

WE ARE IN THE FOOD BUSINESS: PROVIDING CONSUMERS WITH THE QUALITY APPLES THEY WANT

Dr. Eugene Kupferman

Postharvest Specialist, Tree Fruit Research & Extension Center

1100 North Western Ave, Wenatchee WA 98801

Kupfer@wsu.edu

Prepared for the WSHA Meeting December 2005

INTRODUCTION

As WSU Extension Horticulturist for Tree Fruit Quality, I have been involved with a number of research projects over the past 10 years to define the edible quality of apples and focus industry attention on the fact that profitability is tied to edible quality.

Washington growers long relied on Red Delicious grown on standard seedling trees. When I came to Washington in 1973 I was told that there was no interest in research on dwarf rootstocks or in plant breeding since Red was king. My, how times have changed! Yet still today the industry is rewarding growers solely on appearance, size and color.

As the industry first began looking at new planting systems and then later at new varieties I thought about the type of information needed by an industry in transition. I went back to our core competency—growing fruit that appealed to consumers from both a visual perspective (people wanting to pick up a fruit), and an edible perspective (people wanting to buy more fruit).

I was curious about how much information sensory scientists had about how people made choices on what they would eat, and the criteria they used to evaluate what they ate. I developed a relationship with Dr. Roger Harker of New Zealand, who became prominent in my search after I read his review of the texture of fresh fruit, which ran for over 100 pages in one of horticulture's leading scientific journals (Harker 1997).

The Washington Apple Commission provided funding for Dr. Harker to review the world's scientific literature on apple consumption. We got involved in the discussions with the WSHA Grade and Pack Committee about the possibility of developing grade standards for new apple varieties. The Washington Tree Fruit Research Commission provided funding for us to select a sensory lab in the northwest and then to expand our knowledge base of apple consumers. With funding from the Hort Association, I invited Roger to address this group.

Additional studies were conducted (funded by the Washington Apple Commission) to determine loss of quality as fruit left the loading docks here and moved through the distribution centers to retail stores. At the turn of the last century (2000), funded by the Research Commission, we sampled apples off packinglines throughout the state to look at quality at time of packing. We also enlisted the help of fellow postharvest scientists in six different states to purchase and examine apples for sale in their local retail stores four times a year.

The results of these studies have been published in the Good Fruit Grower and on our web site (<http://postharvest.tfrec.wsu.edu/articleTable.php>). I invite you to look at the studies in more detail that I can give in this brief summary.

THE STATE OF THE INDUSTRY

Per person domestic apple consumption had been relatively flat from 1990 to 2000 but has recently fallen and profitability along with it (Figure 1). The industry has gone through a sea change as Gala and Fuji replaced Red Delicious in many orchards (Figures 2 to 4). As I travel abroad I have noticed that every region capable of growing apples has planted Gala. New strains of Gala are emerging that have ever more red skin color. Will Gala be a repeat of the Red Delicious experience?

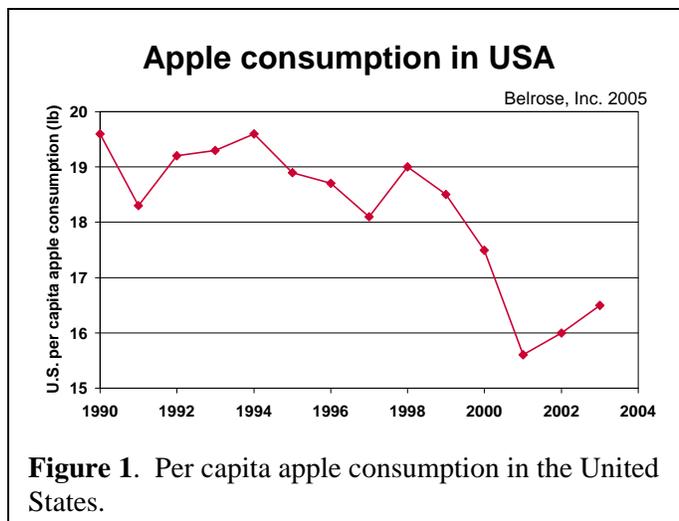


Figure 1. Per capita apple consumption in the United States.

Have we lost our way? Have consumers been talking, but we are not listening? Wholesalers said consumers wanted ever more red apples, and we provided them with redder and redder ever less tasty apples. Consumers responded by purchasing bi-colored apples such as Braeburn and Pink Lady® brand apples.

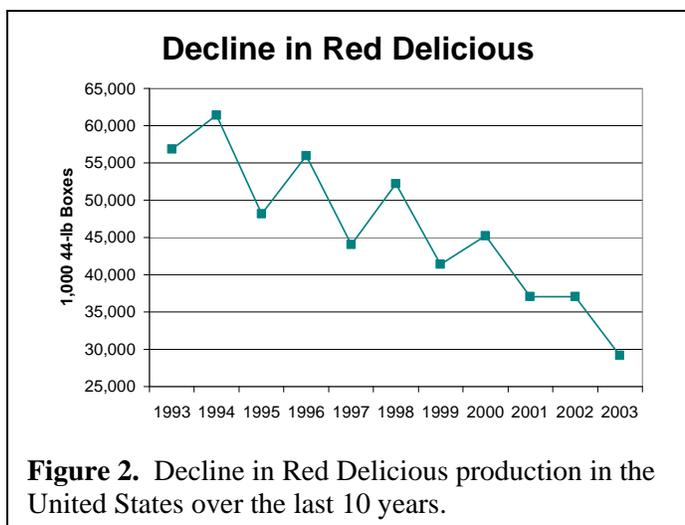


Figure 2. Decline in Red Delicious production in the United States over the last 10 years.

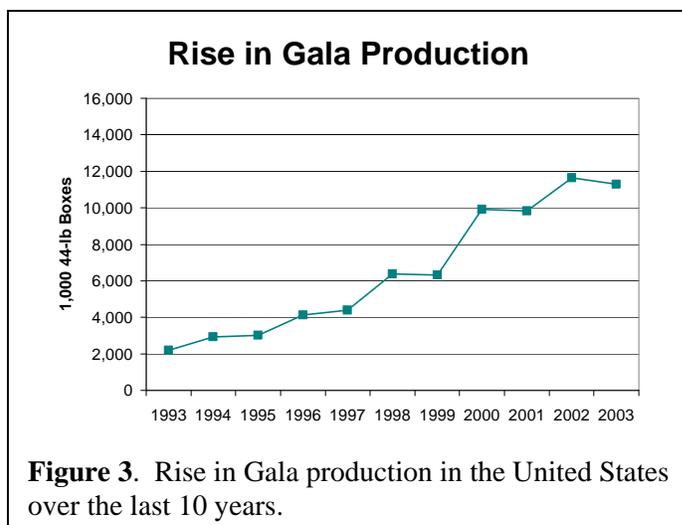
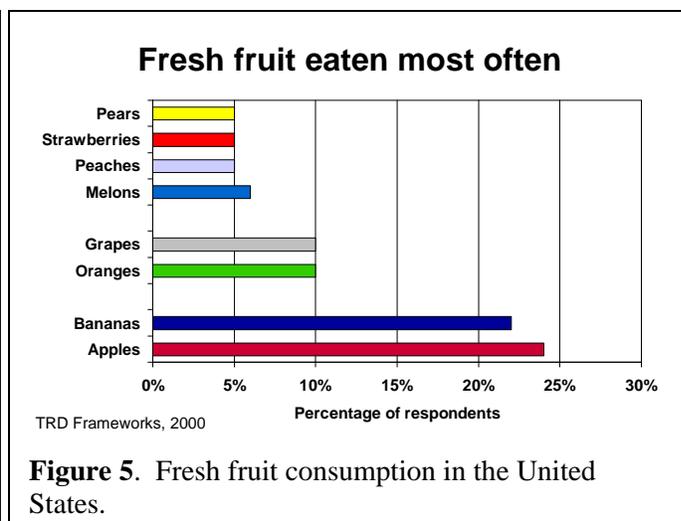
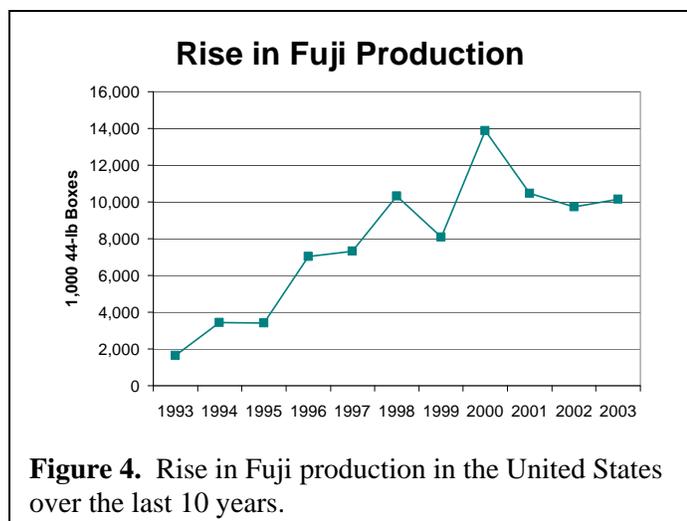


Figure 3. Rise in Gala production in the United States over the last 10 years.

Is it too late to bring consumers back to Red Delicious?

Apples and bananas are the fresh fruit items that consumers eat most often; grape and orange consumption is half that of apples (Figure 5). In the apple category there are two types of consumers: those who like Red Delicious and those who prefer new varieties. Red Delicious consumers are loyal, and select apples by smell and appearance. Buyers of new varieties travel more, are more educated and select apples by taste and texture (TRD Frameworks, 2002).



TRD Frameworks did some excellent work allowing consumers to describe themselves (TRD Frameworks, 2001) and they fell into 5 groups:

- Hard Core apple consumers (21 of consumers) are loyal Red Delicious eaters. If the first bite is good they will love the apple. These are older people and easy to please.
- Stressed Moms (21% of consumers) are not thinking about apples. They are interested in buying apples for their kids and don't want to take much time to think about it as they rush off to take the kids to soccer or dance practice.
- Experimenters (16% of consumers) are apple gourmets who like apples so long as they are not Reds, Golden or Grannies. They like complex flavors and are constantly trying new foods.

These 3 groups account for 58% of apple consumers, but who eat 78% of the apples.

The other groups are:

- Dissatisfieds (27% of consumers) who only eat apples occasionally, but eat other fruits. These are the people who have been disappointed by mealy or no flavor Reds.
- Worrieds (15% of consumers) who don't eat very many apples. They worry about pesticides or prefer to buy fruit that is not waxed. They are concerned about health and nutrition...aren't we all?

Which is the most popular apple variety depends in part on the region of the country in which you live. Consumer preference in the Seattle region lists Fuji as the most popular, with Braeburn and then Gala and Red Delicious. In the rest of the country Red Delicious remains king, with Granny and Golden above the other varieties (WAC 2000).

Have we done a good enough job educating consumers about the differences in apple varieties? Do we need to? In Switzerland and Germany the organic community sells apples in different colored bags. Apples in red bags are sweet, moderate firmness, juicy and low in acidity. Those in green bags are high in acidity and very firm. Those in yellow bags are somewhere between the two extremes. Thus, people may not know the variety, but they know what they like!

What visual qualities do people seek in an apple?

It is obvious that the appearance of the apple is very important to sales. Our study of Washington grown apples on retail shelves pointed to little edible quality differences in 24 markets in 7 states across the USA. What we did find was that in 2002 there was a serious problem with bruising and wax whitening in certain markets (Figures 6 and 7). Most of the bruising comes after fruit leaves the packinghouse, but the fruit have the Washington sticker on it and therefore our reputation is at stake.

Our consumer trials showed that when over 100 people evaluated the color of Red Delicious only 7% approved of the very dark, purple skin color of certain cultivars.

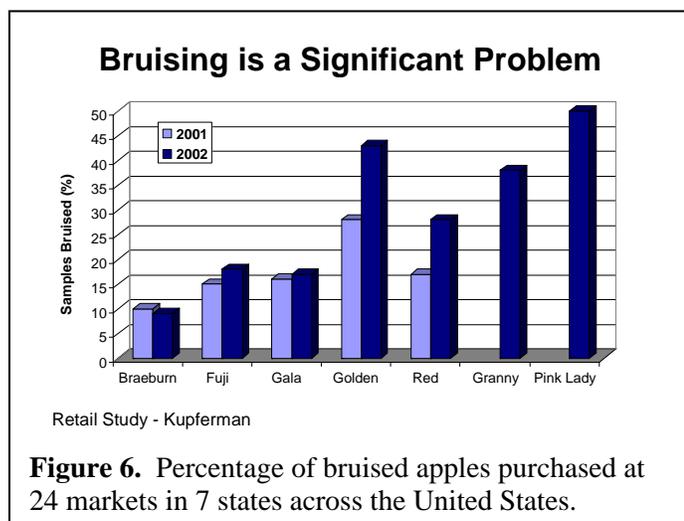


Figure 6. Percentage of bruised apples purchased at 24 markets in 7 states across the United States.

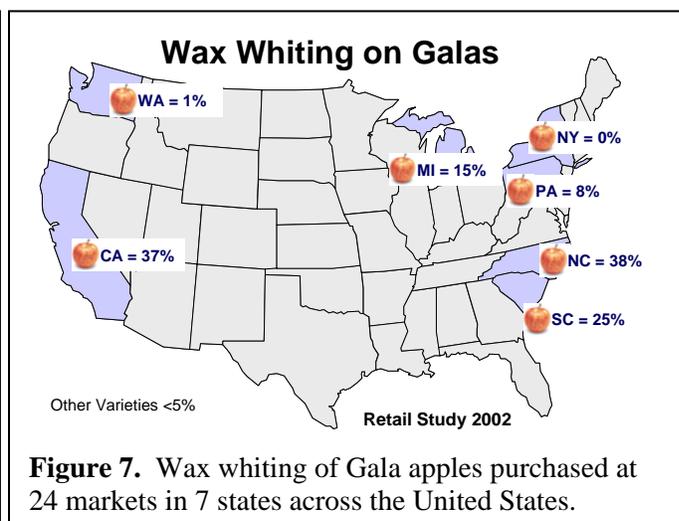


Figure 7. Wax whitening of Gala apples purchased at 24 markets in 7 states across the United States.

What edible qualities do people seek in an apple?

The choice to select an individual fruit stems from a person's impression as to the freshness, flavor and quality of that fruit and by extension of that variety (TRD Frameworks 2000).

The key to a consumer's definition of edible quality comes first with acceptable firmness. In our consumer study with Red Delicious 12% liked soft apples, and 67% preferred hard apples and 21% were not able to discriminate between apples of different firmness levels. Thus it is possible to cater to either the 33% who were either non-discriminators or likers of soft apples, or to appeal to the 67% who like firm apples.

How hard should hard apples be?

In studies I conducted with Oregon State University's Dr. Anna Marin, using Washington apples and Oregon consumers, we determined that with most varieties there was no increase in willingness to buy when the firmness was above 14 lbf. (Figures 8 and 9). Remember this firmness level is at time of consumption, not when it leaves the packinghouse.

Surveys we conducted at 35 packinghouses over a three year period (2000-2003) showed that appreciable amounts of apples were below minimum acceptable firmness at time of packing. However, the recent introduction of SmartFresh™, which allows properly harvested apples to be firmer after storage, may assist packers in meeting this standard. There has not been a survey of fruit quality since that time, but it is realistic to hope that treated fruit are firmer than in these previous years.

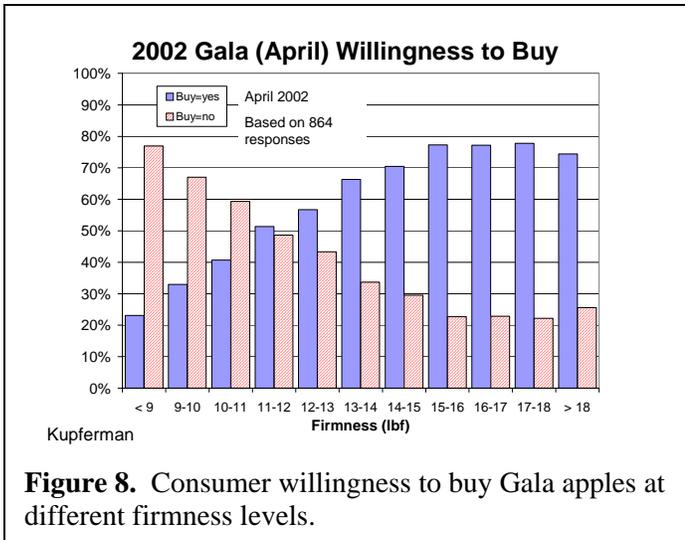


Figure 8. Consumer willingness to buy Gala apples at different firmness levels.

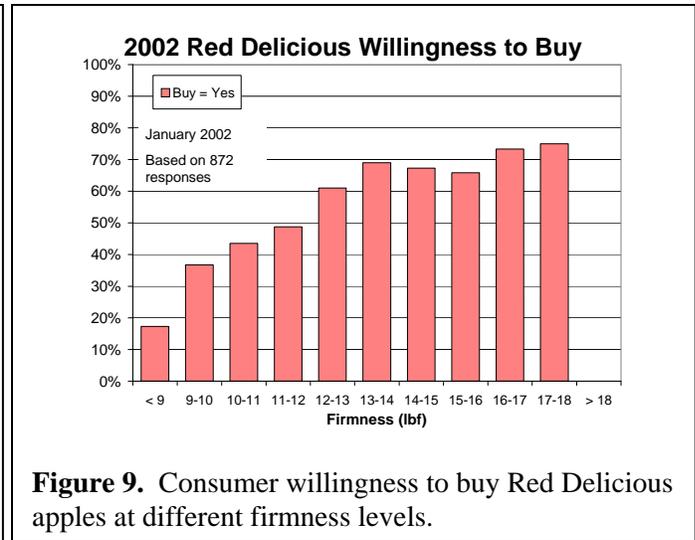
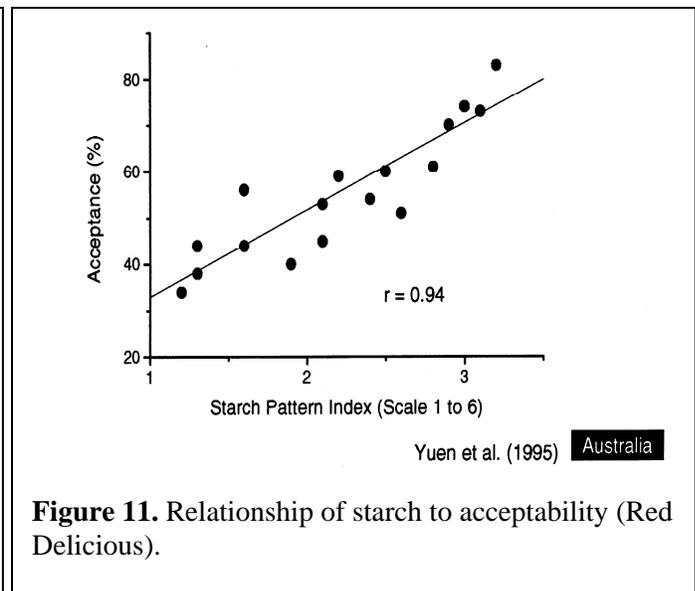
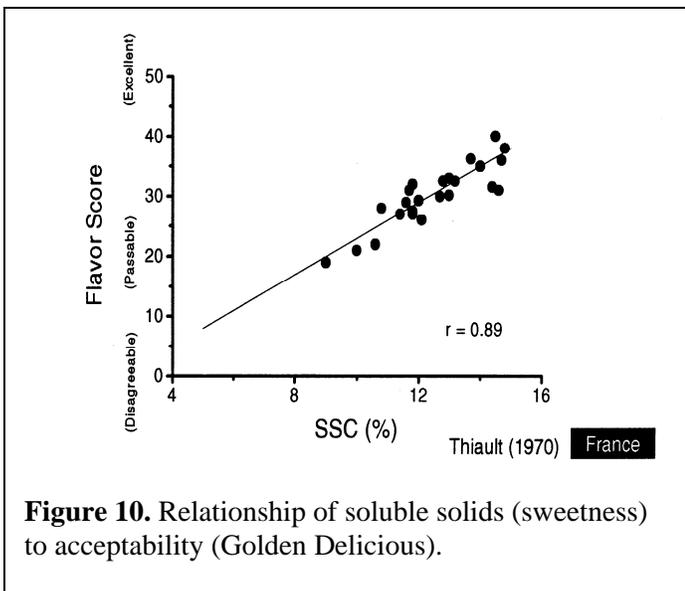


Figure 9. Consumer willingness to buy Red Delicious apples at different firmness levels.

Sweetness and acidity are the other determinants of acceptability. Soluble solids (SS) are a measure of the sweetness of apples. The sweetness of the apples at a specific SS level varies due to differences in the types of sugars as well as the sugar acid ratio. However, it is sufficient to relate that according to European studies optimum soluble solids levels should be at 13.5%. The ranking of acceptability to increasing SS levels is linear ($r^2=0.89$) indicating that ever higher soluble solids will be pleasing to consumers (Figure 10).

Soluble solids (SS) and titratable acidity (TA) balance each other, but most consumers do not like very high levels of acidity, so increasing acidity will not necessarily increase acceptability. Consumers who prefer high acidic apples such as Granny Smith or Pink Lady® brand apples desire a harder apple than people who like less acidic apples.

Consumers do not like to eat apples that taste like potatoes; starch is a turn off (Figure 11). Thus, early harvested apples that contain starch do not entice consumers to buy more fruit.



Can Washington deliver?

Of course, Washington became the top apple producing region of the USA due to the visual and edible quality of apples grown here. The current profile of edible quality of the current varieties provides diverse consumers with a large range of choices including very tart (Granny Smith and Pink Lady® brand apples) to very sweet (Fuji, Honeycrisp) and everything in between (Figure 12). The challenge for the industry to make sure that the flavor of the fruit going to market is true to the variety. When a small fruited variety is pumped up to make it larger (Gala) or a large fruited variety is reduced to lunchbox size (Fuji) consumers are going to be disappointed.

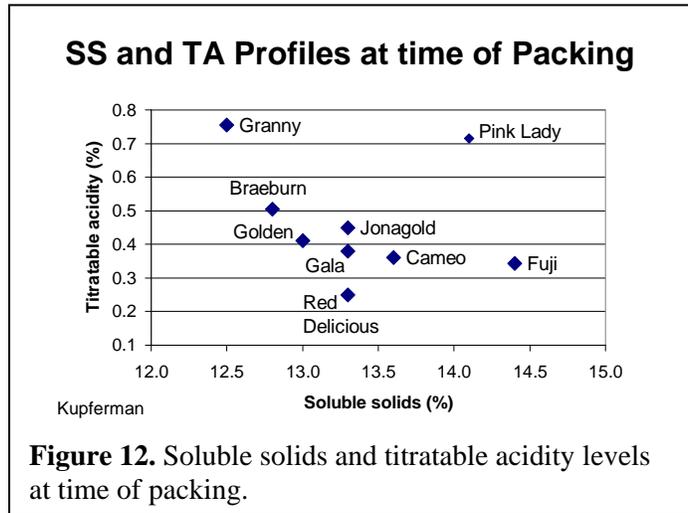


Figure 12. Soluble solids and titrateable acidity levels at time of packing.

Is the distribution system creating quality problems?

We were asked by the industry to look at the deterioration of fruit from the time it leaves the packing plant in Washington through the distribution center then on to the retail store. We loaded trucks with Reds, Gala and Golden and followed the trucks to distribution centers in several cities then on to local retail stores. We determined that apples which had not been properly cooled, and those that were of marginal quality lost weight and firmness.

In that retail study, and in an additional lab simulation, in which fruit were held at temperatures of refrigerated displays vs. those without refrigeration, we found very little difference if the fruit were of high quality. (Recognize that apples on refrigerated shelves are 55 °F while those on non-refrigerated shelves are 68 °F – a very small difference.) Management is everything and when there was no refrigeration at retail and only very the small amounts of fruit were on display, quality was not lost if the fruit sold rapidly. However, when the holding period without refrigeration was extended deterioration did occur.

Changes need to be made to improve both appearance and edible quality. The industry needs to recognize that consumers want firm, sweet juicy fruit. Yet growers are rewarded for appearance, size and color, not for firmness or sweetness. Growers need to be rewarded for harvesting apples that are firm and sweet as well as visually appealing. There needs to be more education and a greater incentive for growers to manage the crop for these attributes.

For years most packers have taken note of soluble solids levels of samples at harvest, yet often nothing is done with this information. Starch may be the best indicator of maturity, but firmness and soluble solids are the best indicators of edible quality. For example, when a consumer is introduced to a Fuji for the first time and it has only 9% SS it is not likely that they will buy another. This apple was bred to be sweet and when it lacks sufficient sweetness it is a disappointment.

Washington needs to have a campaign to make sure that sweet varieties live up to their billing. Orchard and harvest sampling is one place to check quality in specific orchards. Individual fruit

can be tested using near-infrared (NIR) sensors on the packingline. NIR testing of every apple is one tool to use to separate the edible from the disappointing. Our evaluation of NIR instrumentation shows that it is a reasonable way of determining sweetness nondestructively (Figure 13).

We are in the food business: consumer concerns about sanitation and food safety are now covered by HACCP programs; the soft apple problem is to some degree being covered by the use of SmartFresh™. Now we need to turn our attention to how we can provide apples that people wish to eat more of. I am sure Washington growers are up to the challenge.

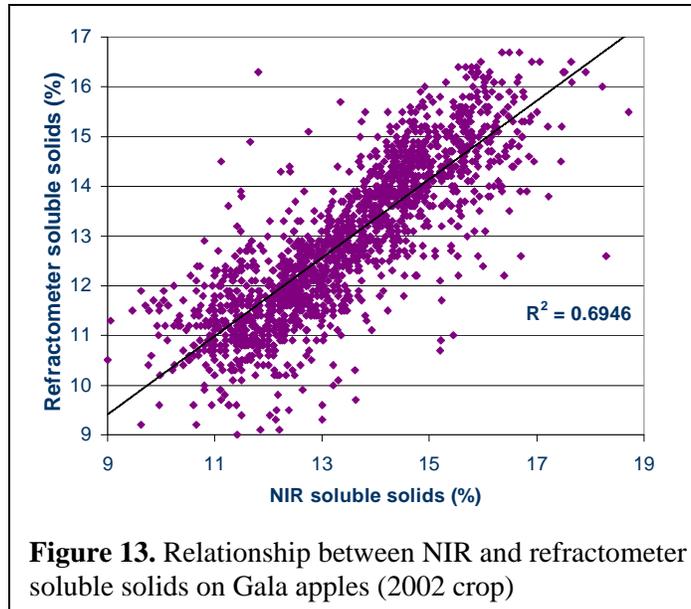


Figure 13. Relationship between NIR and refractometer soluble solids on Gala apples (2002 crop)

FURTHER READING

Harker, F. Roger. 1997. Texture of Fresh Fruit; Hort Reviews (20) 121-224.

Harker, F. Roger, 2000. Ensuring the edible quality of Washington – grown apples. Part I. – Consumer Research; HortResearch Client Report 2001/358.

O'Rourke, Des. 2005; World Apple Report

TRD Frameworks, 2000; Fall 2000 Regional Attitude and Usage Study; Washington Apple Commission

TRD Frameworks 2001; Don't Forget the Consumer; Washington Apple Commission

TRD Frameworks 2002; Red Delicious Analysis Report; Washington Apple Commission

Kupferman, E. <http://postharvest.tfrec.wsu.edu/>