

April 2006

VIRGO
publishing

Connecting You with Your Customer

Food Product

D E S I G N

Surveying Today's
Snackscape

Fresh Ideas for Fruit

By Cindy Hazen
Contributing Editor



When the Delany sisters, Sadie and Bessie, at age 104 and 102, discussed their longevity in the book, “Having Our Say” (Dell Publishing), they attributed it to two things: never having a telephone because it’s intrusive, and eating no less than seven different fruits and vegetables daily.

While all but the most solitary among us likely will shun the first recommendation, most of us see the value of adding more fruit to our diets.

The top three fruits consumed by Americans are oranges, apples and grapes. Though favorites, they are unlikely to generate excitement among consumers and retailers.

“There’s plenty of room for strawberry, apple, cherry and all of the basic fruits, but the industry is

pretty much saturated with all of the products,” says Bill Haddad, vice president technical services, American Fruit Processors, Pacoima, CA. In the beverage category, he believes it’s difficult for anyone in the industry to persuade retailers to consider any more beverages unless they have a unique twist, a new fruit or a new functional ingredient.

Developers can meet the challenge in two ways: by increasing use of basic fruit ingredients beyond the standard applications, and by introducing exotic fruits in more familiar scenarios.

Purées to powders

The first issue formulators face when designing fruit products is picking the correct ingredient.

Choosing the appropriate fruit ingredient entails more than deciding which variety of fruit to use.

The majority of fresh fruit is channeled to grocery, restaurant and immediate-consumption markets, observes Chris Chickering, culinary director, American Spoon Foods, Inc., Petoskey, MI. Product designers generally look at other options. “While some manufacturers use



fresh fruit, limited shelf life and processing requirements can be obstacles,” he says. “Individually quick-frozen (IQF), straight-pack frozen fruits and fruit purées are what I see as the industry standard for preserve and jam processors. Juices and concentrates are used by fresh-market consumers, restaurants and manufacturers. Dried fruit is another wide-use cate-

gory. Consumers see it packed for direct consumption in cereals, baked goods and restaurant plates.”

The choices don’t stop there. Ginny Bank, vice president R&D, RFI Ingredients, Blauvelt, NY, explains the options in fruit powders:

“The simplest is an air-dried or freeze-dried dehydrated powder.

It’s the whole fruit, meaning the only thing removed is water. The advantage of using a product like this is that you label it ‘apple’ or ‘blueberry.’ It has the whole food image.”

However, what could cause problems with these types of ingredients in certain applications, like beverages, is that they contain fiber.

“The dried fruit contains the skin or the fiber from the apple, for instance,” she continues. “Those may not be fully soluble.”

Purées contain some fiber, but less than the whole fruit. “It may be the skins are removed, like in a tomato purée,” says Bank. “Oftentimes, purées are spray dried. They’re not just dried. They have a carrier. Purées are a little more soluble than freeze-dried or air-dried.” The possible disadvantage is that the carrier, such as maltodextrin or tapioca starch, would have to be labeled.

Having a completely soluble fruit ingredient requires a spray-dried juice concentrate, according to Bank. “The product is juiced, leaving out all of the fiber and all the other insolubles. What’s left behind is just what you’ve spray-dried onto a carrier.”

Clarification is an important step for juice concentrates, Haddad ad-

vises. “When you just do a basic extraction, you extract all this other material that may not be water soluble. You put it in a beverage and it starts to settle out and it doesn’t look very pretty on the shelf after awhile.” Clarifying a concentrate and using fine filtrations and enzymes to break down the insolubles gives it a much wider range of applications, he notes.

Ingredient choice depends not only on the application, but on several other variables. Bank suggests considering an ingredient’s taste as well as its price. Powders made from juice concentrates have more flavor than air-dried powders made from whole fruit. “Organics are more expensive. Freeze-drying tends to be more expensive than air-dried. Purées are in between.”

Overcoming the obstacles

While the developer should be aware that each fruit may have unique characteristics, working with fruits often requires several basic considerations. According to Chickering, retaining piece identity is always a problem. “Cooking, pumping and filling processes all break down the delicate fruit particulate,” he says. “This can be somewhat controlled by macerating the fruit, using a two-stage cooking process, and limiting long agitated-fill runs and using specially designed food pumps that minimize particulate breakdown.” He explains that macerating the fruit “reduces the rate or intensity that the fruit cell structure is ruptured or compromised while exposed to heat, allowing for the fruit to retain shape and structure, resisting breakdown of the flesh cells. When the fruit has the benefit of maceration, the cell



Freeze-dried and air-dried fruit maintain the whole-food image, a plus for manufacturers wanting to boost a product's nutritional profile.

“These fruits will lose their original natural flesh color in processing and aging,” he cautions. “Adding other ingredients of the same color and using natural colorings can be of help here.” In a salsa product, he has added green chiles and green bell pepper to keep the color acceptable. “The color of the puréed chiles and peppers is stable,” he continues. With citrus products such as pink grapefruit, he finds success by adding a small percentage of crabapple purée, which keeps the color of the product pink. Browning is another persistent problem. “Many fruits begin to brown within moments of being peeled and processed, where the unprotected flesh is exposed to oxygen,” he says. “Acidulants are often added at processing to arrest the oxidation process. I’ve have had good results with lemon and lime juice to help keep fruits from browning. Additional browning may occur in the jar after fill. Proper fill temperatures, lower pH values and higher Brix (soluble solids) are all ways to limit this.” Sulfites are another method frequently used by food manufacturers to prevent browning.

Fruit functionality

As fruit is becoming more valued in food-ingredient statements, it’s worth looking at some of the ways in which fruits can be used to bring certain attributes to products. “Fruit-juice concentrates provide true flavor-specific sweetness and bright, true, enduring color,” says Chickering. “Fruit purées

structure is more gently broken as much of the juice inside the cell has already been removed. And the cell wall can allow juice to seep through as the heat expands it.”

One recommendation for maintaining the integrity of the berry comes from Tom Payne, industry specialist, U.S. Highbush Blueberry Council, Folsom, CA: Use simple thawing and handling techniques. “Overmixing should be avoided because it may cause breakage and color bleeding,” he warns.

Color bleeding is a common concern when working with dark-colored fruits such as berries and cherries. Their water soluble pigments tend to leach out in aqueous systems, and production can exacerbate the problem with pro-

longed mixing or other less-than-gentle processes. Payne suggests stirring blueberries into batter last to reduce color streaking. “Or they may be added between layers of batter,” he says.

On the plus side, these anthocyanin-based fruits can color a product in a positive way. However, “There has to be a low acidity to keep the color,” Bank says. “High heat is going to affect the color.” Anthocyanins are most stable at a pH below 3.8.

Blueberries experience the opposite with pH. “Acids, such as lemon juice and vinegar, can cause the pigment in the berries to turn reddish,” Payne says, adding “that blueberries may also change color when cooked.”

Chickering finds color retention of kiwi and citrus to be challenging.

Just as dried plums aid in moisture retention of baked goods, they offer the same functionality to soy-extended frozen meats.

are very useful in adding body, viscosity and mouthfeel to a variety of products. I use apple purée in American Spoon Foods' Lemon and Lime Sorbetto products. The natural pectin of the apple helps to stabilize the frozen sorbetto," Apple purée naturally enhances stability and mouthfeel while contributing natural fruit sweetness.

Certain fruits, such as passion fruit, can add punch to more subtle fruits like mango or pineapple. "Passion fruit is very bright, acidic and tropical in flavor," says Chickering. "Passion fruit's vivid, rich-yellow color can create a beautiful tropical feel, look and aroma to a product."

In many applications, fruit ingredients can completely replace sugar, according to Haddad. "If you were to use

apple concentrate as a natural fruit sweetener, it is about 70°Brix," he explains. "If you put 100 pounds of 70°Brix apple concentrate, it would actually replace 70 pounds of sugar. The difference in the 30 pounds is water in the product." All product designers have to do to replace sugar in a given formula is subtract out the additional water, or perhaps adjust the moisture of the other ingredients if there's insufficient water in the formula. "Take 70 pounds of sugar out of your formula, take 30 pounds of water out of your formula, and replace it with 100 pounds of apple," he says.

Plum good ideas

Other fruits can provide more than just sweetening power. Dried plums

contain about 17% sorbitol, notes James Degan, president, James Degan and Company, consultant to the California Plum Board, Templeton, CA. "We discovered there's more sorbitol in plums than any other food that we know of," he says. "It functions as a sugar alcohol, but it also functions as a humectant." Dried plums contain 25% to 35% moisture. In addition, about 7.5% of the dried plum is fiber.

This composition makes dried plums a star of fruit functionality. In the 1980s, dried plums became a fruit solution to fat replacement that works exceptionally well in chocolate products. "We were at 100% of shortening, oil and butter, and we still got comparable sensory results in terms of color, flavor and texture," says Degan. "It's an all-natural way to achieve most of the objectives that you are seeking. One of the things we did when we used dried plums as a fat replacer, we duplicated a couple of the more popular low-fat or fat-free bakery products on the market. We reverse-engineered



Tamarind
www.tamarindfruit.com

Aseptic Tamarind Puree
20/22° Brix

iTi tropicals

3371 Route 1, Ste. 209
Lawrenceville, NJ 08648, USA
Tel. (609) 987-0550
Fax 609-987-0252
info@iTitropicals.com
www.iTitropicals.com



Photo: Cherry Marketing Institute

and made our own using dried plums. Then we recreated the label for both products. When you see the one made with dried plums, we cut about a third of the ingredients out. Your cost goes down. It's a clean label."

The humectancy dried plums provide helps deliver the moist mouth-feel lost when fat is removed from baked goods. Degan suggests another reason dried plums work so well is that their acid composition is different than most other fruits. "A fairly high percent, about 2%, of the acid content of the dried plum is malic acid, which we discovered was a way to enhance or potentiate flavors in reduced-fat foods," he says. "Malic acid coats your mouth just like fat would. As you're chewing it, you are able to expand all the flavors just as you would if you were eating a full-fat product."

The lessons learned during the low-fat craze have other applications. Just as dried plums aid in moisture retention of baked goods, they offer the same functionality to soy-extended frozen meats. A school lunch hamburger found unappealing by kids was transformed with the addition of 3% dried plums to the raw meat block. "We were able to bind the moisture, which again is the result of fiber and sorbitol," explains Degan. "Dried plums could carry a lot more flavor."

A team of researchers at Texas A&M University, College Station, TX, determined that a 2.5% inclusion of fresh plum-juice concentrate or dried plum-juice concentrate in the beef roasts studied reduced the lipid oxidation associated with warmed-over flavor.

Perhaps most beneficial are the results of a study conducted by Daniel Fung, Ph.D., at Kansas State University,

The versatile cherry can add a tart note to simple salads or function as an unexpected flavor or texturizing ingredient in barbecue sauce.

Manhattan, KS. The study found incorporating plums in fresh ground beef suppressed the growth of normal flora and pathogens. After five days, the pathogens and total count were lower in the plum-containing products. "You need only 3% of the raw meat block to realize this benefit," says Degan.

Labeling is an obstacle many meat processors do not want to address, since any ingredient added to meat creates identity changes. Ground beef is no longer ground beef, for example. Yet for certain applications like sausages or patties, dried plum powder can serve as a base for a flavoring system. "Dried plum powder is blended with other flavoring sources," Degan says. "Because dry plum is a natural ingredient, it becomes a natural flavoring system that is then added to the raw meat block. It allows the meat processors to maintain a natural claim. Because dried plum accepts and rounds out a lot of other flavors without really imparting a flavor of its own, especially at the 3% level we're talking about, it really creates a flavor system. The flavor system might be chile-lime. It might be an Italian or Mediterranean blend with seasonings and dried plum powder added."

Just as plums extend the shelf life of meat, they offer the same benefit to baked goods. "Add dry plum juice concentrate into baked goods and you can gain another 14% to 15% shelf life because the sorbitol retards staling," advises Degan. "The acids in dried plums also serve to inhibit mold development."

ELEMENTS

Plum's flavor is unique. "Dried plum and dried plum juice concentrate is used as a base to make compound vanilla replacers," says Degan. "A pruny flavor note is one of the sensory characteristics that flavor tasters and testers would be looking for in certain types of foods. The benefit of all that is that dried plum really takes on other flavors." Combine with chocolate, and the consumer never tastes the plum, he continues. "By adding dried plum to any of the high-acid fruits, such as any of the berry products, you can extend the amount of berry that you need to still get the same amount of flavor." This can provide advantages when formulating with products like raspberries, which are expensive, he notes, as

"you can lower your cost and still get the flavor characteristics. And you get all the other functional benefits of dried plum. You can use as much as 30%. You can't taste it."

Plum's mild flavor makes it useful in a wide range of products. "Blueberries and cherries have a very characteristic flavor," explains Degan. "All of these products have been used as ingredients to do some of the things that dried plum does, but they all have characterizing flavors, whereas dried plums do not."

A taste of the exotic

Guava. Mango. Papaya. Not long ago they were considered unique. Now, in most markets, they are about as mainstream as pineapple, and the

industry wants to catch the next tropical wave.

Actually, the wave may be coming from South America. According to Haddad, açai, a Brazilian palm fruit, is at the forefront. "The açai flavor is a little fatty," he says. "It has a very lingering taste. It's not like any other fruit. It definitely has some flavor issues that have to be overcome." One way to address this is by combining it with other flavors. "Açai does very well with tropicals," he continues. "Probably passion fruit, mango. Passion's got a pretty intense flavor so it does very well. Pineapple works very well with it. Some of the berries—blackberry, raspberry, blueberry, those kinds of things—seem to blend very well with it." He cautions against trying to marry açai with a basic strawberry and apple.

The açai (*Euterpe oleracea*) palm plant is commonly found in the Brazilian Amazon. Its small (1.0 to 1.5 cm diameter) round fruits grow in green clusters that ripen to a dark, purple color. Most of the fruit is taken up by the seed; the fruit is covered by thin fibrous fibers with a small edible layer beneath. Macerating the pulp produces a juice that is approximately 2.4% protein and 5.9% fat. Bank describes açai as a berry. "It has a high nutritional value and a lot of antioxidants," she says. "There are a few companies that



Rife with natural sweeteners, fiber and humectants, and marked by a mild, neutral flavor, plums can be used to enhance everything from baked goods to meat products.

produce an açai juice that's available in health food stores." Testing done at University of Florida, Gainesville, found high antioxidant levels, including compounds such as epicatechin (129 mg/kg fresh weight) and p-OH-benzoic (80.5 mg/kg) as well as gallic acid, (+)-catechin, protocatechuic and ellagic acid, and others.

Another advantage of some of these lesser-known fruits is their high antioxidant activity, which may be a strong consumer selling point.

Noni, *Morinda citrifolia*, is a tropical fruit known for its medicinal properties and is found primarily in the South Pacific, particularly Hawaii and Tahiti. Rich in antioxidants, it's about the size of a potato and its color varies from white to yellow to green. It contains a number of nutrients of interest: polysaccharides (glucuronic acid, galactose, arabinose, rhamose, glycosides), trisaccharide fatty acid ester; scopolin (a compound that might be beneficial for healthy blood pressure and might possess antibacterial and anti-fungal properties); and vitamins and minerals, such as magnesium, iron, potassium, selenium, zinc, and vitamin C. "It works with tropicals, citrus and berries," Haddad says. "It needs products with strong flavor characteristics. Noni is not a very pleasant-tasting product and it smells terrible. Because that is so strong, you can put very little and still get a

pretty strong impact of that aroma."

Mangosteen (*Garcinia mangostana*) is a round, smooth-skinned, dark-purple to red-purple fruit, approximately 3.4 to 7.5 cm in diameter. The bitter rind contains purple, staining juice. The triangular segments of soft, juicy white flesh is slightly acid to acidic and mild in flavor, described

as a combination of grape and strawberry. It has the least intense flavor characteristic compared to açai or noni. "It's a little more mild. It's not quite as harsh," says Haddad.

Cashew fruit is the fruit, or "apple," from the cashew nut tree. In India, they candy the fruit or make it into jam or chutney, or extract the juice for carbonated beverages, syrup or wine. In Goa, India, the juice is used for a locally famous distilled liquor, *feni*. Brazilians eat the fresh fruit and drink the juice as a fresh beverage or use it for wine. The fresh fruits are highly perishable and the juice is astringent, due to its 35% tannin content (in the red type). "We carry a juice powder," says Bank. The juice concentrate powder can be blended with other fruits. "Cashew fruit juice has a pleasant flavor," Bank says.

Caupacu and camu camu are two other exotic juices offered by RFI. "We sell caupacu in a rain forest blend

juice product," Bank says. "It's another unique juice that has some nice flavors that's been used more in concept beverages that are trying to evoke the South American rain forest or the Amazon concept. All of these are being used not so much for their flavor component as being used as concept flavors."

Another advantage of some of these lesser-known fruits is their high antioxidant activity, which may be a strong consumer selling point. "Even though apple juice is good for you—it's healthy, it has all the nutrients, it has antioxidants—in the eyes of the consumer it's still apple juice," says Haddad. "When you get into something like pomegranate, suddenly they look at it as being more of a 'super juice.' It gives you a lot more than just any other juice."

For the record, according to Haddad, it took pomegranate about 17 years to go mainstream. With the advent of the Internet and consumer interest in nutritional research, the new fruits may emerge more quickly since they are being recognized for their nutraceutical properties.

Conceptual possibilities

True fruit salsas are one of the fastest growing categories, says Chickering. But other condiments can profit from added fruit. "Hot sauces and fruit mustards are two that have fruit added because it tastes good, but also because it defines the product," he says. "While still very functional as a mustard or a hot sauce, the products become more interesting, more marketable and more media- or press-worthy. Lower-cost fruits such as apple purée may be used to stretch a more costly fruit to keep a product in a particular price target."

“For rice and pasta dishes, diced, dried blueberries add a new dimension.”

Cherry salsas seem to be a popular concept, according to Cheryl Kroupa, marketing director for maraschino, canned and frozen cherries, National Sweet Cherry Foundation, Traverse City, MI. She suggests using maraschino cherries to add flavor and color pizzazz to desserts. “Maraschino cherries can be colored any color,” she says.

Kroupa sees endless uses for cherries as garnishes atop cakes and desserts. To complement cocktails, cherries might be soaked in anything from vanilla vodka to bourbon. “For the Bar and Nightclub Show this year I’m doing Makers Mark cherries dipped in dark chocolate, and vanilla-vodka blue cherries dipped in white chocolate.”

The U.S. Highbush Blueberry Council suggests incorporating blueberries into a honey-blueberry teriyaki sauce or a hot blue salsa. Citing the popularity of blue M&Ms, the council foresees dusting the outside of chips and snack crackers with powdered blueberries. “For rice and pasta dishes, diced, dried blueberries add a new dimension,” says Payne. “Replace capers with blueberries and

a little lemon juice.” Adding blueberries to black Thai rice complements the natural purple cast of the rice while adding additional health benefits. “For beverages, integrate blueberry skins into the beverage mix,” continues Payne. “It’s in the skins that most of the anthocyanins and color is found. How about a blueberry mojito or a blueberry bubble tea? Many berry juices are marketed as clear juices. Blueberry juice blends treated with pectic or commercial enzymes result in a clearer final product.”

A simple look at the mass market indicates this may not be far-fetched. “A good example is Anheuser-Busch’s blueberry-infused beverages,” says Payne. Two Anheuser-Busch blueberry beers were introduced at the Great American Beer Festival.

In developing new fruit products, Haddad suggests keeping this in mind: “The things that seem to get most people’s attention are products that have a certain familiarity, but have a unique twist on them. Don’t take it to such an extreme that they lose their familiarity with it and are afraid to try it.”

The challenge is as old as product development. “People want something different but they also want something an average consumer might be familiar with,” continues Haddad. “How do you bring something new when people don’t know about it, and, if they know about it, then maybe it’s not new.”

In the end, the answer to increasing fruit consumption may be as simple as the jars found in the Delany sisters’ pantry. “There’s a reason why our ancestors froze and canned all these things,” says Kroupa. “They hold up very well in the canning process. They had multiple uses and they’re good for you.” Maybe, just maybe, it’s time to resurrect the watermelon pickles. ■

Cindy Hazen, a 20-year veteran of the food industry, is a freelance writer based in Memphis, TN. She can be reached at cindyhazen@cs.com.