Soybean [Glycine max (L.) Merr.] is a dominant world crop grown for vegetable oil, protein for animal and human consumption, and industrial uses (ink, glue, diesel, etc.). Corn (Zea mays L.) also is a dominant world crop used for animal feed and consumer products. The area planted in each crop in the USA is now in the 28 to 32 million ha range. The principal area of corn and soybean production in the USA is in the north-central states (Table 1). Soybean is also planted in a large area in the Mississippi Delta and the mid-Atlantic Coastal Plains.

Most soybean and corn crops in the USA are produced under rainfed conditions; however, large areas of both crops are grown with irrigation to stabilize production from year to year (Table 1). As lack of rain and soil properties interact to reduce stored water available to plants, the importance of irrigation to maintain stable production of both crops increases. This is especially true for corn production in Colorado, Kansas, Nebraska, and Texas (Great Plains), and for soybean production in Arkansas, Mississippi, the Missouri Bootheel (lower Mississippi River Valley), and in Nebraska (Great Plains). It is in these areas that a high percentage of a large hectarage of corn and/or soybean is irrigated because irrigation is necessary for the production of a consistently profitable yield.

The water status of plants is a function of soil water supply, evaporative demand of the atmosphere, and the ability of the soil to release water. In the field, large water deficits develop on hot sunny days even in well-watered plants (Hodges and Heatherly, 1983; Hirasawa and Hsiao, 1999). As water is transpired from the leaves, the water potential gradients that develop increase the rate of water uptake from the soil. If roots cannot absorb water rapidly enough, plant water tension increases. These tensions limit growth and affect canopy structure by limiting leaf production and size and internode elongation rates. They reduce grain or seed yield by limiting yield components, such as kernel number and size in corn (Rhoads and Bennett, 1990; Wagger and Cassel, 1993; Yazar et al., 1999) and pod and seed number and seed size in soybean (Reicosky and Heatherly, 1990).