3. CROP AGRONOMY TRIALS

3.1 Rural Finance Barley Challenge - Inverleigh, Vic

Location:
Inverleigh Research Site

Funding:
This trial was sponsored by Rural Finance.

Researchers:
Jon Midwood, Ben O'Connor, Gary Sheppard & Sam Cockayne - all SFS.

Author:
Jon Midwood - SFS.

Acknowledgements:
Thanks to John Hamilton for providing the land for this trials programme.

Paddock history:
2008: Wheat 2007: Canola

Soil type: Sandy clay loam

Soil nutrients:
P = 74 mg/kg (Colwell)
PBI = 55 (V low)
K = 240 mg/kg
S = 16 mg/kg
pH ($CaCl^2$) = 4.8

Deep N test August:
0 - 30cm = 41.6 kg N/ha
30 - 60cm = 26.9 kg N/ha
60 - 90cm = 18 kg N/ha

Take home messages:

- The La Trobe University team are winners of the Rural Finance barley challenge at the Inverleigh site for the second year in succession with the highest margin of $734/ha.
- Grain marketing played a significant part in the outcome of the competition. The La Trobe team would have come 4th had they not forward sold some of their crop.
- Grain quality impacted significantly on the final price teams got for their produce.
- The key to the yield and quality was the timing and amount of nitrogen they applied in conjunction with a fungicide to control mainly scald.
- The highest yielding crop was the Gairdner grown by the Young Guns team at 5.79/ha
- The lowest cost of production was the Fairview grown by team Marcus Oldham at $73/t
- Sowing date had a significant effect on the late sown crop of Gairdner sown by the Landmark team which yielded 1.1t/ha less than Gairdner sown three weeks earlier.

Background/Aim:
When looking to maximize the profitability of growing barley, those who are successful have the ability to make the correct decisions, at the right time, and to deal with the various challenges that are thrown in your way throughout the season. The Barley Challenge at Inverleigh was based on 8 teams from the Geelong branch who decide on crop management decisions for their own crop of barley, which is sown as replicated trial plots to obtain accurate yield data. This year the teams include: two student groups one from La Trobe University and the other from Marcus Oldham, a group of New Zealand farmers, some local farmers who have years of experience, some young farmers who are just starting out, researchers and members from the agricultural industry.

The aim of the competition is to see which team produces the highest gross margin crop (not necessarily the highest yielding crop) against a background of uncertain input and grain prices and unknown growing season rainfall.

A major part of the challenge includes collectively making all of the growing season agronomic decisions from sowing until harvest as well as related grain marketing decisions. Initially teams were given two sowing dates, May and June and the choice of four Barley varieties, two malt and two feed varieties. They then had to decide on seed treatment, sowing rate and what, if any, pre emergence herbicides they wanted to use.

Grain marketing was also available to all teams as another management option. From May 1st each team had the opportunity to market their crop.

All grain marketing quantities and decisions were based on a one hectare tonnage. In other words if your barley yields 5t/ha you had 5t to market. There were two marketing mechanisms available for teams in 2009, prices courtesy of Riordan Grain Services:

- Spot price published on the day of harvest (quality related)
- Forward pricing based on 0.5t lots. If grain tonnages are oversold on the day of harvest teams will have to buy back the relevant tonnage at prices equivalent to (1).

Prices were emailed to team captains every two weeks, on a Monday and were based on Malt and Feed grade quality.

Trial information:
Trial design consisted of a replicated randomised block design using 2 paired plots replicated 4 times. This enables us to statistically analyse any differences between treatments and have more confidence in the conclusions reached. Plot lengths were 12 metres long and 1.45m wide.

Rainfall was highly variable throughout the season, with good early rain in April, a dry winter, then a wet August and September. Rainfall was then low during October with only 60% of the long term average followed by two weeks at the beginning of November with temperatures 4°C above the average and this also coinciding with grain fill.

Diseases:
Due to the wet conditions in August and September and the susceptibility to foliar disease of the two varieties being grown the first signs of scald started to appear in September and became an increasing problem through most of October.

Tillage type:
This trial was seeded with the SFS cone seeder using 2.5cm knifepoints.

Results and discussion:
The team captains supplied a worksheet at the start of the competition in May detailing variety choice, sowing rate, seed treatment and choice of sowing date. This sheet also included any seedbed fertiliser required and any herbicides to be either incorporated by sowing or applied post sowing pre emergence. A breakdown of these costs and the overall costs of production during the season are shown in table 1 below:

Table 1: Team Cost Analysis throughout the growing season ($/ha)

	Germin'	Exiles	Landmark	Marcus Oldham	Young Guns	Lismore Legends	La Trobe	Cant Crusader
Variety	**Fairview 80kg/ha**	**Fairview 80kg/ha**	**Gairdner 80kg/ha**	**Fairview 80kg/ha**	**Gairdner 80kg/ha**	**Fairview 80kg/ha**	**Fairview 80kg/ha**	**Fairview 80kg/ha**
SEED	96	96	92	96	92	96	96	96
Seed Treatment	4	12	12	4	7	4	19	12
Seedbed FERTILISER	66	66	66	66	82	66	66	66
Nitrogen FERTILISER	39	0	34	23	23	36	100	47
Trace Elements	4		3		4	4		
Pre Em HERBICIDES	34	15	34	34	29	12	42	12
Post Em HERBICIDES	28	15	19	14	52	8	15	3
FUNGICIDES	5	10	9	5	10	5	37	25
FIXED COSTS	165	145	167	157	177	157	179	179
TOTAL COST/HA	**441**	**359**	**436**	**399**	**476**	**388**	**554**	**440**

Seed and Seed Treatments:
There was little variation across all teams in terms of sowing rate used even for the Landmark team who chose to sow there crop at the later sowing date which was nearly 3 weeks after everyone else.

Four teams chose to apply an insecticide with their seed treatment but this did not produce a higher yield than teams with similar varieties, sown at the same time, which used standard seed treatments. There was no BYDV seen at this site in 2009 when sowing in the third week of May.

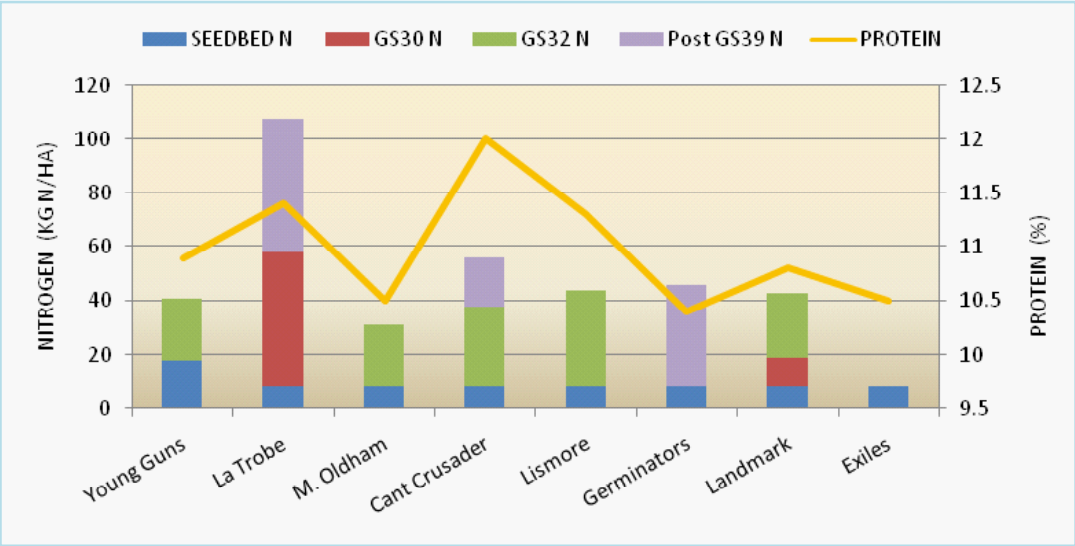
Interestingly, the two highest yielding teams both requested the use of a trace element seed treatment; but as with the insecticides there were other teams who didn't yield significantly lower without this treatment.

Fertiliser:
After the large variations in seedbed fertiliser used in the 2008 Challenge all teams bar one applied MAP at 80kg/ha. With a soil Colwell of 74mg/kg there was going to be little response to applying excess levels of P and so at this rate the teams made some P available to the young plants for establishment and supplied a maintenance rate of Phosphate sufficient to cover off take. The only team who applied something different was the Young Guns who applied 100kg/ha of DAP.
This rate supplied 2.4 kg/ha more of P and 10kg/ha more of N for an additional cost of $16/ha. It is difficult to draw too many conclusions about the success of this strategy as they were the only team who sowed Gairdner, at the May sowing timing; all the other teams chose Fairview.

The management decisions taken by the teams in relation to their Nitrogen management had a significant affect in both the yield of their plots but also the grain quality.

As all the teams chose to grow either Gairdner or Fairview, for the malt barley market, they wanted to maximize yield but also achieve grain proteins between 9% and a maximum of 12%. Six teams grew Fairview and only the Young Guns and the Landmark team chose Gairdner; these were all sown in May, except for the Landmark team which chose to sow in the middle of June.
Details of the teams' nitrogen timings are shown in Table 2.

Table 2: Nitrogen timings and quantities applied, including seedbed and post emergence applications



After the initially small quantity of N supplied at sowing by all teams the first two teams to apply any Nitrogen were the La Trobe team in the form of Urea at close to GS30 and the Landmark team who applied 11 kg N/ha, as UAN as a carrier, in a mix with post emergence herbicides at GS23.

The timing for the majority of teams was early September which was around GS31-32, at this growth stage tillers numbers will have been set and the majority of the N is put into yield. Rates varied from nothing being applied by the Exiles and Germinators and up to 80kg/ha Urea by the Lismore legends team. The majority went with 50kg/ha of Urea at this timing. This application and its timing was critical on the impact it had on the yield and protein levels achieved by the teams, this is clearly shown by the applications made at the later timing around GS49 (awns emerging) to GS55 (50% ear emergence) and the subsequent outcomes:

- The application of 90L/ha of UAN by the Germinators made no significant difference to their yield compared to the Exiles who applied no N post emergence. This application also had no impact on grain protein suggesting that little or none of the $40/ha application was used by the plant at all!
- The 40kg/ha of Urea applied by the Canterbury Crusaders at GS49 made no significant difference to their yield compared to the Lismore Legends who applied similar rates and timing of N to their crop, except for the late application at GS49. It did however make a big difference of 0.7% to the final grain protein level of the Canterbury Crusaders team, taking their protein levels perilously close to the maximum receival standard for grade 1 malt of 12%.
- The La Trobe team applied an extra 100kg/ha of Urea at GS55 which was at the same timing as the Germinators. In the same way, it is unlikely any of this N was used by the plant as their grain protein level was 11.4%, similar to the Lismore Legends who didn't make a late application. It did however cost an extra $50/ha!

The other interesting fact regarding Nitrogen use is looking at the yields achieved by the two teams who sowed Gairdner, where both teams applied 42 kg N/ha. The highest yield in the competition was achieved by the Young Guns Gairdner at 5.8t/ha and close to the lowest yield at 4.7t/ha was by the Landmark team's Gairdner. The big difference between the two teams to create this 1.1t/ha difference was a 20 day delay in sowing by the Landmark team. With both teams having a grain protein of 10.8% it could be argued that for the 2009 season they could have gained some more yield, whist keeping grain protein levels below 12%, by applying more N at GS31/32 but there was always going to be a yield penalty from later sowing that could never be made up.

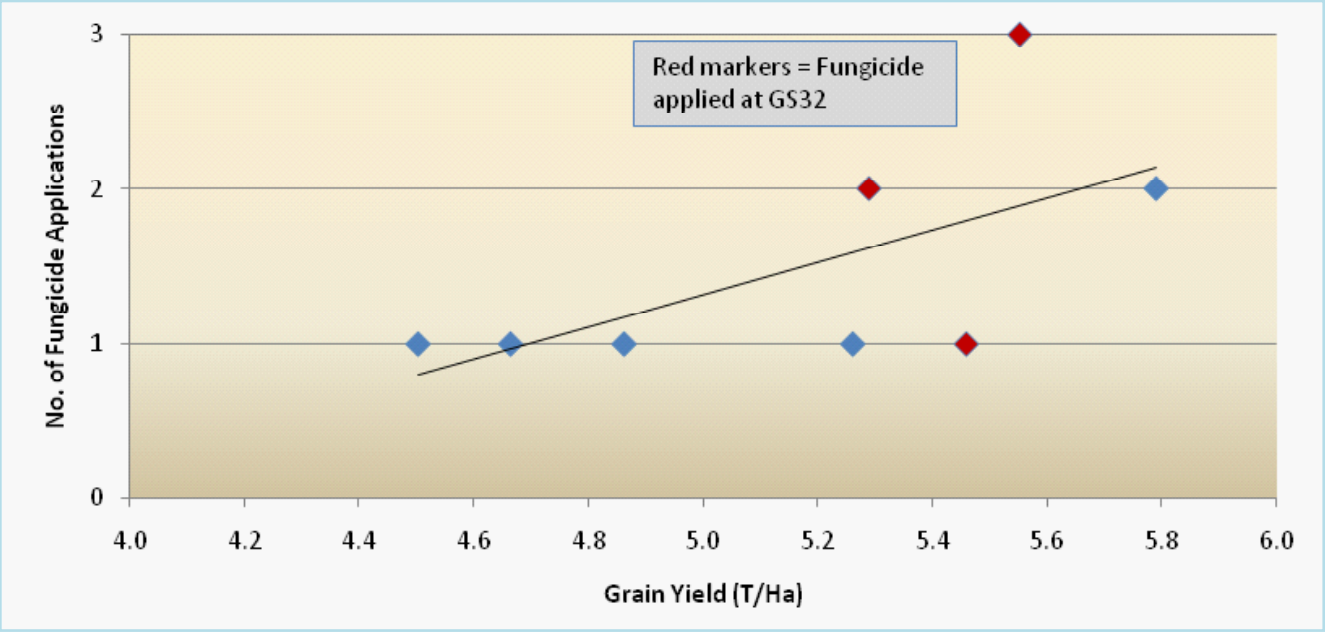
Herbicides:
The total spend by teams on herbicides varied between $15/ha, by the Canterbury Crusaders for applying Trifluralin pre sowing and a post em Logran, up to $81/ha by the Young Gun team, for Trifluralin + Sencor followed by a post emergence herbicide mix to control Ryegrass and broadleaved weeds. The increase in cost between these two approaches is equivalent to a yield increase of nearly 0.35t/ha, based on their final grain price of $190/t, with the same level of weed control!

All the teams used a pre emergence herbicide, incorporated by sowing, and this provided good levels of Ryegrass control for the rest of the season with an average cost of $26/ha. There were however some large variations in the post emergence herbicides which were targeting mainly Radish, varying from $3/ha up to 52/ha.

Fungicides:
Unlike the Wheat Challenge last season when only four teams applied a fungicide, all the teams applied at least one fungicide to their barley crops. Two teams which included the Young Guns and Canterbury Crusaders applied two fungicides and the La Trobe team applied two foliar fungicides and also added Impact to their seedbed fertiliser at sowing.

By charting the number of applications against final yield in Table 3 we can see from the best fit line that there is a trend for a higher yield with increased expenditure on fungicides. Of course there is also the question of getting the timing right to give the best level of control and again we can see that for the variety Fairview that the top three yielding teams all applied their first foliar fungicide at GS32. See Table 3 (◆).

Table 3: Effect of number of fungicide applications on grain yields (T/Ha)



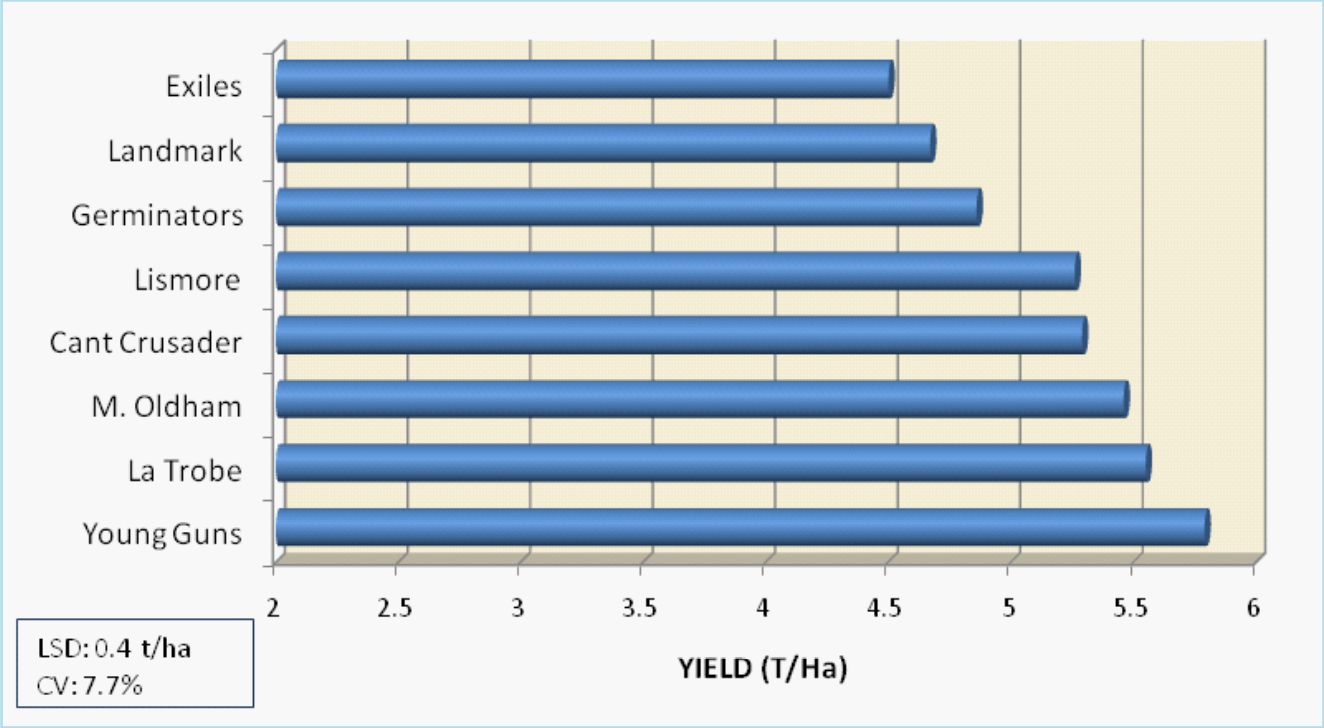
The Young Guns were the highest yielding team and grew Gairdner and as mentioned previously were the only team to sow this variety at the earlier sowing time. They applied two fungicides of Tilt at 0.25L/ha at GS39 (flag leaf) and GS59 (ear fully emerged). It is difficult to say whether any additional benefit would have come from making the first application earlier at GS32 before disease had built up but their barley was downgraded to grade 2 malt due to low retention and high screenings.

Only three teams made grade 1 malt; the Exiles, the Germinators and the La Trobe team. As mentioned earlier the first two teams either applied no in crop nitrogen or what they did apply, in the case of the Germinators, was not used by the plant. This resulted in producing a lower yield but also a plant that had less leaf area and less tillers compared to teams who had applied N post emergence. With the tight finish to the season these plants were better able to fill what grains they had produced resulting in low screenings and retentions above 82%.

In contrast to these two teams was the La Trobe team which took a higher risk strategy by looking to maximise yield but not at the expense of quality. With growing costs close to $200 greater than the Exiles team we got both ends of the risk spectrum. The La Trobe team looked to grow a crop which would establish as well and as quickly as possible, have minimal disease impact and have sufficient N available to maximise yield without adversely affect quality standards. The result was that they achieved this with the highest test weight and retentions, with the lowest screenings of all the teams. That being said the late application of Urea at GS55 could very easily have pushed the grain protein well above 12% if they had had some rainfall after application!

The decision of the Landmark team to sow nearly three weeks after the rest of the teams meant their crop was at a more vulnerable growth stage during late October and early November. During this period there was a combination of very low available soil moisture and well above average temperatures which had the greatest impact on their crop resulting in the lowest retention % and the highest screenings. What works for one team doesn't always help the other!

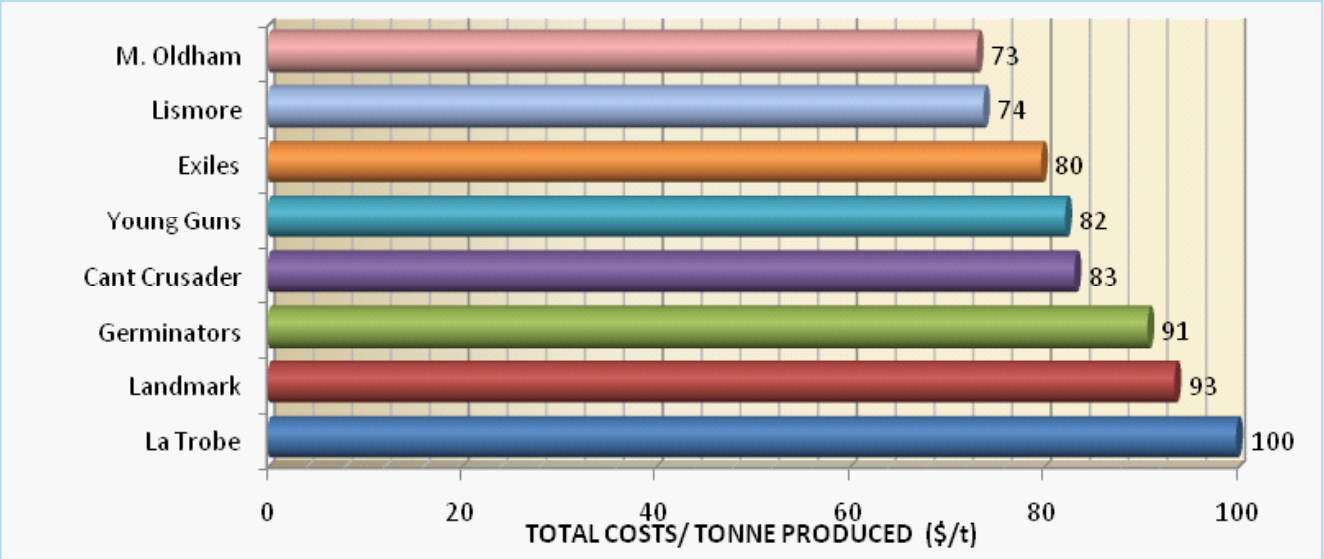
Table 4: Grain Yields (T/Ha) for Inverleigh teams



Having looked at the yields each team produced in the table above it is interesting to then look at what it cost each team to produce a tonne of barley without the influence, at this stage, of either grain quality or marketing; this is shown in table 5 below.

The Marcus Oldham team spent the least amount of dollars per hectare to produce a tonne of barley even though they had the third highest yield. The approach taken by the Exiles again shows a very competitive cost of production which reflects their very low input level for the output they were planning to acheive. Compare that to the La Trobe team who achieved the second highest yield but at a very high cost but as was mentioned earlier this resulted in the best grain quality in the competition.

Table 5: Cost of Production ($/t)

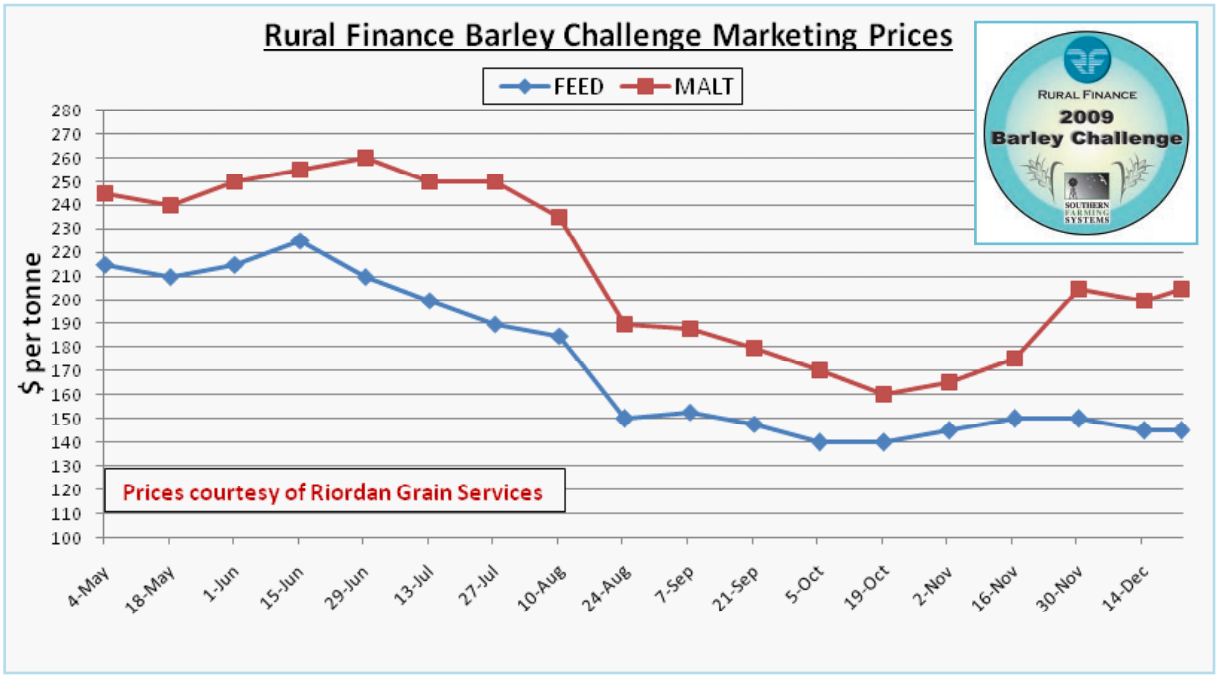


Grain Marketing:
The final management option available to all teams was marketing their grain with the first prices being available from May 1st. All grain marketing quantities and decisions were based on a one hectare tonnage. In other words if your barley yields 4.5t/ha you had 4.5t to market.

There were two marketing mechanisms available for teams in 2009, prices courtesy of Riordan Grain Services:

α) Spot price published on the day of harvest (quality related)
β) Forward pricing based on 0.5t lots. If tonnages are oversold, on the day of harvest teams have to buy back the relevant tonnage at prices equivalent to (a).

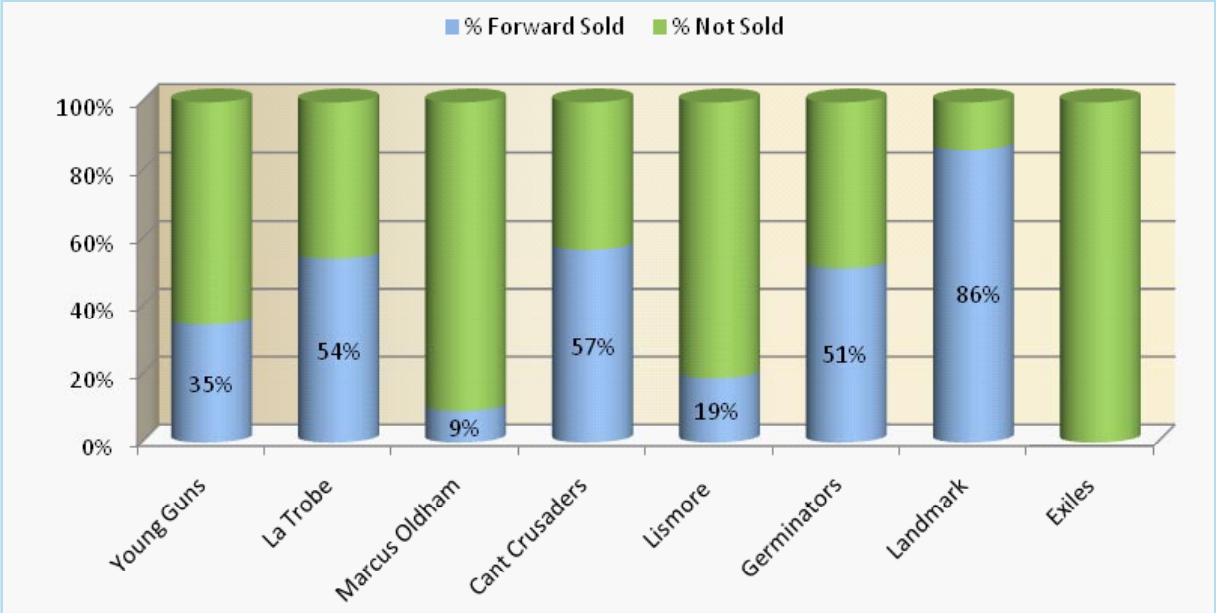
Table 6: Grain prices ($/t) for malt & feed grade barley from May 1st 2009 until December 22nd.



Prices for malt barley at the start of the competition were at $245/t and went to a season high of $260/t on 29th June. After some early activity by five of the eight teams at the first opportunity to sell only two teams bought at the top of the market with the La Trobe team locking in 2 tonnes and the Lismore Legends 0.5 tonne at that stage. As the market began to fall the Landmark team sold 4 tonnes at $250/t which turned out to be of major significance as it nearly doubled their final Gross margin.

Even with this information and the lessons that were learnt last year the Exiles team still sold nothing until the day of harvest. The following chart shows what percentage of their final yield each team sold during the competition.

Table 7: Percentage of final yield sold forward against harvest sale



Was it worth the risk of forward selling any of the crop forward? Yes it was, just as it was in 2008, with all the teams that forward sold improving their overall margin. The Young Guns only improved their margin by $5/ha mainly because they forward sold 1 tonne at $170/t, which ended up being $20/t lower than the final harvest price whereas the Landmark and the La Trobe teams improved their margins by $180/t and $150/t respectively.

Table 8: Gross margins per hectare

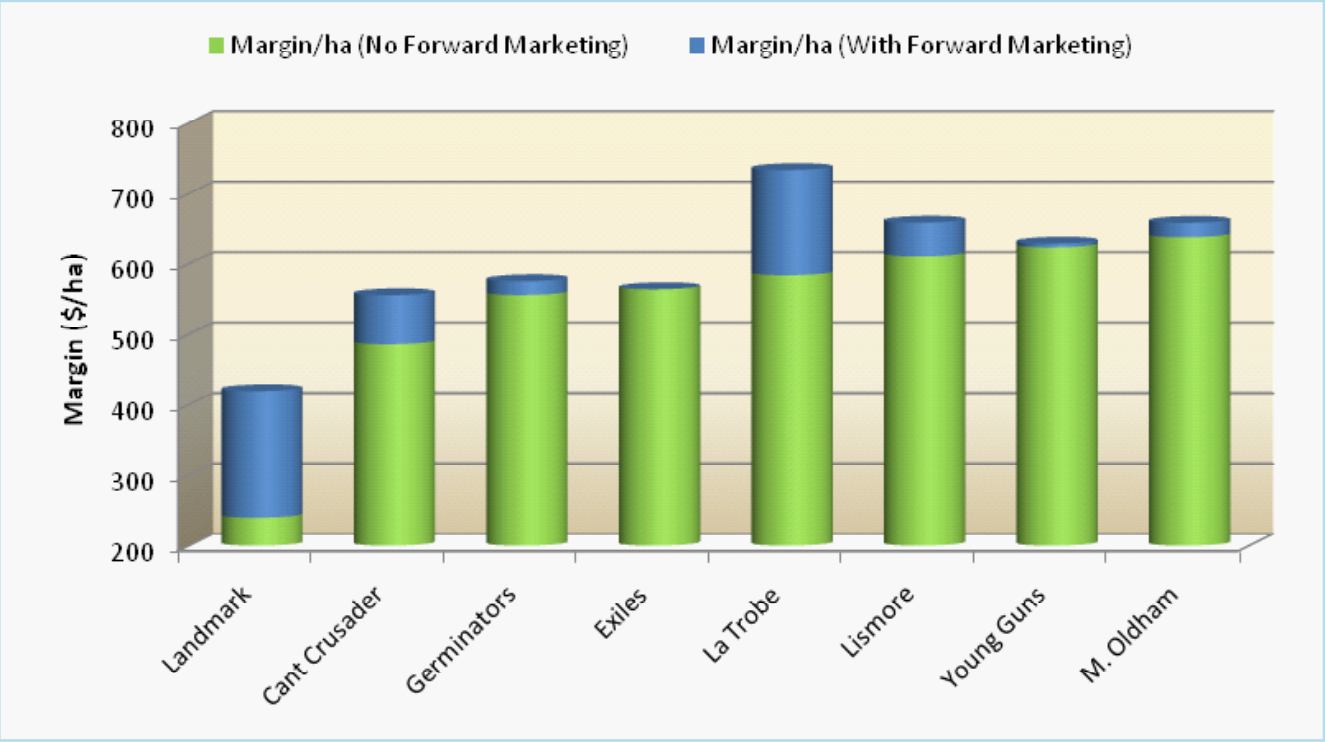


Table 9: Grain Quality and price adjustments

TEAM	TEST WT	RETENTION	SCREENINGS	PROTEIN	DEDUCTIONS	QUALITY	PRICE ($/t)
Young Guns	67.9	62.4	8.9	10.87	Retention < 70 Screenings > 7 $15/t reduction	Grd 2 Malt	191
La Trobe	68.8	86.3	2.5	11.40		Grd 1 Malt	232
Marcus Oldham	65.7	66.4	8.9	10.48	Retention < 70 Screenings > 7 $15/t reduction	Grd 2 Malt	194
Canterbury Crusaders	65.8	59.8	11.6	11.99	Retention < 62 Screenings > 10 $30/t reduction	Grd 3 Malt	188
Lismore Legends	65.7	63.9	9.8	11.33	Retention < 70 Screenings > 7 $15/t reduction	Grd 2 Malt	199
Germinators	67.1	82.5	3.8	10.39		Grd 1 Malt	209
Landmark	66.3	53.8	11.8	10.75	Retention < 58 Screenings > 10 $60/t reduction	Feed	184
Exiles	65.8	83.5	3.1	10.46		Grd 1 Malt	205