

New York's Food and Life Sciences Bulletin

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APPLE #1 FACTS

Varieties of Commercial Interest: 'JONAGOLD'

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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-Shippers 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:

Size range:	Medium to large.
Stem length:	Long.
Fruit shape:	Round to conical, similar to Golden Delicious'.
Skin color:	Yellow/green background with red blush +/- or stripe (depending on strain).
Skin russet:	Not prone.
Lenticels:	Obscure.
Flavor:	Outstanding.

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'.

'Jomured' (Belgium source). Not patented. Breeders 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'[™](Schneicacv.).(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 red 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'.

'Nicobel'[™] 'Jonagold'. Slightly better red color than standard 'Jonagold', with 50% red blush (but reported to have less red than 'Jored').

'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 Wafers 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 striping. 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 pollinizer 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 *j* 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 counter productive 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 temperatures of 40°F or less at night help color development, while low crop loads advance ripening and the development of greasiness.

-) The color standards for various grades of 'Jonagold' are as follows: US ExtraFancy - 50%; US Fancy - 25%; US No.1 -15% (NYS Department of Agriculture and Markets). The typical color standard employed by NYS packers is one-third "good red color". This description represents an appropriate standard for spot picking 'Jonagold'. However, growers are advised to check with their packer for specific standards. Apples without some red color are markedly poorer in flavor.

NY taste panels, harvest date and maturity indexes: In 1993, Ken Silsby, Cornell Cooperative Extension Area Fruit Extension Specialist, examined maturity indices and the best harvest dates of five commercial 'Jonagold' orchards (various strains) located in Niagara and Orleans counties (Western NYS). His report is summarized below:

Storage samples were collected twice weekly between September 29 and October 14 and placed into a commercial CA room (1.9% O₂, 2.4% CO₂, and 33 to 35° F). Samples were removed from storage on February 12, held in regular air storage for five days, and placed in room temperature for seven more days. At that time, an informed taste panel (composed of growers, fieldmen, 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 (on 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):

Starch index:	Equivalent to 5.5 to 6.0 on Generic chart
Flesh firmness:	> 16 to 17 lb. pressure
Water core:	0 < 12% of the fruit affected (the lower the better)
Internal ethylene concentration:	0.1 < 1.5 ppm or 0- <40% of the fruit with an IEC >1 ppm (the lower the better)
Titrateable acidity:	>0.6 to 0.7% malate
Soluble solids:	>12.5 to 14.5%

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 titrateable 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.

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