



Horticultural Reviews

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Dedication: Gregory L. Reighard



This volume of *Horticultural Reviews* is dedicated to Dr Gregory L. Reighard, Professor Emeritus at Clemson University, for his contributions to horticulture and horticultural research, especially in areas relating to fruit production.

Dr Reighard was born in Johnstown, Pennsylvania, in the midst of a rural coal-mining area. He lived next to his grandparents who had a small mountain farm near South Fork, Pennsylvania, where he helped with farm chores and developed an interest in growing fruits and vegetables. He also spent a lot of time in the mountain forests hunting and foraging, so he developed a love for trees. He was the first in his wider family to go to college and attended Pennsylvania State University, attaining his B.S. in Forestry in 1977. He completed his M.S. in Biology at the University of Michigan in 1978, and a Ph.D. in Forestry at Michigan State University in 1984. After working in forest management in Montana and Florida, he decided that he did not want to “harvest” trees as his legacy, but instead nurture and improve them for what fruits or nuts they could provide. After graduation and working at the University of Florida as a research associate, he applied and interviewed for a tree fruit (pomology) position in the Department of Horticulture at Clemson, where he subsequently spent his entire professional career as a faculty member in the College of Agriculture, Forestry and Life Sciences, with research, extension, and teaching appointments. In 2017, he served as Interim Chair of the Department of Plant and Environmental Sciences. At this institution, he has demonstrated excellence in scholarship, and dedication to the discipline of pomology and to the commercial tree fruit industry.

Dr Vance Baird, Chair of the Department of Horticulture at Michigan State University, has observed that “you know someone has been well-educated and possesses adaptable

insight when he can take two degrees in Forestry and one in Biology and translate that into one of the most successful careers in tree fruit physiology and germplasm improvement - and developed a career that has evolved with the state-of-the-science and with commercial production needs.”

Dr Reighard's accomplishments in pomology are impressive, especially as they span the range from applied, field-based work to the fundamentals of molecular biology. His research interests include the study of physiological phenomena of genetically compound fruit trees in terms of effects of rootstocks, interstems, and cultural practices on vegetative growth, fruiting, frost protection, nutrition, disease resistance, and cold injury. Additional research has involved developing new rootstocks that are resistant to nematodes, determining how interstems and growth hormones affect root growth and scion phenology, developing flower bud thinning techniques, and finding molecular markers for traits such as nematode resistance and dormancy control for use in applied breeding programs.

One of his greatest accomplishments came about through his commitment to the performance evaluation and genetic analysis of rootstocks that could provide tolerance to the peach tree short life (PTSL) disease complex. His insight and perseverance, and his collaboration with colleagues at the USDA, resulted in the identification, selection, development, and commercialization of the Guardian® peach rootstock, which provided the industry with a rootstock choice that protected trees from PTSL. This was an outstanding contribution at a critical time when the industry was losing traditional chemical control options. It allowed the peach industry in the southeastern United States to thrive by improving the long-term sustainability and profitability of many farms. Today, at least 90% of all

commercial peaches newly planted in the southeastern United States are planted on Guardian® rootstock. Furthermore, Guardian® rootstock is having a similarly positive impact on peach production in other major stone fruit-producing areas around the world, including California, South Africa, and Australia.

Chalmers R. Carr III, President and CEO of Titan Farms, a 2000 ha peach operation, states, “The southern peach industry, most especially the South Carolina peach industry, second only to California in peach production, was truly headed toward extinction due to PTSL disease. Research by Dr Reighard and colleagues that was dedicated to developing and releasing the Guardian® rootstock not only stopped the dwindling spiral of peach production in the southeast but has allowed the industry to thrive and flourish.”

Other than the development of Guardian®, Dr Reighard's program has also been very successful in achieving an improved understanding of crop load management, harvest modeling, tree habit, bud dormancy, and structural and comparative genomics, not just in peach but also in other important fruit crops such as apple, apricot, pear, and plum. His enthusiasm to collect and evaluate various germplasm for its potential to serve as *Prunus* rootstocks was very fortunate, as the stone fruit industry in the United States is facing yet another extinction-threatening soil pathogen, *Armillaria* spp. Germplasm he collected and maintained at Clemson University is showing tolerance, and it is already being evaluated for its rootstock potential (www.nc140.org) and used in breeding efforts to combat this replant disease.

His research program quickly incorporated the newly emerging prospects made available from molecular plant genetics, an emerging science in the 1980s. Working

closely with Dr Bert Abbott, his graduate students and postdoctoral colleagues were some of the first to find genes for nematode resistance in *Prunus* and the **evg** mutant that was important in identifying the MAD Box genes that control shoot growth and bud dormancy in peach. In addition, the first sequenced peach genome was from a double haploid tree that he had planted at the university research farm.

His extension emphasis is fueled by his passion for growers' success and is based on disseminating current information on orchard management systems for peaches and apples, communicating the relevance of his research findings to commercial growers, and establishing cultivar trials to promote alternative fruit crops for fruit grower diversification. His trials are extensive, often located on commercial properties to achieve the scale necessary for grower acceptance and for their adoption of the findings from that research.

Although teaching and advising have been a small part of his appointment, he has advised 17 M.S. and Ph.D. students to completion. Furthermore, more than 120 undergraduate students have been involved in the projects within his research program. Dr Reighard has also hosted 13 visiting postdoctoral scholars and scientists on sabbatical leave from the United States, China, Turkey, Spain, France, Ukraine, South Africa, and Brazil.

Dr Reighard has an extensive list of over 170 peer-reviewed research publications, and nearly 200 additional outputs in the form of conference proceedings and book chapters, including two chapters in the major text *The Peach: Botany, Production and Uses*, one in *Almonds: Botany, Production and Uses*, and one in a Fruit Breeding series. He has given more than 500 presentations, including 170 invited presentations.

Greg has been highly active within the International Society for Horticultural Science for many years. He has published over 90 papers in *Acta Horticulturae*, served as an editor or on the editorial board for six symposia, served on the scientific committee for seven symposia, and was the convenor for one other symposium.

Dr Reighard has served on many committees in regional, national, and international symposia. He serves as the Peach Rootstock Coordinator for the SAES-422 Multistate Project NC-140, "Improving Economic and Environmental Sustainability in Tree-Fruit Production through Changes in Rootstock Use"; is an honorary member of the Romanian Faculty Academic Council; and has been a reviewer for more than 20 different scientific journals.

Dr Reighard has been recognized numerous times throughout his career with professional awards, including the Wilder Medal by the American Pomological Society for his work in peach tree genetics and culture (2018), his election as a Fellow of the American Society for Horticultural Science (2014), the International Fruit Tree Association Fruit Researcher Award (2012), the American Pomological Society Shepard Award for the best scientific paper published in the Society's journal (in 2017, 2010, and 2004), the American Society for Horticultural Science - Southern Region Julian C. Miller Sr. Distinguished Research Award (2008), and the Godley-Snell Award for Excellence in Agricultural Research (2008).

In regard to his extension appointment, he has prepared and published numerous extension and outreach publications, including handbooks, trade journals, magazines, newsletters, and popular press articles. Other than this, he has also organized and hosted many field days and demonstration tours for fruit tree growers.

His industry-related achievements have been recognized with a number of awards, including the South Carolina Peach Council's "Mr. Peach" Award (2017), the Experiment Station Section Excellence in Multistate Research Award (2015), the Clemson University CAFLS Superior Service Award (2014), the National Peach Council Career Achievement Award (2013), the National Peach Council Carroll R. Miller Award (2002), and the Clemson University Board of Trustees Award for Faculty Excellence (in 2001, 2005, 2007, 2008, and 2011).

Greg is married to Angie (1980), and they have two children: Chelsea Reighard, M.D. (Ophthalmology), and Shane Reighard, M.D. (Cardiology).

In summary, Dr Greg Reighard's professional career is one of exemplary and sustained dedication to tree fruit improvement, which has resulted in high-quality scholarship for the discipline of horticulture, and relevant and impactful deliverables for the industry - domestically and abroad.

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1

Pollination-Induced Changes in the Morphology and Physiology of *Dendrobium* Orchid Flowers Prior to Fertilization: The Roles of Ethylene and Auxin

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ABSTRACT

Pollination in *Dendrobium*, as in several other orchids, induces rapid growth in the width of both the ovary and the column (the organ containing the pollinia and the stigma). The visible effects of that growth do not occur when non-pollinated flowers are exposed to ethylene or after application of the ethylene precursor 1-aminocyclopropane-1-carboxylic acid (ACC) to the stigma of non-pollinated flowers. However, growth of the ovary and column of pollinated flowers is inhibited by the ethylene antagonist 1-methylcyclopropene (1-MCP) and the ethylene synthesis inhibitor aminooxyacetic acid (AOA). The effects on growth, including column and ovary growth, were similar following the application of an auxin such as 1-naphthylacetic acid (NAA) to the stigma, while studies with ethylene inhibitors showed that NAA acted through ethylene. The known presence in the pollinia of ACC and an auxin-like compound apparently explains the initial growth of the column and ovary in response to pollination.

KEYWORDS: 1-MCP; ACC; auxin; antiauxin; ethylene; ethylene antagonist; ovary growth; column growth; pollen tube; pollinia;

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LITERATURE CITED

I. INTRODUCTION

Pollination can induce rapid changes in flower form and color, as well as early flower senescence. Most of these changes also occur, although later, in unpollinated flowers. These early effects of pollination have been reported in many plant families, but are quite common in the Orchidaceae, where they usually occur before fertilization. With many orchids, therefore, it is possible to distinguish between the effects of fertilization and those of pollination. Hildebrand ([1863a,b,c](#)) and Fitting ([1909](#)) noted that the post-pollination effects in orchids depended on the species.