

## Relevance Statement for Projects Submitted to the NE-IPM Program for 2008

### (a) Names of Institutions of PDs and major cooperators:

#### **New York: Cornell University and Cornell Cooperative Extension**

PD - Martha A. Mutschler, Dept. of Plant Breeding & Genetics, CALS, Cornell

PD - Thomas A Zitter, Dept. of Plant Pathology & Plant-Microbe Biology, CALS, Cornell.  
Charles Bornt, Capital District Vegetable Program, Cornell Coop. Extension. Troy, NY

**West Virginia:** PD-Coop. B E. Liedl, Gus R. Douglass Land-Grant Inst., WVSU, Institute, WV

**Virginia:** **Virginia Tech Univ.,** Coop. - Steven L. Rideout, Eastern Shore AREC, Painter, VA

**North Carolina:** NCSU Coop. - Kelly L. Ivors, Mt. Hort. Crops Res. & Ext. Ctr., Fletcher, NC

### (b) Title: Combined Resistance to Late Blight, Early Blight, and Septoria Leaf Spot in Tomato, and Complementary Fungicides for NE and other Temperate Production Regions

### (c) Project Type: Joint Research-Extension

**(d) Project summary** This Research & Extension project (\$164,249 PL89-106, \$10,720 Smith-Lever) targets improved control, with reduced pesticide load, of early blight (EB), late blight (LB), and Septoria leaf spot (SLS), the 3 main fungal diseases of tomatoes in the eastern US. These diseases occur in all NE states to the Southern region and are repeatedly listed as priority items. Another priority is strobilurin resistance found in EB isolates in NY, NC. This project unites breeders, pathologists, horticulturists, and conventional & organic growers in 4 states and two regions to meet priorities by developing LB/EB/SLS resistant tomatoes (adding SLS resistance to a LB/EB resistant line), and testing disease response of these lines with reduced sprays of low EIQ fungicides. Severe SLS damage across the NE in 2008 demonstrates the need for this resistance. We address strobilurin resistance by selecting appropriate replacements, scheduling use (TOM-CAST), and assess how reduced sprays and plant resistance can improve control and reduce grower costs. Conventional and organic grower-cooperators will serve as multipliers. The objectives are: 1 & 2) Combine SLS, LB and EB resistance in elite tomato lines, testing disease response and horticultural; 3 a & b) Determine efficacy of four fungicide treatments for disease control with & without genetic resistance (NY) then compare the best timings on lines with & without EB/LB/SLS resistances (NY, VA and NC); 4&5) Test EB/LB/SLS lines and hybrids in multiple sites (NY, WV) for control and horticultural properties. This project covers the priorities listed in NE-IPM RFP, and explained in the **Justification**.

### (e) Problem, Background and Justification

**Problem.** This project addresses control of LB, EB & SLS in tomatoes in New England (6 states), Northeast (NE: NJ, NY, PA), mid-Atlantic (VA, NC), North Central (MI, IN, OH). Combining NJ, NY, PA VA and NC, 2007 tomato acreage was 16,600A, valued at *ca* \$187 million (USDA Statistics, 2007). Disease control is a major concern in these regions; many fungicide sprays are used to protect yields & quality. Dominant disease varies with years; SLS was devastating in many areas in 2008. Emerging issues include strobilurin- resistant EB isolates and severe SLS in LB/EB resistant tomatoes grown with minimal fungicide. This could greatly increase reliance on protectant fungicides and increase the number of sprays used. Excessive spraying is undesirable for growers, due to increased costs, to the environment and rural community due to increased compound release, and for consumers, due to risks of residuals.

**Background.** LB, EB, & SLS are repeatedly identified as significant problems by tomato growers in New England, Northeast (NE), and mid-Atlantic states. Grower surveys conducted in New England states starting in 2002 (Anon. 2002) and prioritized as IPM Needs for the NE (2003-2007) showed how critical these three diseases are across the region. ([http://northeastipm.org/work\\_vegpriority2007.cfm](http://northeastipm.org/work_vegpriority2007.cfm)), The 2007 Pest Management Strategic Plan for tomato compiled for VA, NC and DE identified the same three diseases. (<http://www.ipmcenters.org/pmsp/pdf/SRTomato.pdf>). These concerns are echoed in letters from extension specialists NY (Born, Mishanec, Hadad, and Reid), VT (Hazelrigg), PA (Gugino) and the NC Tomato Growers Assoc. (Sprague). Some reductions in sprays were achieved using the TOM-CAST (EB, SLS), or Blitecast (LB) forecasting systems, but EB/ LB varieties were released after these systems were created and tested. In a previously funded NEIPM grant (Mutschler & Zitter 2005) LB/EB resistant lines were created, and trials of these lines demonstrated that optimal control of EB is obtained by growing LB/EB varieties in combination with minimal sprays of strobilurins, coppers or biologicals. EB/LB resistant varieties are now being sold by seed companies based on lines from the public breeding programs at NCSU and Cornell. However, trials also showed that growing EB/LB varieties with minimal fungicides results in severe SLS (Mutschler & Zitter, 2005), an emerging issue for growers. This project will add SLS resistance to the elite LB/EB line (a rapid process). Another recent development is the appearance of EB isolate resistant to the strobilurin fungicides favored for EB control. Fungicide resistance has already been identified in tomato in 2 states (NY and NC, Zitter and Ivors, respectively), and is expected to be widespread. However, excellent control was achieved in field studies in 2008 using fungicide replacements for azoxystrobin in conjunction with the most advanced EB/LB hybrid (NC06115). Without advancement of this project we could see a dramatically increase the number of fungicide sprays and a stronger reliance on protectant fungicides. With completion of LB/EB/SLS lines, and the testing of disease control in these resistant lines with/without supplemental fungicides with low EIQs (Environmental Impact Quotients) while following TOM-CAST forecasts, we can make accurate recommendations for controlling LB, EB, & SLS across wide areas with different levels of disease pressure, and in both traditional/organic production.

**Justification.** Since tomato is one of the most popular and widely grown vegetables across many regions, there is great opportunity to reduce fungicide usage. Current technologies/ practices for EB, LB, SLS control in tomato are inadequate, using excessive amounts of higher EIQ compounds and still failing to adequately control these three foliar diseases. Part of our strategy to solve these problems is the development of LB/EB/SLS resistant varieties, using LB/EB and SLS lines already created. Since the resistance to EB, and possibly also that to SLS, does not provide fully protection, the second part of the strategy is to determine the best low EIQ sprays to supplement the disease control provided by resistance. Treatments will be applied using a reduced spray schedule, using TOM-CAST, and test OMRI-listed products. This project covers all of the 14 priorities in the RFP for NE-IPM (Table 1). By working with both conventional/organic growers, selecting growers who are proven innovators and willing to extend their knowledge to other growers, we will attract the largest audience for adoption of our findings. Our cooperators in WV, VA and NC will also be performing similar trials working with growers in their area, since using wider regional trials is critical to broadly test the acceptability of the resistant lines/hybrids and efficacy of the programs/compounds to maximize control of EB & SLS. Another set of stakeholders are the seed companies, who produce/sell seed for new tomato varieties to growers. Seed companies readily accepted LB/EB, resulting in recent LB/EB

hybrids. Companies are interested in the EB/LB/SLS lines in development. By providing companies with access to triple resistant tomato lines, and information on how to use them, enables them to make a series of resistant hybrid varieties available to growers. It is a win-win interaction that provides the greatest benefit to all.

Table 1. The priorities of the NE-IPM program covered by this program

1. <b>Will reduce environmental risks</b> through reducing reliance on pesticides for control of EB/LB/SLS and determining supplementary pesticides with the lowest EIQ that complement LB/EB/SLS lines.
2. <b>Will reduce risks to human health</b> through supporting tomato production with minimal risk of pesticide residue, including supporting organic production of tomatoes.
3. <b>Has stakeholder support:</b> support and priority as cited in the background above.
4. <b>Focused on a pest/crop in at least five states/ cropping regions:</b> since LB/EB/SLS are problems of tomato production in nearly all of the NE states, plus NY, PA, NJ, NC, VA, & Midwest (OH, IN MI).
5. <b>Will fill a unfilled niche</b> since the project addresses the need for new SLS resistance and for alternate low EIQ strategies for new strobilurin resistant <i>Alternaria</i> strains.
6. <b>Involves three or more</b> states in an active partnership, including in NY, WV, VA and NC.
7. <b>Will advance IPM soon;</b> spray trials results immediately useful for current LB/EB hybrids. Variety release can be rapid. Work from 2005 NE-IPM grant contributed to current LB and LB/EB hybrids.
8. <b>Is interdisciplinary,</b> involving a plant breeder, plant pathologists, and extension specialists.
9. <b>Reduces dependency on chemical pesticides</b> through use of triple disease resistance supplemented with minimal sprays (TOM-CAST) with low EIQ compounds.
10. <b>Has significant economic implications:</b> reduce cost of disease control for all growers in the regions.
11. <b>Serves an "underserved audience":</b> involved active cooperation 1890 land-grant institution and it's organic growers participants
12. <b>Addresses emerging problems,</b> specifically of the need to control SLS in new varieties resistant to EB and LB and to address control of strobilurin resistance <i>Alternaria</i> strains.
13. <b>Results are will be adopted by the target audience:</b> seed companies already LB/EB lines, and have requested SLS lines, grower indicate high priority LB/EB/SLS control and are involved in project.
14. <b>Advances a more cost-effective IPM practice:</b> use of a resistant variety imposes little extra costs, done very easily; reduction in the number of sprays reduce costs of disease control.

**(f) Project Objectives and Anticipated Outcomes**

*Obj. 1.* Combine SLS, LB & EB resistances in high quality tomato line (research); Outcome: Development of SLS/EB/LB resistant tomato lines with good type and adaptation to regions. .

*Obj. 2.* Testing disease response and horticultural type in SLS/EB/LB resistant lines and hybrids. (research); Outcome: This objective generate data & produces seed in support of obj. 1, 3, 4 & 5.

*Obj. 3a & 3b.* Determining the efficacy of 4 fungicide treatments for EB & SLS control with & without genetic resistance (NY, VA, NC), (research); Outcomes: By evaluating 4 fungicide programs (reduced sprays, TOM-CAST-18 and -25 and organic treatment), then testing a subset of timings with/without EB/LB/SLS lines, we can assess the contributions of resistance and approved fungicides, showing if supplemental chemicals are needed, and which to use.

*Obj. 4.* Field work in Albany/Columbia Cos. NY in Years 2 and 3 (extension); Outcome: By growing in different locations and over two seasons, we select best material for commercial acceptance and performance in conventional and organic settings.

*Obj. 5.* Field work in WV, Years 2 & 3 (research); Outcome: By growing in organic fields over two seasons, we select best material for commercial organic acceptance and performance.