



Modern Olives Laboratory Services

EVALUATION OF NEW ANALYTICAL METHODS TO DETECT LOWER QUALITY OILS

R&D Project – PRJ003349

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(funded by RIRDC)

Objectives

- ❖ Evaluate the new analytical methods (PPP & DAG) to detect adulterations of oils produced with modern refining technologies and lower quality olive oils.
- ❖ Evaluate correlations between current and new analytical methods.
- ❖ Determine the capacity of the different methods to better describe olive oil quality & authenticity.
- ❖ Characterise commercial extra virgin olive oils sold in Australia.

Methodology

The project was divided in three areas:

- ❖ Australian varieties and environmental screening
- ❖ Evaluation of the impact of storage conditions of those varieties.
- ❖ Australian supermarket EVOO screening

Methodology

❖ Australian Varieties: 21 samples

- VIC, NSW, SA, TAS, WA, QLD
- Arbequina, Frantoio, Coratina, Koroneiki, Barnea, Leccino, Manzanilla and Picual.

97 % in
volume

❖ Different storage conditions tested every 4 months, during 2 years:

- 20°C dark glass bottles
- 20°C clear glass bottles
- 20°C dark plastic bottles
- 30°C dark glass bottles

Normal
Light
Oxygen
Temperature

❖ Market EVOO screening (2008, 2009 & 2010): 265 samples

Methodology

Analysis

- Free fatty acids (FFA). AOCS Ca 5a-40.
- Peroxides value (PV). AOCS Cd 8-53.
- UV coefficients (K_{232} , K_{270} and ΔK). AOCS Ch 5-91.
- Induction time (IND). AOCS Cd 12b-92.
- Total polyphenols (PPH). Colorimetric by Folin & Ciocalteus
- Fatty acid profile (FAP). IOC/T.20/Nº 24.
- Panel Test (PAT). IOC/T.20/Nº 15.
- Bitterness (BIT). CSIC IG method
- **Pyropheophytins A (PPPs). ISO 29841:2009.**
- **1,2-Diacylglycerol Content (DAGs). ISO 29822:2009.**



Results – Different storage conditions

Evolution of quality parameters at 20°C dark glass bottles

Date	FFA	PV	K232	K270	DK	IND	PPH	K225	PPPs	DAGs	DEF	FRU	BIT	PUN
Aug-09	0.19	6.24	1.600	0.073	-0.001	5.7	155	0.09	1.79	85.59	0	5.1	3.0	3.8
Dec-09	0.17	8.97	1.760	0.128	0.000	4.9	165	0.10	5.99	79.16	0	4.8	2.7	3.3
Apr-10	0.18	9.84	1.957	0.138	0.001	4.8	126	0.13	7.18	69.97	0	4.9	2.3	3.6
Aug-10	0.20	9.81	1.926	0.175	0.002	4.1	122	0.13	8.00	64.04	0	4.6	2.2	2.5
Dec-10	0.21	10.97	1.876	0.186	0.003	4.4	140	0.12	10.47	59.17	0	4.7	2.7	2.8
Apr-11	0.24	10.44	1.850	0.190	0.005	4.2	133	0.12	13.59	51.03	0	4.4	1.9	2.4

Results – Different storage conditions

Evolution of quality parameters at 20°C clear glass bottles

Date	FFA	PV	K232	K270	DK	IND	PPH	K225	PPPs	DAGs	DEF	FRU	BIT	PUN
Aug-09	0.19	6.24	1.600	0.073	-0.001	5.7	155	0.09	1.79	85.59	0	5.1	3.0	3.8
Dec-09	0.17	10.16	1.810	0.146	0.002	4.2	159	0.14	5.41	76.84	0	4.8	2.3	3.1
Apr-10	0.18	15.48	2.187	0.165	0.002	4.2	123	0.12	11.86	69.82	0	4.4	2.1	3.0
Aug-10	0.21	9.31	1.945	0.212	0.005	3.9	127	0.11	18.95	64.57	0	4.5	2.1	2.4
Dec-10	0.22	14.02	1.924	0.230	0.006	3.6	129	0.10	25.23	59.66	0	4.4	2.2	2.2
Apr-11	0.24	10.93	1.915	0.222	0.003	3.6	127	0.12	27.32	48.08	1	3.3	1.6	1.6

Results – Different storage conditions

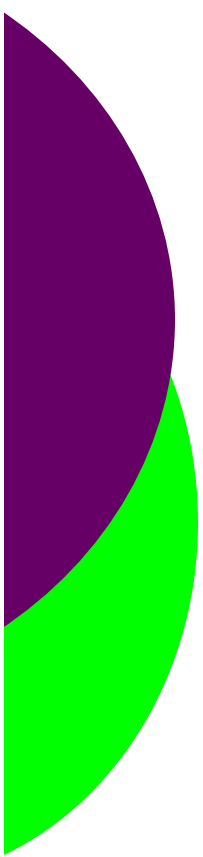
Evolution of quality parameters at 20°C dark plastic bottles

Date	FFA	PV	K232	K270	DK	IND	PPH	K225	PPPs	DAGs	DEF	FRU	BIT	PUN
Aug-09	0.19	6.24	1.600	0.073	-0.001	5.7	155	0.09	1.79	85.59	0	5.1	3.0	3.8
Dec-09	0.17	6.17	1.889	0.111	0.000	3.9	188	0.14	3.88	77.23	0	5.0	2.7	3.6
Apr-10	0.17	12.78	1.953	0.172	0.003	4.1	131	0.14	6.41	68.27	0	4.6	2.2	3.4
Aug-10	0.19	11.65	2.089	0.158	0.001	3.7	138	0.13	7.63	62.29	0	4.4	2.3	2.5
Dec-10	0.21	15.40	2.216	0.177	0.003	3.1	139	0.11	10.08	56.16	0	4.8	2.1	2.1
Apr-11	0.22	14.74	2.087	0.158	0.003	3.2	139	0.13	12.90	49.61	0	4.0	1.6	2.2

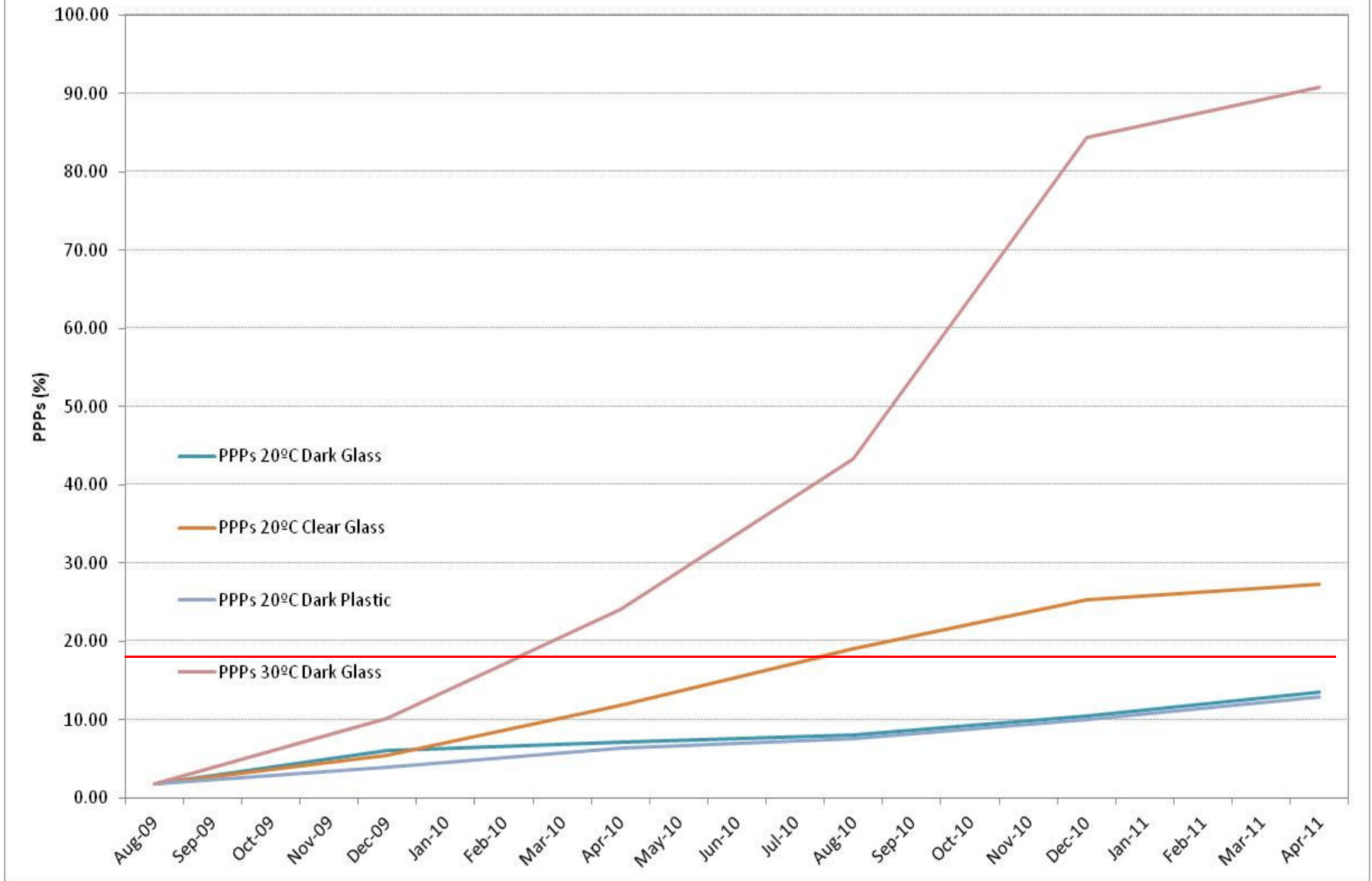
Results – Different storage conditions

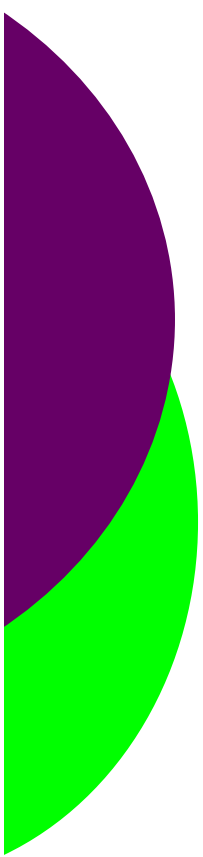
Evolution of quality parameters at 30°C dark glass bottles

Date	FFA	PV	K232	K270	DK	IND	PPH	K225	PPPs	DAGs	DEF	FRU	BIT	PUN
Aug-09	0.19	6.24	1.600	0.073	-0.001	5.7	155	0.09	1.79	85.59	0	5.1	3.0	3.8
Dec-09	0.17	6.06	2.103	0.114	-0.001	4.4	177	0.14	10.11	67.40	0	4.9	2.5	3.2
Apr-10	0.20	13.88	2.108	0.147	0.001	3.9	107	0.13	24.10	48.14	0	4.5	2.1	2.6
Aug-10	0.25	11.26	3.497	0.199	0.002	2.8	98	0.10	43.34	38.14	1	4.5	2.0	2.4
Dec-10	0.30	15.71	3.412	0.286	0.006	2.6	89	0.10	84.35	30.33	1	4.0	1.3	1.5
Apr-11	0.36	12.38	3.384	0.280	0.004	2.8	89	0.10	90.80	30.75	3	2.9	1.0	1.3

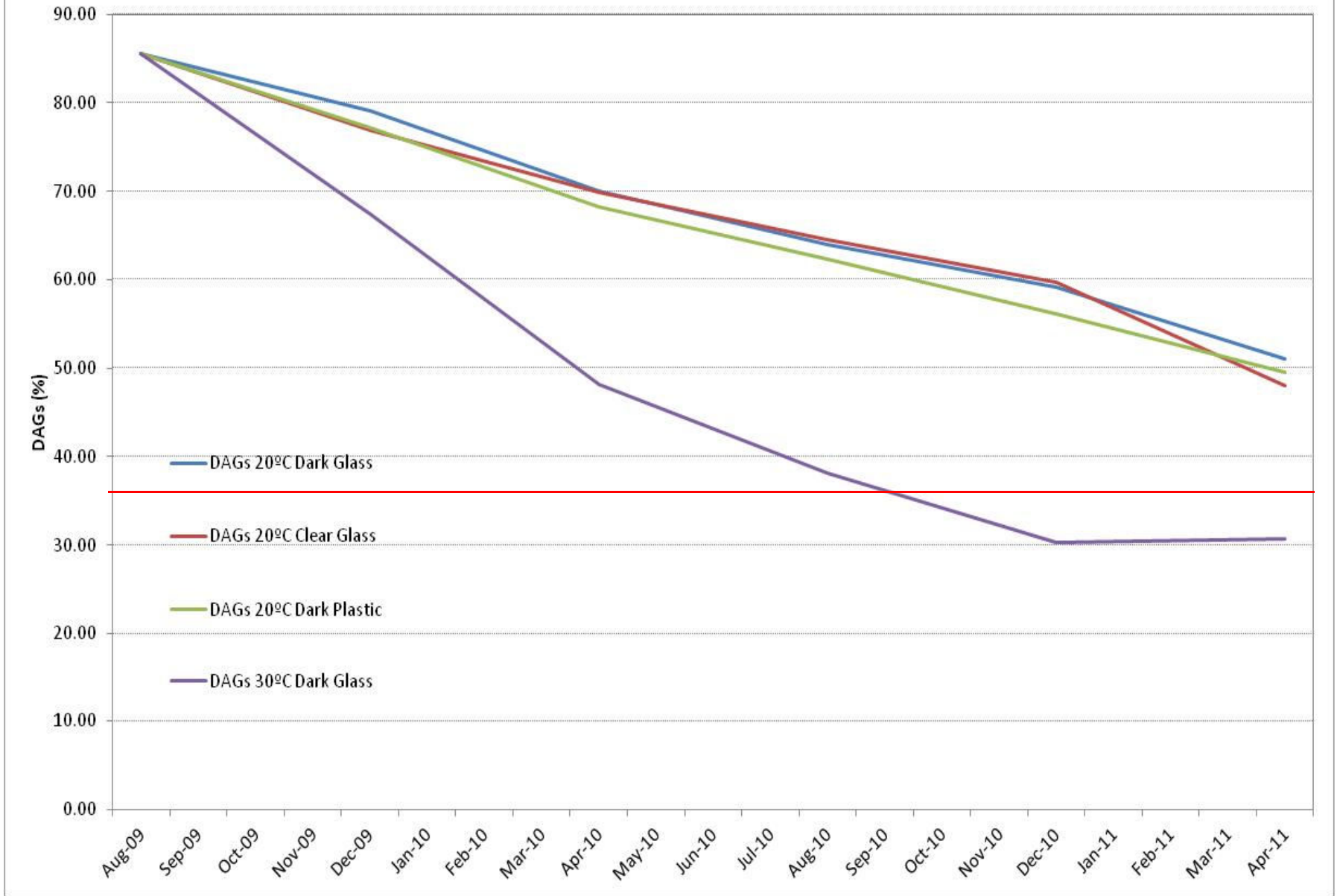


Evolution of PPPs according to Storage Conditions





Evolution of DAGs according to Storage Conditions



Results – Australian Varieties

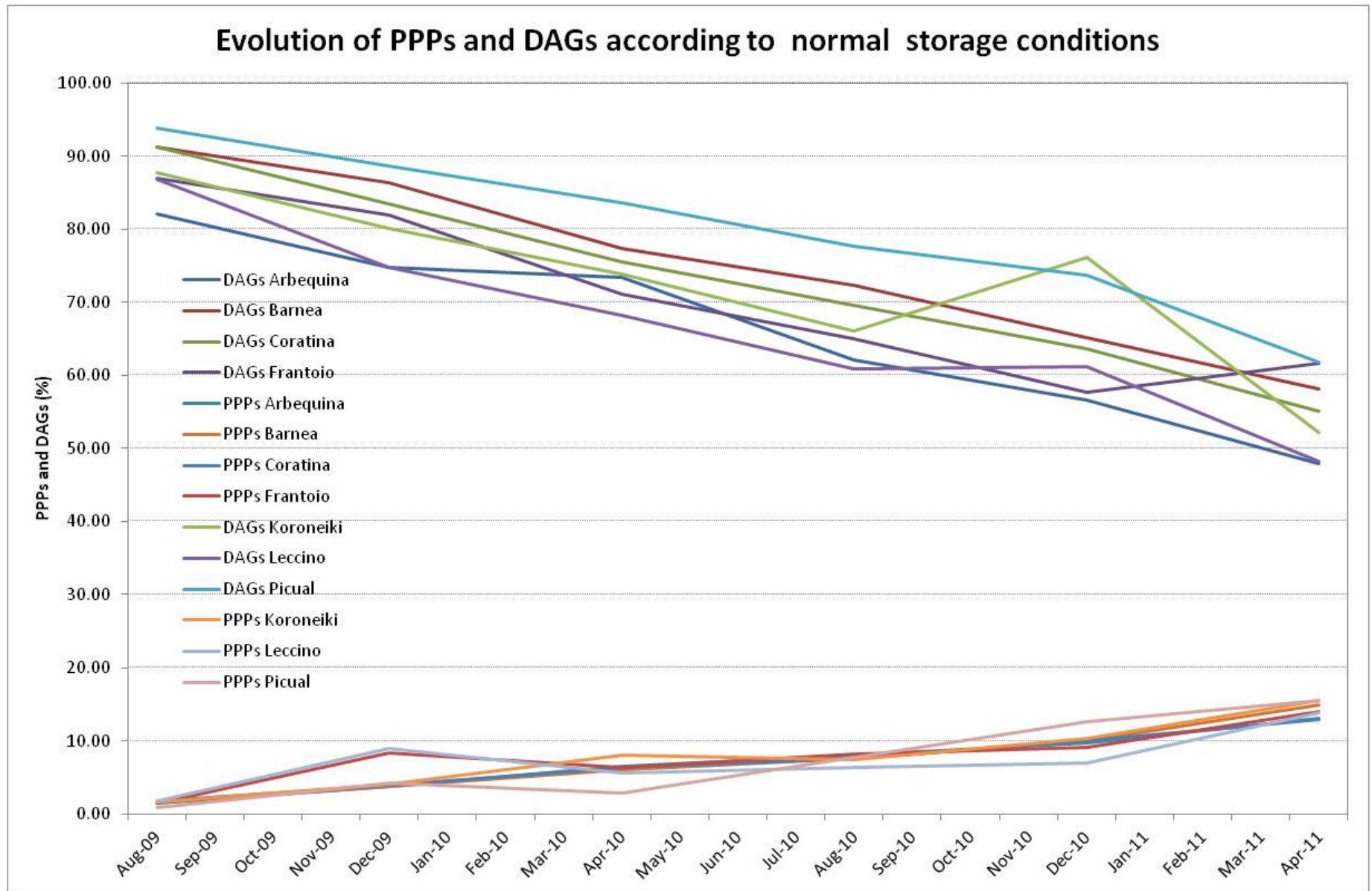
❖ Impact of **variety**:

- dark glass containers at 20°C
- 24 months (tested every 4 months)

None of those samples failed any of the current international standards tests or the new ISO tests (PPPs and DAGs) during the life of the project.

The rate of evolution of PPPs and DAGs was almost identical for all varieties, demonstrating that these methods are not influenced by genetics or growing environments

Results – Australian Varieties



Results – Initial quality

❖ Impact of **quality**:

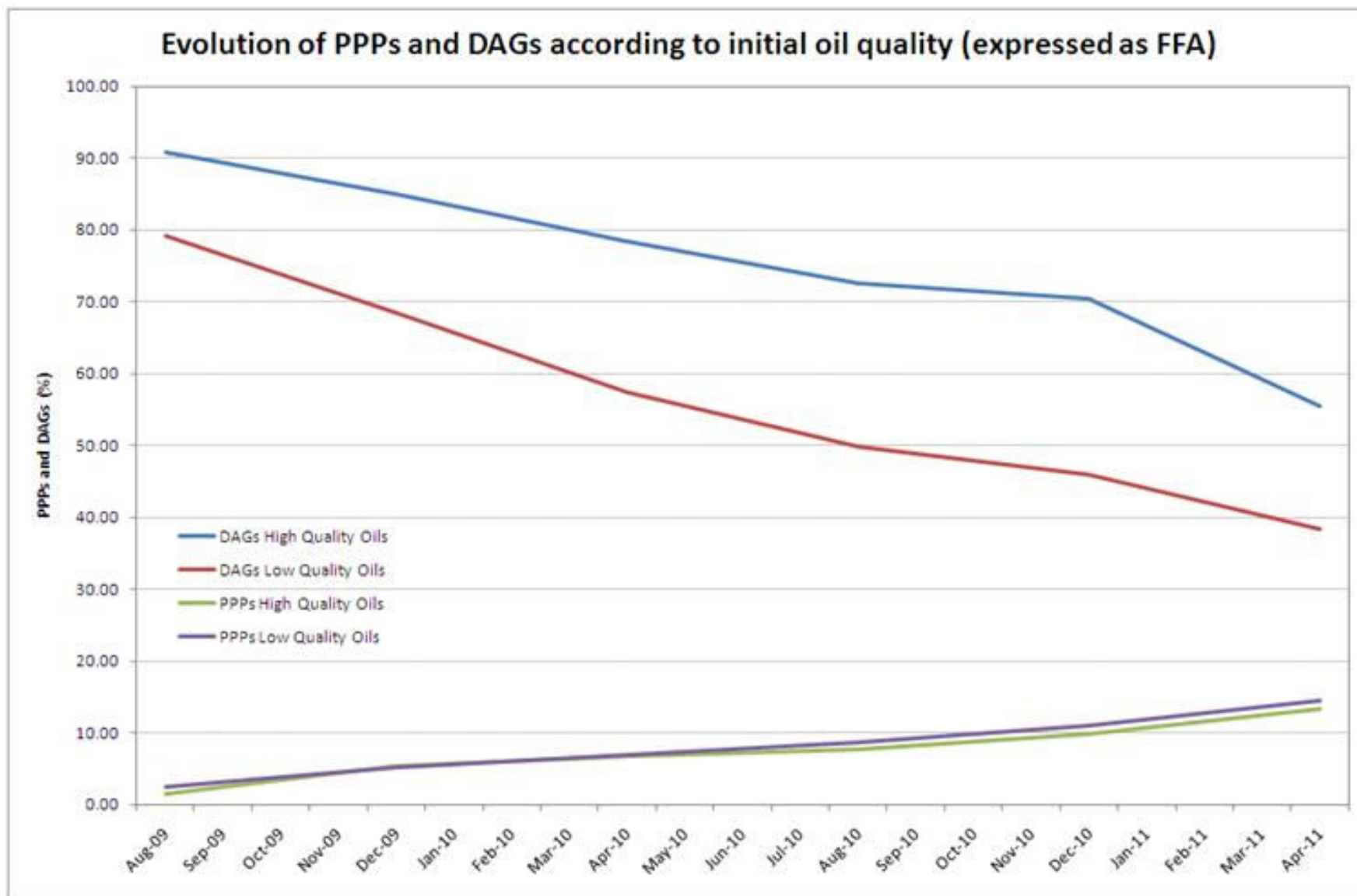
- different FFA (0.16 % vs. 0.29 %)
- dark glass containers at 20°C
- 24 months (tested every 4 months)

None of the high quality samples failed any of the current international standards tests or PPPs and DAGs during the life of the project.

Samples with an average higher acidity failed K270, panel test and are in the limits for DAGs toward the end of the project.

The rate of evolution of PPPs was almost identical for both quality groups.

Results – Initial quality



Results – Market EVOO screening

❖ retail screening:

- extra virgin olive oils (EVOO) from the shelves of the main Australian supermarkets, food service distributors and boutique shops were taken
- the sampling was repeated in December 2008, 2009 and 2010.
- the total samples analysed were **265** (127 from Australian producers and 138 from imported brands)

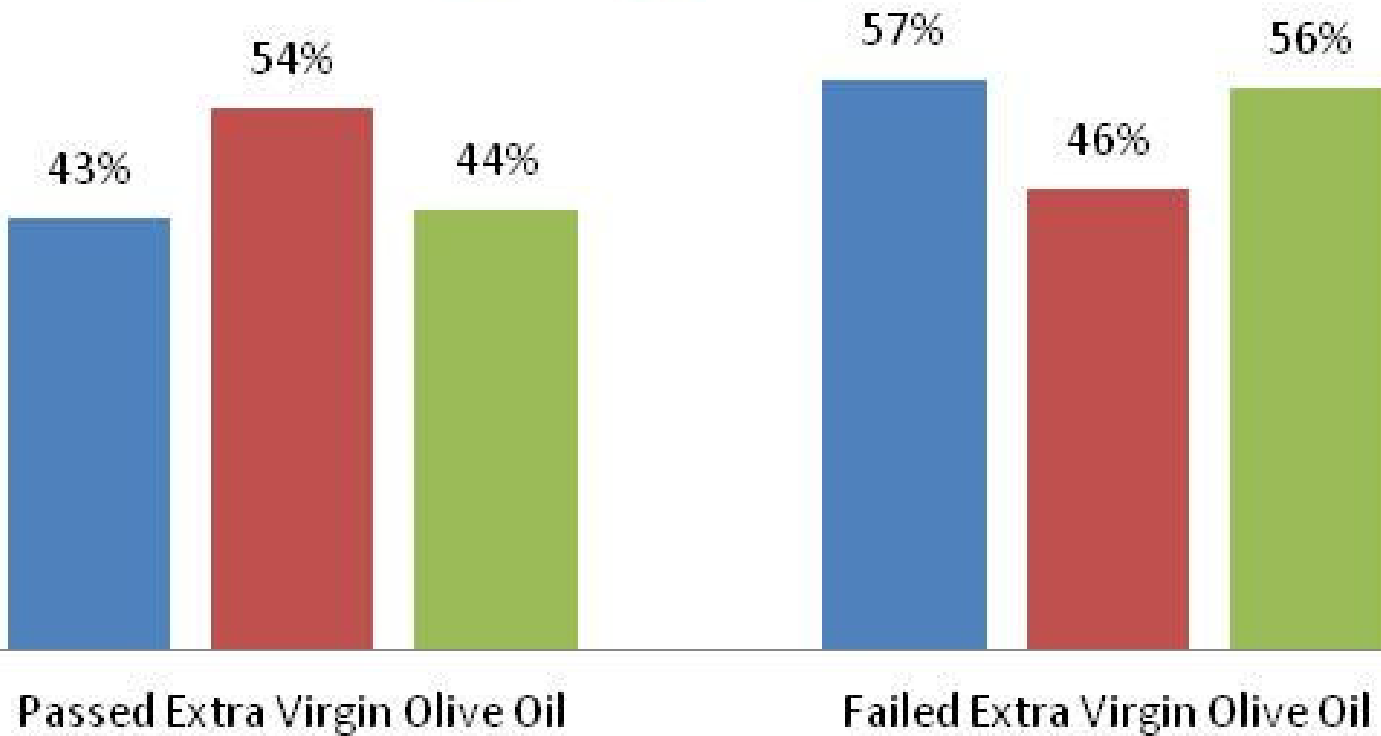
The overall results show poor quality control in the Australian market.

More than a half of the oils labelled as EVOO are not true to label.

Results – Market EVOO screening

Retail Screening 2008-2010

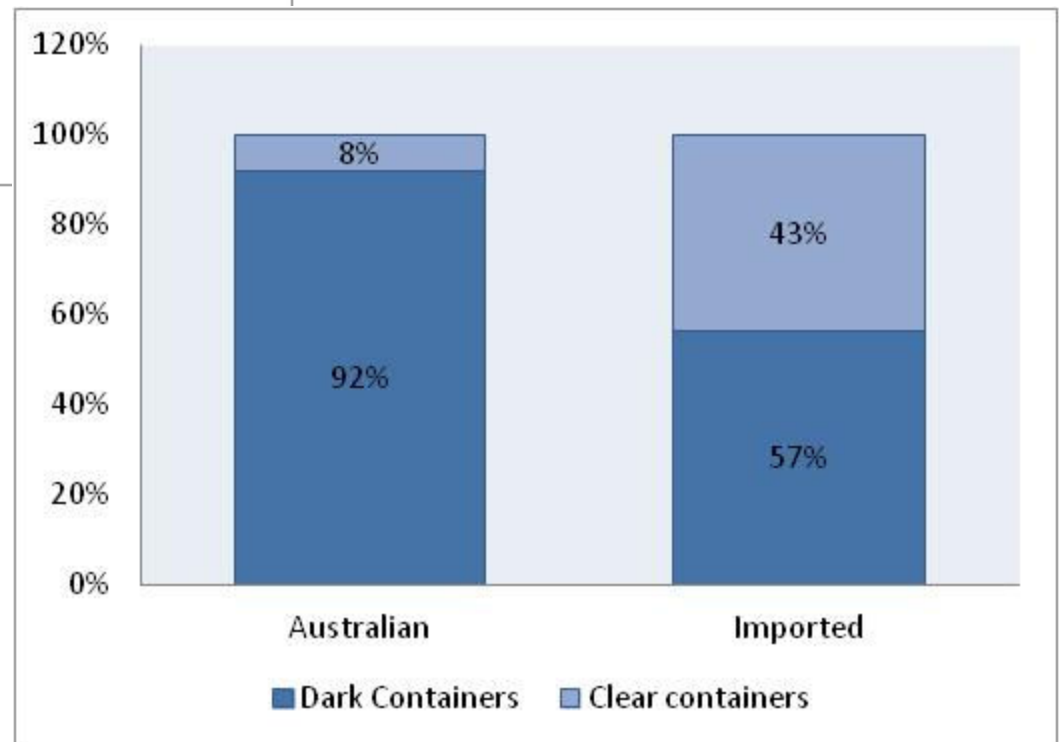
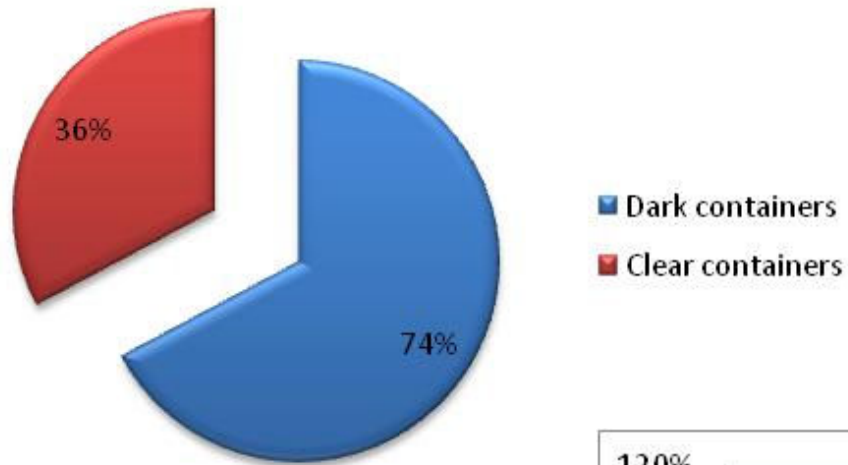
■ 2008 ■ 2009 ■ 2010



Results – Market EVOO screening



Market EVOO screening vs. Containers



Market EVOO screening vs. Containers

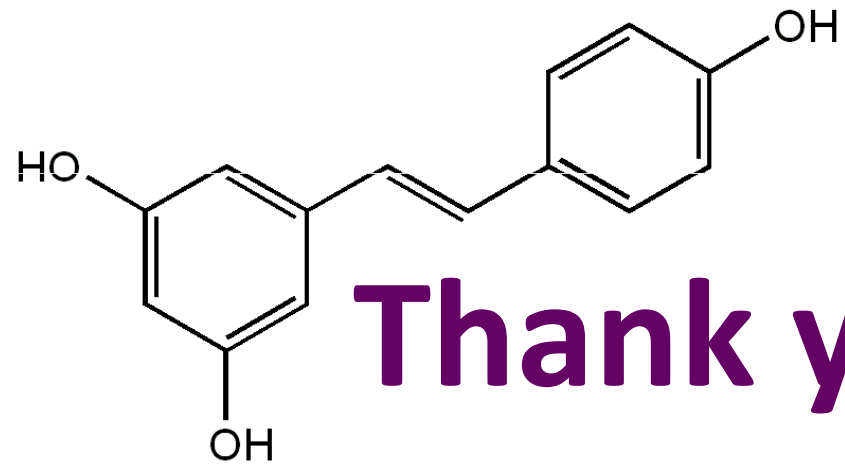
	FFA	PV	K232	K270	DK	PPPs	DAGs	Defects	Fermentation	Oxidation
Total failed	2.3%	2.3%	14.3%	21.1%	1.5%	29.4%	21.1%	26.0%	15.1%	10.9%
Clear glass & PET	3.3%	3.3%	13.3%	46.7%	1.7%	56.7%	26.7%	51.7%	23.3%	28.3%
Dark glass, PET & tins	5.1%	5.1%	38.5%	35.9%	3.8%	56.4%	51.3%	48.7%	33.3%	15.4%

Conclusions

- ✓ Pyropheophytins and 1,2-Diacylglycerols showed a very good performance as indicators of overall olive oil quality and freshness as well as highlighting any problems during the storage of the oil.
- ✓ Their correlations with sensory defects were higher than those shown by the traditional quality tests.
- ✓ PPPs has been demonstrated to be an excellent indicator to detect deodorised olive oils.
- ✓ The evolution of these values (PPP & DAG) is highly predictable if storage conditions are known.

Conclusions

- ✓ There is no evidence of varietal or environmental influence on those tests (PPPs & DAGs) under Australian conditions.
- ✓ The limits adopted for PPPs (<17%) and DAGs (>35%) seem to be reasonably well related to oil aging and the loss of freshness, with no high quality extra virgin olive oil failing those limits after two years of production under normal storage conditions.



Thank you