Determining whether blending before MLF impacts the kinetics, the chemistry and the sensory analysis of base sparkling wines in the UK

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MLF is a key process in ESW…

Why do it?

Reduces acidity:
- titratable acidity (TA) decreased by 1-3g/L
- pH increased by 0.1-0.3

Microbial stability:
- exhausts nutrients required for growth of spoilage bacteria
- Stop MLF naturally occurring in the bottle

Modifies sensory profile:
- acid more palatable
- creamier, rounder wines

Cool Climate region grape gowing

The UK's inconsistent climate makes growing grapes a challenge;

- Shorter ripening periods
- Late ripening season of September/October
- Rate of respiration of L-malic acid is significantly slower in the UK compared to most grapegrowing regions

But is unreliable and unpredictable

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Parameter	Optimal	Unfavourable
Temperature (°c)	18-22	<16, >25
pH	3.3 - 3.5	<3.1
Free SO_2 (mg/L)	<8	>10
Total SO_2 (mg/L)	<30	>40
Alcohol (%v/v)	<13	>14

(The Australian Wine Research Institute, 2016).

Harvest year	Variety	Harvest date	°Brix	Total acidity g/L	pH	Malic g/L
2019	Chardonnay	23rd Oct	17.2	14.1	2.96	7.2
	Pinot Noir	18th Oct	17.9	13.78	3.01	6.45
	Pinot Meunier	17th Oct	17.7	13.82	2.99	6.77
2018	Chardonnay	16th Oct	18	13.99	2.99	7.36
	Pinot Noir	15th Oct	18.2	12.63	3.03	5.98
	Pinot Meunier	15th Oct	18.1	13.07	3.02	6.14
2017	Chardonnay	26th Oct	15.5	14.74	2.98	10.19
	Pinot Noir	20th Oct	16.8	13.58	3.02	8.03
	Pinot Meunier	19th Oct	17	12.23	3.05	7.18
2016	Chardonnay	22nd Oct	16.1	18.23	2.96	9.5
	Pinot Noir	17th Oct	17.2	14.1	2.97	7.43
	Pinot Meunier	16th Oct	17.4	14.55	2.87	7.61
2015	Chardonnay	19th Oct	17.1	15.6	2.98	8.78
	Pinot Noir	18th Oct	18	13.9	2.94	8.48
	Pinot Meunier	17th Oct	18.1	14.8	2.97	9.01
2014	Chardonnay	16th Oct	15.9	14.63	2.96	8.66
	Pinot Noir	15th Oct	16.3	13.5	2.99	6.11
	Pinot Meunier	15th Oct	17	12.64	3.01	5.8

Consequences:

- Volatile Acidity (VA)
- Diacetyl
- Long MLF = economical, environmental and logistical concerns

Why this investigation?

72% of UK wines are sparkling; normal procedure to blend base wines AFTER MLF is complete. HOWEVER:

1. Young (most planted in last 5-10 years, 150% increase in ha in last 10 years)

2. Small (average size 3.75ha)

3. Lack of space/options for production (770 vineyards vs. 165 wineries)
(WineGB 2020)

= Many producers ultimately blend all their varieties together, despite processing them separately

Each grape variety has its own varying degrees of MLF success (see table) - these are very often then blended with other varieties that have also seen MLF, successful or otherwise.

Harvest year	Variety	Time taken for MLF	Complete MLF?
2019	Chardonnay	62	No – stopped with SO_2 addition
	Pinot Noir	41	Yes
	Pinot Meunier	48	Yes
2018	Chardonnay	91	Yes
	Pinot Noir	69	Yes
	Pinot Meunier	63	Yes
2017	Chardonnay	81	Yes
	Pinot Noir	62	Yes
	Pinot Meunier	70	Yes
2016	Chardonnay	105	No – stopped with SO_2 addition
	Pinot Noir	93	Yes
	Pinot Meunier	70	Yes
2015	Chardonnay	78	Yes
	Pinot Noir	64	Yes
	Pinot Meunier	56	Yes
2014	Chardonnay	59	Yes
	Pinot Noir	36	Yes
	Pinot Meunier	36	Yes

We know that …

1. MLF is important in the UK

2. Difficult in the UK

3. Often varieties get blended together ultimately despite processing separately

4. Different varieties have different time rates and different success rates

This study aims to test the hypothesis that if by blending sparkling base wines prior to MLF, the resulting impact on the sensory and chemical profile will be base wines that are cleaner and more qualitative than those blended after MLF.

Method

1. Chardonnay, Pinot Noir & Pinot Meunier processed identically but separately

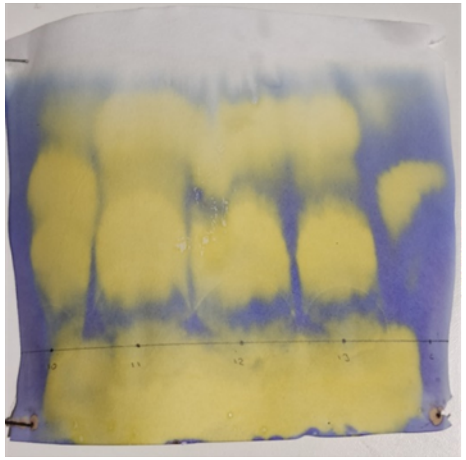
2. After alcoholic fermentation, 15L of each variety was racked into 9 x 5L demijohns - 3 of each variety. A further 5L of each variety was racked and blended together, and then divided between 3 more 5L demijohns as the 'before blend' studies

Rock, 2020

4. All 12 ferments were kept at optimum temperature of 20-25°c throughout the experiment (Riberau-Gayon et al., 2006).

5. Monitored with paper chromatography and enzymatic testing

3. Oenococcus oeni was the selected lactic acid bacteria (LAB) strain = known to be the best adapted to the harsh wine environment, including low pH, presence of sulphur dioxide and high alcohol (Lerm et al., 2010). It conducts MLF by the decarboxylation of L-Malic to L-Lactic acid (Kemp et al., 2014).



Analysis

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After MLF, the wines were racked, had an addition of 30ppm SO_2 to kill off any remaining bacteria (Riberau-Gayon et al., 2006) and were bottled.

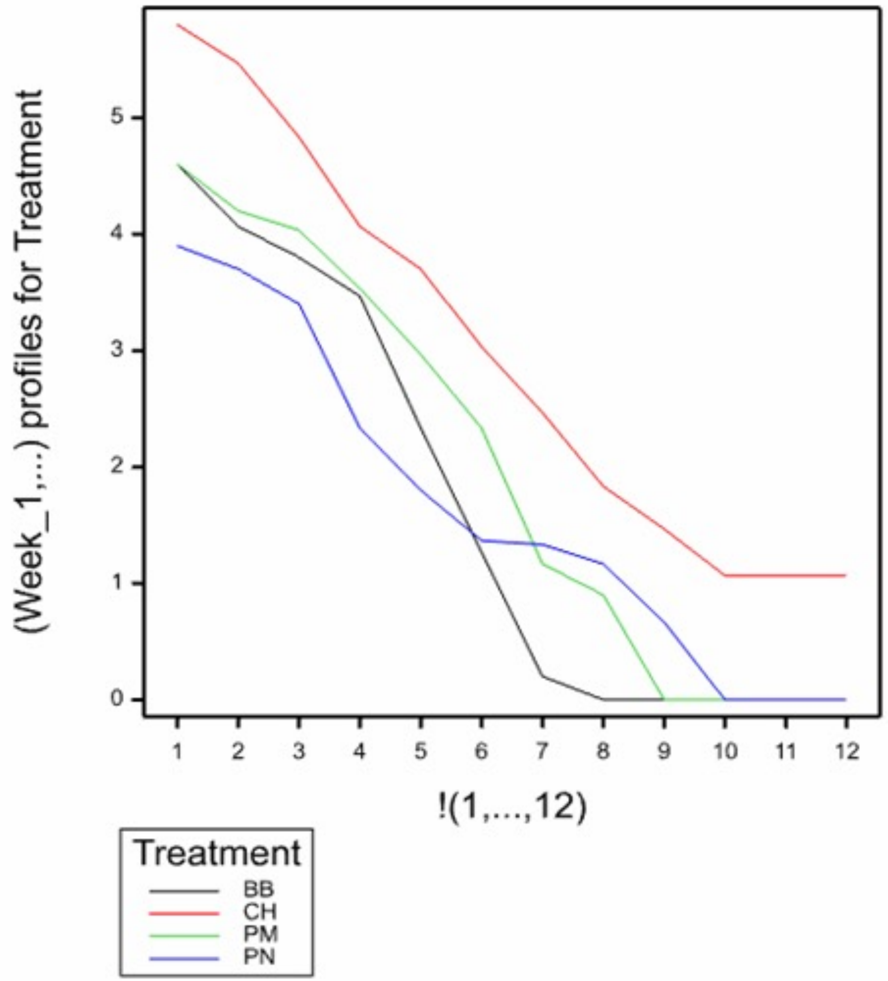
A new blend was created (in triplicate), compromising equal amounts of Chardonnay, Pinot Noir and Pinot Meunier – the ‘after blend’.

1. Chemical analysis; all treatments were analysed for pH, residual sugar (RS), TA, free (FSO_2) and total SO_2 (TSO_2), VA, dissolved Oxygen (DO) and diacetyl.

2. Sensory analysis; panellists of 12 professionals took part in a sorting task, tasting all 3 replicas of all 5 treatments

Rate & Success of MLF across treatments

MLF		
Treatment	**Duration**	**Complete MLF?**
Chardonnay 1	85	No – stopped with So_2
Chardonnay 2	85	No – stopped with So_2
Chardonnay 3	85	No – stopped with So_2
Pinot Noir 1	68	Yes
Pinot Noir 2	70	Yes
Pinot Noir 3	67	Yes
Pinot Meunier 1	57	Yes
Pinot Meunier 2	50	Yes
Pinot Meunier 3	55	Yes
Before Blend 1	50	Yes
Before Blend 2	43	Yes
Before Blend 3	44	Yes



Chemistry Analysis

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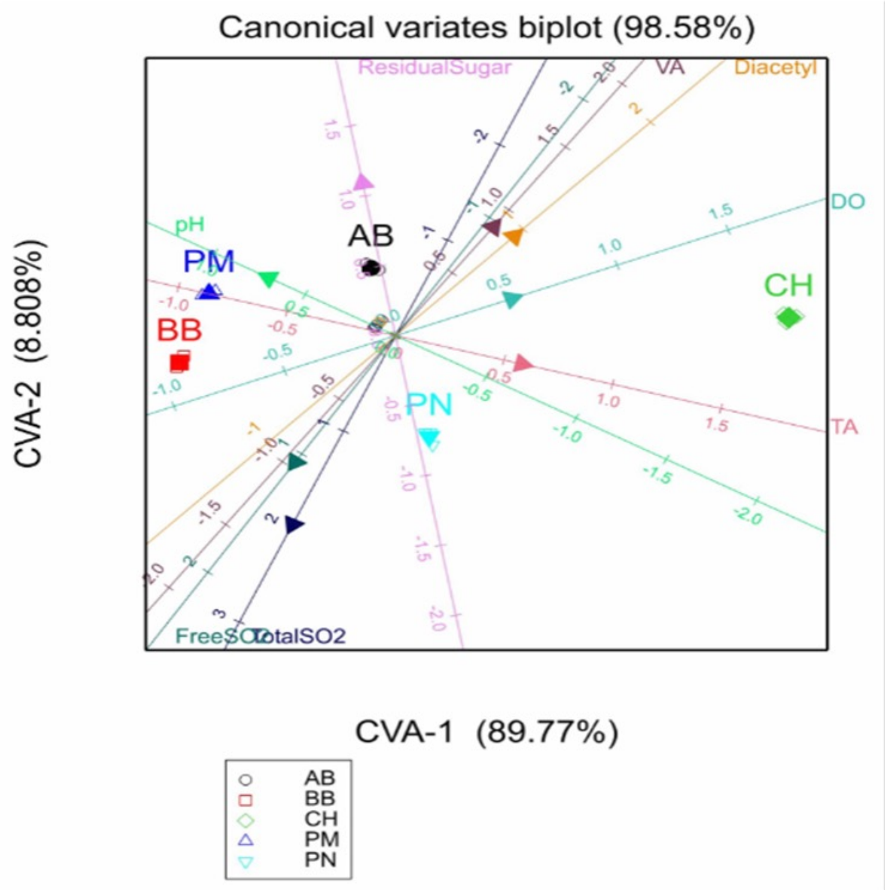


Mean values with significant differences for, VA, DO, pH, TA, FSO_2, TSO_2 and diacetyl results of BB and AB treatments. Different letters indicate significant differences

Treatment	VA	DO	pH	TA (g/L)*	FSO_2 (mg/L)	TSO_2 (mg/L)+	Diacetyl
BB	0.1533 **a**	0.9067 **ab**	3.137 **d**	8.000 **b**	3.333 **b**	28.67 **b**	0.4000 **a**
AB	0.2800 **b**	0.9933 **b**	3.103 **c**	8.233 **c**	0.333 **a**	24.00 **a**	1.0333 **b**

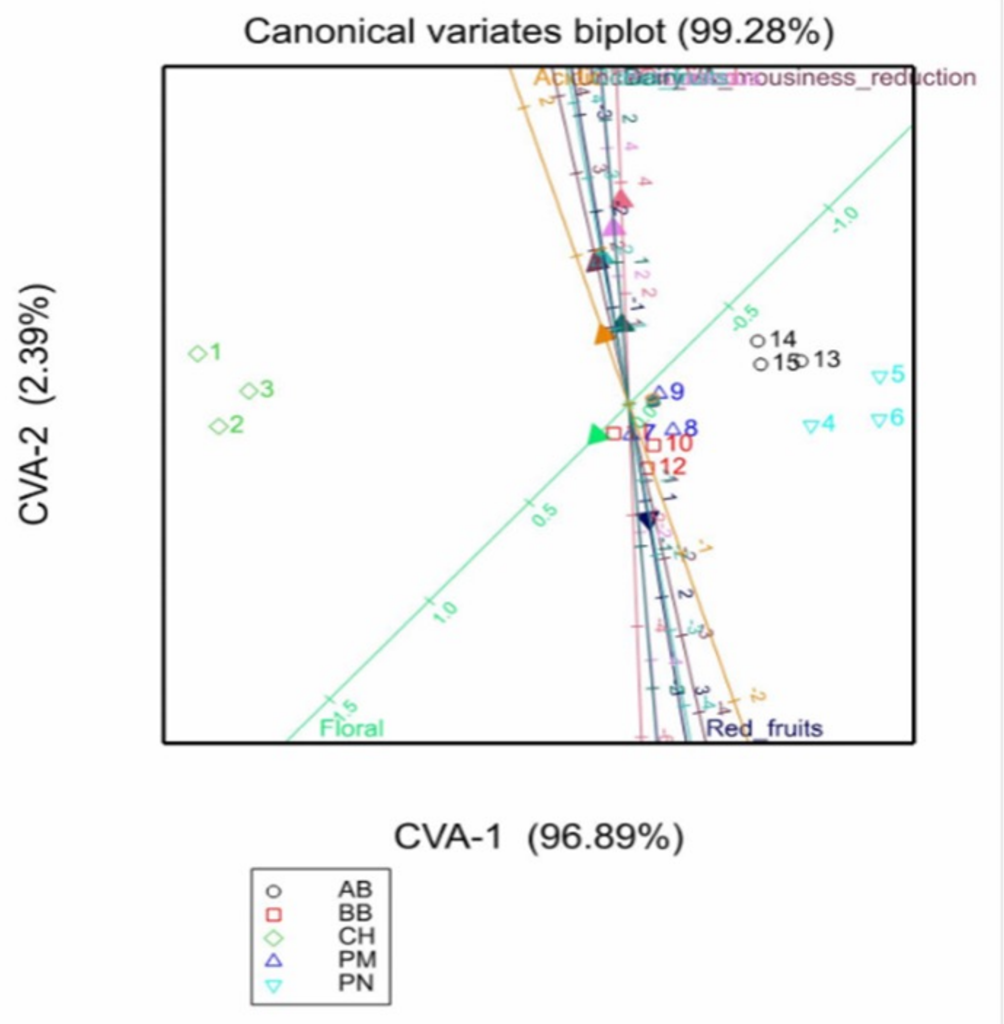
Sensory Analysis

- The sensory analysis displayed little statistical significance.

- Chemical analysis showed that the CH blends were of the lowest quality in terms of faults; the VA, DO and diacetyl amounts were the highest, it had the lowest protection from FSO_2 and TSO_2 and the least desirable TA and pH values. This was not significantly reflected in the sensory analysis; this may be because the figures were not extreme enough to register sensorially

- Panellists remarked they found the task difficult

- Not finished wines, will have secondary ferment and need to age – hard to see past the acidity and neutral flavours



Outcomes

Rate of MLF:

Cheaper:
- Less culture
- Less heating
- Testing for MLF

Environment:
- Carbon footprint of LAB, testing
- Heating/water resources

Logistics:
- Tank space
- Time (testing, processes)

Chemistry Analysis:

Favourable TA/pH's
- Less acidic
- Easier for secondary ferment

Less spoilage aromas
- less SO_2 required – better for sensory profile of wine, helps with secondary ferment, ensures within legal limits, cheaper
- perhaps sensory profile would see differences over time

Other Considerations

Promising first result - more exploration needed:

1. Only one vintage year – unusual year. Needs replication

2. Only one vineyard in one region of the UK

3. Not applicable to larger producers

4. Not applicable to single varietal blends

5. Other grape variety blends

Thank you

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