Responses of Glasshouse-grown Cotton to Irrigation with CO₂-Saturated Water

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Experiments were conducted to test the suitability of using irrigation water as a carrier for CO₂ to enhance growth and productivity of cotton. The amount of CO₂ that can be carried in this manner (1.5 g/l) has a cost which might make the practice profitable if it resulted in significant yield increases. Cotton is one of the most responsive crops to CO₂ enrichment. For this reason, it is a prime candidate for field enrichment studies. Before making gaseous or enriched irrigation releases, a greenhouse study to determine whether cotton responded positively or negatively to high CO₂ in the root zone seemed advisable. With this in mind, two glasshouse studies have been conducted in which cotton was watered daily with CO₂-saturated water.

Potted plants (cv. DPL-61) were irrigated daily with CO₂ saturated water in a greenhouse in Phoenix, AZ. Growth, productivity, and physiological responses of these plants were compared to those irrigated with de-ionized water. All plants were fertilized twice weekly with a complete Hoagland's solution.

Yield, as measured by boll load at maturity, was increased 70% and 53% in two experiments. Rate of photosynthesis during boll loading was increased 38%. Leaf chlorophyll content and starch content were also increased. However, ¹⁴C tracer analysis showed that none of the carbon in lint samples was derived from the CO₂ in the irrigation water. Leaf Zn and Mn were deficient in the control plants but sufficient in the CO₂-treated plants. The CO₂-saturated irrigation increased uptake of Zn and Mn which supported a more robust photosynthetic apparatus in the treated plants. The greater photosynthetic activity during boll loading resulted in a significant increase in yield of the treated plants.

A follow-up study in a field near Phoenix was unable to show a comparable response of the cotton crop in the field in 1986.