University of New Hampshire
Cooperative Extension

Research Report: High Tunnel Eggplant Varieties, Pruning & Postharvest Storage

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Introduction. Recently, parthenocarpic varieties of eggplant (ones that set fruit without pollination) have been developed specifically for greenhouse and tunnel production. In other parts of the world where greenhouse eggplant is more frequently grown, various pruning systems are used to enhance productivity and growth.

Our primary objective was to compare ***yields of eggplant varieties*** in high tunnel production conditions. We specifically chose to focus on elongated types and to include new parthenocarpic varieties selected for high tunnel and greenhouse conditions. We had two additional objectives: 1) to determine whether ***pruning to 2- or 4-leader systems would affect yields*** compared to no pruning, and 2) to compare quality of different varieties in ***post-harvest storage***.

What we did. Eggplants were seeded in seedling strip trays using ProMixBX on 12 April, and were transplanted into 606 flats on 24 April and into the high tunnel on 1 June 2018. Transplants were fertilized weekly with soluble 20-20-20 at a rate of 300 ppm N. We applied soybean meal (7-1-2) and potassium sulfate (0-0-50) preplant to provide 55 lb/A of N and 145 lbs/A of K_2O. Planting beds were spaced 4' on centers, slightly raised (1-2"), covered with embossed black plastic mulch. For the variety experiment, plants were spaced 12" apart in single rows. We used a randomized complete block experimental design, with four (4) reps of experimental units of 6 plants. One application of Azera (pyrthrins, neem) was made on 27 June to control aphids, and one application of Shuttle-O (acequinocyl) was made on 10 August to control spider mites.

Variety	Color	Seed Source	Cost per 100 sds	recommended for:
Angela	Striped	Johnny's Selected Seeds	$125.96	greenhouse
Aretussa	White	Johnny's Selected Seeds	$ 23.15	greenhouse, field
Jaylo	Purple	Johnny's Selected Seeds	$100.38	greenhouse
Michal	Purple	High Mowing Seeds	$ 19.55	greenhouse
Nadia	Purple	Johnny's Selected Seeds	$ 6.80	field
Traviata	Purple	High Mowing Seeds	$ 19.55	field
White Star	White	Harris Seeds	$ 8.10	field

Data collected. We harvested eggplants weekly between 6 July and 18 October, when plants were killed by frost – a period of nearly 15 weeks. Fruit were counted and weighed, and sorted into marketable and unmarketable. Fruit were considered unmarketable if they were scarred or misshapen. On two dates, 6 August and 22 August, harvested fruit were set aside for postharvest experiments, described below.

Support & Pruning. For the variety trial, treatment C (no pruning) was used. Plants were planted in single lines, and each plot of six plants was corralled with twine, with new strings added after a foot

of new growth. For the pruning trial, we compare three systems for three varieties (Michal, Nadia, Traviata):

A – 6" spacing between plants, pruned to 2 leaders; each supported by a piece of twine
B – 12" spacing between plants, pruned to 4 leaders; each supported by a piece of twine
C – 12" spacing between plants; no pruning, plants corralled

What we learned.

Eggplants were quite productive, producing a total of over 6 lbs of fruit per plant for some varieties They produced marketable fruit very early in the season; we harvested the first fruit just five weeks after transplant. Plants continued to produce marketable fruit until frost inside the high tunnel; which was mid-October.

Variety performance. There were ***only slight differences*** in total marketable yield between varieties (see table, above). The white variety **White Star** had significantly lower yields (3.5 lbs /plant over the whole season) compared with **Nadia** (purple, 6.3 lbs/plant) and **Angela** (striped, 6.1 lbs/plant). In early July, Traviata (purple) started producing significantly more early fruit than Nadia (purple); all other varieties were not significantly different. Photos of all varieties are shown on the last page of this bulletin. White Star had a significantly lower frequency of fruit that were marketable (0.69) than other varieties, largely due to scarred and/or misshapen fruit.

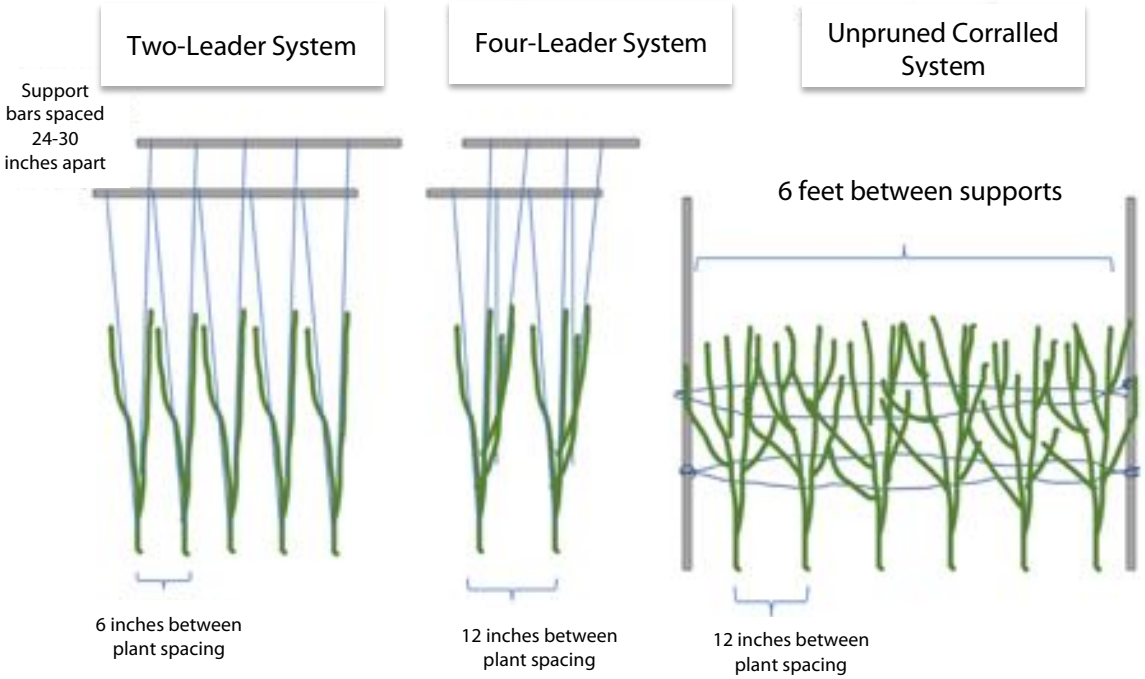
Throughout the season, all varieties showed a good continuity of production, aside from a dip in early September. This may have been at least in part due to a spider mite infestation in August.

Table 1. Marketable yield and frequency of marketable fruit for seven eggplant varieties grown in the high tunnel in Durham, NH.

		Marketable Yield		Frequency of
Type	Variety	No. fruit per plant	Wt (lbs) per plant	marketable fruit
greenhouse	Angela	11	6.1 a	0.94 a
greenhouse	Aretussa	10	4.7 ab	0.86 a
greenhouse	Jaylo	9	5.0 ab	0.87 a
greenhouse	Michal	8	5.1 ab	0.84 a
field	Nadia	9	6.3 a	0.91 a
field	Traviata	9	5.8 ab	0.88 a
field	White Star	9	3.5 b	0.69 b

Of the two white varieties, **Aretussa** was very uniform, whereas **White Star** showed much more variability, including several plants that produced light-green off-type fruit (evident in the photos on the last pages of this report). Of the four purple varieties, **Traviata** and **Jaylo** had distinctly pear-shaped fruit, whereas **Nadia** and **Michal** were more elongated. **Jaylo** was a lighter purple color, with many of the fruit showing pale purple stripes near the base of the fruit. **Angela** produced elongated uniform striped fruit.

Pruning Systems. In our very preliminary study, there was a significant difference between the three pruning systems we used (see table, below). These results should be interpreted with caution because there were only two replicates of each treatment.



The unpruned treatment required the least labor and needed no special skills. Later in the season, however, it became more difficult to harvest the fruit in this system, because the plant and twines created a sort of dense mess. The two-leader treatment was a little more difficult to establish than the unpruned treatment, but it was still quite easy to identify the two main leaders for each plant. The costs of plants, however, was twice as much using this system (given that plants were spaced 6" apart, as compared with 12" in the other systems). The four-leader treatment required a fair amount of decision-making to select the four best leaders. However, after the establishment, pruning took place every 2 weeks or so, and was quite easy. Important note: when maintaining 2 or 4 leaders, each sucker that arose was allowed to form a fruit, and was cut off above that point, unlike tomato pruning systems where entire suckers are removed. The plants grew much taller in the pruned vs. unpruned systems. Based on these preliminary results, the four-leader system appears quite promising – the tradeoff of some initial labor may pay off in terms of easier management later in the season and prolonged (and possibly higher) productivity.

Table 1. Marketable yield and frequency of marketable fruit for three eggplant varieties (Michal, Nadia, and Traviata) grown in three different pruning systems.

	Marketable Yield		Frequency of
Pruning Treatment	No. fruit per linear ft.	Wt (lbs) per linear ft.	marketable fruit
Unpruned (corralled), 12" spacing	9 b	5.7 b	0.88 b
Four leaders, 12" spacing	12 a	7.8 a	0.96 a
Two leaders, 6" spacing	11 ab	6.7 ab	0.95 ab

Postharvest Storage. The ideal storage conditions for eggplant are 10-12°C (50-54°F) and 90-95% relative humidity (USDA Handbook 66). Eggplant fruit are particularly sensitive to dessication and weight loss at temperatures higher than this, and to chilling injury at temperatures below this range. In two experiments, we held eggplants at different temperatures for two weeks to determine whether varieties may be more or less susceptible to these postharvest problems.

Our Postharvest Storage Conditions	Extreme Temperatures		Temperature (°F)	Relative Humidity (%)	
	Max (°F)	Min (°F)	Average ± SD	Average ± SD	
Packhouse = Very Warm	63.3	79.4	73.1 ± 2.3	76.1 ± 6.6	***too warm***
Cooler = Warm	60.0	64.3	62.5 ± 0.9	90.1 ± 3.5	***close to ideal***
Refrigerator = Cold	38.2	47.4	42.2 ± 2.0	96.6 ± 3.5	***too cold***

In our first experiment (6 Aug – 21 Aug), all varieties except Jaylo were held at both Warm and Cold conditions. In our second experiment (22 Aug – 6 Sept), all varieties were held at Very Warm, Warm, and Cold conditions. We only show data from the second experiment; results were similar for both.

	% weight loss		quality 15 days post-harvest	
	7 days	15 days	firmness (1-5)	browning (0-5)
Storage Conditions				
Packhouse (73°F)	6.4 c	12.6 c	3.25 c	0.0 b
Cooler (63°F)	4.9 b	9.4 b	2.27 b	0.0 b
Fridge (42°F)	2.5 a	4.1 a	1.77 a	1.9 a
Variety				
Angela	3.7 b	7.2 b	1.6 c	0.3 c
Aretussa	5.2 ab	9.5 a	2.9 a	1.2 a
Jaylo	4.4 ab	8.2 ab	2.3 abc	0.0 c
Michal	5.7 a	10.5 a	2.7 ab	1.0 a
Nadia	4.4 ab	8.4 ab	2.8 ab	0.8 abc
Traviata	4.6 ab	8.5 ab	2.3 b	0.3 bc
White Star	4.4 ab	8.6 ab	2.5 ab	1.0 ab

Our results clearly illustrate the problems caused by storing eggplant at temperatures that are too cold or too warm. At temperatures that were much too warm (e.g. the packhouse), eggplant fruit lost much more weight and softened much more than if stored at cooler temperatures. At cold (refrigerator) temperatures, eggplant lost the least weight and remained very firm, but they suffered chilling injury, showing surface pitting and browing. Several varieties also exhibited mold on their calyxes after two weeks storage; this was more evident at the higher temperatures than in the refrigerator. See photos on last pages of this report to see effects of storage temperature on variety.

Varieties differed in susceptibility to these problems. **Angela** lost significantly less weight and remained significantly firmer than some varieties (e.g. **Aretussa** and **Michal**). Along with **Jaylo** and **Traviata**, **Angela** also showed the least browning after two weeks' storage; **Aretussa**, **Michal** and **White Star** showed the most browning.

Take-home messages & future directions.

Please use caution when interpreting the results from a single year's study.

We were impressed by the early, prolific, and prolonged fruit production of high tunnel eggplant varieties. Cumulative yields exceeded 6 lbs per plant (1.5 lbs/square foot) in some cases; we suspect that with earlier planting, this could likely be increased.

Challenges associated with high tunnel eggplant production include attractiveness to **aphids** and **spider mites**; growers should monitor frequently for these pests, and have a plan in place to manage them if they are detected.

While the typical field strategy of corralling plants without pruning produced acceptable yields, pruning the plants to **two or four leaders did increase yields** for the varieties we compared. Additional work is needed to 1) confirm this result in additional years and/or locations, and 2) to more carefully assess the labor and management costs of these pruning systems.

We clearly demonstrated the negative impacts of storage at temperatures that are either too hot (weight loss, softening, moldy calyx) or too cold (browning, pitting) on eggplants. At 60-64°F (10°F warmer than ideal storage conditions), eggplant fruit maintained marketable quality for over a week, but showed some softening and calyx mold by two weeks after harvest.

Some varieties appeared to be more susceptible to chilling injury (the two white varieties, **Aretussa** and **White Star**; and **Michal**), showing a lot of browning under refrigerator conditions. The variety **Angela** remained firmer and lost less weight than other varieties when stored at warmer temperatures, and showed very little browning when chilled.

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Fresh harvested

Stored 2 wks, 63°F

Angela

Aretussa

White Star

Michal

Jaylo

Nadia

Traviata

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