Apple Varieties of Commercial Interest

BRAEBURN
Susan K. Brown

Synonyms: None known
Parentage: Probable parents are Lady Hamilton x Granny Smith.
Patent Status: The original Braeburn is not patentable in the USA. Red strains from New Zealand are under test.

FRUIT DESCRIPTION:
Size range: Medium to large.
Stem length: Medium.
Fruit shape: Oval with crown.
Skin color: Poor grade of red stripe on green. Red strains can be all red if there is good exposure to sunlight.
Flavor: Excellent. Sweet/tart and aromatic.
Flesh color: Buff to yellow if mature, pale green if immature.
Texture: Firm, crisp and very juicy.
Storage life: Long-six months in common and likely a year in CA.
Maturity date: Late. Probably overlaps with Rome Beauty, Fuji and Granny Smith. Depends on nitrogen level and vigor of the tree. More grower testing needed to determine the maturity indices.

TREE CHARACTERISTICS:
Vigor: Low to moderate. May run out if over cropped.
Growth type: Spur type.
Precocity: Very good, but has shown biennial tendency.
Bloom season: Mid season. Has extended bloom.
Pollination requirements: Any diploid in the same bloom season. Winter Banana and Red Delicious are being used by some growers as pollenizers.
Cold hardiness status: Appears adequate.
Disease status: Susceptible to scab, mildew, Brooks spot, and fire blight.
Physiological disorders: Braeburn is very susceptible to bitter pit, especially on young trees with a light crop. Depending on vigor and crop load, three to five sprays of calcium chloride may be needed to control this problem. Biennial bearing.
Availability sources: Commercially available from many nurseries.
Commercial status: Braeburn is well established as an export variety for New Zealand. While there is increased interest in the US, Braeburn may not be a success in cool, late season areas.

SPORTS:
While several sports are being tested only Hillwell is available in the US. This sport has not yet fruited at Geneva.

COMMENTS (The following comments represent a compilation of information from the references cited):
Pruning and training: At planting time Braeburn trees that are feathered should have branches headed to prevent blind wood and encourage new growth in the first year. Braeburn will do well as a central leader type tree and will fit into a high density system with this tree structure. Management of the top of the tree is the key to well structured Braeburn trees and the production of large quantities of fruit.
A grower in Oregon has evaluated Braeburn for several years (Waliser, 1989, 1990). Compared to Gala and Fuji he found Braeburn to be a much weaker growing tree, especially in the top where it tends to produce many limbs, often with no dominant central leader. This weak top and tendency to fruit early can cause Braeburn to run out and not grow to its desired volume, reducing ultimate bearing surface potential. In the first 3 to 4 years it is important to allow the trees to grow and fill desired volume before producing heavy crops. Proper crop and tree management are more crucial with Braeburn than with many varieties.
Braeburn characteristically has a weeping habit. However, buds will break and grow into upright shoots which can be used to renew fruiting wood and form new limbs. Fruits are produced on one year old wood and on fruit spurs, with spurs producing the highest quality fruit. A range of fruit shapes occur, from round to long to typey.
Nitrogen: Braeburn is not nitrogen friendly (Waliser, 1989). Moderate to high nitrogen with excessive tree vigor will contribute to bitter pit, lenticel breakdown problems and poor storage life. High nitrogen levels will also result in poor color and quality.

Rootstocks: There is a degree of incompatibility between the stock and scion, forming a weak union. This is especially true on EMLA 26. Braeburn trees must be supported during the first year to prevent breaking at the bud union.

Harvest and storage: Harvest time in Oregon is about a week before Granny Smith and about 7 to 10 days before Fuji. Braeburn develops most of its red color during the week before harvest. Soluble solids should be at least 10 to 12%, with firmness of 16-20 pounds at harvest. Two to three pickings are needed to harvest Braeburn at proper color and maturity. Optimum maturity may be just before the ground color changes from green to yellow. Braeburn stores comparable to or better than Red Delicious. While Braeburn can develop a lenticel breakdown in the skin during storage, this may be associated with fruit from young trees (Kupferman, 1992).

Regional Testing: Braeburn was discussed at the Mid-Atlantic Fruit Varieties Showcase (Marini, 1992). In Virginia, Braeburn matures with or slightly after Golden Delicious. The fruit is unattractive, develops bitter pit, and preharvest drop may be a problem. The fruit quality may improve as trees get older and settle into a good fruiting habit. Shoots are susceptible to quince rust. The tree has a brittle graft union on M.26 or Mark rootstock. In Virginia, the potential is unknown and only limited test plantings are recommended.

Fire blight susceptibility: In Southwest Michigan, 2 and 3-year old trees on M.7a or M.7EMLA were evaluated following a severe fire blight epidemic in 1991. Braeburn was highly susceptible. It had 26 to 50% of the tree blighted in July, with 50 to 75% of the tree blighted by September (Lehnert, 1993).

Comments specific to NY - A major concern is whether we can mature Braeburn in New York. The Braeburn that we have in our collection matured within our harvest season in 1991, but in previous years there had been notes of harvest not being acceptable. The quality was good in 1991, but the external appearance was poor. Apples tested out of storage in February had penetrometer values of 17 pounds and a nice mix of sugar and acid. The fruit quality of Braeburn at harvest may be too acid for some tastes. Extreme susceptibility to fire blight is also a concern.

References:
Ballard, J. 1993 (March). Don’t give up on Braeburn. Good Fruit Grower 43-44.

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Apple Varieties of Commercial Interest

FUJI
Susan K. Brown

Synonyms and strains: Tohoku #7
Origin: Bred by the Tohoku Research Station, Morioka, Japan. Selected in 1939, introduced in 1958 as Tohoku #7, and named Fuji in 1962.
Parentage: Red Delicious x Ralls Janet.

FRUIT DESCRIPTION:

Size range: Medium.
Stem length: Medium to long.
Fruit shape: Round to conical.
Skin color: Similar to standard Delicious, red strains have pin stripes over medium red. Background is green to light buff. Red strains have more color if exposed to good light and cold frosty nights prior to harvest.
Flavor: Sweet - excellent. Good aromatics. Too sweet for some tastes but texture may compensate.
Flesh color: Yellowish-white.
Texture: Firm and fine. Excellent firmness that is maintained in storage.
Storage life: Very good. Can keep up to a full year in CA. In addition the shelf life in retail markets is excellent even at room temperature. External breakdown will occur rather than internal so retailers and consumers are ensured good quality fruit.
Maturity date: Late. May ripen ahead of or with Granny Smith. Maturity can depend upon nitrogen levels.

TREE CHARACTERISTICS:

Vigor: Medium to high vigor. Dwarfing rootstock and French Axe training preferred on the West Coast
Growth type: Standard with very good spur development. Can produce blind wood.
Precocity: Very good.
Bloom season: Mid to late.
Pollination requirements: Any diploid variety in the same bloom season.
Cold hardness status: Presently proving to be adequately hardy, but some reports of possible injury in north central Washington. Less frost tender than Red Delicious, but more tender than Golden Delicious.
Disease status: Susceptible to alternaria spot, mildew, blister spot, and fire blight. Fuji shows a little resistance to apple scab.
Physiological disorders: Scald, watercore and russet have been reported but not at unacceptably high levels. Russet may be more of a problem under eastern conditions.

Availability sources: Many nurseries carry Fuji and its sports.
Commercial status: Fuji is a major variety in Japan where it commands 44% of the market. Washington and California now have large plantings of Fuji.

SPORTS:

The following are some of the strains being tested in the US and their patent status (Ballard, 1990):

BC Type 1 entered Canada as Morihofu #1. It is an irradiated selection with a red blush color pattern. Most nurseries no longer carry this strain where BC Type 2 is available.

BC Type 2 entered Canada as Morihofu #2. It is an irradiated selection with a striped color pattern. It is reported to display stronger red color than the standard.

Naga-fu selections are from the Nagano Fruit Tree Experiment Station in Japan.
Naga-fu #2,6, and 12 are considered their best but are not showing much color as grown in Eastern Washington. TRECO’s catalog states that #6 demonstrates the most consistent and stable striping pattern, without taking away the quality. #12 is said to have the same attributes as #6, but may carry a higher degree of color. BC Nagano #1 is not to be confused with Naga-fu #1.

Aki-fu selections are from the Akita Fruit Research Station in Japan. #1 with faint stripe color pattern is considered inferior as tested in Tasmania. Cannot be called a desirable red strain.

Seiko-fu Red Fuji is an irradiated selection from the Morioka Fruit Tree Experiment Station in Japan.
TRECO Red Fuji T.A.C. -114 matures 4 to 6 days earlier than standard Fuji with reports of striped color over 80 to 95% of the fruit.

Yataka™, is an an early sport of Fuji found in Japan in 1986 which shows two to three weeks advance in maturity. ProTree nurseries, Brentwood CA has the rights to this variety. Mixed reports on appearance, flavor and maturity. Performance in Massachusetts has been promising. A red sport of Yataka, named Beni-Osho, may be available from ProTree in the near future.

Several red sports of Fuji have been found in Washington orchards and are being selected for test. BC clones (Morihou-fu) were cleaned up by Agriculture Canada and released to nurseries without restrictions. BC#1 shows some stripe, but the least amount of color. BC#2 shows the most stripe but not when the tree is young. Nagano 1 is the best colored of the three but it is not striped. Nagafu #2, 6 & 12 were put in heat therapy in Prosser and must be restested after virus removal to see if varietal characteristics are maintained. Nagafu #6 is reported to have the most stripe, then 12, then 2, with the amount of color just the opposite.

Availability: BC #1 and 2, Naga-fu 2,6 &12, TRECO T.A.C. -114, and Yataka are available from nurseries, but the others are not yet named or patented in the US.

COMMENTS (The following comments represent a compilation of information from the references cited):

Pruning and training: Fuji has the tendency in the nursery to make one branch very dominant. This must be addressed at planting time. Fuji’s growth habit is like a standard Delicious. Fuji produces a lot of blind wood, and while much fills in by the end of the third leaf it may not be enough. Tye Flemming of Cameron Nurseries (1989), suggests some type of manipulation of the central leader during the growing season to alleviate this problem, whether it be bending, girdling, leaf removal, pinching or heading in mid-summer. He stated that blind wood on large branches of nursery trees is also a problem and suggests heading back any branches >24” to 14-16”, or girdling them. While girdling was successful heading would probably be more cost effective.

Thinining: Fuji can overset and heavy thinning is required to produce larger fruit, more even maturity and offset its tendency to go biennial. In Oregon three year old Fujis were difficult to thin with very little results from 3/4 pint of Elgetol/100 gallons at full bloom and 1/2 lb Seven per 100 gallons at 10 to 15 mm. Hand thinning was needed to break up the clusters on almost every spur. Stems were thick and a little more difficult to thin than spur Red Delicious (Waliser, 1989).

Fruiting: Fuji appearance can be variable. The skin color can range from a dull muddy brown to a clear bright red. Fuji apples growing on a light crop tree mature earlier than on a well cropped tree by as much as 10 days. Fujis grown on weak fruiting wood or late flowering young spurs mature later than fruit borne on older wood. Fruit on young, vigorous trees have a dull appearance while fruit on older trees are usually more attractive (Kupferman, 1992). Several reports indicate that Fuji does not give good fruit quality the first couple of years. In general, fruit in the first few years will not have as much color, stripe, or internal quality. One Oregon grower recommends thinning early to slow the trees down and get into a fruiting habit. By 3rd or 4th leaf the N level should be lowered considerably. In the west they find that good red color and eating quality is only achieved with reduced nitrogen levels, comparable to levels to produce good quality Golden Delicious (Waliser, 1989). Fuji is moderately precocious- it can produce fruit on one year old wood. Blind wood occurs but some growers say that it is not a problem, it fills in eventually. However, early limb positioning is important. California growers report production at 20 to 30 tons/acre compared to 30 to 40 tons for Granny Smith. They have also noted fruit rots on the tree and stem end cracks associated with late harvest. Late harvest will not be a problem in New York.

Harvest and storage: Harvest and storage information on Fuji was presented by Dr. E. Kupferman, WSU in 1992. He reported that Fuji requires several pickings. In Australia the following harvest sequence is recommended: first picking of all light crop fruit, the main picking includes normally cropped trees except for fruit on 1-year old wood, and the third and final picking includes fruit on 1-year old wood (usually of lower quality).

Soluble solids concentration is not a useful harvest guide because of the tremendous seasonal variation (12 to 19% Brix). Some growers harvest at the first signs of watercore in the most mature fruit on the tree. However, Fuji can watercore and still be very starchy. Selection of fruit to harvest should be gauged by ground color because by the time the fruit have a golden ground color most will have severe watercore. Tests in Washington suggest that fruits are ready to harvest when they start to lose their green ground color.

Researchers at UMass found that in 1990 Fuji maturation coincided with the end of Golden Delicious harvest and the start of Rome harvest (Greene and Autio, 1990).

Fujis have a reputation as having long storing ability. Fujis stored in regular storage at 32-33 F until June remained above 15 lbs firmness. CA results have depended on the study, but in one test CA fruit was 3 lbs firmer than that in regular storage.

Bruising and stem punctures: Because of its light skin color Fuji easily shows bruising. Skin is easily punctured by thick stems (2-5% reported by some growers).

Storage disorders: Fuji is susceptible to storage scald and DPA is needed to minimize scald. The thin skin of Fuji makes fruit susceptible to storage rots and also to shrivelling in storages with low humidity. While severe watercore can develop in Fuji very early in the harvest season there are reports that slight to
moderate watercore may disappear. Internal core browning has been reported in Washington with some present in fruits at harvest. In Australia moldy core susceptibility (5%) has been reported (Kupferman, 1992).

**Regional testing:** Comments at the Mid-Atlantic Fruit Varieties Showcase indicated that Fuji is generating a lot of excitement. The fruit was reported to mature before Granny Smith in Virginia. Processed slices looked and tasted like York. This variety has enough good qualities in Virginia to be planted on a trial basis. It appears to be the most promising of the new varieties and may have a place as a dual purpose variety (Marini, 1992).

**Fire blight susceptibility:** Fuji is very susceptible. Strikes of fire blight on Fuji were so extensive on young trees in New York and on the West coast that many growers were very concerned about the future of this variety, especially on susceptible rootstocks like M.26. In Southwest Michigan 2 and 3-year old trees on M.7a or M.7EMLA were evaluated for fire blight severity following a severe epidemic in 1991. Fuji was rated as highly susceptible. It had 26 to 50% of the trees blighted in July, with 50 to 75% of the tree blighted by September (Lehnert, 1993).

**Comments specific to NY** - This variety has been of great interest because of its excellent quality, firmness and storage life. The question still remains whether we can mature Fuji here. Many years at Geneva it does not fully mature and is small, green and of poor quality. The other question is whether east coast Fujis can compete with the quality and quantity of the product produced out west. If you are interested in testing Fuji, the Yataka strain should be tested because it is about two to three weeks earlier than standard Fuji. A red sport of Yataka, named Beni-Osho, will be available in the US in the near future. The extreme susceptibility to fire blight must be considered in planting this variety.

References:

Ballard, J. 1990 (April). Fuji profile sheet. Pacific Northwest Fruit Tester’s Variety Characteristic Profile. Also comments from the annual reports.


Apple Varieties of Commercial Interest

GALA
Susan K. Brown

Synonyms: Kidd’s D8
Parentage: Kidd’s Orange x Golden Delicious.

FRUIT DESCRIPTION:

Size range: Small to medium.
Fruit shape: Uniform oval round.
Skin color: Pale to golden yellow with red stripes or blush (depending on strain).
Stem length: Long.
Skin russet: Generally free.
Flavor: Very sweet and aromatic.
Texture: Fine, firm and crisp.
Maturity date: About one week before McIntosh
Storage life: About three months in common storage and about seven in CA. Best if consumed within four months. Loses flavor and crispness if stored too long.

TREE CHARACTERISTICS:

Vigor: Vigorous and upright, similar to Golden Delicious.
Growth type: Semi-spur. All strains of Gala have excellent spur development.
Bloom season: Mid-season.
Pollination requirements: Any diploid in the same bloom season except Golden Delicious or Kidd’s Orange.
Cold hardiness status: Has proven hardy for most US apple areas. Reported to be similar to Red Delicious in susceptibility to late frosts.
Disease status: Susceptible to mildew, cedar apple rust, and scab. Very susceptible to fire blight. Gala is an indicator for rubbery wood virus.
Physiological disorders: Rains during harvest can cause stem end cracking, especially in late harvested fruit.

SPORTS:

The situation with strains of Gala has been compared to that with Delicious. There has been a concern that as we select for increased color we are sacrificing flavor. With Gala gaining a reputation as an attractive bi-colored striped apple there is also a concern about establishing a market for striped fruit and then emphasizing blushed fruit that bear little resemblance to the original variety. The situation is compounded by the fact that some of the sports have shown varying rates of reversion to the standard type. The stability of the sports will need to be addressed.

The following lists some of the strains and their patent status. The “quotations” from the patent office indicates their prominent differences. This information is from the Pacific Northwest Fruit Tester’s Variety Characteristics Profile (Ballard, 1992).

Royal Gala (Tenroy selection) (PP 1977). “Possess an all over bright red color overlaid with obscure darker broad striping”.
Imperial Gala (Mitchell selection)- There are arguments over whether this is or isn’t the same as Royal. In New Zealand some feel that Imperial has more color stability and is slightly longer than Royal. Plant patent was not approved in the US.
Regal Gala (Fulford selection). Color and pattern like Gala although the percentage of coloration is greater and maturity is a few days earlier.
Scarlet Gala (Creech selection) (PP 1988). “Glossy and bright scarlet red over substantially the whole area of the fruit”.
Treco Spur Red Gala #42. (Cooper selection). (PP 1990). “Early and extensive red coloration while maintaining a distinctly striped color pattern. Spur growth habit of tree”.
Galaxy Gala (Kiddle selection) (PP 1989). “Solid cherry red coloration present over the entire surface with often indistinct red overstriping”.
Ultrared Gala. (Obragala selection) (PP applied for). “Solid nopal red coloration over 90-100% of the fruit surface”. Matures a few days earlier than Royal Gala; fruit of lesser color intensity shows hints of striping.
Other reports on sports include the following:

Dr. Duane Greene, U. Mass reported in Fruit Notes the following color rating in his trials (from reddest to least red): Regal> Imperial> Royal> Scarlet> Kidd’s D-8. He and Dr. Wes Auto (1993) evaluated Kidd’s D-8 (standard Gala) and the strains Royal, Regal (Fulford), Imperial and Scarlet and summarized the growth, flowering, fruit characteristics and fruit quality. They reported indications that Regal Gala was an early maturing strain. In a taste panel Royal, Scarlet and Regal were judged to have better flavor than Kidd’s D-8. Royal and Scarlet were judged to have the crispest flesh, with the flesh of all strains rated as more acid than Kidd’s D-8. There were no differences detected in aroma, skin tough-ness, juiciness, sweetness, or starchiness. Regal Gala was judged as the most attractive strain with the brightest and most uniform red color.

At the Mid-Atlantic Fruit Showcase it was reported that about 10% of the trees in the striped strains Royal and Imperial may revert to a poor coloring strain. Fulford Gala was reported to be a blush strain that does not show reversion; the tree is somewhat spurry, the flesh is softer and the fruit may mature a little earlier than other strains (Marini, 1992).

Dr. C. Walsh and R. Volz (1990) compared fruit size, color, quality and development between standard Gala, and Regal, Royal and Imperial Gala grown in commercial orchards in New Zealand. Color Meter differences in ‘a’ values of the peel suggested that red color is a poor predictor of fruit maturity, but that green cheek ‘a’ values and ethylene were correlated. Preliminary investigations suggested that Royal Gala and Gala maturation and quality were similar, although Regal Gala fruit appeared to be softer and have lower soluble solids at the same level of maturity.

**Training and pruning:** Gala tends to form strong limbs which compete with the central leaders, so strong laterals should be removed early. Limb bending is difficult, branches break easily. New Zealand researchers suggest renewal pruning to keep fruit on wood that is not over three years of age.

**Pollination:** On the west coast Gala bloom is a day or so ahead of Red Delicious and is an excellent pollen source for it.

**Thinning and fruit size:** Early heavy chemical and hand thinning is needed to achieve good fruit size and regular bearing. As trees get older, large fruit size is harder to achieve. Walsh (1990) reported that Carbaryl (SEVIN 50W) is used to thin Gala in New Zealand, while in the US growers tend to thin Gala as they do Golden Delicious with NAA. New Zealand uses Sevin to avoid problems with “pygmy” fruit. Maryland use of NAA has not resulted in pygmy fruit, however thinning trials with amide-thin have produced pygmy fruit readily.

Researchers at the University of Massachusetts reported ways of increasing fruit size of Royal Gala (Greene et al., 1992). Since fruit on one-year-old wood were significantly smaller than other types of wood, they suggested that strategies be developed to remove fruit on one-year-old wood selectively. When they examined distribution of flowering and fruit set on Royal Gala they found that over two-thirds of all flowers were produced on one-year-old wood. Thinning experiments on six-year-old Gala/M.26 suggested that 1 lb/100 gal of Sevin plus 3 ppm NAA was the most appropriate thinning treatment for the Royal Gala block in Massachusetts in 1991. Average fruit diameter from this treatment was about 2.9”. Once fruit have reached proper maturity, Gala should not be allowed to remain on the tree to obtain additional size.

**Rootstocks:** Growers in Canada have found performance on M.9 superior to M.26 and M.7. This is similar to Dutch reports.

**Fruit finish:** Gala can russet with most any spray applied under slow drying conditions.

**Harvest and Storage:** Gala is not subject to pre-harvest drop. All strains require at least two pickings to gain best color and quality, but four or five color pickings based on ground color may be required to achieve uniform maturity. Red color should not be used to judge maturity on any of the sports.

Dr. C. Walsh, Univ. Maryland has developed a starch iodine rating system for harvesting Gala for long term storage. He believes that fruit become prone to cracking as sugar levels increase, but cracking can be minimized if fruit are harvested before much starch is converted to sugar (Marini, 1992). A starch chart for Gala has also been developed by Dr. W. Auto (Bulletin # F-106 is available from the University of Massachusetts Cooperative Extension).

Dr. E. Kupferman, WSU Extension horticulturist, reported that Gala fruits size rapidly during the harvest season, and that red skin color, firmness, soluble solids and acidity do not relate well to internal maturity (1992). New Zealand growers harvest Gala 4 to 5 times using ground color standards, and Washington growers are harvesting excellent quality when ground color changes from green to yellow. Kupferman stated that in 1990 Royal Gala harvested with white ground color had firmness of 17.5 lbs, 13.3% soluble solids, 0.376% acidity and starch rating at 3.6 on a 1 to 5 scale. He stressed that it is important that fruit used for starch analysis be of uniform ground color. Fruit for storage should be harvested slightly on the green side and multiple picking still seems to be essential. Gala in storage for more than 4 months lost flavor and texture even in CA. Acidity can be lost and softening can occur if fruit is not placed in CA directly after harvest. Dr. Kupferman warned that it is not possible to achieve good results if CA is delayed. Researchers in France stated that fruit with low calcium levels are more prone to become mealy and crack after going into storage.
Gala apples have a more porous skin than Red Delicious so they can shrivel in storage unless humidity is high. Storing in plastic liners is effective, but there have been some reports of cracking and increased incidence of rots with liner use.

**Optimization of performance:** Dr. C. Walsh (1990) suggested that in order to produce high quality fruit, growers must pay particular attention to bud quality, crop load, irrigation, and understand that the fruit grows rapidly during maturation and harvest. He reported that best sized fruits are grown on terminal buds of 3 to 12 inch long spurs and the terminal buds of last year’s shoots. Good sized fruit is grown on true spurs, and the smallest fruit are borne on lateral buds on last year’s shoots. In terms of fruit growth and crop load, Walsh warns that because Gala is extremely precocious one should avoid setting heavy crops borne on lateral buds in the second and third leaf to minimize overcropping and small fruit size. In estimating orchard spacing Gala’s scion vigor should be viewed as similar to the vigor of non-spur Delicious.

**Irrigation:** Irrigation is extremely beneficial for Gala fruit size, as fruits are maturing in late-August to early-September when seasonal water deficits are greatest. Rapid fruit growth occurs when the fruit is maturing. Several growers report that the fruits behave like they have a final swell.

**Fire blight susceptibility:** Strikes of fire blight on Gala were so extensive on young trees in New York that many growers were very concerned about the future of this variety, especially on susceptible rootstocks like M.9 or M.26. In Southwest Michigan 2 and 3-year old trees on M.7a or M7EMLA were evaluated following a severe fire blight epidemic in 1991. All Gala sports tested were rated as moderately to highly susceptible. Spur Gala Go Red had 7 to 12% of the tree blighted in July, with 26 to 50% of the tree blighted by September (Lehnert, 1993).

**Comments specific to NY:** Gala is becoming of interest to the apple industry because of the excellent fruit quality and the high degree of consumer acceptance and demand. However, concerns for our area include its extreme susceptibility to fire blight, competition with west coast production, the tendency for small fruit size, the need for multiple harvests, the possibility of fruit cracking, and the fact that Gala in New York state tends to be susceptible to scarf skin (a disorder caused by environmental conditions and perhaps certain fungicides). The fruit has speckled appearance caused by oxygen trapped under the skin. Some growers state that this has not affected sales, but this may not always be the case if competing with fruit from other regions. Gala should only be stored for a short time. The best quality is maintained in storage for only about two to four months, after which the flavor becomes quite bland.

References:


Ginger Gold

Susan K. Brown

Synonyms and strains: Mountain Cove 509.
Parentage: Unknown.
Patent Status: PP 7063 and Ginger Gold TM is owned by Adams County Nursery, Aspers, PA.

FRUIT DESCRIPTION:
Size range: Medium to large.
Fruit shape: Round to oblate. Smooth and typey.
Stem length: Medium.
Flavor: Sweet but mildly tart - "very good".
Skin russet: Only slight at stem end under eastern growing conditions.
Skin color: Vibrant yellow when tree ripe, otherwise greenish golden.
Flesh color: White to cream, depending on nitrogen level. Slow oxidizer.
Texture: Very good. Crisp.
Storage life: Good (6 months in regular storage, unknown in CA). Will need to be determined. Adams County likes to have it picked just as it turns from green to yellow. That corresponds to August 1st in PA (6 weeks earlier than Golden). At this time flesh color is turning from white to cream and soluble solids are at about 12.5. The longer it stays on the tree the more the sugars increase. We evaluated fruit from young trees at Geneva 3 weeks earlier than we harvested Golden Delicious and the quality was excellent although a slightly blotchy blush had developed (in a high coloring year).

TREE CHARACTERISTICS:
Vigor: An open spreading tree with medium to high vigor.
Precocity: Good.
Bloom season and Pollination requirements: Any early to mid season diploid blooming at the king bloom time. It has an extended bloom like Gala. Good results with Red Delicious and Empire. Some suspicion that it could be self-fertile.
Cold hardiness status: Thought to be the same as Winesap.
Disease status: Most unknown. Susceptible to mildew and fire blight.
Physiological disorders: None known at this time. May be susceptible to bitter pit.
Availability sources: Adams County Nursery and Van Well Nursery.
Commercial status: Many growers are planting large numbers of Ginger Gold.

COMMENTs: (The following comments represent a compilation of information from the references cited):

Rootstocks, Tree Growth and Training: As grown in PA, the vigor of this cultivar needs the control of a more dwarving rootstock than M7, such as M.26, Mark or M.9. Adams County has received a lot of orders for trees on M.26 but they have not noted incompatibility on any stock. Tends to produce flat limbs with good crotch angles. Blooms profusely on one year wood and although the tree grows in a willowy leggy pattern, the crop volume, finish and type are all very good.

Quality: Reported by several testing groups and researchers as being the best or one of the best varieties in its season (Marini, 1992). It is well received by consumers. The flavor is reported to be a little more tart than Golden Delicious but it mellows when stored.

Disease Susceptibility: In Southwest Michigan 2 and 3-year old trees on M.7a or M.7EMLA were evaluated following a severe fire blight epidemic in 1991. Ginger Gold had 26 to 50% of the tree blighted in July, with 89-99% of the tree blighted by September (Lehnert, 1993). While other areas have reported moderate susceptibility of Ginger Gold to fire blight, a report from the Pacific Northwest also reported extensive infection that moved rapidly through the tree. Mildew susceptibility has been noted, with several growers stating that mildew control is challenging and essential.

Comments Specific to NY: The quality of this variety does indicate good potential for the early season, but reports of extreme susceptibility to fire blight suggest that trial plantings be initiated before large numbers are planted. Harvest maturity for NY will need to be determined. For best quality, fruit may need to hang on the tree longer than suggested for other regions.
References:

Ballard, J. 1992 (Feb.). Ginger Gold profile sheet. Pacific Northwest Fruit Tester's Variety Characteristic Profile. Also comments from the annual reports.


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This is an excellent quality apple which has been widely planted throughout Europe and is increasing in importance in the US. ‘Jonagold’ is suitable for the fresh market and for processing. The best fruit color is obtained on dwarf and semi-dwarf rootstocks.

There are no accurate varietal production figures. However, NYS ‘Jonagold’ production in 1995 was reported at 375,000 bushels (New York State Agricultural Statistics Service). In 1995 the Washington State ‘Jonagold’ crop was estimated at 536,000 bushels (Yakima Valley Growers-Shipers Association).

According to the 1990 New York Fruit Tree Survey, there were 66,719 ‘Jonagold’ trees in New York state representing only 1.5% of all dwarf and semi-dwarf plantings. However, ‘Jonagold’ accounted for 5% of all apple trees planted in New York State between 1988 to 1990, making it the fourth most widely planted variety during that period (NYS Agricultural Statistics Service).

**ORIGIN:**
Developed by Cornell University’s apple breeding program at the New York State Agricultural Experiment Station, Geneva, NY. Selected in 1953 and introduced in 1968.

**SYNONYMS:**
NY 43013-1 prior to naming.

**PARENTAGE:**
‘Golden Delicious’ x ‘Jonathan’.

**FRUIT DESCRIPTION:**

<table>
<thead>
<tr>
<th>Size range:</th>
<th>Medium to large.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem length:</td>
<td>Long.</td>
</tr>
<tr>
<td>Fruit shape:</td>
<td>Round to conical, similar to Golden Delicious’.</td>
</tr>
<tr>
<td>Skin color:</td>
<td>Yellow/green background with red blush +/- stripe (depending on strain).</td>
</tr>
<tr>
<td>Skin russet:</td>
<td>Not prone.</td>
</tr>
<tr>
<td>Lenticels:</td>
<td>Obscure.</td>
</tr>
<tr>
<td>Flavor:</td>
<td>Outstanding.</td>
</tr>
</tbody>
</table>

| Flesh color:           | Creamy yellow.  |
| Texture:               | Breaking.       |
| Storage life:          | Ten months CA storage. Skin may get greasy after storage or if harvested late. Should be consumed within two months at regular storage. |
| Maturity date:         | Between ‘Empire’ and ‘Red Delicious’. Some strains mature four to five days earlier than standard ‘Jonagold’ |
TREE CHARACTERISTICS:

**Vigor:** Moderately vigorous. Semi-spur growth type.

**Precocity:** Very good.

**Bloom season:** With ‘Delicious’

**Pollination requirements:**
- ‘Jonagold’ is a triploid and thus cannot be used to pollinate other varieties. It requires cross pollination with any diploid in the same mid-bloom season except ‘Golden Delicious’ with which ‘Jonagold’ is incompatible.

**Cold hardiness status:**
- Appears to be less cold tolerant than ‘Golden Delicious’.
- ‘Jonagold’ is susceptible to spring frosts at blossom time in Quebec, cold hardiness differences were evident across sites, with ‘Jonagold’ not being as hardy as ‘Cortland’ or ‘McIntosh’.

**Disease status:**
- Susceptible to scab, mildew and fire blight.

**Physiological disorders:**
- ‘Jonagold’ is susceptible to bitter pit and to sunburn. Calcium sprays are recommended to control bitter pit and are essential for control on young trees.

**Availability sources:**
- Almost all nurseries carry ‘Jonagold’ and its sports.

SPORTS:

There are over 70 sports of ‘Jonagold’ so that the issue of which sport to choose is complex. The following are some of the strains that may be available for testing:

- ‘Decoster’® (Swillen cv.). (USPP #8049). This sport originated in Belgium as a whole tree mutation. It has a bright red color. This sport may be earlier ripening than standard ‘Jonagold’.
- ‘Jonure’ (Belgium source). Not patented. Breeder’s rights applied for.
- ‘Jonagored’ (Morren). (USPP #5937). ‘Jonagored’ is a limb sport of ‘Jonagold’ discovered in Belgium. It was introduced in 1985. The color tends to be brownish during the 3 week period before harvest but then the color turns to an attractive solid red. The red is darker (more purplish) than standard color in some areas. It is reported to be one of the top selling strains in Europe.
- ‘Jonica’™ (Schneica cv.). (USPP #7146). A red fruited mutation of ‘Jonagold’ that originated in Germany. The fruit is similar to standard ‘Jonagold’ but with a deeper overcolor and a faded red hue. Fruit shape is less oblong than standard ‘Jonagold’. Its flavor is medium sweet.
- ‘New Jonagold’ (Japan). This sport is not patented in the US and is not considered a real strain. It was discovered by M. Saito in the Aomori Prefecture, Japan. While it has a deep red stripe overall it is not redder than standard ‘Jonagold’; although it may be harvested slightly earlier. However, some testers say that coloration is better than standard ‘Jonagold’.
- ‘Nicolai’s® Jored King (Jonagold)’ (USPP #8851). Assigned to TRECO Nursery. A limb mutation discovered in Belgium by J. Nicolai. It has 70 to 85% red blush. It is reported to color early.
- ‘Romagold’ (USPP #9541). A limb mutation of ‘Jonagold’. It is reported to have a broadly striped red color pattern and excellent quality.
- ‘Rubinstar’ Jonagold (Herr cv.) (USPP #7590). Originated as a bud mutation in Germany in 1980. Assigned to Waflers Farm, Inc., Wolcott, NY. Identical with standard ‘Jonagold’ except that it matures about four to six days earlier and displays a more intense red coloration over 70 to 90% of the surface with little to no stripping. Some testers have commented that the background color can be brownish, but it is not known whether this may relate to immaturity as is the case with ‘Jonagored’.
- ‘Wilmuta’. This sport is not patented, not assigned, and not very red. It is a selection from heat treated clone #2361 from Belgium. It is very similar to ‘New Jonagold’.

De Coster (1986) summarized the performance of Belgium-grown ‘Jonagored’ as coloring up to 100%, and having higher acidity, and higher firmness than standard ‘Jonagold’. Storage was until May, and the color was dark. In clonal selections of ‘Jonagold’ the sports ‘New Jonagold’ and ‘Wilmuta’ were reported to have clear chimeras. These two selections color better than normal, but they have sectoral bands that are colored more or less than normal and this has been objectionable.

Comparisons between sports are sometimes difficult because often the age of the trees and the rootstock differ. Replicated plantings of ‘Jonagold’ sports in several regions of the US are needed to effectively compare strain performance. Trials of standard Jonagold and 5 sports were set out in commercial orchards in NY in 1996.

COMMENTS (The following comments represent a compilation of information from growers, researchers, extension specialists, and the references cited):

**Quality:** Nineteen apple experts were polled on their favorite dessert apple and ‘Jonagold’ was rated as the first choice (Norton, 1989).

**Training and pruning:** ‘Jonagold’ is considered a grower friendly tree. Steve Hoying, Cornell University Cooperative Extension Regional Fruit Specialist, recommends heading ‘Jonagold’ higher than normal (34 to 36") to compensate for its droopy growth habit. Tie up to lower branches to maintain bottom scaffolds. During pruning always cut to uprights. ‘Jonagold’ branches freely, and develops nice side branches and thus fits nicely in a vertical axis training system. It responds well to renewal pruning of fruiting branches.

**Vigor management:** Management of fertility is crucial. If the trees are too vigorous color development is poor. However, if tree vigor is too low the crop load is not finished off. Growers are advised to manage nitrogen leaf analysis levels so that they are not below 2.0% nitrogen. Excess nitrogen and overthinning results in ‘Jonagold’ fruits that are too large for market acceptance. In addition, excess vigor increases susceptibility to bitter pit and storage disorders.

**Pollination:** For a pollinator you need something mid-season such as ‘Cortland’, ‘Red Delicious’ or ‘Gala’.
**Thinning and fruit size:** Managing crop loads on ‘Jonagold’ is the most challenging part of managing this variety. ‘Jonagold’ is strongly biennial. In addition, excessive crop loads (low leaf to fruit ratios) often result in slowed fruit color development providing an important incentive for careful management of crop loads. Jonagold must be thinned early (soon after petal fall) and adequately to avoid alternate cropping. Steve Hoying, Cornell Cooperative Extension Regional Fruit Specialist, states that young trees when they first crop can be too easily thinned, so thinners should be avoided or used with caution. However as trees age they are very hard to thin and sometimes require thinning rates as high as ‘Empire’. Bienniality can be serious even if crop loads are only slightly too high.

**Summer pruning:** Summer pruning in August improved fruit color and reduced fruit size (Williams, 1985). In New York excessive summer pruning may reduce photosynthesis too much to properly mature the crop. It may also be counterproductive in terms of coloring.

**Harvest and storage:** ‘Jonagold’ will bruise easily, so care in harvesting is crucial. Fruit may become greasy in storage. “Greasiness” increases with delayed harvest. Three pickings at 5 to 7 day intervals with the middle picking occurring near the suggested optimum harvest date for best storage performance (between ‘Empire’ and ‘Red Delicious’) may help to achieve consistent maturity and color. Moderate crop loads, good vigor, and extension specialists) was used to determine the best harvest dates of each orchard based on selection of samples displaying the best taste and appearance. The best harvest dates of all orchards fell between October 4 and 10 in that year. This range of dates (the “harvest window”) overlapped with the estimated harvest windows of ‘Empire’ and ‘Red Delicious’. The harvest window of these ‘Jonagold’ orchards was associated with a mean starch iodine index near 7 on the “Generic Starch Iodine Reference Chart for Apples” (Blanpied and Silsby, 1993). Individual orchard means varied from 6.7 to 7.4 on their best harvest dates. These index readings were somewhat more advanced than indicated in British Columbia (Lau, 1992).

A similar set of samples from these same NY orchards were held in regular (32°F) air storage until January 14th and examined for disorders after 13 days at room temperature. These samples revealed that some blocks of ‘Jonagold’ were susceptible to soggy breakdown and internal breakdown. Both of these disorders should be expected to increase in severity with delays in harvest. Soggy breakdown can be controlled by CA storage or by holding lots in regular air storage at temperatures of 36 to 38°F for the first few weeks following harvest (at the sacrifice of fruit firmness). Apples displaying internal breakdown usually contained remnants of watercore. As a result, growers are advised to avoid the lengthy storage of orchard lots harvested after significant watercore development.

The ‘Jonagold’ samples stored very well in the CA ‘Empire’ room used in the experiment. The average pressure test of all samples was 13.8 lbs (February 17) and compares with an average reading of 9.7 lbs for cold storage samples tested approximately one month earlier.

‘Jonagold’ blocks in this study did not appear to gain significantly more color when harvest was delayed beyond the harvest window in spite of good coloring conditions. Later harvest dates appeared to result in apples of larger size. In addition, later harvested samples appeared waxier (“greasier”), duller, and with progressively increasing yellow ground color after storage.

**Canadian trials:** Lau (1992) suggests ‘Jonagold’ is ready to be picked for long term storage at 32°F when it has acquired some of the following fruit characteristics (in order of importance):

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starch index</td>
<td>Equivalent to 5.5 to 6.0 on Generic chart</td>
</tr>
<tr>
<td>Flesh firmness</td>
<td>≥ 16 to 17 lb. pressure</td>
</tr>
<tr>
<td>Water core</td>
<td>0 ≤ 12% of the fruit affected (the lower the better)</td>
</tr>
<tr>
<td>Internal ethylene concentration</td>
<td>0.1 - 1.5 ppm or 0 - 40% of the fruit with an IEC ≥ 1 ppm (the lower the better)</td>
</tr>
<tr>
<td>Titratable acidity</td>
<td>≥ 0.6 to 0.7% malate</td>
</tr>
<tr>
<td>Soluble solids</td>
<td>≥ 12.5 to 14.5%</td>
</tr>
</tbody>
</table>

Lau found that fruit harvested at optimal maturity (within one week of the first acceptable pick date) kept well in air at 32°F until February. Fruit kept longer than 4 months, were soft, bland, and prone to breakdown and coreflush. For CA storage, fruit picked at an optimal maturity could be held at 1.5 % O2 and CO2 at 32°F until June without any breakdown or fruit injury symptoms. CA-stored fruit were 25% firmer, 47% higher in titratable acidity, had less watercore, less coreflush and a higher flavor rating than air-stored fruit.

Girard and Lau (1995) harvested ‘Jonagold’ twice weekly starting about two weeks prior to commercial harvest. Fruits were stored at 32°F in air or in a controlled atmosphere (CA, 1.5% O2 and 1.5% CO2) for 6 months. Early harvests and CA significantly reduced the loss of acidity and firmness in stored apples but did not influence total soluble solids content. CA decreased
production of volatile compounds by half. Harvesting at starch index values equivalent to about 5.8 to 7.3 on the generic reference chart allowed a higher concentration of odor-active compounds while retaining acceptable levels of acidity and firmness.

Marketing: When removed from storage 'Jonagold' must be marketed promptly to avoid overmaturity and softening. It does not withstand the stress of unrefrigerated marketing as well as 'Fuji', 'Gala' or 'Delicious' (Sonneman, 1995). Fruits become dull in appearance as they start to degrade.

Rootstock: 'Jonagold' is compatible with most commercial rootstocks, but is very brittle on 'Mark' in the early years. Andrews and Rom (1993) noted mortality of 'Jonagold' on 'Mark' rootstock. Some was due to breakage at the graft union when trees were not supported, but half of the 'Jonagold' trees lost were supported. Perry (1990) also noted that 'Mark' rootstock has shown incompatibility problems with triploid varieties like 'Jonagold'. Warmund et al. (1993) used magnetic resonance imaging (MRI) to examine poor scion growth of 'Jonagold' on 'Mark' rootstock, and found that trees budded in September in Washington state had insufficient growth of rootstock and/or scion tissues at the union in the fall.

Performance of 'Jonagold' on M.9 has been exceptional. The level of tree vigor with M.9 fits very well in high density orchards in New York.

Bitter pit: Five to eight calcium sprays are required to control bitter pit. Control of tree vigor is essential.

Sunburn: 'Jonagold' is susceptible to sunburn in hot climates.

Virus status: Goddrie and Kemp (1990) compared yields of virus infected colored sports of 'Jonagold' with two standard 'Jonagold' types. The yield of virus infected mutations was 12 to 18% lower after four growing seasons.

References:

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