Grant Awarded by USDA Specialty Crop Research Initiative to Focus on Improving Production Efficiency and Managing Emerging Diseases in Southern Highbush Blueberries

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Scientists from the University of Georgia (UGA), along with colleagues at the University of Florida, North Carolina State University, Mississippi State University, and the USDA-ARS recently were awarded a 4-year, $1.7 million grant from the USDA’s Specialty Crop Research Initiative (SCRI) to advance southern highbush blueberry production efficiency by enabling mechanical harvest, improving fruit quality and safety, and managing emerging diseases. The SCRI is a new competitive funding program, established through the 2008 Farm Bill, that seeks “to solve critical United States specialty crop issues, priorities, or problems through the integration of research and extension activities that take systems-based, trans-disciplinary approaches. The intent of the SCRI is to promote collaboration, open communication, the exchange of information and the development of resources that accelerate application of scientific discovery and technology to solving needs of the various specialty crop industries.”

Project background and objectives

The exponential growth of the southern blueberry industry during the past three decades has been a remarkable success story within the United States specialty crops sector. Indeed, nearly one-third of the United States cultivated blueberry acreage is located in the South, and within the next 5 years the region is projected to become the largest blueberry-producing area in the nation (Strik and Yarborough 2005). Growth in acreage and production has been especially impressive for southern highbush blueberries, which ripen during a favorable market window and provide an important source of income for small and medium-sized farms and a lifeline for the surrounding rural communities. However, in the face of increasing domestic supply, rapidly strengthening international competition, increased pressure on producer prices, and looming shortages in labor, blueberry growers will have to elevate their overall production efficiency considerably to remain profitable and sustainable. The goal of this grant project is to enable an unprecedented leap in efficiency through a comprehensive, interdisciplinary research and extension effort integrating three major themes: (i) overcoming the genetic, horticultural, and engineering barriers that stand in the way of mechanical harvesting southern highbush blueberries for the fresh market; (ii) improving overall fruit quality and safety; and (iii) addressing emerging systemic diseases that threaten the viability of the industry. Specific objectives are to:

1. Develop and evaluate superior southern highbush blueberry cultivars with enhanced mechanical harvest capability and understand the genetic basis for improved fruit detachment;
2. Evaluate and demonstrate horticultural and engineering principles with the potential to improve mechanical harvest capability of fresh-market blueberries;
3. Develop strategies to improve overall quality, shelf life, & microbial safety of harvested blueberries;
4. Understand the etiology and develop management strategies for emerging systemic blueberry diseases; and
5. Conduct economic assessments and engage in outreach and technology transfer with growers, packers/ shippers, and consumers.
Mechanical harvest for the fresh market

Production of southern highbush blueberries is capital-intensive, with a total cost of production exceeding $13,000 per acre and year (Fonsah et al. 2006). In the face of increasing domestic supply, rapidly strengthening international competition, and increased pressure on prices, blueberry growers will need to elevate their overall production efficiency considerably to remain economically viable and sustainable. The greatest leap in production efficiency could be achieved by developing a mechanical harvest system for highbush blueberries. At present, the majority of blueberry fruit destined for the fresh market (including all of the early-maturing southern highbush cultivars) are hand-harvested to ensure high fruit quality. However, with farm labor in increasingly short supply, the cost of hand-harvesting will continue to increase in the near future. Current mechanical harvesting systems, used widely with the later-maturing and lower-value rabbiteye blueberries, are generally not yet capable of delivering southern highbush blueberry fruit of sufficient quality and shelf life for the fresh market (Funt et al. 1998, Takeda et al. 2008). A comprehensive, interdisciplinary effort is therefore needed to overcome the genetic, horticultural, engineering, postharvest, and pathological barriers that stand in the way of achieving this critical goal. Advanced selections and new cultivars with “crispy” flesh are expected to offer the most potential for mechanical harvest of southern highbush. New growth regulators to assist at harvest will be evaluated. To reduce machine ground loss, crown restriction, trellises, and newly designed catch pans will be tested. To discover where bruising occurs in the harvest and packing line, electronic blueberry mimics will be constructed that measure impact. With this data, bruising reduction techniques and harvester padding strategies will be improved.

Fruit quality and safety

Regardless of whether blueberry fruit are hand- or machine-harvested, an increasing berry supply will result in 1) consumers becoming more discerning and demanding with respect to fruit quality, given the wider selection, and 2) fruit having to be stored for longer periods after harvest, e.g., on supermarket shelves or during long-distance shipping to our northern, Asian, and European markets. Thus, a concerted effort to further improve key fruit quality parameters (especially firmness, shelf life, resistance to fungal decay, and the contents of health-promoting phytochemicals) without negatively impacting sensory qualities (aroma and flavor) is urgently needed. In addition, the effects of mechanical harvesting and postharvest treatment practices on microbial safety of blueberries need to be ascertained. The second main theme of our grant project will address these critical fruit quality and safety concerns through collaborative work among breeders, horticulturists, postharvest physiologists/pathologists, and food scientists.

Emerging diseases

As production intensity has increased, disease problems have become more prevalent in southern blueberries (Scherm and Krewer 2003). Common foliar and root diseases affecting blueberry are currently well managed based on integrated disease management recommendations developed at the universities participating in this project (Brannen and Smith 2008, Cline et al. 2006). However, few management options are currently available for bacterial leaf scorch (caused by Xylella fastidiosa) and Botryosphaeria stem blight (caused by Botryosphaeria spp.), two diseases that have caused significant plant death in southern highbush blueberry plantings in recent years. Bacterial leaf scorch is a new disease that was first documented in 2006; as such, very little is known about its etiology, epidemiology, and control. Field observations suggest considerable differences in host resistance to the disease (Brannen et al. 2008), but a comprehensive effort to assess new cultivars and advanced selections, especially those with mechanical harvesting potential, for resistance or tolerance to X. fastidiosa and its vector(s) is currently lacking.
A similar germplasm evaluation effort is urgently needed for stem blight, especially in anticipation of the fact that more widespread use of mechanical harvesting will increase the likelihood of lower stem injuries, thereby providing infection courts for *Botryosphaeria* spp. (Lyrene 2008). In addition, blueberry propagation systems that can eliminate both *Xylella* and *Botryosphaeria* as well as other vegetatively transmitted diseases such as *Blueberry red ringspot virus* need to be worked out. Based on these considerations, a third major component of our grant project is a comprehensive approach to manage emerging diseases through host resistance, better understanding of pathogen and vector epidemiology, and improved propagation systems.

**Putting it all together**

In isolation, progress in the disciplinary elements of this project will be insufficient to advance production efficiency to the level necessary for the southern highbush blueberry industry to remain sustainable in the long term; it is only through integration of these advances (in breeding and genetics, horticulture, biological engineering, plant pathology, entomology, postharvest physiology, and food science) via a systems approach that mechanical harvest capability and the crucial leap in production efficiency can be achieved. This requires a careful re-evaluation of the entire production chain from biological, engineering, and economic perspectives. In addition, comprehensive efforts in outreach and technology transfer are needed to ensure that the new knowledge and technologies developed will be put into practice. Thus, the final, cross-cutting goal of our grant project is to conduct economic assessments and engage in outreach and technology transfer with growers, packers/ shippers, consumers, and other stakeholders.

**A team approach**

The SCRI research and extension team is being led by Harald Scherm, professor of Plant Pathology at UGA in Athens. UGA co-investigators include Gerard Krewer, Dan MacLean, and Anish Malladi (Horticulture); Phillip Brannen (Plant Pathology); Robert Shewfelt (Food Science & Technology); and Changying Li (Biological & Agricultural Engineering). The team further includes scientists from the University of Florida (Phillip Harmon, Paul Lyrene, Donald Hopkins, and Moukaram Tertuliano), North Carolina State University (William Cline and James Ballington), Mississippi State University (Kimberly Morgan), and the USDA-ARS Appalachian Fruit Research Station (Fumiomi Takeda). We will also be working closely with the county agents in the blueberry district.

**The blueberry industry is stepping up to the plate**

The SCRI grants program has a significant matching requirement, whereby each federal dollar awarded needs to be matched 1:1 with non-federal funds. The southeastern blueberry industry has been instrumental in helping to meet this matching requirement through cost-sharing and/or in-kind contributions and support letters. Listed in alphabetical order, the following farms, companies, groups, or associations provided key support during development of the proposal: Alma-Pak, Alma, GA; Bacon County Cooperative Extension Service and Bacon County Commission, Alma, GA; Florida Blueberry Growers’ Association, Gainesville, FL; Georgia Blueberry Growers Association, Alma, GA; Georgia Fruit and Vegetable Growers Association, LaGrange, GA;
Jamestown Blueberries, Homerville, GA; Juliana Plantation, Auburndale, FL; MBG Marketing, Grand Junction, MI; Mixon Family Farm, Haynes City, FL; North American Blueberry Council, Folsom, CA; North Carolina Blueberry Council, White Lake, NC; Oxbo International, Lyndon, WA; Southern Plant Diagnostic Center, Gainesville, FL; Southern Region Small Fruit Consortium, Raleigh, NC; Straughn Farms, Waldo, FL; and SunnyRidge, Winter Haven, FL. Additional and significant in-kind contributions have been provided by the four universities participating in the project.

We look forward to working with individual farms, county extension agents, marketing and shipping organizations, equipment manufacturers, and the blueberry industry as a whole to accomplish the grant objectives over the next 4 years. In the meantime, any feedback and suggestions from the industry would be greatly appreciated. You can contact us via your county agent or directly at (706) 542-1258 (Harald Scherm, scherm@uga.edu) or (229) 392-1388 (Gerard Krewer, gkrewer@uga.edu).

Literature cited


