Editors' Note: This is the last in a seven-part series on Extension, teaching and research programs being performed at Purdue University in West Lafayette, Ind.

Purdue and the Global Greenhouse

EXTENSION RESEARCH DOESN'T STOP AT OUR NATION'S BORDER.

By Christopher J. Currey and Roberto G. Lopez

As this series of articles featuring the ornamental production team at Purdue University has hopefully underscored, it is the influence of the industry and, therefore, Extension that drives much of our research program. Whether producers are local, regional or national, our goal is to conduct research to generate information that serves our stakeholders regardless of their location. However, Extension doesn't stop at our nation's border — especially in a worldwide industry such as greenhouse and floriculture crop production. It is important to maintain global context, connections and understanding of the industry.

Ornamental horticulture is a truly global industry. From the importation of unrooted cuttings and cut flowers, to the exportation of production technologies, an international perspective helps keep Purdue's research, teaching, and Extension activities in-step with the rest of the global greenhouse. This being the final article in the series on ornamental horticulture at Purdue University, we wanted to broaden our scope and highlight some of our international activities relating to ornamental greenhouse crop production.

Figure 1. *(From left to right) Dr. Brian Krug, Dr. Roberto Lopez, Chris Currey and Syngenta employees.*

Central American Stock Plant Facilities

A significant portion of our research at Purdue is focused on cutting propagation. While growers in North America receive boxes filled with bags containing unrooted

stem-tip cuttings just in time to produce their crop, the stock plant facilities that produce, package and ship the cuttings are an important, but often forgotten, part of the supply chain. One of our current main research thrusts is to evaluate the effects of daily light integral on propagation of cuttings. While most of this research focuses on the production period from when growers receive the cuttings through finishing, the production of cuttings is the first step. Therefore, we thought an international Extension trip to visit major stock plant facilities would enhance our understanding of the entire vegetative propagation cycle and enhance our research activities, while hopefully sharing some useful information with the producers.

In January, Drs. Brian Krug from the University of New Hampshire and Brian Whipker of North Carolina State University joined us on an intense week-long junket through Central America (Figure 1). This trip was made possible with the generous support of the D. Thomas Woods Scholarship from the Office of International Agriculture at Purdue and the John K. Rathmell Scholarship for horticultural study abroad from the American Floral Endowment. The goal of these programs is to provide support to graduate students to enrich their education and research with international perspectives; in this case, they have clearly succeeded!

Our trip started in Costa Rica, where we visited Ball Linda Vista and Innova Plant. Next, we headed north to El Salvador to visit the Las Mercedes facility Dümmen recently built in El Salvador. Finally, we completed our tour in Guatemala, visiting Syngenta and Ecke. All of our hosts were extremely gracious and welcomed us (and our curiosity!) into their facilities. After visiting all of these facilities, seeing how each operation managed to deliver a seemingly "similar" product (high-quality unrooted cuttings) using very different approaches to production, harvest and post-harvest was interesting. For instance, we observed stock plants grown in containers filled with a traditional soilless substrate or crushed volcanic rock, as well as plants grown directly in the ground (Figure 2). Additionally, the variation in packaging and cold-chain management from

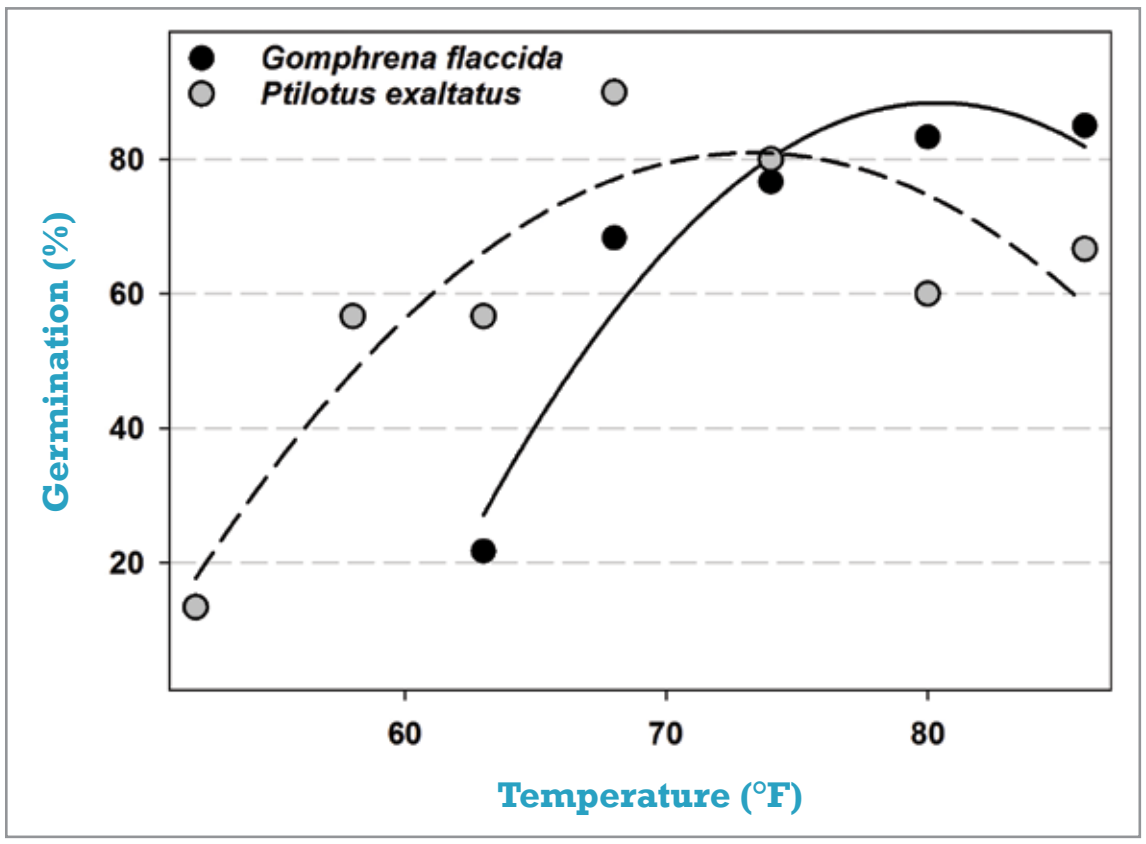

Figure 2 (above). *Various growing substrates and plantings for stock plant production. Stock plant facilities varied from traditional peat-based substrate in a rigid plastic container, to lava rock in a small tub to in-ground production.*
Figure 3 (left). *Cumulative germination and germination rate for pink mulla-mulla (*Ptilotus exaltatus*) and gomphrena weed (*Gomphrena flaccida*) over a variety of substrate temperatures. Species varied in the optimal temperature for maximum germination and germination rate.*

harvesting cuttings to shipping out orders varied widely across producers. From vacuum to forced-air cooling, minimizing cutting stress and desiccation is the common goal of cutting producers.

Although there was variation in the production and postharvest handling cuttings, sanitation practices were one aspect that appeared similar across locations. Although the specific design of sanitation stations at the greenhouse entrance may have varied by design and product(s) used, the procedure was generally the same. Similarly, the instruments used to harvest cuttings (i.e., razor blades, sheers, etc.) were regularly sanitized, sterilized and/or replaced frequently to minimize transmitting pathogens.

Australia's Center for Native Floriculture

This past summer, our lab had the opportunity to collaborate on an international research project with Drs. Margaret Johnston and Dion Harrison of the Centre for Native Floriculture at the University of Queensland in Gatton, Australia. The research was supported by an Early Career Researcher grant awarded to six Ph.D. students or post-doctoral researchers at Purdue University to conduct research with a research group at the University of Queensland and the research was supported by both universities. Additional support was received in the form of the John K. Rathmell Scholarship for graduate student floriculture research abroad, awarded by the American Floral Endowment.

The Centre for Native Floriculture is a joint initiative of The University of Queensland and the Queensland State Government focusing on Australia's native plants and their development for use in the cut-flower, foliage, potted color, and bedding plant markets. Research at the Centre focuses on breeding, propagation, production, post-harvest, and marketing native Australian plant species with potential as floriculture crops.

The goal of our recent research was to gain a better understanding of the effect of temperature on seed germination of several Australian species, most notably gomphrena weed (*Gomphrena flaccida*) and pink mulla mulla (*Ptilotus exaltatus*). These species have the potential to be used as potted plants or as bedding annuals. However, efficient and economical production of these crops in a commercial environment necessitates effective production of young plants such as plugs or liners. Both species have hairy stems and leaves and do not readily propagate vegetatively by cuttings, necessitating the use of seed for commercial production.

We germinated seed of pink mulla-mulla and gomphrena weed, as well as two additional mulla (Ptilotus) species, at temperatures ranging from 47 to 86° F to identify optimal temperatures for germination. In order to comprehensively assess the effect of temperature on germination, we looked at several factors including cumulative germination, time to median germination, and germination rate. The species differed in regards to what temperature or temperature range appeared to optimize germination (Figure 3). While pink mulla mulla appeared to have poor performance at temperatures exceeding 68 to 79° F, gomphrena weed germination seemed best at the highest temperatures. Therefore,

producers will need to provide different temperatures for germination through the use of bottom heat or germination chambers to maximize the number of germinated seedlings and speed of germination.

Conclusions

The research conducted at Purdue is intended to benefit not only our local and regional greenhouse floriculture and ornamental industry, but also those around the world. Although we are still focused on the challenges growers in the Midwest and across the United States, it is important to stay connected with what is happening around the globe.

Additionally, much of the support for this research and travel was received through grants and scholarships targeting graduate student experiences. It cannot be understated how valuable this support is for providing experiences that will surely contribute to maintaining and increasing the caliber of our future floriculturists.

Christopher J. Currey is a graduate research assistant and Roberto G. Lopez is an associate professor and floriculture extension speciality at Purdue University. They can be reached at ccurrey@purdue.edu and rglopez@purdue.edu.

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