21ST GIESCO INTERNATIONAL MEETING: 'A MULTIDISCIPLINARY VISION TOWARDS SUSTAINABLE VITICULTURE' NIR SPECTROSCOPY AS A CONTACLESS RAPID TOOL TO ESTIMATE THE AMINO ACIDS PROFILE IN INTACT GRAPE BERRIES

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Abstract: Context and purpose of the study - Nitrogen composition of grape berries plays a key role in determining wine quality, affecting the development of alcoholic fermentation and the formation of volatile compounds. Grape nitrogen composition is influenced by several factors such as viticultural practices, soil management, timing or rate of fertilization and use of rootstock, among others.In this study a proximal, non-destructive tool based on NIR spectroscopy is presented to track the accumulation of a wide range of amino acids in intact grape berries during the ripening process. Material and methods - Clusters of grapevines of Vitis vinifera L. cv. Tempranillo were collected in a commercial vineyard located in Tudelilla, La Rioja, Spain (Lat. 42°18' 18.26", Long. -2°7' 14.15", Alt. 515 m) on five different dates from veraison to harvest in 2016 season. Contactless (at 25 cm from berries) spectral measurements from intact grape berries were acquired using a NIR spectrometer working in the 1100 - 2100 nm spectral range under laboratory conditions.A total of 19 individual amino acids in 120 grape clusters were quantified by HPLC, which was used as the reference method for the validation of the spectral tool. Principal component analysis (PCA) and Modified partial least squares (MPLS) regressions were used to explore the data structure and for the prediction of the amino acids profile in grape berries, by building calibration and

validation models. Results - A wide variability of all studied parameters was found during the ripening process with amino acid content ranging from 0.07 mg N/l (Glycine) to 534 mg N/l (Arginine). On average, Arginine was the most abundant amino acid (46.64 %), followed by Glutamine (14.70 %) and Proline (6.76 %). The best calibration and cross-validation models were built for Arginine, Cysteine and Proline with correlation coefficients values of 0.80, 0.77 and 0.75, while the standard errors of cross validation (SECV) were 43.04 mg N/l, 0.40 mg N/l and 5.87 mg N/l, respectively. In terms of the Free Amino Nitrogen content (FAN) the values of 0.71 and 104.85 mg N/l were gathered for the correlation coefficient of cross validation and SECV, respectively. The potential of NIR technology to fingerprinting the amino acid content in intact berries has been investigated. This technology could be used to select or classify grape berries during ripening in the vineyard, or at harvest time at the reception of the grapes in the production line (winery). This could be very useful to adapt the enological fate or grape berries to different wine qualities or styles, as well as to adopt different viticultural (thinning, selective harvesting) or enological decisions. Nevertheless, further examination of the influence of more varieties, seasons, and origins should be conducted with the aim of developing more robust, global, and predictive models.

Keywords: Grape ripening, non-destructive evaluation of berries, nitrogen composition, spectral techniques.