"Assessing the adaption of long season wheats in South Australia, 2015"

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Key Outcomes:

- Despite the dry seasonal conditions at Paskeville, early sown long season wheats performed well comparative to well adapted main season cultivars
- Frost at the Riverton site again showed that sowing too early can result in severe yield losses. Despite this, early sown longer season varieties still produced outstanding yields when sown early.
- Deliverable quality of the variety has a significant effect on profitability, with ASW appearing to be the minimum quality needed.
- Trojan was again the outstanding variety when sown at the end of April. It performed very well at this time of seeding at both sites.

Trial Objectives:

1) To determine if the profitability of wheat in South Australia can be improved by sowing long season varieties early when the opportunity arises

2) Investigate if there are any long season varieties currently available that are adapted to South Australia's unique combination of soils and climates

3) To determine if there is potential to improve whole farm profitability by ensuring that all wheat/other crops are sown in their respective "optimum" sowing window

Trial Duration: 2015

Location: Navan **Farmer Co-operators**: Pat & Mary Connell

Soil Type: Red Clay Loam

Paddock History: 2014 – Faba Beans
2013 - Wheat

Monthly Rainfall:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
69.5	4	1	70	52	23	56.5	82.5	30.5	9	80.5	36.5

- **Yield Limiting Factors:** Frost, Below Avg. spring rainfall, high temperatures in spring
- **Type of Trial:** Replicated small plot trial
- **Trial Design:** Randomised Complete Block Design, 4 replicates

Treatments:

There were two trial sites sown, one at Paskeville (Avg ARF 400mm) and Riverton (Avg ARF 525mm). Each site had 2 times of seeding: Very Early (28th March, Riverton & 29th March, Paskeville) and Early (24th April, Riverton & 25th April, Paskeville). 20 varieties were sown in each trial (See **Table 1**). Each variety was treated with imidacloprid seed dressing to avoid early BYDV infection. All varieties were sown at 100 seeds/m^2 and with 80 kg/ha MAP + 1% Zinc. Nitrogen was applied to all plots at a rate sufficient to prevent nitrogen becoming a limiting factor in the experiment. Zadocks growth stage data was taken for all varieties across all times of sowing at regualr intervals during the year (data not shown), harvest indices taken for each variety (data not shown) as well as yield and grain protein. Other quality perameters were not recorded such as screenings and test weight. It is aknowledged that these factors may have had a futher significant effect on the quality outputs of each variety, given the seasonal conditions experienced.

Unfortunately, the site at Paskeville was sown into wheat stubble, which received no pre-sowing rain to germinate volunteer wheat. Consequently, there was a substantial contamination of volunteer wheat present in the trials which (along with extremely low rainfall), may have affected the quality of the data.

Table 1: *Varieties sown in SAGIT long season wheat trials, Paskeville and Riverton, 2014*

Variety	Maturity / Type (Max Grade SA)	Variety	Maturity / Type (Max Grade SA)
Trojan	Mid Late Spring Wheat (APW)	***Estoc***	Mid Late Spring Wheat (APW)
Mace	Early Mid Spring Wheat (AH)	***Cutlass***	Mid Late Spring Wheat (APW)
Cobra	Early Mid Spring Wheat (AH)	***Kiora***	Mid Late Spring Wheat (AH)
Chara	Mid Late Spring Wheat (AH)	***LPB11-0032***	Mid Late Spring Wheat (AH)
Beaufort	Late Spring Wheat (FEED)	***RAC 2341***	Mid Winter Wheat (APW**)
DS Pascal	Mid Late Spring Wheat (APW)	***Lancer***	Mid Late Spring Wheat (APW)
DS 11.9419	Late Spring Wheat (APW**)	***Bolac***	Mid Late Spring Wheat (AH)
DS 08.0169	Mid Late Spring Wheat (APW**)	***VO 7041-39***	Late Spring Wheat (APW**)
Eaglehawk	Late Spring Wheat (APW)	***Whistler***	Late Winter Wheat (ASW)
Gazelle	Mid Late Spring Wheat (ASF1/2*/AGP)	***Wedgetail***	Late Winter Wheat (APW)

* - Gazelle able to be delivered as Soft biscuit wheat (ASF1/2) in Mid North

** - Unclassified at the time of publication. For the purpose of the financial analysis it has been assumed that these lines would be released as MINIMUM APW.

Results:

GROWTH STAGES

Detailed Zadock's growth stages were recorded at both sites for each time of sowing across the season. This was used to assess the adaptability of each variety in terms of its ability to flower in the preferred "flowering window" for each site, depending on time of sowing. We have assumed an flowering window of 10 days for each site with the ideal window for Paskeville being the 1-10th (Julian Days 244-253) of September and the 10th-20th (Julian Days 253-263) of September for Riverton. These figures can be seen in **Tables 1 & 2** (Paskeville) and **Tables 3 & 4** (Riverton) below. **NB:** Cells highlighted in green denote variteies that were able to flower in the ideal window, yellow highlighted cells have flowered within a week of the ideal window.

Table 1: Growth Stages vs. Julian Day, TOS 1, Paskeville, 2015

Variety	GS 30	GS 39	GS 49	GS 60	GS 70
ADV 2 (11.9419)	204	246	260	269	281
ADV 3 (08.0169)	143	157	161	197	246
Beaufort	156	177	200	211	266
Bolac	141	153	170	196	230
Chara	148	170	190	196	230
Cobra	146	161	183	196	240
Cutlass	146	177	220	240	260
DS Pascal	141	165	177	197	230
Eaglehawk	146	211	226	244	266
Estoc	147	161	188	204	246
Gazelle	143	158	168	204	246
Kiora	141	161	188	204	240
Lancer	146	166	190	195	240
LPB 11.0032	141	230	244	252	268
Mace	146	161	177	193	230
RAC 2341	190	230	238	248	266
Trojan	141	164	184	211	246
VO 7041-39	146	170	220	243	274
Wedgetail	170	230	238	255	268
Whistler	170	218	230	244	265

Table 2: Growth Stages vs. Julian Day, TOS 2, Paskeville, 2015

Variety	GS 30	GS 39	GS 49	GS 60	GS 70
ADV 2 (11.9419)	211	251	266	277	285
ADV 3 (08.0169)	177	220	240	256	273
Beaufort	177	228	248	259	273
Bolac	161	190	213	246	273
Chara	161	197	218	242	264
Cobra	161	218	228	256	267
Cutlass	170	197	224	240	266
DS Pascal	161	218	228	238	268
Eaglehawk	170	224	246	260	274
Estoc	155	197	218	240	266
Gazelle	170	197	213	229	264
Kiora	177	218	233	246	272
Lancer	170	204	215	244	269
LPB 11.0032	170	240	255	263	274
Mace	161	197	214	240	264
RAC 2341	170	238	248	260	272
Trojan	170	214	222	230	263
VO 7041-39	161	240	253	261	270
Wedgetail	170	235	249	262	271
Whistler	185	244	245	257	269

Table 3: Growth Stages vs. Julian Day, TOS 1, Riverton, 2015

Variety	**GS 30**	**GS 39**	**GS49**	**GS60**	**GS70**
ADV 2 (11.9419)	181	220	261	274	F
ADV 3 (08.0169)	155	176	199	219	F
Beaufort	159	182	214	240	256
Bolac	146	177	191	210	F
Chara	139	176	190	203	F
Cobra	148	174	191	204	F
Cutlass	153	173	196	210	F
DS Pascal	136	178	191	211	F
Eaglehawk	156	199	243	261	271
Estoc	138	176	191	215	F
Gazelle	136	170	187	202	F
Kiora	138	176	190	212	F
Lancer	138	171	197	201	F
LPB11-0032	153	201	245	265	273
Mace	144	169	185	200	F

RAC 2341	176	212	237	249	260
Trojan	146	175	188	202	F
VO 7041-39	138	183	200	236	262F
Wedgetail	176	216	241	258	265
Whistler	176	211	228	250	260

F = Frost, therefore difficult to distinguish end of flowering

Table 4: Growth Stages vs. Julian Day, TOS 2, Riverton, 2015

	GS 30	GS 39	GS 49	GS 60	GS70
ADV 2 (11.9419)	219	260	271	276	285
ADV 3 (08.0169)	175	231	253	271	278
Beaufort	200	237	251	265	272
Bolac	194	228	250	266	270
Chara	182	224	247	259	266
Cobra	178	218	235	250	257
Cutlass	176	226	246	263	268
DS Pascal	176	220	244	258	267
Eaglehawk	200	258	271	278	279
Estoc	178	227	242	258	267
Gazelle	177	216	247	264	270
Kiora	176	226	243	265	271
Lancer	175	220	246	264	269
LPB11-0032	190	240	272	277	279
Mace	171	215	233	249	257
RAC 2341	195	233	250	264	268
Trojan	176	221	241	255	263
VO 7041-39	192	240	256	274	277
Wedgetail	197	245	255	269	275
Whistler	200	241	254	267	270

YIELD

The yield results varied dramatically between sites in 2015. Paskeville experienced one of its driest years on record, whereas Riverton recorded average rainfall for the year, albeit with below average spring rainfall. Despite this, both sites recorded highly significant TOS x variety effects. The yield results for Paskeville (**Figure 1**) and Riverton (**Figure 2**) are displayed separately.

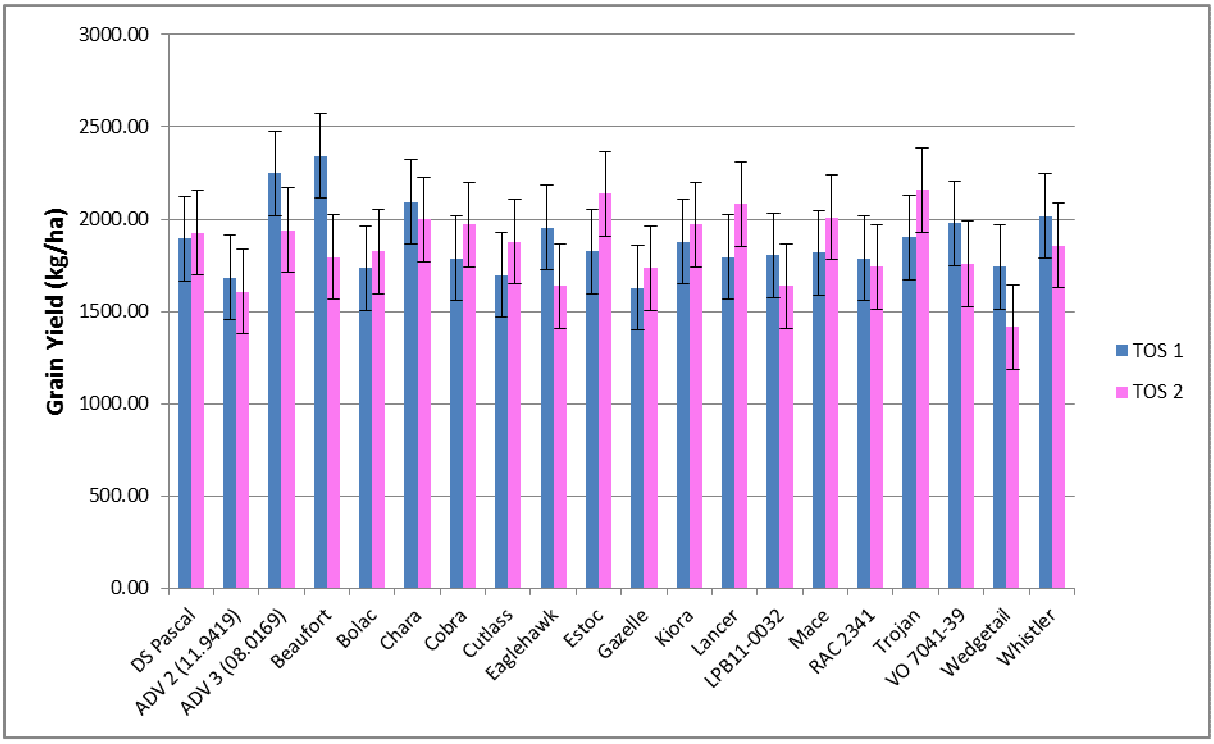
TOS 1 Paskeville: The yields of the longer season spring wheats Beaufort, DS 08.0169 and Chara were the highest in the trial at this time of sowing. Despite the poor seasonal conditions, these yield results highlighted the value of varieties that are adapted to the soil types and climatic conditions in which they are grown. Each of these varieties demonstrated versatility by flowering early and filling grain prior to serious moisture defecit and hot weather in spring.

TOS 2 Paskeville: Trojan, Estoc and Lancer were the highest yielding varieties at this time of sowing. Each of these varieties demonstrates some photoperiod sensitivity, which has enabled the maturity of these varieties sown at this time of sowing to flower and fill grain in the ideal window for this environment, despite the dry seasonal conditions. Once again, this result shows the value of well adapted wheats sown in their ideal sowing window.

TOS 1 Riverton: The yields at Riverton at this time of sowing were again highly variable due to frost events in June, July and September. Yields varied from 2.5-6.5t/ha, with the lower yields coinciding with the temperature (more rapid early development) sensitive varieties producing the lowest yields as they were at a more advanced reproductive stage when the frost events occurred. Beaufort and Whistler again demonstrated their ability to yield in this environment at very early times of seeding. This concurs with results seen at this time of sowing at Riverton in 2014.

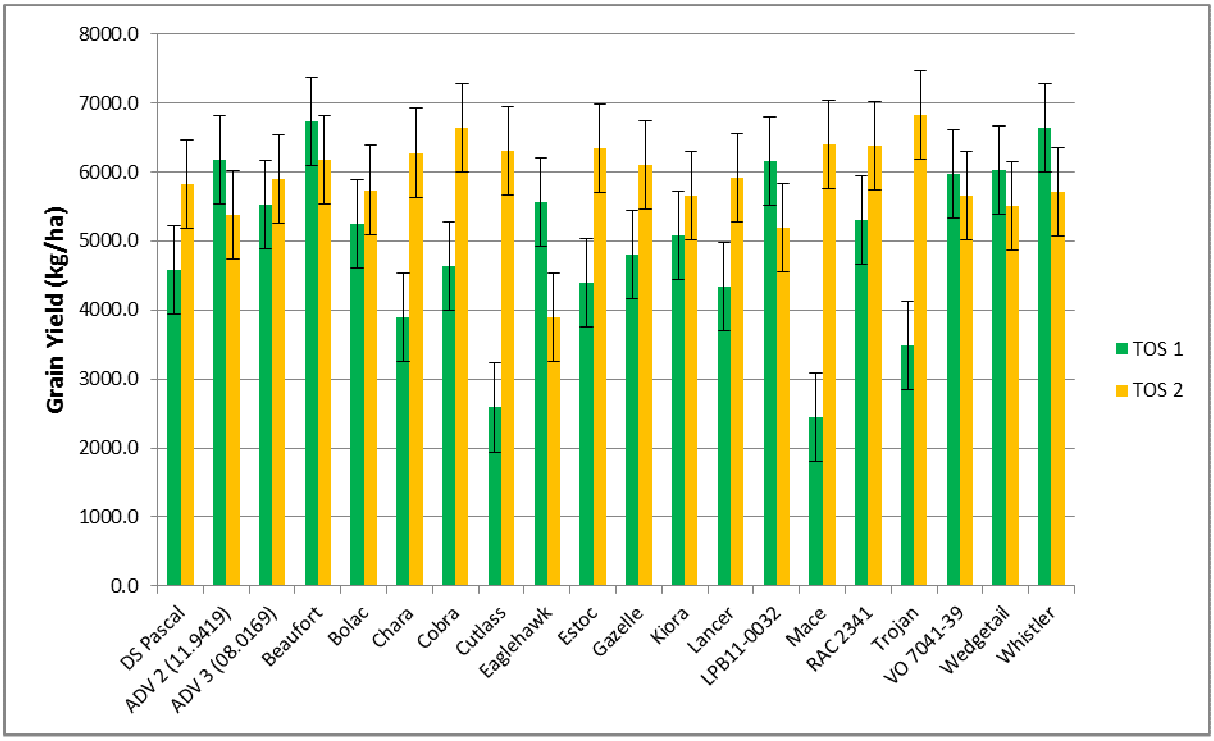
TOS 2 Riverton: Trojan, Cobra, Mace and Estoc produced the highest yields at this time of sowing. Each of these varieties is well adapted to this environment and produced excellent yields at the same time of sowing in 2014. Despite some of these varieties flowering slightly earlier than is considered ideal in this environment, high yields were still able to be achieved, as spring rainfall was all but non-existent, allowing these varieties to fill grain under conditions of less moisture and heat stress.

Figure 1: Grain Yields vs. Time of Sowing and Variety at Paskeville, 2015



TOS x Variety LSD 5% - 229kg/ha

Figure 2: Grain Yields vs. Time of Sowing and Variety at Riverton, 2015



TOS x Variety LSD 5% - 641kg/ha

GRAIN PROTEIN

The grain protein contents (**Table 6**) at Paskeville were again generally lower at the first time of sowing than the second. The conditions for grain experienced by the early TOS are likely to have been more favourable due to their early maturity. The over all lower protein levels achieved at this site are a reflection of paddock history (wheat stubble) and also dry conditions resulting in less overall nitrogen uptake.

At Riverton, the protein levels of plots sown at TOS 1 were highly variable ranging from 9.6-17.7% (See **Table 6**). This is largely a yield dilution effect, with many of the higher protein plots experiencing yield loss due to frost and consequently less grain protein dilution. The protein range at TOS 2 was considerably less, but highlighted the differences in vareties grain protein content. This was also associated with yield diliution, but not to the same extent as seen in TOS 1.

Grain protein was used as the basis for a simple financial analysis along with grain yield and the maximum grade achievable for that variety in South Australia. The prices used can be seen in **Table 5**. For unclassified varieties/breeders lines, it has been assumed that their minimum classification in SA, would be APW, in line with the majority of recent commercial releases in the state.

Table 5: Wheat Prices vs. Grade Spreads, Glencore Cash Prices, Nov 25th 2015, Delivered Port Adelaide

Grade	Price ($/t)
AGP	229
APW	254
ASW	244
AUH2	252
AUW1	222
FEED	208
H2	261
H1	268
SF1	299
SF2	289

*Gazelle able to be delivered as Soft 1 (<9.5% Protein) in Mid North

Table 6: Grain Protein Content (%) vs. Time of Sowing and Variety at Paskeville and Riverton, 2015

	Paskeville		Riverton	
Variety	**TOS 1**	**TOS 2**	**TOS 1**	**TOS 2**
DS Pascal	10.3	11.5	14.4	10.3
ADV 2 (11.9419)	10.5	11.5	9.8	9.6
ADV 3 (08.0169)	9.9	11.6	12.9	10.7
Beaufort	9.3	11.5	9.6	9.4
Bolac	10.1	11.3	14.0	11.4
Chara	10.6	10.8	15.2	10.7
Cobra	10.1	11.0	16.2	11.0
Cutlass	9.7	10.7	16.8	9.9
Eaglehawk	9.9	11.5	10.7	12.5
Estoc	10.7	11.9	14.7	10.8
Gazelle	10.0	11.1	11.3	8.2
Kiora	10.4	11.2	13.5	11.4
Lancer	10.9	12.2	15.3	12.0
LPB11-0032	9.4	11.0	10.6	11.3
Mace	9.6	11.4	17.7	9.2
RAC 2341	10.0	10.7	12.9	11.3
Trojan	9.5	10.5	15.7	8.9
VO 7041-39	9.7	11.5	11.7	10.4
Wedgetail	10.1	11.3	10.6	12.1
Whistler	9.7	10.8	11.1	10.6
TOS x Variety LSD 5%	***TOS x Var NS TOS 1 0.54 TOS 2 0.87***		***1.71***	

FINANCIAL ANALYSIS

The grain yield and protein responses for each variety at both times of sowing have been combined to produce a simple financial analysis for each site (See **Figures 3 & 4**). It is acknowledged that there are other factors (screenings, test weight, physical grain characteristics) that are used to assess the quality of grain at the receival point, however the time and equipment involved to perform these analyses were beyond the scope of this project. This simple analysis may inadvertently favour lower yielding treatments (i.e. frosted) as they tended to produce higher protein grain, which may have been downgraded on other characteristics if delivered in a real world situation.

From this simple analysis, we can see that very early sowing of mid-late season varieties that could achieve ASW grade or better were most profitable at Paskeville. The Dow Seeds breeding line 08.0169, Chara and Whistler were highest gross earning varieties at this time of sowing. Each of these varieties exhibits mid-late maturity, making them well suited to early sowing in this warmer, shorter season environment.

The second time of sowing at Paskeville again revealed the value of sowing well adapted varieties (Estoc, Lancer, Trojan) in their preferred seeding window (Late April). The profitability of these varieties sown at the second time of seeding matched and often exceeded many of the other longer season varieties sown earlier.

The Riverton site again revealed how sowing certain varieties too early can result in severely negative financial implications, particularly when there is a risk of frost (NB Riverton NOT generally classified as a frosty environment). Once again, the value of varieties that could achieve ASW or greater quality at harvest is apparent in the financial analysis. The Riverton site, with its cooler winters and longer spring, has also enabled us to see that there is a place for well adapted winter wheats in this environment, with the varieties Whistler, Wedgetail and Longreach Plant Breeders line 11.0032 in the top 3 for yield and financial return at TOS 1. There were slightly better yields and financial returns seen at TOS 2, with the well adapted main season varieties Gazelle, Cobra and Trojan ranking in the top 3 in yield and financially. It is worth noting at this time of sowing that outstanding financial performance of Gazelle was achieved by producing grain of ASF1 (Biscuit Wheat) standard, which commanded a premium in 2015 in response to the seasonal conditions.

These results from the second year of testing these varieties across two environments have reinforced the learnings of the first year. If sowing very early (<Mid April), the variety must have sufficient developmental “holds” to allow the variety to flower in the appropriate window for optimal yield in each environment. The other factor is that many growers are now well capitalized in terms of seeding machinery, allowing large areas to be sown in short periods of time. If this is the case, there appears to be very little evidence to support the uptake of long season wheat in SA. However, in environments where frost is an issue, time of seeding is unable to optimized due to

scale or where waterlogging may be an issue early in the season, well adapted long season varieties have a definite role to play going forward.

It was felt following the results of last year that long season varieties from interstate programs were not adapted to the unique growing conditions experienced in SA. Upon reflection on the results however, there has been some consistency of performance in some of these varieties that could be built on to produce higher yields from both an agronomic and breeding perspective.

Figure 3: Gross Income ($/ha) of wheat varieties vs. Time of Sowing at Paskeville, 2015

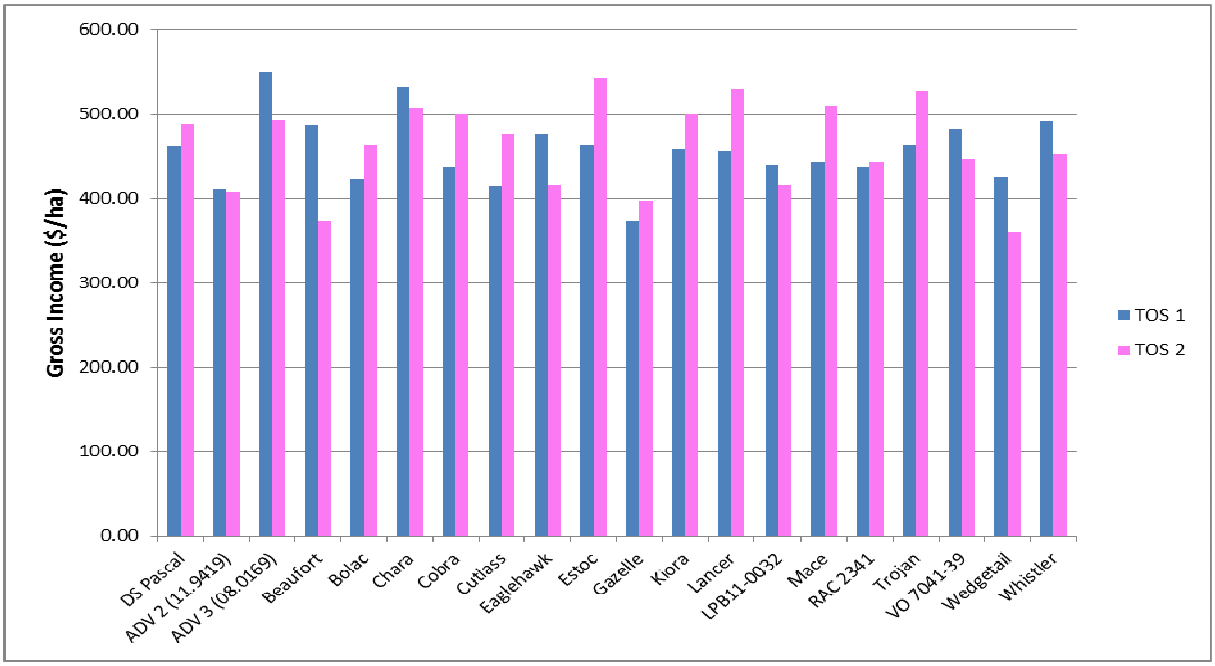
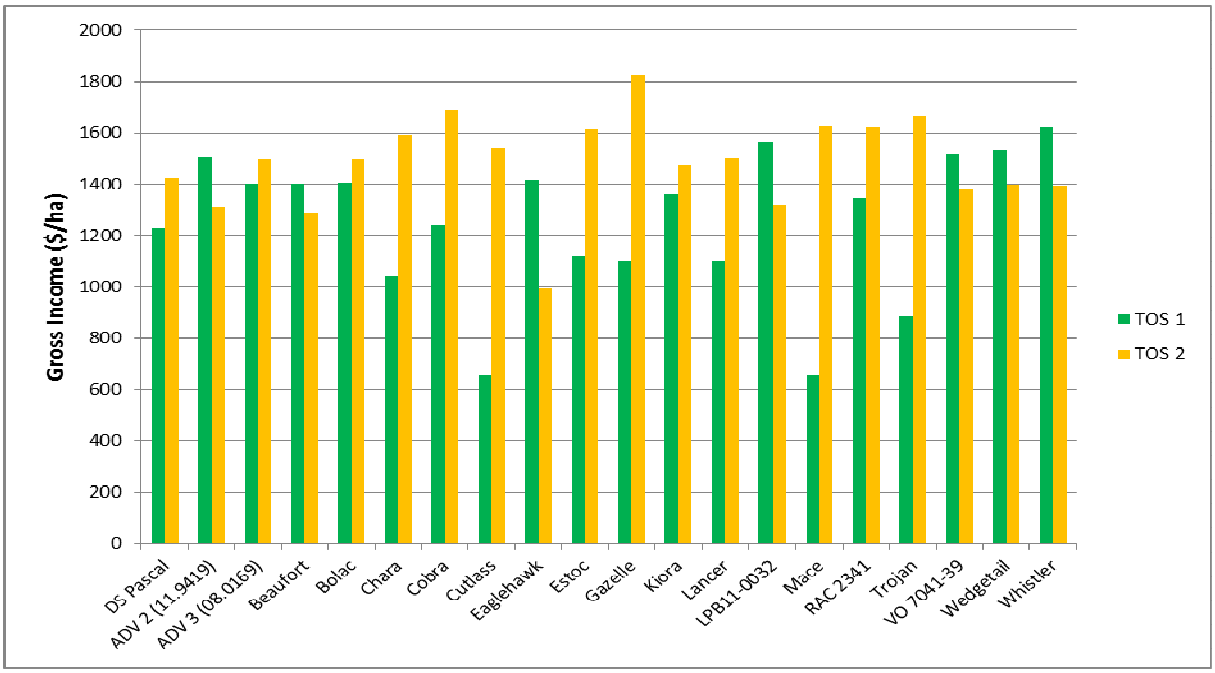


Figure 4: Gross Income ($/ha) of wheat varieties vs. Time of Sowing at Riverton, 2015



Comments:

- There are long season varieties commercially available that are well adapted to South Australian conditions.
- These varieties are able to produce similar financial returns to established main season benchmarks, providing the grain quality at harvest is a minimum of ASW.
- Growers looking at adopting long season varieties need to consider their seeding operation and its timeliness, frost and waterlogging risk.

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