A RED FRUITED, WILT AND MOLD RESISTANT FORCING TOMATO

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COVER PICTURE

$F_2$ hybrid of Tucker's Forcing $\times$ Ohio WR3.
Tucker’s Forcing
A Red Fruited, Wilt and Mold Resistant Forcing Tomato

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INTRODUCTION

Practical control of the many diseases affecting the tomato under greenhouse culture remains one of the foremost problems of the forcing industry. With the exception of occasional virus outbreaks, fusarium wilt and Cladosporium leaf mold take the highest toll. Although losses from these diseases have been reduced materially by proper soil sterilization and better greenhouse management, the final answer to the greenhouse disease complex is believed by many to lie in the development of varieties that show multiple disease resistance and possess good horticultural characteristics.

Greenhouse growers do not agree on the “ideal type” of forcing tomato. Differences of opinion exist as to such important factors as fruit color and size, as well as the merits of disease resistance. In some production areas the medium-sized, red-fruited varieties are popular; in other areas the pink-fruited tomato is regarded as a “trademark” of a greenhouse tomato. The retail price of quality greenhouse tomatoes is at times such that the cost of a single large tomato tends to develop consumer resistance. The larger fruited varieties tend to be rougher, less uniform in size and shape, and run a higher percentage of dark faced and irregular fruit. Consequently, the current trend, in this area at least, appears to be for a fruit size of 4 to 5 ounces.

Greenhouse growers usually have sufficient justification to be critical of the shortcomings of any variety. For example, those who prefer “pinks” desire the vigor, productivity, and wilt resistance of Ohio WR3 but object to the large, roughened, somewhat flattened fruit frequently found on the lower clusters.

All the common red-fruited forcing varieties have rather serious limitations. Break-O-Day, a wilt-resistant standby of older growers, has largely disappeared because of unproductiveness and poor fruit color. Most other red-fruited varieties are susceptible to fusarium wilt, or Cladosporium or both. Considerable difficulty is experienced with Michigan State Forcing with uneven ripening (green tops) and blotchy ripening. The fruit size of Bay State, a very uniform and smooth tomato, is generally considered too small. Valiant has many desirable fruit and plant qualities but it has not been a dependable cropper. This appears to be associated with its susceptibility to disease.

The advantages in earliness, uniformity, and productivity offered by early generation hybrids have become well established. The cost of $F_1$
hybrid seed represents only a relatively small part of the production cost of a greenhouse tomato crop. Consequently, greenhouse growers are anxious to try the newer hybrids. The results are frequently disappointing because of the low level of disease resistance carried by the hybrids currently available.

With the specific objective of greater disease resistance in mind, the Departments of Botany and Horticulture started a joint project to select desirable forcing types from field lines carrying the immunity type of resistance of Mo. Accession 160 of the species Lycopersicon pimpinellifolium Mill. Continued back crossing to commercial forcing varieties, followed by individual plant selection for several generations, has resulted in the variety now known as Tucker’s Forcing.

WILT RESISTANCE CONTRIBUTED BY MO. ACCESSION 160

In an earlier publication (3), Bohn and Tucker reported the immunity of Mo. Accession 160 of the wild Currant tomato, Lycopersicon pimpinellifolium Mill, to the prevalent form of the fusarium wilt organism, Fusarium oxysporum f. Lycopersici (Sacc.) Snyder and Hansen. The Mo. accession possesses a gene which confers an immunity type of resistance and which is inherited according to a simple dominant Mendelian ratio. The early hybridization work with commercial varieties is also reported in this publication.

With the distribution of advanced wilt resistant breeding lines to the Ohio and other Agricultural Experiment Stations, differential responses with respect to Fusarium resistance were reported. This led to the discovery of physiological specialization in the wilt fungus reported by Alexander and Tucker (2). Of the two known races of the wilt fungus, hybrids of Mo. Accession 160 have proved resistant only to Race 1, which is by far the most widely distributed and troublesome form.

Resistance carried by the Mo. hybrids of Mo. Accession 160 has been used in the development of other wilt-resistant tomato varieties. M-8-2 was selected from advanced breeding lines by Alexander and others of the Ohio Agricultural Experiment Station and used in the development of Ohio W. R. 3 (1). Another Ohio introduction, the Ohio W-R Brookston, a canning type, was selected from Mo. 4-309-6.

CLADOSPORIUM LEAF MOLD RESISTANCE CONTRIBUTED BY BAY STATE

The degree of resistance of Tucker’s Forcing to the various physiological forms of the leaf mold fungus is not known. A very low level of infection, however, has been observed among the common form (s) prevalent in this
area. Resistance also has been reported by the Purdue Agricultural Experiment Station.

The resistance carried by Tucker's Forcing was contributed by Bay State. The development of Bay State by crossing with Lycopersicon pimpinellifolium (Jusl.) Mill. and its resistance to the most virulent form (s) of the Cladosporium fungus have been reported by Guba (5).

Cooperative tests with commercial growers under conditions of heavy infection and humidity favorable for the fungus development are encouraging. The foliage of Tucker's Forcing has remained healthy while adjacent plantings of more susceptible varieties have succumbed prematurely.

PEDIGREE OF TUCKER'S FORCING

This tomato was first grown in the greenhouse in the spring of 1951. It is the progeny of seed collected from plant (II-183-3) selected in the previous field-grown crop. The genetic history is as follows:

Earliana x Lycopersicum pimpinellifolium #160 x Break-O-Day, selfed, open-pollinated x Ponderosa, open-pollinated x Greater Baltimore x Indiana Baltimore, open pollinated for 3 generations x Long Calyx, selfed for 2 generations and crossed with Bay State, selected to the ninth generation.

Two selections were made from II-183-3 and grown in 1952, but further selections were made only from one designated as I-205-3. Little segregation of characters has been observed in subsequent generations.

DESCRIPTION

General

Tucker's Forcing was developed as a forcing type tomato to meet the needs of greenhouse growers—a uniform red-fruit, multiple disease resistance, adaptation to setting under conditions of cloudy fall weather and tolerance of the high greenhouse temperatures frequently encountered in the spring.

In the breeding process an attempt was also made to obtain earlier maturity and the setting ability and uniformity of fruit size and shape of Bay State, but with larger fruit size. Maturity of Tucker's Forcing is slightly later than Break-O-Day.

Fruit

Flowering and fruiting characteristics most nearly resemble Bay State. The red fruit are borne on elongated racemes in clusters of four to seven. They are very uniform in size and shape. Fruit weight on typical greenhouse soils ranges from 4.2 to 5 oz. Little difficulty has been experienced with roughness, flattened fruit or catfacing, even on the first fruit cluster.
<table>
<thead>
<tr>
<th></th>
<th>Tucker's Forcing</th>
<th>Break-O-Day</th>
<th>Michigan State Forcing</th>
<th>Ohio WR-3</th>
<th>Improved Bay State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Mkt. Yield</td>
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<td></td>
<td></td>
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<tr>
<td>Lbs./plant</td>
<td></td>
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<tr>
<td>1952 (to May 23)</td>
<td>3.66</td>
<td>2.41</td>
<td>1.83</td>
<td>4.42</td>
<td>2.91</td>
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<tr>
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<td>0.58</td>
<td>1.91</td>
<td>1.08</td>
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<tr>
<td>1954</td>
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<tr>
<td>1955</td>
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<tr>
<td>Total Mkt. Yield</td>
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<td>Lbs./plant</td>
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<tr>
<td>1952</td>
<td>11.66</td>
<td>6.83</td>
<td>7.33</td>
<td>11.08</td>
<td>8.66</td>
</tr>
<tr>
<td>1953</td>
<td>10.00</td>
<td>3.66</td>
<td>9.66</td>
<td>8.91</td>
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<tr>
<td>1954</td>
<td>3.00</td>
<td>2.00</td>
<td>4.75</td>
<td>4.50</td>
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<td>---</td>
<td>4.83</td>
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<tr>
<td>Av. Fruit Size</td>
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<td>oz./fruit</td>
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<tr>
<td>1952</td>
<td>4.1</td>
<td>5.4</td>
<td>5.8</td>
<td>6.9</td>
<td>4.2</td>
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<tr>
<td>1953</td>
<td>5.4</td>
<td>5.5</td>
<td>6.5</td>
<td>7.1</td>
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</tr>
<tr>
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<td>4.6</td>
<td>5.0</td>
<td>5.1</td>
<td>6.3</td>
<td>---</td>
</tr>
<tr>
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<td>5.8</td>
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<tr>
<td>Color Fruit</td>
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<tr>
<td>1952</td>
<td>Good</td>
<td>Fair</td>
<td>Some uneven ripening</td>
<td>Good (pink)</td>
<td>Poor</td>
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<tr>
<td>1953</td>
<td>Good</td>
<td>Poor</td>
<td>Poor</td>
<td>Good</td>
<td>---</td>
</tr>
<tr>
<td>1954</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td>Some green top</td>
<td>---</td>
</tr>
<tr>
<td>1955</td>
<td>Good</td>
<td>Fair</td>
<td>---</td>
<td>Some green top</td>
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<tr>
<td>Shape Fruit</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1952</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>1953</td>
<td>Good</td>
<td>Sl. rough</td>
<td>Flat, rough</td>
<td>Sl. rough</td>
<td>---</td>
</tr>
<tr>
<td>1954</td>
<td>Good</td>
<td>Sl. flat &amp; rough</td>
<td>Sl. rough</td>
<td>Sl. rough</td>
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</tr>
<tr>
<td>1955</td>
<td>Good</td>
<td>Sl. flat &amp; rough</td>
<td>---</td>
<td>Sl. rough</td>
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</tbody>
</table>
The fruit consists of three or four cells, regular in shape, with medium thick walls and good internal color. The stem scar is small, neat in appearance, with little corky tissue. Little is known regarding its comparative susceptibility to cracking and to blotchy ripening. Losses from these troubles in several years of testing, however, have been consistently low. The fruit ripen more uniformly than most forcing varieties with little tendency toward green stem ends. The stem snaps off easily at the first node and can be removed from the fruit with little injury.

**Plant and Foliage**

The plant is of medium vigor, indeterminate and lends itself well to pruning and training to a single stem. Because of its tendency to set heavy clusters of fruit, extra foliage provided by axillary suckers (4) immediately below the flowering cluster may be beneficial. Additional nitrogen side dressings after the third cluster has set will maintain vegetative growth and result in increased fruit size late in the season. A relatively short internode length permits more fruiting clusters per stem and easier plant handling.

**Performance Records**

Testing Techniques: Twenty-four breeding lines and varieties are planted in a greenhouse ground bed each spring. Four replications of three plants...
are made in a planting arrangement which allows a uniform representation
with respect to the edges of the bed. In 1952 and 1953 seedlings were trans-
planted to 4-inch pots and inoculated with Fusarium A-2, an isolate of Race
1, January 5, and transplanted in the ground bed and reinoculated January
29-31. The commercial varieties used as standards were not inoculated. The
transplanting dates in 1954 and 1955 were approximately one month later
and harvest terminated in all cases from June 15-20. Hence the low yields
the last two years. Other than the inoculation, the cultural operations are
those typical in a commercial planting.

F<sub>1</sub> HYBRIDS WITH TUCKER'S FORCING

Tucker’s Forcing appears to be a good parent for further breeding. The
progeny of courses with wilt susceptible commercial varieties however, have
shown considerably lowered resistance to wilt.

The F<sub>1</sub> progeny of Tucker’s Forcing x Ohio WR-3 show some of the
desirable characteristics of Ohio WR-3 while retaining a satisfactory level of
resistance to both fusarium wilt and Cladosporium. The yields of marketable
fruit in replicated tests have usually been from 1-2 pounds per plant greater
than that of either parent, with the red fruit averaging around 5 oz. in
weight. The fruit appears more uniform in size and shape than Ohio WR-3,
but is rougher than Tucker’s Forcing. The fruit of this hybrid does not
separate as readily from the stem as Tucker’s Forcing, resembling Ohio
WR-3 in this respect.

Other hybrids with Tucker’s Forcing have been developed and are now
being evaluated.

LITERATURE CITED

   Immunity in Lycopersicon pinnellifolium Mill. and its inheritance in hybrids.