SOME FACTORS AFFECTING APPLE DEHYDRATION

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Apples comprise one of the largest fruit crops in the United States with an annual production of about 3 million tons (Agricultural Statistics)[1]. Even though the major portion of the crop is consumed in the fresh state, over 170,000,000 lbs. (fresh basis) is preserved by dehydration. Numerous factors affect the quality of dehydrated apples; for instance, maturity, variety, and drying conditions. Processors and consumers alike are interested in the final quality of the dehydrated products. In dried apples, "quality" is usually attributed to the lightness or whiteness of the fruit and to flavor. There is a relationship between the sulfur dioxide content of cut dried fruits and their lightness (Nury _et al._)[3]; also, fruits with more SO_2 will remain light longer.

This study was conducted to determine the effect of soluble solids and variety on adaptability of apples to dehydration and on final quality.

Preliminary work was done by finding the Brix variation within an apple, to develop a procedure for determining their soluble solids without macerating them. Pieces of apple tissue were cut from different locations, the juice expressed onto a refractometer prism and the Brix reading determined. By this procedure it was found that there was up to four degrees Brix variation within an individual apple. The core area tissue gave the lowest Brix with the readings increasing on approaching the perimeter (Fig. 1). The procedure for analysis that was adopted consisted of determining the Brix on two pieces of apple tissue cut from opposite sides of the center perimeter.

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1. Agricultural Statistics, U.S. Dept. of Agriculture, Washington, D.C. (1962).
3. Nury, F.S., Taylor, D.H., and Brekke, J.E., Research for Better Quality in Dried Fruits - Apricots. ARS-74-19 (1960).

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Fresh Gravenstein, Red Delicious, Golden Delicious and Jonathan apples were obtained from a commercial apple processor. The apples were peeled, cored and then each apple was sliced into one-half inch rings. Two pieces were cut from the perimeter of the center rings, directly opposite each other, and their Brix determined. The slices were then weighed, dipped in a 0.5% $NaHSO_3$ solution, sulfured further with burning fumes of sulfur for one-half hour and then dried at 150°F for 5-1/2 hours in a cabinet dehydrator. After drying, the apples were weighed again and packaged. Apples of similar Brix were packaged together. Sulfur dioxide and moisture content were determined after the samples had equilibrated for one week. Moisture was determined by finding the weight loss after drying the samples in a vacuum oven for 30 hours at 60°F at less than 2 mm Hg pressure. Sulfur dioxide was determined by the Monier-Williams method (A.O.A.C.)[2].

In a given variety of apples, high soluble solids paralleled high sulfur dioxide absorption (Fig. 2). This trend appeared in all varieties tested. The influence soluble solids had on sulfur dioxide absorption was confirmed by tests on a model system. Fresh apples dipped in a 1% sucrose solution contained approximately 300 ppm more sulfur dioxide after drying than untreated apples.

Although sugar content influenced sulfur dioxide absorption, there were also variations due to variety. Different varieties, all identically sulfured and dried, showed different sulfur dioxide absorption characteristics (Fig. 2). The Red Delicious absorbed more SO_2 than any other variety tested.

Variety and soluble solids also influence the appearance of dried apples. Lower Brix apples dry to a lighter finished product. This was very noticeable in both Red Delicious and Jonathans. Also, these varieties both dried to a whiter color than did Golden Delicious or Gravenstein; the Golden Delicious dried to a yellowish product.

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2. A.O.A.C. "Methods of Analysis". 9th ed. Association of Official Agricultural Chemists, Washington, D.C. (1960).

Also, variety and soluble solids influenced the drying ratio of apples (Fig. 3). Apples with higher soluble solids had a lower drying ratio; in other words gave a greater yield.

Summary

In summary, I have pointed out that apples with higher soluble solids in a given variety absorbed more SO_2 and had lower drying ratios. Of the apple varieties tested, Red Delicious absorbed more SO_2 than others.

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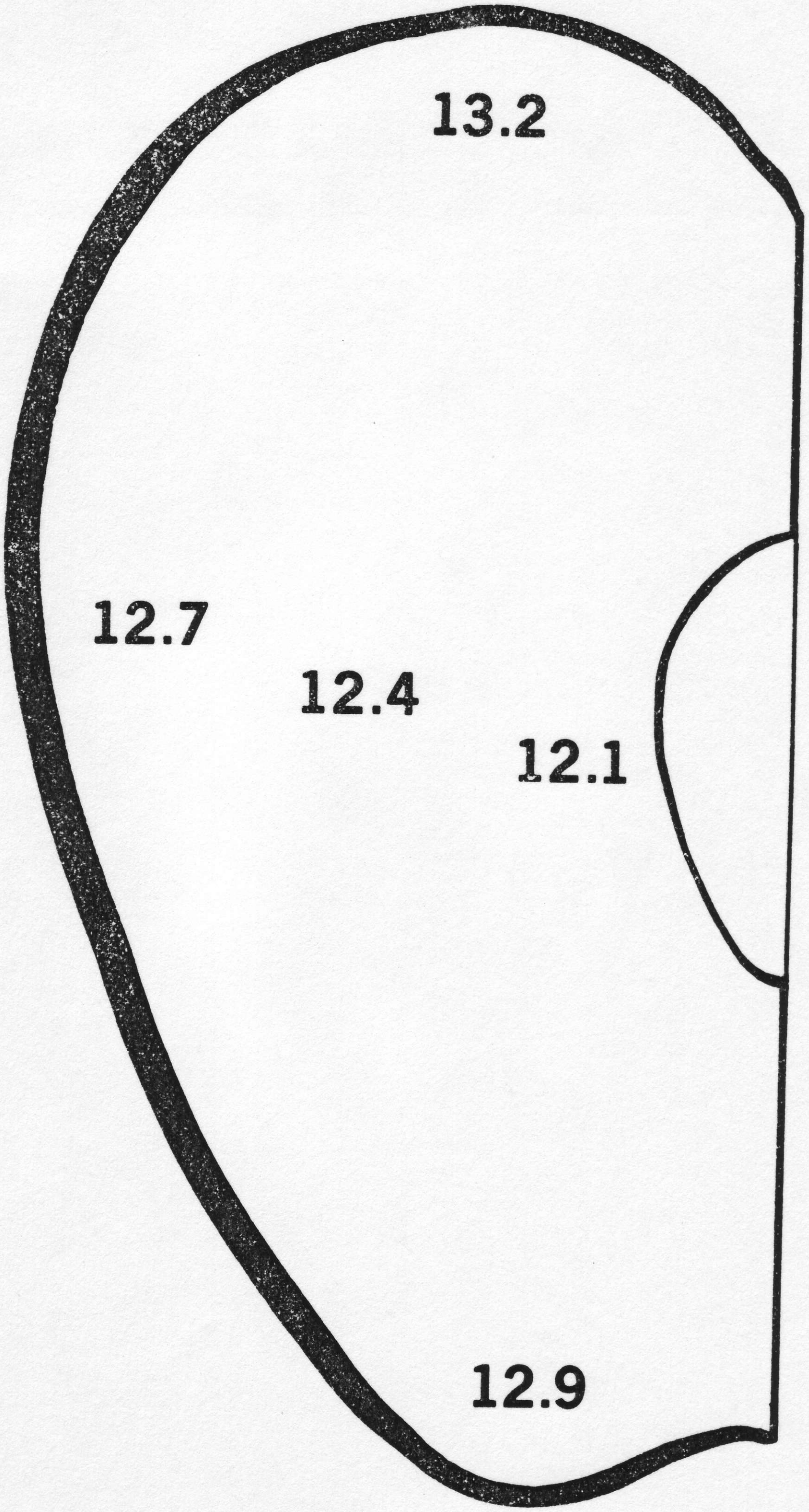

Fig. 1. Brix Variations within an Apple.

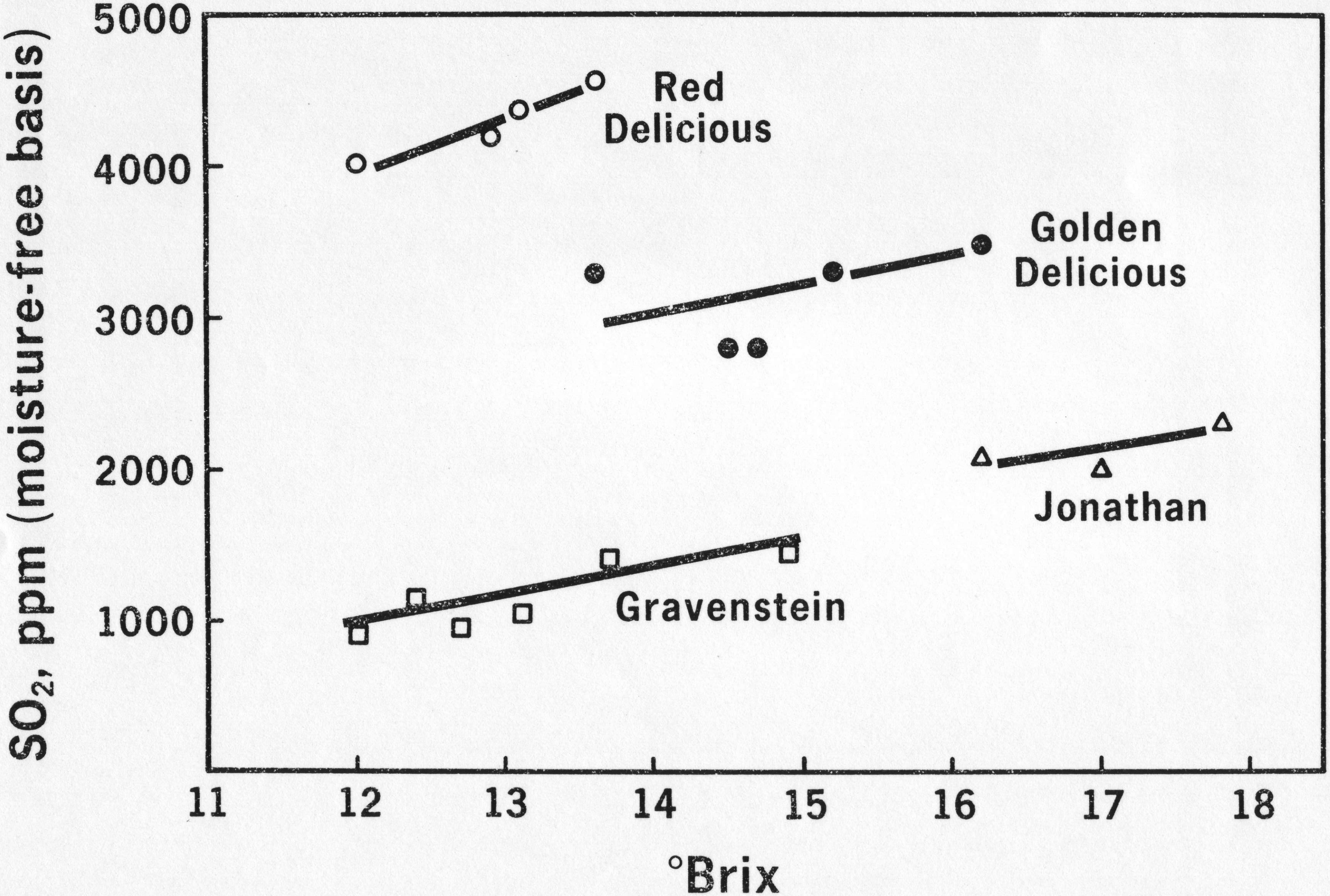

Fig. 2. Effect of Soluble Solids on SO_2 Absorption in Different Apple Varieties.

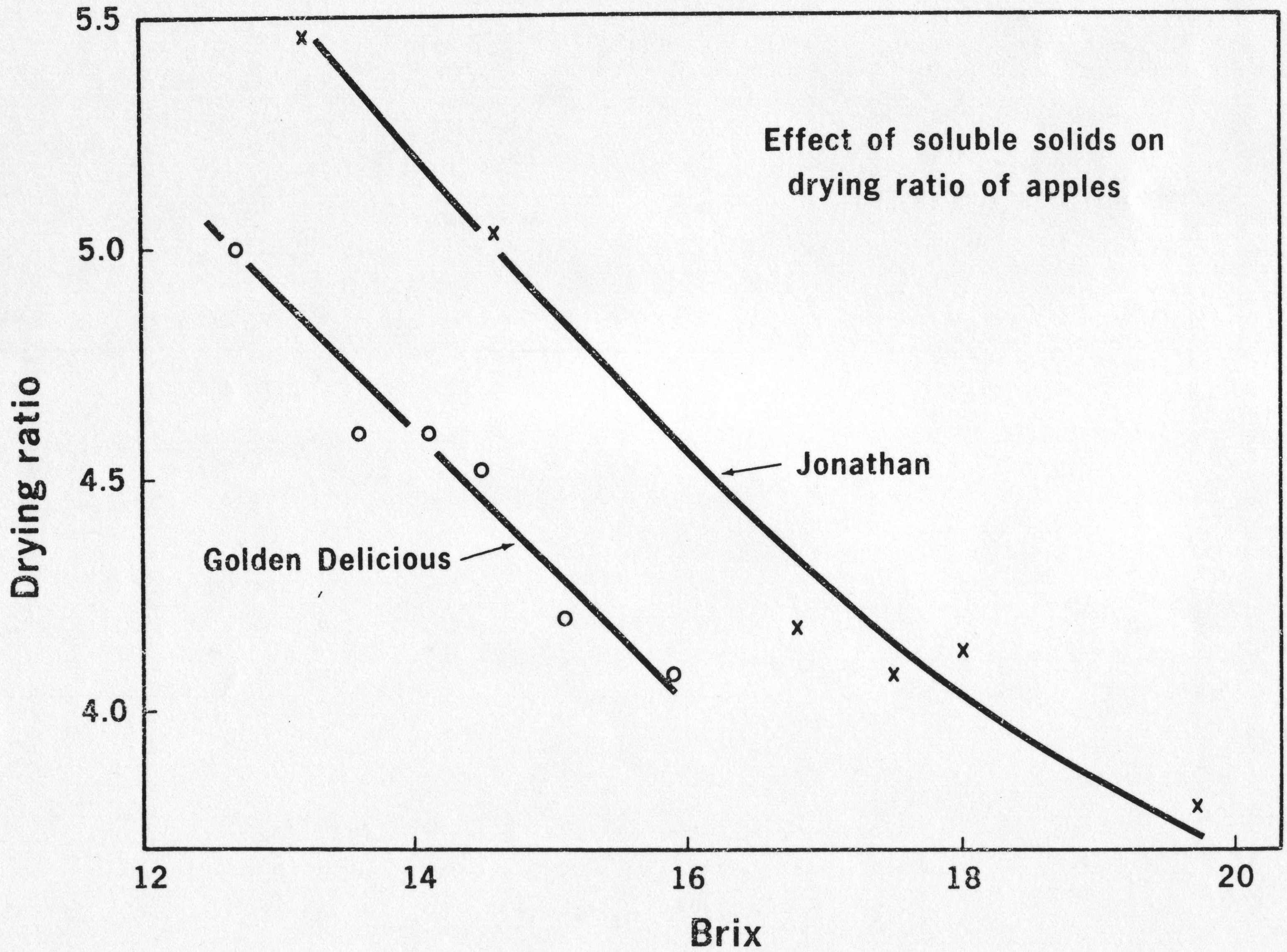

Fig. 3. Effect of Soluble Solids on Drying Ratio of Apples.