OBJECTIVE METHOD OF ESTIMATING ANTHOCYANIN CONTENT FOR DETERMINING COLOR GRADE OF GRAPES

INTRODUCTION

The USDA color grade of hand-harvested grapes is determined visually (USDA, 1965). Such a subjective technique is not satisfactory for grading color of mechanically-harvested grapes, because the skins of these grapes are often separated from the pulp during harvest. Since the skins are the source of color, it is necessary to develop a rapid, objective method for estimating Acy content, which can be used to grade the color of mechanically-harvested grapes. The study was designed so that macerates prepared from grapes of different maturities can be used for Acy analyses. For soluble solids determination, samples are collected randomly from bins and macerated together.

MATERIALS & METHODS

HAND-HARVESTED CONCORD GRAPES of different maturities were air-shipped from Westfield, N.Y., to Beltsville, Md. 58 stem-free samples, each about 250 g, were macerated in a Waring Blender under a stream of nitrogen for 60 sec. Each sample was then analyzed for soluble solids content and another was measured optically to determine the feasibility of estimating the Acy content. The remainder of the sample was placed in a 4 oz jar and frozen at -20°C until analyzed for Acy content within a 2-month period.

Soluble solids

Total soluble solids of juice from the macerates was determined with a Bausch and Lomb temperature-controlled refractometer. The total Acy content was calculated with the log of the Acy content (r = 0.982) (Fig. 1). Grapes of minimum acceptable color contained about 55 mg Acy/100 gfw. Most of the optical measurements of the macerated samples were correlated with a geometric function of the Acy content.

Total anthocyanin content

The total Acy content was determined by a method described for cranberries (Fuleki and Francis, 1968) with modification. A 100-g sample of frozen macerate was thawed and remacerated with 200 ml of extracting solution (95% ethanol, conc HCl and water, 85:2:13). The macerate was vacuum-filtered through a Buchner funnel containing Celite Analytical Filter Aid on Whatman No. 1 filter paper. The residue on the filter pad was washed repeatedly with extracting solution until the washings were clear. The filtrate was brought to 500 or 1000 ml with extracting solution. A 2-ml aliquot of filtrate was transferred to a 100 ml volumetric flask, brought to volume with extracting solution, and mixed. The pH of the solution was measured and adjusted to 1 if necessary, and the solution was stored in the dark at room temperature for 2 hr. Absorbance was measured with a Bausch and Lomb Model 25 Color Difference Meter, standardized with a white standard tile. A 6.5 cm diam sample of the macerate, containing macerate to a depth of 2.5 cm was placed on the measuring port (4.9 cm diam) of the instrument and the Hunter L, aL and bL values were recorded.

Light absorbance (absorbance = l/T, which includes absorbance, reflectance and scatter of light) of l-cm deep macerate was determined with a USDA Spectrophotometric Difference Meter (SDM) as described by Birth and Norris (1965). From the absorption spectra of a few grape macerates differing in maturity, two wavelengths 630 and 690 nm, were selected for measuring the absorbance. Most of the absorbance at 630 nm was assumed to be due to anthocyanins. Other factors which absorbed at 630 nm, were assumed to be absorbing at all other wavelengths, thus the difference in absorbance at 690 nm from that at 630 nm was used as the SDM reading of the anthocyanin content.

RESULTS & DISCUSSIONS

The visual color of the fresh grapes ranged from acceptable to unacceptable based on USDA grading standards. The Acy content of these Concord grapes of different maturities ranged from 30-120 mg/100 g fresh weight (gfw). Grapes of minimum acceptable color contained about 55 mg Acy/100 gfw. Most of the optical measurements of the macerated samples were correlated with a geometric function of the Acy content.

The difference between the absorbance at 630 and 690 nm (ΔA (630-690 nm)) of the macerated samples correlated with the log of the Acy content (r = 0.982) (Fig. 1). Grapes with minimum acceptable color (55 mg/100 gfw) had a ΔA (630-690 nm) of about 0.94. This value could be used as the threshold for estimating the Acy content of Concord grape macerates.
The soluble solids content correlated with Acy content \( (r = 0.966) \). This close association between soluble solids content and Acy content has been reported (Clore et al., 1965) and was anticipated due to the increased concentration of both with ripening. However, the regression equation for estimating Acy content from soluble solids content would not necessarily be the same for grapes from different geographical locations. The soluble solids content of grapes from the Southern and Northern United States would be about the same at harvest, but the Acy content of grapes from Southern United States generally would be less than that from Northern United States due to differences in temperature. Thus, the soluble solids content would not be a good index for estimating the Acy content for grade standards.

**CONCLUSION**

THE Acy CONTENT of freshly macerated grapes could be estimated objectively and rapidly by optical methods. The light-absorbance technique was effective for estimating Acy concentration between 40–70 mg/100 gfw. The light-reflectance technique was effective when the concentration range was between 50 and 100 mg/100 gfw. Since the Acy content of grapes with minimum color was about 55 mg/100 gfw either technique could be used for determining color acceptability of grapes to be processed.

**REFERENCES**


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 Mention of a specific brand name does not imply endorsement by the authors or institutions at which they are employed to the exclusion of others not mentioned.