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Untypical ageing off-flavour and masking effects due to long-term nitrogen fertilization

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These authors try to find a cause for "untypical ageing" off-flavor in wines. They find that nitrogen fertilization cannot explain this wine taint. Untypical ageing is more complex than anticipated.

• Untypical ageing (UTA), also referred to as atypical ageing (ATA), is a condition first described in 1993, affecting mainly white wines, and consisting of a change of bouquet that has been described as naphthalene, floor polish, wet wool, fusel alcohol, or acacia blossom. The causal agent has been identified as *aminoacetophenone* (AAP), a degradation product of the phytohormone indole-3-acetic acid. Even though the vineyard factors that lead to UTA remain unknown, previous studies have hinted at the possible role of permanent cover crops and dry weather conditions. The goal of this study was to evaluate the impact of nitrogen fertilization on the intensity of untypical ageing off-flavor.

• The study took place in the Rheingau, Germany, on Riesling, during 1996-1999. The trial site had been fertilized since 1986 with different levels of nitrogen in the form of ammonium nitrate (0, 30, 60, 90, 150 kg N per hectare per year). Each treatment had 4 replications (consisting of 48 vines each) in a completely randomized design. The vineyard soil, a sandy loam, also received P, K, and Mg fertilization according to commercial practices.

• Each year of the trial, the authors made small-scale wines out of each replication (4 wines per treatment) and measured: 1) the compound responsible –AAP– (by gas chromatography/mass spectrophotometry); 2) antioxidant capacity; and 3) the intensity of UTA off-flavor on a scale from 0-10 (no information about the tasting panel was presented). To detect any effect of wine ageing on the wines, a second sensory evaluation was conducted 4 years later (2003).

• **Effect of vintage on UTA**. In spite of exhibiting the same AAP concentrations, the vintages 1996 and 1998 were less tainted with UTA than the vintages 1997 and 1999. (A table from the authors does not point out a correlation with average temperature or rainfall pattern). Previous work had suggested that the vintage differences in UTA could be associated to yield (more yield, more UTA), or to soluble solids (lower Brix, or earlier harvest, more UTA). But when the authors plotted these parameters against UTA, there was no correlation.

• **Effect of N fertilization on UTA**. 1) In all years, wines produced from the zero N treatment had the lowest UTA. But for the remaining treatments, UTA increased with increased N fertilization, even though vintage variations existed. For instance, this effect was extreme in 1997, when 150 kg/ha N had twice as much UTA as the remaining N treatments. 2) In general, antioxidant capacity decreased with increased N fertilization. Finally, 3) the authors found a good correlation between levels of AAP and UTA intensity. One exception was in 1996, when no correlation was found, probably because

AAP levels were too low to reach an odor threshold. This suggests that additional compounds besides AAP might be involved in UTA.

• But, as the authors admit in their discussion, there were "problems". Yes - more problems than we would like to see on a research paper:

_ there were masking effects due to fruity aromas. Even if higher N supply would tend to increase UTA, it would also tend to increase the fruity character of the wines, thus interfering with the detection of UTA by the tasting panel;
_ the tasting of the wine replicates belonging to the same N fertilization treatment showed extreme differences in UTA. This was confirmed by AAP analysis;
_ the wines from certain vintages had more UTA than others, even when they had the same AAP concentrations;
_ sometimes UTA was high, yet AAP was low;
_ the authors believe that, had they analyzed for AAP at the same time than they performed the sensory evaluation (AAP analysis took place between 2001 and 2003), the AAP levels of the zero N fertilization might have exceeded those of the fertilized treatments;
_ the authors fear that, for certain aged wines, the normal ageing of the wine might have been interpreted by some members of the panel as a UTA taint [this, I'm afraid, is fatal in the context of this study, as most of the work revolves around UTA sensory perception, not its instrumental measurement];
_ even though there were significant effects of *year* and *fertilization*, the authors explain that a high residual variance (more than 50% of total variance in UTA) could not be explained;
_ the current results –that increased fertilization increases UTA- contradict several previous results, particularly a 2000 study on Silvaner and Müller-Thurgau involving various vineyards, in which lower UTA intensity was found when fertilization was increased.

• The authors were aware of these shortcomings, and wondered *which substances in wine could be both causing and masking UTA.* So they also looked for possible correlations with a wide variety of wine components (total soluble solids, residual sugar, higher alcohols, dry extract, mineral concentrations, sulfur containing compounds), but none really stood out.

So… the results the authors found are inconsistent, and too many pieces of the puzzle are missing to draw any conclusions. The value of this study is to familiarize ourselves with the serious problem of "untypical ageing" of wines, and the equally serious efforts to elucidate its causes. As the authors state, "it is still necessary to continue searching for a suitable viticultural management to prevent UTA".

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