Surveying white wine cultivars for YAN and amino acids

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Background

Nitrogen is an essential nutrient for yeast growth and fermentation activity. The sensorial attributes of wine can be positively or negatively affected by must nitrogen levels and consequently affect wine quality. Measuring the ammonia and primary amino acid levels in the juice indicates the nutritional status of nitrogen in the must. The Yeast Assimilable Nitrogen (YAN) value obtained from these independent measurements of ammonia and primary amino nitrogen can be utilised by the winemaker to determine if must supplementation with DAP or complex yeast nutrients is necessary to maintain a healthy fermentation and the quantity of product to apply.

Materials and methods

Sampling

- 2016 harvest
- 374 white cultivar samples (settled juices)
- 35 cellars from the Western Cape

Chemical analyses – YAN

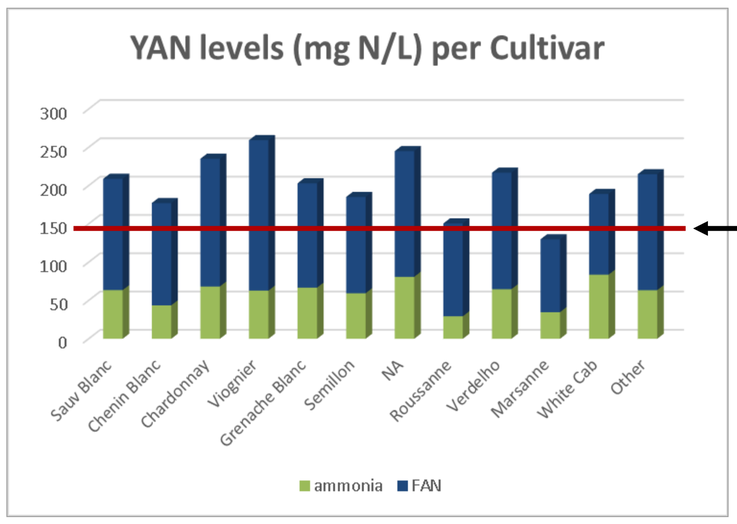
- ammonia, FAN, YAN: enzymatic method (Arena Konelab robot)

Chemical analyses – amino acids

- derivatized AA using AccQ-Tag kit (Waters) and HPLC-FLD

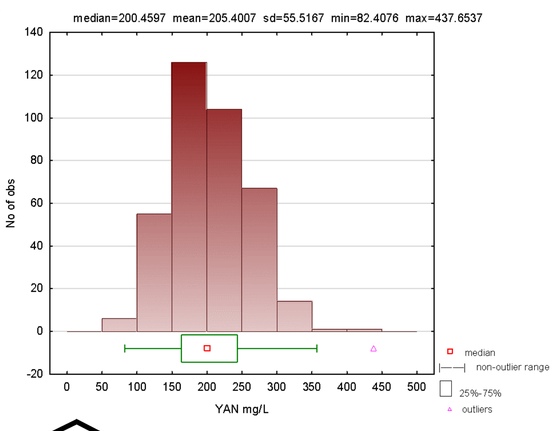
Results

YAN analysis

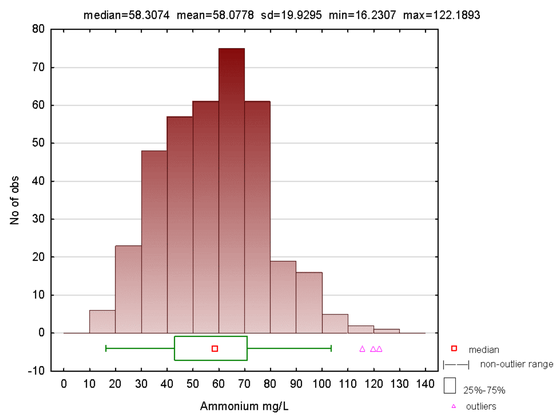


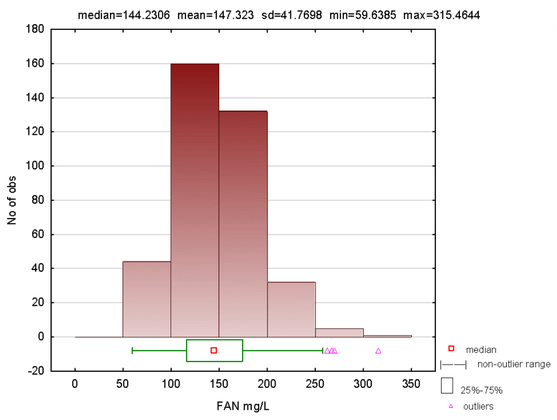
150 mg/L N is considered "critical level" for fermentations with *Saccharomyces cerevisiae spp*.

Distribution of samples (regardless of cultivar or source). Very few samples can be considered outliers. It can be observed that most samples are above the 150 mg/L N threshold (approx. 90% of the samples).



The two components of YAN are ammonium and FAN (free amino nitrogen). Optimal ratios between these two aspects are not clearly established.





- Average YAN was 205 ± 55 mg N/L with a range of 82 to 437 mg N/L
- Ammonium range was 16 to 122 mg N/L with an average of 58 ± 19 mg N/L and FAN range 63 to 315 mg N/L with average 147 ± 41 mg N/L
- Only 38 juice samples (10.4 % of all samples) were below YAN threshold
- Viognier had the highest average YAN of 259 ± 56 mg N/L (28 samples)
- Chenin blanc had the lowest average YAN of 177 ± 46 mg N/L (128 samples)
- 40% of the participating wineries had samples below the YAN threshold

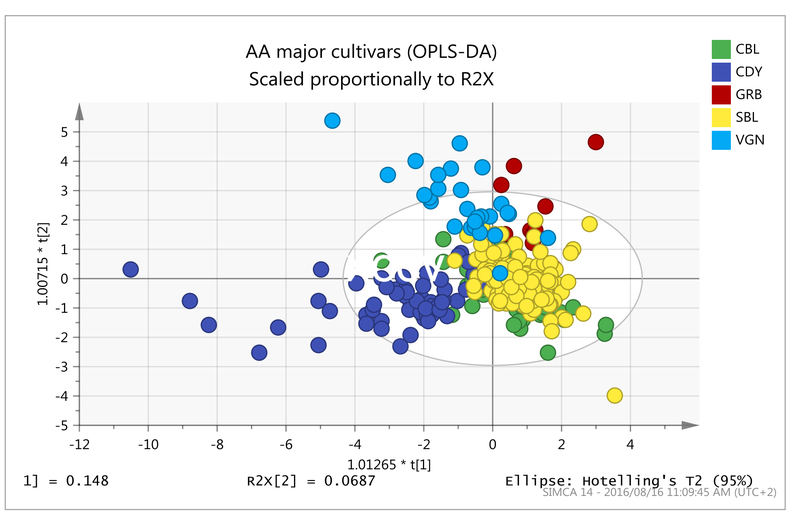
Amino acid analysis

Amino acids (AA) are divided into groups according to their importance in yeast metabolism during the fermentation: yeast preferred AA (Asp, Glu, Asn, Ser, Arg, Ala, Gln), AA precursors of branched esters (Val, Leu, Ile, Phe), and others.

Even though Proline was, as expected, the most abundant, it is not a preferred amino acid and yeast uses it only under constraint. NB. Proline and hydroxyproline are secondary amino acids so the YAN measurements do not include them.

With the exception of Arginine and Glutamine, Chenin blanc samples have a similar average as the general sample set.

	all samples			Chenin Blanc samples only		
	min	*max*	*ave*	*min*	*max*	*ave*
yeast preferred amino acids						
Asp	0.0	163.9	36.0	3.9	122.4	33.7
Glu	0.0	428.3	56.2	13.7	224.5	52.4
Asn	0.0	125.3	13.9	0.0	125.3	12.6
Ser	8.0	243.1	67.3	19.9	184.2	62.8
Arg	38.3	1406.8	310.3	38.3	933.8	257.9
Ala	12.6	538.3	99.2	25.8	433.2	93.2
Gln	0.0	477.6	85.5	0.0	265.4	65.0
Total	159.3	2833.9	668.4	159.3	2011.4	577.6
amino acids precursors of branched esters						
Val	0.0	154.4	26.1	6.2	89.1	27.2
Leu	0.0	129.0	18.3	0.0	72.6	19.9
Phe	0.0	293.2	30.7	0.0	195.1	36.7
Ile	0.0	68.2	12.0	0.0	49.5	12.2
Total	0.0	644.8	93.1	13.9	335.3	96.0
other amino acids						
Gaba	13.9	389.7	84.7	14.5	389.7	87.8
Gly	0.0	9.7	2.7	0.0	5.4	2.2
His	0.0	251.4	31.0	5.2	98.3	21.8
Met	0.0	21.4	2.3	0.0	15.7	1.6
OHPro	0.0	43.7	6.1	0.0	23.5	5.7
Orn	0.0	12.6	1.5	0.0	12.6	1.1
Pro	33.2	2900.3	401.9	78.4	1322.6	336.2
Thr	0.0	373.2	75.1	12.7	373.2	89.1
Trp	0.0	337.6	17.8	0.0	81.5	12.2
Tyr	0.0	104.5	17.7	0.0	40.5	12.2
Total	448.0	10488.8	2163.6	605.8	6516.1	1916.9



The diversity of the samples reflects in the wide variety of levels for amino acids, but a more in-depth look at the data indicates that the cultivars are grouped according to amino acid composition.

Research is ongoing and the idea is to establish a database per cultivar.

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