Building a bridge from basic botany to applied agriculture

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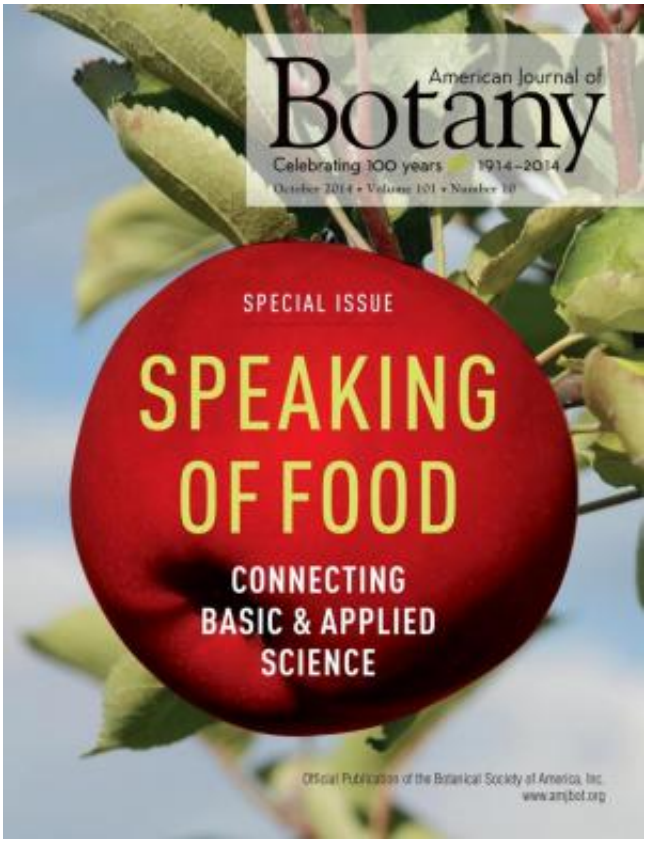

This special issue of the *American Journal of Botany*, "Speaking of Food: Connecting Basic and Applied Plant Science," emphasizes how a broad range of basic plant science is relevant to global food demands. Credit: Gayle M. Volk. Cover design: Adrianna Sutton.

One of the planet's leading questions is how to produce enough food to

feed the world in an increasingly variable climate. The Food and Agriculture Organization of the United Nations predicts that food production must rise 70% over the next 40 years to feed a growing global population, and plants are one major component of the necessary rise in food production. Plants—grains, cereals, fruits, vegetables, and more—feed humans directly and indirectly by supporting livestock. Current research must tap into our knowledge of how plants work to develop more efficient and higher yielding agricultural systems that produce more food using fewer resources and with reduced environmental impacts.

The solutions to feeding the world are certainly multi-faceted, requiring knowledge from a diversity of fields and practices to successfully raise food production and maintain ecosystem security. Thus, three prominent scientists are highlighting the importance of basic plant science and its relevance for pressing global issues like applied agriculture. A special issue of the *American Journal of Botany*—co-edited by Allison Miller, Associate Professor of Biology at Saint Louis University; Elizabeth Kellogg, Member and Principal Investigator at the Danforth Plant Science Center and former president of the Botanical Society of America; and Briana Gross, Assistant Professor of Biology at the University of Minnesota Duluth—emphasizes how a broad range of basic plant science is relevant to global food demands.

Traditionally, basic plant research is motivated by curiosity to understand fundamental biological phenomena, while applied research is mainly motivated by practical applications. With that said, basic research discoveries often extend beyond their original intention. "The more we know about how plants work, how they evolve, the genes underlying adaptive variation, and many other topics," says Miller, "the better our capacity to develop sustainable agriculture, and to understand the impacts of agriculture on natural plant diversity."

The special issue contains articles from a range of research fields to call attention to the diversity of studies that bridge basic plant science and applied agricultural research. Research fields in the issue include plant ecology, evolution, phylogenetics, quantitative genetics, and economic botany. Conserving crop germplasm is addressed in articles that tackle the geographical and historical origins of crop plants. Controlling agricultural weeds is addressed in articles on plant population genetics. Crop fertility and diversity is addressed in articles on basic pollination biology and floral evolution. "Knowledge about one plant," comments Kellogg, "so often informs the study of other plants, whether they are cultivated or not."

In all fields of science, groundbreaking research studies are conducted using non-target organisms. In human health, for example, research on understanding and treating diseases is often done with non-human systems such as fruit flies, round worms, mice, and yeast. Plants are no exception. Basic research on non-crop wild plants provides tools for cultivated plant production. Kellogg explains, "A lot of the basic molecular and cellular work goes much faster in model systems, and if we understand the molecular and cellular details of how model and wild plants deal with drought, or heat, or pathogens, and how they keep producing seeds even in the face of such stresses, we can figure out how to keep crops producing amidst global changes."

Miller points out, "There are more than 300,000 species of plants on the planet that have evolved and diversified into a breathtaking array of forms. Understanding these forms has the potential to shed new light on what we know about how plants survive and thrive in a range of environments and under a host of different selection pressures." Miller and colleagues hope to inspire botanists to reexamine their work in the broader context of basic plant biology and relevancy to plant-related global issues like agricultural practices, plant and soil conservation, and biotechnology. A good way to start is by encouraging scientists to

bookend publications with statements about how the knowledge of their study system might apply to sustainable agriculture.

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