

IMPACT

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IMPACT is a series of publications highlighting how UC Davis' College of Agricultural and Environmental Sciences makes a difference in the lives of Californians. Through research, teaching, and outreach programs, UC Davis research touches almost all aspects of Californian life. Today, millions of people eat safer foods, breathe cleaner air, and drink healthier water with the help of our researchers. We're making discovery work – for California and the world.

IMPROVING PLANT BREEDING

THE ISSUE

Advances in molecular breeding techniques have revolutionized crop science, allowing plant breeders to develop better commodities to feed, shelter, and clothe the world such as more nutritious wheat, tastier produce, and new sources of energy. However, there is a huge global need for plant breeders with the full spectrum of training—from lab to field—to bring new varieties to fruition.

Industry, government, and philanthropic leaders say the shortage of plant breeders is hampering efforts to alleviate global hunger. Hundreds of high-paying jobs for breeders go unfilled.

WHAT WE'RE DOING

Since its inception, UC Davis has helped develop many of the more than 250 commodities grown in California. The impact of UC Davis crop science is found on farms and nurseries throughout the state. For example, virtually all walnut varieties sold in California nurseries are UC Davis varieties. And decades of exemplary plant breeding science have given California strawberry farmers a 12-month growing season compared to a few months or weeks in other regions. California strawberry growers provide more than 87 percent of the strawberries consumed in North America.

UC Davis continues to support breeding programs for grapes, peaches, strawberries, almonds, walnuts,



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prunes, peppers, beans, lettuce, tomatoes, rice, and wheat, but in different ways than before. With some crops, researchers no longer develop and release new varieties into the public domain. Rather, they focus on the molecular and biological side of the breeding spectrum, identifying genes likely to control important traits and releasing the corresponding germplasm for use by industry and others to develop new varieties.

“Our plant breeding programs are science driven,” said Neal Van Alfen, dean of the College of Agricultural and Environmental Sciences.

Two professors in the Department of Plant Sciences recently received \$40 million in U.S. Department of Agriculture grants to develop climate-change-tolerant plants and new bioenergy sources. Geneticists Jorge

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Dubcovsky and David Neale are leading research teams from more than 50 U.S. universities.

Dubcovsky's team is identifying variations in wheat and barley genes that can enhance the ability of the plants to resist disease, make efficient use of water and nitrogen, and optimize crop yield. Neale's team is sequencing the genomes of loblolly pine, sugar pine, and Douglas fir, hoping to accelerate breeding efforts for fast-growing varieties of these trees—enhancing their use as feedstocks for biofuels and mitigating the effects of climate change.

As researchers and funding agencies focus on understanding the molecular, cellular, and genetic underpinnings of plant life, attention to the more applied aspects of plant breeding has diminished at most universities including UC Davis. But that's changing. UC Davis is retooling its programs—offering new training, creating new curriculum, hiring new faculty, and conducting world-class research to meet a growing demand for new crops and breeders.

“That's excellent because UC Davis is in a perfect position to educate plant breeders,” said Xingping Zhang, a watermelon breeder with the local seed company Syngenta. “UC Davis is a great center of science and technological inventions, located right in the heart of agricultural abundance.”

Student enrollment is increasing in new majors that focus on the full spectrum of plant breeding which should deliver more breeders to the job market. In the meantime, the Seed Biotechnology Center (SBC) at UC Davis is helping fill the gap by

training professionals through its Plant Breeding Academy, which is a thriving resource for trained plant breeders worldwide. Now offered in Europe, as well, the academy is modeled on professional M.B.A. programs that allow participants to continue in their current jobs while getting advanced training.

“Most of our students are working in the field, doing plant breeding, but they don't yet have the training to set up their own programs and trials,” said Allen Van Deynze, professional researcher with the SBC. “In the academy, they develop a deeper knowledge of genetics, statistics, and breeding theory so they can direct their own breeding programs.”

Also, Van Deynze is leading a hands-on program with the UC Davis Student Farm geared to educate 300 undergraduates and 1,500 primary-school students on the use of genetic diversity in plant breeding. The center also offers courses on seed biology, production, quality, and breeding with molecular markers.

A SHARED VISION

Over the past century, UC Davis has honored its mandate as a land-grant university—to provide quality higher education and address the needs of society—in part by educating plant breeders and developing improved varieties to keep agriculture productive and strong. That work continues as UC Davis builds diverse plant breeding programs to meet a growing demand.

That's impact—educating plant breeders to meet global need.

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