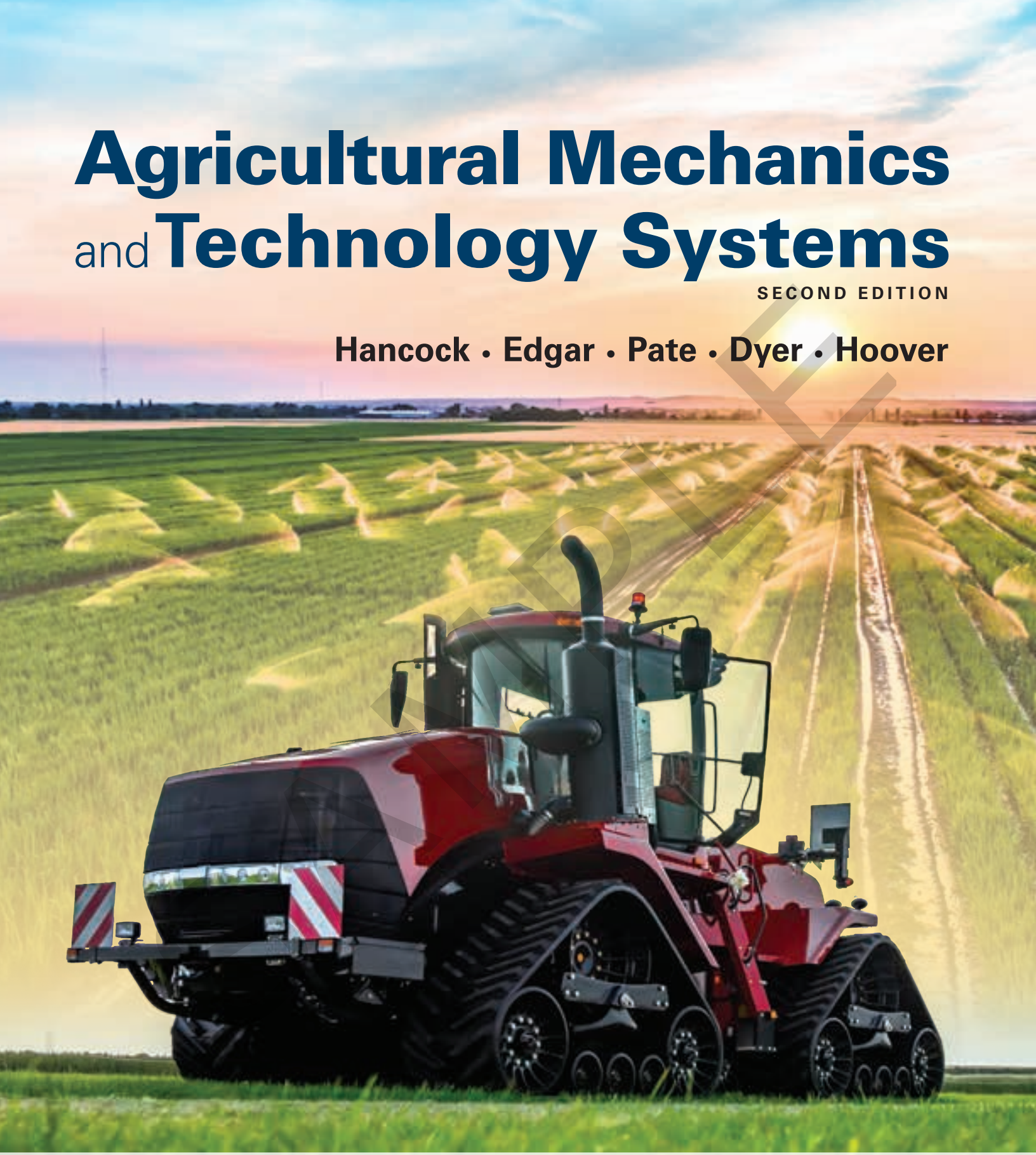
Agricultural Mechanics and Technology Systems

SECOND EDITION

Hancock • Edgar • Pate • Dyer • Hoover



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Preface

In creating a modern and completely original curriculum resource for courses on agricultural technology systems, the authors of *Agricultural Mechanics and Technology Systems* set several goals for themselves. First, the text's coverage had to be basic enough for learners who have little or no prior experience with mechanical systems and yet detailed enough to challenge those with an aptitude for mechanics and technology. Second, coverage had to be broad enough to cover all the major skilled trades—including building construction, electricity, welding, and power systems—in true-to-life agricultural contexts. Third, it had to provide meaningful presentations of theory and enough depth to promote inquiry-based hands-on learning in the classroom and lab. And fourth, the text had to be concisely written in order to balance limited classroom and lab hours with the demands of introducing multiple disciplines.

An additional imperative was to place the study of agricultural technology within the framework of the AFNR Career Cluster Content Standards, and not only attract students to the Power, Structural, and Technical Systems Career Pathway, but to also take subsequent courses.

In creating the text, the author team drew on their experience as both educators and subject matter experts, which has allowed for pedagogical soundness and a high degree of technical accuracy. They were guided by a diverse and geographically balanced panel of expert reviewers, who critiqued every chapter and made many important contributions to the text. In this second edition, updates are included to keep up with everchanging advancements in technology.

Working safely is an overarching theme of the text, with a dedicated chapter on safety (Chapter 5), technology-specific safety coverage in nearly every chapter, and extensive safety notes throughout the text. The repeated exposure to safety issues is intended to help instructors develop a safety-first culture within the classroom and lab and reinforce the point that safe work habits are required in every area of agricultural technology systems.

Developing an appreciation for the variety of career options available in agricultural technology systems is another theme of the text. Along with an early chapter on careers (Chapter 2), the text offers practical information and advice to those participating in career development events (CDEs).

In support of the modern agricultural education model, the text promotes a deep understanding of Supervised Agricultural Experiences (SAEs) and the many ways they can be designed to enrich the study of agricultural technology systems. The new edition includes exciting *SAE for ALL Profiles* featuring students and industry professionals at the beginning of each section. Chapter 3 provides an overview of experiential learning, and numerous SAE For All Connections and FFA Connections throughout the text extend and apply it. Active learning is further developed by Hands-On Ag Mechanics features and by the chapter-ending STEM and Academic Activities.

In recognition of the importance of cross-curricular tie-ins, reading and writing skills are developed by the careful definition and use of technical terms in Words to Know, by Before You Read guidance provided at the start of every chapter, and by vocabulary-building exercises at the end of every chapter. Enhanced study questions were developed and included in this edition for each chapter. The myriad applications of agricultural technology systems to science, technology, engineering, and mathematics are explored in STEM Connections throughout the text and reinforced in STEM and Academic Activities.

Special care has been taken to address the needs of visual learners. To highlight safe, correct, and current practices, four-color photographs, many of which were created specifically for this text, and line art appear on nearly every page of the text.

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About the Authors

J. P. Hancock

Mr. Hancock is an Assistant Lecturer in the College of Agriculture and Life Sciences at Texas A&M University, where he is responsible for teaching classes on how to teach agricultural mechanics and safety in high school agriculture programs. In addition to teaching, Mr. Hancock is responsible for supervising student teachers in the field. He focuses on developing and teaching curriculum designed to provide students with hands-on experiential learning experiences. Prior to joining Texas A&M, Mr. Hancock taught high school agriculture science for nearly 30 years. He holds an undergraduate and master's degree of science in Agricultural Education from Texas A&M University.

Don W. Edgar, PhD

Dr. Edgar is a Professor of teacher education and agricultural mechanization at New Mexico State University, where he also offers methods of teaching and laboratory instruction. Dr. Edgar holds an undergraduate and master's degree of science in Agricultural Education from Tarleton State University and received his PhD from Texas A&M University. His professional interests include methods of teaching, learner-centered instructional design, and delivery strategies. As a former secondary instructor in Texas, Dr. Edgar's interest in methods of instruction in laboratory settings frames his research agenda in addition to determining the impact of age and gender toward student engagement and knowledge acquisition in mechanized systems. These interests allow his research focus to analyze the teaching and learning processes involved in secondary educational settings. Dr. Edgar has written numerous chapters and other publications for agricultural education. Presently, he is focusing on developing curriculum toward digital and smart agricultural systems and best practices toward adoption of producers in agricultural settings.

Michael L. Pate, PhD

Dr. Pate is an Associate Professor of undergraduate agricultural systems technology at Utah State University. His agricultural work experience includes beef cattle and poultry production. Dr. Pate received his undergraduate and master's degrees in Agricultural Education from the University of Arkansas and completed his PhD program in agricultural education at Iowa State University. Prior to pursuing graduate studies, Dr. Pate taught agriculture and life sciences at the high school level. His teaching philosophy is grounded in the use of extensive laboratory practicums to emphasize problem-based application of agricultural engineering principles, the function and use of agricultural technology, and the integration of technology management concepts for the food, fiber, and natural resources industry. Dr. Pate serves as a coordinator for the Utah FFA Agricultural Technology and Mechanical Systems Career Development Event. His research focuses on the safety and health of individuals working in production agriculture. Dr. Pate has authored over 34 refereed journal articles. He is the current chair for the NCERA-197 Agricultural Safety and Health Research and Extension Committee and Past-President for the International Society for Agricultural Safety and Health (ISASH).

Lori A. Dyer

Ms. Dyer is the Project Director, USDA Grant for Rhodes State College where she is implementing an agriculture technology program. She has developed multiple curricula in agriculture business, agriculture robotics, and unmanned aerial systems and overseen the development of courses in prescription mapping, precision equipment, and GIS/GPS. Ms. Dyer taught high school agriculture for 30 years and is a Certified Master Teacher with Curriculum for Agriscience Education, being certified in three curricula. Ms. Dyer holds an undergraduate science degree from Ohio State University in Agriculture, and a master's degree of instruction in economics from the University of Delaware. She has contributed to *The Agricultural Education* magazine and has developed two state-adopted high school career education curricula. She operates a beef cow-calf herd and row crop farm with her family.

Brian Hoover, PhD

Dr. Brian Hoover is a professor at Murray State University in Murray, Kentucky, where he teaches undergraduate and graduate classes in the Agricultural Systems Technology program. Dr. Hoover earned his doctoral degree from Purdue University and his undergraduate and master's degrees of science from Murray State University in agricultural systems. Dr. Hoover has contributed greatly to improving agricultural safety instruction over the last twenty years through his teaching, research, and authorship. A wide variety of learning experiences on his family's farm prepared Dr. Hoover for a career in agriculture. His farm continues to provide him a valuable connection to crop production, livestock production, and agricultural machinery.

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Reviewers

The author and publisher wish to thank the following industry and teaching professionals for their valuable input into the development of *Agricultural Mechanics and Technology Systems*.

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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 how we can better support their SAE for ALL efforts. As a result, SAE for ALL Profiles are featured at the beginning of each section, 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 an exciting new design, the second edition of *Agricultural Mechanics and Technology Systems* has 37 new and updated *Career Connections* that include salaries and job outlooks for the next decade.
- The revised text also includes new hands-on activities and hundreds of new images and illustrations.
- Additional *Safety First* notes have been added throughout the textbook to help students develop safe work practices.
- The new edition of *Agricultural Mechanics and Technology Systems* features new review materials and activities, including revised *Know and Understand* review questions, *Analyze and Apply* activities, *Thinking Critically* questions, and *STEM and Academic Activities*.
- New *SAE for ALL Opportunities* are included in the chapter review and assessment section to provide students with creative ideas for all types of SAE projects. *SAE for ALL Check-Ins* help students monitor progress on their SAEs.
- New digital-only material includes a *Virtual Toolbox* that helps students practice identifying tools and materials.



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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.

Agricultural Mechanics and Technology Systems is correlated to the *Agriculture Mechanics* credential offered by NOCTI and to the *Agricultural Mechanics 115* certification offered by Precision Exams by YouScience.

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 *Agricultural Mechanics and Technology Systems* correlates to credentialing and certification standards, visit the Correlations tab at www.g-w.com/agricultural-mechanics-technology-systems-2024.

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TOOLS FOR STUDENT AND INSTRUCTOR SUCCESS

Student Tools

Student Text



Agricultural Mechanics and Technology Systems is a comprehensive text that focuses on the information, techniques, processes, and procedures used by agriculture professionals in a variety of areas in the agriculture industry.

Lab Workbook

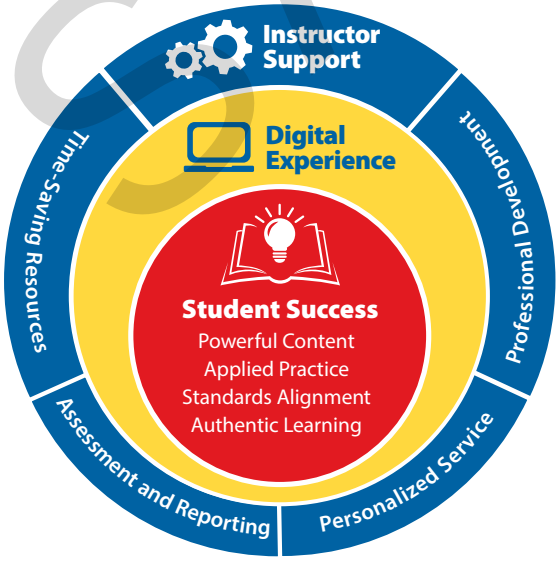
- Hands-on practice includes questions and activities.
- Projects offer students opportunities to work on various construction and mechanical challenges.

G-W Digital Companion

- For digital users, e-flash cards and vocabulary exercises allow interaction with content to create opportunities to increase achievement.

Online Learning Suite

- Online student text and lab workbook, along with rich supplemental content, brings digital learning to the classroom.
- All instructional materials are accessible at home, at school, or on the go.
- New digital-only material includes a Virtual Toolbox that helps students practice identifying tools and materials.



Instructor Tools

LMS Integration

Integrate Goodheart-Willcox content within your Learning Management System for a seamless user experience for both you and your students. EduHub 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.

G-W Common Cartridge provides a complete learning package for you and your students. The included digital resources help your students remain engaged and learn effectively:

- **Digital Textbook**
- Online **Lab Workbook content**
- **Videos**
- **Drill and Practice** vocabulary activities

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.

For instructors, the Common Cartridge includes the Online Instructor Resources. 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)

- The **Instructor Resources** provide instructors with time-saving preparation tools such as answer keys, editable lesson plans, and other teaching aids.
- **Instructor's Presentations for PowerPoint®** are fully customizable, richly illustrated slides that help you teach and visually reinforce the key concepts from each chapter.
- Administer and manage assessments to meet your classroom needs using **Assessment Software with Question Banks**, which include hundreds of matching, completion, multiple choice, true/false, and short answer questions to assess student knowledge of the content in each chapter. The Question Banks also contain assessments for the digital-only Virtual Toolbox.

See https://www.g-w.com/agricultural-mechanics-technology-systems-2024 for a list of all available resources.

Professional Development

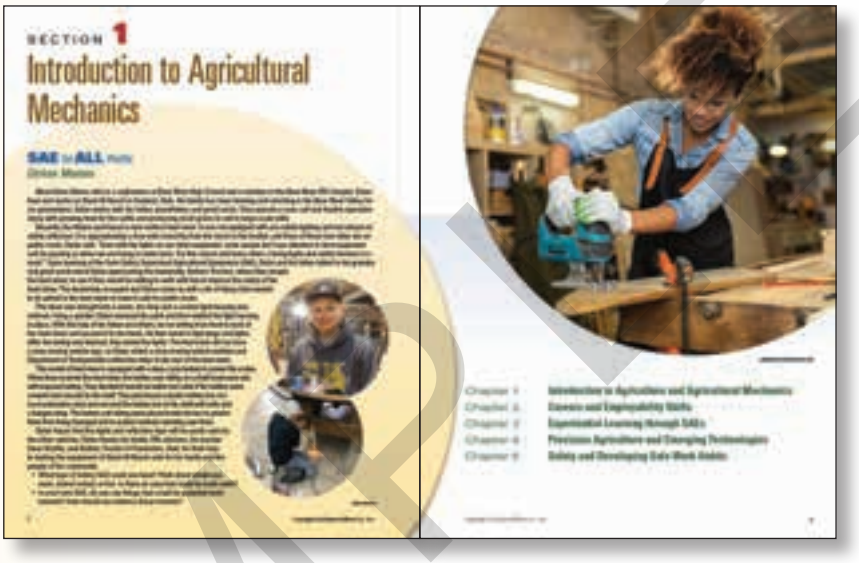
- Expert content specialists
- Research-based pedagogy and instructional practices
- Options for virtual and in-person Professional Development

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Guided Tour

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

SAE for ALL Profiles open every section and provide relevant examples and insight into opportunities made possible with successful student SAE projects.



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

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

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



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

Safety First notes alert you to potentially dangerous materials and practices.



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SAE for ALL Connections make real-life connections to a variety of interesting SAE opportunities.



Ag Ed Connection features introduce you to the exciting world of leadership and personal development opportunities, including career development events in a variety of areas.

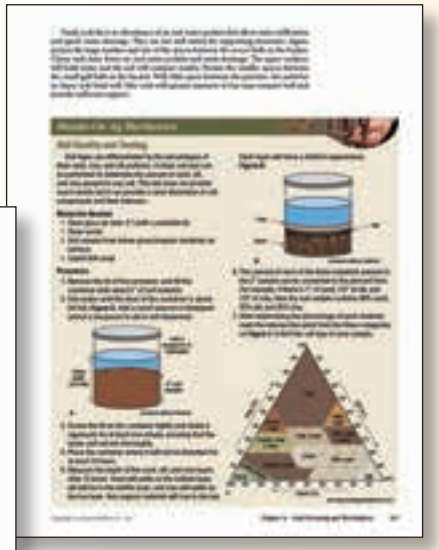


FFA Connection features introduce students to the exciting world of FFA opportunities, including Career Development Events in a variety of agricultural areas.



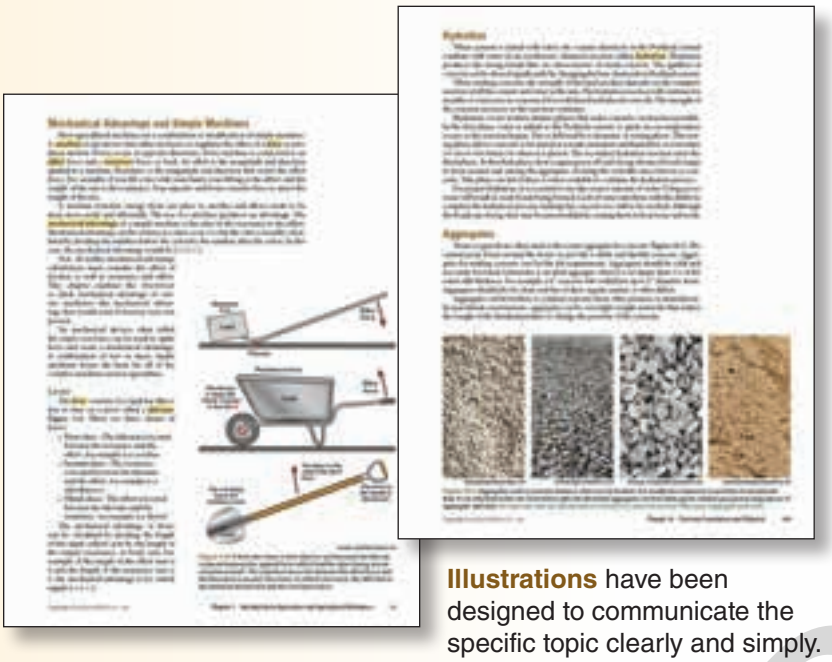
Hands-On Ag Mechanics features are highlighted throughout the textbook to provide clear instructions for hands-on service activities. You can refer to these procedures easily.





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

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Illustrations have been designed to communicate the specific topic clearly and simply. Illustrations have been updated for this edition. Photographic images have been updated to show the latest equipment.

Sustainable Agriculture notes highlight key items related to sustainability, energy efficiency, and environmental issues.





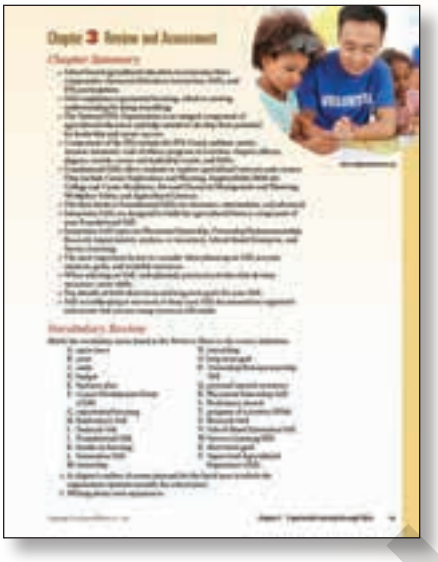
Career Connections introduce careers in different agricultural areas and can help provide a path for career success.



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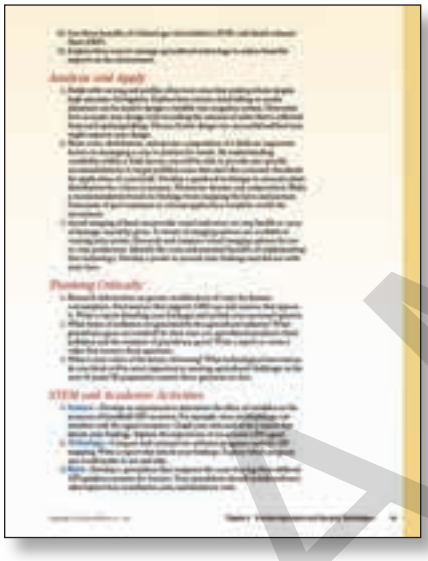
Chapter Summary features provide an additional review tool for you and reinforces key learning objectives.

Vocabulary Review matching activities reinforce vocabulary development and retention. All Words to Know are included in the text glossary and are connected to numerous online review activities.



Know and Understand questions allow you to demonstrate knowledge, identification, and comprehension of chapter material.





Analyze and Apply questions and activities allow the transfer of concept comprehension to new applications both in and out of the agricultural fields.

Thinking Critically questions develop higher-order thinking, problem solving, personal, and workplace skills.

STEM and Academic Activities are provided in the areas of science, technology, engineering, math, social science, and language arts to extend learning and aid the application of knowledge.

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

SAE for ALL Check-In reminds students to review and record progress on their SAEs.



Communicating about Ag Mechanics questions and activities help integrate reading, writing, listening, and speaking skills.

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