

Twin Oaks Seed Farm

2013 Downy Mildew Cucumber Trial Report

This trial was funded by Sow True Seeds and Twin Oaks Seed Farm, with help from Organic Seed Alliance.

Introduction:

Downy Mildew pressure was extremely high in Central Virginia in 2013. We had already observed it on other cucurbit crops at our farm by June 20th – more than two weeks before planting the cucumber trial on July 5th. A combination of very wet weather and a predominance of south wind probably contributed to early arrival of the disease (which overwinters in Florida and blows north on the wind each year), as well as to its proliferation. We planted the trial late in order to maximize exposure to Downy Mildew. It has been our experience that late planted cucumber crops are often unproductive due to Downy Mildew, and this was especially true this year for most of the varieties we trialed.

We planted 36 cucumber varieties, from a variety of sources: Southern Exposure Seed Exchange, Sow True Seeds, High Mowing, Johnny's, Cornell University, USDA Plant Introductions program, Territorial Seeds, Fedco, Heavenly Seeds, Adaptive Seeds, and Twin Oaks Seed Farm. Of these, only four produced well: Suyo Long (Twin Oaks), Shantung Shuyo F1 (Fedco), Ivory Queen F1 (Cornell) and Green DMR (Cornell). 10 varieties did not produce at all, and one produced very poorly. Five varieties had insufficient stands (see below about Green DMR and Ivory Queen). 16 varieties produced poorly to moderately.

We also observed and rated Downy Mildew pressure on the leaves 6 times during the trial. The average of these ratings for each variety generally correlates with yields.

We rated flavor on one occasion, and attempted to identify maximum harvestable size for best eating quality. It was difficult to discern differences in flavor. This may have to do with the abundance of rainfall. The only seedstock with bitterness present was Plant Introduction 197088, which is not a variety but a breeding source. The criteria for flavor ratings were sweetness, lack of bitterness and lack of sourness. Several varieties tended to have cucumber beetle damage on the fruit: Tendergreen Burpless, Diva, Mideast Peace and Muncher. See "Additional Notes" section for more information about flavor, shape and other qualities.

Problems:

There were two major problems with the trial.

1) Plant emergence of some varieties was not good due to heavy rainfall after planting, resulting in poor stands of those varieties. The intention was to have 10 plants of each variety. 7 varieties had 6 or fewer plants, complicating yield comparisons between these varieties and others. It could be wise to disregard the yield data from these varieties. However, in the cases of Ivory Queen and Green DMR, which (even with fewer plants) yielded 3 and 5 times the average production in the trial and which far out-produced everything except Suyo Long and Shantung Shuyo F1, valid conclusions can be drawn about comparative productivity. I have removed the other 5 varieties (with poor stands) from the data analysis and

spreadsheet. Stand density is a common problem with cucumber trials. See “Stand Correction Methods for Cucumber Fruit Yield” <http://cuke.hort.ncsu.edu/cgc/cgc21/cgc21-7.html>

2)Harvest size was not set ahead of time. The trial evaluated several different types of cucumbers that have a wide variation of optimal and intended harvest sizes. This was further complicated by the fact that many varieties, under conditions of stress from DM pressure, began ripening or fattening fruits at smaller than normal size. Harvest size was guided by a qualitative evaluation of good eating size for each variety.

The results of the trial must be considered with these problems in mind. They make yield comparisons between the varieties difficult. However, there are valuable conclusions to be drawn from the trial. It could be several years before another year of such high Downy Mildew pressure, so it is important not to pass up the opportunity to do so.

There are three ways that significance can be found in the results in the face of these problems:

1)Downy Mildew ratings often corresponded to yields.

2)Number of fruits produced can be used along with yield to rank variety productivity, addressing the problem of different harvest sizes when comparing productivity.

3)It is possible to isolate the best performers and the failures in the trial. Differences between varieties in the middle are harder to ascertain, but may also be possible to some extent.

Conclusions:

-The eleven worst performers by yield are also the worst performers by observed Downy Mildew Resistance and number of fruits. Of these, 3 were listed as DM resistant, and should be de-listed. This includes Spacemaker 80 and two seedstocks of Arkansas Little Leaf H-19.

-The top four performers by yield and by fruits per plant (Suyo Long, Shantung Shuyo F1, Ivory Queen F1 and Green DMR) are also in the top 5 for DM resistance evaluation (along with PI29088). Green DMR, Suyo Long and Shantung Shuyo are the top 3 for number of fruit. Ivory Queen, which only had three plants, is seventh for number of fruits, but had the second highest number of fruits per plant (15.3), which is 50% higher than the third highest (Suyo Long at 10 fruits per plant). These varieties yielded 70%-289% higher than the next highest yielder (Ashley). The fruit of these varieties was of good quality (unaffected by Downy Mildew stress). They were clearly the most productive and DM resistant, and yielded well.

-More research is needed to assess the DM resistance of the 16 varieties that were not clear failures or clear successes. It is clear that none of these varieties are good producers in cases of extremely high DM pressure. It may be possible to make some distinctions within this group based on yields and number of fruit. The top six producers in the group based on both yield and number of fruit (Ashley, Mideast Peace, Muncher, Platinum, Salt and Pepper and PI 197088) have at least double the yield and number of fruit compared to the lowest 5 producers in the group (Calypso F1, Marketmore 97, Diva, Sumter and

MM80BW). These 5 lower producing varieties are all listed as DM resistant. This trial calls the DM listings into question.

There is also an issue of marketability of fruit. Many of the slicers in the group had a tendency to produce deformed fruit, with pointy ends, bottlenecks, or fruit that fattened at a small size. This includes Green Finger, General Lee, MM80BW, Sumter, Marketmore 97, Marketmore 76, Muncher, Diva and Mideast Peace. Platinum, Homemade Pickles, Salt and Pepper, Poinsett 76 and Ashley produced better quality fruit.

-More research is also needed to assess the varieties with insufficient stands (besides Green DMR and Ivory Queen), although Metze White and Boston performed so poorly that they could be grouped with the 11 failing varieties.

-The worst performing 19 varieties by yield are also the worst performers by number of fruits. Of these, 11 were listed as DM resistant.

Methods:

36 varieties of cucumbers were planted on July 5th, 2013. We mainly selected varieties that are listed as Downy Mildew resistant, plus some that are regionally popular. Four varieties were hybrids and 32 were open pollinated.

Seeds were planted 10 inches apart in stations – 10 stations per seedstock; 25 inches between varieties. We planted 3 seeds per station, except where seed supply was limited, in which case we planted 2 per station. Seed emergence evaluation was not one of the goals of the trial. Due to several days of heavy rain just after planting, emergence of some varieties was poor. Plants were thinned on 7/22 to 1 per station. Two plants were left in stations next to gaps. See Spreadsheet Notes section for more details. There were two rows planted 6 feet apart. 5-10 feet at the ends of each row were planted with Ashley cucumber (these plantings not rated in the trial) to avoid edge effect.

The trial took place in LB1 field at Twin Oaks Seed Farm, which is certified organic. Soil type is Alta Vista Sandy Loam. Fertility was based on a soil test from A and L Eastern Labs. Amendments used were tofu okara (for nitrogen), at a rate of one ton per acre side dressed on August 8th. An over-wintered Crimson Clover cover crop was the main source of nitrogen. Potassium was supplied with an application of Potassium Sulfate at a rate of 400 pounds per acre. Phosphorus levels in the soil are very high, and pH is 6.4. Plants were covered with row cover until 7/22 to prevent plant mortality from cucumber beetles. Weed control was accomplished by hoeing in-row, hand weeding (once around plants), and tractor cultivation.

Downy Mildew pressure on leaves was observed and rated six times during the trial (from 7/28-9/24), using a 1-9 rating system (9 being the highest DM presence, and 1 indicating no DM presence). Harvest took place on 12 dates between 8/20 and 10/06.

Spreadsheet Notes:

Column A: Variety, source and lot number (when applicable)

Column I: Average Downy Mildew rating for each variety.

Column Y: Total yield.

Column AD: Yield Percentile is the percentage for each variety of the best yielding variety (Suyo Long).

Column AF: Number of fruits harvested.

Column AG: Fruits per plant.

Column AH: I did not have pre-set criteria about what size to harvest fruits. Size depended on cucumber type (harvested pickling cucumbers small), and a qualitative evaluation of eating quality (I attempted to harvest cucumbers before they became too big for good eating). Due to Downy Mildew stress, several varieties produced fruits that were pointy on the blossom end or that started to become inedible when shorter in length than normal. As a general rule I harvested these fruits while they were still good to eat. Lastly, due to excessive intervals between some harvests, and due to fast fruit sizing for some varieties (especially Ivory Queen and Cornell DMR) a number of oversize fruits were harvested.

Column AI: This indicates whether varieties/seedstocks were listed as Downy Mildew resistant.

Column AJ: Per acre yield. Each variety had approximately 57.5 square feet. Yield per acre is calculated as follows: $(43560/57.5)*\text{yield}$.

Column AK: Taste Ratings, from 9/3 harvest. See Summary and Additional Notes sections for more information about taste and other qualitative fruit characteristics.

Column AL: Maximum size for good eating. Not determined for all varieties. Based on 9/3 and 9/14 harvests.

Column AM: Number of plants. There were emergence problems due to prolonged wet weather after planting. The goal was to have 10 plants per variety; the figure in column AL is the actual number of plants as of July 28th. Five varieties have been left out of the data analysis due to poor stands. These are listed separately at the bottom of the spreadsheet.

Column AN: Overall Ratings.

A=Top rated for yield, DM evaluation and number of fruits. Green DMR, Suyo Long, Shantung Shuyo F1, Ivory Queen F1.

B=Middle Rating (16 varieties).

B1 group, likely better than B3 group. Number of fruits and yield are at least double B3 group. Ashley, Muncher, Mideast Peace, Platinum, Salt and Pepper, PI 197088.

B2 group: a clear distinction may not be made compared to B1 or B3 groups. General Lee, Homemade Pickles, Poinsett 76, Marketmore 76 and Green Finger.

B3 group, likely worse than B1 group. Number of fruits and yield are less than half of B1 group. Diva, Calypso F1, Marketmore 97, Sumter, MM80BW.

F=Failed plantings, worst performance based on all criteria (10 of these produced no fruit). Richmond Green Apple, Ellen's Family White, Edmondson, Straight 8s, Spacemaster, Armenian, Spacemaker 80, Arkansas Little Leaf H-19 (SESE and Sow True seedstocks), Bush Pickle, White Wonder.

Additional Notes:

The following notes were taken on 9/3:

Ivory Queen: Seeds small in bigger cukes. Good flavor, hint of sweetness.

Suyo Long: Good flavor, some sweetness, berry-like flavor. Necks make good pickles. Lighter color than Shantung Shuyo

Ashley: Decent flavor, thick skin

Shantung Shuyo: Decent/good flavor. Necks make good pickles.

DMR PI 197088: Bitter.

Green Finger: Good flavor, some sweetness.

Salt and Pepper: Good/decent flavor, some sweetness.

Platinum: Good/decent flavor, some sweetness.

General Lee: Thicker skin, mild taste.

Green DMR: OK taste, mild, some sourness detected. Tendency to have hollow or triangulated middle.

Tendergreen Burpless: Decent/good flavor, not real sweet. Scabbing from cucumber beetles.

Sumter: Off flavor?

Mideast Peace: Crisp for a slicer, decent/good flavor. Scabbing from cucumber beetles.

Marketmore 97: Decent/good flavor.

Boston: Mild, decent/good flavor.

Muncher: Flavor OK, mild. Thicker skin. Scabbing from cucumber beetles. Bulb end fattening early.

Homemade Pickles: Decent flavor, mild, slightly thick skin for a pickler.

Marketmore 76: Flavor decent/good. Thin skin for a slicer.

Poinsett 76: Flavor decent, not so sweet.

Diva (9/14): Sweeter than Muncher. Cucumber beetle scabbing damage.

Green Finger (9/14): Pointy ends.

Green Finger (9/6): Lots of bottlenecks.

DMR PI 197088: Two plants dead as of 8/12 from what appears to be bacterial wilt. Sent in disease sample and it came back as "insufficient sample." One more died a little later.

Plants that had lower vigor (observed on 8/12 and 8/28) apart from an appearance of Downy Mildew pressure: Marketmore 80 (SESE), Poinsett 76, Tendergreen Burpless, Diva, Wautoma.

The presence of Downy Mildew was confirmed on 8/2 by Virginia Tech Plant Disease Clinic, on a sample of Edmondson cucumber plant.

More notes on irregular fruit appearance will be gathered by looking at pictures.