MARKETABLE YIELD EVALUATION OF ELEVEN HEIRLOOM TOMATO VARIETIES

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Abstract

New England growers are producing heirloom tomato varieties in order to attract consumers to retail farm operations. In 2001, we tested eleven different heirloom varieties of tomato (Lycopersicon esculentum Mill.) for production characteristics and fresh market suitability in Vermont. Tomato seedlings were transplanted into a well-drained sandy soil at the Horticulture Research and Education Center in South Burlington, VT. A completely randomized design was used with four replicates for each variety. Each replicate consisted of 12 plants (total of 48 plants per variety). Row spacing was 0.9 m and between row spacing was 1.5 m. 'Amish Paste', 'Brandywine', 'Cherokee Purple', 'Cosmonaut Volkov', 'Costoluto Genovese', 'Green Zebra', 'Ida Gold', 'Moskvich', 'Purple Calabash', 'Prudens Purple', and 'Yellow Brandywine' varieties were produced organically using plastic mulch beds and drip irrigation. 'Better Boy' served as a hybrid control. Plants were fertigated weekly using a balanced organic liquid supplement (3-3-3) or nitrogen (16-0-0) based on extension recommendations for New England. Tomatoes were harvested weekly (10 total harvests) and every fruit was individually graded according to USDA standards. Findings include: 'Costoluto Genovese' produced significantly greater total marketable yield by weight when compared to 'Brandywine' (Tukey, n=40), 'Ida Gold' produced significantly more US No. 1 fruit by weight when compared to 'Brandywine' (Tukey, n=40), and all varieties tested produced the same amount of culls by weight (Tukey, n=40). Interestingly, one heirloom variety outperformed 'Better Boy' during this trial and others produced the same as 'Better Boy'. 'Ida Gold' produced significantly more U.S. No. 1 fruit (1.44 kg fruit·plant^{-1}) than 'Better Boy' (0.33 kg fruit·plant^{-1}) (Tukey, n=40). When comparing total marketable yield of the round, red varieties in this trial 'Moskvich' and 'Cosmonaut Volkov' produced the same as 'Better Boy' (Tukey, n=40).

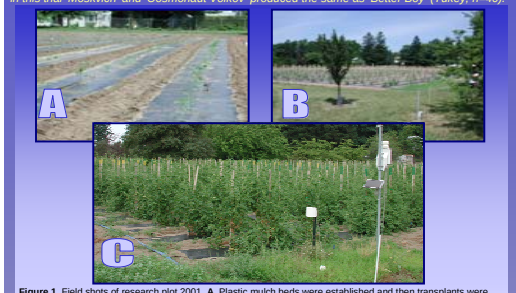


Figure 1. Field shots of research plot 2001. **A.** Plastic mulch beds were established and then transplants were planted out. Planting date was May 31. **B.** Plants were individually staked and tied as needed throughout the season. **C.** Early August where the tops of stakes had been painted to illustrate different 12-plant replicates. To the right is a weather station that records local weather conditions.

Introduction

Fresh market tomatoes are an important vegetable commodity, which occupies vast amounts of acreage (Colberg-Riveria et al., 1996; Wyatt and Mullins, 1998). Nationally, cultivar evaluations to improve yield and the economic potential for local and export markets deserves research attention (Colberg-Riveria et al., 1996). Trials have been conducted for many years to test suitability for the commercial fresh market tomato industry throughout the U.S. (Kraus, 1949; Colberg-Riveria et al., 1996; Wyatt and Mullins, 1998; Vavrina et al., 1997). It has been noted that specialty market tomatoes are increasingly favored and heirloom tomatoes have the potential of fulfilling the specialty market niche (Vavrina et al., 1997). How these varieties perform in various locations throughout the country needs to be more thoroughly investigated under commercial production regimes.

Location is an important factor as varieties may respond differently to local meteorological conditions. Colberg-Riveria et al. (1996) conducted an evaluation of 18 tomato cultivars and their results indicated significant differences between two locations and also found significant differences between cultivars in total marketable yield. Wyatt and Mullins (1998) conducted a three-year evaluation and found differences in marketable yield between cultivars as well as differences between years illustrating weather conditions impact on overall fruit quality.

With a short growing season for most of Vermont and the Northeast region of the United States, it could be beneficial for growers, whether they are home gardeners or commercial producers, to know which crops will out-perform others under the climactic conditions of their region. In VT there are ~330 vegetable farms occupying nearly 1,214ha, which account for approximately 5% of cash receipts or ~$10,000,000. A large percentage of the growers are certified organic producers who utilize heirlooms, where possible, allowing them to save seed. Additionally, over half of the vegetables marketed in Vermont are sold to retail consumers due to higher prices through direct marketing (Pelsue and Finley-Woodruff, 1996).

The objective of this study was to evaluate 11 different heirloom tomato varieties and compare yield parameters to a known commercial hybrid tomato when grown under commercial production practices.

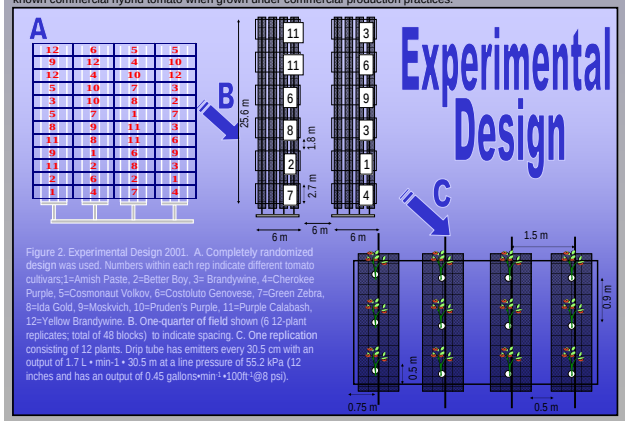
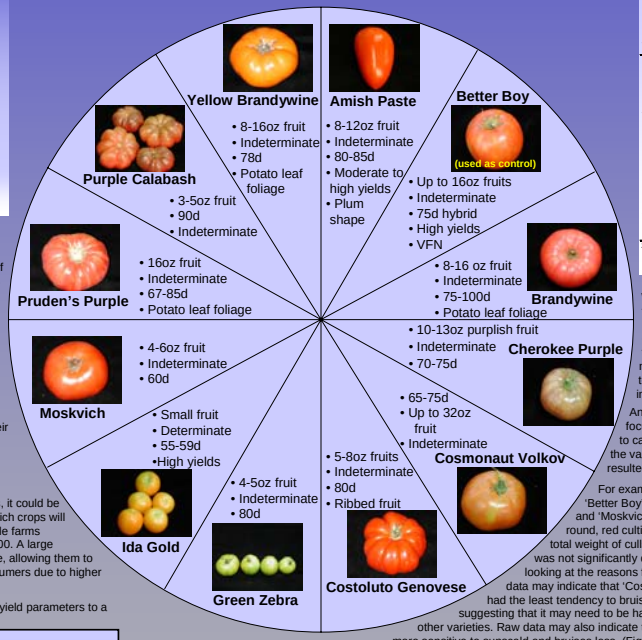


Figure 2. Experimental Design 2001. A. Completely randomized design was used. Numbers within each rep indicate different tomato cultivars;1=Amish Paste, 2=Better Boy, 3= Brandywine, 4=Cherokee Purple, 5=Cosmonaut Volkov, 6=Costoluto Genovese, 7=Green Zebra, 8=Ida Gold, 9=Moskvich, 10=Pruden's Purple, 11=Purple Calabash, 12=Yellow Brandywine. B. One-quarter of field shown (6 12-plant replicates; total of 48 blocks) to indicate spacing. C. One replication consisting of 12 plants. Drip tube has emitters every 30.5 cm with an output of 1.7 L • min-1 • 30.5 m at a line pressure of 55.2 kPa (12 inches and has an output of 0.45 gallons•min^{-1}•100ft^{-1}@8 psi).

Experimental Design

Figure 3. Tomato picking and grading process. **A.** Tomatoes shown in bins just after harvest. Each bin contains one 12-plant replicate. **B.** Fruit were then sized and separated based on grade class. Pictured is Chris Baker sorting 'Costoluto Genovese'. **C.** Cull fruit of 'Cherokee Purple'. Culls were sorted and data was taken on each blemish that made individual fruits cull. Most obvious cull here is "green shoulders." **D.** Illustration of grade class separations. Pictured is 'Purple Calabash'. 1= US#1, 2= US#2, 3= US#3, 4= cull.



Results and Discussion

'Ida Gold' was the first variety to be harvested. 'Ida Gold' also produced the most US#1 fruit. 'Costoluto Genovese' produced the highest total marketable yield, but most of the fruit were US#2, and US#3. (Table 1).

When comparing total marketable yield of 'Moskvich' and 'Cosmonaut Volkov' to 'Better Boy' hybrid, this study indicates that these heirloom cultivars produced the same. This indicates that there may be potential for some heirlooms to fulfill market needs as well as hybrids. It is interesting to note that 'Better Boy ' produced the same amount of cull fruit as 'Brandywine', but significantly out-produced it in the grade classes of US#2 and US#3. (Table 1).

One year of data suggests that many of the heirlooms tested may have the potential to fulfill a commercial fresh market niche for heirloom tomatoes. If consumers are interested or have certain desires for special color, taste, or are interested in the heritage behind heirloom tomatoes, the varieties mentioned may be able to fulfill local market needs. The results of this study are based on only one year of data, and changes in yearly meteorological conditions may have an impact on the performance of these varieties. Vavrina et al. (1997) noticed some tolerance of late blight in 'Cherokee Purple', but also noted that 'Green Zebra' seemed to show a more rapid advance of the disease. This may be important if weather conditions are favorable to certain diseases, and if the varieties grown are not tolerant to a certain disease pressure.

Table 1. Yield (kg·plant^{-1}) by cultivar for 2001 heirloom tomato trial arranged in descending order for total marketable yield also showing yield for each USDA grade class and cull (kg·plant^{-1}).[z]

	2001				
	Marketable (kg plant^{-1})				Cull
Variety	Total	US#1	US#2	US#3	(kg plant^{-1})
Costoluto Genovese	4.96 a	0.85 a b c	1.56 a	2.55 a	1.48 a
Moskvich	4.62 a b	0.99 a b	1.49 a b	2.14 a	2.39 a
Better Boy	4.47 a b	0.33 b c	1.64 a	2.49 a	4.62 a
Amish Paste	4.13 a b	0.62 a b c	1.16 a b c	2.34 a	3.52 a
Cosmonaut Volkov	4.02 a b	0.62 a b c	1.26 a b c	2.15 a	1.79 a
Green Zebra	3.87 a b	0.87 a b c	1.12 b c	1.88 a b	1.54 a
Ida Gold	2.95 a b c	1.44 a	1.02 b c	0.49 b	1.18 a
Purple Calabash	2.36 a b c	0.05 c	0.49 b c	1.82 a b	4.17 a
Cherokee Purple	1.89 a b c	0.01 c	0.44 b c	1.43 a b	4.86 a
Prudens Purple	1.81 a b c	0.03 c	0.45 b c	1.33 a b	4.83 a
Yellow Brandywine	1.28 b c	0.03 c	0.27 c	0.97 a b	2.95 a
Brandywine	0.48 c	0.00 c	0.06 c	0.41 b	4.30 a

[z] Mean separation by Tukey's REGWQ in SAS. Significance is indicated by different letters when P<0.05

When looking at 'Cherokee Purple' our results are similar to Vavrina et al. (1997). They found this cultivar to produce high amounts of fruit with radial cracking and blossom end rot as well as illustrating that heirlooms may not be able to handle the rigorous process of the gassed-green tomato industry. We found that 'Cherokee Purple' had high amounts of fruit culled due to cracking (data not shown), but also found heirlooms that have the potential to fulfill a fresh market niche. They also noted that a few varieties, such as 'Green Zebra', may have the potential to be used for a vine-ripe specialty market. It is interesting to note that their assay was conducted in Florida.

An additional area of focus in this study was to catalog the disorders of the varieties tested that resulted in culls.

For example, when comparing 'Better Boy', 'Cosmonaut Volkov', and 'Moskvich', which are the three round, red cultivars in this trial, the total weight of culls produced per plant was not significantly different. When looking at the reasons for culled fruit raw data may indicate that 'Cosmonaut Volkov' fruit had the least tendency to bruise and crack suggesting that it may need to be handled differently than other varieties. Raw data may also indicate that 'Moskvich' is more sensitive to sunscald and bruises less. (Figure 4).

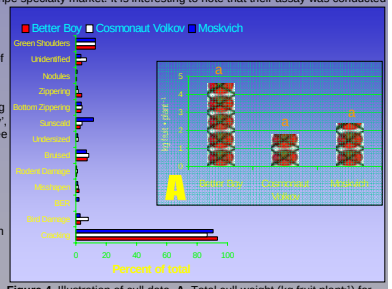


Figure 4. Illustration of cull data. **A.** Total cull weight (kg fruit·plant^{-1}) for 'Better Boy', 'Cosmonaut Volkov', and 'Moskvich'. B. Cull Disorder criteria showing percent of total fruit culled for 'Better Boy', 'Cosmonaut Volkov', and 'Moskvich' (raw data shown).

A downfall of many of these cultivars we tested is that they exhibit flaws that make them non-appealing to consumers. From cracking to the development of nodules and green shoulders, these blemishes have the potential of deterring consumers from purchasing such fruit. Also fruit with cracking most likely will have a reduced storage time when compared to fruit with no cracking. This may be an important consideration when producing fruit that will not be sold within a few days of harvest. These blemish related parameters need to be more quantitatively analyzed to assess the market potential of heirloom tomatoes.

Conclusions and Future Directions

This study demonstrates that there is potential for some heirloom tomatoes to produce similar amounts of marketable fruit as garden commercial hybrids. There is the potential for heirloom tomatoes to offer the shape, taste and color that consumers desire within specialty markets. Growers that produce value added products may also find that the color of some of the heirloom tomatoes beneficial. It is important to quantify the pro's and con's of the numerous heirloom tomatoes so that growers can increase production efficiency. Further testing of heirloom varieties is necessary before appropriate recommendations can be made concerning the use of heirloom tomatoes for a commercial market in Vermont. Year to year meteorological conditions tend to play an important role in the quality of fruit produced by these cultivars.

Currently in 2002, we are replicating the same experiment following nearly the same protocol. To insure a more uniform transplant size for all cultivars, transplants were grown from seed under the same conditions at the University of Vermont greenhouses. We have just entered harvest season for 2002, and we are also analyzing 2001 cull data to better understand the culled fruit distribution. During peak harvest this season we are also going to hold a taste test at our on-campus farm market.

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