
West Virginia '63 . . .

A New Home-Garden Tomato Resistant to Late Blight



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West Virginia '63 is the first tomato variety to be released from a breeding program initiated in 1950 by the West Virginia University Agricultural Experiment Station. The aim of this breeding program was to develop a tomato variety resistant to late blight (caused by the fungus *Phytophthora infestans*).

West Virginia '63 has the highest degree of blight resistance now known to exist in the tomato (*Lycopersicon* species). Its good horticultural characters are suitable for use by home gardeners in West Virginia and the Appalachian region. The variety has not been grown extensively outside this area. Its adaptability to other climates and its suitability as a processing and fresh market tomato are not yet known. The characters of West Virginia '63 are described below.

Pedigree – The pedigree of West Virginia '63 is shown in diagram 1. The accession numbers 36, 106 and 700 have fruit of cherry size or smaller. These wild tomato lines were originally collected by plant introduction workers of the United States Department of Agriculture.

Disease Resistance

Late blight – West Virginia '63 carries both monogenic and multigenic resistance to late blight. The monogenic resistance is governed by one dominant gene pair. West Virginia accessions 36 (PI 204976), 106 (PI 198245), and 700 (PI 204996) served as sources of this gene, named Ph₁ (formerly TR₁).² Progeny segregating for this resistance gene were

screened in the young seedling stage with tomato race *O* of *Phytophthora infestans*. The source of multigenic resistance was accession 700. Progeny segregating for this type of resistance were screened when five to six weeks old with tomato race *1* of the fungus. Because the several unknown quantitative factors which control multigenic resistance were reduced to half their number in the F₁ of crosses with susceptible varieties, initial screening was carried out in the F₂.

The sensitivity of multigenic resistance to the influence of environment and nutrition often resulted in either excessive kill or excessive survival. This necessitated repeated selfing and screening in later generations to assure that a selection carried the full complement of multiple genes.

Presence of gene Ph₁ makes West Virginia '63 immune to late blight caused by race *O*, the race most commonly found in West Virginia. However, during cool and rainy summers, late blight may appear on West Virginia '63 due to the development of another race of the fungus. This race, which probably arises by mutation, has been named race *1*. When this race appears, the spread of the disease is then slowed down by the multigenic resistance of West Virginia '63. Multigenic resistance makes it possible for a crop to be made despite the presence of blight. Considerable blight may occur on West Virginia '63 in severe epidemics, but, in comparison, susceptible varieties such as Rutgers usually are killed when the disease is severe. Since blight may occur

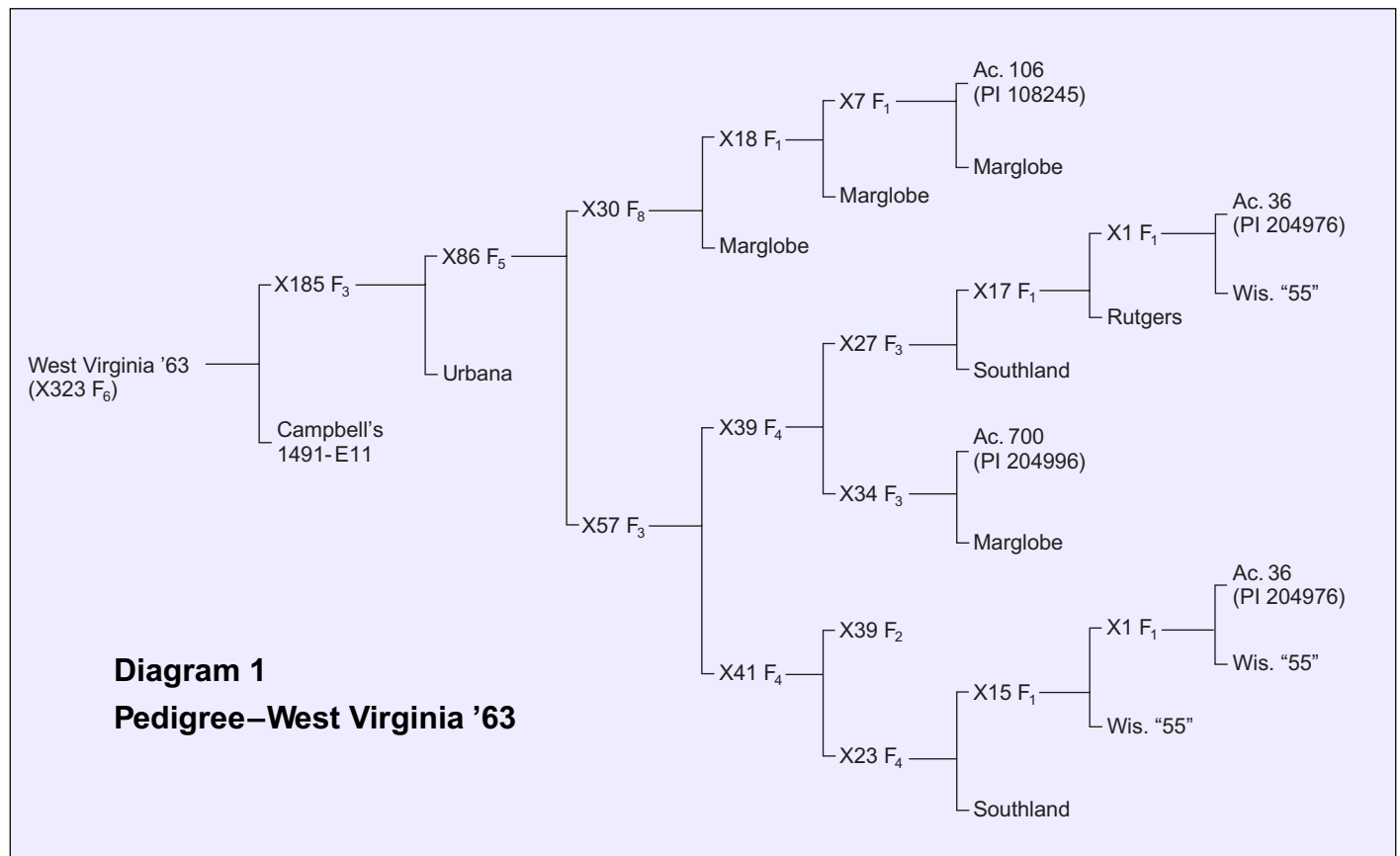
on West Virginia '63, it is recommended that the plants be sprayed regularly with a fungicide such as maneb or zineb during cool and rainy weather. Genetic resistance and the fungicide will then work together as partners to combat the disease.

Verticillium wilt – This disease, caused by the fungus *Verticillium albo-atrum*, has been the most destructive tomato disease in West Virginia during the past several years. It is particularly destructive when the temperatures are cooler than normal. The main symptoms are yellowing and browning of the lower leaves, premature leaf drop, and a gradual stunting with a reduction in fruit size. The vascular bundles become discolored. True wilting may occur but is rare. Some gardeners mistakenly consider this disease to be late blight. However, the late blight disease is recognized by individual leaf spots which are brown to olivaceous and surrounded by a light green halo; a white downy mildew growth is also present on the lower surface of the leaf underneath the spot.

West Virginia '63 carries the Ve gene for resistance to *Verticillium* wilt. The source of this gene was the breeding line C1491-E11 of the Campbell Soup Company. Segregating progeny were screened by the root-dip method with a virulent isolate of the fungus obtained from tomato plants growing in a home garden in Morgantown, West Virginia.

Fusarium wilt – The best known and perhaps most widespread wilt disease of tomato is caused by the fungus *Fusarium oxysporum* f. *lycopersici*. It is most common in warmer regions of the United States. In West Virginia, *Fusarium* wilt is most prevalent at the lower elevations when the growing season is warmer than normal. The symptoms of this disease are similar to those of *Verticillium* wilt. However, true wilting is much more common with the *Fusarium* disease.

West Virginia '63 carries the multigenic type of resistance to *Fusarium* wilt. Monogenic resistance due to the I gene was present in



the parents Southland and Campbell 1491-E11 and originally was thought to be in West Virginia '63. Segregating progeny were screened for resistance with Wellman's R₅₋₆ isolate of the fungus. West Virginia '63 gave an immune reaction in the first screening, but this was later found to be due to multiple-gene resistance contributed by Marglobe, Rutgers, and Wisconsin "55."

Vine – the vine of West Virginia '63 is large, indeterminate, vigorous, and provides good leaf cover for the fruit to prevent sunscald. It is similar to Marglobe. The vine trains well and may be staked.

Fruit – the fruit of West Virginia '63 are medium to large. The average weight of all fruit harvested at Point Pleasant in 1962 and 1963 was 0.40 lb. (Table 1). Considerable variation in fruit size was noted between plants in trials at Huttonsville. The fruit of West Virginia '63 is larger than the fruit from Big Boy hybrid, but smaller fruit is more common. Internally the fruit is deep red and very "meaty" with small irregularly scattered seed locules. The core is shallow. Externally the fruits are oblate to globe in shape, smooth, and red. They ripen uniformly and resist cracking. The uniform-ripening gene gives immature fruit a light green cast and prevents the formation of green shoulders. The high color, uniformed-ripening, and crack-resistant characters were contributed by Campbell 1491-E11.

The many unsolicited reports from gardeners who grew West Virginia '63 in 1963 mention its extremely fine flavor (slightly sweet), its

Table 1
Comparative Performance of West Virginia '63
with Three Commercial Varieties in Field Trials at Point Pleasant
 (Data extracted from replicated plantings of several advanced selections and commercial varieties.)

Variety	Average Fruit		Tons Per Salable Fruit			
	Size (lbs.)		1962		1963	
	1962	1963	No. 1	Total	No. 1	Total
Urbana	0.36	—	26.5	30.9	—	—
Campbell 146	—	0.43	—	—	19.1	25.1
Rutgers	0.43	0.38	26.5	28.9	13.9	23.1
W.Va. '63	0.41	0.41		28.9	16.7	24.4
LSD (19:1)					2.7	NS

meaty texture, high yields, and the high color in home-canned products.

A slight variation in fruit size and shape was still present in the variety when seed was released to commercial seedsmen in 1963. Large fruits from some plants showed small to medium stylar scars. Fruits of the first clusters from still other plants had rough, catface-like bottoms. Attempts were made to eliminate these defects by close selection in 1963. If still present, they should be eliminated by continuous selection in future generations.

Maturity – West Virginia '63 is a late-maturing variety requiring about 80 days after transplanting for earliest ripening. In 1963 the time required for earliest ripening and for peak production was very similar to that required for Rutgers and Campbell 146.

Yields – Yield trials were carried out at the Ohio Valley Experiment Station, Point Pleasant, West Virginia, in 1962 and 1963, by C.B. Sperow, Superintendent, and C.E. Hickman, Graduate Assistant in Horticulture. Both fruit size and yield of West Virginia '63 compared favorably with Urbana, Rutgers, and Campbell 146 (Table 1).

References

1. The tomato breeding program is a cooperative effort between the Department of Plant Pathology, Bacteriology, and Entomology and the Department of Horticulture. The writer wishes to acknowledge the contributions toward the development and release of this tomato variety by J.D. Downes, M.E. Marvel, W.M. Brooks, J.R. Shoemaker, and K.C. Westover, former members of the Department of Horticulture, and C.N. Hardin and D.O. Quinn, present members of the Cooperative Extension Service.
2. Gallegly, M.E., 1960. Resistance to the late blight fungus in tomato. *In* Proceedings Plant Science Siminar-1960, p. 113-135. Campbell Soup Company, Camden, New Jersey.