Annual Results Report Template

2021
Annual Results Report
Using long season wheats for increases in profits and grazing opportunities

Project code:	9177492 / SDI1906-005RTX
Prepared by:	Daniel Hester
	danielhester@pedaga.com.au
	Southern Dirt
	Adele Scarfone eo@southerndirt.com.au
Date submitted to GRDC:	27 April 2022

REPORT SENSITIVITY

Does the report have any of the following sensitivities?

Intended for journal publication	NO	
Results are incomplete	NO	
Commercial/IP concerns	NO	
Embargo date	NO	If Yes, Date: DD/MM/YYYY

BACKGROUND

Traditionally, sowing wheat in Western Australia is not recommended before the 25th of April (Brenda Shackley et al., 2017). This is due to higher frost risk. Many growers in the southern region of Western Australia have mixed farming enterprises and aim to sow their cereal crops in mid-May to maximise yield potential whilst managing frost risk. However this later sowing can lead to a reduced yield potential. Farmers in southern WA are sometimes presented with early sowing opportunities through summer rainfall events or early breaks in the season.

Farmers are looking for a cropping option to utilize this early available moisture without excessive frost risk reducing yields. Long season wheats can be sown March – Mid April and utilise the available early moisture and warmer temperatures.

The aim of the project is to assist growers in introducing long-season wheats into their farming systems to best utilise summer rainfall and early-sowing opportunities. Growers in south western WA are also interested in adding wheat back into their crop rotations. Currently, many growers are relying on continual canola barley rotations to maximise profits. Growing more wheat will add diversity to their cropping rotations which will combat fungicide and herbicide resistance issues in all crops.

There is limited information, on which varieties to grow with a very early sowing opportunity in Southern WA. The key to successful early sown wheat is for growers to match their region's optimal flowering window with the correct varieties and sowing dates. There is a requirement to produce localised data to aide growers about which varieties to grow and when to sow them. Since 2000, there has been a general increase in summer rainfall and a corresponding decrease in winter rainfall (AEGIC data 2018). As a result, not only are traditional crop yields being affected, but there is an opportunity to take advantage of early available moisture and a longer growing season to achieve higher yields when these seasonal opportunities are presented.

Grazing winter crops can be the key to mixed farming profitability and is starting to gain traction through programs such as grain and graze, whereby oats, barley, wheat and canola have been sown early to capture the benefits of grazing. Therefore ,an additional opportunity for sowing long season wheats is an enhanced ability to graze them with minimal yield penalty and greater management flexibility. Winter type wheats are easier to graze than spring wheats because they remain vegetative for much longer. This means they can be grazed for longer periods of time compared to spring type wheats, with less risk of yield loss. Having early sown established wheat crops will help address the autumn feed gap that growers face every year.

These varieties can provide value to the livestock component of an enterprise by providing high quality feed in June – July which replaces supplementary feeding. It also can allow the time for new pastures to establish, or to increase pasture dry matter for later in the season.

OBJECTIVES

There is growing interest from growers in southern Western Australia around the opportunities that long season wheats can provide them in a mixed or 100% cropping farming enterprise. The primary objective of this project is to demonstrate to growers the agronomic and enterprise fit and associated benefits of including a long season wheat into their rotation and to encourage the adoption through the farmer scale demonstrations and economic analysis

The project will demonstrate time of sowing, best available varieties suited to the areas of the demonstration sites and season permitting, the opportunity for grazing without yield penalty. It is worth noting the 2020 season did not allow the opportunity to graze any of the demonstrations. The project

will also provide practical guidelines or agronomic packages for production of long season wheat in the medium to high rainfall zones of South Western Australia. The key outcomes of this project are:

- Demonstrate the yield potential of different long season wheat varieties relative to spring wheat varieties with an early sowing window

- Develop economic analysis comparing long season and spring wheat varieties and time of sowing regarding yield to assist producers in making informed decisions

- Begin the development of an agronomic package on growing long season wheats, time of sowing, seeding rates and fertiliser application and timing will be examined within this project.

- Develop protocols around the importance of time of sowing for long season wheat varieties that are best suited to different areas within southern Western Australia

- Where seasonal conditions allow, demonstrate the ability of sowing long season wheats to manage the feed gap in Autumn and winter through crop grazing with having minimal yield penalty

Methodology

In 2021 two demonstration sites was established in the Albany Port Zone within the Southern Dirt Region. The two demonstrations had 2 replicates which allowed the appropriate statistical analysis on both sites to be conducted. In 2021 two demonstration sites were also established in the Albany port zone within the Corrigin Farm Improvement Group Region. The two demonstrations had three replicates.

The West Muradup trial sites had 3 long season wheat varieties and two control spring wheat varieties, while the Muradup trial site had 4 long season wheat varieties and one control spring wheat variety. The chosen varieties, both long season and spring wheats were selected as the most agronomically appropriate varieties for the trial locations.

The West Muradup site was grazed as the seasonal conditions allowed for an early sowing and the crop to be established to allow a grazing and still enough time to remove the sheep and only have a minimal impact on the final yield.

In-crop assessments were taken during the growing season which included NDVI readings, plant and tiller counts, soil tests and grain yield. All demonstration sites were managed as a commercial crop.

West Muradup

The West Muradup trial site was seeded on the 17th of April 2021 into good to average moisture. The site was planted to canola in 2020. All varieties were seeded at 80 kg/Ha at a 9 inch spacing. Catapult and Scepter spring wheat was chosen as control to represent a popular wheat variety currently being grown within the region. The three long season wheat varieties have the following key attributes:

- Denison: An APW classification, slow to very slow spring wheat fit for sowing in mid April in most parts of WA.
- Accroc: is a bearded, medium to long season dual purpose winter wheat with high yield potential. Can be sown any time from early Autumn through to early winter with short stiff straw.
- Illabo: AH classification, high yielding dual purpose winter wheat variety with high yield potential.

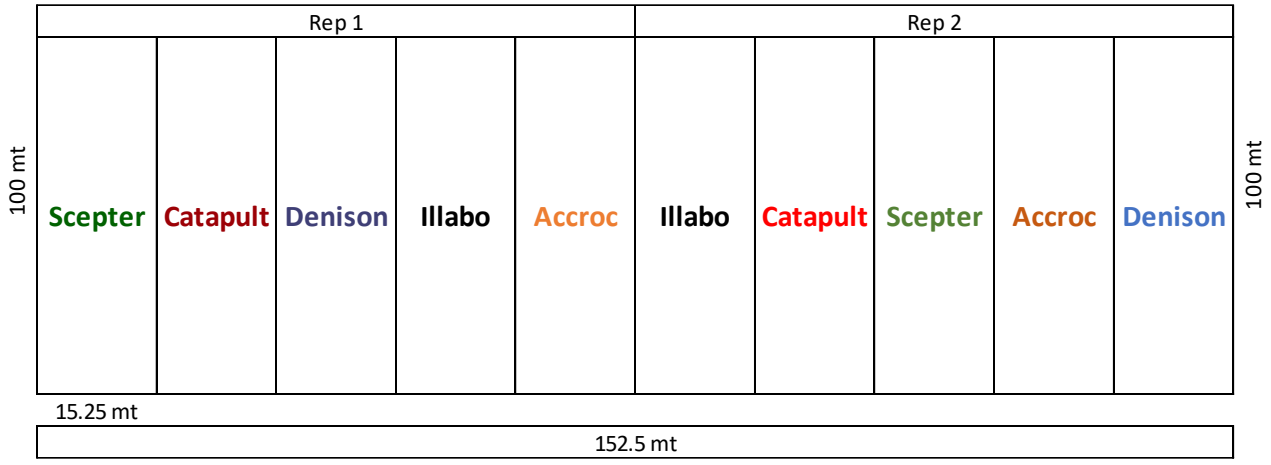


Figure 1 – West Muradup trial design

The trial was sown with 100 kg/Ha of MAPSMn. It received 50 kg/Ha of urea on the 15th of June, 80 kg/Ha Urea on the 23rd of July and then was topped up with 80 kg/Ha of Urea on the 19th of August.

Crop observations were recorded and plant counts conducted at each trial plot on 3rd June 2021 to quantify seedling emergence and tiller counts were conducted on 6th September 2021.

The trial plots were harvested by the producer, who provided the yield data.

The West Muradup demonstration site was grazed by ewe hoggets at 20 DSE for 32 days in line with the best practice guidelines for grazing crops in the Great Southern Region.

Muradup

The West Muradup trial site was seeded on the 17th April 2021 into good to average moisture. The site was planted to canola in 2020. All varieties were seeded at 90 kg/Ha. Catapult spring wheat was chosen as control to represent a popular wheat variety currently being grown within the region. The four long season wheat varieties have the following key attributes:

- Denison: An APW classification, slow to very slow spring wheat fit for sowing in mid April in most parts of WA.
- Accroc: is a bearded, medium to long season dual purpose winter wheat with high yield potential. Can be sown any time from early Autumn through to early winter with short stiff straw.
- Illabo: AH classification, high yielding dual purpose winter wheat variety with high yield potential.
- Zanzibar – a bearded main season red wheat suited to late April to Mid May sowing with vary high yield potential. Plus it has excellent straw strength and stripe rust resistance.

T10	T9	T8	T7	T6	T5	T4	T3	T2	T1
Illabo	**Denison**	**Illabo**	**Catapult**	**Accrock**	**Accrock**	**Accrock**	**Denison**	**Zanzibar**	**Catapult**

Figure 2 – Muradup trial design

The site was planted to Canola in 2020 and then sown across a range of dates due to the availability of seed. The trial was sown on 250mm spacing with a DBS. The sowing dates across the demonstration were:

- 18th March 2021 Accroc
- 28th April 2021 Catapult
- 28th April 2021 Denison
- 28th April 2021 Illabo
- 20th May 2021 Zanzibar

The trial area had 50 kg/Ha of MoP spread in February 2021 and was sown with 90 kg/Ha of MAP plus trace elements plus 5 kg/Ha MnSO4.It received 150 kg/Ha of urea on the 15th of June, 80 L/Ha UAN on the 15th of August and then was topped up with 40 L/Ha of UAN on the 11th of September.

Representative soil samples of the trial plots were collected on 10th of April 2021, at depth 0-10cm, 10 – 20cm and 10 to 30cm. Samples were analysed for a range of soil properties including pH, electrical conductivity, major nutrients and organic carbon.

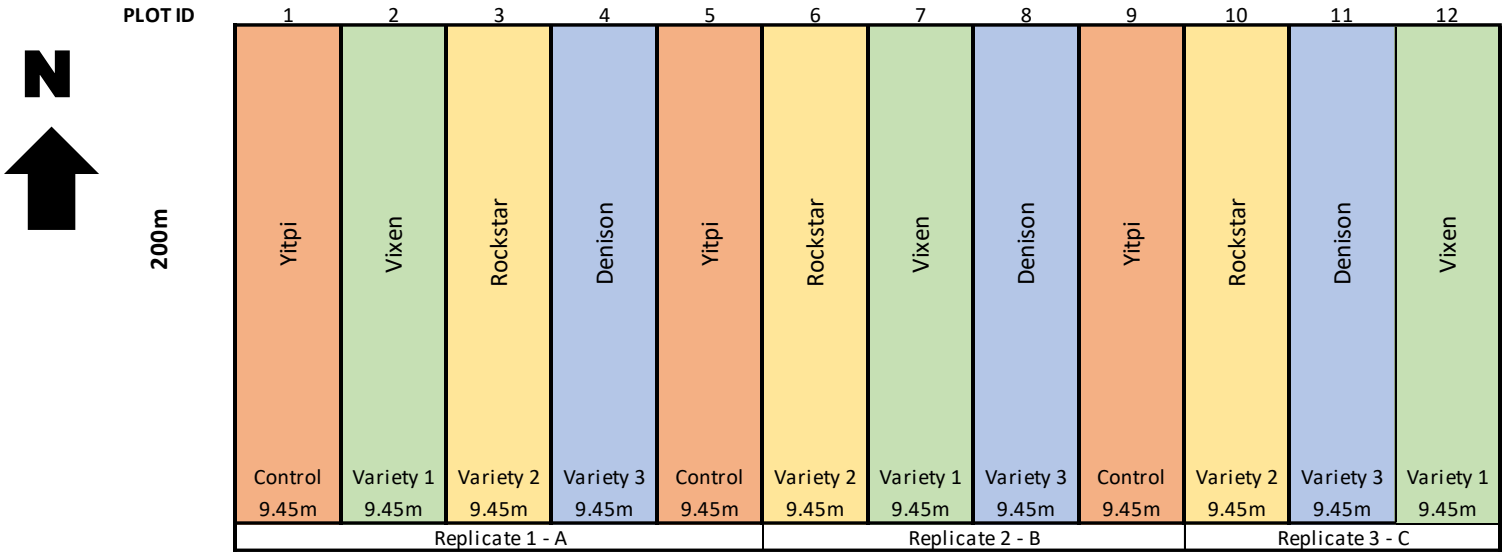
Crop observations were recorded and plant counts conducted at each trial plot on 3rd June 2021 to quantify seedling emergence and tiller counts were conducted on 6th September 2021.

The trial plots were harvested by the producer, who provided the yield data.

Kurrenkutten

The Kurrenkutten trial was sown with four varieties laid out in a plot design outlined below:

- Yitpi: Control long spring wheat variety
- Vixen: Spring wheat
- Rockstar: Long spring wheat
- Denison: Long spring wheat



The following observations were recorded across the trial site throughout the season

Plant establishment counts – 25/5/21 and 15/6/21

NDVI at GS.14 - 25/5/21 and 15/6/21

NDVI at GS.31 - 8/7/21 and 27/7/21

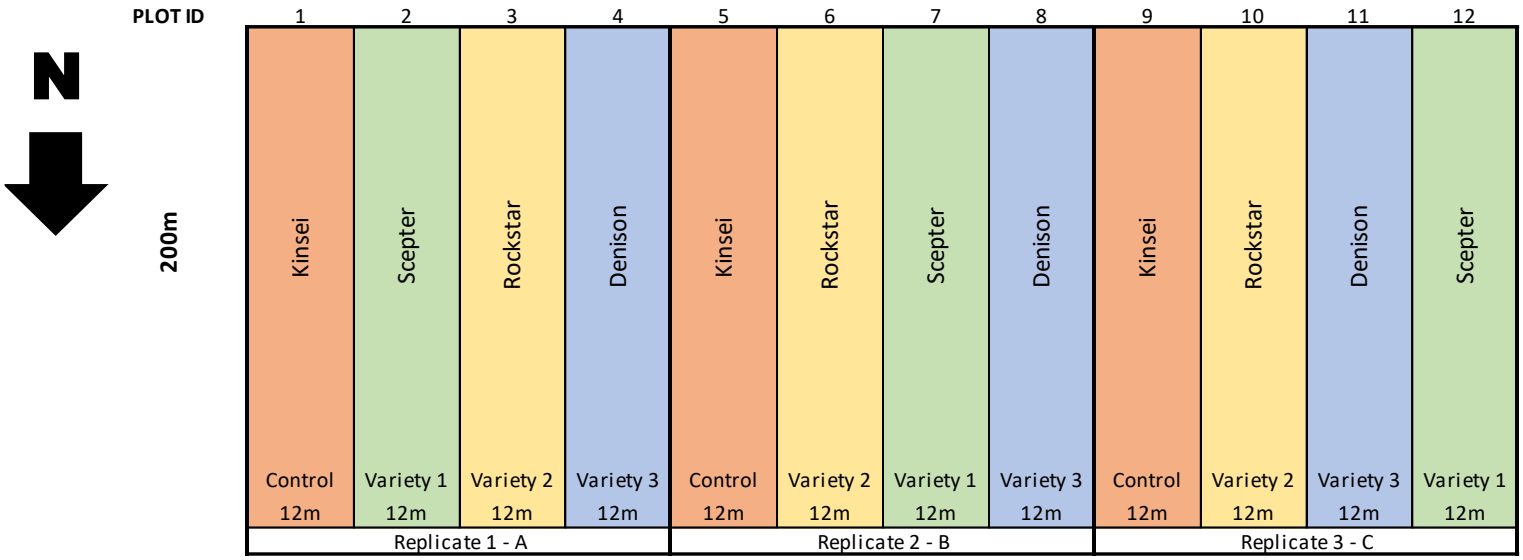
Tiller and grain counts – 26/11/21

Yields – 7/12/21

Mount Walker

The Mount Walker trial was sown with four varieties laid out in a plot design outlined below:

- Kinsei: Control long spring wheat variety
- Scepter: Spring wheat
- Rockstar: Long spring wheat
- Denison: Long spring wheat



The following observations were recorded across the trial site throughout the season

Plant establishment counts – 31/5/21 and 28/6/21

NDVI at GS.14 - 31/5/21 and 28/6/21

NDVI at GS.31 - 5/8/21

Tiller and grain counts – 29/11/21

Yields – 7/12/21

LOCATION

NOTE: Where field trials have been conducted please include location details: Latitude and Longitude, or nearest town, using the table below (please add additional rows as required):

	Latitude (decimal degrees)	Longitude (decimal degrees)
Trial Site #1	-33.5344	116.5740
Nearest Town	Muradup	
Trial Site #2	-33.89865	116.80532
Nearest Town	Muradup (West Muradup site)	
Trial Site #3	-32.339197	118.079314
Nearest Town	Kurrenkutten	
Trial Site #3	-32.034167	118.765972
Nearest Town	Mount Walker	

If the research results are applicable to a specific GRDC region/s (e.g. North/South/West) or GRDC Agro-Ecological Zone/s please indicate which in the table below:

Research	Benefiting GRDC Region (can select up to three regions)	Benefiting GRDC Agro-Ecological Zone (see link: http://www.grdc.com.au/About-Us/GRDC-Agroecological-Zones) for guidance about AE-Zone locations	
Experiment Title	Choose an item. 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

RESULTS

West Muradup

Plant and Tiller Counts

Plant counts for the West Muradup site occurred on 3rd of June 2021. The average number of plants by variety ranged between 227 plants/ m^2 for Scepter and 289 plants/ m^2 for Catapult wheat (Chart 1).

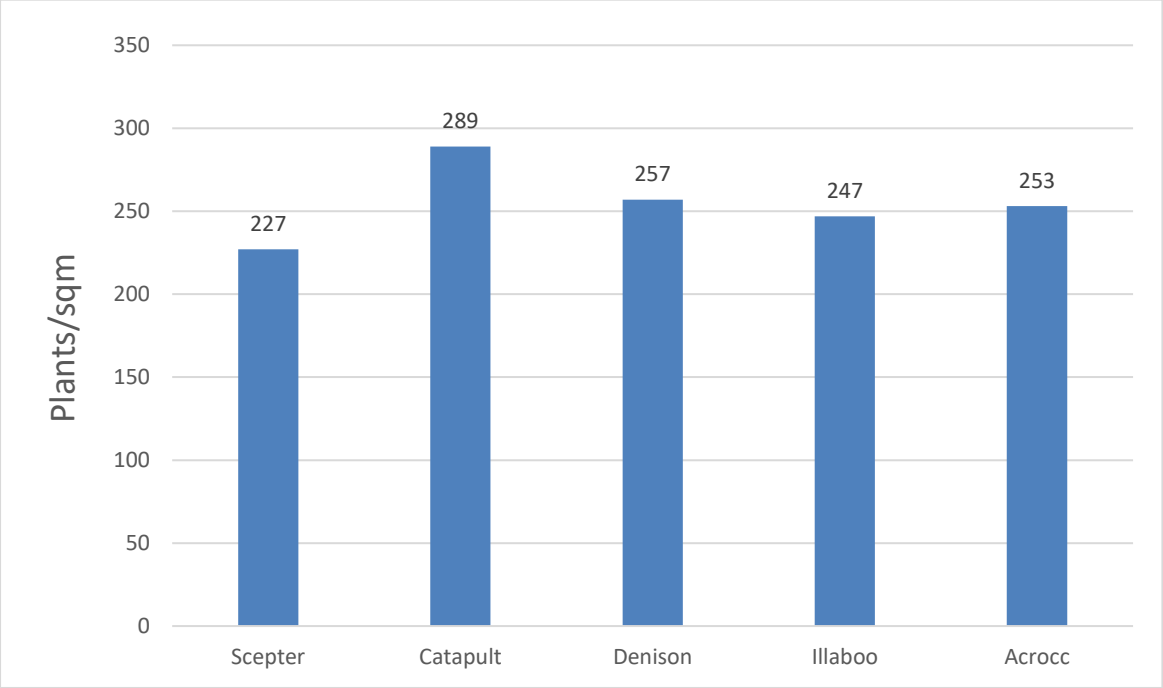


Chart 1: Average plant counts per variety (P = NSD).

Tiller counts were conducted on the 6th of September 2021 (Chart 2). Results show that the Accroc red wheat had the highest average number of tillers per square meter at 587 and Scepter had the least tiller per square meter at 393.

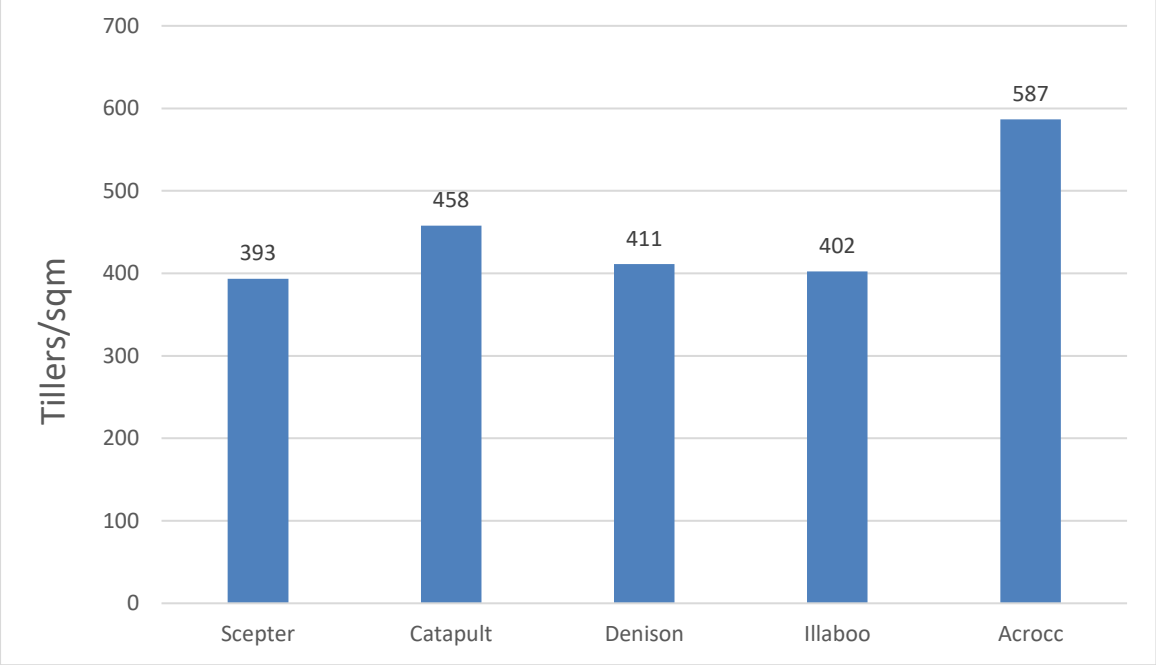


Chart 2: Average tiller count per variety (P = NSD).

Harvest Yield data

Across the trial, average yields were quite even except for Scepter which was affected by a frost event(s). Accroc was the highest yielding variety at 6.90 MT/Ha followed by Illabo, 6.70 MT/Ha then Catapult 6.66 MT/Ha, Denison, 6.26 and lastly Scepter yielding 4.50 MT/Ha (Chart 3).

Statistical analysis was determined between the varieties and despite Scepter yielding considerably lower than the other varieties the P value was greater than 0.05 meaning there was no statistical difference between any of the varieties.

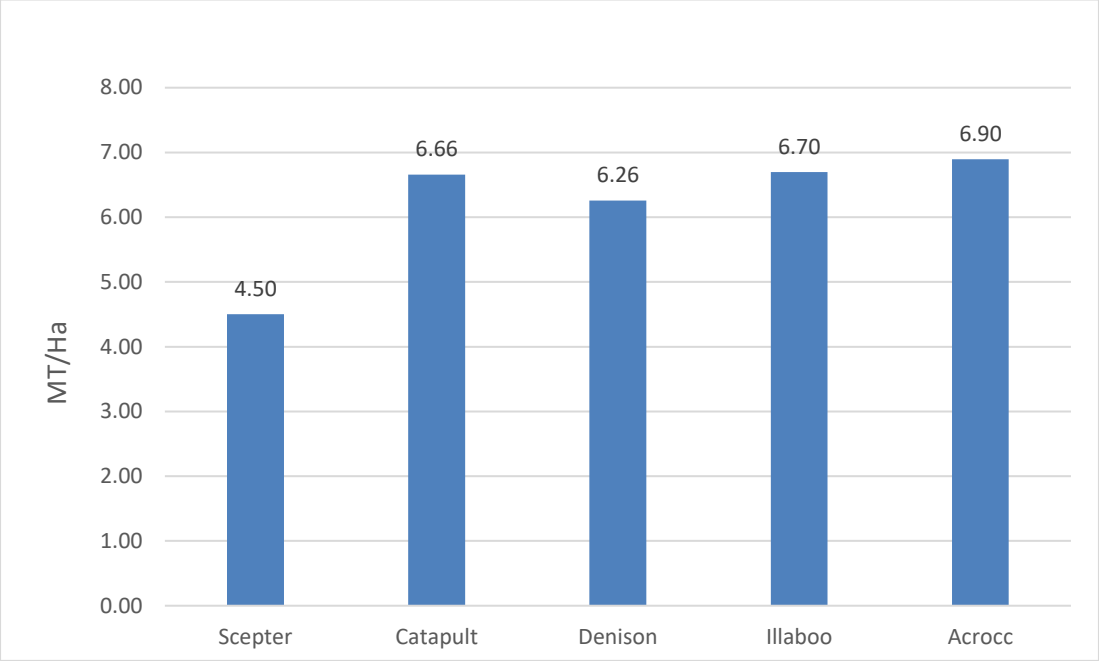


Chart 3: Harvest 2021 yields (P = NSD).

Crop Grazing Results

The demonstration and surrounding paddock was grazed by 1,600 ewe hoggets when the wheat was between the Zaddock growth stage, GS22 – GS24. The total area of paddock was 80 Ha giving an average DSE rate of 20 DSE/Ha. The hoggets entered the paddock on the 14th June and exited on the 16 June. Grazing cages (1m x 1m) were erected within each of the demonstration plots to measure the impact of the grazing on the final yield. The caged control areas were hand harvested to measure yield. To calculate the results the average of the ungrazed area was compared to the average of the grazed areas. As can be seen in Chart 4 the grazed area yield 99.6% of the ungrazed area.

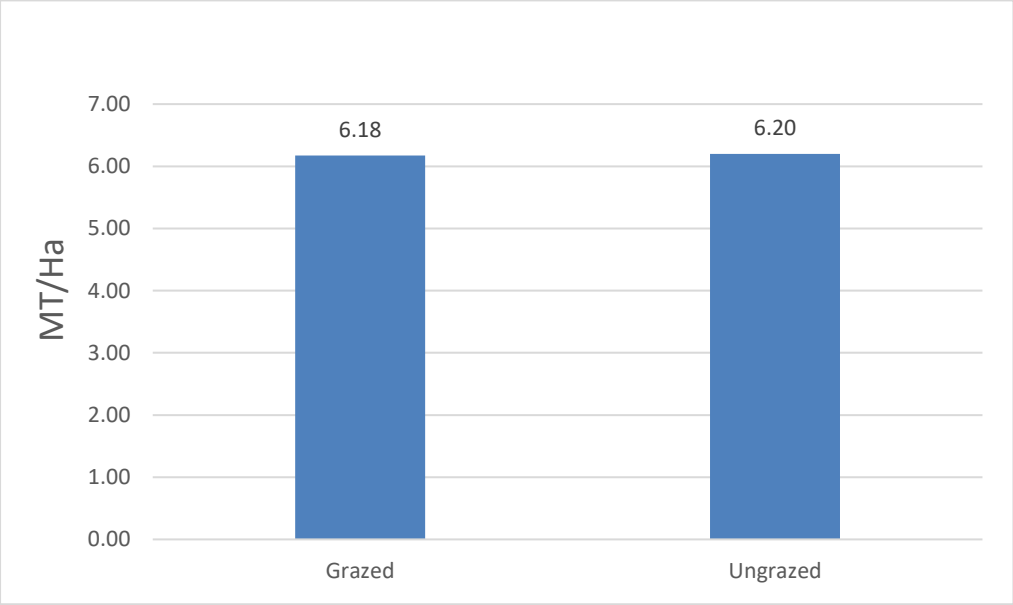


Chart 4: Average yields of grazed vs ungrazed areas across the trial plots (P = NSD).

Muradup

Soil samples were collected on the 10th of April 2021, prior to seeding from the 0-10cm, 10–20cm and 10-30cm horizons and analysed at CSBP Laboratories. The results are detailed in Table 1.

The soil in the red wheat trial plots was dark grey in the top 10 cm and changed to yellow brown at 20 – 30 cm, with 0 - 10% gravel. Soil pH ($CaCl_2$) was 4.8 in the 0-10cm horizon, decreasing slightly to 4.5 in the 10-30cm layer. Soil organic carbon decreased from 1.80% at the surface to 0.39% in the 20-30cm layer. Electrical conductivity was low at 0.237 dS/m.

	Lab No	UES21092	UES21093	UES21094	UES21095	UES21096	UES21103
	Name	D	A	B	E	C	F
	Code	Site Kent B 0 10cm	Site Kent A 1 10mm	Site Kent A 10 20mm	Site Kent B 10 20cm	Site Kent 20 30mm	Site Kent B 20 30 cm
	Sampled Date	10/04/2021	10/04/2021	10/04/2021	10/04/2021	10/04/2021	10/04/2021
	Barcode	SOILB0042739	SOILB0042737	SOILB0042736	SOILB0042725	SOILB0042735	SOILB0042724
	Depth	0-10	0-10	0-10	0-10	0-10	0-10
	Latitude	-33.835849092984 2	-33.835745772203 6	-33.835728505645 9	-33.835705390732 5	-33.835721543323 2	-33.835718201408 1
	Longitude	117.16017991304 4	117.15935848653 3	117.15931523591 3	117.15947650373	117.15949594974 5	117.15951170772 3
Colour		DKGR	DKGR	BRGR	DKBR	YWBR	YW
Gravel	%	5-10	5	5-10	0	5	5
Texture		1.5	1.5	1.5	1.0	1.5	1.0
Ammonium Nitrogen	mg/kg	6	28	2	9	< 1	2
Nitrate Nitrogen	mg/kg	64	55	13	10	5	5
Phosphorus Colwell	mg/kg	31	34	36	27	19	24
Potassium Colwell	mg/kg	55	47	43	41	28	21
Sulfur	mg/kg	60.4	47.5	13.3	13.1	9.2	7.3
Organic Carbon	%	1.89	1.71	1.20	1.26	0.40	0.38
Conductivity	dS/m	0.217	0.258	0.069	0.053	0.034	0.031
pH Level (CaCl2)		4.8	4.8	4.6	4.5	4.6	4.4
pH Level (H2O)		5.4	5.6	5.6	5.6	5.8	5.4
PBI		58.8	79.6	92.8	103.1	57.5	49.1

Table 1: Soil Sample results for red wheat 2021 demonstration.

Plant Counts

Plant counts for the red wheat project trial sites occurred on 3rd of June 2021. The average number of plants by variety ranged between 197 plants/ m^2 for Accroc up to 248 plants/ m^2 for Illabo wheat (**Error! Reference source not found.**5).

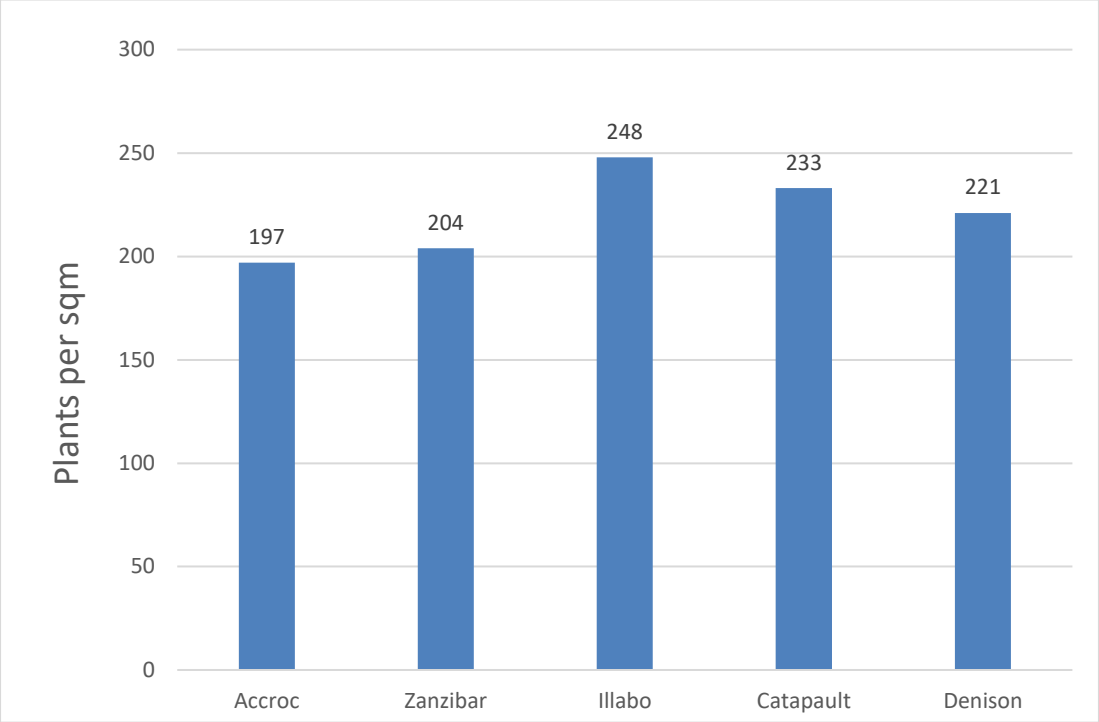


Chart 5: Average plant counts.

Tiller counts

Tiller counts were conducted on the 6th of September 2021 (Chart 6). Results show that the Denison wheat had the highest average number of tillers per square meter at 755. Catapult had the least tiller per square meter at 502.

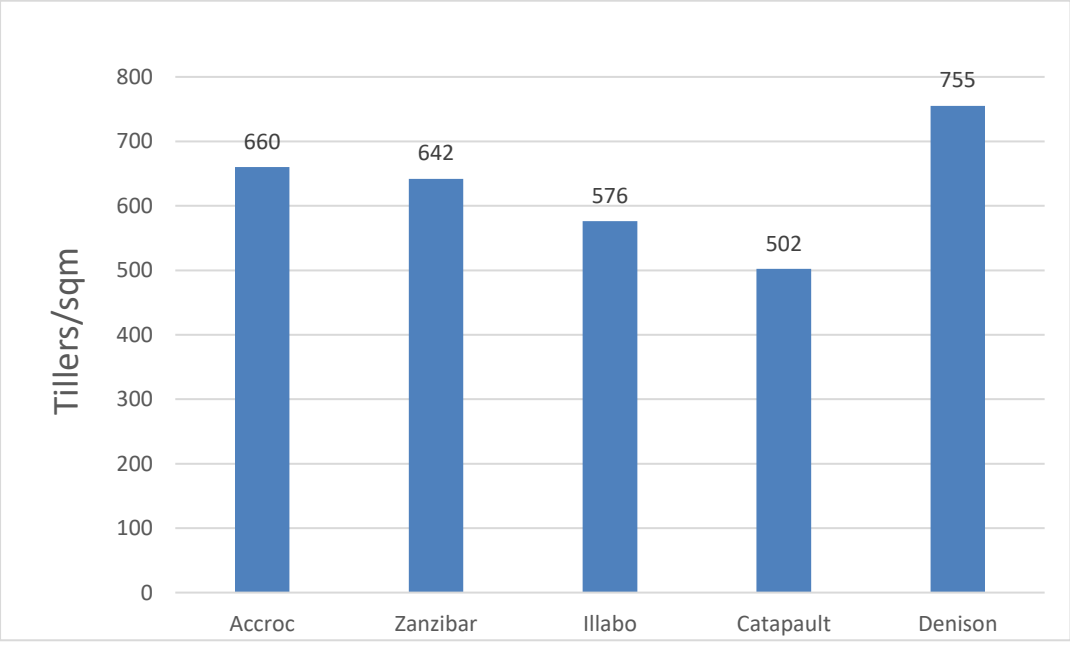


Chart 6: Average tiller counts.

Harvest Yield Data

Across the trial, average yields ranged considerably due to the frost damage caused during grain production. Accroc was the highest yielding variety and appeared to be largely unaffected by the frost

events yielding 8.40 MT/Ha. The other four varieties in the trial all appeared to be affected by frost with Zanzibar yielding 5.09 MT/Ha, Illabo 2.99 MT/Ha, Catapult spring wheat 2.12 MT/Ha and Denison 1.41 MT/Ha(Figure 5).

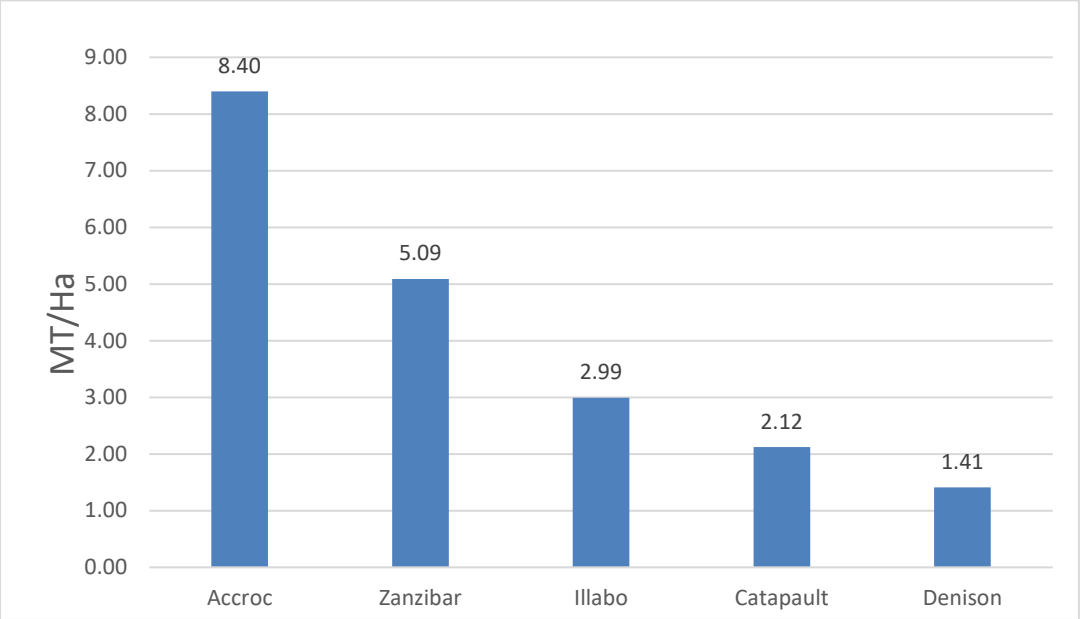


Chart 7: Harvest 2021 yield.

Kurrenkutten

Plant and Tiller Counts

Plant counts for the Kurrenkutten site occurred on 25th of May 2021. The average number of plants by variety ranged between 144 plants/ m^2 for Yitpi and 165 plants/ m^2 for Denison wheat (Chart 8).

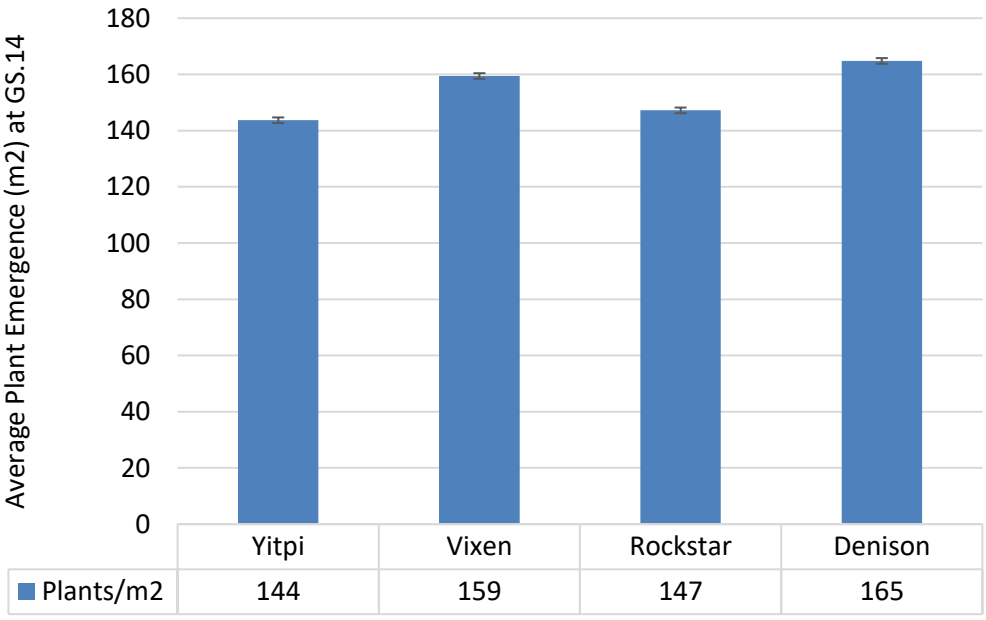


Chart 8: Average plant counts per variety (P = NSD).

Tiller counts were conducted on the 26th of November 2021 (Chart 9). Results show that Yitpi and Denison wheat had the highest average number of tillers per square meter at 254 and Vixon had the least tiller per square meter at 209.

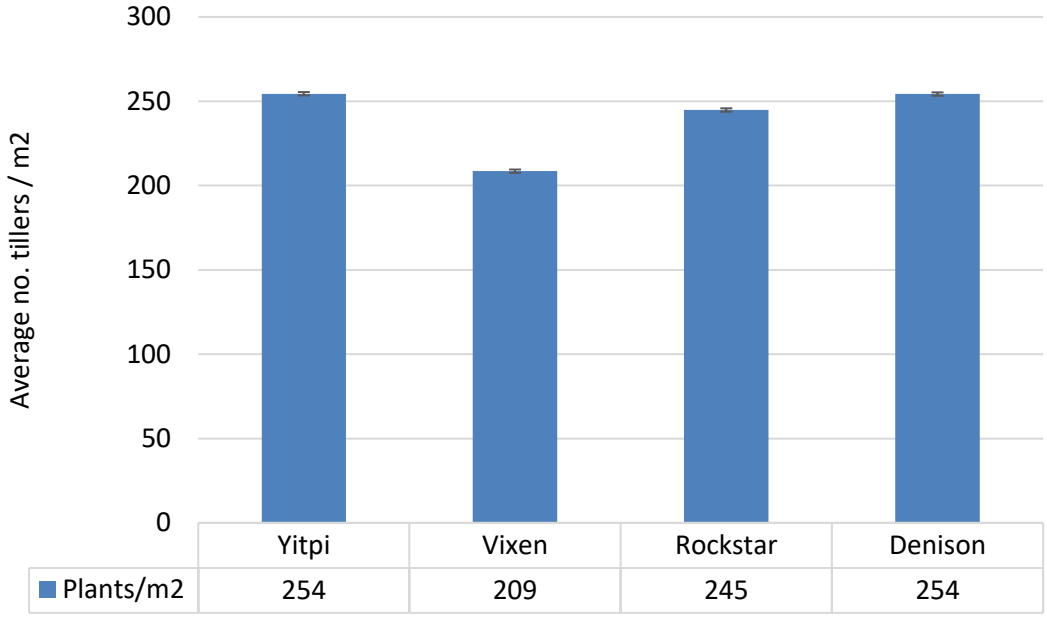


Chart 9: Average tiller count per variety (P = NSD).

Harvest Yield data

Across the trial there were significant differences in yields between the varieties. Denison was the highest yielding variety at 3.32 MT/Ha followed by Vixon 2.91 MT/Ha, then Yitpi 2.85 MT/Ha and lastly Rockstar yielding 2.47 MT/Ha (Chart 10). Rockstar final yield was impacted by frost despite being a long season wheat.

Statistical analysis was determined between the varieties and demonstrated Denison yielded significantly higher than the other 3 varieties followed by Yitpi and Vixen which both yielded significantly higher than Rockstar.

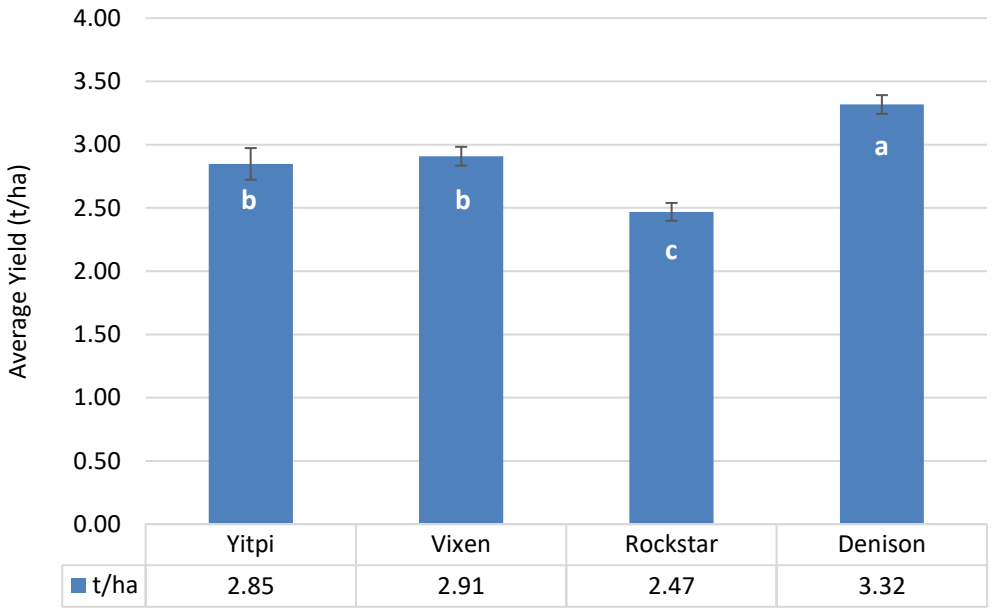


Chart 10: Harvest 2021 results.

Mount Walker

Plant and Tiller Counts

Plant counts for the Mount Walker site occurred on 31st of May 2021. The average number of plants by variety ranged between 51 plants/ m^2 for Rockstar to 109 plants/ m^2 for Scepter wheat (Chart 8).

Plant numbers for Scepter were significantly higher (P>0.05) than the other three varieties.

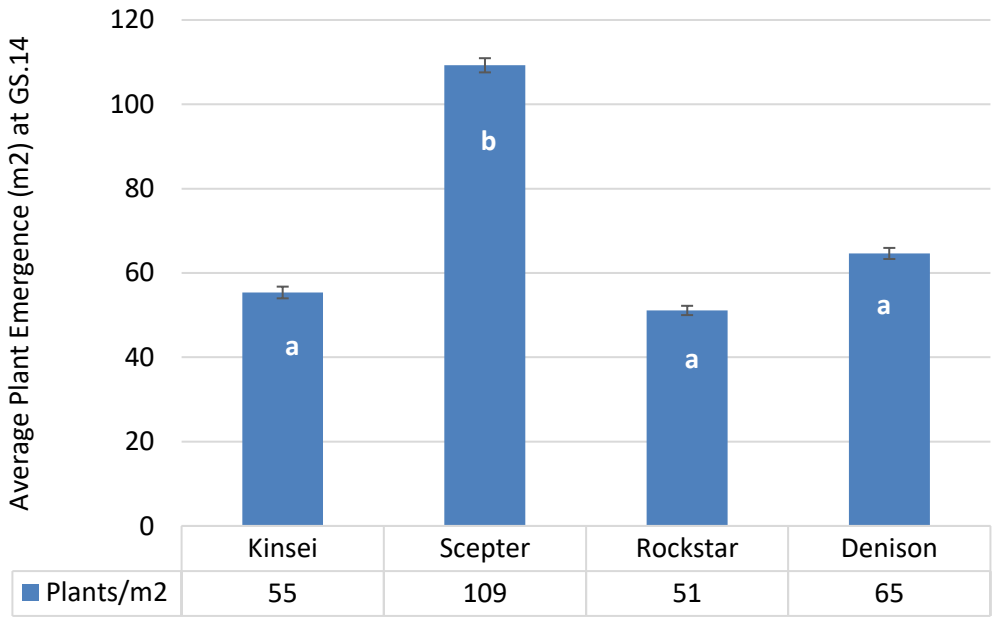


Chart 11: Average plant counts per variety (P = NSD).

Tiller counts were conducted on the 29th of November 2021 (Chart 12). Results show that Scepter wheat had the highest average number of tillers per square meter at 217 and Denison had the least tillers per square meter at 164.

Tiller numbers for Scepter were significantly higher (P>0.05) than the other three varieties.

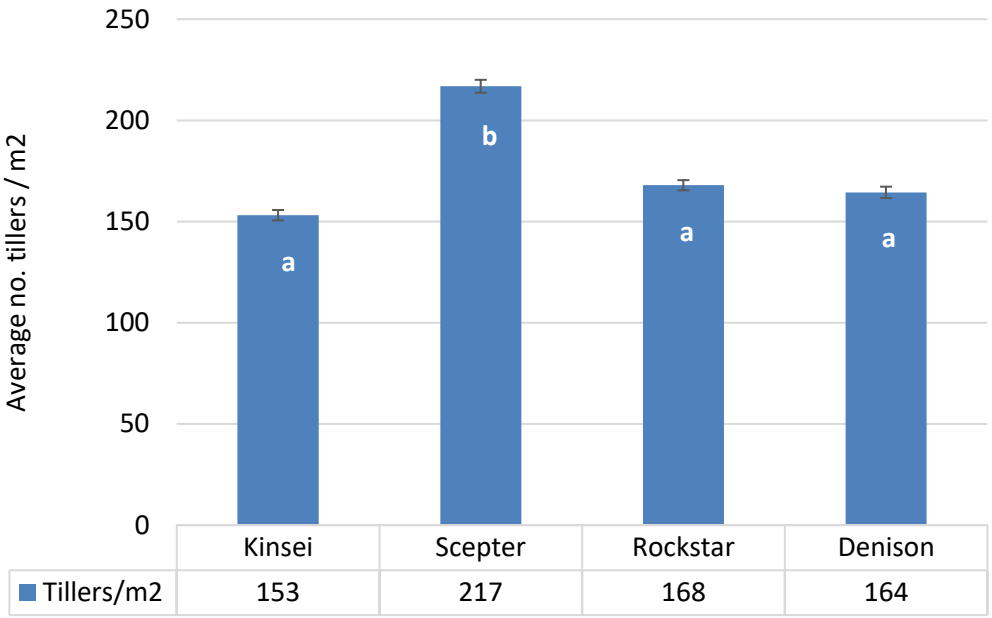


Chart 12: Average tiller count per variety.

Harvest Yield data

Across the trial there were significant differences in yields between the varieties. Scepter was the highest yielding variety at 1.90 MT/Ha followed very closely by Denison 1.87 MT/Ha, then Kinsei 1.68 MT/Ha and lastly Rockstar yielding 1.38 MT/Ha (Chart 13). Rockstar's final yield was again impacted by frost over flowering despite being a long season wheat.

Statistical analysis was determined between the varieties and demonstrated Scepter and Denison yielded significantly higher than Rockstar. Denison and Kinsei yields were not significantly different and Scepter was significantly higher than Kinsei.

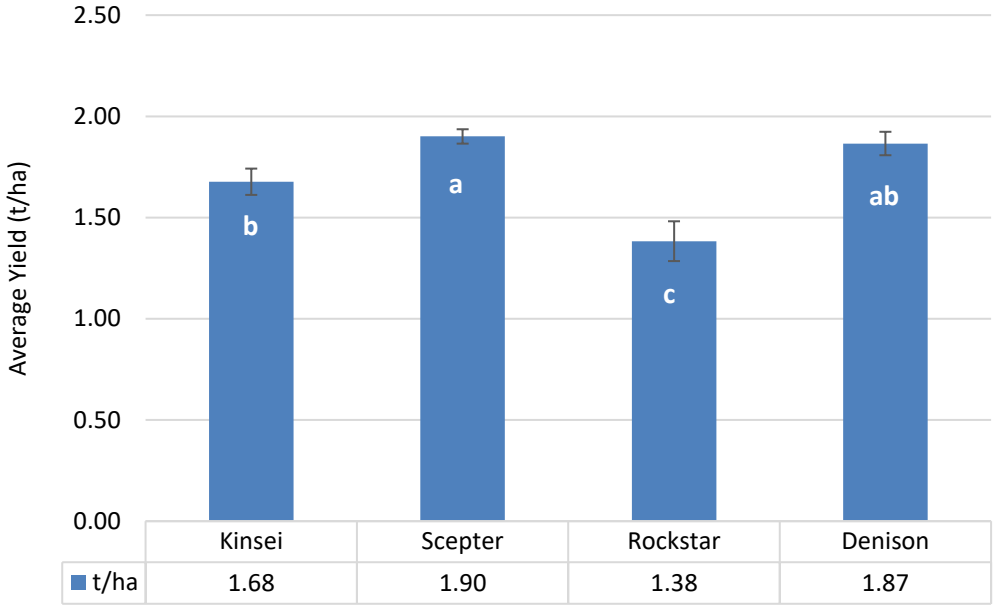


Chart 13: Harvest 2021 results.

APPENDIX

75584
Southern Dirt Incorporated

	Lab No	UES21092	UES21093	UES21094	UES21095	UES21096	UES21103
	Name	D	A	B	E	C	F
	Code	Site Kent B 0 10cm	Site Kent A 1 10mm	Site Kent A 10 20mm	Site Kent B 10 20cm	Site Kent 20 30mm	Site Kent B 20 30 cm
	Sampled Date	10/04/2021	10/04/2021	10/04/2021	10/04/2021	10/04/2021	10/04/2021
	Barcode	SOILB0042739	SOILB0042737	SOILB0042736	SOILB0042725	SOILB0042735	SOILB0042724
	Depth	0-10	0-10	0-10	0-10	0-10	0-10
	Latitude	-33.8358490929842	-33.8357457722036	-33.8357285056459	-33.8357053907325	-33.8357215433232	-33.8357182014081
	Longitude	117.160179913044	117.159358486533	117.159315235913	117.15947650373	117.159495949745	117.159511707723
Colour		DKGR	DKGR	BRGR	DKBR	YWBR	YW
Gravel	%	5-10	5	5-10	0	5	5
Texture		1.5	1.5	1.5	1.0	1.5	1.0
Ammonium Nitrogen	mg/kg	6	28	2	9	< 1	2
Nitrate Nitrogen	mg/kg	64	55	13	10	5	5
Phosphorus Colwell	mg/kg	31	34	36	27	19	24
Potassium Colwell	mg/kg	55	47	43	41	28	21
Sulfur	mg/kg	60.4	47.5	13.3	13.1	9.2	7.3
Organic Carbon	%	1.89	1.71	1.20	1.26	0.40	0.38
Conductivity	dS/m	0.217	0.258	0.069	0.053	0.034	0.031
pH Level (CaCl2)		4.8	4.8	4.6	4.5	4.6	4.4
pH Level (H2O)		5.4	5.6	5.6	5.6	5.8	5.4
PBI		58.8	79.6	92.8	103.1	57.5	49.1

Appendix 1 – Muradup demonstration site soil sample results

REFERENCES & USEFUL LINKS

List of key publication references and web links relevant to the project and for further exploration of the topic.