
Preface

This textbook is developed from lectures for a graduate class in soil-plant-water relations taught at Kansas State University. Students in the class are from a number of departments, including agronomy, biology, horticulture, forestry and recreational resources, biochemistry, and biological and agricultural engineering. The book can be used as a text for a graduate- or upper-level undergraduate courses or as a self-study guide for interested scientists. The book follows water as it moves through the soil-plant-atmosphere continuum. The text deals with principles and is not a review of recent literature. The principles covered in the book, such as Ohm's law and Poiseuille's law, are ageless. The book has equations, but no knowledge of calculus is required. Because plant anatomy is often no longer taught at universities, chapters review root, stem, leaf, and stomatal anatomy. Instrumentation to measure status of water in the soil and plant also is covered. Many instruments could have been described, but the ones chosen focus on traditional methods such as tensiometry and psychrometry and newer methods that are being widely applied such as tension infiltrometry and time domain reflectometry. Because the humanistic side of science is usually overlooked in textbooks, each chapter ends with biographies that tell about the people who developed the concepts discussed in that chapter.

Although a textbook on water relations might logically include developments in molecular biology, this topic is not covered. Rather, the text

focuses on water in the soil and whole plant and combines knowledge of soil physics, plant physiology, and microclimatology. Chapter 1 reviews population and growth curves and provides a rationale for studying water in the soil-plant-atmosphere continuum. Chapter 2, which defines physical units, at first may appear elementary, but many students have not had a class in physics. The definitions in this chapter lay the foundation for understanding future chapters. Chapter 3 goes over the unique structure and properties of water, which makes life possible. Chapter 4, on tensiometry, is the first instrumentation lecture. Other instrumentation lectures include Chapter 9 on penetrometer measurements; Chapter 10 on measurement of the oxygen diffusion rate in the soil; part of Chapter 11 on applications of tension infiltrometry to determine soil hydraulic conductivity, sorptivity, repellency, and solute mobility; Chapter 13 on time domain reflectometry; Chapter 16 on psychrometry; Chapter 17 on pressure chambers; Chapter 22, which includes ways to measure stomatal opening and resistance; and Chapter 24 on infrared thermometers. Chapters 4 through 13 focus on water in the soil; Chapters 14 through 22, on water in the plant; and Chapters 23 through 27, on water as it leaves the plant and moves into the atmosphere.

Within any one chapter, the notation is consistent and abbreviations are defined when first introduced. When the same letter stands for different parameters, such as *A* for "ampere" or "area" and *g* for "acceleration due to gravity" or "grams," these differences are pointed out.

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