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IMPACT OF AGRONOMIC AND CLIMATIC FACTORS ON THE FREE AMINO ACIDS CONTENT OF GRAPEVINE NEUTRAL VARIETIES: A CASE STUDY ON PINOT BLANC

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Introduction – The effects of same agronomic parameters on the aminoacidic content of grape juices and wines have been investigated (Bell and Henschke, 2005; Palomo *et al.*, 2007). It was seen that the amino acids content could effectively influence the final wine aroma in both neutral and aromatic cultivars (Hernández-Orte et al., 2002; Swiegers *et al.*, 2005). Pinot blanc, a neutral variety, is characterized by no dominant flavours with a neutral bouquet (Rapp, 1995). Moreover, few information are available on the chemical composition of this variety. The aim of the presented study is to determine whether the cultivation site and agronomic factors influence the aminoacidic content of Pinot blanc grape juice.

Materials and methods – The selected vineyards of cv. Pinot blanc were located in the Adige Valley of South Tyrol (Italy) at different altitudes (low-fields 220-449 m.a.s.l. and high-fields 550-730 m.a.s.l.) (Fig. 1). The nitrogen availability of the soil was evaluated at full blooming. The concentration of nitrogen in the grape tissues was determined both at blooming and veraison stages. Temperature data of air, soil and grapes were collected during the whole vegetative period (April-October) (Fig. 2). The grapes were harvested (2017) at two different ripening stages, corresponding to 18 °Babo and 20 °Babo. After crushing and pressing, the obtained musts were analyzed to determine the amino acids content by Ultra High Pressure Liquid Chromatography-Triple Quadrupole (UHPLC-QqQ) instrument (Fig. 3).

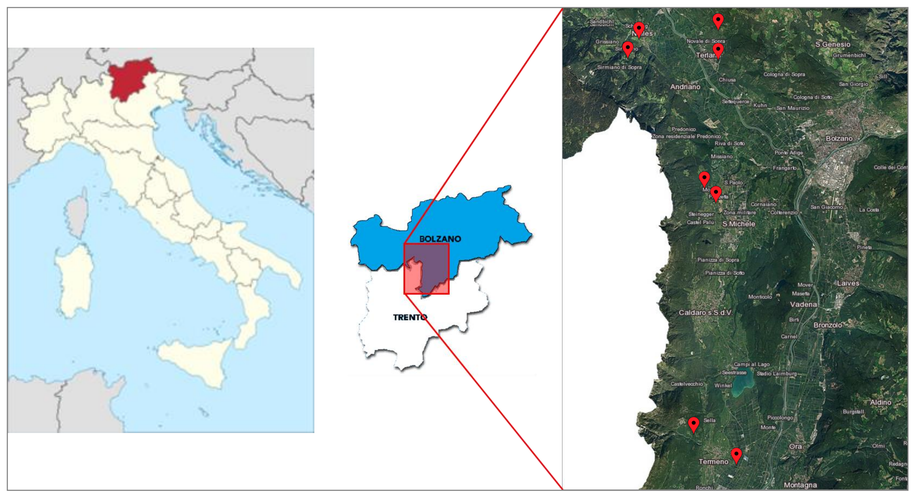

Figure 1: Vineyards under investigation. The study was carried out in South Tyrol (northern Italy). The eight vineyards were located along the the Adige Valley. Each red spot localizes a vineyards.

Figure 2: Example of vineyard. The sites were comparable for age of implant, clone, rootstock, canopy management and differed in altitude. A meteo-station was placed in each site.

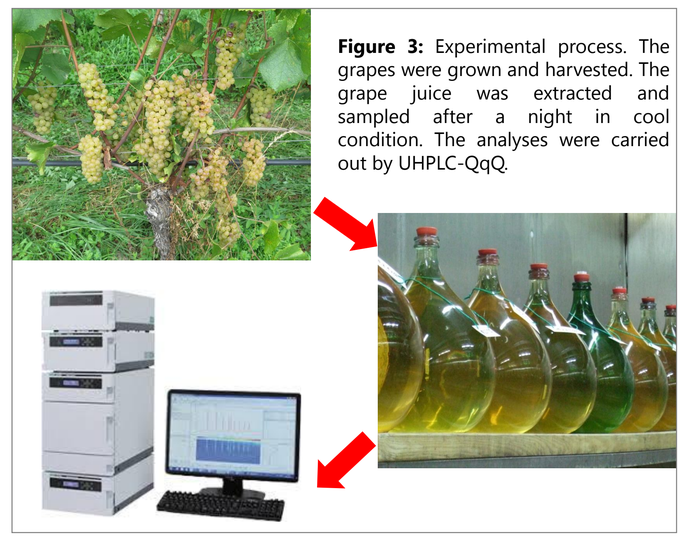

Figure 3: Experimental process. The grapes were grown and harvested. The grape juice was extracted and sampled after a night in cool condition. The analyses were carried out by UHPLC-QqQ.

Results

Preliminary results showed that the dominant amino acids in the Pinot blanc juice are proline and arginine followed by threonine (Tab. 1).

Table 1: Composition in free amino acids of Pinot blanc grape juice. Values are the mean of the measurements done in triplicate within eight vineyards.

Amino acid	mean (mg/L)	st. err.
(Iso)leucine	13,64	0,78
Alanine	91,15	4,66
Arginine	319,57	18,80
Asparagine	2,45	0,19
Aspartic acid	61,42	3,70
Glutamic acid	80,99	3,13
Glutamine	56,14	5,07
Glycine	4,47	0,30
Hystidine	11,76	0,66
Lysine	3,63	0,24
Methionine	1,88	0,14
Ornithine	2,68	0,20
Phenylalanine	13,78	1,28
Proline	345,75	17,87
Serine	56,96	2,91
Threonine	102,82	5,41
Tryptophan	4,15	0,34
Tyrosine	3,27	0,18
Valine	14,78	0,80
TOTAL	1305,83	62,65

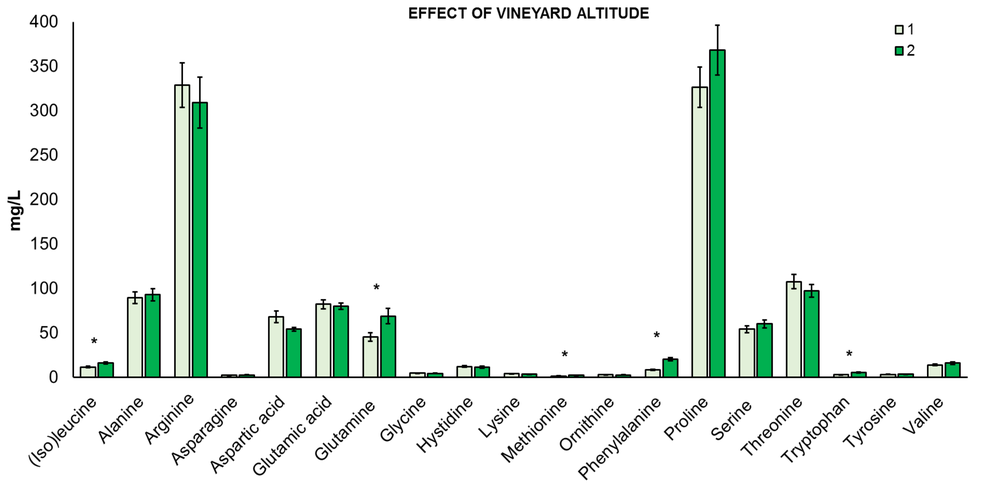

Figure 4: Altitude effect (1, low-fields; 2, high-fields) on the amino acids content in Pinot blanc juice. Asterisks indicate values that significantly differed according to *Student´s* t-*test*, α=0.05.

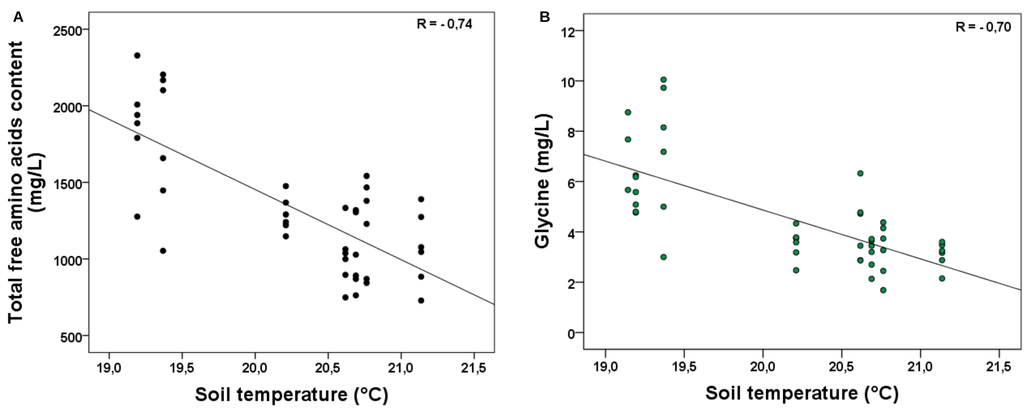

Figure 5: Scatter plots between average soil temperature in blooming-veraison period. A) total free amino acids content (mg/L) and B) example of Glycine (mg/L). *Pearson correlation* test was performed.

The altitude of the vineyard did not affect the total free amino acids content of grape juice. Interestingly, the concentration of single amino acids (isoleucine, glutamine, methionine, phenylalanine, tryptophan) significantly differed between the site location (Fig. 4). The thermal parameters related to the altitude, such as air and inner grape-clusters temperature, did not correlate with the final total free amino acids content of the grape juice. Furthermore, the soil temperature seems to play an important role in the accumulation of amino acids during the early stage of berry ripening (Fig. 5).

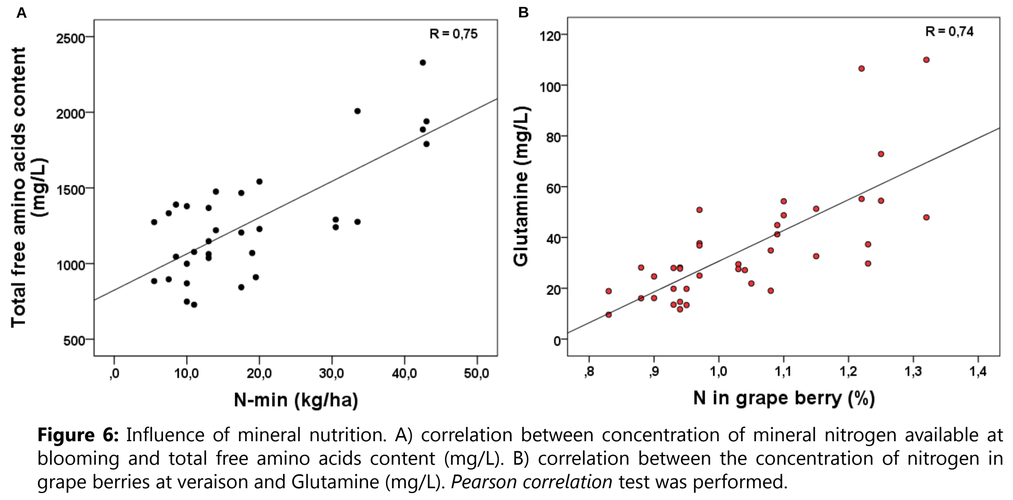

Figure 6: Influence of mineral nutrition. A) correlation between concentration of mineral nitrogen available at blooming and total free amino acids content (mg/L). B) correlation between the concentration of nitrogen in grape berries at veraison and Glutamine (mg/L). *Pearson correlation* test was performed.

The level of soil nitrogen availability (N-min) positively correlated with the total free amino acids content (Fig. 6). At veraison, the nitrogen concentration in berries positively correlate with the amount of five free amino acids detected in grape juice. The concentration of total free amino acids increased during ripening with a significant difference between the two selected maturity stages. The large increase of proline (Fig. 7) may be related to a senescence process (Kliewer, 1968).

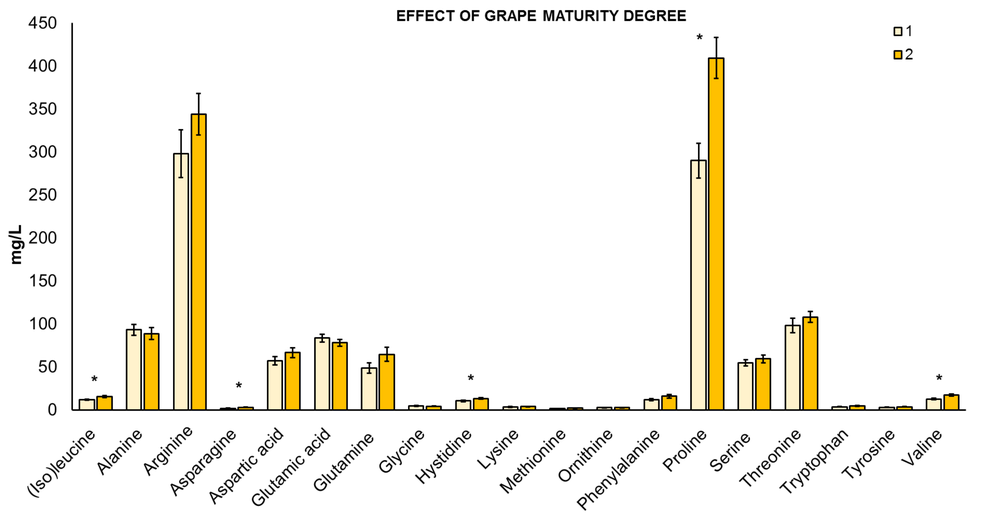

Figure 7: Effect of grape maturity degree (1, 18° Babo; 2, 20° Babo) on the amino acids content in Pinot blanc juice. Asterisks indicate values that significantly differed according to *Student´s* t-*test*, α=0.05.

Conclusion – The present study highlights the impacts of nitrogen availability and soil temperature on the composition of free amino acids of Pinot blanc juice. The soil temperature that is involved in the mineralization process could be influenced by different factors such as sun-light exposure and slope. However the soil temperature seems not to be the only factor related to the altitude that might influence the concentration of amino acids, suggesting that further studies are needed. According to literature, the observed changes on the amount of specific amino acids may influence the wine bouquet, for instance by the synthesis of thiols and higher alcohols. However, the relation between the concentration of specific amino acids and the aromatic profile of Pinot blanc wines still need to be investigated.

Acknowledgments
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