HOW EFFICIENT IS WATER USE BY CROP PLANTS?

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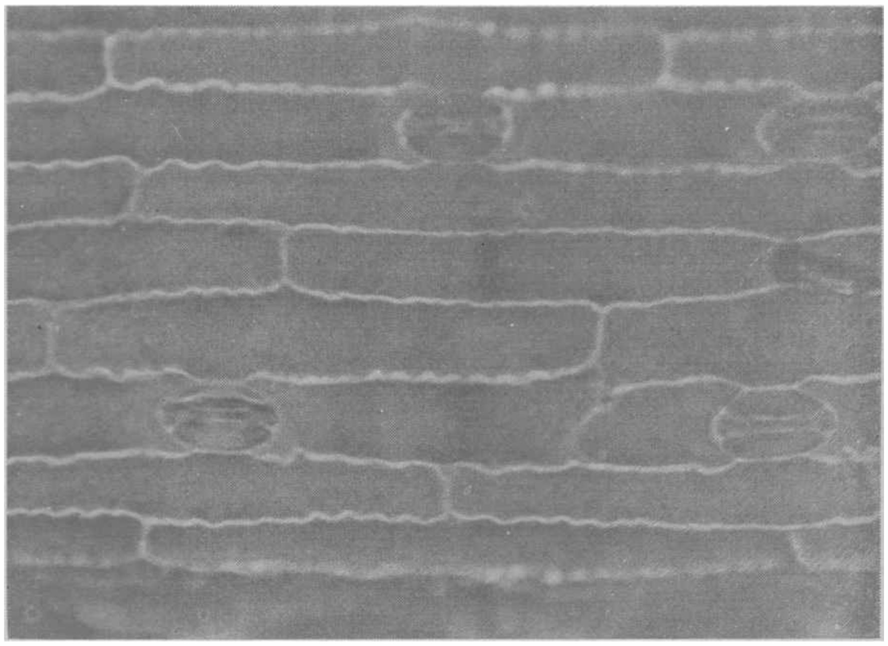

UPPER SURFACE of a leaf of Blue Panicgrass, showing epidermal cells and the stomates. Most of the water absorbed by the plant is lost in the form of vapor through small pores in the leaf.

Agronomists at the University of Arizona are asking these questions: Do plants really need to absorb 800 to 1500 grams of water for every gram of dry matter produced? Is all this water lost by plants as vapor into the atmosphere absolutely necessary in the biochemical processes of the plant? Can agronomically important plants be improved so that they will produce more dry matter with less water?

Scientists in the Agronomy and Botany Departments at the University of Arizona are attempting tc answer these and other questions related to more efficient use of water by crop plants, through a grant supported by the Cooperative State Research Service of the Department of Agriculture.

Some Drink More Water

Grasses and legumes are being grown in controlled environmental growth chambers and used to determine "high" and "low" water users. These plants will be used to compare differences in morphological, biochemical, and anatomical features in search of the key to water efficiency. We need a good selection "tool" so we can separate the more water-efficient plants within a species from the less water-efficient ones.

The number, size, and daily activities of the stomates will be investigated in detail. The stomatal apertures (small slit-like openings in the leaves through which most of the water absorbed by plants is lost into the atmosphere) of blue panicgrass as shown in the accompanying photo, may be the selection tool for water efficiency. Plants have been shown to have from 1,000 to 60,000 stomates per square centimeter of leaf area. Some plants have stomates on both the upper and lower sides of the leaves, and some have these small pores only on the bottom side.

Learning What Goes On

Biochemical constituents such as free amino acids, total amino acids, and various other metabolites concerned with hydrophyllic fractions of cells will be investigated in an attempt to better understand biochemical processes between efficient and non-efficient water-using plants.

The Arizona farmer is being faced with the problem: What crops can I now produce with the least amount of water? Competition for water is inevitable. As industrial and urban demands for this natural resource grow, less and less water will be available for agricultural enterprises.

Our research will try to find the reasons why some plants use water more efficiently than others. Then we can incorporate these features into agronomic plants, so that more food can be produced with less water.