Riverina
WINEGRAPE GROWERS

Australian Government
Grape and Wine Research and Development Corporation

Balancing your quality dollar – yield loss vs colour gain in the Riverina

FINAL REPORT to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: **RT 05/05-3**

Principal Investigator: **Ms Emma Grabham & Mr Jason Cappello**

Research Organisation: **Wine Grapes Marketing Board**

Date: **28th July 2006**

Executive Summary

Red winegrape berry colour is now a key determination to the payment of red winegrapes prices for producers. The rapid development and uptake of berry colour assessment by wine companies has led to winegrape growers having to understand the impacts of their viticulture practices and environment on the results of the fruits of their vines produced for red winemaking, the significant learning curve is continually being refined and trialled with research outcomes and developments with understanding berry colour development.

Due to the mixed understanding amongst local growers and limited information to support the various views this small trial intended to assess the winegrape maturity parameters in the Riverina region and measure the link between baumè, colour and yield parameters to the grower's fruit value and ultimately hip pocket.

The trial was set up across 3 vineyards of varying scales from 2 hectare to 25 hectare blocks with Cabernet Sauvignon, Merlot and Shiraz varieties being assessed. Trial set-up and crop assessments were conducted in late December to early January and sampling and assessing of fruit commenced towards the end of January and ceased in mid-April. Fruit assessment was carried out on a weekly basis in line with the gradual increase of fruit baumè ripeness. The sampled fruit was analysed for pH, TA, baumè, berry anthocyanin colour, berry weights and bunch weights.

Background

In achieving berry colour parameters determined by wine companies, winegrape growers and winery staff have many different views to when maximum price return and colour results can be achieved. A mixed response has been received on this matter with comments saying earlier ripening winegrapes produced the highest quality and coloured fruit but then there is the view that leaving grapes on the vine longer and achieving higher baumè will help achieve higher quality and better coloured fruit and improved financial return.
While leaving fruit on the vine for longer to achieve higher baumè results and potential berry colour we need to investigate how much value growers may possibly lose based on yield loses from fruit shrivel or dehydration to compensate for increase colour.

Objectives

The objectives of the project were to:

1. Conduct small trials with 3 red winegrape varieties – Cabernet Sauvignon, Merlot & Shiraz, to collect influential harvest parameters – Baume, Yield, & Colour (mg anthocyanin per gram of berry weight) to assess the effect these have on vineyard financial return.
2. Carry out laboratory analysis of all samples taken on a weekly (or baumè point increase) basis for the above fruit quality parameters and yield changes in bunch and berry weights.
3. Assess harvest trial data to calculate the value of red winegrapes at various harvest points (from 12 to 16 baumè) to help growers make the most sustainable decision regarding the ideal harvest point for their winegrapes.
4. Collate all the trial data and potential calculation outcomes for growers into an information extension tools with the project outcomes for presentation and distribution to growers during 2006.
5. Determine the likely requirement to continue the development and operation of the trial for future vintages for improved data and assessment of seasonal impacts such as extreme climatic conditions.

Extension

It is envisaged that the objectives be delivered through the following methods:

1. Produce a tangible information package for growers to take back to their business. The information package would include a 1 page flyer with an overview of the project, results, outcomes of the financial calculations and related information in regards to colour development in warm climates.
2. Present the information from the trial at local grower meetings being held in mid July – December 2006.
3. Gauge interest from attending growers through an open discussion on the merits of continuing the trial work in future vintages.

It was proposed that the information package contain a colour gain/yield loss chart, as well as a small training information booklet from the trial results. Due to the scale of the trial these items would not be beneficial to produce and possibly present inaccurate information for growers. Continued operation and collection of information related to the project in future vintage would enable the development of such extension items.

Method

Site selection

- 3 commercial vineyards were selected with 2 individual blocks on each vineyard selected as trial sites for the project. The vineyards were selected across the district which the Wine Grapes Marketing Board operates within to reduce any impacts from any severe localised climatic conditions such as hail and storm events. To protect their privacy, the vineyards are not listed.
- From the 6 trial blocks 3 consisted of Shiraz, 2 of Cabernet Sauvignon and 1 of Merlot. These were chosen based on concern of each variety with relation to this topic in the local industry.

Yield assessment and Fruit sampling

- Site and crop details were collected from the growers for each block for forecasting purposes to determine potential block yields in the 2006 vintage.
- Using forecasting calculation sheets bunch numbers were counted across the range of vines determined to provide the least variation in each block amongst the score of individual vine bunch numbers.
- Dependant on block size and variability at least 3 sites in each block were selected to cover the entire blocks and 12 bunches per site were collected from each site.
- Collection of samples and analysis of fruit occurred from 8 baumè and ceased at 15 baumè for most blocks.
- Individual full vines were harvested when fruit reached 12 baumè through to 15 baumè.

Laboratory analysis

- Grape composition was conducted by the Wine Grapes Marketing Board vintage laboratory. Analyses were conducted for Brix/baumè, pH and TA, anthocyanin colour, average bunch weight and average berry weight.

Results / Discussion

The information collected during the season showed that fruit once above the 12 baumè level showed a steady increase in anthocyanin colour at about 0.1mg/g berry weight per baumè increase. The season did not allow for fruit to achieve the desired upper baumè level of 16 due to higher then expected crop levels and extreme heat temperatures recorded during January and February. The highest baumè level achieved was 14.6 for Shiraz. Anthocyanin colour levels for the season were below average for most red winegrapes in the Riverina region and this affected our trial results to predicted financial gains that fruit would produce as anthocyanin colour increase above minimum levels. From the trial small financial calculations were possible for Cabernet Sauvignon and Shiraz.

Merlot fruit just reached minimum colour levels set by several local wineries although would not have been accepted with several others.

For most of our blocks used in the trial colour in the fruit did not drop off as the baumè level reached 15bè. There was a strong positive relationship between the baumè and colour variables for Shiraz (R^2=0.997), Cabernet Sauvignon (R^2=0.980) and followed by Merlot (R^2=0.925).

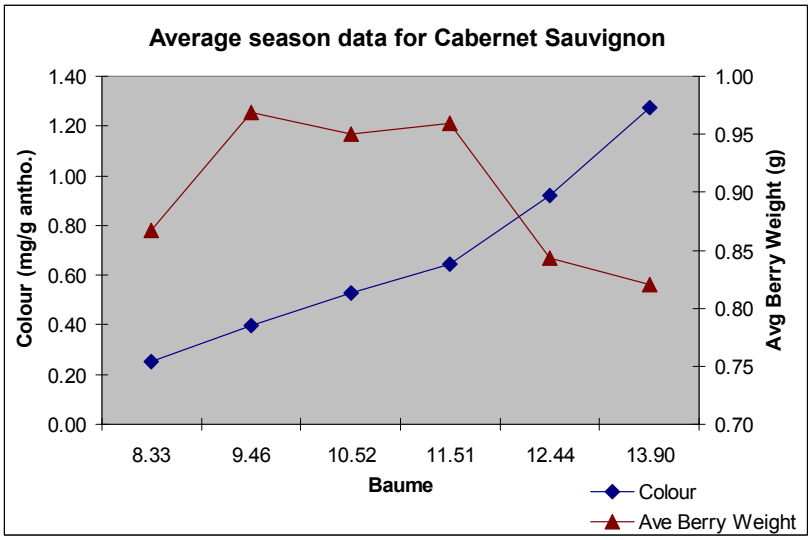
Another seasonal effect was the extreme high temperatures and the consequent delayed ripening and colour accumulation during the season.

Month	Long-Term mean max. Temp	2005/06 mean max. Temp	Long-Term mean min. Temp	2005/06 mean min. Temp
December	30.9	33.4	15.2	14.3
Janurary	32.9	38.6	16.5	15.9
Feburary	32.1	35.2	17.3	16.2
March	28.6	n/a	14.3	n/a

Table 1. Monthly Mean temperatures for the 2005/06 season against long term averages

The above average daily maximums particularly for January were well above the long term regional average.

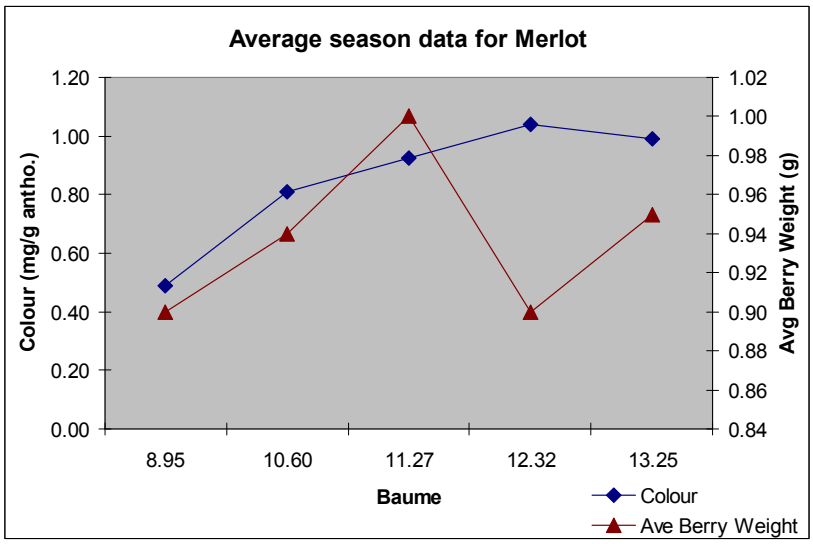
The following graphs display the change in baumè against anthocyanin (antho.) colour & average berry weight for each variety.



Graph 1. Cabernet Sauvignon Baume against Colour and Berry Weight

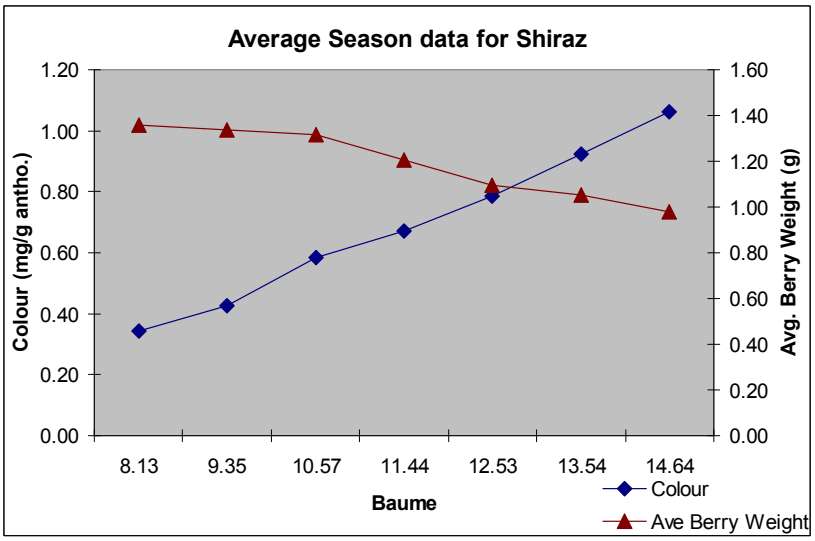
The Cabernet Sauvignon as ripeness increased as stated earlier colour showed a strong positive relationship increasing from an average 0.25mg antho/g berry weight to 1.27mg antho/g berry weight at the completion of the sampling period. Average Berry and bunch weights decreased over the ripening period also from a peak of 113.24g to 79.53g over the 6 week period. During the 12.5 to 13.5 sampling period berry weight lost was 15% but bunch weight loses were up to 30%. This yield loss balanced with an increase in price return for higher colour levels would achieve a net loss of $32 per tonne due to a greater

loss of overall yield against the income which would have been received if fruit was harvested at 12.5 baumè.



Graph 2. Merlot Baume against Colour and Berry Weight

In the project Merlot had 1 trial block. Only a small number of samples were collected during the ripening period to understand if this variety was any different to the Cabernet and Shiraz which we believe is not the case. A larger sample size would allow enhanced assessment of the yield change parameters as fruit is left to aim for higher colour results. Colour results peaked at 12.3 baumè then declined the following week at 13.25 although a positive correlation between baumè and colour was still evident. Berry weights and bunch weights were varied across the harvesting period showing no direct change as the ripening period increased.



Graph 3. Shiraz Baume against Colour and Berry Weight

Shiraz fruit showed a 30% decrease in berry and bunch weight from the start of the sampling period till the final harvest point conducted. The Shiraz fruit assessments between the 12 to 15 baumè range were possible to see effects of yield and colour change over an extended harvest period. During the 12 to 15 baumè sampling period berry & bunch weights lost 12% but colour increased 35% or a possible $50 per tonne based on several winery colour payment systems. At these figures the fruit would have gained $25 per tonne equivalent for the extra berry colour achieved at the 14.6 baumè reading.

An individual Shiraz block showed losses greater then the average up too 23% in its yield. The gain in colour did not benefit the yield loss over the ripening period and resulted in an overall loss in $ value per hectare. A small price return for the colour increase did not compensate the overall yield reduction. Results are shown in the following table.

Date & Week	Baume	pH	TA	Ave Berry Weight (g)	Ave Bunch Weight (g)	Colour (mg/g)
20/03/06 Wk 7	**12.30**	**4.05**	**5.00**	**1.05**	**136.13**	**0.59**
27/03/06 Wk 8	**12.63**	**4.09**	**4.52**	**1.00**	**124.97**	**0.77**
03/04/06 Wk 9	**13.17**	**4.12**	**4.38**	**1.03**	**118.77**	**0.83**
10/04/06 WK 10	**13.95**	**4.24**	**4.55**	**0.93**	**108.57**	**0.90**
17/04/06 WK 11	**14.60**	**4.25**	**4.21**	**0.95**	**101.07**	**1.03**
Change from Wk 8 to Wk 11					-23.65%	25.45%

Table 2. Vineyard 1 Shiraz harvest results during 12 to 15 baumè ripening period

Small grower meetings held in the region have had a short presentation with the background and preliminary results for the trial. Altogether 150 growers were involved in the meetings.
The results and concept of the trial opened up positive discussion amongst the growers present at the meetings regarding the project concept and positive feedback was received to see continued data collection and assessments be made in coming vintages.
Growers understood the trouble the season presented to collect hard data for the vintage to calculate end financial changes, and believed the continued progression of fruit ripening would result in continued yield change more likely to be negative but continued work is needed to quantify the level of change in relation to colour increase and end financial outcomes.

Outcome / Conclusion

For the 2006 vintage this trial found a strong correlation between baumè increase and anthocyanin colour accumulation. The trial intended to assess the level of yield change when fruit is held out beyond harvestable levels to aim for improved base value of the fruit without consideration for overall return due to yield change effects. Berry and bunch weights results for the season were varied across varieties with all varieties having some negative change and losses up to 30% were calculated.
The decision for growers to leave fruit on the vine to improve financial return would need to carry out to ensure the overall yield change did not result in a net value loss due to a greater yield loss then the price gain which would be received through improved fruit colour where winery systems are based on colour.

To obtain further benefit from this project the Wine Grapes Marketing Board will be looking to continue the trial in the 2006/07 growing season and vintage to build the required data to improve the 2006 vintage data and help growers to identify optimum winery harvest points for financial return.
In the current industry climate it is becoming increasingly important for growers to be able to identify their optimum harvest point for maximum return, thus trying to ensure vineyard sustainability.

Acknowledgements are made to the GWRDC for providing funding for this project

Appendix 1

Overall average summary of fruit analysis parameters

Variety	Baume	pH	TA	Colour	Ave Berry Weight	Ave Bunch Weight
Cabernet Sauvignon	8.33	3.24	10.33	0.25	0.87	113.24
	9.46	3.41	8.23	0.40	0.97	109.13
	10.52	3.57	6.26	0.53	0.95	117.38
	11.51	3.63	6.14	0.64	0.96	107.47
	12.44	3.71	5.09	0.92	0.84	113.56
	13.90	3.70	4.72	1.27	0.82	79.53
Merlot	8.95	3.40	6.89	0.49	0.90	79.15
	10.60	3.46	6.09	0.81	0.94	93.14
	11.27	3.53	4.90	0.93	1.00	87.60
	12.32	3.77	4.33	1.04	0.90	89.14
	13.25	3.91	3.66	0.99	0.95	95.75
Shiraz	8.13	3.39	6.97	0.34	1.36	137.16
	9.35	3.61	5.91	0.43	1.34	129.79
	10.57	3.64	5.67	0.59	1.31	122.81
	11.44	3.73	5.25	0.67	1.21	112.90
	12.53	3.93	4.86	0.79	1.10	103.63
	13.54	4.04	4.32	0.92	1.05	91.48
	14.64	4.15	4.28	1.06	0.98	90.46

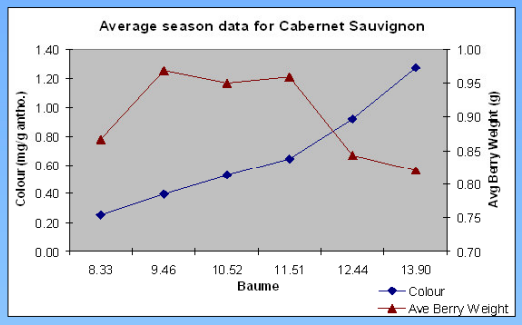
Appendix 2

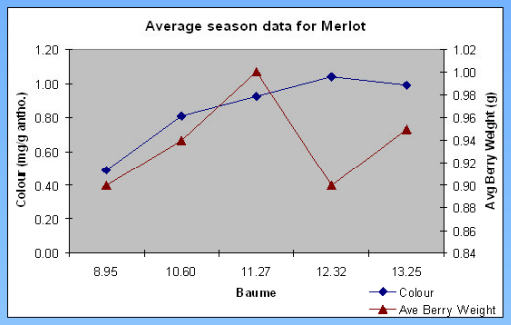
Information flyer produced from the 2006 vintage results

WGMB Be Mapping Trial

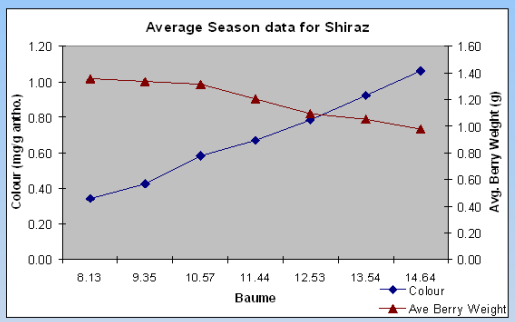
Riverina WINEGRAPE GROWERS

The WGMB baumè mapping trial with support from the GWRDC was carried out during the 2006 vintage to collect region ripening data for Cabernet Sauvignon, Merlot and Shiraz grapes. The results were to assess how growers financial returns where impacted when grapes were left to achieved higher colour result when ready to harvest to try to improve the base value per tonne, but with this extended ripening period the amount in yield change is not clearly understood.





These graphs show the 2006 vintage results from the trial over the range of baumè points which fruit was harvested at and assessed the change in colour & berry weights as the fruit baumè increased as the fruit was held longer on the vine. Seasonal impacts restricted the potential aim for higher baumè levels which we see occur to fruit which is left in vineyards during periods of slow winery intake capacity and anticipation to achieve higher levels of colour.



Based on yield data collected during the trial losses for particular varieties reached 30% in bunch weights when ripening fruit was left to improve colour results.

The table below simply shows if a grower aims to achieve a particular price return for their fruit grown (e.g. $300/tonne) at a particular colour level to meet winery expectations what the impact fruit yield will have on the end financial return. E.g. Having to produce 25% less crop valued at the 5th grade (1.2mg/g) will be the same value as producing a bigger crop at the base level value.

From the table example, if a winery or grower wants fruit to achieve a colour of 1.2 but only records 0.9 (so would receive $325/t) and waits over a time period to achieve the 1.2 colour they would need to ensure the yield did not reduce by more then 20% to avoid negative financial Impacts

Amount of Yield Loss	Colour Requirement to achieve particular $/t ~ aim ≥ $300				
	0.8 mg/g	0.9 mg/g	1 mg/g	1.1 mg/g	1.2 mg/g
0%	$300	$325	$350	$375	$400
10%	$270	$293	$315	$338	$360
15%	$255	$276	$298	$319	$340
20%	$240	$260	$280	$300	$320
25%	$225	$244	$263	$281	$300
30%	$210	$228	$245	$263	$280
35%	$195	$211	$228	$244	$260
40%	$180	$195	$210	$225	$240
45%	$165	$179	$193	$206	$220
50%	$150	$163	$175	$188	$200
55%	$135	$146	$158	$169	$180

Australian Government
Grape and Wine Research and Development Corporation

Be Mapping Trial Overall Results

Variety	Baume Range	Sample Size	Analysis	Baume	pH	TA	Colour (mg/g)	Ave Berry Weight (g)	Ave Bunch Weight (g)
Cabernet Sauvignon	≤ 8.9	13	Variance	0.41	0.01	2.55	0.01	0.01	131.68
			STD DEV	0.64	0.09	1.60	0.11	0.25	32.20
			Average	**8.33**	**3.24**	**10.33**	**0.25**	**0.87**	**113.24**
	9.0 - 9.9	16	Variance	0.07	0.02	2.03	0.01	0.00	180.70
			STD DEV	0.27	0.13	1.42	0.08	0.07	13.44
			Average	**9.46**	**3.41**	**8.23**	**0.40**	**0.97**	**109.13**
	10.0 - 10.9	13	Variance	0.09	0.01	0.50	0.01	0.01	126.32
			STD DEV	0.29	0.11	0.71	0.12	0.10	11.24
			Average	**10.52**	**3.57**	**6.26**	**0.53**	**0.95**	**117.38**
	11.0 - 11.9	20	Variance	0.08	0.02	0.43	0.04	0.01	438.30
			STD DEV	0.29	0.13	0.65	0.19	0.11	20.94
			Average	**11.51**	**3.63**	**6.14**	**0.64**	**0.96**	**107.47**
	12.0 - 12.9	14	Variance	0.09	0.02	0.42	0.05	0.02	1354.41
			STD DEV	0.31	0.13	0.65	0.23	0.13	36.80
			Average	**12.44**	**3.71**	**5.09**	**0.92**	**0.84**	**113.56**
	> 13.0	5	Variance	0.06	0.01	0.01	0.01	0.00	293.14
			STD DEV	0.24	0.12	0.11	0.12	0.04	17.12
			Average	**13.90**	**3.70**	**4.72**	**1.27**	**0.82**	**79.53**

Variety	Baume Range	Sample Size	Analysis	Baume	pH	TA	Colour (mg/g)	Ave Berry Weight (g)	Ave Bunch Weight (g)
Merlot	≤ 9.9	2	Variance	0.85					372.64
			STD DEV	0.92					19.30
			Average	**8.95**	**3.40**	**6.89**	**0.49**	**0.90**	**79.15**
	10.0 - 10.9	5	Variance	0.06	0.00	0.68	0.03	0.00	178.37
			STD DEV	0.25	0.03	0.82	0.17	0.05	13.36
			Average	**10.60**	**3.46**	**6.09**	**0.81**	**0.94**	**93.14**
	11.0 - 11.9	3	Variance	0.08	0.00	0.20	0.01	0.00	77.83
			STD DEV	0.29	0.03	0.45	0.08	0.00	8.82
			Average	**11.27**	**3.53**	**4.90**	**0.93**	**1.00**	**87.60**
	12.0 - 12.9	10	Variance	0.06	0.00	0.23	0.02	0.00	282.55
			STD DEV	0.24	0.06	0.48	0.13	0.07	16.81
			Average	**12.32**	**3.77**	**4.33**	**1.04**	**0.90**	**89.14**
	> 13.0	2	Variance	0.04	0.01	0.01	0.00	0.05	37.85
			STD DEV	0.21	0.10	0.08	0.06	0.21	6.15
			Average	**13.25**	**3.91**	**3.66**	**0.99**	**0.95**	**95.75**

Variety	Baume Range	Sample Size	Analysis	Baume	pH	TA	Colour (mg/g)	Ave Berry Weight (g)	Ave Bunch Weight (g)
Shiraz	≤ 8.9	19	Variance	0.55	0.03	1.27	0.01	0.02	622.89
			STD DEV	0.74	0.79	1.94	0.11	0.34	39.73
			Average	**8.13**	**3.39**	**6.97**	**0.34**	**1.36**	**137.16**
	9.0 - 9.9	11	Variance	0.10	0.01	0.42	0.00	0.01	1334.54
			STD DEV	0.31	0.12	0.64	0.07	0.11	36.53
			Average	**9.35**	**3.61**	**5.91**	**0.43**	**1.34**	**129.79**
	10.0 - 10.9	18	Variance	0.10	0.06	0.40	0.01	0.02	267.18
			STD DEV	0.32	0.25	0.64	0.09	0.13	16.35
			Average	**10.57**	**3.64**	**5.67**	**0.59**	**1.31**	**122.81**
	11.0 - 11.9	16	Variance	0.10	0.04	0.27	0.01	0.03	473.65
			STD DEV	0.32	0.20	0.52	0.11	0.18	21.76
			Average	**11.44**	**3.73**	**5.25**	**0.67**	**1.21**	**112.90**
	12.0 - 12.9	30	Variance	0.09	0.03	0.29	0.02	0.02	245.39
			STD DEV	0.29	0.18	0.53	0.13	0.13	15.66
			Average	**12.53**	**3.93**	**4.86**	**0.79**	**1.10**	**103.63**
	13.0 - 13.9	11	Variance	0.12	0.03	0.11	0.03	0.01	375.67
			STD DEV	0.35	0.16	0.33	0.16	0.11	19.38
			Average	**13.54**	**4.04**	**4.32**	**0.92**	**1.05**	**91.48**
	> 14.0	5	Variance	0.17	0.02	0.12	0.00	0.01	107.47
			STD DEV	0.42	0.15	0.35	0.07	0.08	10.37
			Average	**14.64**	**4.15**	**4.28**	**1.06**	**0.98**	**90.46**