

HORTICULTURE TODAY

Jodi Songer Riedel ♦ Elizabeth Driscoll

SECOND EDITION



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Preface

Horticulture Today was designed to meet the need for a comprehensive, thoroughly modern, and visually exciting introduction to the study of horticulture. The authors of *Horticulture Today* set out to provide learners with a breadth of horticultural knowledge while also creating awareness of green industry careers and workplace skills needed to be successful in today's green industry. To help readers achieve these goals, the authors have incorporated SAE for ALL Profiles, supplemental activities, such as interactive sidebars, Historical and STEM Connections, and Career Connections throughout the text.

The organization and content coverage of *Horticulture Today* was developed with valuable insight from a panel of expert reviewers and with the National Agriculture, Food, and Natural Resources Standards at the forefront. The textbook content also correlates to various state standards and to exam standards for Career Skills Certification™ by Precision Exams by YouScience. *Horticulture Today* is presented in 33 chapters with six logical sections to help readers develop a fundamental knowledge of plant science and build on this knowledge with ensuing topics.

The initial chapters concentrate on building leadership, communication, and business skills that can be used in both school and work environments. Chapters one and two are focused on FFA and SAE support fundamentals in leadership skills and experiential learning. Additionally, chapter three seeks to help students develop communication and critical thinking skills needed to compete in today's green industry. Chapter five focuses on horticulture business management and continues to build student professionalism, preparing them for future employment.

The second group of chapters focuses on horticultural biology. Chapter seven is dedicated to taxonomy, and chapters eight through ten cover basic biology as well as plant growth and development. Readers will develop an understanding of basic plant biology as well as how environmental controls can be used to manipulate plant growth. Plant nutrition and soils and media are discussed in chapters eleven and twelve. This highly illustrated section includes extensive coverage of deficiencies, as well as sustainable practices, building soil health, and stewardship. The third group of chapters is dedicated to plant propagation—ranging from traditional to modern micropropagation techniques.

The fourth section encompasses a myriad of horticultural practices, including greenhouse operations to field cultivation of fruits, vegetables, and ornamental plants. Readers will gain an understanding of practices ranging from traditional methods to modern-day hydroponics. The fifth section covers design practices in the landscaping, floriculture, and turfgrass industries. Hands-on, step-by-step instructions, installation procedures, and management practices are also included. The final section provides detailed coverage of integrated pest management (IPM). Individual chapters cover IPM, insects, diseases, weeds, and pesticide safety and management.

We hope you enjoy our presentation of horticulture for our modern society and continue to learn and grow as you pursue a career in the green industry or hone your skills as a home gardener.

About the Authors

Jodi Songer Riedel

Ms. Riedel has 20 years of teaching experience in agricultural education. She has instructed and created curriculum for courses in horticulture, sustainable agriculture, forestry, and environmental and natural resources. Ms. Riedel has also instructed many student teachers and has keenly observed and learned what young teachers, especially those with limited horticultural knowledge, need to successfully instruct agricultural education courses.

In her Wakefield High School classroom, Ms. Riedel employs learning by doing. With Ms. Riedel's instruction, students:

- Have designed and installed prize-winning gardens at the state fair.
- Maintain ornamental landscapes and edible landscapes on school grounds.
- Facilitate a "Garden Army" uniting elementary, middle, and high school students to explore horticulture all year.
- Raise plants for year-round sales through their School-based Enterprise SAEs.

Ms. Riedel also organizes and supervises urban service-learning projects and Supervised Agricultural Experiences (SAEs) in Raleigh, North Carolina. Ms. Riedel funds and sustains her inspirational program and its efforts each year through grants and annual plant sales, cultivated by students. Ms. Riedel's dedication and enthusiasm earned her a Career Science Math and Technology Award through Burroughs Wellcome in 2015, which included a \$175,000 grant.

Elizabeth Driscoll

Ms. Driscoll holds the position of 4-H Subject-Matter Specialist across the departments of Crop and Soil Sciences, Entomology and Plant Pathology, and Horticultural Science and Soil at North Carolina State University with the North Carolina Cooperative Extension. She has been working to connect youth and educators to issues in agriculture and natural resources in relevant and



Jodi Songer Riedel and Elizabeth Driscoll, photo courtesy of Reno Palombit

meaningful ways for over 18 years. Ms. Driscoll's 4-H "Grow For It" program focuses on developing resources and experiential projects that foster curious and wondering youth, inspire critical thinking and problem solving, build a positive science self-concept, connect kids to good food, and nurture environmental stewards of the land through gardening and agriculture.

With a BS and an MS in horticultural science from Michigan State University, she actively translates agricultural research from the land-grant universities into hands-on, inquiry-based curricular resources to support county-based 4-H youth programs. Serving over 350 Cooperative Extension county field faculty in agriculture, horticulture, 4-H, and family and consumer sciences, Ms. Driscoll uses a strong train-the-trainer approach to broadly and deeply engage audiences in their own innovative delivery of agricultural programs to youth. She leads multiple precollege programs for youth, including the Horticultural Science Summer Institute and the Resource Conservation Workshop, as well as other youth leadership programs. Additionally, Ms. Driscoll works with colleagues in the North Carolina Cooperative Extension and many local partners to connect kids to healthy food in schools through school gardens, garden-enhanced food and nutrition education, and access to local food through farm-to-cafeteria projects.

Reviewers

The author and publisher wish to thank the following industry and teaching professionals for their valuable input into the development of *Horticulture Today*.

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SAMPLE



TOOLS FOR STUDENT AND INSTRUCTOR SUCCESS

Student Tools

Student Text

The *Horticulture Today* textbook provides an exciting, full-color, and highly illustrated learning resource. The textbook is available in a print or online version.

Lab Workbook

The lab workbook that accompanies *Horticulture Today* provides hands-on practice with questions and lab activities. Each chapter corresponds to the text chapters and reinforces key concepts and applied knowledge.

Online Learning Suite

The Online Learning Suite provides the foundation of instruction and learning for digital and blended classrooms. An easy-to-manage shared classroom subscription makes it a hassle-free solution for both students and instructors. An online student text and lab workbook, along with rich supplemental content, brings digital learning to the classroom. All instructional materials are found on a convenient online bookshelf and accessible at home, at school, or on the go.

Online Learning Suite/ Student Text Bundle

Are you looking for a blended solution? Goodheart-Willcox offers the Online Learning Suite bundled with the printed text in one easy-to-access package. Students have the flexibility to use the printed text, the Online Learning Suite, or a combination of both components to meet their individual learning styles. The convenient packaging makes managing and accessing content easy and efficient.

Instructor Tools

LMS Integration

Integrate Goodheart-Willcox content within your Learning Management System for a seamless user experience for both you and your students. LMS-ready content in Common Cartridge® format facilitates single sign-on integration and gives you control of student enrollment and data. With a Common Cartridge integration, you can access the LMS features and tools you are accustomed to using and G-W course resources in one convenient location—your LMS.

To provide a complete learning package for you and your students, G-W Common Cartridge includes the Online Learning Suite and Online Instructor Resources. When you incorporate G-W content into your courses via Common Cartridge, you have the flexibility to customize and structure the content to meet the educational needs of your students. You may also choose to add your own content to the course.

QTI® question banks are available within the Online Instructor Resources for import into your LMS. These prebuilt assessments help you measure student knowledge and track results in your LMS gradebook. Questions and tests can be customized to meet your assessment needs.



Online Instructor Resources (OIR)

Online Instructor Resources (OIR) provide all the support needed to make preparation and classroom instruction easier than ever. Available in one accessible location, the OIR includes Instructor Resources, Instructor's Presentations for PowerPoint®, and Assessment Software with Question Banks. The OIR is available as a subscription and can be accessed at school, at home, or on the go.

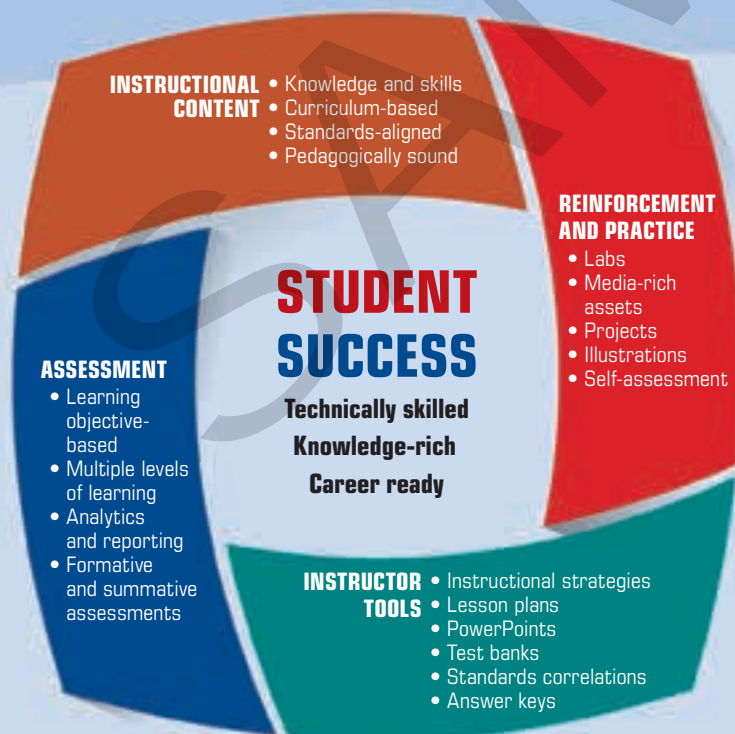
Instructor Resources One resource provides instructors with time-saving preparation tools such as answer keys, editable lesson plans, and other teaching aids.

Instructor's Presentations for PowerPoint® These fully customizable, richly illustrated slides help you teach and visually reinforce the key concepts from each chapter.

ExamView® Assessment Suite Administer and manage assessments to meet your classroom needs. The ExamView® Assessment Suite allows you to quickly and easily create, administer, and score paper and online tests. Included in the assessment suite are the ExamView® Test Generator, ExamView® Test Manager, and ExamView® Test Player. G-W test banks are installed simultaneously with the software. Using ExamView simplifies the process of creating, managing, administering, and grading tests. You can have the software generate a test for you with randomly selected questions. You may also choose specific questions from the question banks and, if you wish, add your own questions to create customized tests to meet your classroom needs.



G-W Integrated Learning Solution

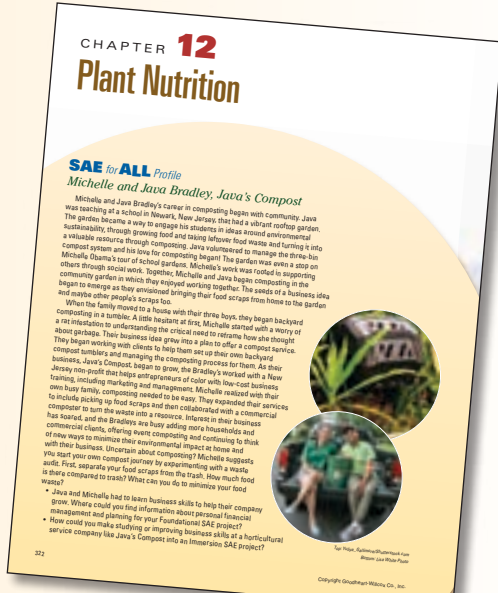


The G-W Integrated Learning Solution offers easy-to-use resources that help students and instructors achieve success.

- ▶ EXPERT AUTHORS
- ▶ TRUSTED REVIEWERS
- ▶ 100 YEARS OF EXPERIENCE

Features of the Textbook

The instructional design includes student-focused learning tools to help students succeed. This visual guide highlights the features designed for the textbook.



Before You Read literacy integration activities at the beginning of each lesson encourage development of confidence and skill in literacy and learning.

SAE for ALL Profiles open every chapter and provide students with relevant examples and insight into where their SAEs can take them!

Essential Questions provoke deep thought, lively discussion, and new understanding.

Chapter Objectives clearly identify the knowledge and skills to be obtained when the chapter is completed.

STEM Connections integrate all four components of STEM education as well the social sciences and language arts.

Corner Questions spur conversation related to chapter content.



Words to Know list the key terms to be learned in the chapter.

Illustrations clearly and simply communicate the specific topic.

Career Connection features introduce students to careers in the Green Industry.

Career Connection
Careers in Plant Biology

There are many specialties and career opportunities in the plant biology field. Careers in plant biology may include: research centers, industry, and education. A bachelor's degree is required for most careers in plant biology and may increase pay.

Botanist

Botanists study all forms of plants and their relationship to the environment and other living things. A botanist who enjoys the outdoors and research may study plants and their uses. Some botanists may do environmental research, studying the effect of climate change on various plant populations. Botanists who work in botanical gardens, arboreta, herbaria, and zoos may study plants and their interaction in each environment.

The annual salary range is currently \$20,000 to \$20,000. The salary depends primarily on the geographical location, experience, and education. A minimum level of education required is a science-based bachelor's degree, a master's degree, and PhD are often necessary to be competitive in the field.

Science Teacher

Science teachers instruct students in the concepts of science. A degree in plant biology is essential for those who wish to teach students about plant science, the environment, natural resources, and earth sciences. The ability to share information about plant growth and development can engage young people in learning. A science teacher with a plant background can create hands-on experiences that help students understand the photosynthetic organisms around them. A bachelor's degree in plant biology, botany, horticulture, or agriculture is required. Additional coursework and experience is favored.

A minimum of a bachelor's degree in education with high school teaching experience is required for grade school and high school teachers. Additional coursework and teaching experience at the college level requires a master's degree in the chosen area. Science teachers may earn an annual salary of \$32,000 to \$75,000, depending on their level of education, experience, and geographical location.

Research Associate

Plant biology offers a broad background that can be applied in research settings with agricultural companies trying to solve key challenges in global crop production. A research associate's role engages in the discovery and development of techniques and products that will solve the development of production problems. This might include the development of novel pesticides, biological control, or molecular methods of changing plants. Applicants to these positions need strong technical, organizational, and communication skills.

A minimum of a bachelor's degree in an agriculturally related field with preference to agriculture, horticulture, plant biology, biology, or another related field is required. Some research associates positions require a master's or doctoral degree. Salaries range from \$40,000 to \$90,000 with opportunities to earn over \$100,000.

Figure 3-8 A—Researching and determining what type of plants are best for pollinators such as bees is one way to increase the success of a research project. B—Another project that requires a research analyst SAE is determining what type of organic material to use for an arborvitae tree.

Figure 3-9 A—Researching and determining what type of plants are best for pollinators such as bees is one way to increase the success of a research project. B—Another project that requires a research analyst SAE is determining what type of organic material to use for an arborvitae tree.

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Did You Know? features point out interesting and helpful facts about the agricultural industry.

Did You Know?

How many Myers-Biggs assessments, a form of personality tests, are given each year?

Did You Know?

The Florida Nursery Growers and Landscaping Association offers a Professional program to recognize authority in the horticulture industry.

Employability Practices

Professional Certifications in Horticulture

Industry certifications in horticulture demonstrate and verify an excellence and professionalization within the trade that is not exhibited by all professionals within the industry and can be satisfied knowing that the training and have volunteered in horticulture efforts with these organizations are some of the most respected horticultural organizations offering professional certifications. State agencies may also offer additional certifications, so check with your state's extension agency or a member of the horticulture industry to find out more.

American Society of Horticultural Science

skilled in all areas of horticulture. Those who are and must have three years of professional and/or educational experience in horticulture.

Master Gardener

Each state's cooperative extension agency can offer a master gardener program. Master gardeners are home growers who have received a great deal of horticultural training and have volunteered in horticulture efforts with these organizations are some of the most respected horticultural organizations offering professional certifications. State agencies may also offer additional certifications, so check with your state's extension agency or a member of the horticulture industry to find out more.

Landscaping Professionals

Some certifications provided by the association include landscape industry certified manager, arborist, tree technician, interior technician, horticultural technician, lawn care manager, and horticulturist.

Each of these certifications ensures that the person to demonstrate rigorous training and evaluation green industry.

Chapter 3 Horticulture Business Measurement 125

Employability Practices provide students with tips to improve their employability skills.

AG ED Connection features introduce students to the exciting world of leadership and personal development opportunities, including career development events in a variety of areas.

SAE Connection **Beekeeping SAE**

You can make bees and rest their hives to pollinate your garden. **Apiculture** (beekeeping) is the study and maintenance of honey bees. Bees can be kept in hives or in the hives. Farmers can register their hives, or the hives can be registered by the apiculturist. Bees can be kept in hives or in the hives. Bees can be kept in hives or in the hives. Bees can be kept in hives or in the hives.

Consider This

1. What supplies would you need to get up a beehive? Are there ready-made "boxes"?
2. Research and determine what you would need to begin the venture and determine the cost of the materials.
3. Identify the types and sizes of hives used to house bees and describe their differences, as well as each one's purpose.
4. If you permit, create a visual presentation explaining how a person would set up a beehive.

Using Social Media Safely and Responsibly

You can help yourself to prospective employers in a positive light by using social media responsibly. Unprofessional or inappropriate postings, comments, and photos made on social media can hurt employment opportunities or even get you fired. Here are a few tips to help ensure your social media profile is appropriate:

- Check your privacy settings and make certain they are on private.
- What you post can come back to haunt you. A secret study showed that up to 90% of employers and college admissions coordinators check candidates' social media profiles.
- Remove any postings that are not to public that may be considered inappropriate.
- Do your homework. Analyze the mission statements and vision statements of the company. Many companies will have different levels of tolerance regarding social media postings. Keep your profile professional and unbiased.
- Review your profile postings and images in their entirety. Postings made several years ago may not represent current beliefs.
- Tools from the social media site can be used to search for photos of yourself that have been added by others. Check these photos and ask that inappropriate images be removed.

Saving Safe Online

- Do not assume that someone on social media who they say they are. If you get a message from someone you do not know, do not interact with him or her until you can verify his or her identity.
- Always make sure you involve your parents or guardians in any decision you make related to bringing your virtual friends into your real life.
- Never provide personal information through social media. Sharing your home address, schedule, or other personal information on your social media pages can allow scammers or other bad actors to find out where you live and how to reach you.
- Always complete how much someone may figure out about you from your profile or things you post.
- Find evidence and determine whether sources are credible.
- Analyze documents with questions and comments.
- Summarize the main points of information.
- Evaluate information to determine whether it is credible and factual.

Search

When you have a choice to research or need to find the answers to a question, you may begin by thinking critically, as well as you begin a search for information. You may begin by thinking critically, as well as you begin a search for information. You may begin by thinking critically, as well as you begin a search for information. You may begin by thinking critically, as well as you begin a search for information.

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FFA Connection features introduce students to the exciting world of FFA opportunities including Career Development Events in a variety of agricultural areas.

Extemporaneous Speaking

In this event, a single participant is given only 30 minutes to prepare a speech that is between 4 and 5 minutes in length. The purpose of this event is for students to learn how to express themselves verbally and to present a speech in very little time.

Extemporaneous Presentations

An extemporaneous presentation is an impromptu speech that is performed without advance preparation. There are times in industry when a business manager may have little or no time to prepare a statement or speech. Figure 3-14 is a common for an employee whose job is public relations to act on the company's behalf with very little preparation. This type of presentation is also often associated with competitions. The FFA and other groups offer extemporaneous speech events to test the skills and knowledge of FFA members. This event is much like being part of a debate team where contestants are posed a question and asked to respond.

Persuasive Presentations

When the owner of a landscape design company talks to his employees on Monday morning and encourages them to find more clients and reach out to older customers, he is trying to persuade his employees. This is often referred to as a pep talk, but it is literally a mini motivational speech.

Persuasive speeches are those that try to convince the audience to believe in something or take some action. This is no different from the times in a locker room when a coach tries to convince his team that they are unstoppable and that they can defeat their opponent. A persuasive speech can be formal or informal. One of the most memorable

Figure 3-14 The Secretary of Agriculture announces the opening of a presentation. When there is little time for preparation, this is known as an extemporaneous speech. What do you think are the most important things to focus on when giving a speech without time for preparation?

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SAE Connections help students make real-life connections to a variety of new and interesting SAE opportunities.

Caption questions help the students connect the text to the art, while encouraging active reading and critical thinking.

Identification Glossaries include plants, equipment, pests, disorders, diseases, and weeds from the CDE Identification lists in full-color and all in one location.



Hands-On Horticulture activities are highlighted throughout the textbook to provide clear instructions for hands-on service activities. You can refer back to these procedures easily.



Sustainable Horticulture features highlight key items related to sustainability, energy efficiency, and environmental issues.



Credentialing Partners and Support

Goodheart-Willcox appreciates the value of industry credentials, certifications, and accreditation. We are pleased to partner with leading organizations to support students and programs in achieving credentials. Integrating industry-recognized credentialing into a career and technical education (CTE) program provides many benefits for the student and for the institution. By achieving third-party certificates, students gain confidence, have proof of a measurable level of knowledge and skills, and earn a valuable achievement to include in their résumés. For educators and administrators, industry-recognized credentials and accreditation validate learning, enhance the credibility of programs, and provide valuable data to measure student performance and help guide continuous program improvement.

Horticulture Today is correlated to the Horticulture-Landscaping credential offered by NOCTI and to the Plant and Soil Science certification offered by Precision Exams by YouScience.

NOCTI NOCTI Certifications

Goodheart-Willcox is pleased to partner with NOCTI, a leading provider of industry certification solutions for CTE programs across the nation. With over 50 years of experience, NOCTI is a valuable partner in the CTE community's efforts to improve America's workforce. Goodheart-Willcox has created correlations between select products and the standards and competencies that make up the NOCTI credentials, to the benefit of states, instructors, and students working to achieve NOCTI credentials.

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To see how *Horticulture Today* correlates to credentialing and certification standards, visit the Correlations tab at www.g-w.com/horticulture-today-2023.

New to This Edition

Goodheart-Willcox understands the importance of the three-circle model of instruction used in Agriculture Education, and we know the value of supervised agricultural experiences (SAEs)! During the revision of this title, we spoke with agriculture educators and students across the country—asking them how we can better support their SAE for ALL efforts. As a result, SAE for ALL Profiles are featured at the beginning of every chapter, providing students with SAE inspiration and a glimpse into their exciting potential future in the agriculture industry! With this feature, we highlight current and former students of agriculture education, as well as industry icons!

In addition to the new SAE for ALL Profiles and the exciting new design, the second edition of *Horticulture Today* has new and updated Career Connections that include salaries and job outlooks for the next decade. The authors have also included new hands-on activities that promote teamwork and leadership skills, as well as activities on harvest and storage issues for keeping produce fresh.

The new edition of *Horticulture Today* features new and revised end-of-chapter questions and activities, including critical thinking questions and STEM and academic activities. There are also new SAE for ALL Opportunities to provide students with creative new ideas for all types of SAE projects and a quick check-in for SAE progress.



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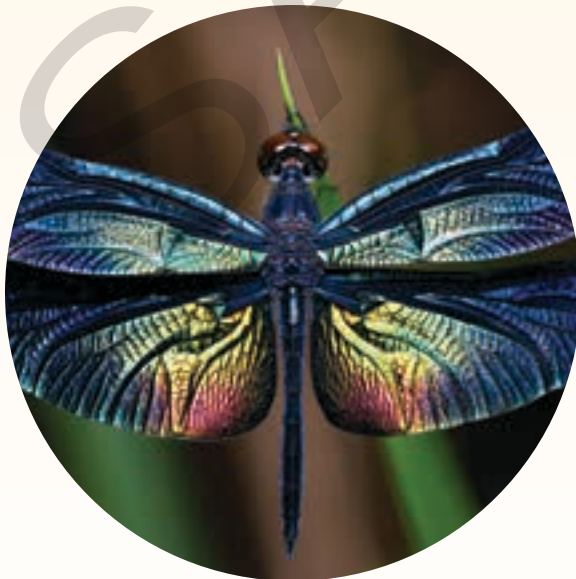
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