Final Technical Results Report

2023

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 ☒
Embargo date	YES ☐ NO ☒ If Yes, Date: <Choose date>

Contents

KEY MESSAGES

- Grazing wheat penalised grain yield regardless of variety.
- Illabo wheat yielded the least in both the grazed and ungrazed treatments.
- Where there is no moisture or opportunity to sow a winter wheat, waiting to sow a spring wheat was more profitable.

BACKGROUND

The early autumn feed gap for stock has long posed a challenge for mixed farming enterprises. Modern winter wheat varieties have been considered a potential solution to this issue, as they can both fill this gap and be carried through to a crop with some also having AH classification.

The research site at Kojonup sought to determine whether there are varietal differences between winter and spring wheats and their suitability for grazing potential and yield. This study aims to provide valuable insights for growers, enabling them to expand their understanding of growing winter wheat and effectively managing grazing practices.

OBJECTIVES

- By March 2024, winter wheat agronomy demonstration trials, will have been established and harvested and the results successfully extended to local growers and advisers.

- The project will include benchmarking of current grower practice and evaluation of potential impact and grower adoption.

- This project will help to answer many questions that growers and advisors have on optimising the performance of winter wheats and how they fit into the farming system.

METHODS

Design

The three wheat varieties trialled were Illabo (winter), Mammoth (very long spring) and Scepter (spring). Plots were split horizontally to incorporate the grazing treatment on half of the trial. The plots were arranged in a partially randomised layout, replicated three times (Figure 1).

Rep 1			Rep 2			Rep 3		
101	102	103	201	204	203	302	301	303
Illabo Grazed	Mammoth Grazed	Scepter Grazed	Mammoth Grazed	Illabo Grazed	Scepter Grazed	Mammoth Grazed	Scepter Grazed	Illabo Grazed
105	106	107	205	208	207	306	305	307
Illabo	Mammoth	Scepter Grazed	Mammoth	Illabo	Scepter Grazed	Mammoth	Scepter Grazed	Illabo

Figure 1. Trial design for Kojonup, detailing wheat varieties by grazing.

Soil Analysis

Soil cores were taken prior to seeding, at flowering and in autumn 2024 to access soil moisture to depth and assess the impact of winter wheats on stored soil moisture over the season. Soil nutrition samples were also taken at 3 depths (0-10cm, 10-30cm, 30-50cm) prior to sowing.

Trial Implementation

Using grower machinery Illabo and Mammoth were sown on the 24th of April and Scepter was sown on the 23rd of May into dry conditions. The trial received 80kg/ha mono-ammonium phosphate (MAP) and 120 kg/ha urea (46% nitrogen) to supply 64N:18P:1S. All wheat was sown at 60kg/ha.

Sheep were introduced to the grazed treatments from the 20th of August until the 2nd of September with 100 wethers on 1ha (100 DSE). Despite the date, grazing was still prior to GS30 which was delayed due to late emergence and slow growth rate due to cold seasonal conditions.

Field measurements

Establishment counts were taken on the 5th of June once all times of sowing (TOS) had emerged, with panicle counts and NDVI readings taken at anthesis on the 12th of October. NDVI biomass measurements were taken at three locations in each plot. This measurement helped assess the effect grazing had on variety through crop density.

Yield

Trials were harvested using grower machinery at crop maturity and yield was measured with the harvester's in-built yield monitor. Grain samples were collected and sent to CBH for grain quality sampling and were graded accordingly.

RESULTS

Seasonal conditions

The Kojonup site had 100mm less than its historic average in the growing season (April-October), it also experienced minimal summer rain leading into seeding and a dry May (Figure 2). Establishment at the site was unsatisfactory with the addition of wheel tracks in the paddock acting as water harvesting points and resulting in further unevenness. The winter wheat germinated on the 8th of May, approximately two weeks after sowing.

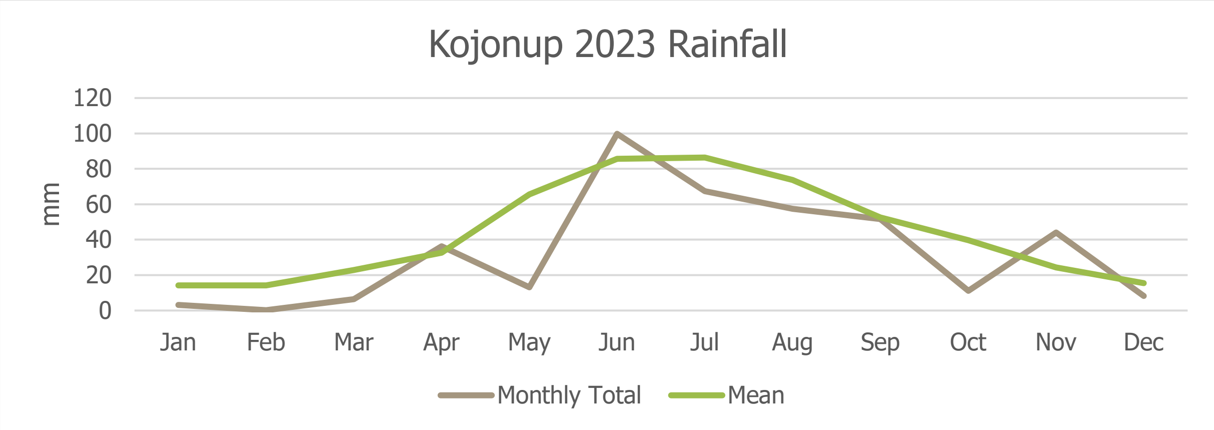

Figure 2. Kojonup Rainfall 2023 compared to long-term average.

Soil Analysis

Soil test results show low soil phosphorus and pH levels, with adequate potassium present. Seeding fertiliser, however, would have alleviated these constraints for the 2023 season. (Table 1).

Table 1. Soil test results for three depths at the Kojonup trial site.

Soil Test Results			
Site	**0-10cm**	**10-30cm**	**30-50cm**
Texture	1.5	1.5	3.5
Colour	GRYW	GR	GRYW
Gravel (%)	5-10	15-20	0
N03 (mg/kg)	5	6	<1
NH4 (mg/kg)	3	3	1
OC (%)	0.31	0.26	0.19
P (mg/kg)	10	8	2
K (mg/kg)	88	63	46
S (mg/kg)	3.4	5	43.4
pH	4.7	4.8	5.9
EC (dS/m)	0.029	0.024	0.092

Soil moisture cores show a drop in stored moisture from seeding to anthesis with no notable differences between treatments. The lack of summer rain is also identified through the low gravimetric moisture percentage in the autumn measurements (Table 2).

Table 2. Gravimetric Moisture (%)

<table>
<tr><th>Treatment</th><th>Pre-seeding</th><th>Anthesis</th><th>Autumn 2024</th></tr>
<tr><td>Illabo</td><td rowspan="6">5.64%</td><td>1.98%</td><td rowspan="3">2.97% (Illabo)</td></tr>
<tr><td>Illabo Grazed</td><td>No data - error</td></tr>
<tr><td>Mammoth</td><td>1.85%</td></tr>
<tr><td>Mammoth Grazed</td><td>1.81%</td><td rowspan="3">5.08% (Scepter)</td></tr>
<tr><td>Scepter</td><td>1.42%</td></tr>
<tr><td>Scepter Grazed</td><td>2.61%</td></tr>
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Field Measurements - Establishment and NDVI

Establishment was improved in the Scepter treatments (Table 3) though not significantly. Scepter treatments were sown on the 23rd of May into moisture and germinated immediately after.

Table 3. Establishment (plant/m2) Kojonup- 2 weeks after sowing

Variety	Plants/m2 (average)
Illabo	51
Mammoth	53
Scepter	68

NDVI recordings (Figure 3) found there was no effect of variety or grazing on crop biomass at anthesis. This indicates that despite the late grazing, the crop had sufficient resources to accumulate similar biomass to the ungrazed treatments which was helped by the low plant numbers established.

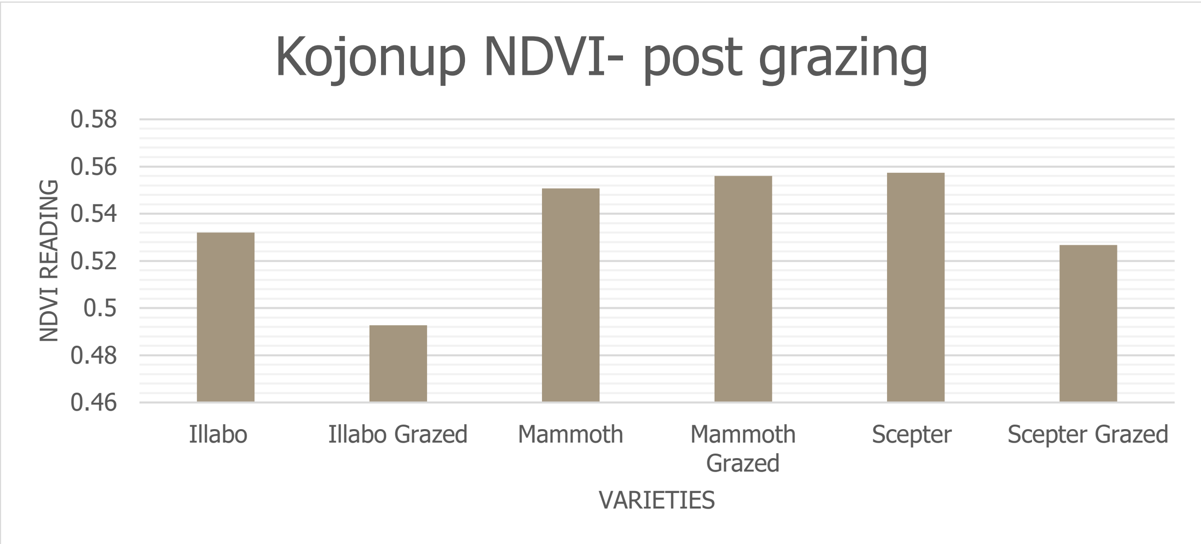

Figure 3. NDVI Kojonup 12th of October

Field Measurements- Panicles

Panicle counts showed a higher number in Scepter and Mammoth when compared to Illabo (Figure 4). This was despite there being no statistical differences between plant establishment between varieties. There was no effect of grazing on panicle number.

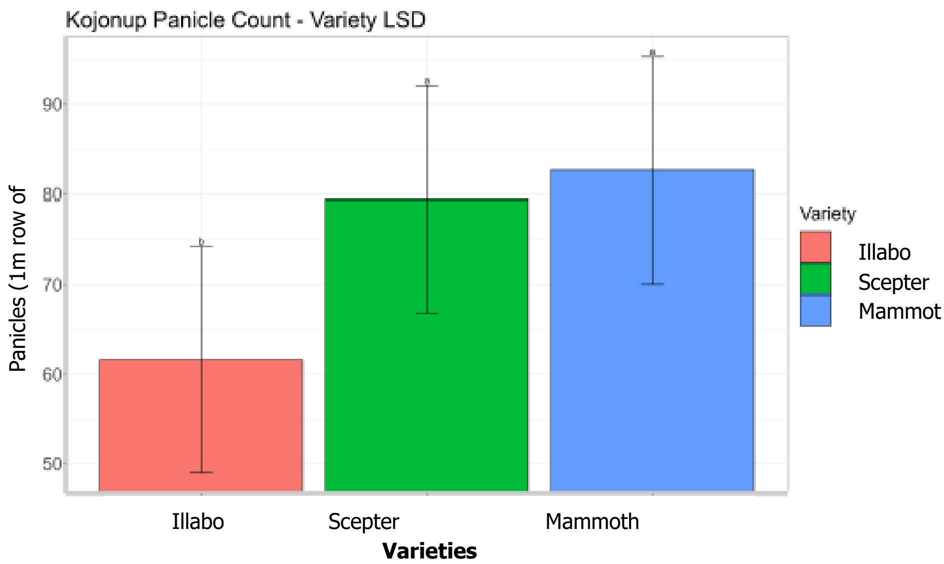

Figure 4. Kojonup Panicle Count- 12th of October

Grain yield

The effect of grazing on grain yield was highly detrimental. Grazing caused an 18% yield penalty (648 kg/ha) across varieties (Figure 5). The effect of grazing was so significant that it overruled the varietal effect and there was no difference between varieties. However, Illabo suffered more yield penalty than other varieties which may be attributed to late grazing time.

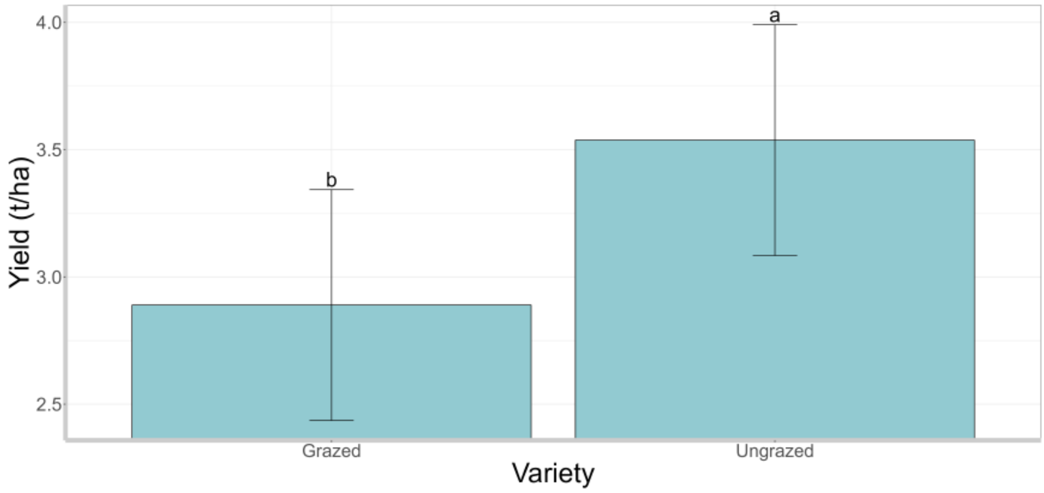

Figure 5. Kojonup grain yield by grazing

There was no statistical difference between varieties for grain yield, shown in Figure 6.

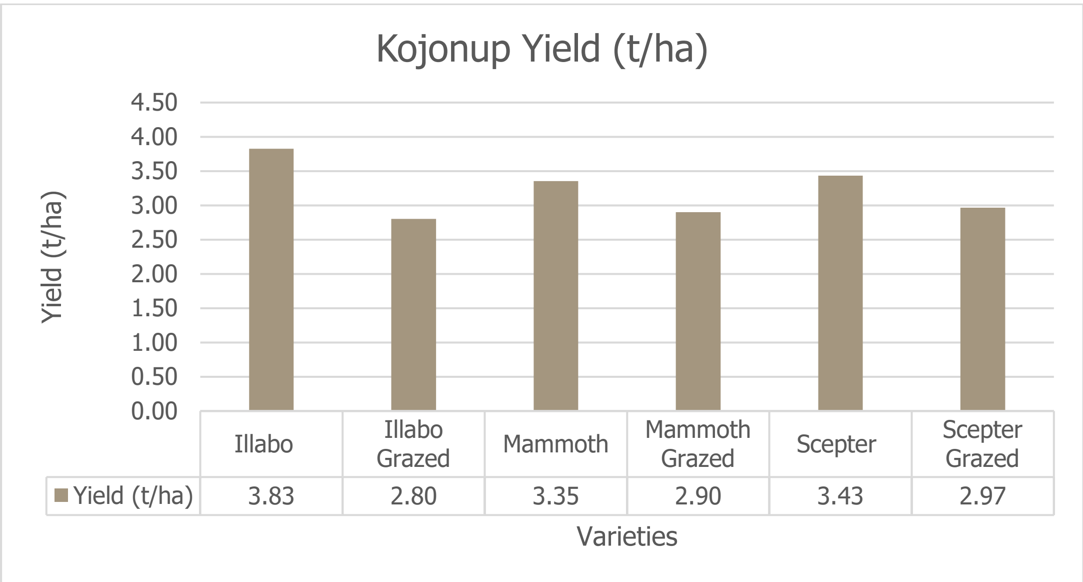

Figure 6. Kojonup grain yield

CONCLUSION

The findings from this study shed light on critical factors influencing the performance of winter and spring wheat varieties in mixed farming systems, particularly concerning grazing potential and yield outcomes.

Following the grazing period, all varieties experienced a decline in yield. This highlights the importance for growers to carefully consider the benefits of grazing crops compared to the potential yield loss when utilising wheat for dual purposes in short growing seasons. It is important to note that the grazing period finished on the 2nd of September which was due to logistical constraints getting the sheep to the paddock and the delayed season break. With below average spring rainfall, crop recovery was restricted resulting in significant yield penalty.

Effective management strategies are essential to ensure that gains from grazing offset any reduction in crop yield.

There was no interaction in grain yield between varieties which shows that winter wheat is yield competitive to spring wheat, even in a short growing season in this environment. With a growing season closer to 'average' it could be expected that winter wheat could be sown earlier and yield higher without additional frost risk.

If growing winter wheat purely to focus on grain yield, then grazing these crops in a short growing season is not recommended. Winter wheat is a tool and should be sown when seasonal conditions favour early germination opportunities.

LOCATION

Where field trials have been conducted, provide the following location details in the table below: latitude and longitude, or nearest town. (Add additional rows as required.)

Year	Site #	Latitude (decimal degrees)	Longitude (decimal degrees)	Nearest town
2023	Trial Site #1			Kojonup

If the research results are applicable to a specific GRDC region/s (e.g. North/South/West) or GRDC agro-ecological zone/s, indicate which in the table below:

Research	Benefiting GRDC region (select up to three)	Benefitting GRDC agro-ecological zone	
Kojonup Winter Wheat	Western Region Choose an item. Choose an item.	☐ Qld Central ☐ NSW NE/Qld SE ☐ NSW Vic Slopes ☐ Tas Grain ☐ SA Midnorth-Lower Yorke Eyre ☒ WA Northern ☒ WA Eastern ☐ WA Mallee	☐ NSW Central ☐ NSW NW/Qld SW ☐ Vic High Rainfall ☐ SA Vic Mallee ☐ SA Vic Bordertown-Wimmera ☒ WA Central ☐ WA Sandplain