

## 2008 Studies on Opportunities with Organic and Heirloom Tomatoes

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### HIGHLIGHTS:

- Across all varieties, there was no difference in total marketable yields among the Conventional, Standard Organic, or Brandt Organic production systems, but they were all higher than the control.
- The Brandt system provided good control of Septoria leaf spot, a disease that is becoming more of a problem in western North Carolina. Powdery mildew was also well controlled.
- Both organic systems were effective at disease and insect control, although the Brandt Organic System was approximately 28% less expensive to use than the Standard Organic System.

### INTRODUCTION

Consumers are willing to pay high prices for heirloom tomatoes, and the demand for locally grown, organic heirloom tomatoes always exceeds supply. Growing heirloom tomatoes in western North Carolina, especially in an organic system, however, can be difficult and there are many quality issues that made commercial production unattractive to many farmers. Finding new products to improve production is necessary to make growing organic heirloom tomatoes easier for farmers.

Former NC State tomato breeder, Randy Gardner has been breeding some heirloom-type hybrid tomatoes in an effort to improve some of the poor characteristics of many heirloom tomatoes, e.g., thin skins, tendency to crack, and lack of disease resistance. We have cooperated on heirloom and heirloom-type hybrid tomato studies in conventional and organic systems for four years. The studies have clearly demonstrated that high quality heirloom tomatoes and organic heirloom tomatoes can be grown in western North Carolina. Randy's improved heirloom-type hybrids are good producers and have excellent consumer acceptance. With strong markets and retail prices of \$3.00 per pound and up, grower interest is very high.

In 2008 we conducted two studies in western North Carolina. In one study we compared three heirloom varieties with three heirloom-type hybrids grown in two organic systems, a conventional system, and a control. In the other study, we set out to see how those same varieties would grow in an organic system in the high country.

### MATERIALS AND METHODS

One study was conducted at the Mountain Research Station in Waynesville, NC. It was a split plot design with four replications. The main plots were four production systems: Conventional, Brandt Organic, Standard Organic, and a Control. The subplots were tomato varieties: three heirlooms (Stupice, Mr. Stripey, and Red Brandywine) and three new hybrids that are similar in appearance to the three heirlooms [NC 05114, 118L-1W (2007), and 161L-1W (2007), respectively]. In the Conventional treatment, standard practices recommended by the NC

Cooperative Extension Service were used, including synthetic fertilizers, fungicides, and insecticides. The Control plots were fertilized the same as the Conventional plots, but no disease or insect control measures were adopted. Only National Organic Program approved practices were used for the two organic systems which were both fertilized with Nature Safe 8-5-5 and Neptune's Harvest fish emulsion. The Brandt Organic system was treated with the Brandt OMRI approved fungicide (Sporatec), insecticide (Ecotec), and copper (Kocide) (no longer OMRI approved, but we used it because it was purchased while it was OMRI approved). In the Standard Organic system, Serenade and copper (Kocide) were used for disease control and Neem oil and BT (Dipel DF) for insect control. All the tomatoes were grown on raised beds with black plastic mulch, drip-irrigation, and high trellises. Plants were evaluated weekly for disease and insect damage. Weekly harvests were conducted and four public taste tests were held. Tomato yields were recorded in pounds of fruit by system by variety. Fruits were graded out into Jumbo (>3.5 inches), Large (>2.5 inches), or Medium (<2.5 inches) as well as any bursts (tomato skins noticeably broken and leaking) and/or cracks (tomato's shoulder has crack extending from the flower pedicel over the tomato's shoulder) present on the fruit at the time of harvest.

Four public taste tests were held over the course of the harvest season. The taste tests were held in conjunction with public events including the 100<sup>th</sup> anniversary celebration for the Mountain Research Station, the heirloom tomato workshops at the Mountain Research Station and the Upper Mountain Research Station, and the True Nature Country Fair in Mills River. Over 200 adults participated in the taste tests. They rated each variety for taste as poor, fair, good, very good, or excellent. They also answered questions about what they look for in a tomato, how they shop for tomatoes, and basic demographics.

The second study was conducted at the Upper Mountain Research Station in Laurel Springs. It was a randomized complete block design with four replications. The treatments were the same tomato varieties grown in the Waynesville study. They were all being grown in the Brandt Organic System, as described above. Farmscaping, the practice of growing companion plants to provide habitat for beneficial insects, was practiced by growing strips of mixed species plants in-between the tomato beds. All the tomatoes were grown on raised beds with black plastic mulch, drip-irrigation, and high trellises. Weekly harvests were conducted and fruit were graded as described above.

## **RESULTS AND DISCUSSION**

### **Production System and Variety Study at the Mountain Research Station**

#### Tomato Yield and Fruit Quality

Across all varieties, there was no difference in total marketable yields among the Conventional, Standard Organic, or Brandt Organic production systems, but they were all higher than the control (Figure 1). Across all production systems, Stupice, Mr. Stripey, and NC 05114 had significantly higher marketable yields compared to Red Brandywine and NC 118L, but were statistically similar to each other and to NC 161L (Figure 2). NC 161L and Red Brandywine were statistically similar ( $p>0.05$ ) to each other.

The heirloom varieties showed significantly more ( $p<0.05$ ) burst fruit (19%) than the heirloom-type hybrid's (2%), with Mr. Stripey having more than all other varieties (data not shown). Red

Brandywine (76%), Mr. Stripey (79%), NC 118L (74%) and NC 161L (66%) had significantly more ( $p < 0.05$ ) cracks than NC 05114 (<1%) and Stupice (14%), but were statistically similar ( $p > 0.05$ ) to each other. NC 05114 had significantly less ( $p < 0.05$ ) bursts and cracks (<1%) compared to all varieties. Stupice had significantly less ( $p < 0.05$ ) bursts and cracks compared to all other varieties except NC 05114.

#### Disease and Insect Damage and Control

Disease pressure was not severe in 2008, probably because of the extremely dry conditions. Early blight, Septoria leaf blight, and bacterial speck were the major diseases present in the study. Disease management measures were necessary, however, as evidenced by the reduction in yield (Figure 3) and defoliation of the plants that occurred when no disease control efforts were taken (Figures 3 through 6). A timeline is presented in Figure 7. It indicates the on-set and continued presence of diseases, insects, and potassium deficiency observed in the different production systems. As was found in 2007, the Brandt system provided good control of Septoria leaf spot, a disease that is becoming more of a problem in western North Carolina (Figure 7). Powdery mildew was also well controlled. Bacterial speck was controlled best by the Standard Organic and Conventional Systems. Overall, both organic systems were effective at disease and insect control, although the Brandt system was approximately 28% less expensive to use than the Standard Organic System.

#### Taste Tests

Although consumers often report that the heirloom varieties, Brandywine (large, red fruit) and Mr. Stripey (large, red and yellow fruit), are favorite tomatoes, they did not fare well in the 2008 taste tests (Figure 8)! Stupice, a little known, red salad size heirloom tomato, was consistently the best liked of all the heirloom tomatoes (Figure 9). But it was two of the heirloom-type hybrids, NC05114 (red, salad size) and NC 161 (red, large fruited) that taste test participants rated the highest for flavor.

#### **Organic Variety Trial at the Upper Mountain Research Station**

This study was considered a preliminary trial to gauge the local interest in organic tomato production, to give the project leader and her staff experience growing organic, indeterminate tomatoes in the high country, and to learn to work with the research station staff on an organic tomato research project.

The interest in organic production in the high country is high (Figure 10) and there is good support for continuing in this area of research in the region. There were some fairly significant differences in producing organic tomatoes in Laurel Springs compared to the southern mountain region where this project leader had been growing organic tomatoes for many years. As such, this growing season was helpful in gaining experience with timing of cover crop planting, when to transplant tomatoes, length of harvest season, and disease, insect, bird, and mammal pressures.

The trends in marketable yields by variety were very similar to those obtained in Waynesville; although yields were lower (data not shown).

**Outreach**

Workshops were held at both research stations and included a classroom component, taste test, and field visit (Figure 10). The trial at the Mountain Research Station was also included in the 100<sup>th</sup> anniversary celebration of the research station. The trial at the Mountain Research Station was included in the Specialty Crops Field Day. Information about the trials was included in the NC Specialty Crops Program newsletter and the Carolina Farm Stewardship Association newsletter. Displays on the project were presented at the Sustainable Agriculture Conference in Anderson, SC.

**Project Funding**

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**Impact Statement(s):**

This project has indicated the potential economic equivalence between a conventional tomato production system and two organic tomato systems as well as the potential economic superiority of heirloom-type hybrids compared to heirloom varieties. Yields from the heirloom-type hybrid tomatoes were comparable or exceeded yields of the heirloom varieties in all comparisons with the exception of NC 118L which was a more determinate type growth habit than the others.

Production of organic heirloom and heirloom type tomatoes can be a profitable enterprise for western North Carolina farmers. It will be necessary to refine the organic production system, but using Brandt products will reduce production costs, making it more attractive to growers. Based on yields obtained in these studies and actual prices received by farmers in Asheville in 2008, potential gross returns of over \$200,000 per acre could be achieved.\*

\* Based on 6,290 plants/acre (12 inch spacing; 5 foot centers)

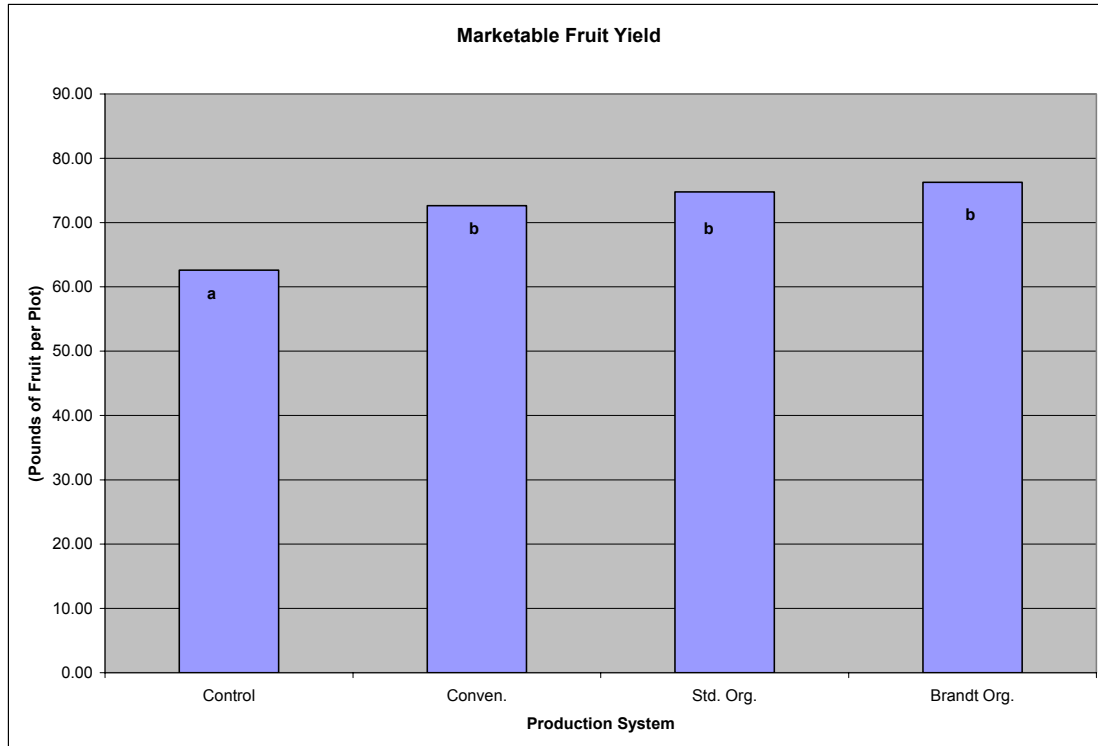


Figure 1. Average marketable fruit yield of tomatoes grown in a Control, a Conventional Production System, a Standard Organic System (based on Serenade and Neem), and a Brandt Organic System based on Brandt organic pest control products.

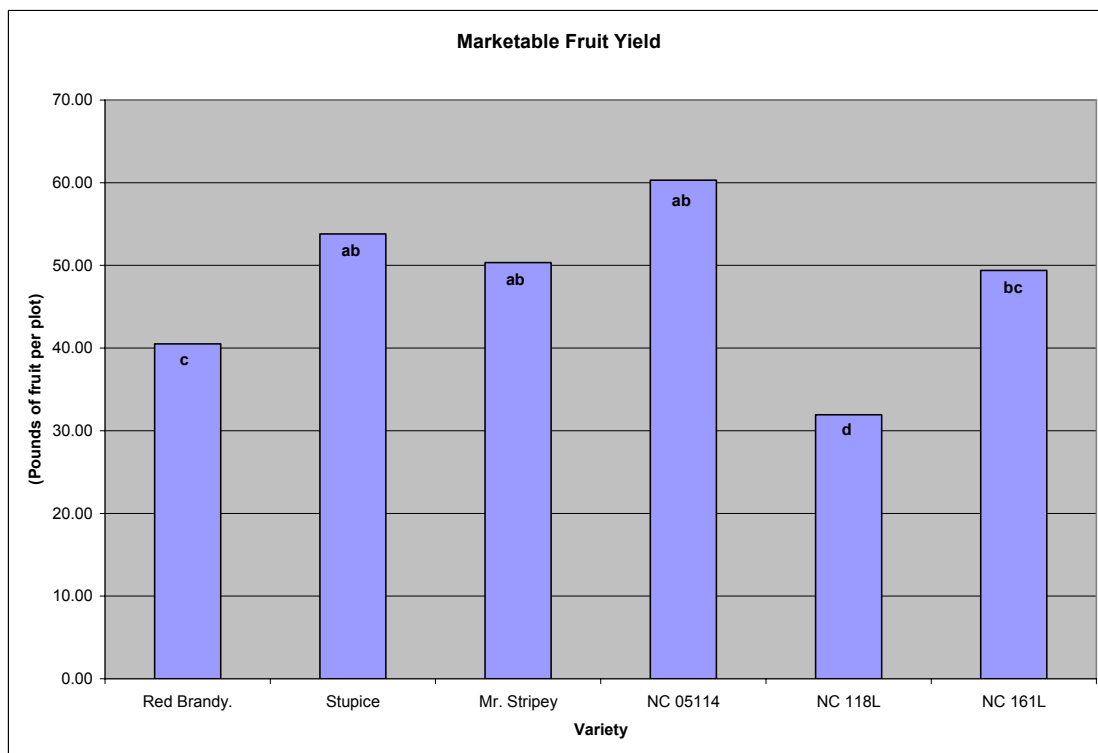


Figure 2 Average marketable fruit yield by variety.





Figure 3. Representative plot for the Standard Organic System and the NC 05114 variety.



Figure 4. Representative plot for the Brandt Organic System and the NC 05114 variety.





Figure 5. Representative plot for the Conventional System and the NC 05114 variety.



Figure 6. Representative plot for the Control and the NC 05114 variety.

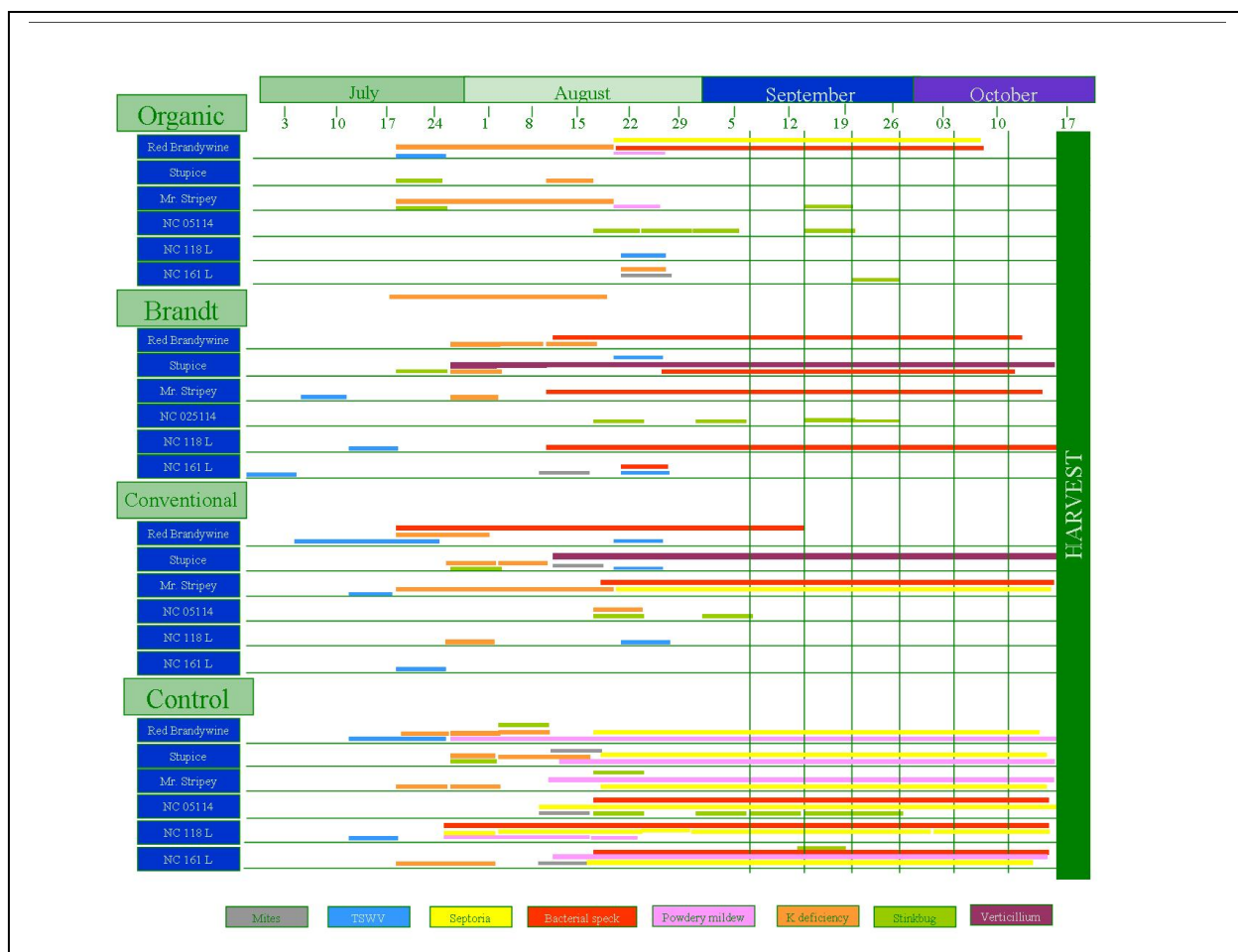


Figure 7. Disease time line for the four production systems. Gray=mites, blue=tomato spotted wilt virus, yellow=Septoria leaf spot, red=bacterial speck, pink=powdery mildew, orange=potassium deficiency, green=stink bug, and purple=Verticillium.





Figure 8. Tomato taste test held at the Mountain Research Station during the 100<sup>th</sup> anniversary celebration.

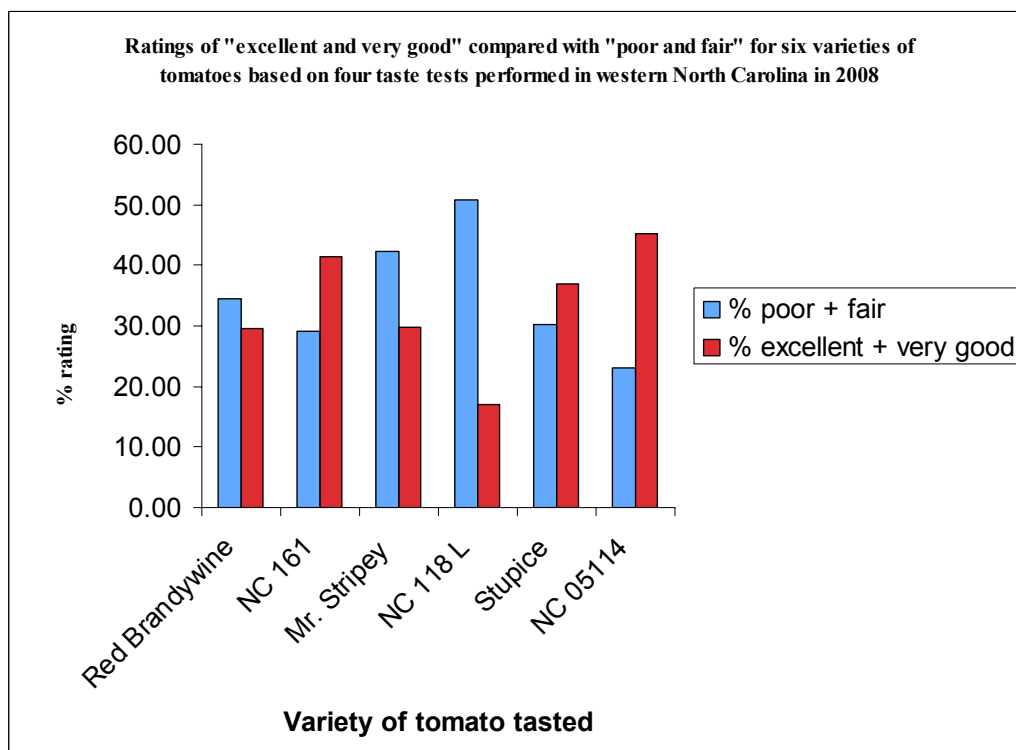


Figure 9. Taste tests results comparing six tomato varieties.



Figure 10. People inspecting the field plot at heirloom tomato workshop at the Upper Mountain Research Station in Laurel Springs.

Jeanine Davis is an associate professor and extension specialist working with organic agriculture, medicinal herbs, mushrooms, and other specialty crops. Randy Gardner is professor emeritus and tomato breeder. Dilip Panthee is an assistant professor and tomato breeder. Richard Boylan is an alternative agriculture extension agent in Ashe and Watauga Counties.