Texas AgriLife researchers working to develop heartier, better-adapted crops

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Dr. Daniel Leskovar, a Texas AgriLife Research plant physiologist at the Texas AgriLife Research and Extension Center in Uvalde, has been investigating ways to help vegetable plants make a less stressful transition from the greenhouse to the field.

"This research can aid in the successful production and possibly even the further profitability of some vegetable crops by producing high-quality, more adaptive plants that will establish well," Leskovar said. "It could also enable some vegetable plants to produce beyond their regular season or succeed within a stressful growing environment."

An expert in vegetable physiology, Leskovar said his research has been "centered in the identification and understanding of plant adaptation mechanisms to temperature, water and biological stresses as part of an integrated vegetable cropping system." He and his collaborators already have been successful in creating heartier pepper, tomato, watermelon and cantaloupe seedlings for transplantation.

Leskovar has been joined in his research efforts by other AgriLife Research personnel, including researchers from the Texas AgriLife Research and Extension Centers in Weslaco and Amarillo, and a researcher from the Institute for Adriatic Crops in Croatia.

"Our work has primarily involved modulating naturally occurring growth regulators in vegetable plants," Leskovar said. "One of these is abscisic acid, or ABA, which is a hormone naturally produced by the plant.

"Abscisic acid affects the closing of plant stomates and controls plant physiology such as leaf transpiration," he said. "The hormone also slows plant growth temporarily, which is important for producing compact transplants in commercial nurseries."

In many southern regions of the U.S, high temperatures, dry winds and rapidly drying soil after planting are detrimental to or impair the early growth of vegetable transplants, Leskovar said.

"Results of our previous research suggested abscisic acid was an effective tool to modulate transplant shoot growth and enhance drought-stress tolerance of several vegetable species," he said. "Now our research is being targeted toward foliar spray application to control growth of mature vegetable transplants in the greenhouse."

Leskovar noted vegetable plants often suffer transplant shock because of an imbalance between water loss through transpiration and water absorption through the roots, typically causing plant wilting. He added that windy conditions or high temperatures can accelerate water loss.

"Abscisic acid closes the stomates and reduces water loss through transpiration, preventing further moisture loss in times of low water availability," he said.

Research efforts to date have shown that external application of abscisic acid to cabbage, watermelon and pepper transplants had reduced undesirable excess shoot growth during plant development in the greenhouse environment, Leskovar said. They also show that its application on pepper, tomato and artichoke seedlings was superior to that of other commercial "film-forming antitranspirants" in improving overall plant water status.

"Practices that reduce plant transpiration have the potential to enhance stand establishment, thus conserving soil moisture and reducing irrigation frequency," Leskovar explained. "Abscisic acid appears to be useful for conditioning vegetable seedlings to withstand temporary stress from water deficiency and to improve stand development under stressful field conditions."

He said vegetable transplants quickly recovered their water potential, stomatal efficiency and photosynthetic rates, and resumed their growth after a short period of water stress in response to the external application of the hormone.

Leskovar added that the work he and his fellow researchers have been doing has been supported through the interest of the industry and cooperation with commercial greenhouses in the Rio Grande Valley and Florida.

"Another aspect of our current research is investigating the application of gibberellic acid, or GA, to artichoke plants so they can produce in Texas, especially in the late fall," he said. "Gibberellic acid is a hormone which stimulates growth and is found naturally in plants, including artichoke and other vegetable species."

For the past several years, Leskovar has been investigating the viability of growing artichokes as an alternative crop in parts of Texas. He and South Central Texas producers, including some in the state's Winter Garden area, have been growing and assessing several varieties of green and red artichokes.

Artichokes are normally planted in late fall, so earlier planting can be a hit-or-miss proposition for Texas, especially South and Central Texas, because the plants require successive days of low temperatures to trigger bolting and produce the edible head, Leskovar explained.

"We can mimic the effects of cold weather on the plant by introducing gibberellic acid as a natural treatment that will fulfill the plant's requirement for bolting during warmer-than-needed temperatures," he said.

Leskovar noted that gibberellic acid is applied during commercial artichoke production in other parts of the world, particularly during the summer months.

"We're using natural compounds that are part of existing plant physiology to improve vegetables and make them less susceptible to different stress factors," he said. "The process isn't new, but there's still a lot to learn about the response mechanisms in plants, the best way and amounts to apply, and what effect these will have on a variety of vegetables during different stages of development."

Leskovar said the research will be useful as part of an integrated cropping system strategy for developing more stress-tolerant vegetable plants which can be grown not only in Texas, but also other southern states with similar environmental and climatic challenges.

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