Processing Tomato Breeding Report to the Ontario Tomato Research Institute, November 2009

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1. Brief review of program background

(a) In earlier tomato breeding work at Harrow, modern cultivated varieties of tomato were hybridized with wild species of tomato. These crosses represent a source of new genetic variation to broaden the genetic base of processing tomatoes for Ontario. A wide genetic base among cultivars is associated with reduced risk of disease epidemics, and greater tolerance to weather extremes.

(b) While it is not an easy task, in some respects, it is easier to make the cross between the wild species and cultivated tomatoes than it is to bring the resulting hybrid to a point where it is useful to private sector breeders. The work at Ridgetown continues to focus on backcrossing and selection to combine the new genetic variation with commercially adapted traits.

2. Summary of program objectives

(a) The Ridgetown processing tomato breeding program has the primary objective of providing enhanced germplasm for O.T.R.I. member breeders to promote sustainability of the Ontario tomato industry.

(b) Horizontal, or additive genetic resistance to disease is a system of disease resistance largely overlooked by tomato breeders in the past. This strategy offers durable tolerance to disease and has potential for managing diseases where traditional vertical resistance has not yet proved helpful.

(c) Soluble solids are an important quality component of tomatoes for sauces and paste since the concentration of tomato solids represents a significant energy requirement in the manufacture of these products. Measurements on the natural tomato soluble solids content of advanced breeding lines can assist when selecting parents for the development of new breeding lines.

3. Release of breeding lines

Ninety advanced lines from the Ridgetown program were made available for licensing in time for 2009 planting.

4. Disease resistance breeding

Anthracnose and Bacterial Spot:
Breeding plots based on using modified mass selection to develop quantitative or horizontal resistance to anthracnose and bacterial spot were planted out in 2009. Seed production from crossing in the greenhouse was delayed slightly and so planting was delayed until mid June. Plants of the 2 anthracnose resistance populations, and the 3 bacterial spot resistance populations plots were established. The plots grew quickly and the bacterial spot plots were inoculated with T2, T3 and T4 strains provided by Diane Cuppels. These plots are unsprayed, as are all the breeding plots and they were severely affected by late blight. We were unable to make any selections from these plots.

The greenhouse crossing cycle will be repeating to produce seed so that we can repeat these trials in 2010.

Bacterial speck, Fusarium 1, Verticillium 1:
All field selections are routinely screened for resistance to these diseases using seedling tests in the greenhouse.

5. Selection for late blight tolerance

Late blight developed gradually in the breeding plots and eventually all plots were affected. It made selection very difficult. Only very limited data could be collected on earliness and field-holding ability this year.

An unexpected benefit of the incidence of late blight this year allowed us to screen our breeding population for any tolerance to this fungus. There were several breeding lines with a common parent that showed very strong tolerance to late blight. In some lines there was a dramatic difference between the tolerant plots where the foliage still appeared quite healthy and the foliage on all adjacent plots that was completely dead.

The Harrow pedigree 93.0120 is a common parent in many lines showing tolerance. We observed a strong foliar tolerance to late blight from other sources as well. Almost without exception, lines with *Solanum habrochaites* (PE-41) in the background showed good tolerance to late blight. It turns out that one parental line with this species in the background had been a very good parent over many years and the late blight tolerance was evident across several resulting generations of breeding lines currently under development.

An example of a breeding line at the end of the season with healthy foliage while all plots surrounding it are severely affected by late blight.

6. Summary of field selections in 2009

There were 1,303 breeding lines from F2 to F6 generations planted this year in our general breeding population. They originated from selections made at Ridgetown during fall 2008 plus new F2 lines. In a change from previous seasons, brought about by the incidence of late blight, selection in 2009 tended to focus on earliness, yield and good fruit size. This permitted us to exert unusually high selection pressure in favour of early development of good-sized fruit. In fall 2009, 1,082 selections were made.

7. Soluble solids measurement

In 2008 we began measuring the soluble solids (NTSS) on selections in the F6 breeding lines. In spite of the late blight we able to do this on the majority of the F6 selections in 2009. NTSS measurements were based on subsamples of aggregate samples of 2 representative fruit from each plant in the plot from which individual plant selections were made. Samples were collected when each selection reached 80% red ripe, and measurements were taken on 2 check varieties that same day and at a similar stage of maturity as a comparison. It is not fair to compare soluble solids levels measured from one year to the next for this group since they represent completely different pedigrees from year to year. The results represent a "snapshot" of a particular segment of the breeding program.

NTSS were measured on 81 selections in 2009. The average NTSS for all selections this year was 4.0 with the lowest at 3.2 and the highest at 4.9. For comparison the average of all measurements on the check varieties (multiple measurements spread over 7 varieties) was 4.1.

Distribution of natural tomato soluble solids measured in F6 breeding lines, 2009	
Range of NTSS measured	Number of breeding lines
3.2 – 3.9	39
4.0 – 4.9	42

While we are not necessarily breeding specifically for higher soluble solids, this information provides another means to discriminate among selections. It can also guide future choices of parents for the development of new breeding lines.

8. Plans for 2010

It is anticipated that the size of the breeding plots in 2010, and the overall project objectives, will remain unchanged from 2009. We will repeat screening the horizontal disease resistance populations in 2010 since those trials were unsuccessful in 2009.