Summary of extracts from the project “Pinot noir clonal variation in South East England in viticulture and in sparkling winemaking”

Stuart McKenzie Graham

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An important question faced by growers of grapes for English Sparkling Wine is which clone of Pinot noir to plant. The variety is especially mutagenic (Robinson 2006; Smart, Dambergs et al. 2010), with over 82 clones grown in Champagne (Zoecklin 2002). This article gives extracts from a study conducted as part of an undergraduate project at Plumpton College which questioned whether clones are significantly different in England and looked at how those differences can be characterised.

A broad-based study was conducted to investigate differences between Pinot noir clones grown in England by taking measurements in the vineyard, the winery and the sensory lab. Grapes were kindly donated by a vineyard in the south-east of England, with fruit taken from a single homogenous field on chalk subsoil, with clone/rootstock combinations as shown in Table 1. Sparkling wine was made up to the base wine stage.

Table 1, Summary of treatments, with clone and rootstock identities

Treatment	Clone	Clone origin	Rootstock
1	115	Côte-d'Or (Burgundy)	SO4
2	292	Jura (east of Burgundy)	41B
3	386	Champagne	Fercal
4	521	Champagne	SO4
5	870	Champagne	41B
6	Fr1604	Freiburg, Germany	SO4
Clone origin source (ENTAV, INRA et al. 1996)			

Having different rootstocks between treatments is far from ideal in a clonal study. However, studies have shown that scion genetics are more significant drivers of the quality and style of juice composition (Dry 2005; Harbertson and Keller 2012; Henschke 2007). Results from Pinot noir studies in other regions such as the Adelaide Hills, Oregon, Tasmania and California (Anderson, Smith et al. 2008; Castagnoli and Carmo Vasconcelos 2006; Cowham and Hurn 2001; Smart, Dambergs et al. 2010) have shown some support for typical preconceptions of Pinot noir. For example, clones were selected in Burgundy for their higher quality and sugars, and in Champagne for their total yield. However, conventions and research in one region do not necessarily apply to others.

In the vineyard the 6 treatments were considered in triplicate. For pressing the replicates were combined per treatment as necessitated by fruit scarcity and the challenges of consistently pressing tiny quantities in the selected hydropress (~10kg). After chaptalising to a consistent density, quadruplicate fermentation treatments in 75cl bottles were considered in the winery and lab (Figure 2). Tests were performed and the significance of differences between results analysed using ANOVA statistical techniques (Table 2).

Figure 1, Hen and chickens was common in many UK vineyards in 2011 due to poor weather during flowering leading to inconsistent pollination

Figure 2, The author with the wine during fermentation

In the vineyard, the first notable observation was treatment 3's significantly later veraison date. Whether this is because of the unique clone (386) or the unique rootstock (Fercal) or some other factor is unclear. Champagne clones showed higher yields than the Burgundy clone. However it should be noted what a low yielding year 2011 was in most UK vineyards due to the poor weather during flowering (Figure 1). Pinot noir clonal studies from other regions showed higher yields such as 4.4t/ha in Oregon (Castagnoli and Carmo Vasconcelos 2006), higher in California (Anderson, Smith et al. 2008) and over 15 t/ha in Champagne (Goode 2010) making direct comparison with UK clone-specific yields questionable. However, it has been shown that relative clonal differences tend to dominate vintage variation (Farquhar 2006).

Table 2, Results from some of the measures taken

Treatment	Veraison date	Tonnes / hectare (note very low 2011 yield)	Juice pH (=-log of H^+ ion concentration)	Juice TA (g/l as tartaric acid)	Density (Oe) before chaptalisation	Potential alcohol after chaptalisation	Yeast Assimilable Nitrogen (YAN) (mg/l as N) (of juice)	Protein (Σ kDa for 9 areas) (see Figure 3)	Malic acid (g/l) (of wine)
1	11 Sep (a)	2.3	2.70 (bc)	13.4 (c)	76.0	10.6%	270	7.5	4.5 (ab)
2	11 Sep (a)	5.6	2.53 (bc)	13.7 (c)	73.5	10.3%	175	3.2	4.8 (bc)
3	15 Sep (b)	3.7	2.60 (a)	14.0 (d)	74.0	10.3%	212	2.3	5.2 (d)
4	12 Sep (a)	4.1	2.63 (ab)	12.9 (b)	74.5	10.3%	366	2.6	4.9 (c)
5	12 Sep (a)	3.4	2.65 (bc)	12.5 (a)	73.0	10.3%	251	3.2	4.4 (a)
6	11 Sep (a)	3.7	2.58 (c)	14.7 (e)	75.3	10.4%	255	4.6	5.3 (d)

- Means shown where treatments replicated. For tests with replicated treatments, those with similar ANOVA TUKEY letters were not shown to be significantly different.
- A further 2 treatments (excluded from the study after the vineyard stage) had Burgundy clones 114 and 115 on rootstock 161-49. The veraison dates for these were significantly earlier around 8th Sep.
- The very low level of pH is likely due to incorrectly calibrated equipment. Multiple reading across the replicates showed the results were consistent if not accurate.

Expectations from Champagne of titratable acidity (TA) 14 g/l, pH 2.95 and malic acid 8 g/l (Tusseau 2009; Tusseau, Valade and Moncomble 2012) can be compared to values in Table 2. TA for clones 521 and 870 (both Champagne) were the lowest, and highest for the German clone which also had the highest levels of malic acid. For the Burgundy clone both sugar density and pH were the highest of all treatments.

Keeping the micro-pressings consistent was challenging, and perhaps this is why the protein analysis shows higher results (Figure 3) for treatment 1 which was pressed harder and faster. An overall 83% correlation between press yield and protein seems to back this up. Treatment 1 was also darker than others, as confirmed by spectrophotometric testing.

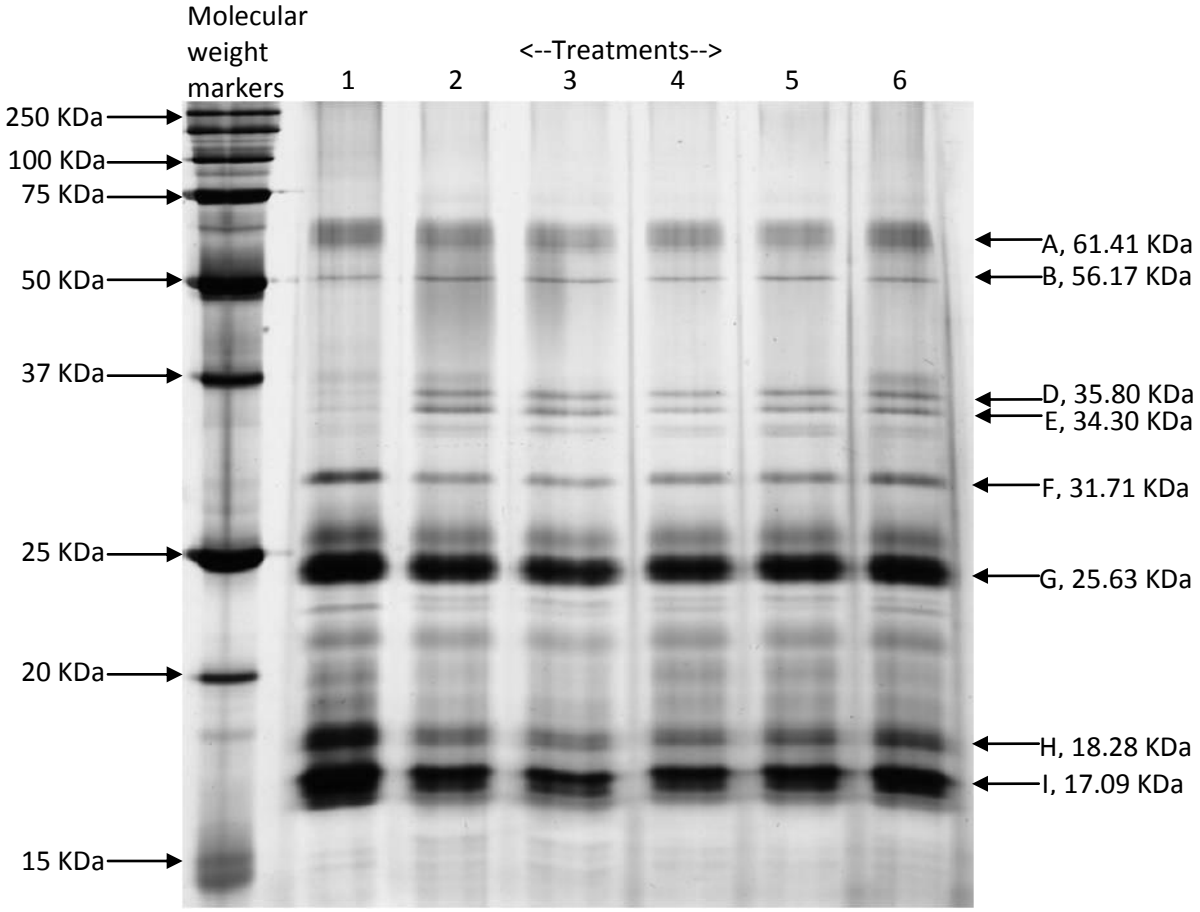

Figure 3, The protein content of juice was measured by SDS-PAGE electrophoresis, kindly conducted by colleagues at Reims University. Different weights (in KDa) of protein appear as separate bands. A darker band indicates more protein.

A good way to look at the overall results is to use Principal Component Analysis (PCA). This technique reduces the dimensionality of results by transforming them into a 2-dimensional "shadow" to reveal something of the internal structure of the data whilst accounting for as much of the variability in the original data as possible. The PCA (Figure 4) shows the grouping of Champagne clones which were earlier ripeners with higher nitrogen levels, the Burgundy clone was the ripest, the German clone was the most acidic and the Jura clone was the highest yielding. The slight separation of treatment 3 from the other Champagne clones is largely due to higher acidity, possibly caused by the lower pressing received by this treatment (Tusseau 2009).

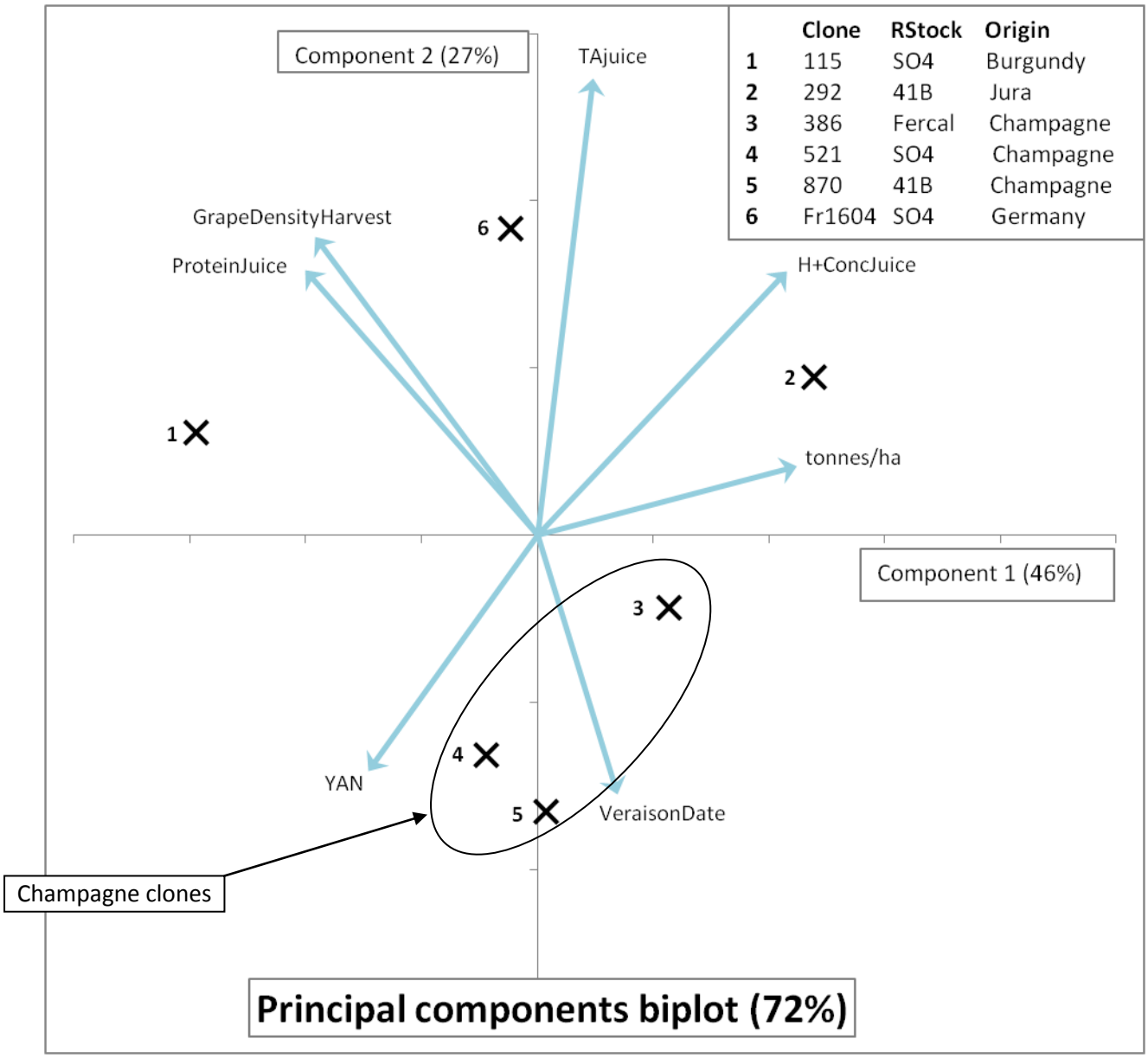

Figure 4, PCA analysis of results, showing the 2 derived components explaining 72% of the variance of the data

Finally, sensory evaluation by an experienced tasting panel was conducted, though only for the 4 pairs of treatments with similar rootstocks. No difference between clones was discerned. Further informal tasting indicated that this similarity extended beyond the pairs tested.

In conclusion, for the majority of tests which were run where replicates were available the various treatments were shown to be statistically different. Perhaps the most interesting feature is the agreement with many of the existing cool-climate studies and literature. This gives a broad indication that detailed studies and clonal choices made in those regions might be applicable to winemaking in England. Further local research is required. Such research would benefit from analysis of replicated, commercially-sized pressings of grapes from a homogeneous site with a range of clones on the same rootstock.

Of course a vine's performance depends strongly on the idiosyncrasies of a particular site (Keller 2010), so there is no single "right" Pinot noir clone for sparkling wine in England. Planting a variety of vines is recommended to test which rootstocks and clones work best in a particular site (ENTAV, INRA et al. 1996; Keller 2010). Also, wines blended from several clones can be superior in terms of taste complexity and body (ENTAV, INRA et al. 1996).

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