Martha A. Mutschler

Martha A. Mutschler attained her M.S. (1977) and Ph.D. (1979) in Plant Breeding/Plant Genetics from the University of Wisconsin-Madison, working on breeding for improved quality of bean seed protein. Over a 43-year career as a professor and vegetable breeder at Cornell University she worked on breeding and genetics of tomato and onion, with small side projects on butternut squash and broccoli. Since my presentation at the 2024 Texas A&M Plant Breeding Symposium will use examples from my tomato breeding program, this short bio is also limited to that program

TOMATO BREEDING

Mutschler's fresh market tomato focused on breeding for control of biotic stresses that limit tomato production or harm fruit quality with the overarching goal of substantially reducing the use of pesticides and fungicides for insect and disease control. Biotic stressors targeted include critical insect pests and viral diseases transmitted by these pests, and a range of fungal, oomycete, and bacterial diseases.

Disease resistance tomato lines:

- Lines with combination of resistances to early blight, late blight
- Identification of resistance to Septoria leaf spot, and creation of lines combining early blight, late blight and Septoria leaf spot.
- Discovery of additional resistance to early blight, and creation of lines combining early blight, late blight and Septoria leaf spot with resistances to bacterial spot and bacterial speck.

These classes of tomato lines have been used by some seed companies for production of hybrids that are particularly appreciated by organic growers. They are also being used as germplasm by commercial and public breeders to transfer the resistances to different forms of tomato adapted to different growing regions.

Tomato lines with acylsugar-mediated control of insect pests and the viral diseases they transmit. Three sets of lines were produced.

- The benchmark line CU071026, and sister lines containing the S. pennellii introgressions in CU071026 necessary for increased acylsugar level, plus one to three additional S. pennellii introgressions that further increase acylsugar level, or alter acylsugar level, or both. These lines have been used as a research platform by entomologists and plant pathologists at a number of universities to determine the impact of different levels and/or chemical forms of acylsugars on incidence of different pests/virus in greenhouse or field grown plants.
- The newer benchmark line CU17NBL was created to resolve a reduced fruit and seed set trait of CU071026 and its derived sister lines. A set of CU17NBL-derived lines, containing the S. pennellii introgressions in CU17NBL necessary for increased acylsugar level, plus one to three additional S. pennellii introgressions that further increase acylsugar level, or alter acylsugar level were also created.

  Since the CU17NBL lines are far better than the CU071026 lines, the CU17NBL set of lines has been deposited in been deposited in the USDA germplasm repository (GRIN) and the Tomato Genetics Resource Center (TGRC) for use as a research platform by scientists in allied fields. The newer CU-GBL are recommended for breeding purposes.

- The newest benchmark line, CU-GBL was created to reduce sizes of introgressions, removing QTL for negative plant and fruit traits carried by the original longer introgressions in prior lines, and reducing the S. pennellii control of the benchmark line from the 12 to 13% of CU071026 and CU17NBL to 2 to 3% in CU-GBL. One to three additional QTL were added to CU-GBL, to create its set of lines with different levels/types of acylsugars.

  The CU-GBL line and its' derived lines were released in 2023 for use in commercial and public breeding programs for transfer of the acylsugar trait to commercial hybrids of different types and adaptations, as well as for use in research. However, the CU-GBL set of lines has fewer combinations of additional introgressions than the CU-17NBL set of lines, so the CU17NBL set of lines could have advantages for research.

To facilitate the transfer and use of the acylsugar-mediated resistance in breeding and research, the release of both sets of acylsugar lines were accompanied by information on the location and sizes of introgressions, sets of markers that can be used for each introgression, and protocols for measurement of acylsugar level and type.

The negative impacts of insects and insect transmitted virus in tomato and many other vegetable crops are serious problems for these crops worldwide. The acylsugar program not only is of value for tomato but is also "Proof by Example" that plant secondary metabolites can be bred into and modified by breeding to deploy resistance against insects and insect transmitted virus. The approach would be feasible for other crops: other solanaceous crops with wild relatives that produce acylsugars, or other non-solanaceous crops whose wild relatives have resistance due to production of different secondary metabolites.

PATENTS:

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