CHAPTER 4B

Water Transport and Balance Within the Plant: Stomatal Mechanics and Gas Exchange

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I. INTRODUCTION

Water transport within plants occupies a place of prominence in crop production—in both an economic and a physiological sense. It is this latter aspect that is the focus of Chapter 4A by Wenkert. Actually the scope is slightly broader, since an understanding of water transport within the plant depends in a fundamental manner upon the role of the two interfaces: plant-atmosphere and plant-soil.

The discussion that follows may be grouped into three categories: (i) general comments on mathematics in plant-water relations, (ii) specific comments on the mechanics of stomatal aperture, and (iii) some consideration of gaseous transport.

II. MATHEMATICS IN PLANT-WATER RELATIONS

Wenkert concentrates predominantly upon the physical aspects of water transport and succeeds in giving some useful order-of-magnitude characterizations of that process. Mathematical models occupy a prominent supporting role in that discussion. Indeed, the study of plant-water relations has benefited more than most aspects of the study of crop production from the application of mathematics. That mathematics will play an even more decisive role in crop physiology in the future is clear and is illustrated throughout this book.

Two rather different approaches are manifest in the literature. One may consider water transport on a whole-plant basis. On the other hand, one may consider more limited and specialized studies, e.g., stomatal diffusion, water movement through sieve plates, the role of the Casparian strip, etc. Crop physiologists tend to emphasize the former, although both approaches are productive.