Effects of Plant Source, Age, and Foliar Molasses Application on Brix Readings of Kale Extracts

Lingyu Huang, Changzheng Wang* and Michael Bomford
Community Research Service, Kentucky State University
Frankfort, KY 40601

ABSTRACT

Refractometers estimate the soluble solid content of juice by measuring the refraction of light passing through it, expressed in °Brix. They are commonly used to assess fruit ripeness, but have also been proposed as instruments for measuring vegetable quality. In a series of three experiments we tested the precision and variation in Brix values of kale (*Brassica oleracea* L., Acephala group) extracts as a function of source, leaf age, leaf moisture content, and storage duration. We measured the °Brix of filtered juice from fresh leaves purchased from three Kentucky producers and two supermarkets, then refrigerated in sealed plastic bags for 0, 7, and 18 days. A second experiment compared extracts of young and mature leaves over 2 weeks of refrigerated storage. A third experiment compared extracts of untreated leaves with those of leaves sprayed 2 weeks before harvest with a solution of black molasses, which is reputed to increase leaf soluble solid content. Despite the large variation between leaves, leaf source and moisture content affected mean Brix values. Leaves from one local producer and one supermarket had higher values than leaves from other sources. No consistent effect was found due to pre-harvest molasses treatment, post-harvest storage time, or leaf age at harvest. Leaf moisture content was inversely correlated with °Brix, which increased rapidly in wilting leaves. A better understanding of any relationship between Brix values and vegetable quality parameters is needed before °Brix value can be accepted as a vegetable quality indicator.

INTRODUCTION

Refractometers are commonly used to assess fruit ripeness, but they have also been proposed as instruments for measuring vegetable quality. Rex Harill (1994) published the book "USING A REFRACTOMETER TO TEST THE QUALITY OF FRUITS & VEGETABLES". "BRIX=QUALITY CHARTS" were provided to guide consumers. However, the scientific base for these charts is questionable. It is not clear whether Brix value really reflects quality of vegetables and how Brix may vary due to the maturity and storage conditions.

OBJECTIVE

To determine the variation in Brix values of kale (*Brassica oleracea* L., Acephala group) juice due to the source, leaf age,

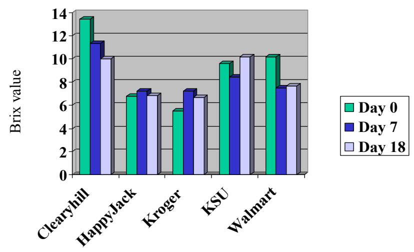
leaf moisture content and storage conditions.

MATERIALS AND METHODS

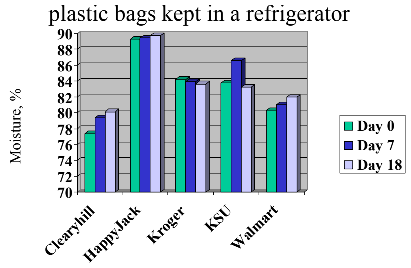
In experiment 1, kale were purchased from three Kentucky producers and two supermarkets, then refrigerated in plastic bags for 0, 7 and 18 days. On each sampling day, kale leaves were freed of the stems and the juices were squeezed out and filtered through nylon cloth before the Brix value was determined with a hand-held refractometer. Moisture content of kale leaves were determined as the weight loss on drying in a oven at 105 C to constant weight. Samples were ashed at 550 C for 48 hours to determine their ash content. In experiment 2, newly-unfolded (young) and mature leaves were harvested from kale grown on the research farm at Kentucky State University, and stored in zip-loc bags placed in a refrigerator for 2 weeks. Brix value and moisture content were determined as in experiment 1. In experiment 3, kale grown under the same condition were spread with or without a solution of black molasses, reputed to increase soluble solid content. Two weeks later, the leaves were collected and measured for Brix and moisture content. In experiment 4, kale from the same source were stored in open or sealed plastic bags stored either at room temperature or in a refrigerator. The Brix value and moisture content were determined as described above.

RESULTS

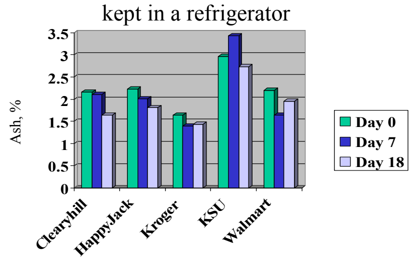
Brix value of kale from different sources stored in sealed plastic bags kept in a refrigerator



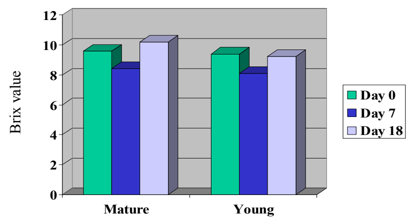
Moisture content of kale from different sources stored in sealed plastic bags kept in a refrigerator



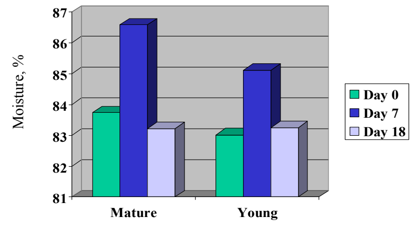
Ash content of kale from different sources stored in sealed plastic bags kept in a refrigerator



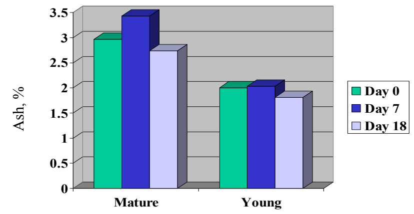
Brix value of young and mature kale leaves stored in sealed plastic bags kept in a refrigerator



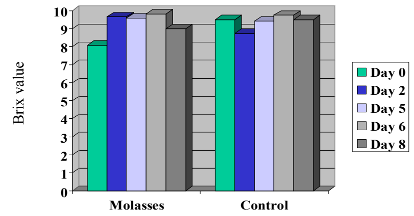
Moisture content of young and mature kale leaves stored in sealed plastic bags kept in a refrigerator



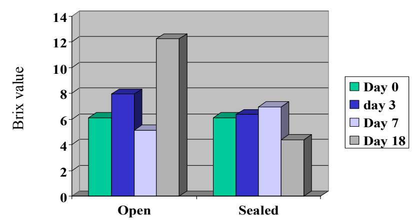
Ash content of young and mature kale leaves stored in sealed plastic bags kept in a refrigerator



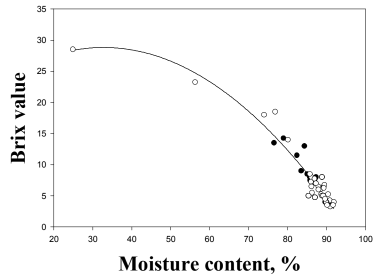
Brix value of kale pre-treated with or without molasses



Brix value of kale stored in open or sealed plastic bags kept in a refrigerator



Relationship between moisture content and Brix value for kale leaves



Low Brix (top) vs. High Brix kale (bottom)

SUMMARY OF RESULTS

1. There was large variation between leaves in Brix value (CV=27%);
2. There is no significant difference in Brix value between young and mature leaves even though mature leaves had higher ash content;
3. Kale from two local sources (Clearyhill and KSU) and one supermarket (Wal-mart) had higher Brix value;
4. Pre-harvest molasses treatment and post-harvest storage time did not affect Brix value of kale stored in a refrigerator;
5. Storage in sealed bags prevented loss of moisture and changes in Brix value;
6. There is a quadratic relationship between moisture content and Brix value, which increased rapidly in wilting leaves.

CONCLUSION

A better understanding of any relationship between Brix values and vegetable quality parameters is needed before °Brix value can be accepted as a quality indicator of vegetables like kale.