Stress Signals: Evaluating Cellular Signals in Cotton, Soybeans, and Corn by Colorimetric Means as an Inexpensive Method of Crop Monitoring

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The project's purpose was to find an affordable way for farmers to check their crops for heat stress at the cellular level before they are mature, allowing farmers to react to the stressors prior to yield reduction. Control and heat stressed plants grown under controlled conditions at the Altheimer Lab were tested for ATP, membrane leakage, and chlorophyll levels and then compared to calcium, phosphate, nitrate, and ammonia colorimetric tests to find if there was correlation between the tests. Cotton, corn, and soybeans were grown at the high school lab under similar conditions and tested for calcium, phosphate, nitrate, and ammonia to further verify the technique. Altheimer lab average control results: calcium 19.5 ppm, phosphate 2.15 ppm, ATP 15604046.15 RLU, and boll mass 14.7 g. The average stressed results: calcium 23.2 ppm, phosphate 0.98 ppm, ATP 14306507.5 RLU, and boll mass 11.8 g. High School lab average control results: cotton calcium 4.70 ppm, corn 5.20ppm, soybeans 4.89 ppm; cotton phosphate 1.77 ppm, corn 1.03 ppm, soybeans 0.72 ppm; cotton leaf dry matter (%) 6.40, corn 11.2 and soybeans 13.0. The stressed results: cotton calcium 6.50 ppm, corn 9.70 ppm, soybeans 11.3 ppm; cotton phosphate 1.50 ppm, corn 1.08 ppm, soybeans 0.44 ppm; cotton leaf dry matter (%) 7.20, corn 9.40, and soybeans 11.4. In conclusion farmers could use the calcium to test if the plants were stressed and the phosphate to determine ATP levels, so the farmers could test for stress and reduce yield loss.

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