Taste Evaluation of Apples from an Ontario Fruit Garden

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PART I

"There is in the Apple a vast range of flavours and textures, and for those who adventure in the realm of taste, a field for much hopeful voyaging." (4:3)

This article presents a taste tour through a Toronto fruit garden which has fruited several hundred apple cultivars. It attempts to evaluate fresh fruit eating quality, traditionally defined by multifaced terms such as dessert value, condition, flavour, flesh, texture, aroma, taste and quality.

Part II will give the author's ratings—good and bad—with comments on 22 top rated cultivars so as to provide a frame of reference for the reader. But standards must be established for any evaluation to be meaningful. Hence, Part I will first review some of the problems inherent in the subjective task of characterizing and judging eating quality.

The perception of fruit flavours and their description has always intrigued and frustrated the pomological world. In the practice of systematic pomology, little has changed, other than by abstention or standardizing on stereotypes such as a "pleasant," "characteristic flavour," "good as dessert," etc., since J. J. Thomas (10:161) deplored in 1846 "the miserable looseness which has prevailed with nearly all pomological writers, relative to the unvarying and most distinctive test of varieties, the flavor."

The dilemma stems from the copiousness of flavour constituents and the inherent isolation problem. A blindfolded person whose nose is plugged can not distinguish between pieces of onion, apple and turnip touching his tongue. They have the same slightly sweetish taste and it takes the olfactory membranes of the nose to perceive their real character or aroma.

The flavour sensings by tongue, palate and nose report through different nerve channels registering simultaneously in the brain. There the analytical operation takes place by which we judge—and originally named—Winter Banana as well as Moscow Pear, Pineapple Russet, Norton's Melon, Lowland Raspberry, D'Arcy Spice, etc., etc. While the perception route is traceable, the process itself is so immensely complex that it far exceeds the capacity of any computer. "It takes thousands of taste buds, tens of thousands of nerve fibres and hundreds of millions of olfactory cells to arrive at a flavor impression" (7:8). The current stereochemical theory which goes back to an imaginative Roman epicurean, Lucretius, holds that every component of an aroma such as fruity, flowery, spicy, musky, etc., corresponds to a molecular shape and size pattern which, like a key, will fit a particular receptor socket in the nose.

Of the subjective factors influencing taste, variations in perceptive potential appear to be more significant than likes or dislikes. Thus, sugar taste thresholds vary greatly between age groups, according to Moncrieff (6:228). He also found that children have a greater appreciation of fruit odours than adults have (7:10). Anosmia, the "plugged nose" effect or taste blindness — the Chinese call it "inability to distinguish a fragrance from a stink"—occurs in varying degrees and types. Ultimately it may be one reason that tastes differ from person

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to person. Tempo and thoroughness of chewing are also significant. If we stop chewing our apple its taste will fade away. Only when mastication resumes and the cud is moved around new taste buds come into play, new fruit cells are exposed and flavour is again perceived.

Regional preferences are not necessarily taste selections but probably reflect psychogenic factors such as the engraining effect of adopted cultivars in good supply. So does in our opinion a super-regional difference mentioned by Brown (3:18), the preference for low sugar–low acid cultivars in North America comparing with a medium to high sugar–medium acid preference in Europe.

Some of the environmental factors affecting the eating quality of dessert cultivars coincide with growing considerations: locale, cultural practices, tree age, crop size, solar exposure and rootstock. Fruits from trees or tree parts with inadequate assimilation areas are predestined to insufficiencies in sweetness and, more critically, in aroma. Golden Delicious, when developing less than 12% sugar, will not give an acceptable aroma (9:266). Atypical and "off" flavours are known to be caused by organophosphate sprays as well as by calcium based bitter pit sprays. There is also evidence that acidity variances result from different cross pollinations.

"The right season to eat an apple is a matter of importance; to catch the volatile esters at their maximum development, and the acids and sugars at their most grateful balance requires knowledge and experiment" (4:5). The ripening span offers a wide and varied flavour spectrum. Taste improves or suffers as accelerating enzyme systems change acids, sugars, alcohols, pectins, moisture and trigger the formation and loss of volatile compounds. Cell walls, weakened by senescence, are changing the flesh texture of the fruit. Determining the ideal constellation, the moment of optimum eating pleasure and of fair evaluation becomes a subjective and somewhat irrational task, but any valid test requires the attempt.

Although individual flavour preferences vary greatly and on occasion, and allowance must be made for varietal performance, the opinions of discriminating pomologists are surprisingly congruent. They may not see eye to eye about "the best dessert apple" but show more agreement than divergence. Yet most of them did not assign a very high proportion of the merit potential of an apple cultivar to its eating quality. Distinction between "commercial" and "special market and home" cultivars even resulted in different maximum scores. Sears (8:19) uses 12% and 30%, McCue (quoted in 5:266) 15% and 25%, respectively, to denote the relative importance of eating quality. A preferred maximum is 20%, indicating that apple production and marketing are hardly oriented to epicures. Perhaps this is why taste excellence is not a target or an economically vital criterion in the breeding and selection of modern apple varieties.

Our evaluation uses three criteria which, cumulatively, determine the score of each cultivar.

1. **Organoleptic Impact.** This is the initial taste experience before any analytical consciousness. It takes only about 1/400th of a second. Catching the evanescent flavour nuances it may be love at first bite, a first total impression which establishes a degree of pleasure and desirability.

2. **Chemical Impression.** Analytically more accessible, this appraises the types, balance and synergisms of flavour components. Basic categorization was established by Truelle (11:27), the first to use chemical analysis for corroborating taste evaluations of dessert apples. The flavour characters he

considers indispensable are sweetness, aroma and acidity. Important contributory sensations are bitter, cool and astringent.

Aroma must be considered the most significant and characteristic flavour component of dessert apples. It determines the refinement or "class" of a cultivar or specimen over and above the typical and average. It is derived from more or less volatile compounds developing in the skin and the pulp of the apple but, typically, concentrated just below the skin. The skin is often insignificant as aroma carrier. Very close paring and immediate tasting is essential. Many of the constituents in the apple are instable in contact with air, light, heat, saliva, or knife blade. Degree of volatility or fixation of the aromatic compounds varies greatly and is not a quality criterion in itself. The redolence of Gravenstein or McIntosh has its peer in the fixed aroma of Cox Orange or Blue Pearmain. Aromatic substances and their precursors add up to about 1/25,000 of the weight of an apple. An aldehyde and ester fraction of about 1/10 of this minute quantity establishes the "typical" flavour of a cultivar together with still unidentified minor compounds.

Sweetness and acidity are the other flavour essentials, independently and in combination. The sugars and prosugars that contribute to the measurable sugar content vary in sweetening value and perceptible effect. Thus Red Delicious may contain less total sugar than Northern Spy but taste sweeter, an effect accented by the latter's higher acid content.

Tartness or "richness," in the language of the old pomologists, of an apple is determined by acids, some with significant aroma value. Malic acid is dominating and typical but, unlike the cumulative sweetening effect of the sugars, the acid constellation appears to influence the taste quality independently of pH or titratable acidity. An almost crude simplicity of the malic seems to prevail in some summer apples. Red Astrachan, Ladies Finger, Court of Wick call for a lower score than the tangy yet balanced tartness of Cludius, Jonathan or Blenheim Orange.

A refinement contributed by tannic acid is the trace of piquant astringency at the flavour peak of some varieties, particularly noticeable in Russets. Moncrieff (6:99) reports that tannins increase taste sensitivity to other acids.

A balanced sugar and acid content adds to the flavour appeal. Thiault and Debeunne (9:260) found that a sugar-acid ratio of 25:1, determined by refractometer and titration, respectively, is about threshold for tartness acceptability in Golden Delicious and also that a proportionate increase of both improves the flavour score. This ratio will not apply to all tastes or cultivars but a gustatory correlation of sugars and acids definitely exists. So will increased noise levels raise the absolute perception threshold for sugar but lower that for tartaric acid (1:228), and the fair sex is reported (1:58) to have a higher sensitivity than men for sweet but less for sour. Top rated cultivars have enough reserves of both to assure a continuous appeal during the eating process.

3. **Physical Impression.** This is a composite criterion embracing any sensation contributing to the mouthful of an apple. No systematic terminology exists for it. It is much more complex than the conventional term "texture" implies. Between the first bite and the final swallowing one may experience a variety of mouthfuls. An apple may be tender, soft, tough, crisp, coarse, dry, slippery. It may retain juice and/or flavour or drain them quickly. There are other kinesthetic and tactile sensations which are not readily definable. The sound of biting and munching plays a role. So

does temperature as Baten (2:84 ff.) has demonstrated. He found the same group prefer an eating temperature of 33° F. for McIntosh, Fameuse, Grimes Golden and Delicious and one of 72° F. for Baldwin, Rhode Island Greening and Steele's Red. One may speculate that the less aromatic apples benefit from the higher temperature to taste their best.

PART II

Applying the criteria set out in Part I rating terms have been established in the following ranges: 18-20 Best; 15-17 Excellent; 12-14 Good; 9-11 Acceptable; 5-8 Inferior; 1-4 Poor. This scale is an adaption of the linear hedonic scales commonly used in food evaluation.

Obviously such ratings are informative only in a relative sense and cannot substitute for analytical flavour profiles. This Part II will commence with impressionist comments and metaphors about some of the author's favorite apples including a few foreign cultivars not likely to have been widely tested in North America. Ratings of the other varieties follow in seasonal groupings.

All specimens originated in a fruit garden located one mile north of Lake Ontario just within the northern limit of Plant Hardiness Zone 5a under these conditions: Fox Sandy soil, mulched and fertilized sod, sloping south-eastern exposure, multivariety trees mostly on EM IX, repressive pruning for open centers and horizontal extension, hand thinning.

THE FAVOURITES

Blaze: Strong, almost effervescent aroma composition dominated by a piquant stimulating "lacquer thinner" note. Tanginess just subdues sweetness. A respectable thirst quencher.

Cludius: Exciting, titillating fruitiness with brisk quince tones. Pleasantly sharp. Tartness buffered by tender flesh and tangible sweetness.

Cox Orange: Strong, warm, harmonious blend of the typical in apple with the flavours of almond, persimmon, anisette, fennel and traces of other sweet-spicy aromas. Low volatility retards loss of aroma to the atmosphere and preserves the full flavour spectrum. Fine, prickly acidity and abundant sweetness.

Dr. Oldenburg: Sprightly with typical reinette character and fragrant notes of pineapple and grape. Excells by highly refined tanginess.

Ellison's Orange: Intense floral bouquet and tropical fruit notes. Scent is a revelation. Very succulent. Retains flavour to the last swallow.

Erwin Baur: Strong fruity wine aroma reminding of muscatel with added touches of pineapple and pear. Well rounded-off and persistent tanginess.

Herring's Pippin: Full-bodied ethereal aroma composition highlighting coumarin, lilac and fennel notes. Mildly acid. Tender flesh is almost melting in the mouth.

Kerry Pippin Reminiscent of the sweet spiciness of Margil but jucier, brisker and with a touch of dead ripe banana. Enhanced by a subtle fresh tang.

Kidd's Orange Red: Flavour of the Cox Orange type. Added touches of floral, cucurbital and herbal (fresh parsley) aromas add to the uniqueness appeal. High fructose-type sweetness but not cloy.

Lady Sudeley: Flavour related to that of Ellison's Orange but lighter, subdued and with an ethereal note. Juicy and sprightly refreshing. Rather subject to vintage variations.

Mantet: Pervasive typical apple flavour with accents of strawberry and 7-Up. Sweetness and acidity well balanced. Added pleasure impact from succulence and unexpectedly tender, almost slippery flesh.

Margil: Rather concentrated fruity composition with faint overtone of pear drops. Spicy admixture suggestive of fennel and cinnamon. Sweet, dense flesh with threshold acidity.

Merton Beauty: Ambrosial aroma symphony of floral, fruity and spicy elements. "Chanel No. 5" of the apple world. Superbly integrated flavour culminates in ethereal suggestions of musky pear, cinnamon, rose and refined petunia. Optimum sugar—acid balance and easy eating flesh.

Melon (Norton's): Medium intense, classically typical apple flavour. Impressive by directness and purity with a congenial touch of ripe cantaloupe.

Owen Thomas: A pomified fruit salad mainly of banana, cantaloupe, maraschino cherry with a dash of rose water.

Red Ribston: A fruity-spicy aroma blend integrating elements of apricot, musk, almond and fennel. Ideal acid-sugar complex. In the words of Eden Philpott's poem "Ribston Pippin":

"Oh more than apple: an elexir too;
Who would not woo
The incomparable mystery he stores
From Orient garths and spicy
scented shores?"

Rose de Berne: A "feminine" type with gentle sweetness. Aroma is suavely delicate, a filigree of violet, jessamine, carnation and strawberry aganist a pure apple background. Flavour poise at its best.

Tumanga: So far the best apple with modern bouquet. Light-bodied Red Ribston flavour with a dash of Champagne, a touch of tannin and a soupcon of Russia leather. Inobtrusive sugariness.

Wayne: Fresh tutti-frutti aroma with undertone of pear, banana and clean, white-fleshed peach. Also a spicy accent. Delectable high sweetness tempered by refined acidity.

Winston: Pronounced fresh pineapple accent with a suggestion of dead ripe gooseberry. A fine touch of bitters gives body to its peppiness.

Zoba: Strongly aromatic reminding of Fameuse but less dominated by what could be ethyl acetate. Piquant touch of dill. Succulent, sweet and with a fine tang.

Zuccalmaglio: Strong harmonious fruitiness, exciting and titillating with tones of wood strawberry, quince, pineapple and pear and a fine floral touch. Penetrating without pungency. Sugar and acid in perfect balance. Although subject to vintage variations this could be an ideal breeding partner to "wake up" Golden Delicious.

RATINGS

* = Subject to pronounced vintage variations

Prior to August 31

Rating	
16/17	Astillisch
16	Austin
4	Baladi
10/11	Beacon
8	Beauty of Bath*
7	Blushed Calville
13	Charlamoff
12/13	Duchess
13	Early McIntosh
16	Exeter Cross
11	Fenton
13/14	Garden Royal*
8	Lodi
18	Mantet
13/14	Mela Carla*
19/20	Merton Beauty
14	Miami
12	Monstrueuse de Navrivroche
12/13	Montreal Peach*
12	Moscow Pear
8	Nicholson
13	Ottawa 292
11	Papirovka Polska

Rating	
17	George Cave
15	George Neal
9	Gordon Hill
10	Huvitus
13/14	Irish Peach*
14/15	Julyred
14	Kalco*
18	Kerry Pippin
19	Lady Sudeley*
6	Lavia
13	Laxton's Epicure
11	Liveland Raspberry
17	Owen Thomas
14	Quinte*
7/8	Red Astrachan*
8	Red Atlas
11/12	Red Melba
7	Red June
16/17	St. Everard
6	Sops of Wine
11	Summer Rose*
11	Sweet Winesap
10/11	William's Early Red
11	Yellow Transparent

September 1 to 15

Rating	
16/17	Beverley Hills*
12	Calville Rouge d'Automne
15/16	Chenango Strawberry
13	Ein Schener*
19	Ellison Orange
8	Garland
17	Herrings Pippin
6	Hollow Log
8	Iowa Beauty
8	Ladies Finger
13/14	Langley Pippin*
15	Laxton's Advance
10	Lyman's Large*
14/15	Primate
9	Rev. Wilks
7	Stark's Earliest
16	Tydeman's Early Red*

September 16 to 30

Rating	
10	American Summer Pippin
15	Ananas Rouge
17/18	Blaze
12	Canvada*
10	Chestnut Crab
12/13	Dulmer Rose
9/10	Fey's Record
15/16	Gilliflower of Gloucester
15	Golden Manna*
16/17	Golden Nuggett*
7	Heyer 12
12	James Grieve
13	Jefferis
13	Joyce
10	Lord Roseberry
14/15	N.Y. E-18*
16/17	Red Gravenstein
17	Signe Tillisch*
14/15	Worcester Cross

October 1 to 15

Rating	
10	Brunnsapple
14	Calville Rouge Mont d'Or
10/11	Chehalis*
13/14	Goodland
12	Kandil Sinape*
8	Lord Lambourne*
13	Lord's Seedling
17/18	Rose de Berne
16	Saltcote Pippin
14/15	Schaener von Nordhausen
7	Seidenhemdchen
12/13	Snygg
16/17	Spigold
11/12	St. John

Rating	
13/14	Peace Garden
9	Pewaukee
13/14	Pink Pearl*
15	Reddie
12	Red Esther
18	Red Ribston
13	Tioga
15	Transparent of Croncels*
15	White Pippin
13	William Crump
17	Zoba

October 15 to 31

Rating	
15	Black Gilliflower*
15/16	Blenheim Orange
13/14	Blue Pearmain
11	Bridgewater Pippin
13/14	Cellini*
7	Court of Wick
17/18	Cox Orange
13	Curltail
16/17	Dr. Matthews
17	Dr. Oldenburg*
11/12	Fallawater
13	Finkenwerder Prinz*
15/16	Foxwhelp
16	Fraise
14	Gewurzluiken*
13	Golden Harvey
14	Groninger Kroon
10	Haas
14/15	Holstein Cox
14	Howgate Wonder
15	Hudson's Golden Gem
14	Ingrid Marie
14/15	Jersey Black
16/17	Jonathan
16	King of the Pippins
12/13	King of Tompkins County
11	Landsberger Reinette
13/14	Linnton
8/9	Maiden Blush
17	Melon (Norton's)
3	Messire Jacques
14/15	Mother
9	Muster
10	New Holland Pippin
13	Niagara
9/10	Nodhead
11/12	Old Nonpareil
12/13	Opalescent
13/14	Pomphelia Reinette*
12	Prairie Spy
14/15	Redgold*
11	Smokehouse
15	Spartan
16	Tinsley Quince
9	The Houblon
7	Tropical Beauty
17	Wayne
12	Washington Strawberry*
8	Wilson's Juicy
14/15	Zabergau
18/19	Zuccalmaglio's Reinette

November and December

Rating	
10	Abbondanza
15	Adam's Pearmain
11/12	Alant
11	American Golden Russet
16/17	Ananas Reinette
15	Anise Reinette
12	Belle et Bonne*
17/18	Cludius
18	Cornish Aromatic
9	Lombart's Calville
12/13	London Pippin*
10/11	Longfield*
17	Lord Burghley
15	Macoun
17	Margil
15	McIntosh Red
14/15	Minnetonka Beauty*
12	Monocacy
11/12	Muscat Reinette

Rating	
8	Cortland
14	Court Pendu Plat
13	Danziger Kant*
14	Dutch Mignonne
18	Erwin Baur
13/14	Esopus Spitzemberg
9/10	Fireside
9	Franc Roseau*
17	Freyberg
13/14	Fuerst Bluecher
17	Golden Delicious (tree ripened)
16	Golden Reinette of N.Y.
14	Gronsveldter Klumpke
14	Gule (Yellow) Richard*
14/15	Hildesheimer Gold
13	Hoary Morning*
12/13	Holiday
11/12	Hubbardston Non Such
17/18	Kidd's Orange Red
10	King David*
16/17	King's Acre Pippin
14	Kuhlander

Rating	
13/14	Mutsu
6	Newtosh
14/15	Ohenimuri
13/14	Pigeonet Blanc
10	Pigeonet de Rouen
15/16	Pomme Poire
11	Pumkin Sweet
14	Red Delicious
16	Regent
13/14	Reinette Grise Ausseur*
15	Reinette Grise Parmentier
13	Rubin
11	Roman Stem
9/10	Rosa Gentile
7/8	Russet Pearmain
16	Secor
14	Spencer
10/11	Sutton
14	Sweet Russet
15/16	Swiss Orange
14	T-391 (Ontario)
18/19	Tumanga
9	Turk's Cap
11	Versveldt*
17/18	Winston

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