RED WINE VINIFICATION, RAPID-EXPANSION (PART B)

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NOTE: THIS IS THE SECOND ARTICLE IN A 5 PART SERIES BY ESCUDIER

1.4. Red wine vinifications

1.4.1. Conditions

- ***Destemming***

The negative properties of the stems are well known, especially if they are added to the character of the grape (acidity, bitterness, etc). It is not desirable to extract their components. Thus, it is necessary to thoroughly destem.

All experiments were carried out with grape batches from homogenous plots that were manually harvested in wooden tubs with 50 Kg capacities.

The traditionally vinified batch (named control) was fermented on skins for 10 days under controlled temperature (maintained between 27°C – 30°C; 81-86°F) and pumping over once a day. A destemmer from Egretier and a pneumatic press from Vaslin- Bucher were used, for destemming and pressing, respectively.

3 g/HL (0.25-lb/1000 gal) of SO_2 and 20 g/HL (1.67-lb/1000 gal) of LSA Fermivin (DSM) active dried yeast were added to the homogenous batches.

The Rapid-Expansion batches were heated for 4 mins at 90°C (194°F) and immediately cooled to 25°C (77°F) under vacuum. Following this, the vinification was carried out in the same way as the reference control batch (same durations, same temperatures, same pumping over).

1.4.2. Enological consequences

- ***Composition***

The analysis of Syrah (Shiraz) wines made with or without Rapid-Expansion is given as an example in table 2. Same results were obtained with Carignan, Merlot, and Grenache wines of several vintages.

The Rapid-Expansion wine underwent a partial concentration in this case. The compositional difference of the wines is particularly marked regarding the gain in phenolic compounds and dry extract, which were both increased in the Rapid-Expansion wine.

An evaluation of the polyphenols was carried out according to the indices suggested by Glories (1978). Overall, the qualitative indices (expressed as percentages) remained comparable between the two wines. However, the quantitative indices (expressed as concentration or absorbance units) were clearly higher for the Rapid-Expansion wine (table 3). Thus, it seems that this new technique extracts the different polyphenols in similar proportions to classic vinifications, but with a higher yield.

With 3 years of experience, it can be noticed that Rapid-Expansion extracts between 30 to 60% more polyphenols than the control, even if the latter underwent a traditional 3-week maceration with destemmed grapes.

Table 2 : Comparison of the composition of Syrah (Shiraz) wines produced with or without Rapid-Expansion with samples taken 6 months after filling.

Parameter	***Syrah Rapid-Expansion***	***Control Syrah Gordon why are you taking off the destemmed?***
Density g/l	0,9933	0,9927
Dry extract g/l	31,0	27,1
Ash g/l	3,1	2,5
Alkalinity mg/l	32,7	27,2
Sugars g/l	0,9	0,7
Alcohol % vol.	12,90	12,20
Glycerol g/l	9,2	8,6
pH	3,70	3,60
Total Acidity g/l H_2SO_4	3,50	3,15
Volatile Acidity g/l H_2SO_4	0,35	0,36
Tartaric Acid g/l H_2SO_4	2,05	1,80
Lactic Acid g/l	2,25	1,95
Malolactic fermentation	completed	completed
free SO_2 mg/l	34	19
total SO_2 mg/l	76	43
K^+ mg/l	1,47	1,07
Na^+ mg/l	16	22
Ca^{++} mg/l	68	63
Fe mg/l	1,6	1,5
Cu mg/l	0,33	0,12
Mg mg/l	200	174
Mn mg/l	2,40	2,00

Table 3 : Polyphenolic composition of Syrah (Shiraz) wines produced with or without Rapid-Expansion with samples taken 6 months after filling.

Parameter	***Syrah Rapid-Expansion***	***Control Syrah same comment***
Anthocyanin composition		
Total anthocyanins mg/l	836	601
PVP Index %	39	31
Ionization Index %	33	29
Free anthocyanins mg/l	508	414
Anth. combined with tannins mg/l	328	187
Coloured anthocyanins mg/l	276	174
Heating Index %	29	26
Polymerized pigments Index %	51	49
Tannin Composition		
Procyanidines g/l	4,55	3,10
Abs. 280 nm x dil.	83,4	58
Folin Ciocalteu Index	350	258
Procyanidines/Anthocyanins	5,43	5,12
HCl precipitated tannins %	36	27
Gelatin precipitated tannins %	67	68
Ethanol precipitated tannins %	11	13
Non-dialyzed tannins after 3 days %	31	27
Non-polymers – polymers %	73 - 27	76 - 25
Colour		
Colour intensity A420 + A520 + A620 – 10 mm	23,83	15,28
Hue A420/A520	0,54	0,55
Abs 420 %	30	30
Abs 520 %	56	56
Abs 620 %	14	14

Table 4 summarizes results obtained with the variety Grenache in different appellation areas of Southern France.

Table 5 shows results obtained for four red grape varieties of the Corbières appellation from the 1998 vintage, which was of very good quality. The Grenache Rapid-Expansion batch underwent a partial concentration since the condensates formed during the vacuum treatment were not reintroduced into the grapes.

- ***Stability over time***

It is known that wines made by heat treatments and subsequent liquid phase fermentations yield well coloured wines but that the stability of the colour is limited to 6 - 12 months.

It has been verified with different grape varieties that the wines produced by Rapid-Expansion had a very good colour stability over time.

The gain in polyphenol extraction and colour, which is generally around 30 - 60% when compared with traditionally vinified wines, is maintained over time in the same proportions. The studies have been carried out for the last four years.

- ***Botrytis cinerea affected grapes***

The evaluation of this method was done with healthy but also with affected grapes.

The classic heat treatment for grapes (70°C (158°F) for 20 minutes) is equal to 1.2 seconds at 91°C (196°F) regarding the inactivation of laccase. Thus, at the conditions prevailing during Rapid-Expansion (4 mins at 90°C (194°F)) the oxidative activities, including those caused by Botrytis, are theoretically inhibited. A confirmation for this was obtained in 1997 by the measurement of the laccase activity prior to and after Rapid-Expansion.

Table 4 : Study of Grenache (values in parentheses are gal/acre; T_0, time zero, i.e. at filling; A.O.C., controlled appellation of origin, V.d.P., regional wine)

Parameter ***Variety / Plot***	***- Yield/hl/ha*** ***- Anth. content/kg berries*** ***- Tannin content g /kg berries***	***Wine dry extract g/l***	***Anthocyanins mg/l*** ***and OD 280*** ***at T_0 + 6 months***	***Colour Intensity at*** ***T_0 + 6 months***
Control				
Grenache	41 hl/ha (438)	22	210	3,8
Massif de la Clape			43	
1993 Vintage				
Rapid-Expansion				
A.O.C. Corbières	x	25	260	4,6
Premultiplication			46	
Control				
Grenache	42 hl/ha (449)	24,8	250	5,5
Massif de la Clape	0,804 g/kg		49	
1994 vintage				
Rapid-Expansion				
A.O.C. Corbières	5,34 g/kg	29,2	270	8,9
Premultiplication			53	
Control				
Grenache	72 hl/ha (770)	26,8	200	8,2
Massif de la Clape	0,82 g/kg		42	
1995 vintage				
Rapid-Expansion				
A.O.C. Corbières	5,00 g/kg	30,7	300	9,7
Premultiplication			52	
Control				
Grenache	65 hl/ha (695)	29,3	240	5,2
Massif de la Clape	0,65 g/kg		44	
1995 vintage				
Rapid-Expansion				
A.O.C. Corbières	4,45 g/kg	30,2	320	7,4
grand bellevue			53	
Control				
Grenache	65 hl/ha (695)		380	1,10

A.O.C. Côte du Rhône 1995 vintage	1,08 g/kg		46	
Rapid-Expansion			460 51	 12,2
Control Grenache V.d.P. Gard 1994 vintage	90 hl/ha (962) x	25,2	x 41	5,3
Rapid-Expansion	 x	26,3	x 47	 5,6
Control Grenache Massif de la Clape 1994 vintage	30 hl/ha (321) 0,06 g/kg	24,2	200 32	6,5
Rapid-Expansion e A.O.C. Corbières grand bellevue	 3,21 g/kg	 26,1	 260 45	 7,6

Table 5 : Study of Grenache (RE, Rapid-Expansion)

	CARIGNAN		GRENACHE	
	RE	Control	RE	Control
Classic Analyses				
pH	3,53	3,65	3,82	3,86
Alcohol (% vol.)	12,44	12,45	15,07	14,01
Potassium (mg/l)				
free SO_2 (mg/l)	21	21	20	23
Total acidity H_2SO_4(mg/l)	3,52	3,0	3,32	2,8
Polyphenol Analyses				
Total Anthocyanins (mg/l)	770	603	251	235
Free Anthocyanins (mg/l)	516	407	189	162
PVPP Index	33	32	25	31
Anthocyanins/tannins (mg/l)	254	196	62	73
Ionisation Index	20	13	11	8
Polymerized Pigments Index	35	44	48	60
Coloured Anthocyanins (mg/l)	157	81	28	18
A 420	3,36	2,78	1,45	1,32
A 520	6,44	4,47	1,59	1,2
A 620	1,16	1,05	0,49	0,39
Heating Index	10,96	8,3	3,53	2,91
Hue	0,52	0,62	0,91	1,10
HCl Index	2	26	24	17
Procyanidines mg/l	2473	1998	1690	1390
Gelatin Index	70	74	59	82
A 280	51,4	47	41,96	31,0
Ethanol Index	5	6	14	12
Dialysis Index	15	24	25	22

	MOURVEDRE		SYRAH (SHIRAZ)	
	RE	Control	RE	Control
Classic Analyses				
pH	3,6	3,59	3,94	3,82
Alcohol (% vol.)	12,79	12,73	12,8	12,55
Potassium (mg/l)				
free SO_2 (mg/l)	33	32	33	20
Total acidity H_2SO_4 (mg/l)	4,49	4,6	2,67	3,2

Polyphenol Analyses				
Total Anthocyanins (mg/l)	587	494	1059	886
Free Anthocyanins (mg/l)	280	244	607	514
PVPP Index	52	50,5	43	42
Anthocyanins/tannins (mg/l)	307	249	452	372
Ionisation Index	22	18	14	15
Polymerized Pigments Index	52	50	52	42
Coloured Anthocyanins (mg/l)	131	91	145	132
A 420	4,36	3,12	5,13	3,75
A 520	6,46	4,05	7,72	5,87
A 620	1,75	1,23	2,28	1,46
Heating Index	12,57	8,4	15,13	11,08
Hue	0,67	0,77	0,66	0,64
HCl Index	35	37	23	29
Procyanidines mg/l	4576	3370	2974	1654
Gelatin Index	74	81	58	47
A 280	82,3	57,1	79,8	55,6
Ethanol Index	14	9	4	6
Dialysis Index	24	16	20	14

- ***Organoleptic Aspects***

The wines produced from Rapid-Expansion treated grapes are more coloured and have a better texture. The astringency is higher, however, without increased bitterness or acidity compared with the control. A sensation of fullness, even “sweetness” is often experienced.

These wines are often different regarding their aromas when compared with the controls, essentially because their concentration gives them a better protection from oxidation.

In account of the non-selectivity of the Rapid-Expansion method, the quality of the raw material is the prime criterion to be taken into account.

Insufficiently ripe grapes, grapes with insufficient content in polyphenols, or insufficiently destemmed grapes will have their unfavourable qualitative impact highlighted by the Rapid-Expansion method.

The wines made by Rapid-Expansion from quality raw material harvested at ripeness will be distinguishable and preferred most often because of their texture, color, and roundness in the mouth with good respect of their character.

The qualitative benefit has already led to significant applications and further development of the method. About ten units are currently installed in various viticultural areas in France and the rest of Europe.

- ***Maintaining the Character***

The method does not lead to a standardization of wine quality. However, the varietal character of Cabernet-Sauvignon or Syrah (Shiraz) is easily recognized.

In a study done in 1994, two harvests of Carignan grapes proceeding from vines with very different yields (50 and 90 hl/ha; 534 and 962 gal/acre) were compared. The two Rapid-Expansion wines were better structured than the respective controls while having their overall character. The wines made by Rapid-Expansion were quite different from each other: one with a herbaceous and hard character; the other one fruitier with finer tannins (Escudier *et al.*, 1995).

Numerous evaluations carried out in controlled appellation of origin areas in France since 1998 have validated the typical character of Rapid-Expansion produced wines regarding the varieties planted in these zones.

- ***Conclusion***

The Rapid-Expansion method uses strong vacuum and targets the interaction with grape skins for a better extraction, along with other techniques, including enzyme utilization, special vats, final hot maceration, and long skin contact times.

The experiments carried out at INRA since 1993 and the evaluations obtained for a long list of grape varieties at industrial scale wineries highlight the following points:

-The extractions are significantly increased, even compared with long skin contact times.

-No marked selective effects can be found. The extraction gains are general and affect the totality of macromolecules of the wine as long as the vinification and fermentation are carried out with the grapes and with a sufficiently long skin contact fermentation (e.g. depletion of sugars).

- In account of the non-selectivity of the Rapid-Expansion method, the quality of the raw material is the prime criterion to be taken into account. Grapes that are insufficient in

ripeness or polyphenols or poorly destemmed always have an adverse impact but the Rapid-Extraction method will further amplify it.

- The wines made by Rapid-Expansion from healthy raw material harvested at ripeness will be distinguishable and preferred most often because of their texture, their color and their roundness in the mouth with good respect of their character.

The qualitative benefit has encouraged and already led to a significant industrial implementation and further development of the method: about ten facilities in Bordeaux, Côtes du Rhône, Languedoc, Provence, and now South America. This technology was initiated by INRA and Aurore Développment and is developed for enology by Imeca Della Toffola.