Journal of the American Pomological Society 75(2): 115-129 2021

Stark Brothers' Nurseries & Orchards: Two Centuries of New Fruit Cultivars and Innovations

Michele R. Warmund[1]

Additional index words: fruit, nuts, history, nurserymen, plant patents

Abstract

Established near Louisiana, MO in 1816, Stark Bro's Nurseries and Orchards Company has had a lasting impact on modern fruit production in the cultivars grown, nursery stock production practices, and the protection of plant material with patents. From Kentucky, James Hart Stark brought 'Jeniton' ('Rall's Janet') scions with him to Missouri and began propagating trees on native crabapple rootstock. As the family nurseries grew, Clarence M. Stark incorporated the business in 1889 and astutely established a relationship with Luther Burbank to acquire new plant material. 'Delicious', 'Golden Delicious', and 'Gala' apple, along with many spur-type and dwarf types of these cultivars, are but a few of the notable cultivars that Stark Bro's purchased from individuals. In an attempt to protect their acquisitions, Paul C. Stark Sr. was a primary advocate for plant patent legislation. In 1932, the first fruit tree patent was assigned to Stark Bro's for 'Hal-Berta Giant' peach, with many more to follow for such cultivars as 'July Elberta' and 'Saturn' peach. Over time, Stark Bro's has been the assignee for about 131 fruit and nut patents. They also revolutionized the tree fruit industry with the introduction of spur-type apple trees, development of a mechanical tree digger, and the initiation of a virus-indexing program. Weathering boom years and lean times, when many fruit nurseries failed, Stark Bro's Nurseries continues to provide an array of plant material to commercial producers and backyard gardeners.

The Stark Family Dynasty

The ancestral roots of the Stark family dynasty were in Scotland. The name "Stark" was coined by King James IV after John Muirhead saved the monarch from a charging bull during a hunt in 1642 (Terry, 1966). From that fateful day, Muirhead and his descendants would forever be known as the Stark clan with their motto: *Fortiorum Fortia Facta* (brave deeds of brave men) and their coat of arms depicting a rugged bull. The King also granted Muirhead land near Loch Lomond, where the Stark family lived at Killermont estate. As was customary, the eldest son of each successive Stark generation, was often named John or James.

In 1710, John Stark, an ancestor of Muirhead, emigrated to New Hampshire, where his family built Stark's fort, later known as Starkstown as the settlement grew. It was later renamed Dunbarton for the Stark's Sottish homeland. In 1730, James Stark (John Stark's second eldest son) moved his family to Virginia, where he and his wife eventually had 15 children (Zotta, 2015). Two generations later, Captain James Stark was granted 809 ha of land in Hutchinson, Bourbon County, KY for his meritorious service in the Revolutionary War. In Kentucky, Captain Stark had large orchards, likely established with scions from his father's property in Virginia. These orchards were purportedly the first planted with grafted trees in the southcentral United States (Hedrick, 1950). Captain James Stark had 19 children. The seventh child, James Hart Stark, was born in 1792 and labored in his father's orchards.

When James H. Stark was 18 years-old, he became a government land surveyor (Zotta, 2015). On a surveying trip across the Mississippi River in 1815, he found land for his future homestead in what is now Pike County, Missouri. One year later, he moved his wife and son to Missouri and brought with them

[1]Professor of Horticulture, Division of Plant Sciences, Columbia, MO 65211 warmundm@missouri.edu

'Jeniton' ('Rall's Janet'; Beach et al., 1905) scions for his future orchards. Shortly after building a log cabin, James started clearing land for his orchard and began grafting his scions onto native crabapple rootstock. As his orchard grew, settlers traveled across the state to obtain his fruit trees, which he generously shared. However, as demand grew, he began selling trees in 1816. His orchards flourished and soon thereafter, he was shipping thousands of barrels of apples by steamboat to faraway markets. In 1840, James was elected Pike county judge (Terry, 1966). Thereafter, known as Judge Stark, he and a few others championed a railroad connecting multiple Mississippi River towns, which would later become advantageous to the family's growing business. James H. Stark died on May 27, 1873. However, during his lifetime, he fathered 17 children and steadily expanded his orchards and nursery sales. Over the years, eight members of the Stark family would steer their company, and many other of James Hart's descendants would take part in the family business over a span of six generations (Fig. 1).

James H. Stark's son, William Watts Stark was born in 1827 and took over the business at age 14. The nursery flourished in the capable hands of William (Stark Bro's Nurseries and Orchards, 1916). He was unable to serve in the Civil War due to a heart condition. However, William served as Sheriff of Pike County and was instrumental in organizing the first Missouri Horticultural Society meeting in 1859, which remains the primary organization for commercial fruit growers in the state today. He also served as Vice-President of this Horticultural Society for 12 years. At these meetings, William promoted the selection of high quality apples and the cultivation of trees that would boost fruit yields and shared his vast knowledge of fruit production with others. In 1870, William moved the

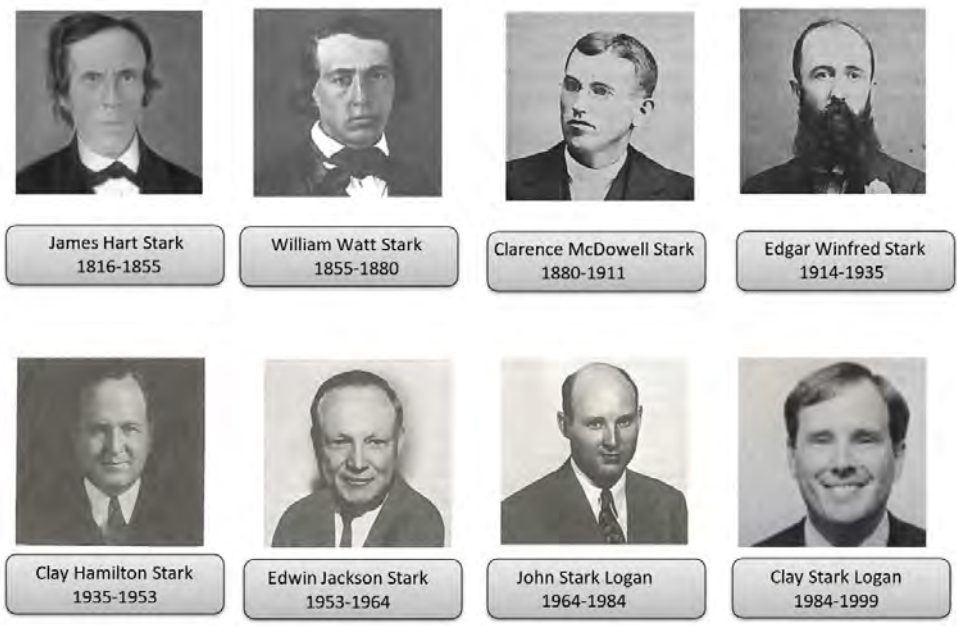

Fig. 1. Members of the Stark family who served as President of Stark Bro's Orchards Nurseries and Orchards Company with their dates of service.

Fig. 2. The first Stark Bro's Company logo developed by Clarence M. Stark.

original nursery to its present location near Louisiana, MO. By 1873, he had a thriving enterprise with five orchards, as well as the nursery. However, when the financial panic of 1873 occurred in Europe and North America, William signed his distressed neighbors' bank notes. At the end of the Panic, William lost all his orchards, except for the nursery, after paying all his debts. However, he continued the business until he died working in the orchard in 1880.

William's three sons, Clarence McDowell (1855-1914), Edgar Winfred (1856-1935), and William Pharr (1862-1943) each had a role in the company. After assuming the primary responsibility for the family business, Clarence and Edgar incorporated Stark Brother's Company in 1889 for $50,000. In 1893, another financial panic ensued across the United States, with a run on currency and banks closing (U.S. Dept. of the Treasury, 2020). With generous donations from their loyal employees and family friends, the Stark business was able to survive this crisis. Also, to protect their assets, they reorganized and reincorporated as Stark Brothers Nurseries and Orchards Company (Stark Bro's) for $300,000 in 1893.

Clarence served as president of the company and was a true marketing genius. He developed their iconic slogan, "Stark Trees Bear Fruit" printed upon their bear logo, which is still recognizable and in use today (Fig. 2). By 1887, the Starks were advertising nationally and overseas in *Harper's Magazine* and *Collier's Weekly: An Illustrated Journal* (Zotta, 2015). One of their classic advertisements in *Harper's* depicted a man poised to throw a rock at a boy in a fruit tree with the text, "It TAKES stones and bull-dogs to drive boys out of STARK Trees!", with their logo in bold type posted on a fence (Fig. 3).

Fig. 3. A portion of one of Stark Bro's Company's early advertisements printed in Harper's Magazine, Collier's Weekly Magazine and in newspapers. This illustration was captioned, "It TAKES stones and bulldogs to drive boys out of STARK trees."

In 1893, the ever-enterprising Clarence created the First International New Fruit Show in search of new cultivars that they could sell to replace the poor-flavored 'Ben Davis' apple that was widely-grown (Terry, 1966). After sending invitations to apple growers and placing advertisements for the event across the nation, they received hundreds of entries from 27 states, including an oddly-elongated, red apple with stripes and five prominent calyx lobes. After biting into the apple, Clarence proclaimed, "Delicious! That will be its name. Who sent them?" After a frantic search, it was discovered that the entry card with the submission information was missing. Undaunted, Clarence soon sent letters to each grower who had entered the contest, inviting them to send fruit again next year. Once again, Jesse Hiatt sent his odd-shaped apple named Hawkeye to the 1894 Fruit Show where it was proclaimed the winner. Thereafter, Clarence and Edgar traveled to Peru, Iowa to purchase the rights to what would become the Stark 'Delicious' apple. Even though the Stark brothers were ecstatic about the 'Delicious' apples, others were not nearly so impressed because it lacked the preferred round fruit shape. Thus, to promote this astonishing new apple, Stark Bro's included ten free apples labeled Key Z26 with each large order (Zotta, 2015). Once these test trees began bearing fruit, grower's wrote to Stark Bro's, demanding more information about this impressive new cultivar. Later, Stark Bro's would write, "Graft the tender shoot; thy children's children shall enjoy the fruit." This was the admonition of Virgil to the Roman husbandman nearly two thousand years ago-such was the one thought of Jesse Hiatt when he ate the first apple from little seedling tree in his old Iowa orchard− and such has been our sole purpose in sending nature's greatest creation, 'Stark Delicious', all over the earth. You may search pomological history but nowhere will you find the equal of 'Stark Delicious'. Peerless, it will remain the worlds best until nature again blesses us with another" (Stark Bro's Nurseries and Orchards, 1916). As prognosticated, consumers enjoyed the fruit from millions of these trees sold worldwide for many years.

Clarence also created their first sixteen-page catalog in 1894 (Terry, 1966). On the catalog cover, there were three photographs, including one with 300 nursery workers lined up to receive their wages, a second of their grafting operation, and the last was a 10 ha rose nursery. Included in the catalog were descriptions of their 50 apple cultivars, with listings of their first- and second- choice types. 'Akin', a first-choice apple, had the description, "We have never eaten an apple, which in perfection of quality is so nearly ideal. Besides possessing excellence undreamed of in the philosophy of the apple markets, it has just the right size and brilliant color not only for hotel and fancy trade, but for export." Also featured in this catalog were their pear, peach, plum, cherry, apricot cultivars, as well as roses and other ornamental plants. In 1896, Clarence produced their first catalog with color illustrations of true-to-size fruit. These illustrations were from paintings of the actual fruit commissioned by Stark Bro's. In Stark Bro's 1901 catalog, their "Six Quality Kings ('Chicago', 'Delicious', 'Senator', 'Stayman Winesap', 'Jonathan', and 'Grimes Golden' apples) were "painted from nature" (Terry, 1966). Until color photography was common, cultivar illustrations derived from paintings were used multiple times in their catalogs and fruit yearbooks (Fig. 4).

Another boon to the Stark's burgeoning business was the 1904 World's Fair in St. Louis. At this fair, they exhibited their fruit and distributed over 100,000 catalogs. After President Theodore Roosevelt opened the World's Fair, he traveled to Stark Bro's headquarters in Louisiana, Missouri, where he was met with great fanfare and generated more publicity for their business (Zotta, 2015).

Clarence also befriended Luther Burbank during a visit to see his orchards that solidified their friendship and business relationship (Terry, 1966). Realizing the value of

Fig. 4. Illustrations of some of the fruits marketed by Stark Bro's Nurseries. Top to bottom and left to right in each illustration. (A) late apples (Stayman Winesap, Mammoth Grimes Golden, Senator, Winesap, Jeniton, Champion, Ingram, and Stark Gold Crab); (B) currant (Wilder, Red Cross, Diploma, Perfection, White Imperial and London Market and gooseberry (Pearl, Josselyn, Downing, Oregon Campion, Portage); (C) mid-season peaches (Elberta, Niagara, Capt. Ede, Idaho Mammoth, Fox seedling, Washington Free, Illinois, Crawford Late Improved, Yates Red Cling, Martha Fern Cling; (D) Berries (Cumberland, Cardinal, New American and Cuthbert raspberries, Gorgeous mulberry, Golden Queen and St. Regis raspberry, Blowers blackberry, Monarch mulberry, Lucretia dewberry, Early Harvest, Eldorado, and Snyder blackberry); (E) plums (Red June, America, Stark Damson, Mammoth Gold, , Omaha, Early Gold; (F) cherries (Montmorency Stark, Stark Gold, Black Tartarian Improved, Royal Duke, Montmorency Sweet, Napoleon, Suda Hardy, Montmorency King, Dyehouse, Montmorency Monarch). (Stark Bros. Centennial Fruits, 1916).

Burbank's germplasm, Clarence paid Burbank $9,000 for three of his cultivars, two of which were the 'Gold' plum and 'Van Deman' quince. This agreement was only the beginning of the Burbank/Stark Bro's business dealings. Before his death, Burbank specified that he wanted Stark Bro's to continue his work. Thus, in 1927, Burbank's widow sold his experimental farm, including the rights to sell his plant material for 10 years to Stark Bro's for $27,000. Stark Bro's was later assigned patents for six plums, a sweet cherry, three peaches, and a rose selected by Burbank (Table 1). For many years, Stark Bro's introduced and marketed several other of Burbank's unpatented fruit and nut

Table 1. United States patent numbers of fruits and nut cultivars assigned to Stark Bro's Nurseries, the year awarded, and their trade names and attributes.[z]

Patent no.	Year	Fruit or Nut name	Attributes
7	1932	Hal-Berta Giant peach	Cross of J.H. Hale & unknown cultivar; very large fruit size
12[y]	1932	June Redskin plum	Parentage unknown; deep red skin; freestone; early maturing
13[y]	1932	Great Yellow plum	Parentage unknown; skin yellow; freestone; early maturing
14[y]	1932	Flaming Delicious plum	A Japanese plum hybrid; dark red flesh; freestone; early maturing
15[y]	1932	July Elberta peach	Skin red with small pit; freestone; ripens 2 weeks before Elberta
16[y]	1932	Mammoth Cardinal plum	Red skin with yellow flesh; clingstone; good for shipping
18[y]	1932	Golden Delicious plum	Parentage unknown; fruit with gold skin; freestone
29	1932	Montlate sour cherry	Fruit ripens 10 to 14 d later than Montmorency
30	1932	Montearly sour cherry	Fruit ripens 10 to 14 d before Montmorency
41[y]	1932	Honey Heart sweet cherry	Yellow skin with red blush; not susceptible to cracking or brown rot
42	1932	Early Giant grape	Concord-type ripening 25 to 30 d earlier; large fruit size & cluster size
57	1933	Scarlet Staymared apple	Bud-sport of Stayman Winesap with early red coloring& ripens 30 d earlier
85	1934	Jonared apple	Mutation of Jonathan with earlier & solid red skin color
258	1937	York-A-Red apple	Bud-sport of York Imperial with solid red skin color
271	1938	Hardy-Berta peach	Resembles Elberta but fruit ripens 2 weeks later
290[y]	1938	Burbank's Orchid peach	Large, double pink flowers with small edible fruit; freestone
291[y]	1938	Burbank's Santa Rosa peach	Large, double crimson flowers; small edible fruit with white flesh, freestone
306	1938	Tom Thumb peach	Low-growing ornamental with attractive flowers & edible fruit
585	1943	Grand Champion pear	Mutation of Gorham; fruit has golden russet & ripens 14 d after Bartlett
623	1944	Freeland peach	Similar to Elberta; freestone
627	1944	Late Lambert & Stark Royal Purple	Bud–sport of Lambert that ripens 10 to 14 d later
642	1944	Stark Earliest apple	Ripens before Yellow Transparent; ships well; cooking apple
670	1946	Stark Sure-Crop peach	Open-pollinated seedling of Greensboro; white flesh; clingstone; fruit ripens early
674	1946	Earli-Orange apricot	Late blooming; deep orange flesh; ripens 10 d earlier than Riland
720	1946	Redgold apple	Golden Delicious x Richared Delicious
759	1947	Stark Early Flame nectarine	Open-pollinated seedling of Flaming Gold but ripens 14 d earlier; semi-freestone
764	1947	Starking Hardy Giant Sweet Cherry	Large, dark red-colored fruit; tree very hardy
765	1947	June Wealthy apple	Open-pollinated seedling of Wealthy; fruit has light yellow skin with red blush, ripens early
793	1948	Giant cherry plum	Open-pollinated seedling of Abundance; a myrobalan plum; clingstone
794	1948	Stark JonGrimes apple	Fruit skin yellow with red streaks; tart flavor; ripens 2 to 3 weeks before Jonathan
803	1948	Starking Delicious peach	July Elberta mutation; freestone; fruit ripening 6 d before Redhaven
878	1949	Early White Giant peach	Seedling of Hal-Berta-Giant; white-fleshed; semi-freestone; early-maturing fruit

888	1949	Honey Dew Hale peach	White skin with pink blush; white flesh; good shipper
970	1950	Golden Early Bird peach	Open-pollinated seedling of Crawford; very early-ripening; semi-freestone
1021	1951	June-Berta peach	Mutation of Fair Beauty; fruit ripening 8 weeks before Elberta
1041[y]	1951	Unnamed plum	Dwarf tree habit; purple skin; virus-infected; not marketed
1044	1951	Starking Delicious pear	Parentage unknown; large fruit; resistant to fire blight
1064	1952	Starking Delicious plum	Red peel and flesh; clingstone; resistant to bacterial leaf spot and canker
1063	1952	Stark Kwik Krop black walnut	Light-colored kernel with mild flavor; nut cracks easily into quarters or halves
1095	1952	Starkrimson Dwarf pear	Bud-sport of Clapp Favorite; 100% red skin
1321	1954	Stark LateGold peach	Elberta peach seedling x Hal-Berta giant; ripening 10 d later than Elberta
1329	1954	Stark RedGold peach	Hal-Berta Giant x NJ 133; ripens 15 d before Elberta; resistant to bacterial spot
1361	1955	Starking Hardy Giant pecan	Thin shell with large kernel; early maturing; tree hardy
1365	1955	Starkrimson strawberry	Midland x Fairpeak; dark red fruit; resistant to *Mycoshparella fragariae*
1422	1955	Stark Summer Delicious apple	Open-pollinated seedling of Delicious; fruit ripens 4 to 5 wks earlier than Delicious
1494	1956	Starking Black Giant black raspberry	More productive than Cumberland & more tolerant of high temperatures & drought
1550	1957	Law Rome Beauty apple	Bud-sport of Rome Beauty with elongated fruit shape; early red coloring
1565	1957	Starkrimson Red Delicious apple	Spur-type Delicious; elongated fruit with dark red, non-striped skin
1632	1957	Stark EarliGlo peach	Mutation of Redhaven with fruit ripening 10 d earlier
1668	1957	Peach	Fruit ripens 8 to 10 d before Mayflower; flowers are cold-hardy
1721	1958	Stark EarliBlaze apple	Fruit ripens at same time as Wealthy with even ripening & firmer flesh
1777	1958	Jonalicious apple	Fruit resembling Starking Delicious but matures near or slightly after Jonathan
1921	1960	Stark Delicious nectarine	Late-maturing Le Grand x Star Grand nectarine; fruit 100% red skin with yellow flesh; freestone
1929	1960	Stark SunGlo nectarine	Fruit ripens 7 d before Sun Grand nectarine with darker red skin
1930	1960	Starkspur Red Delicious apple	Precocious, spur-type Delicious with deep-red color and striped fruit
1946	1960	Unnamed peach	Sun Grand nectarine x Merrill Gem peach; fruit ripens with Merrill Gem
1947	1960	Stark RedGold nectarine	Yellow skin with substantial red color; fruit ripens 10 d after Sun Grand nectarine
1949	1960	Stark EarliBlaze nectarine	Sun Grand x Le Grand x Merrill Gem peach; ripens 2 weeks before Redhaven; for shipping
2024	1961	Starkspur Golden Delicious apple	Spur-type Golden Delicious; elongated fruit with five prominent calyx lobes
2035	1961	Stark Cardinal crabapple	Pendulous purplish-pink flowers; edible fruit; heavy-bearing: resistant to scab & fire blight
2124	1962	Stark LateGlo peach	Mutation of Elberta but fruit ripens 2 to 3 weeks later
2179	1962	Stark Summer Gold apple	Yellow skin with red blush& waxy; ripens 2 weeks before McIntosh; sprightly flavor
2313	1963	Starkspur Winesap apple	Spur-type growth habit & more productive that Winesap
2440	1964	Super Starking apple	Fruit resembling Starking Delicious with earlier red coloring (30d); at maturity fruit skin solid red (obscure stripes)
2460	1964	Stark Splendor apple	Originated from a seedling; bright red skin but resembles Golden Delicious in size & shape
2571	1965	Stark MacVerna Delicious plum	seedling of Japanese plum; fruit with red-purple skin & flesh; resistant to bacterial leaf spot
2572	1965	Unnamed sweet cherry	Bud-sport of Bing with double white flowers; ornamental value
2608	1966	Unnamed apple	Originated from a seedling with fruit resembling Jonalicious but ripening 2 wks earlier
2702	1967	Stark Summerglo apple	Fruit resembles Beacon but with superior flavor; ripens in early August
2793	1968	Nectarine	Cross of Late Le Grand x Early Sun Grand; freestone; ripens with Late Le Grand
2835	1968	Stark Blushing Golden	Fruit resembles Golden Delicious with red blush, russet-free & ripens 10 d later
2884	1969	Stark Red Giant strawberry	Larger fruit & more uniform size throughout harvest than Christ strawberry

2941	1969	FrostKing peach	Seedling of unknown parentage; late blooming, ripens with Early Elberta
2944	1969	Starlet peach	Dwarf tree; low-chill requirement; fruit matures in mid-June to early July in California
2956	1969	Red Bouquet apple	Purplish-pink flowers; fruit resembling Starking Delicious with intense, solid red skin color
3025	1971	Stark Earlibrite Delicious apple	Fruit resembles Ryan Red Delicious but coloring one mo. earlier with solid bright red skin color
3058	1971	Dwarf apple (interstem)	Open pollinated seedling of Clark Dwarf; it produces a tree slightly larger than a M.8 interstem & more tolerant of stem-pitting virus
3061	1971	Dwarf apple (interstem)	Open-pollinated seedling of Clark Dwarf; it produces a tree more dwarfing than a M.9 interstem; tolerant of stem-pitting virus
3121	1972	Starkspur Red Rome Beauty apple	Spur-type Red Rome Beauty
3159	1972	Stark Champion English walnut	Tree self-fruitful and cold hardy to -29°C; nut size slightly smaller than Lake English walnut
3158	1972	Stark Surecrop pecan	Tree self-fruitful and cold hardy to -28°C; more productive than Starking Hardy Giant
3304	1973	Starkspur Montmorency sour cherry	Mutation of Montmorency; no fruit cracking
3330	1973	Nectarine	Dwarf tree; clingstone fruit ripens about 30 d before Golden Prolific nectarine
3388	1973	Autumn Gold peach	Fruit ripens 10 d later than Elberta peach with no red staining of flesh near the pits
3477	1974	Nectarine	Freestone fruit ripens earlier than Late Gold
3541	1974	Starkspur Supreme Red Delicious	Spur-type similar to Starkrimson Red Delicious with bright cherry red peel
3550	1974	Stark Bounty apple	Late-blooming; firm fruit resembling Stayman Winesap in appearance & flavor
3557	1974	Starkspur UltraRed Delicious	Bud-sport of Starking Delicious with early-coloring fruit with brighter red color
3567	1974	Starking FullRed Delicious apple	Bud-sport of Delicious; fruit develops full red color at least 4 d before Super Starking Delicious
3637	1974	Gala apple	Kidd's Orange x Golden Delicious; yellow fruit with red blush; ripens 2 wks before Jonathan
3882	1976	Starkspur Prime Red apple	Mutation of Topred Delicious; spur-type; fruit skin bright red with stripes
3927	1976	Stark Giant Tilton apricot	Mutation of Tilton with larger fruit
3928	1976	Stark Jumbo pear	Mutation of Bartlett; very large fruit
4053	1977	Plum	Fruit resembles Italian Prune but ripens 17 d earlier; resistant to bacterial & fungal leaf spots
4060	1977	Stark Supreme Staymared	Mutation of Scarlet Staymared; fruit peel with deep red color & less cracking
4076	1977	Stark Early Bird nectarine	Red Diamond x May Grand nectarine; skin solid red color; freestone; good for shipping
4080	1977	SweetHeart apricot	Vigorous tree; small fruit with sweet flesh & kernel
4121	1977	Stark Royal Gala	Mutation of Gala with bright red peel color with dark stripes
4170	1977	Stark Early Loring	Bud-sport of Loring but fruit ripens 10 to 14 d earlier
4171	1977	Peach	Mutation of Rio Oso Gem but fruit ripens 17 to 18 d earlier
4413	1979	Crimson King	Fruit resembles Starks Red Giant but ripens 7 to 10 d earlier
4382	1979	Starkspur Compact Mac apple	Spur-type McIntosh; extremely dwarf tree with upright growth habit
4383	1979	Starkspur UltraMac	Mutation of Summerland Red McIntosh; spur type; fruit peel intense red color
4572	1980	Peach	NJ seedling 585414 x Autumnglo; late-maturing; resistant to bacterial leaf spot
4731	1981	Stark Puregold & Ultra Gold	Mutation of Goldensheen; usually free of fruit russet; non-spur type
4740	1981	Stark Summer Treat apple	NJ 109055 x Mollies Delicious; fruit ripens about 28d before Starking Delicious
4789	1981	Stark HoneyGlo nectarine	Fruit with yellow skin & 50% red blush ripens 14 d before Loring; a dwarf tree
4793	1981	Starkspur Law Rome	Spur-type mutation of Law Red Rome Beauty; tree has compact growth habit
4800	1982	Starkspur Cortland	Spur-type Cortland with compact growth habit

4901	1982	Starkspur Winter Banana	Spur-type Winter Banana; pollinizer for Delicious
5116	1983	Stark Bountiful butternut	Five or more nuts/cluster; nut easily hulled
5123	1983	Stark Saturn peach	Fruit shape flattened (peento peach) fruit of commercial quality; white flesh
5124	1983	Stark Sensation peach	Dwarf peach tree for pot culture; fruit ripens 49 d before Elberta
5461	1985	Stark Gulf Pride peach	Red Grand nectarine x Desert Gold peach; low chill requirement; skin 50% red blush
5463	1985	Stark Gulf Queen peach	Open-pollinated seedling of Ruby Gold nectarine; low chill requirement
5472	1985	Starkspur Ultrastripe Delicious apple	Spur-type; fruit resembling Starking Delicious with earlier red coloring & pronounced stripes
5547	1985	Starkspur DixieRed Delicious apple	Spur-type Delicious; colors 15 d earlier than Oregon Spur; dark red fruit color (no stripes)
5651	1986	Stark SweetHeart & Double Delight apricot	Medium-small tree with extended bloom & frost tolerance; fruit has edible kernel
5655	1986	Stark Finale peach	Seedling of Louisiana Surecrop; ripens late, 10 d after Rio Oso Gem
6361	1988	Adina apple	Open- pollinated Golden Delicious seedling for warm growing areas; red skinned
6406	1988	Stark Ultrared Jonathan apple	Mutation of Snyder cultivar of Jonathan but brighter red fruit peel & colors 10 d earlier
6955	1989	Stark Galaxy Gala	Mutation of Royal Gala with earlier fruit coloring; cherry red peel (indistinct dark red stripes)
8621	1994	UltraRed Gala apple	Bud-sport of Gala; 90 to 100% red color; coloring occurs 10 d earlier than Galaxy
8949	1994	Stark Encore nectarine	Mutation of N.J. 260 peach but fruit lacks pubescence & ripens with Encore peach
9173	1995	Earli Sun apricot	Mutation of Castlebrite apricot that ripens 2 d later
9263	1995	Stark Ovation nectarine	Freestone fruit ripens late in eastern U.S; cold hardy fruit buds
11348	2000	Stark GrandGala apple	Larger fruit size than Stark Royal Gala with more pronounced calyx lobes & ripens earlier
28773	2017	Russeted Bartlett	Bartlett x A-Ri-Rang Asian pear; fruit resembles a russeted Bartlett
29880	2018	Peggy Asian pear	Mutation of A-Ri-Rang & ripens 30 d earlier; long storage life
30925	2019	Stark Scarlet Crush apple	Pink Lady x Honeycrisp; pink peel; fruit has citrus flavors
30978	2019	Stark Ruby Darling apple	Buckeye Gala x Honeycrisp; resistant to fire blight; red tint in fruit flesh; late ripening

[z] United States Plant Patent & Trademark Office, 2020.
[y] Cultivars developed by Luther Burbank.

cultivars (Table 2), as well as many ornamentals. When this new plant material appeared in Stark's early catalogs, customers had to sign an agreement that they would not "give away or sell or permit anyone else to give away or sell or to take these new Luther Burbank varieties of trees and (or) plants or their progeny, or scions, buds or cuttings from these trees and (or) plants" for a period of 25 years as a condition of the sale. Similar purchase agreements were used by Stark Bro's into the 1940's.

During his tenure as President, Clarence was diagnosed with "tuberculosis" and was advised to seek a drier climate. Thus, he purchased 40 ha of land near Littleton, Colorado and promptly planted 12,000 fruit trees. In this non-irrigated orchard, a Clark disk harrow was used to control weeds and its dragging attachment sealed the soil surface to reduce moisture loss. The U.S. Department of Agriculture Pomologist Dr. H. E. Van Deman described these practices and stated that "this one lesson in practical horticulture, if heeded, will be worth millions to the country" (Van Deman, 1892).

By 1903, there was discord developing within the Stark family when Edgar unofficially filled in for Clarence as President of Stark Bro's (Stark Bro's Nurseries and Orchards, 1916). Although Clarence was diagnosed with tuberculosis, it is likely that he

Table 2. Fruits developed by Luther Burbank's that were marketed by Stark Bro's under their trademark or not patented.

Fruit	Cultivar name	Fruit	Cultivar Name
Black walnut[z]	Burbank Royal	Plum	June Red-Skin
Nectarine	Flaming Gold	Plum	Monster
Peach	Burbank's Giant Freestone	Plum	Orange Ball
Peach	July Gold	Plum	Purple Flame
Peach	Peach-Arine	Plum	Red Ace
Pear	Christmas Holiday	Plum	Red Cannon Ball
Plum	America	Plum	Royal Purple
Plum	Cranberry	Plum	Santa Rosa
Plum	Elephant Heart	Plum	Splendor
Plum	Golden Heart	Plum	Vanderbilt
Plum	Golden Sugar	Pluot	Orange
Plum	Grand Prize	Pluot	Purple
Plum	Heart of Gold	Sweet cherry	Black Giant
Plum	Honey Dew Gage	Sweet cherry	Early Honey Heart
Plum	Honeymoon	Sweet cherry	Rainbow-Stripe
Plum	June Blood		

[z] *Juglans californica* x *J. nigra*.

had symptoms of dementia and was eventually declared legally insane. Clarence's brother, William, who served temporarily as the business manager, demanded more control over the business for his branch of the family. While Edgar and William feuded, they essentially removed Clarence from control of the business in May 1911. Unable to reach an agreement on the future direction of Stark Bros., Edgar eventually paid William $1000 to leave Stark Bros. Still, the two brothers fought over the rights to a new peach cultivar ('J.H. Hale') and William and his son started their own business, William P. Stark Nurseries, in Chester (later renamed Stark City), Missouri. The U.S. Supreme Court eventually ruled against William for trademark infringement, but by then he had sold his nursery to Josiah Hazen and had left Missouri to work for Cottage Gardens Nurseries in Eureka, CA.

After William lost the lawsuit against Edgar, the elder brother remained in control of Stark Bros. Edgar was an astute businessman and was known as "the efficiency expert". He excelled at streamlining production and developed the mechanical tree-digger and other equipment for use in field production and in the packing houses with employee, Homer L. Reed. Eliminating the need for hand-digging, their new machine revolutionized the nursery industry (Schafer and Smith, 1990). By the time Stark Bro's was celebrating their centennial year in business (1916), they had shipped trees to Mexico, Canada, Europe, Africa, Asia, and Australia (Stark Bro's Nurseries and Orchards, 1916). Because plant patents were not yet in existence, Stark Bro's trademarked the names of several of their important fruit cultivars. After William left Stark Bro's, Clarence's eldest son, Lloyd Crow Stark (1886-1972), was brought home from the Navy to become the new Vice President and General Manager (Zotta, 2015). Meanwhile, Clarence's younger son, Paul Clarence Stark, Sr., completed his B.S. degree in Pomology at Cornell University in 1912 but returned to Missouri to assume responsibilities in the family's business.

In April 1912, A.H. Mullins sent Stark

Bro's three yellow apples that had a long storage life in his cellar. Paul Sr. and Lloyd were so impressed that they sent one of the apples to the USDA Pomologist, Colonel G.B. Brackett, in Washington, D.C., who was also excited by this discovery. In the autumn of 1912, Paul Sr. was sent in pursuit "of the golden apple" to a remote point on Porter's Creek, West Virginia. Paul Sr. traveled across the country on several trains, then hired a horse and buggy, and finally road the last 32 km on a horse to find this extraordinary tree (Stark, Jr., 1971). In 1915, Stark Bros. acquired the rights to Mullins' tree and the 8.4 m^2 of land for $5,000. On this land, they enclosed their precious new tree in fencing and equipped it with an alarm to protect their investment. This apple was named 'Golden Delicious'. Pomologists across the U.S had high praise for this astonishing new cultivar. The USDA Principal Horticulturalist, H.L. Crane proclaimed, "It is likely that Stark's 'Gold Delicious' will be the parent of a family of fruit trees that will revolutionize apple growing. I have never seen anything like it before. Here it is, showing fruit maturing on terminals, fruit spurs, and most important of all, on lateral buds." Luther Burbank stated, "After observing 'Golden Delicious' in my experiment grounds and giving it careful tests, I have no hesitancy in stating that it is the greatest apple in all the world." U.S. Senator Selden Spencer from Missouri also wrote, "Today on calling on the President [Calvin Coolidge], I took along a Stark's Golden Delicious apple and presented it to him. It attracted his attention and admiration and he immediately took a knife and cut a piece of it and then a piece for me. He enjoyed it as much as I did." As its fame spread, Stark Bro's was awarded the Wilder Medal for this cultivar from the American Pomological Society (APS) in 1919.

Stark Bro's next important apple cultivar was the result of a letter received from Lewis Mood in New Jersey. Mood wrote that a branch on his 'Delicious' tree was "acting strangely", bearing dark red, non-striped fruit three weeks before color development occurred on apples on other limbs. Paul Sr. then rushed to visit Mood and acquired the limb for $6,000 in 1923. This bud sport was trademarked 'Starking Delicious'. With this payment, Mood happily sent his son, Lewis Jr. to college. Leading pomologists and industry representatives from across the U.S. gathered in Monroeville, NJ in 1925 to see this remarkable discovery and discuss the potential usefulness of bud-sports for commercial apple production. In 1929, Leo Antles, Orchard Production Manager of the American Fruit Growers, Inc. sent Stark Bro's a telegram stating, "Am sending photo [of] first car of all Starking apples shipped from Northwest. Leading growers and shippers who visited [the] car and examined fruit are deliighted with these wonderful Starking apples. Growers, shippers, and inspectors, and district horticulturalists pronounce this the finest carload of apples ever shipped from Wenatchee district Washington and say it is beginning of a new epoch in the apple industry."

As predicted, the discovery of Starking 'Delicious' marked the beginning of "the bud sport era" (Terry, 1966). Following this remarkable introduction, many fruit cultivars derived from bud-sports have been marketed worldwide. The significance of the discovery was recognized in 1926, as Stark Bros. received another Wilder Medal for 'Starking Delicious'.

After Edgar's death in 1935, his son, Clay Hamilton Stark became President of Stark Bros. Although the previous presidents were well-grounded horticulturists, Clay and those who followed him were primarily dedicated to financial aspects of the business (Fig. 1). After Clay assumed the presidency, Lloyd left to join the realm of politics and was elected the 39th Governor of Missouri from 1937 to 1941. Paul Sr. continued as Vice President of Research and Production at Stark Bro's, but also served as Director of Home Food Supply for the War Food Administration at the behest of President Harry Truman. Paul

Sr. also served as President for a private organization, the National Victory Garden Institute, during World War II. As Chairman of the National Committee for Plant Patents, Paul Sr. was instrumental in lobbying Congress to pass legislation protecting new plant discoveries (Zotta, 2015). At one point, the Plant Patent bill was stalled in the House of Representatives by Congressman Fiorello La Guardia. After the bill's sponsor read a letter of support written to Paul Sr. from Luther Burbank, La Guardia was swayed to vote in favor of the bill and soon thereafter it was passed by the U.S. Senate. Thus, The Plant Patent Act of 1930 ensured that a plant breeder or discoverer could legally protect their new and distinctly different tree or plant (except for tubers) that was asexually-propagated for 17 years (Kevles, 2007). Thereafter, Stark Bro's received the first fruit tree patent, USPP7 for 'Hal-Berta Giant' peach on 16 Feb. 1932 (U.S. Plant Patent & Trademark Office, 2020). Since then, Stark Bro's has held about 131 patents, most of which are fruit or nut cultivars. In 1972, Paul Sr. received the Wilder Medal for his contributions as a nurseryman and the development of dwarfing rootstocks.

Paul Clarence Stark, Jr. followed in his fathers' (Paul Sr.) footsteps. He graduated from Cornell University with a B.S. degree in Pomology in 1940. After this, he was briefly an instructor of fruit science at University of California-Davis from 1940 to 1941, but returned to work at Stark Bro's as a Vice President for Special Research and was responsible for identifying new germplasm (Terry, 1966). In 1950, Paul Jr. obtained U.S. patent 2,523,600, which was a novel method to propagate four-part dwarf apple trees in two growing seasons (U.S. Plant Patent & Trademark Office, 2020). This method involved bench grafting a long stem piece of 'Virginia Crab' onto a seedling nurse-root (Hartmann et al., 2011). In March, this graft was planted beneath the soil surface in the field to obtain additional rooting from the 'Virginia Crab'. The following winter, a desirable fruiting cultivar was bench-grafted onto a dwarfing stem piece and then this combination was subsequently grafted onto the 'Virginia Crab' stock growing in the nursery row in March. Trees produced by this method were advertised as hardy dwarf "quadruple-life" apple trees that could be planted at higher densities to enhance fruit yield.

Stark Bro's also produced "double dwarf" apple trees, using their 1971 patented selection of 'Clark Dwarf', which could be used as an interstem (or rootstock) (Terry, 1966). Using their propagation technique for producing trees in two growing seasons, double dwarf trees also had four-parts, consisting of a 'Virginia Crab' rootstock, a 'Clark Dwarf' interstem piece, a 'Hibernal' stem, and a spur-type cultivar. Growers were encouraged to plant double dwarfs at a density of 988 trees/ha. The assignor of the 'Clark Dwarf' patent and the originator of the "double dwarf" tree system was long-time employee, Harry Guengerich, who served as Director of Research at Stark Bro's for more than 30 years (U.S. Plant Patent & Trademark Office, 2020). He and Daniel K. Millikan from the University of Missouri also demonstrated the transmission of the stem pitting virus through apple tissues (Guengerich and Millikan, 1956, 1959; Millikan and Guengerich, 1959a, 1959b). Subsequent to this discovery, Guengerich initiated and implemented virus indexing of plant material at Stark Bro's.

Paul Jr. is credited with the discovery of a compact-growing 'Delicious' apple tree found in Roy Bisbee's orchard in Hood River, Oregon. Stark Bro's paid $25,000 for this cultivar in 1956 and named it 'Starkrimson Red Delicious' (U.S. Plant Patent & Trademark Office, 2020). This introduction marked the beginning of Stark Bro's quest for spur-type fruit cultivars.

Another major acquisition made by Paul Jr. was a mutation from Phillip Jenkins's apple orchard near Parker, Washington. Stark Bro's paid $51,000 to obtain this cultivar in 1961 and named it 'Starkspur Golden Delicious'. Ultimately, Stark Bro's was assigned

patents for other spur-types, such as 'Starkspur Red Rome Beauty', 'Starkspur Supreme Red Delicious', 'Starkspur Compact Mac', 'UltraMac', 'Starkspur Law Rome', 'Starkspur Cortland', 'Starkspur Winter Banana', and 'Starkspur DixieRed' apples, as well as 'Starkspur Montmorency' sour cherry (Table 1).

The next remarkable (and profitable) apple, for which Stark Bro's was assigned a patent, was 'Gala'. In 1974, this cultivar was acquired by Stark Bro's from Donald W. McKenzie of Havelock North, New Zealand (U.S. Plant Patent & Trademark Office, 2020). As the popularity of 'Gala' grew, fruit nurseries scrambled to find mutations of this cultivar that they could patent. Stark Bro's next secured patent rights for the red-colored mutation, 'Royal Gala' in 1977, for which they aggressively sought legal action against unlawful propagators. Thereafter, they added other highly red-colored mutations to their inventory, including 'Galaxy Gala', 'Ultra-Red Gala', and 'Grand Gala' that varied in the time of ripening, fruit color and size, and maturity date (Table 1).

Unfortunately, not all cultivars that Stark Bro's patented were successful introductions. For example, the extremely dwarf spur-type 'MacIntosh' apple, purchased from Anthony Wijcik and patented in 1974 was never profitable. In 1994, Stark Bro's produced several dwarf, columnar trees that were marketed as Colonade types ('Ultra Spire', 'Crimson Spire', 'Emerald Spire', 'Irish Spire', and 'Scarlet Spire' apples, and 'Maypole' flowering crabapple). These trees could be planted at 30 to 60 cm spacings in orchards or in containers, but never become popular even in home landscapes.

Although Stark Bro's may be best known for their apples, they patented many other fruits, including crabapple, European and Asian pear, peach, nectarine, sweet and sour cherry, European and Japanese plum, apricot, strawberry, black raspberry, pecan, and Eastern black walnut. Additionally, they secured exclusive mail order rights to apriums and pluots from Floyd Zaiger and patented ornamental plants, such as roses and thornless barberry, as well as a rhubarb. Since 1894, they have grown and sold many other fruits and ornamentals to maintain their thriving mail-order business, which shifted to online sales in later years.

Paul Jr. was an active member of the American Pomological Society (APS). Over the years, he wrote articles and commentaries on cultivar and rootstock trends, small fruit performance, and fruit nomenclature, which were published in the Fruit Varieties and Horticultural Digest (now Journal of APS) (Stark, Jr., 1955, 1956, 1958, 1960b, 1962a, 1962b, 1962c, 1962d, 1971, 1972, 1974). Most notably, he was awarded the Shepard Award in 1960 for his article, "Fruit Growing in the South Pacific" following his trip to New Zealand, Australia, and Tasmania (Stark, Jr., 1960a). Also, Paul Jr. received the International Dwarf Fruit Tree Association Grower Award in 1975 and served as President of the Missouri State Horticultural Society (Zotta, 2015).

Over the years of the Stark family ownership, the nursery faced financial panics, the Great Depression, and several economic recessions. Additionally, they weathered numerous droughts, as well as historic floods of the Mississippi River in 1785, 1844, 1927, 1937, 1993, and 1997 (Missouri State Archives, 2020). The latter two were known as "500-year floods", which were only supposed to occur once at that interval of time. Because of the erratic climate in Louisiana, Missouri, Stark Bro's had other growing locations over the years in Hannibal and Marionville, MO; Atlas and Rockport, IL; Farmington and Fayetteville, AR; Perry, KS; Checotah, Porum, and Stigler, OK; Danville, NY; Tyler, TX; Wapato, WA; and Farland and Sebastopol, CA; North Girard, PA; and Angers, France.

Through shear grit and ingenuity, Stark Bro's had over $15 million in sales in 1979 and produced 4 million trees in the early 1980's, before production spiraled down-

ward across the United States and many nurseries went out of business (Zotta, 2015). Still, Stark Bro's remained a family-held business until 1994 when they were sold to a catalog company, Foster & Gallagher, after 179 years in business. However, the iconic company name was retained. Foster & Gallagher eventually went bankrupt after its other business holdings failed, and Cameron Brown and Timothy Abair purchased Stark Bro's in 2001. In 2019, they were assigned patents for 'Scarlet Crush' ('Cripps Pink' x 'Honeycrisp') and' Ruby Darling' ('Buckeye Gala' x 'Honeycrisp') apples and currently market an impressive array of fruits, nuts, vegetables, herbs, ornamentals and growing supplies (Stark Bro's Nurseries & Orchards, 2020).

Legacy

Stark Bro's has a rich history as the oldest fruit nursery in the United States continuously owned and operated by a family. For more than 200 years, it identified, acquired, and marketed a plethora of pomological cultivars to sell to hobby and commercial growers worldwide. Stark Bro's championed the right to protect novel germplasm and played a key role in persuading Congress to pass the Plant Patent Act in 1930. From its mass mailings of catalogs, brochures, and instructional guides, as well as its online presence, Stark Bro's has educated the masses about growing fruit trees. Moreover, Stark Bro's has advanced commercial fruit production with the introduction and propagation of unique germplasm, resulting in more compact-growing trees that can be grown at high densities.

Literature Cited

Auckley, J. 2020. The 1995 flood. Missouri Conservationist Magazine. 10 Aug. 2020. <https://mdc.mo.gov/conmag/1995/08/1995-flood>.

Anonymous. 1967. Early American nurserymen and seedsmen. Plants & Gardens 23:75-76.

Beach, S.A, N.O. Booth, and O.M. Taylor. 1905. The apples of New York. Vol. 1. J.B. Lyon Comp., Albany, NY.

Guengerich, H.W. and D.F. Millikan. 1956. Transmission of the stem pitting factor in apple. Plant Dis. Rptr. 40:934-938.

Guengerich, H.W. and D.F. Millikan. 1959. Reaction of own-rooted trees of Spy 227 and Virginia Crab to infection with stem-pitting virus. Plant Dis. Rptr. Suppl. 254:30-32.

Hartmann, H.T., D.E. Kester, F.T. Davies, Jr., and R.L. Geneve. 2011. Hartmann and Kester's plant propagation: Principles and practices. 8th ed. Prentice Hall, Boston, MA.

Hedrick, U.P. 1950. A history of horticulture in America to 1860. Timber Press, Portland, OR.

Kelves, D.J. 2007. Patents, protections and privileges. The establishment of intellectual property in animals and plants. Isis 98:323-331.

Millikan, D.F. and H.W. Guengerich. 1959a. Some pomaceous indicator hosts for the stem-pitting virus of apple. Plant Dis. Rptr. Suppl. 254:32-34.

Millikan, D.F. and H.W. Guengerich. 1959b.Tolerance of some hardy apple stocks to the stem pitting virus. Plant Disease Rptr. Suppl. 254: 35-36.

Missouri State Archives. 2020. Missouri disasters, 1785-present-floods. Missouri Office of the Secretary of State. 10 Aug. 2020. <https//www.sos.mo.gov/archives/mdh_splash/default.asp?coll=disasters floods>.

Schafer, R. and S.L. Smith. 1990. Riding the technology. Amer. Nurseryman 171 (12):169-197.

Stark Bro's. Nurseries and Orchards Company. 1916. Stark Bros. Centennial fruits. Cone, Parker & Storfer, Chicago, IL.

Stark Bro's. Nurseries and Orchards Company. 2020. Stark Bro's catalogs. 10 Aug. 2020. <https://www.starkbros.com/about/request-a-catalog>.

Stark, Jr., P. 1955. Stability of 'Delicious' strains. Fruit Var. and Hort. Dig. 10:30.

Stark, Jr., P. 1956. The Starkrimson (Bisbee strain) 'Delicious' apple. Fruit Var. and Hort. Dig. 11:31.

Stark, Jr., P. 1958. Rootstocks for apple. Fruit Var. and Hort. Dig. 13:27.

Stark, Jr., P. 1960a. Fruit growing in the South Pacific. Fruit Var. and Hort. Dig. 14:65-68.

Stark, Jr., P. 1960b. More on 'Tydeman's Early Worchester' apple. Fruit Var. and Hort. Dig.15:19.

Stark, Jr., P. 1962a. Apple production and variety trends. Fruit Var. and Hort. Dig. 16:57-58.

Stark, Jr., P. 1962b. Naming new fruit varieties. Fruit Var. and Hort. Dig. 16:62.

Stark, Jr., P. 1962c. Performance of new strawberry varieties in New Zealand. Fruit Var. and Hort. Dig. 17:8.

Stark, Jr., P. 1962d. The 'Canby' red raspberry. Fruit Var. and Hort. Dig. 16:22.

Stark, Jr., P. 1971. The Golden Delicious story. Fruit Var. and Hort. Dig. 25:89-92.

Stark, Jr., P. 1972. Apple varieties in the San Joaquin Valley of California. Fruit Var. and Hort. Dig. 26:40-42.

Stark, Jr., P. 1974. The 'Ozark Gold' apple. Fruit Var. and Hort. Digest. 28:20-21.

Terry, D. 1966. The Stark story. Stark Nurseries 150th Anniversary. The Bulletin. Missouri Historical Soc. St. Louis, MO.

United States Department of the Treasury. 2020. Financial panic of 1873. 10 Aug. 2020. <https:treasury.gov/about/history/freedmans-bank-building/financial-panic-of-1837>. U.S. Plant Patent & Trademark Office. 2020. Patent search. 10 Aug. 2020. <http://patft.uspto. gov/netahtml/PTO/srchnum.htm>.

Van Deman, H.E. 1892. Report of the Secretary of Agriculture 1892. 10 Aug. 2020. <https://babel.hathitrust.org/cgi/pt?id=coo.31924054683440&view=1up&seq=293&q1=stark>.

Zotta, L. 2015. 200 Years and growing: the story of Stark Bro's nurseries & orchards. Stark Bro's Nurseries & Orchards Comp., Louisiana, MO.