

Reducing Non-Genetic Variability of the Internal Color of Tropical Calabaza

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Cucurbita moschata Duch., known in Spanish as calabaza (Cuba, Florida, Puerto Rico), auyama (Dominican Republic) or ayote sazón (Costa Rica), is an important vegetable throughout the Caribbean. Little breeding work has been reported other than the selection of 'La Primera' in Florida (4). This has a yellow pulp, preferred by people of Cuban heritage. In contrast, Puerto Ricans and Dominicans prefer orange to orange-red calabaza. A thick pulp is widely preferred. We noticed variability within cultivars for pulp color. We wanted to 1) assess the effect of fruit age and position on the vine on internal color; 2) see if reliable harvest maturity indicators existed, to standardize the harvest of samples for color evaluation; and 3) see if genetic differences for pulp color could be easily detectable in a selection program.

Methods. Internal color was evaluated with Plate 10, the orange-yellow transition, of Maerz and Paul (3). This has 12 rows progressing downwards in increasing brightness or value and 12 columns (A - L) progressing from left to right in increasing saturation (colors more pure and less dull). For analysis, column L was given numbers 1-12, column K 0-11, etc. Square A-1 has 66.7% gray reflectance and is labeled "oyster white". L-10, L-8 and K-6 are equivalent to Munsell 5YR 6/12, 7.5YR 7/16 and 10YR 8/14, respectively. L-12 is "Tangier". A color of 4 to 5 is commercially good for Puerto Rico.

In June 1984 and Feb. 1985 'Borinquen', the only existing Puerto Rican cultivar, was planted at Isabela, PR. Borinquen has a good pulp color. Fruits were tagged at anthesis. Data were collected at five day intervals on whether tendrils at the fruit node were green or dry, approximate groundspot color, and change in skin color to yellow-green or to a dusty/opaque sheen. (Borinquen has a dark green skin color.) Sample fruits were harvested at five day intervals from 15 to 75 days in 1984 and 30 to 75 days in 1985, and cut in half for color data. Regressions were done of fruit color on harvest date.

In Feb. 1985, seven S_1 -derived S_2 lines and Borinquen were planted at Isabela and Juana Diaz, PR. Sample fruits were evaluated 50 days after anthesis as above. Distance from fruit to root was measured at Isabela, and a regression done of pulp color on distance. A correlation was done between pulp color and thickness. Variable numbers were sampled per line, but an analysis of variance was possible using four samples per line and location. When more than four fruits were sampled, four were randomly chosen.

Results. Fruit color tended to follow an inverse exponential distribution in the upper right-hand quadrant. The regression of color on distance was non-significant ($P < 0.50$, 111 d.f.). Numerous fruits aborted shortly after anthesis, but a total of 29 non-aborted fruits were available in 1984 and 23 in 1985 for the regression of color on harvest date. This was highly significant in 1984 ($a = -2.20$; $b = 0.13$) and significant in 1985 ($a = 2.73$; $b = 0.05$). In both years an average internal color of 4 - 5 occurred at about 50 days.

A linear increase in red-orange color after fruit harvest has been noted (1,2), attributable to a linear increase in beta-carotene (2). Our results show this commences before harvest, but varies with year in regression slope. Fruit age was reported to obscure varietal differences for characters like soluble solids and sugars (1,4). With uniform sampling at 60 days after anthesis, however, cultivar differences in various quality traits were detectable (1).

We detected genetic differences. Borinquen and La Primera sampled at each of three locations in 1984 had consistent differences in pulp color. In the S₂ test, there were highly significant differences among lines for pulp color. Location had an effect at P = 0.06, but there was no line x location interaction. Pulp color and thickness were significantly correlated (r = 0.17; 111 d.f.). Thus selection for pulp color should not decrease pulp thickness, and may even increase it slightly.

Maturity indicator data for Borinquen from all tests at Isabela are summarized in Table 1. All seemed imprecise. Groundspot color changes were difficult to ascertain and this measure was dropped. Many fruits showed no change in skin color by harvest. Dates of color change and dried tendrils were not correlated. We concluded that the best method for evaluating internal color is to harvest tagged fruits at 50 days after anthesis.

Table 1. Means for days after anthesis, (number of fruits and standard deviations) for harvest maturity indicators of 'Borinquen' calabaza.

	Dried tendrils	Some yellow color on fruit	Opaque, dusty appearance
1984	28.1 (26, 8.2)	not taken	40.0 (9, 10.6)
1985	31.5 (59, 10.4)	40.4 (45, 6.6)	44.3 (35, 6.2)

Literature Cited

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