ABSORBANCE OF THE SOAK WATER TO PREDICT CANNING QUALITY

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Breeding dry bean (*Phaseolus vulgaris* L.) for improved canning quality characteristics is a long process. It can take up to six generations from the time the first cross is made until there is enough seed of a breeding line to evaluate canning quality characteristics. In black bean, excessive leaching (color loss during thermal processing) can cause beans to appear gray and washed-out. Typically, this would result in the breeding line being discarded from the program due to unacceptable canning quality, specifically poor visual appeal. Determining the propensity of a breeding line to leach in earlier (F_3 or F_4) generations could be a valuable tool much like marker assisted selection allowing the breeder to discard those lines that have a propensity toward leaching earlier in the breeding process.

Fifty randomly selected $F_{2:8}$ breeding lines derived from crosses between 'Shiny Crow' and 'Black Magic' or between 'Black Magic' and 'Raven' were used in the soak water color test (1) to quantify the amount of particulate matter than had leached into the brine as well as to determine the correlations between the absorbance of the brine, the soak water color score, the amount of water imbibed by the seed, and the shininess or opaqueness of the seed coat. Ten beans from each randomly selected breeding line were blanched and soaked according to the protocol for the soak water color test (1). The color of the soak water was scored on the 1 to 5 scale, the percent water imbibed was determined, and the shininess or opaqueness of the beans was documented. The absorbance was measured using a spectrophotometer to assign a quantitative value to the visual color score of the soak water. The spectrophotometer used for measuring the soak water was calibrated using the same brine solution used for the soak water color test at a wavelength of 600nm. The soak water from each vial of the soak water color test was then transferred to a cuvet to have the absorbance measured. Anthocyanins rapidly oxidize in the presence of light so to prevent any degradation from occurring that could influence the absorbance readings; the absorbance was measured immediately following the completion of the experiment.

There were significant positive correlations ($P<0.001$) between absorbance and shininess or opaqueness of the seed coat, percent water uptake and color of the soak water (Figure 1). The Pearson's correlation coefficients were 0.54, 0.60, and 0.58 respectively. The lower the absorption, the less water the sample imbibed, the lower the color score of the soak water and the less likely it was to have an opaque seed coat. The significant correlation between the absorbance and the color score of the soak water indicated that the soak water color could be used as a predictive tool for the relative amount of leaching that will occur.

Based on scanning electron microscopy measurements (data not shown) taken on 20 black bean samples from the near isogenic populations used for this study, there was some variation in the size of the vacuoles in the seed coat. Variation in vacuole size has also been noted in other cultivars of black bean (2). Anthocyanins are localized in the vacuoles of the seed coat palisade cells; therefore, larger vacuoles may initially contain more anthocyanins than their smaller counterparts. The amount of leaching observed for 'Raven' and 'Black Magic' was quantified (3) and showed that 'Raven' exhibited a higher percentage of leaching in relation to the total anthocyanin content of the seed coat. Therefore, the size of the vacuoles, the initial

anthocyanin content of the vacuoles and the rate at which a cultivar will leach will all contribute to the appearance of the bean seed coat following thermal processing. This test predicts the propensity of a breeding line to leach but may not predict if the breeding lines will have an acceptable canning quality appearance following thermal processing.

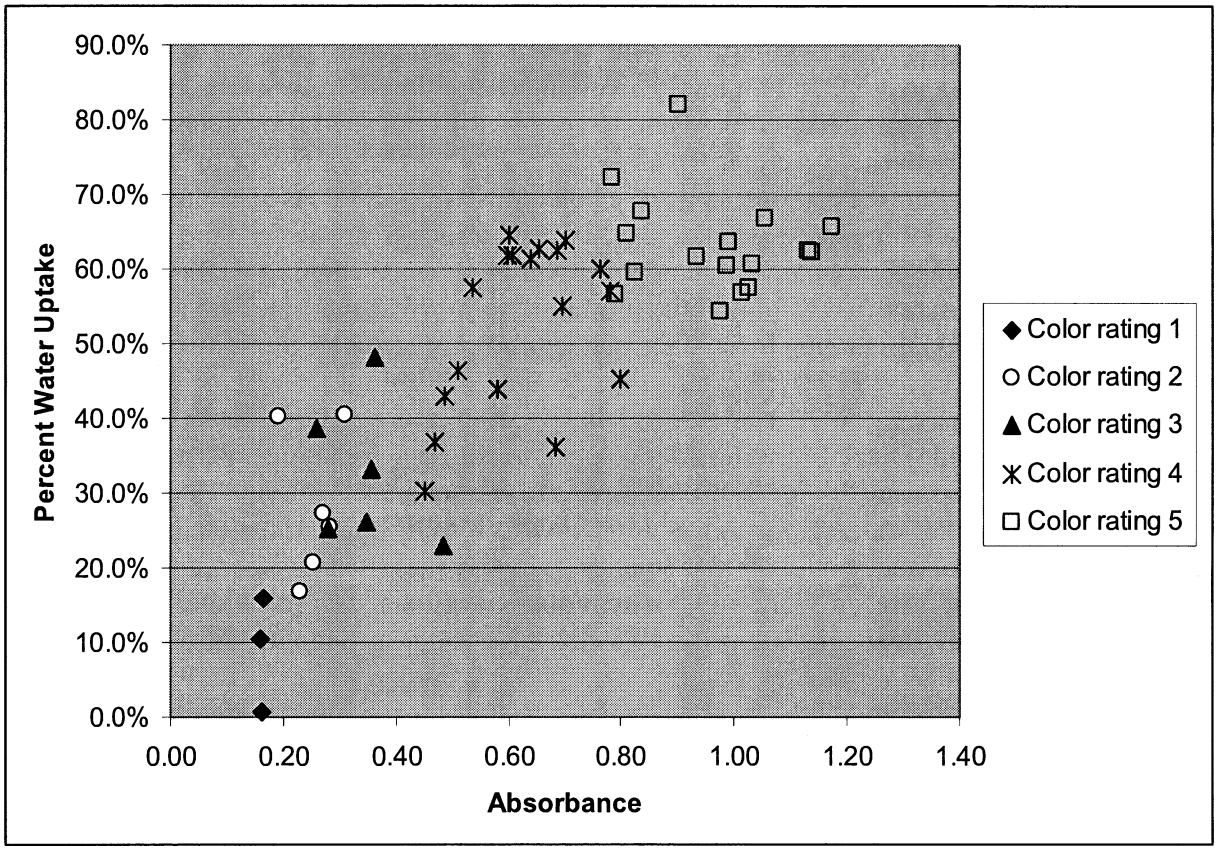

Figure 1. Graph showing correlations between percent water uptake, color of the soak water and absorbance.

Literature Cited

1. Bushey, S.M.. and GL. Hosfield. 2007. A test to predict color loss in black bean during thermal processing. Ann. Rept. Bean Improv. Coop. 50: 41-42.

2. Beninger, C.W., G.L.. Hosfield, M.J. Bassett, and S. Owens. 2000. Chemical and morphological expression of the *B* and *Asp* seed coat genes in *Phaseolus vulgaris*. J. Amer. Soc. Hort. Sci. 125: 52-58.

3. Bushey, S.M., G.L. Hosfield, and C.W. Beninger. 2000. Water uptake and its relationship to pigment leaching in black beans (*Phaseolus vulgaris* L.). Ann. Rept. Bean Improv. Coop. 43: 104-105.