



VA

***Varietal Accreditation Evaluation 2013
Stage 2 of 2***

**Admiral (trial) and Baudin (control) Malts
Starch Adjunct Brew**

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1. Variety Trial Outcomes and Overview

Pilot brewing trials were carried out using Admiral malt and compared with a control malt, Baudin from the 2012 season. The Baudin control malt represents export quality malt.

Trial variety description	Admiral is a high extract, high DP and high fermentability export type malting barley suitable for medium to high rainfall areas.
Breeding origin	University of Adelaide, WI4259
Target malt markets	Export markets requiring high DP and high fermentability.
Competing varieties in same growing regions	Admiral is not aimed to directly replace any existing varieties as it will be grown under a closed loop arrangement.

Assessment	Comments
Malt	Malt quality was of a high standard, although DMSP was slightly above the maximum PBA specification.
Milling and mashing	There were no problems encountered during milling and mashing of Admiral and its performance was in line with the Baudin controls.
Lautering	Despite having a slightly longer lautering time, the performance of Admiral malt during lautering was acceptable. Wort run-off flow rate was also consistent with the controls.
Wort clarity	Wort clarity of Admiral malt was similar to the Baudin controls.
Fermentation	Fermentation performance of Admiral wort was similar, if not slightly better than the two Baudin fermentations and the apparent gravity was reached between 7-8 days.
Beer quality	The finished beer was similar to the controls in terms of alcohol level, pH and bitterness. However, the Admiral beer had better physical stability and was slightly fuller on the palate.

2. Results and Discussion

2.1 Malt Analysis

Barley samples were commercially malted and analysis results are outlined in Table 1. Refer to Appendix A for the malting schedule.

TABLE 1 - Malt Analysis

Parameter	Baudin control malt (PE1817)	Baudin 5 year average	Admiral trial malt (A13720)	Specification Starch
Moisture %	3.5	4.6	4.9	5.0 max
Fine Extract d.b.%	80.9	81.5	82.8	80.0 min
Fine-coarse	1.2	1.1	0.7	
Colour EBC	4.4	3.6	3.1	3.0 – 4.5
Total Nitrogen %	1.83	1.69	1.68	1.44 – 1.89
Total Protein d.b.%	11.5	10.6	10.5	9.0 – 11.8
Soluble Nitrogen d.b.%	0.80	0.73	0.71	
Soluble Protein d.b.%	4.98	4.56	4.40	
Kolbach Index %	43.6	43.1	42.1	37 - 46
Diastase WK	389	359	350	300 min Starch
Viscosity mPa.sec	1.52	1.52	1.56	1.58 max
Wort Beta Glucan mg/L	131	114	83	180 max
AAL %	83.7	83.9	84.7	82 min
FAN mg/L	197	168	169	150 min
Carlsberg modification %	92.1	93.1	97.7	
Carlsberg homogeneity %	80.0	83.5	81.3	
Alpha Amylase D.U.	73	55.6	56	
Friability %	82.9	88.0	91.3	80 min
DMS (total) ppm	12.1	11.7	12.8	
DMS precursor ppm	1.1	-	5.4	5.0 max
Malt screenings – Sortimat (>2.8,>2.5,>2.2,<2.2mm) %	81.5/15.7/3.5/0.7	80.0/16.4/3.1/0.7	76.0/20.2/4.6/0.2	

Out of specification parameters are marked in **red bold type**.
Malt analyses represent a mean of 3 malting labs

2.2 Brewing Performance Analysis

Beers were produced using the PBA starch program. Refer to the PBA handbook for details of brewing and analysis. Brewing performance data is presented in Table 2.

TABLE 2. Brewing Performance of Admiral Malt

Parameter	Performance rating
Milling	Good
Mashing	Good
Lautering	Good
Wort Clarity	Good
Fermentation	Good

Definitions:

Excellent = Performance significantly improved over the control

Good = Performance comparable with the control

Fair = Performance worse than the control but within plant capability

Unsatisfactory = Performance outside production capability and/or acceptability

Lautering Performance	Lauter time (all in lauter tun to all in kettle)	Wort run-off time
Baudin control	69 ± 1	53 ± 1
Admiral trial	78	62
Av of last 5y control	92	75
SD of last 5y control	26	23

Comments:

- The run-off performance was acceptable. The Baudin control brews had an average run-off time of 53 minutes. The Trial variety, Admiral, had a run off time of 62 minutes.
- Wort clarity was on par with the controls.

2.3 Wort Analysis

TABLE 3. Data for Wort Samples

Sample	Original Gravity °P	Limit Gravity °P	% AAL	pH	EBC Colour	FAN mg/L	β-glucan mg/L
Baudin	14.05	1.7	87.9	5.68	6.7	216	60
Admiral	14.07	2.0	85.8	5.67	5.6	213	30
Av of last 5y control	13.90	1.8	87.1	5.61	7.8	208	64
SD of last 5y control	0.55	0.1	0.8	0.12	1.1	20	24

Comments:

- The Admiral wort produced a similar original gravity to the controls. However it had a higher limit gravity and therefore a lower AAL compared to the Baudin controls, which was consistent with last year's Stage 1 result.
- The Admiral wort had a similar pH and was slightly lower in colour compared to the controls.
- The wort FAN level for Admiral was similar to the controls, however the Admiral wort had a lower beta-glucan level..

2.4 Fermentation Analysis

The time to reach constant gravities was between 168 and 192 hours (7-8 days).

TABLE 4. Fermentation Data

Sample	Present Gravity °P	Alcohol % v/v	pH
Baudin control	2.14	6.63	4.54
Admiral trial	2.15	6.55	4.55
Av of last 5y control	2.16	6.49	4.54
SD of last 5y control	0.21	0.26	0.22

Figures 1 and 2 show the fermentation curves of the Baudin and the Admiral brews.

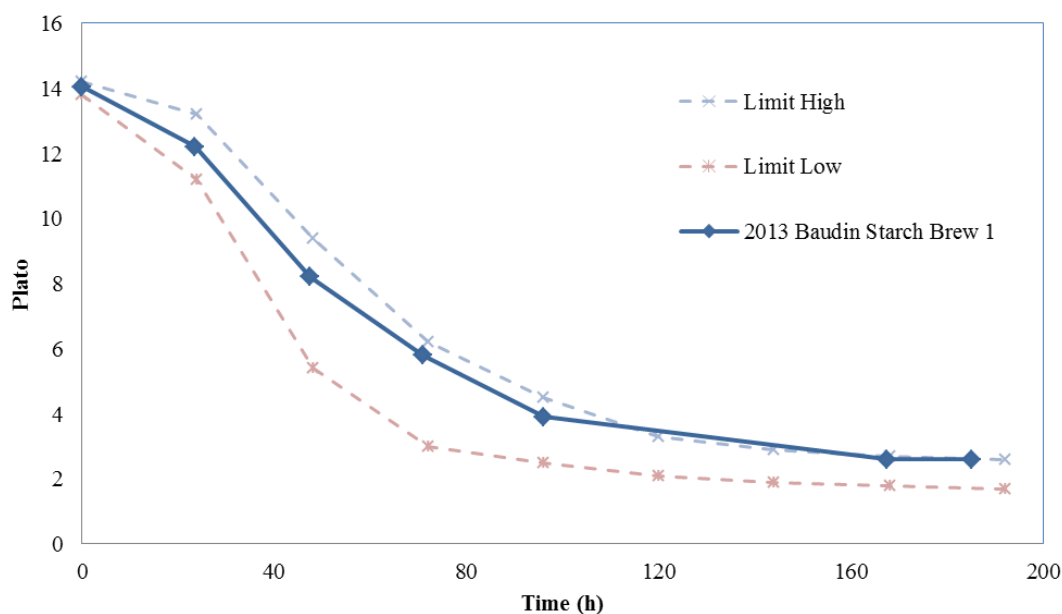
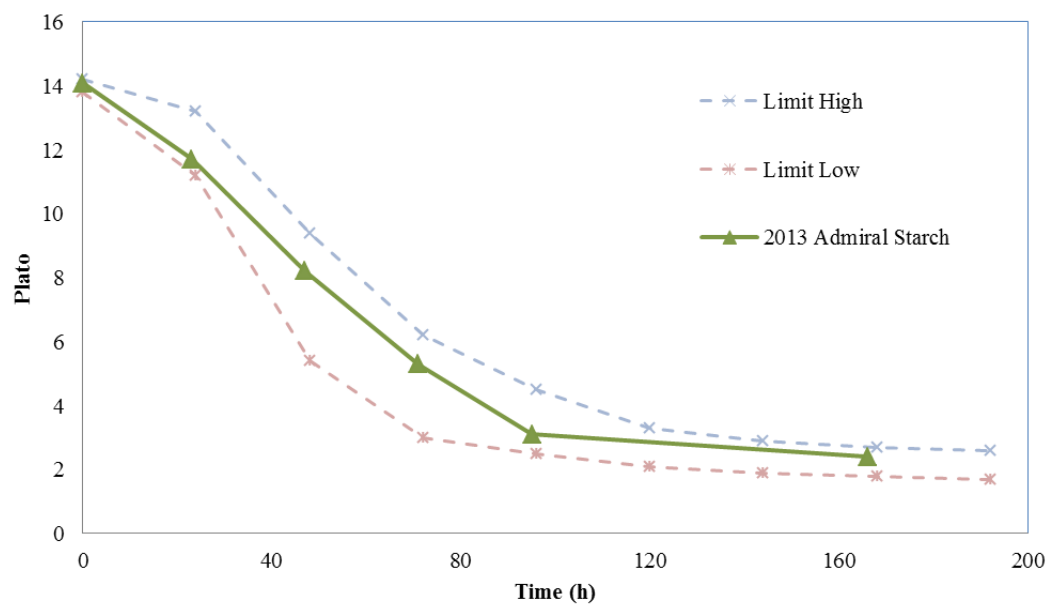
FIGURE 1. Fermentation Curve of the Baudin Control Brew

FIGURE 2. Fermentation Curve of Admiral Trial Brew**Comments:**

- The fermentation curve of the Admiral wort was in line with the two control brews. Fermentation was completed between 7-8 days and total VDK was lower than the specification limit.
- Present gravity and pH of the Admiral storage beer were similar to the controls, though alcohol yield for the Admiral ferment was slightly lower than the controls.

2.5 Packaged Beer Analysis

Packaged beer analysis is given in Table 5. The analysis was completed by an ISO accredited laboratory.

TABLE 5. Packaged Beer Analysis

Analysis #	Baudin control malt (PE1817)	Admiral trial malt (A13720)	Av of last 5y control	SD of last 5y control
<i>Chemical</i>				
Original extract °P	10.9	11.0	10.8	0.1
Apparent extract °P	1.53	1.58	1.55	0.14
Alcohol %v/v	4.91	4.94	4.85	0.07
pH	4.52	4.57	4.54	0.22
Colour EBC	5.0	3.4	4.6	0.4
Bitterness B.U.	20.9	21.2	22.4	3.5
VDK µg/L	9.0	14.0	22.0	16.0
DMS µg/L	14.5	16.0	20.3	8.5
Total Esters mg/L	23.7	23.3	25.5	2.9
Total Alcohols mg/L	87.0	108.5	92.8	13.9
<i>Physical</i>				
Initial Stability EBC	0.93	0.95	0.82	0.52
Forced Stability EBC	2.00	1.33	1.66	0.50
8 week 25C hot room Stability EBC	0.89	0.67	1.17	0.59
Foam stability by NIBEM seconds	241	241	240	13
Vmax L	0.30	0.50	0.34	0.13

Refer to the PBA handbook for analysis details.

Note: In 2013, hot room stability samples were stored at 25°C for 8 weeks. This is approximately equivalent to the 4 weeks at 30°C used in the past and will be used going forward.

Comments:

- The Admiral beer had similar Apparent gravity, alcohol level, pH and bitterness to the controls. Its colour is lower than the controls.
- Total VDK and DMS levels in the Admiral beer were similar to the controls.
- The Admiral beer had similar total esters and higher total alcohols compared to the controls
- Long-term physical stability of the Admiral beer seemed to be better than the controls.
- Beer foam stability between Admiral and the controls was very similar.
- Filterability of the Admiral beer was better than the controls.

2.6 Sensory Evaluation

The expert tasting panel described the Admiral beer as clean, estery, fruity, full, waxy, dry and raw hop extract character.

The Baudin 2013 control beer was described as clean dry, vanilla, low bitterness, perfume, IAA (isoamyl acetate) and having a slightly soapy palate.

Both beers were satisfactory with no malt related defects.

2.7 Conclusion

Milling and mashing performance of the Admiral malt throughout the PBA evaluation process was comparable to the Baudin controls.

The lautering performance of Admiral was acceptable; though wort run-off was slightly slower than the controls.

As with the stage 1 results, the Admiral beer was low in colour but was similar for most other chemical parameters compared to the Baudin controls.

The sensory evaluation showed there were no malt related flavour defects.

Filterability and physical stability of the Admiral beer was better than the Baudin controls. A similar result was also obtained from the Stage1 trial last year.

This completes the stage 2 pilot brewing evaluation for Admiral barley and the report will now be forwarded to the MBIBTC for assessment as part of the BA accreditation process.

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Date: 30th January 2014

3. Appendix A

Barley Quality - Baudin control

Parameter	Results
Barley Growing Location	Pingelly, WA
Crop year	2012
Total Protein (dry basis) – NIR %	11.7
Total Protein %(dry basis) – DUMAS if new variety	-
Moisture %	10.7
Screenings (< 2.2 mm) %	3.4
Plump Grain (>2.5 mm) %	-

Malting Protocol – Baudin Control

Date Maltd	25 July 2013				
Malt Supplier	BBM Perth				
Steeping	First soak	Air rest	Second soak	Steep temp.	Other
	Hrs	Hrs	Hrs	°C	
	7	8	6	16	
Germination	Days	Air on temp °C	Other		
	4	15			
Kilning	Temp range °C	Total time Hrs			
	50-81	38 (double decker kiln)			
Gibberellic acid use (GA3)	GA3 applied ppm				
	0.7				

Barley Quality – Admiral trial

Parameter	Results
Barley Growing Location	Yorke Peninsula, SA
Crop year	2012
Total Protein (dry basis) – NIR %	10.2
Total Protein %(dry basis) – DUMAS if new variety	-
Moisture %	-
Screenings (< 2.2 mm) %	-
Plump Grain (>2.5 mm) %	-

Malting Protocol – Admiral trial

Date Malted	1/5/2013				
Malt Supplier	JWM, Cavan				
Steeping	First soak	Air rest	Second soak	Steep temp.	Other
	Hrs	Hrs	Hrs	°C	
	8	8	2	18	
Germination	Days	Air on temp °C	Other		
	4	20			
Kilning	Temp range °C	Total time Hrs			
	50 - 79	21			
Gibberellic acid use (GA3)	GA3 applied ppm				
	0.25				