TOMI: Tomato Organic Management and Improvement Project

Lori Hoagland [1*], John Beck[2], Natasha Cerruti[1], Micaela Colley[3], Jeanine Davis[4], Julie Dawson[5], Dan Egel[1], Brian Emerson[5], Sanjun Gu[2], Lisseth Zubieta Hernandez[1], Tyler Jones[1], Cathleen McCluskey[3], Laurie McKenzie[3], Tesfaye Mengiste[1], Jim Myers[6], Luping Qu[4], Jared Zystro[3]

[1]Purdue University, [2]North Carolina A&T, [3]Organic Seed Alliance, [4]North Carolina State University, [5]University of Wisconsin-Madison, [6]Oregon State University; *Corresponding author: lhoaglan@purdue.edu

Introduction

- Demand for organic, locally grown tomatoes is increasing rapidly. Customers shopping in these markets expect fruit to have superior flavor in comparison to fruit purchased in supermarkets.
- Organic growers struggle to meet this demand because existing varieties with good flavor are often susceptible to foliar pathogens that cause late blight, early blight and Septoria leaf spot.
- The goal of this interdisciplinary project is to overcome these challenges by integrating varietal development with fundamental research in plant-microbial relationships, and identification of safe and effective organic fungicide and biopesticide combinations. Outreach activities are integrated within each of these components.

Select improved tomato varieties in organic systems

Organic tomato growers need varieties that are resistance to foliar pathogens, are competitive in organic production systems, and have exceptional fruit flavor. Participatory breeding offers an ideal approach to meet these goals.

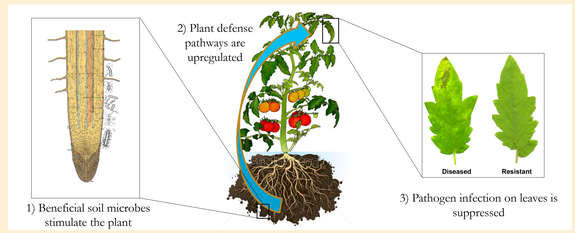
Objectives

- Select new indeterminate, fresh-market tomato varieties that thrive under organic management
- Quantify stability of genotype performance across variable environments
- Increase the practice of participatory plant breeding

Approach

- Experimental material will be screened alongside commercial varieties in IN, NC, OR and WI over four years
- Seed from the best populations in each environment will be recombined during winter
- Final selections will take place on working organic farms

Facilitate expression of induced systemic resistance



Induced systemic resistance (ISR) is an enhanced defensive state in plants mediated by beneficial microbes. Incomplete understanding of the genetic and soil factors that facilitate its expression currently limit practical application in the field.

Objectives

- Identify tomato genotypes that are responsive to ISR
- Improve understanding of the genetic mechanisms regulating ISR in tomato
- Determine how management practices that alter soil microbial structure influence ISR expression in the field

Approach

- A diverse collection of tomato genotypes will be screened for their responsiveness to ISR with select microbes
- Gene expression will be quantified in responsive genotypes
- Responsive genotypes will be tested in on-farm trials and correlations between root microbes and disease determined

Identify effective organic fungicides and biopesticides

Copper fungicides provide fair disease control, but these products must be applied often resulting in buildup of residues that negatively affect soil quality. Copper is now banned in Europe and is expected to be banned in the U.S. soon.

Objectives

- Identify safe and effective fungicide and/or biopesticide combinations that control foliar pathogens without negatively impacting soil quality or human health
- Characterize the relationship between biopesticides, ISR, and pathogen suppression

Approach

- A wide variety of organic fungicides and biopesticides will be tested alone and in combination in greenhouse trials
- Gene expression will be quantified in select treatments
- Five of the best treatments will be evaluated in field trials in IN and NC over two years

Outreach activities

- Participatory organic tomato breeding program
- Annual field days at research stations and on-farm trials
- Project website hosted by eOrganic
- Workshops and posters at agricultural conferences
- Webinars and videos on eOrganic
- Peer-reviewed manuscripts
- Extension publications:
  - Organic tomato seed production guide
  - Organic tomato foliar pathogen IPM guide

This project is funded by the National Institute for Farming and Agriculture (NIFA). Award #2014-51300-22267. Period of funding 2015-2019.

United States Department of Agriculture
National Institute of Food and Agriculture