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Adaptive Responses of Soybean and Cotton to Water Stress
—I. Transpiration Changes in Relation to Stomatal Area and Stomatal Conductance—

Inamullah[1)] and Akihiro Isoda[1)]

1) Faculty of Horticulture, Chiba University

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Abstract: The adaptive responses of soybean and cotton to various irrigation levels were explored in terms of transpiration, stomatal role in transpiration, leaf temperature (T_L) and CO_2 assimilation rate (A_N). Compared with cotton, soybean showed a lower flow rate of stem sap (FRSS), transpiration rate (E), stomatal conductance (g_s), stomatal density and A_N and had a smaller stomatal area but larger leaf area, heavier root dry matter and higher T_L at all irrigation levels. Under water stress conditions, FRSS, E, g_s, and A_N decreased and T_L increased more in soybean than in cotton. Stomatal area decreased in response to water stress though nonsignificantly but stomatal density was not affected by water stress in soybean. Stomatal area decreased significantly in response to water stress in cotton. We concluded that soybean and cotton adapted to water stress differently. Soybean adapted to water stress by reducing transpiration while cotton adapted to water stress by maintaining higher transpiration as compared with soybean. Soybean reduced the transpiration rate by reducing g_s. Reduction of g_s in soybean was due to reduced FRSS, which might have resulted from the lower root moisture absorption efficiency. The higher transpiration in cotton was due to a higher g_s, which was supported by a higher FRSS, larger stomatal area, and probably the diaheliotropism. The higher g_s and transpiration rate suppressed the increase in T_L thus preventing the decrease of A_N in response to water stress.

Keywords: *Glycine max* (L.) Merr., *Gossypium hirsutum* L., Leaf movement, Stomatal area, Transpiration, Water stress

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