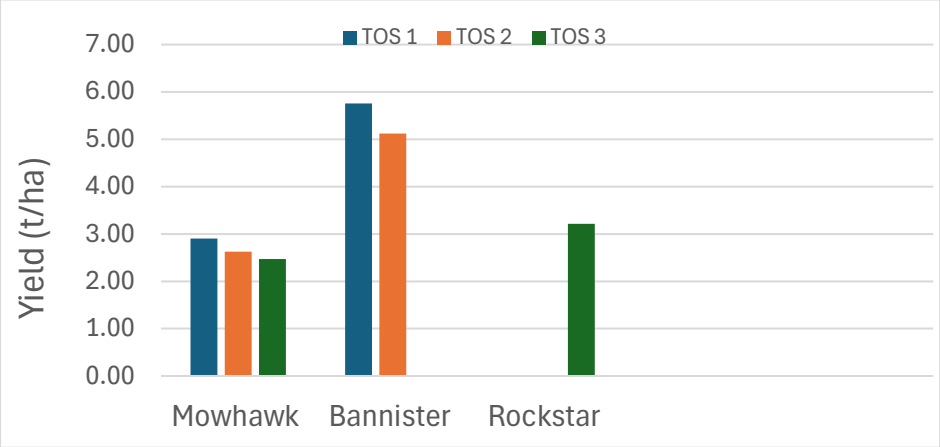


Figure 5 Grain yield of winter wheat (Mowhawk), oats (Bannister) and spring wheat (Rockstar) at three times of sowing.

Table 3- Crop biomass (anthesis).

Trt	Time of Sowing	Variety	Crop Biomass (t/ha)	
1	1	Mowhawk	9.16	bc
2		Bannister	12.12	a
4	2	Mowhawk	7.70	cd
5		Bannister	11.89	a
6	3	Mowhawk	7.56	d
3		Rockstar	9.63	b
	P Value		<0.01	
	LSD		1.57	
	CV		9.125742	

Economics

The gross income of the best oat treatment (Bannister, TOS1) generated more than twice the income of the best wheat treatment (Rockstar, TOS3) through a combination of yield and price. When comparing winter wheat vs spring wheat, the Mowhawk in TOS1 was only slightly behind Rockstar in TOS3 ($1082/ha vs $1124/ha). While in 2024 oats were high priced relative to wheat, the yield difference alone would mean that nearly every year the oats would generate higher income.

DISCUSSION OF RESULTS

Mowhawk performed best when sown on the 27th of March, however, it was not significantly better than the 30th of April seeding time. It would be interesting to evaluate the difference if the crops had not been grazed, which effectively narrowed the gap in maturity. There was a significant yield penalty for sowing Mowhawk winter wheat on the 25th of May. This timing appears too late for winter wheat varieties like Mowhawk, so care needs to be taken if dry sowing winter wheat when the emergence date is unknown. Spring wheat varieties remain a better option for sowing in the second half of May. In this trial Rockstar wheat yielded 740kg more than Mowhawk in TOS3.

The similar incomes between Rockstar in TOS3 and Mowhawk in TOS1 indicate that there is potential for winter wheat varieties to expand on the traditional sowing window. However, there are other potential factors to consider such as time of sowing/emergence, ability to graze, susceptibility to waterlogging and weed effects which will also be major deciding factors when choosing to grow winter wheat, rather than simply income alone.

Oats performed very well in this trial and demonstrated their competitive ability against ryegrass. The high yield (5.75t/ha) from Bannister sown on the 27th of March should give growers confidence to seed Bannister very early. This widens the sowing window for oats with yields above 5t/ha for both 27th March and 30th April sowing times. The natural frost tolerance of oats and the fact that Bannister sown early did not significantly rush its maturity means early sown Bannister oats are a low-risk strategy for managing frost risk while still capturing early sowing opportunities. They also grew more biomass than wheat which means oats also have greater grazing potential in a dual purpose system.

Key Advantages of Winter Wheat

- Allows an early seeding cereal option.
- Grazing opportunity
- Water-logging tolerance of an established plant.

Disadvantages of Winter Wheat

- Pre-emergent herbicides don't work as well.
- Grass weeds will require an expensive herbicide package.
- Could be seeding canola or oats instead

CONCLUSION

The trial results demonstrate that early sowing of winter wheat (Mowhawk) can be a viable strategy, with the highest yield and grain quality achieved when sown on March 27. However, the benefits of early sowing were likely diminished by grazing, which reduced crop competitiveness against ryegrass and impacted yield. Spring wheat (Rockstar) sown later in May outperformed Mowhawk in yield and income, highlighting its suitability for late sowing windows. Oats (Bannister) significantly out-yielded both wheat varieties and showed superior weed suppression and grazing recovery, making them a strong early sowing option with high economic returns. The trial highlights the importance of matching crop type and sowing time to seasonal conditions and management practices, particularly grazing and weed control, to optimize yield and profitability.

The trial also highlighted the importance of paddock selection for growing winter wheat. Despite being grown after a canola crop with good, grass weed control there was a sufficient seed bank of annual ryegrass that competed strongly with the crop. Improved yield results could be achieved from winter wheat with clean paddock selection or with good weed control (having oats in the trial limited optimum herbicide options for wheat). This supports previous research in the project showing the necessity of post-emergent grass control when growing winter wheat.

IMPLICATIONS

The findings from this trial have several important implications for the Australian grains industry. Firstly, they highlight the potential for **winter wheat varieties like Mowhawk to extend the sowing window**, offering flexibility in seeding operations and the opportunity to better utilize early season rainfall. However, the results also caution that **weed control is critical**— particularly from ryegrass, which remains a major challenge in Australian cropping systems. The strong performance of **Bannister oats** suggests that oats could play a larger role in early sowing programs, especially in mixed farming systems where dual-purpose use (grazing and grain) is valuable. This should be a source of future research.

Additionally, the trial reinforces the importance of **matching crop phenology to sowing time** and **adapting herbicide strategies** accordingly. For growers, agronomists, and industry stakeholders, these insights support more nuanced decision-making around crop selection, sowing timing, and integrated weed and grazing management to maximize profitability and sustainability in variable Australian conditions.

RECOMMENDATIONS

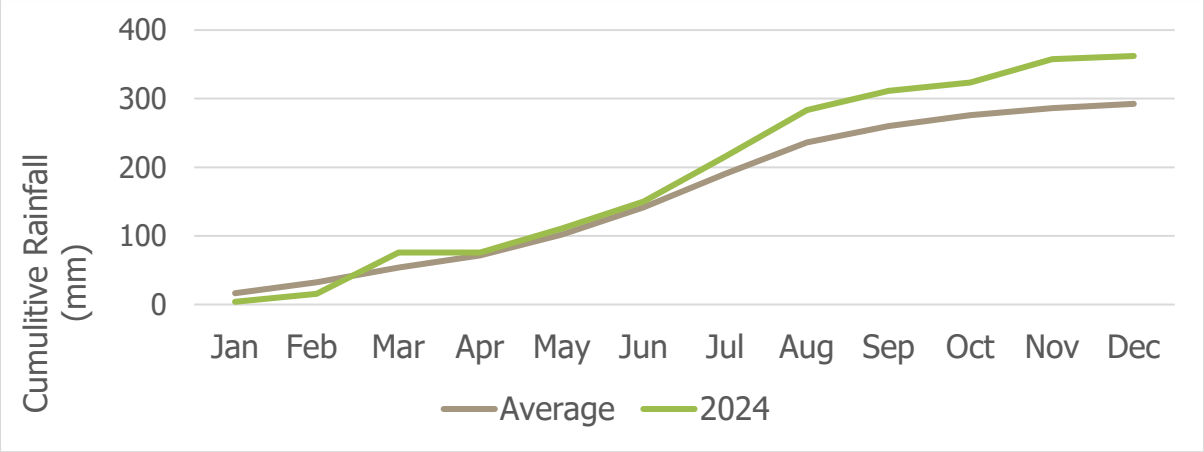
- Select paddocks with low grass weed burden or be prepared to use premium herbicides for grass weed control.
- If opting to graze, consider the weed competition you will lose.
- Despite not observing a significant yield reduction compared to TOS1 in this trial, 30th of April sown Mowhawk is later than recommended in this environment - spring wheat may be better suited.
- Oats should be a strong consideration when an early seeding opportunity arises.

APPENDIX A: Daily rainfall from Yealering

Obtained from:
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_stn_num=010912&p_startYear=2024&p_c=-23835699

2024	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Graph												
1st	0	0	0	0	2.8	0	0.2	8.4	0.4	0	0	
2nd	0	0	12.2	0	5.6	6.0	1.6	0	0	0.6	0	
3rd	0	0	10.2	0	8.2	0.2	0	0.2	0	9.0	0	
4th	0	0	26.8	0	0	0	0.2	0	1.8	0.4	0	
5th	0	0	0	0	0	0	0.2	0.2	11.6	0	0	
6th	0	0	0	0	0.2	0	0	0	4.6	0	0	
7th	0	0	0	0	0	12.4	3.2	19.8	0.4	0	0	
8th	0	0	0	0	0	1.2	1.2	0.4	0.2	0	4.6	
9th	0	0	4.0	0	0	1.2	1.6	0.2	0	0	7.6	
10th	0	0	0	0	0	2.4	7.4	0	0.2	0	0.2	
11th	0	0	0	0	0	0	0.8	1.6	0	0	0	
12th	1.0	0	0	0	0	0	0.2	0	0	0	0	
13th	0.2	0	0	0	0	2.6	0	2.6	0	0	0	
14th	0	0	6.6	0	0	0	0	3.2	0	0	0	
15th	1.4	0	0.6	0	0	0.2	0.6	0.4	0	0	0	
16th	0	0	0	0	0	0	0	0.2	0	0.2	0	
17th	1.2	0	0	0	0	1.8	0	0	0	0.2	0	
18th	0.2	0	0	0	0	0	17.8	7.0	0	0	0	
19th	0	0	0	0	0	0	2.0	0.2	0	0	1.6	
20th	0	0	0	0	0	0	0	0	0	0	1.0	
21st	0	0	0	0	0	0	1.0	2.6	0	1.8	18.8	
22nd	0	0	0	0	0	0.8	0.2	7.4	0	0	0.2	
23rd	0	0	0	0	0	0	21.2	0.8	0	0	0	
24th	0	0	0	0	0	0	1.6	9.2	0	0	0	
25th	0	3.8	0	0	3.4	0.2	0.2	0.8	0	0	0	
26th	0	7.6	0	0	0	0	0.8	0.2	0	0	0	
27th	0	0.2	0	0	0	4.6	0.2	0	0	0	0	
28th	0	0	0	0	0.2	4.6	0	0.4	8.6	0	0	
29th	0	0	0	0	14.4	0.4	3.0	1.6	0	0	0	
30th	0		0	0	0.2	0.2	1.0	0.2	0	0	0	
31st	0		0		0		0	0		0		
Highest Daily	1.4	7.6	26.8	0.0	14.4	12.4	21.2	19.8	11.6	9.0	18.8	
Monthly Total	4.0	11.6	60.4	0.0	35.0	38.8	66.2	67.6	27.8	12.2	34.0	

APPENDIX B: Cumulative rainfall from Yealering



GLOSSARY AND ACRONYMS

Below is a sample abbreviations and acronyms list. Be sure to include all abbreviations and acronyms that appear in the report.

FIS	Free In Store grain pricing point
DAP	di ammonium phosphate
MOP	Muriate of Potash