

## Variety Trial Report:

### 2016 Northern Organic Vegetable Improvement Collaborative

UW-Madison Organic Research and Extension Program

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# Organic Field Tomatoes



## Introduction

### About NOVIC:

In its second iteration, the Northern Organic Vegetable Improvement Collaborative (NOVIC) joins researchers and farmers in Northern U.S. states to address organic farmers' seed and plant breeding needs. The collaborative includes researchers and educators from Oregon State University, University of Wisconsin-Madison, Cornell University, Washington State University, Organic Seed Alliance, and the USDA. The project partners with over 30 organic farmers to breed new varieties, identify the best performing existing varieties for organic agriculture, and educate farmers on organic seed production and plant variety improvement.

NOVIC conducts vegetable variety trials on certified organic ground, at research stations, and on cooperating organic farms, using the mother-daughter trialing method adopted from international agriculture. Trials include the five crops in the NOVIC breeding program (sweet corn, red bell and roasting peppers, tomatoes, cabbage, and winter squash) and one additional crop chosen by farmers regionally.

Results for NOVIC variety trials are published in the Organic Variety Trial Database, a national database of organic variety trial results maintained by collaborators at eOrganic. Reports can also be found on the UW-Organic site. See [varietytrials.eorganic.info/](http://varietytrials.eorganic.info/) for national trial results, or [uworganic.wisc.edu](http://uworganic.wisc.edu) for UW-Madison organic variety trial results.

The overall goal of NOVIC is to develop open-pollinated varieties specifically adapted to meet the needs of organic growers. NOVIC breeding efforts focus on

key traits to improve market presence for the focal crops.

### About this Trial:

All UW-Madison NOVIC trials take place at the West Madison Agricultural Research Station (WMARS) at 8502 Mineral Point Road, Verona, WI 53593. Trials can be viewed in person during the annual WMARS Organic Research Field Day during late summer (please feel free to contact [westmadison@cals.wisc.edu](mailto:westmadison@cals.wisc.edu) for more info on field days). In 2016, tomatoes were also grown at four partner sites – Luna Circle Farm in Rio, WI; LotFoTL in Elkhorn, WI; Scotch Hill Farm in Broadhead, WI; and Spooner Agricultural Research Station in Spooner, WI.

Tomatoes are a common crop grown by organic farmers, for wholesale, CSA, and market enterprises. Yet tomatoes without conventional inputs, particularly in regards to disease management, can be extremely challenging. This trial is focused on yield and disease pressure under organic management for seven salad/slicer type, and four plum/paste type tomato cultivars. It should be noted that six of these cultivars are breeding accessions not yet available commercially.

## Methods

### Field Methods:

The trial was planted in single-row plots, with two outer “border” rows at the perimeter of the field, and three replications in a complete randomized block design. Rows within plots were 18' long, with eight plants per row (2' in-row spacing, followed by a 2' alley), with 5' between rows.

All varieties were first seeded by West Star Organics in Cottage Grove, WI on April 16<sup>th</sup>,

and after some delays because of weather, were transplanted on June 6<sup>th</sup> into freshly rototilled ground that had drip irrigation under plastic mulch laid with a Mechanical Transplanter Company Model 85 Mulch Layer. The field had been amended in early spring with feathermeal (13-0-0) at a rate of 0.75ton/acre and Midwest BioAg's Microhume product at a rate of 20lb/acre. Drip irrigation was used as needed – every 1-2 days during particularly dry periods - but a surprising amount of the season relied only on rainfall. While 2016 was a particularly wet year – between June 6<sup>th</sup> and August 15<sup>th</sup> there was ~14.02in of rain accumulation – the plastic mulch had the effect of both holding in moisture longer, and preventing infiltration in that specific area during light rains.

Aisles were mulched at a rate of 10 tons of ground hay per acre – about 3 inches thick. Before mulching stirrup hoes were used for weed control. After a bad thunderstorm in late July that washed away significant patches of mulch, intermittent hand weeding and hoeing was used to control weeds setting seed.

Plants were monitored every other day to determine when the first ripe fruit occurred. Target harvest dates were set as two weeks after first ripe fruit. Due to logistics target harvest dates were compromised to decide the first harvest, which ended up being August 15<sup>th</sup>, 121 days after seeding. Thereafter, harvest of all fruit at a breaker stage or more mature was conducted weekly for all plots. Data was only collected from the center six plants of any plot, leaving one plant on each end as a buffer.

Fruit was qualitatively identified as marketable and unmarketable, and counted and weighed separately. Fruit was deemed unmarketable if it had any splitting,

cracking, cat facing, zippers, significant checking, lesions, sunscald, or fruit that was otherwise overly misshapen. There was some forgiveness for very small zippers or small spots (less than three per fruit), and small catfacing or small, healed cracks in abnormally shaped, “heirloom” fruit types.

Picking ease was rated at the first harvest, and fruit measurements were taken in week three of harvest. Samples for soluble solids analysis (Brix) were also taken during the third harvest and frozen for later processing. While Brix readings must be approached with caution, and do not necessarily equate to overall quality, it is commonly used as a proxy for quality. For instance, International Ag Labs, Inc., a consultancy, rates squash quality poor at 4, average at 6, good at 8, and excellent at 12 °Brix.

### **Analysis:**

Data was averaged to a plot level using Microsoft Excel, and was analyzed to a variety level using R Studio. Normality and variances for each outcome were assessed visually by plot (and by Shapiro and Levene's tests when visual assessments were questionable) and mostly determined to be acceptable for standard Analysis of Variance (ANOVA). Transformations were used as needed. The TukeyHSD function was used as an initial post-hoc test and the HSD.test function was used to group means based on significant differences. Each variety was approached as a different treatment, and the three above tests were used for each outcome. Traits were analyzed as collected, at a plot level, even when presented at a per plant level for ease of interpretation. Some traits for which data could not be normalized by transformations were only ranked.



## Results

### Days Till First Ripe Fruit:

Monitoring when the first ripe fruit appears is necessary for determining when to begin full harvest. It can also be considered a proxy for early maturation. Stats were not run on this trait due to lack of normal data, but averages were ranked. Mountain Rouge and S200-1-1 were the first to have fruit ripen, just after 108 days since seeding. LB8-3 and Crimson Sprinter followed closely after at 109 days, while Stellar, Mountain Merit, and Iron Lady took the longest at 118 days.

### Total Fruit Set:

Total fruit set removed from the plots, including marketable and unmarketable fruit, differed significantly by variety ( $F=21.15$ ,  $p=9.04 \times 10^{-9}$ ; Fig 1). Plum Perfect and Plum regal led the way with more than 80 fruit per plant, although the experimental slicer/salad lines LB8-7 and NC12 were close behind. True to its varietal description, Stellar also produced well with 62.39 fruit per plant, outcompeting other commercially available slicer/salad types in

the trial. As might be expected of their much larger size, Mountain Merit and Mountain Rouge set the least fruit at 37.28 and 24.94 fruit respectively. Crimson Sprinter also had a low total fruit set with 36.33 fruit per plant, despite only having medium size fruit.

### Marketable Yield:

Total marketable yield weight was very significantly different depending on variety ( $F=18.11$ ,  $p=3.73 \times 10^{-8}$ ; Fig 2). Variety also significantly influenced total number of marketable fruit ( $F=24.34$ ,  $p=2.44 \times 10^{-9}$ ). The new breeding accession NC12 led the pack, averaging 16.93 lb per plant, with the two runners up, Plum Regal and Stellar, averaging just over 13 lb per plant. These rankings largely held over the course of the harvest season (Fig 3). LB8-3 and S200-1-1 led the early harvests by a small margin, but were quickly overtaken by NC12, Mountain Merit, and Mountain Rouge in the third harvest. NC12 continued to lead in the fourth harvest, when Plum Regal, Stellar, and Iron Lady all peaked between 30-40 lbs per plot (6 plants). By the last harvest many of the varieties were yielding close to no marketable fruit, while NC12 declined sharply to just below 20 lbs, with Stellar and Plum Regal at just over 20 lbs.

Variety	Type	Days to First Ripe Fruit	rank	Picking Ease	Marketable Yield	Total Fruit	Marketable Fruit	Percent Unusable	Disease Rank	Avg Fruit Weight	Avg Width x Length	Avg Brix	rank
		since seeding		1=difficult 5=easy	lb per plant	per plant	per plant	%	1=best	oz	in	*Brix	
NC12 (F1)	Salad	116.7	7	2.33	16.93 a	75.72 ab	61.11 a	19.41 d	1 b	4.44 b	2.98 x 2.27	4.30	10
Plum Regal (F1)	Plum	116.7	7	2	13.60 ab	83.17 a	62.89 a	24.44 d	6 ab	3.46 cd	2.15 x 3.08	4.01	11
Stellar (F1)	Salad	118	9	3.67	13.36 ab	62.39 abc	50.22 abc	19.62 d	2 ab	4.26 bc	2.70 x 2.37	4.43	9
Mountain Merit (F1)	Salad	118	9	3	11.14 bc	37.28 de	26.78 de	28.27 bcd	10 ab	6.65 a	3.11 x 2.51	5.12	4
Plum Perfect (F1)	Plum	115.3	6	4	10.75 bc	81.83 a	62.89 a	23.25 d	8 ab	2.73 e	2.02 x 2.64	4.50	8
Iron Lady (F1)	Salad	118	9	2	10.05 bcd	51.28 cd	32.67 cde	32.80 bcd	3 ab	4.91 b	2.69 x 2.45	4.60	7
LB8-3-1-1-1 (F1)	Plum	109	3	4	7.43 cde	56.33 bcd	36.55 bcd	34.37 abcd	11 a	3.26 de	2.27 x 2.27	4.93	5
Mountain Rouge (F1)	Salad	108.3	1	3	7.29 cde	24.94 e	14.22 e	43.04 abc	7 ab	8.17 a	3.24 x 2.48	5.27	2
LB8-7-1-1-1 (F1)	Plum	113.7	5	3.33	7.16 cde	74.67 ab	54.39 ab	27.08 cd	4 ab	2.10 f	1.99 x 2.15	5.17	3
S200-1-1 (F1)	Salad	108.3	1	3	6.20 de	57.06 bcd	31.56 de	45.87 ab	9 ab	3.23 de	2.56 x 1.97	4.83	6
Crimson Sprinter (OP)	Salad	109.7	4	3.67	5.47 e	36.33 de	17.83 e	51.23 a	5 ab	4.88 b	2.95 x 2.15	5.67	1

**Table 1: Field Tomato Trial Results**

Results by variety for the 2016 NOVIC Winter Squash Trial are color coded with green being most desirable for the trait and red being least desired. Means for traits that showed significant differences in ANOVA ( $p<0.05$ ) were grouped using multiple comparisons of treatment means using the Tukey method; varieties that share a letter for that trait are not statistically significantly different from each other.

Plum Regal and Plum Perfect led by numbers of marketable fruit, both averaging 62.89 marketable fruit per plant. NC12 was close behind at 61.11 marketable fruit per plant. It is notable that the rankings of marketable fruit (Fig 4) mostly followed total fruit rankings (Fig 1). For commercially available salad/slicer types Stellar again produced best, with 13.36lb and 50.22 marketable fruit per plant.

#### **Unmarketable Yield:**

Total percentage of fruit deemed to be unmarketable was very significantly influenced by variety ( $F=9.18$ ,  $p=1.20 \times 10^{-5}$ ; Fig 5). Rankings largely followed the marketable fruit rankings; NC12 had the lowest percentage of unmarketable fruit, followed by Stellar, Plum Perfect, and Plum Regal. The open-pollinated Crimson Sprinter fared the worst, with over 51% of fruit being unmarketable, with S200-1-1 and Mountain Rouge close behind with over 43% unmarketable fruit. The worst affected varieties, Crimson Sprinter and S200-1-1, were usually deemed unmarketable for the same reasons as other varieties – cracking, scarring, etc. – just in larger quantity. These trends largely held over the course of the season (Fig 6) with the highest percentages of unmarketable fruit unsurprisingly coming at the beginning and end of the season.

#### **Leaf Curl:**

Statistics were not performed on leaf curl. Despite being somewhat rootbound at transplant, leaf curl was hardly noticeable for any variety.

#### **Hornworm Damage:**

Statistics were also not performed on hornworm damage because of abnormality. LB8-7, LB8-3, and S200-1-1 had the most damage, while Plum Regal, NC12, Mountain Rouge, Iron Lady, and Crimson Sprinter all

led for the least. However, overall damage and the differences between varieties were minimal, and without being able to run statistics it is impossible to say weather differences were due to anything more than random chance.

#### **Disease Progression:**

Variety was not quite significant for disease progression, but there was a trend ( $F=2.34$ ,  $p=0.0503$ ). However, the Rep was significant ( $F=4.89$ ,  $p=0.019$ ). The 3<sup>rd</sup> rep, which was downhill from the other two, had the highest disease pressure, while the first rep, uphill from the others, had the lowest pressure. NC12 and LB8-3 seemed to show significant differences in disease progression, but those differences varied hugely between repetitions, so the significance may be inflated.

Overall, NC12 fared best, followed by Stellar and Iron Lady, in close succession. The same complexes of disease appeared to affect all plots, with septoria leaf spot and early blight appearing early in the season and worsening quickly, till some plots were effectively dead and not producing by the last harvest – especially LB8-3 and Mountain Merit. However, it should be noted that NC12 began to have fruit rotting on the plant before other cultivars. Yet the *Xanthamonas* sp. bacterial speck that affected some of the other cultivars did not affect NC12.

#### **Picking Ease:**

The top yielding varieties, NC12 and Plum Regal, scored as some of the most difficult to pick, although Stellar did score well. Plum types were the easiest to pick, with Plum Perfect and LB8-3 scoring best.

#### **Fruit Size:**

Unsurprisingly, variety had a significant effect on average marketable fruit weight

( $F=81.92$ ,  $p=1.61 \times 10^{-14}$ ). Mountain Rouge, the “Heirloom-type hybrid” from North Carolina State University, was by far the largest, averaging 8.2oz, with some fruit well above that. Mountain Merit was relatively close behind at 6.65oz. The top yielder, NC12, averaged 4.4oz and Plum Regal 3.46 oz. NC12 was also one of the most consistently sized, having the smallest standard deviation for weight, length, and width. Mountain Rouge, on the other hand, had the largest deviations, as might be expected of heirloom types.

### **Fruit Quality:**

Difference in average Brix (soluble solids) between varieties was not significant ( $F=0.41$ ,  $p=0.92$ ). That said, there were some trends visible. Crimson Sprinter, the worst yielder, had the highest average at 5.67 °Brix. Mountain Merit competed best for a decent yielder, at 5.12 °Brix.

## **Interpretation and Additional Resources**

The results of a variety trial must always be approached with caution. Annual weather fluctuations, soil type, field disease history, and aspects of a farm’s microclimate can have a huge impact on varietal performance. Moreover, certain varieties yielded well but did not score well for quality, and vice versa; farmers will always have to balance the needs of their market enterprises with the agronomic traits of cultivars they choose. Lastly, some of the best performing cultivars in this trial are not yet commercially available.

The NC12 breeding accession, from a partnership between Cornell and North Carolina State, was clearly a top performer across many traits; it had the best disease

tolerance, the lowest percent of unusable fruit, and the highest yield. That said, Stellar, which is a commercially available cultivar with similar traits, was close behind. It yielded an average of three pounds/ten marketable fruit less per plant, but it was the second best cultivar for disease tolerance, had almost as large fruit, and scored slightly better for soluble solids.

For plum/paste types, Plum Regal was a clear winner. It was the second best yielder in the trial despite average disease tolerance, had a relatively low percentage of unusable fruit, and weighed more than other plum types. However, it did have the worst soluble solids readings in the trial. That said, according to the rating scheme by Ag Labs International, mentioned above, all varieties scored below average. This may have been due to the sampling procedure; 5 whole representative marketable tomatoes per plot were frozen together and thawed, and the mixed juices were tested – the tomatoes took a long time to thaw, and it is possible there was some decay in quality over the long thaw time.

Mountain Rouge proved to be a good alternative if growers are looking for a new heirloom-type tomato, but need enough disease tolerance to continue yielding. It scored in the middle for disease tolerance, but that is still good compared to many traditional heirlooms. However, its lower rate of disease may be partly due to the fact that it was the only indeterminate variety, and continued to grow new foliage even as older dead foliage dropped off the plant, thus make its ratio of affected foliage look better than other varieties. While it didn’t yield particularly well by weight or count, the additional margin commanded by heirloom types may make it a good option; it set by far the heaviest fruit in the trial,

and also scored second best for soluble solids.

Rankings at the replicated trial site were mostly commensurate with results from grower sites, although it seemed that NC12 and Stellar did not do as well further north, while Iron Lady and Mountain Merit did slightly better.

The particularly wet and hot summer made disease pressure and progression quite bad. However, this did allow for tolerance differences to become readily apparent. As always, it is a reminder of how key a good rotation is in preventing inoculum build up in soil. The fact that the Rep was more significant for disease than variety is also a reminder that the direction and method of transmission is extremely important – consider what fields might be isolated from potential sources of inoculum by natural vegetation, or distance from infected soil. In this trial, there was an interaction present between variety and rep for disease progression. This interaction was most pronounced for NC12 and LB8-3, the two that showed a difference. Clearly some aspect of particular areas of the field where those two varieties were planted elicited highly differential disease response – perhaps pointing to different levels of inoculum in the soil, or different vectors of transmission. The diseases also were also seen in complex, so it could be that the different reps had different levels of septoria or early blight, and that the two varieties responded poorly to one disease but well to the other, making the third rep look more diseased than the first.

Varieties for this trial were chosen by Dr. James Myers' lab at Oregon State University. If you would like to suggest a variety for inclusion in this trial, or have any questions about the design, conditions, results, or

management of the trial, please contact Dylan Bruce. Resources for organic tomato production can be found by contacting your local extension agent, and many are available online. For a useful, if somewhat dated guide on fresh market production from the University of Wisconsin Extension, see the link below. Couple regional information found there with organic production principles found in the sustainable agriculture guides published by the [National Center for Appropriate Technology](http://attra.ncat.org/appropriate-technology/) (NCAT).

1. Contact Dylan Bruce at [dbruce3@wisc.edu](mailto:dbruce3@wisc.edu).
2. UW-Madison Extension's guide, "Growing tomatoes, peppers, and eggplants in Wisconsin: <http://learningstore.uwex.edu/assets/pdfs/a3687.pdf>
3. NCAT's Organic Production guides: <https://attra.ncat.org/organic.html>

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United States  
Department of  
Agriculture

National Institute  
of Food and  
Agriculture

## Appendix

### Variety Descriptions and Seed Sources:

#### Crimson Sprinter

Source: High Mowing

Info: "Brilliant candy-apple red fruit and strong performance in cool conditions. Medium-sized mild fruits are early, abundant and ripen well on the vine. The earliest cultivar to carry the famous crimson gene for high lycopene. Holds well due to its thick skin. Developed by

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Professor T. Graham of OAC, Ontario. Semi-determinate · Prolific ·” (High Mowing)

### **Iron Lady**

Source: High Mowing

Info: “Impressive resistance to late blight, early blight, septoria and more. Fine-textured fruit is both dense and juicy with good tomato flavor. Must be planted away from other tomatoes to prevent early blight infection. From our collaboration with Cornell University and North Carolina State University. Determinate” (High Mowing)

### **LB8-3-1-1-1**

Source: OSU

Info: Derived from a complex cross that involves Legend, an OSU breeding line, a *Solanum habrochaites* accession and a Cornell line. The OSU material contributes Ph-2, *S. habrochaites* contributes a quantitative source of resistance and the Cornell material provides Ph-3. Line is a determinant paste type tomato. This is the first time this line has been trialed.

### **LB8-7-1-1-1**

Source: OSU

Info: Derived from a complex cross that involves Legend, an OSU breeding line, a *Solanum habrochaites* accession and a Cornell line. The OSU material contributes Ph-2, *S. habrochaites* contributes a quantitative source of resistance and the Cornell material provides Ph-3. Line is a determinant paste type tomato. This is the first time this line has been trialed.

### **Mountain Merit**

Source: Johnny's

Info: “Mountain Merit is a medium-large, 8-10 oz., red slicer with an excellent disease package to keep it healthy in the field. Larger than Defiant PHR, though flavor is not quite as good. Mountain Merit has one of the best disease packages around for a variety of field conditions. High resistance to fusarium wilt races 0-2, late blight, nematodes, and tomato spotted wilt virus. Determinate. AAS winner.” (Johnny's)

### **Mountain Rouge**

Source: Dr. Dilip Panthee (NCSU)

Info: Mountain Rouge' is an improved heirloom-type F1 hybrid tomato (*Solanum lycopersicum* L.) with large, smooth, pink fruit, excellent flavor, and an indeterminate growth habit. It is resistant to late blight [*Phytophthora infestans* (Montagne, Bary)] and root knot nematodes (*Meloidogyne* spp). (Hort Science)

### **NC12TMV007x 141233-62**

Source: Dr. Dilip Panthee (NCSU)/ Cornell

Info: The NC12TMV007x 141233-62 is an experimental fresh market tomato hybrid that is the cross of a new NCSU tomato line that has the TM2 gene for TMV resistance, and 141233-62 is a Cornell line that combines late blight (ph2 and Ph3) resistance, Septoria leaf spot resistance (SLS-1 and SLS-2) and early blight tolerance. (Dr. Martha Mutschler-Chu, Cornell)

### **Plum Perfect**

Source: Cornell University

Info: “Plum Perfect' is an experimental plum hybrid from Cornell. Cornell is trying to find a company that will license and sell this one. It is extremely productive, has very firm meaty fruit with good color and good processing quality. Like many plums/processing tomatoes it is uniform ripening (not green shouldered) and jointless. It has quite a few resistances including Verticillium (Ve), Fusarium races 1 and 2 (I2), late blight (Ph3), tomato spotted wilt virus (Sw-5), bacterial speck (Pto) and nematode resistance (Mi). The fruit size is similar or slightly larger than Romas, which unfortunately is not quite large enough anymore for conventional agriculture and major seed companies which are pushing for even longer fruit. However the combination of productivity, high fruit quality and extensive disease resistance might make it attractive for organic production. (Dr. Martha Mutschler-Chu, Cornell)

### **Plum Regal**

Source: Johnny's

Info: “A productive plum tomato with late blight resistance. Medium-size plants with good leaf cover produce high yields of blocky, 4 oz. plum tomatoes. Fruits have a deep red color with



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good flavor. Good disease resistance package. High resistance to fusarium wilt races 1, 2, late blight, tomato spotted wilt virus, and verticillium wilt; and intermediate resistance to early blight. Determinate.” (Johnny’s)

### **S200-1-1**

Source: OSU

Info: A medium-sized determinant red slicer from the OSU breeding program with good resistance to late blight. It is from a cross of an OSU breeding line with *Solanum habrochaities*

to combine Ph-2 with a quantitative source of resistance from *S. habrochaities*.

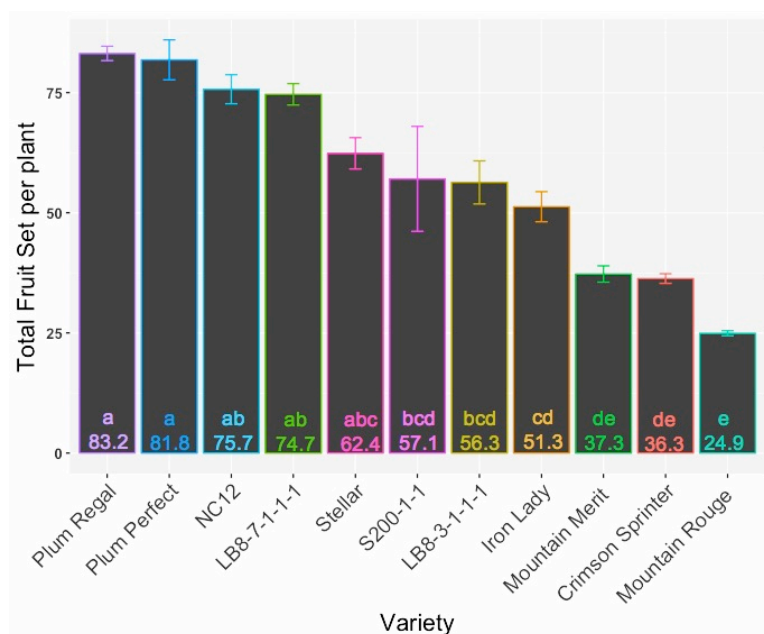
### **Stellar**

Source: PanAmerican Seed

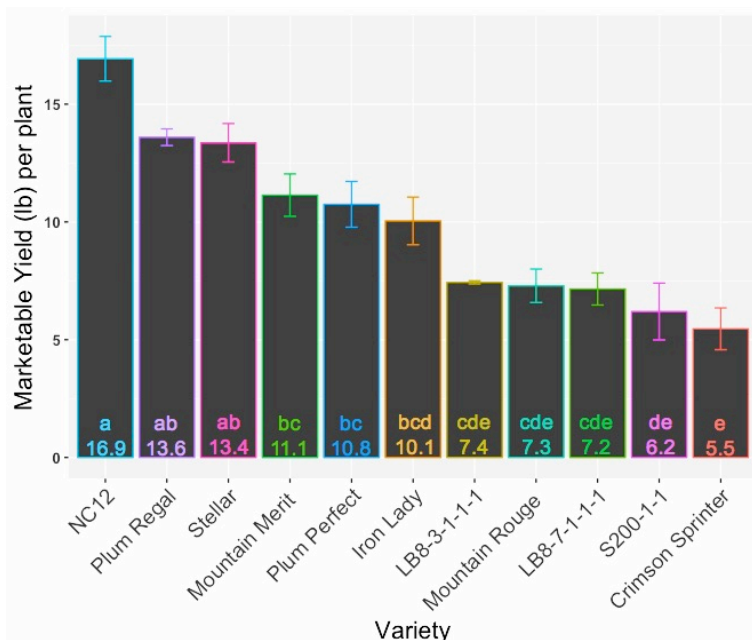
Info: “Produces lots of round, red, slicing tomatoes, perfect for all uses. This durable newcomer has high resistance to Late Blight, Fusarium Race 2 and Verticillium, as well as Intermediate resistance to Septoria Leaf Spot and Early Blight. Determinate.” (PanAmerican)

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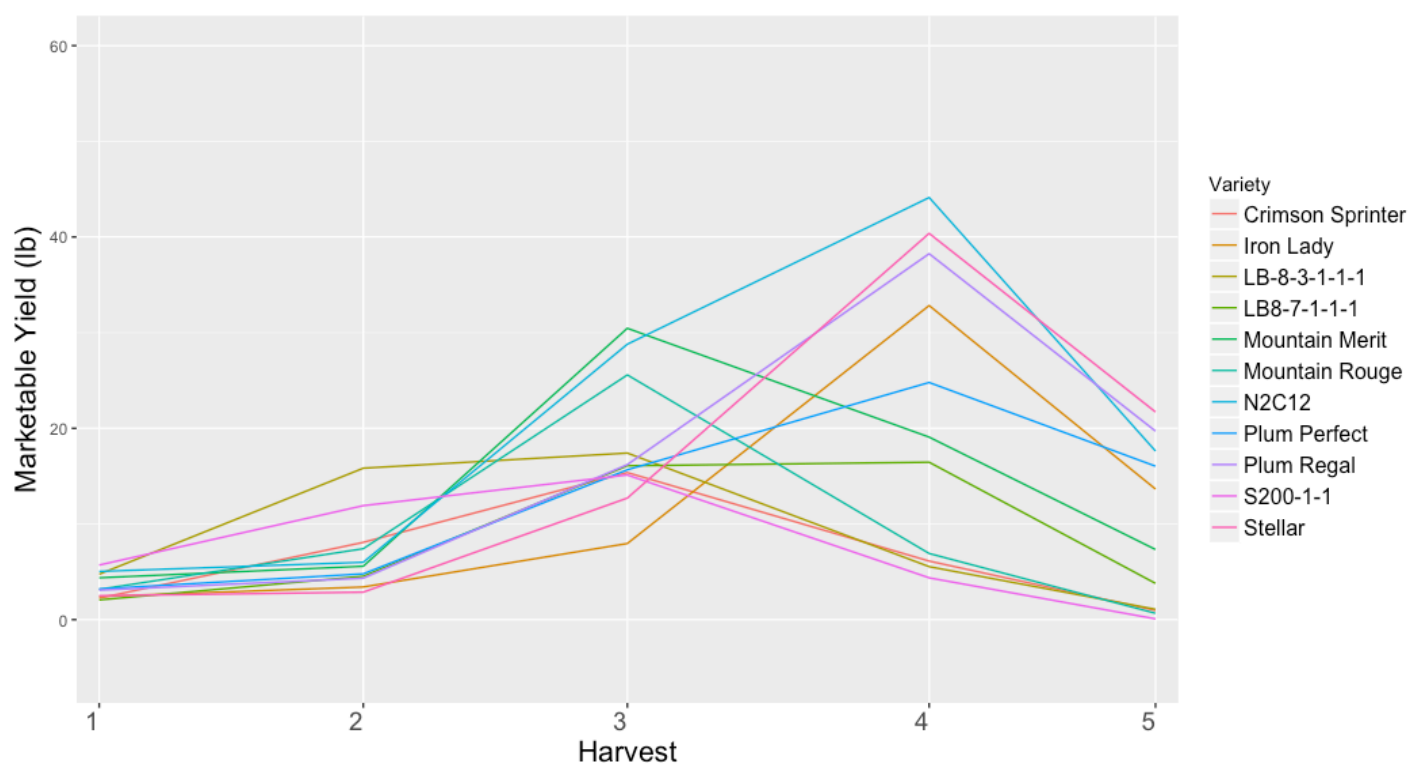
## Figures



**Figure 1: Total Fruit Set.** Variety significantly influenced total fruit set. Plum varieties generally yielded more total fruit, but NC12 and Stellar competed well. Varieties that share a letter are not statistically significantly different.

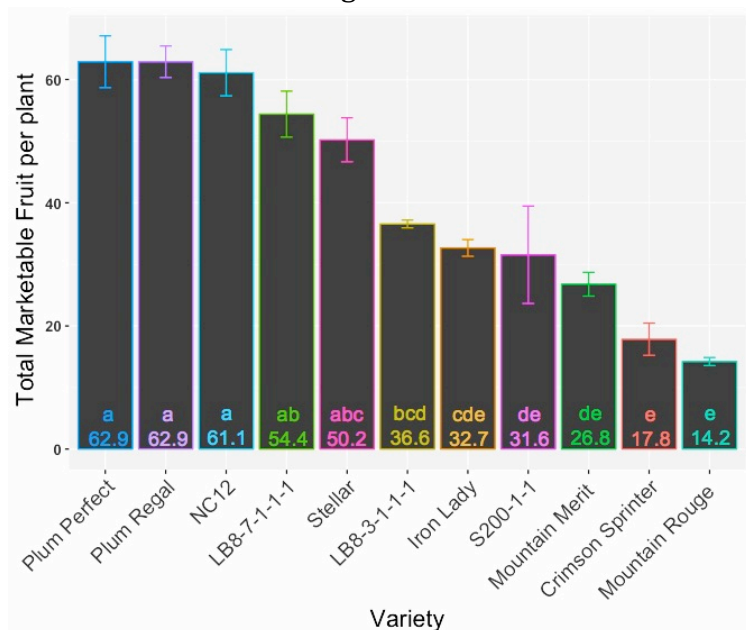


**Figure 2: Marketable Yield.** Variety significantly influenced marketable yield. In general there was relatively low variability. Varieties that share a letter are not statistically significantly different.

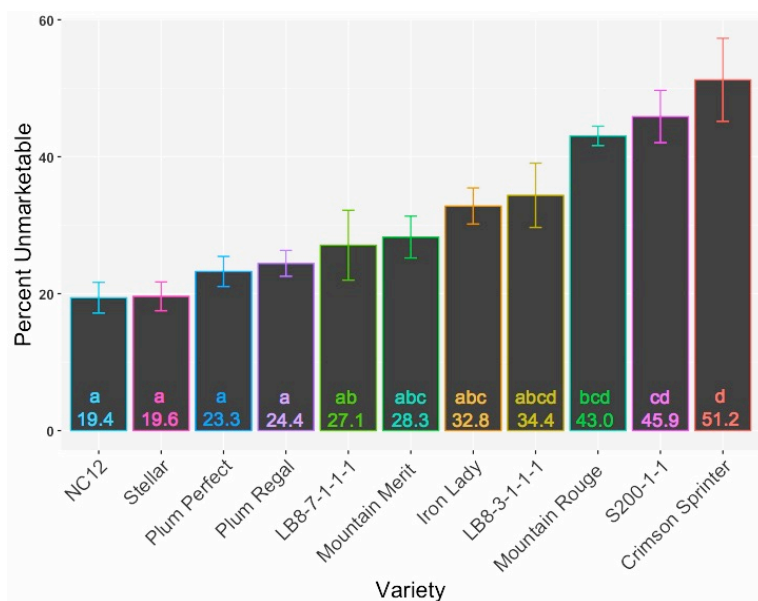


**Figure 3: Marketable Yield Over Time.** Variety significantly influenced marketable yield, and rankings were largely visible over the season. LB8-3 and S200-1-1 led the early harvests by a small margin, but were quickly overtaken by NC12, Mountain Merit, and Mountain Rouge in the third harvest. NC12 continued to lead in the fourth harvest, when Plum Regal, Stellar, and Iron Lady all peaked between 30-40 lbs per plot (6 plants). By the last harvest many of the varieties were yielding close to no marketable fruit, while NC12 declined sharply to just below 20 lbs, with Stellar and Plum Regal at just over 20 lbs. Harvest 1 occurred on 8/15/16, Harvest 2 on 8/22/16, Harvest 3 on 8/29/16, and Harvest 4 on 9/6/16.

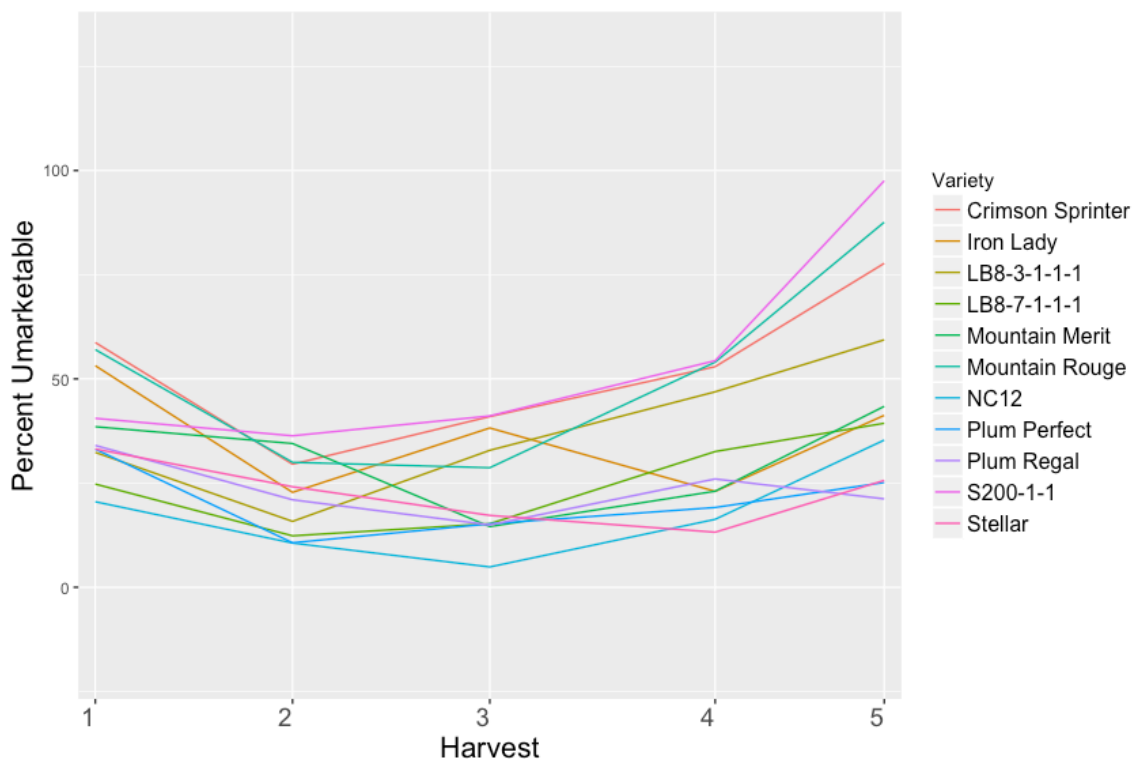
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**Figure 4: Marketable Fruit Count.** Variety significantly influenced marketable fruit count, with rankings mostly mimicking that of the total fruit set. Varieties that share a letter are not statistically significantly different.

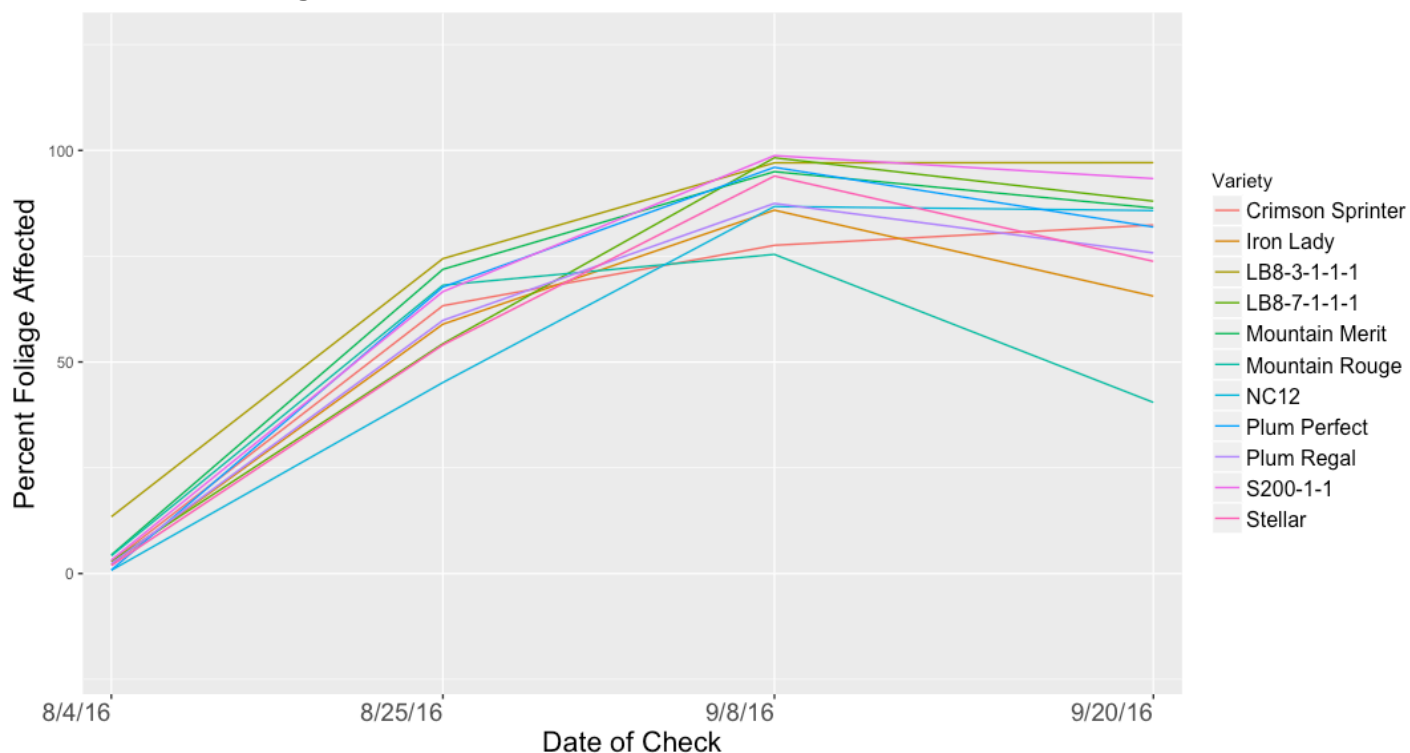


**Figure 5: Percent Unmarketable.** Variety significantly influenced percent of fruit deemed unmarketable. Varieties that share a letter are not statistically significantly different.

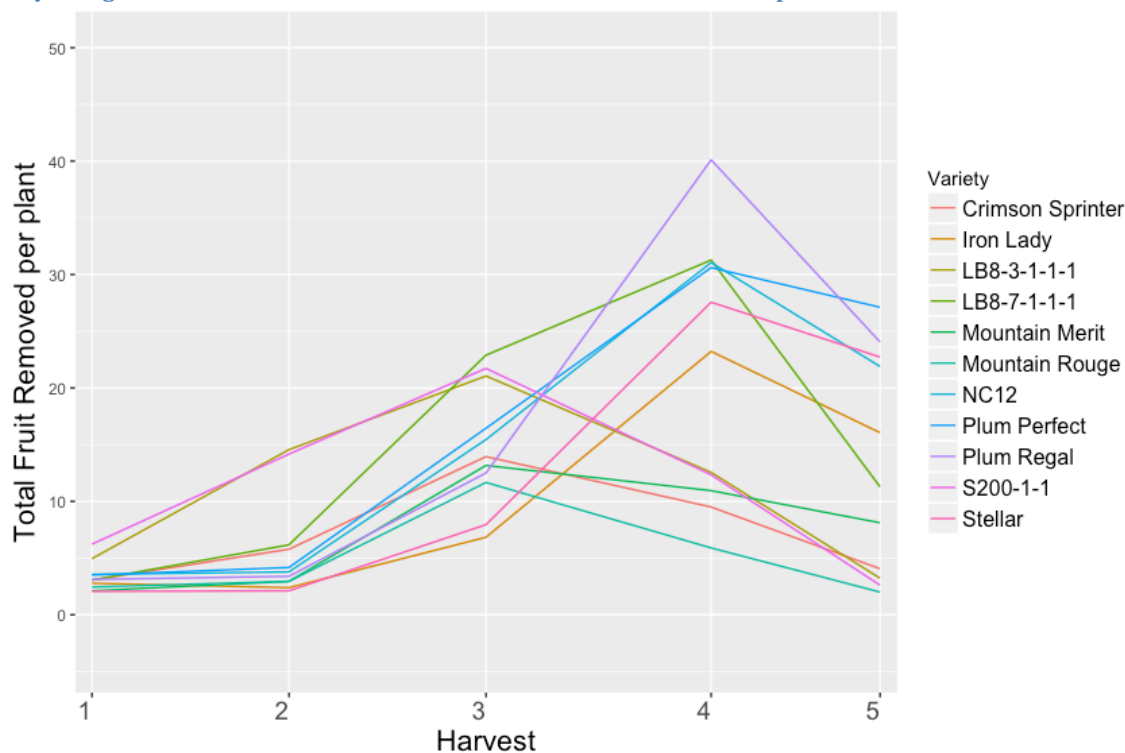


**Figure 6: Percent Unmarketable Over Time.** Variety significantly influenced percent of fruit deemed unmarketable, with the highest percentages of unmarketable fruit unsurprisingly coming at the beginning and end of the season. Harvest 1 occurred on 8/15/16, Harvest 2 on 8/22/16, Harvest 3 on 8/29/16, and Harvest 4 on 9/6/16.

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Additional Figure: Disease progression showed trends influenced by variety. Many varieties appear to trend slightly downward at the end of the season, but this is largely because they are losing the heavily diseased, dead foliage while still maintaining some level of new growth, thus appearing to decrease the percent of foliage affected. Unsurprisingly, this was most pronounced in Mountain Rouge, the only indeterminate variety in the trial. However, disease severity did increase throughout the season; the area of healthy foliage would have been a more marked score to the health of the plants decline.



Additional Figure: Total Fruit Removed per Harvest. Harvest 1 occurred on 8/15/16, Harvest 2 on 8/22/16, Harvest 3 on 8/29/16, and Harvest 4 on 9/6/16.

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### Causes of Unmarketability:

Variety	Growth Habit	Primary Causes of Unmarketability
Crimson Sprinter	Semi-determinate	Cracking, scarring, rot and speck (late season)
Iron Lady	Determinate	Cracking, scarring, catfacing
LB8-3-1-1-1	Determinate	Cracking, scarring
LB8-7-1-1-1	Determinate	Cracking, scarring, rot (late season)
Mountain Merit	Determinate	Cracking, scarring, misshapen, rot and speck (late season)
Mountain Rouge	Indeterminate	Cracking, bug damage, speck (late season)
NC12	Determinate	Cracking, scarring, rot (midseason)
Plum Perfect	Determinate	Scarring, rot and speck (late season)
Plum Regal	Determinate	Scarring, cracking, rot (mid-late season), speck (late season)
S200-1-1	Determinate	Cracking, scarring
Stellar	Determinate	Cracking, scarring, misshapen, bug damage and rot (late season)

### Grower Site Results

UW-Madison NOVICI	Crop: Tomato	Sites Grown*: Luna Circle in Rio, WI; Scotch Hill Farm in Broadhead, WI; LotFotL in Elkhorn, WI; Spooner Ag Station, Spooner WI					
Variety (in order of yield at UW-Madison Replicated Trial)	Maturity Date of first ripe fruit	Yield Potential Avg 1=low yield, 5=high yield	Disease**	Pest**	Overall Score 1=poor, 3=average, 5=excellent	Notes/Comments	
NC12 (F1)	8/10; 7/30;	5; 2		3 NR	4; 3	good variety	
Plum Regal (F1)	8/10; 7/30;	4; 4		3 NR	4; 4	"really nice, good size" - Luna Circle grows this variety in their main crop	
Stellar (F1)	8/10; 7/30;	5; 2		3 NR	5; 3	good production at Luna Circle; not so good at Spooner big, but few fruits and lots of splits; better production at Scotch Hill Farm	
Mountain Merit (F1)	8/10; 7/30;	2; 2		3 NR	2; 3	Luna Circle liked variety and will grow again in main crop; Scotch Hill says "Avg producer but small and hearty fruits"	
Plum Perfect (F1)	8/03; 7/30;	5; 4		3 NR	5; 4	good size but average production and lots of splits	
Iron Lady (F1)	8/10; 7/30;	3; 4		3 NR	3; 4	small size	
LB8-3-1-1-1 (F1)	8/10; 7/30;	3; 1		3 NR	3; 2	ok	
LB8-7-1-1-1 (F1)	8/10; 7/30;	2; 1		3 NR	2; 1	thin skin; showed more disease at one of the sites	
S200-1-1 (F1)	8/10; 7/30;	1		3 NR	1	lots of splitting; Scotch Hill found to be small and poor quality	
Crimson Sprinter (OP)	8/10; 7/30;	1		3 NR	1		
* all traits presented in order of growing sites shown here							
** 0=absent, 1=slight damage/pressure, 2=moderate damage/abundant pressure, 3=severe/lethal levels (ratings are for last harvests)							
NR= not rated							
- Mountain Rouge was not grown at farmer sites due to seed shortage							
- All grower sites except LotFotL showed high disease pressure							
- Scotch Hill found the varieties to be overall disappointing and not competitive with her favorite varieties, although disease pressure was very high; they provided comments but not scorings							
- Crimson Sprinter and S200-1-1 not grown at Spooner Ag Station							