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HS921

Growing Heirloom Tomato Varieties in Southwest Florida[1]

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Introduction

Heirloom tomatoes (*Solanum lycopersicum* L.) have seen a rebirth in popularity because of increasing demand for fresh, fully ripe, tasty tomatoes. Heirloom vegetables are nonhybrid varieties that have been preserved from generation to generation as seeds (Coolong 2009). Heirlooms are open pollinated, which means that the fruit is similar to the fruit of the previous generation (Flomo 2010). A tomato must meet three criteria to be considered an heirloom variety: The variety must be reproduced by seed, must have been cultivated for more than 50 years, and must have a history (Watson 1996). Many vegetables are available in heirloom varieties, and tomatoes are among the most important species (Figure 1). Heirloom tomatoes are known for their singular taste, shape, and color, which include purple, orange, and yellow, in addition to the common red tomatoes (Grassbaugh et al. 1999).

Figure 1. Common heirloom varieties growing in South Florida

Credits: Monica Ozores-Hampton

Heirloom tomatoes are a trend food or part of a package sought by consumers who frequent farmers' markets, enjoy vegetable gardening, adhere to organic production, and explore specialty foods (Jordan 2007). However, since heirloom tomatoes are not the result of breeding programs, heirloom varieties are not generally disease resistant; therefore, heirlooms are more susceptible to pathogens and have lower heat tolerance than the F1 hybrid varieties (Flomo 2010). Heirloom tomatoes also have a shorter shelf life and are highly susceptible to bruising, which requires marketing within a few days after harvest (Coolong 2009). Given the impact of weather on tomato fruit production, heirloom tomato flavor and appearance are significantly impacted by high temperatures, and a variety of fruit defects can occur, such as blossom-end scar, catfacing, cracking, grey wall, and odd shapes that may make them unmarketable by commercial standards (Table 1). The target audience of this publication includes conventional and organic producers as well as home gardeners.

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Grafting heirloom tomatoes

Grafting consists of splicing the shoot of one plant (called the *scion*) to the roots of another plant (called the *rootstock*) (Zhao and Simonne 2008) (Figure 2). The scion produces the desired heirloom fruit, and the rootstock is generally of a variety with some specific disease resistance (Rivard and Louws 2006). This technique can be used to manage soilborne diseases and increase fruit yield (Flomo 2010). The rootstock variety should be chosen by its genetic attributes, such as being resistant or tolerant to the target diseases (Table 3). Commercial seed companies provide both heirloom and suggested rootstock varieties (Table 2).

Grafting heirloom tomatoes can be an effective integrated pest management tool for growers who face heavy disease pressure from soilborne pathogens since many heirloom varieties are susceptible to soilborne diseases. Grafting has been used to manage Fusarium wilt (*Fusarium oxysporum* f.sp. *lycopersici*), Verticillium wilt (*Verticillium dahliae*), bacterial wilt (*Pseudomonas solanacearum*), Fusarium crown rot (*Fusarium oxysporum* f.sp. *radicis-lycopersici*), root-knot nematodes (*Meloidogyne* spp.), and tobacco mosaic virus (Zhao and Simonne 2008). A variety of methods can be used for grafting heirloom tomatoes, such as cleft grafting, tongue grafting, micrografting, and the most common commercial technique, tube grafting (Diánez et al. 2007; Ozores-Hampton, Zhao, and Ortez 2010; Rivard 2006).

According to Rivard (2006), there was no evidence of bacterial wilt when 'German Johnson' heirloom tomato was grafted to the resistant rootstocks 'CRA 66' and 'Hawaii 7996', as compared to 70%–75% disease incidence among nongrafted treatments. Also, a grafted 'German Johnson'/'Maxifort' union showed no Fusarium wilt, while nongrafted and self-grafted controls showed a 45%–50% disease incidence (Rivard 2006). Also, 'Maxifort' as a rootstock produced the greater yields with the highest fruit quality (Flomo 2010). For more information about how to grow vegetable transplants, see Vavrina (2011).

Heirloom varieties

When choosing a suitable Florida tomato heirloom variety to grow, several factors need to be considered. First, identify the market or niche where the heirloom tomatoes are to be sold. Second, determine what flavors, shapes, and colors are preferred by consumers. Third, consider seed availability, pathogen pressure (except when using soilless media in the greenhouse or pathogen-resistant rootstocks), and the production system (conventional or organic).

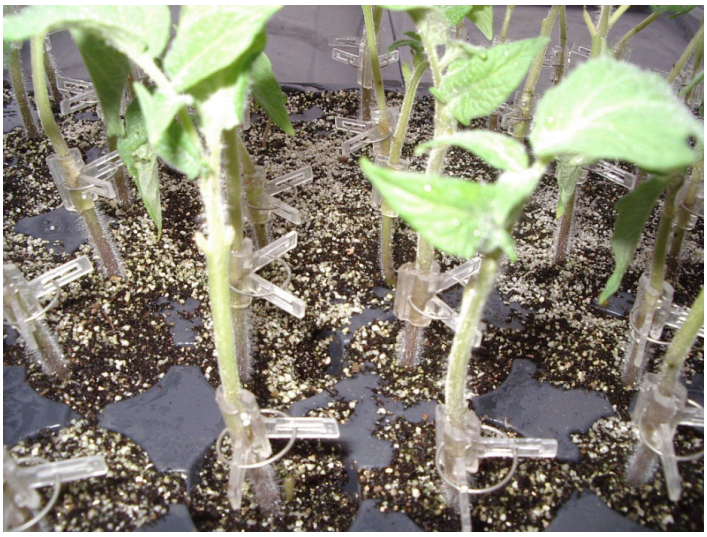

Figure 2. Grafting tomato plants by combining the shoot from a scion plant and the root from a rootstock plant using a grafting clip

Credits: Monica Ozores-Hampton

During the spring seasons of 1997 and 1998, two open-field evaluations of 15 heirloom varieties were conducted at the University of Florida's Southwest Florida Research and Education Center (UF/SWFREC) in Immokalee (Table 4). Heirloom variety evaluation included fruit physical characteristics (average weight, size, number, and total yield/plant) (Table 5) and defect incidence (blossom-end rot, blossom-end scar, catfacing, concentric and radial cracking, grey wall, odd shape, and zipper scar) (Table 6). Additionally, the incidence of late blight (*Phytophthora infestans*) during the 1997 spring season prompted evaluation of varieties for susceptibility to the disease (Table 7).

Heirloom varieties 'Flamme', 'Mr. Stripey', and 'Pink Ping Pong' produced higher yields but of relatively small fruit compared to 'Clear Pink Early' and 'Garden Peach', which had medium yields of medium-sized fruit, while 'Arkansas Traveler', 'Eva Purple Ball', and 'Green Zebra' had lower yields of medium-large fruit. 'Arkansas Traveler', 'Clear Pink Early', 'Eva Purple Ball', 'Flamme', 'Green Peach', 'Green Zebra', 'Mr. Stripey', and 'Pink Ping Pong' produced fewer fruit defects compared to the other varieties. It should be noted that all heirloom varieties in the trials were considered poor candidates for the commercial Florida gassed-green tomato industry because they would not stand up to the harvesting, packing, and shipping protocols of the present-day culture.

Based on the above variety evaluation and an unpublished grower survey, open-field heirloom tomato varieties growing in Florida are summarized in Table 8. In areas affected by Fusarium wilt or Fusarium crown rot, grafted plants can be used to overcome these diseases.

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Heirloom seeds

Heirloom tomato seeds can be obtained from commercial suppliers (Table 2) or can be collected and saved by the heirloom grower. When seeds are being saved for the next season, special care should be taken during the reproduction phases to maintain the purity of seeds to avoid unwanted crosses. The seeds should be harvested from the best plants to ensure that characteristics of the mother plant have been passed to the next generation. Additionally, be aware of suitable temperature and proper humidity (cool and dry) when drying and storing the seeds to preserve an acceptable germination rate (Coolong 2009).

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Table 1. Common defects of heirloom tomato varieties

Defect	***Description***
Blossom-end rot	Caused by a localized calcium deficiency in the developing fruit, blossom-end rot begins with light tan, water-soaked areas that can then enlarge and turn black and leathery in appearance.
Blossom-end scar	Corky tissue at the distal end of the fruit that may contain channels, usually extending into the locules (cavities containing seeds that are derived from carpels).
Catfacing	Caused by an internal or external factor that occurs during the formation of the flower, it appears as a gross fruit deformity.
Cracking (concentric/radial)	Occurs when the internal expansion is faster than the expansion of the epidermis, causing the epidermis to split. Concentric appears as a ring or rings around the stem scar; radial appears from the stem end and progresses toward the blossom end.
Grey wall	Dark, necrotic areas usually in the vascular tissue of the outer walls; grayish appearance caused by partial collapse of the wall tissue. Cause is not completely understood; more of a problem during cool, short days.
Odd shape	Fruits that are out of the standard tomato shape.
Zipper scars	Caused by an anther that is attached to the newly forming fruit, it appears as scars that extend partially or fully from the stem scar area to the blossom end.
Source: Barten and Scott 1992; Olson 2009	

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Table 2. Commercial sources of seeds for rootstocks and heirloom tomato varieties

Company	Website
Heirloom varieties	
Annie's Heirloom Seeds	http://www.anniesheirloomseeds.com/
Baker Creek Heirloom Seeds	http://rareseeds.com/
El Dorado Heirloom Seeds	http://eldoradoheirloomseeds.com/
Heirloom Seeds	http://heirloomseeds.com/
Henry Field's Seed and Nursery Co.	http://www.henryfields.com/
High Mowing Organic Seeds	http://highmowingseeds.com/
Irish Eyes Garden Seeds	http://www.irisheyesgardenseeds.com/index.php
Johnny's Selected Seeds	http://www.johnnyseeds.com/
Neseed	http://www.neseed.com
Park Seed Co.	http://parkseed.com/
Seeds for the South	http://www.seedsforthesouth.com/
Siegers Seed Company	http://www.siegers.com/default.htm
Southern Exposure Seed Exchange	http://www.southernexposure.com/
Sustainable Seed Co.	http://sustainableseedco.com/home.php
The Cook's Garden	http://www.cooksgarden.com/
Tomato Fest	http://www.tomatofest.com/
Tomato Growers Supply	http://www.tomatogrowers.com/
Victory Seeds	http://www.victoryseeds.com/
Rootstock varieties	
American Takii Seed	http://www.takii.com
BHN Seed	http://www.bhnseed.com/
DP Seeds	http://www.dpalmerseed.com
De Ruiter Seeds	http://www.monsanto.com/products/Pages/deruiter-seeds.aspx
Johnny's Selected Seeds	http://www.johnnyseeds.com
Neseed	http://www.neseed.com/
Paramount Seeds Inc.	http://www.paramount-seeds.com/
Rijk Zwaan USA	http://www.rijkzwaanusa.com
Source: Bonina and Cantliffe 2009; Ozores-Hampton, Zhao, and Ortez 2010; Zhao and Simonne 2008	

Table 3. Resistant rootstock tomato varieties

Variety	Resistance[1]
BHN 833	FCR, F-R 1,2,3, N, PYL, TMV, and V (1)
Beaufort	FCR, F-R 1,2, N, PYL, TMV, and V (1)
Maxifort	FCR, F-R 1,2, N, PYL, TMV, and V (1)
Multifort	C 1-5, F-R 1,2,3, FCR, N, TMV, and V (1)

Source: BHN agent, Paramount Seeds (http://www.paramount-seeds.com)
[1]Disease Key
C 1-5 = Leaf mold races 1, 2, 3, 4, 5 (*Fulvia fulva* [*Cladosporium fulvum* Cooke])
F-R 1, 2, 3 = Fusarium wilt races 1, 2, 3 (*Fusarium oxysporum* f.sp. *lycopersici)*
FCR = Fusarium crown rot (*Fusarium oxysporum* f.sp. *radicis-lycopersici)*
N = Root-knot nematode (*Meloidogyne arenaria*, *M. incognita*, and *M. javanica)*
PYL = Corky root rot (*Pyrenochaeta lycopersici)*
TMV= Common mosaic of tomato (*Tobacco mosaic virus)*
TYLCV = Tomato yellow leaf curl (*Tomato yellow leaf curl virus)*
V (1) = Verticillium wilt (*Verticillium dahliae* race 1)

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Table 4. Heirloom tomatoes used in the variety trial at UF/SWFREC during 1997–1998 seasons in Immokalee, FL

Variety	*Growth habits/days to first harvest*	*Description*
Arkansas Traveler	Indeterminate[z]/85	Southern heirloom; rose pink; fruits have a creamy, mild flavor; heat tolerant
Aunt Ruby's German Green	Indeterminate/80	Beefsteak type; a pale greenish-yellow ("lime Jell-O green") with a slight pink blush that extends to the inside when fully ripe; sweet flavor with a hint of spice
Black	Indeterminate/83	Russian heirloom; dark mahogany brown with green shoulders that average 4 ounces; smooth and slightly elongated fruit with a pointed tip; sweet, balanced, complex flavors
Black Prince	Indeterminate/70	Siberian heirloom; deep garnet; round; full of juice and rich fruit flavors; excellent yield
Cherokee Purple	Indeterminate/80	Tennessee heirloom; dusky rose to purple fruit with green shoulders; rich, complex, sweet flavors
Clear Pink Early	Determinate[y]/67	Russian heirloom; regular leaf; glossy, light pink, round fruits; very good flavor; high yield
Eva Purple Ball	Indeterminate/70	German heirloom; dark pink/pinkish-purple fruits are round and blemish free; excellent producer in hot climates; very disease resistant
Flamme	Indeterminate/70	French heirloom; round, small, bright orange fruits; very soft and fragile when ripe
Garden Peach	Indeterminate/80	Small, delicate, meaty fruits; peach color outside and hint of red inside; mild, sweet taste; light fuzz on fruits and leaves
Green Zebra	Indeterminate/75	Amber green with dark green/yellow stripes; ripens to yellow stripes; lemon-lime flavor
Lemon Boy	Indeterminate/72	A hybrid, lemon-yellow fruit (not a true heirloom)
Mary Ann	Indeterminate/78	Classic beefsteak; deep pink to orange red; dense, creamy, sweet flesh with rich, complex flavors
Mr. Stripey (Tigrella)	Indeterminate/56	Red and orange striped; tangy; fruits are low in acid
Nebraska Wedding	Indeterminate/>90	Nebraska heirloom; meaty; globe-shaped, deep orange fruits; good sweet/acid balance; lots of flavor
Pink Ping Pong	Indeterminate/75	Sweet pink fruit about the size of a ping pong ball; juicy and bursting with superb flavors

Source: Ozores-Hampton et al. 2011; Seven Acre Seeds (http://www.sevenacreseeds.com); Tomato Growers Supply Company (http://www.tomatogrowers.com); Tomato Fest (http://www.tomatofest.com)

[z] Indeterminate varieties grow and produce fruit until killed by frost and can reach heights from 6 to 10 feet. They bloom, set new fruit, and ripen all at the same time throughout the growing season. They require staking (approximately 6 feet or taller) and tying.

[y] Determinate varieties are bred to grow to a compact height (approximately 4 feet). They stop growing when fruit sets on the terminal or top bud, ripen their entire crop at or near the same time (usually over a 2-week period), and then die.

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Table 5. Fruit yield characteristics of heirloom varieties at SWFREC, Immokalee, FL (1997–1998)

Variety	Average fruit weight (oz.)	Average fruit size	Fruit number per plant	Total yield (lb/plant)
1997 season				
Aunt Ruby's German Green	8.4 b*	XL	22 e	11.6 cd
Black Prince	3.7 f	M–L	59 cd	13.7 bc
Cherokee Purple	10.3 a	XL	19 e	12.5 c
Eva Purple Ball	4.7 e	M–L	43 d	12.7 c
Flamme	1.9 g	S	99 a	11.9 cd
Garden Peach	2.1 g	M	92 ab	12.0 cd
Green Zebra	3.6 f	M–L	46 d	10.4 c
Lemon Boy	5.9 d	M–L	50 d	18.3 a
Mary Ann	9.2 b	XL	22 e	12.8 c
Nebraska Wedding	6.9 c	XL	18 e	8.0 d
1998 season				
Arkansas Traveler	3.43 a	NA	41 c	8.9 b
Black	2.71 c	NA	52 bc	8.8 b
Clear Pink Early	2.93 b	NA	69 b	12.7 a
Mr. Stripey (Tigrella)	1.51 d	NA	107 a	10.2 b
Pink Ping Pong	1.41 d	NA	92 a	8.0 b

* Values followed by the same letter(s) are not significantly different by Duncan's Multiple Range Test ($P \leq 0.5$).
NA = No available data

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Table 6. Percent of defects by fruit number for all harvests of heirloom varieties at SWFREC, Immokalee, FL (1997–1998)

Variety	*Blossom-end rot*	*Blossom-end scar*	*Catfacing*	*Cracking (concentric)*	*Cracking (radial)*	*Grey wall*	*Odd shape*	*Zipper scars*
1997 season								
Aunt Ruby's German Green	2.0 ab	36.4 a*	1.5 b	3.0 bc	60.0 b	0.0 b	6.1 a	0.7 a-c
Black Prince	0.1 b	0.5 b	1.4 b	17.8 a	9.2 de	0.0 b	0.3 d	3.1 ab
Cherokee Purple	0.0 b	30.5 a	7.4 a	4.1 bc	73.3 a	0.0 b	3.3 bc	3.4 a
Eva Purple Ball	0.3 b	0.4 b	0.4 b	1.0 bc	6.3 de	2.8 a	0.2 d	0.4 bc
Flamme	3.2 a	0.2 b	0.1 b	1.6 bc	0.8 e	0.0 b	0.1 d	0.3 c
Garden Peach	0.2 b	1.6 b	1.8 b	0.1 c	1.1 e	0.2 b	0.7 cd	0.1 c
Green Zebra	2.7 a	0.5 b	0.5 b	7.0 b	6.5 de	0.0 b	0.6 cd	2.1 a-c
Lemon Boy	0.3 b	0.9 b	0.9 b	3.6 bc	15.1 cd	0.0 b	1.1 cd	0.4 bc
Mary Ann	0.0 b	36.8 a	1.8 b	3.1 bc	50.4 b	0.0 b	4.0 a	3.3 a
Nebraska Wedding	0.0 b	4.3 b	0.9 b	1.9 bc	26.0 c	0.0 b	0.6 cd	1.2 a-c
1998 season								
Arkansas Traveler	0.4 a	0.4 a	0.0 a	0.2 c	0.0 b	NA	0.0 a	0.1 a
Black	0.4 a	0.0 a	0.1 a	40.3 a	0.0 b	NA	0.1 a	0.8 a
Clear Pink Early	0.1 a	0.2 a	0.2 a	3.9 c	2.6 a	NA	0.2 a	1.2 a
Mr. Stripey (Tigrella)	0.2 a	0.0 a	0.0 a	21.9 b	0.1 b	NA	0.0 a	0.1 a
Pink Ping Pong	0.2 a	0.1 a	0.0 a	2.7 c	0.1 b	NA	0.4 a	0.5 a

* Values followed by the same letter(s) are not significantly different by Duncan's Multiple Range Test ($P \leq 0.5$).
NA = No available data

Table 7. Incidence of late blight in heirloom varieties at SWFREC, Immokalee, FL (1997)

Variety	**May 2, 1997**	**May 5, 1997**	**May 8, 1997**
Aunt Ruby's German Green	3.2 a-c*	3.5 a-c	3.8 a-e
Black Prince	2.5 b-d	2.5 b-d	3.2 b-e
Cherokee Purple	1.2 d	1.2 d	1.2 f
Eva Purple Ball	1.8 cd	1.8 cd	2.2 ef
Flamme	2.8 a-d	3.2 a-c	3.2 b-e
Garden Peach	2.2 b-d	2.5 b-d	3.0 c-f
Green Zebra	3.5 a-c	4.5 a	4.8 a-c
Lemon Boy	4.0 ab	4.8 a	5.0 ab
Mary Ann	4.5 a	5.0 a	5.2 a
Nebraska Wedding	2.2 b-d	2.2 b-d	3.0 d-f

Note: 0 = *none*, 10 = *heavy*
*Values followed by the same letter(s) are not significantly different by Duncan's Multiple Range Test ($P \leq 0.5$).

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Table 8. Summary of open-field heirloom tomato varieties growing in Florida

Variety	Susceptibility[1]
(Jaune) Flamme	BS, FCR, F-R (1, 2, 3), and TYLC
Amana Orange	BS, FCR, F-R (1, 2, 3), and TYLC
Big Zebra	BS, FCR, F-R (1, 2, 3), and TYLC
Brandywine	BS, FCR, F-R (1, 2, 3), and TYLC
Cherokee Purple	BS, FCR, F-R (1, 2, 3), and TYLC
Green Zebra	BS, FCR, F-R (1, 2, 3), and TYLC
Pruden's Purple	BS, FCR, F-R (1, 2, 3), and TYLC
Striped German	BS, FCR, F-R (1, 2, 3), and TYLC

[1] Disease Key
BS = Bacterial spot (*Xanthomonas* spp. [*X. vesicatoria, X. euvesicatoria, X. perforans, and X. gardneri*])
F-R 1, 2, 3 = Fusarium wilt race 1, 2, 3 (*Fusarium oxysporum* f.sp. *lycopersici*)
FCR = Fusarium crown rot (*Fusarium oxysporum* f.sp. *radicis-lycopersici*)
TYLCV = Tomato yellow leaf curl (*Tomato yellow leaf curl virus*)