CAN THERMODYNAMIC LAWS DRIVE PRODUCT DISCOVERY FOR INCREASED YIELD?

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Four laws of thermodynamics define the operation of the natural world. Only recently have we seen in the literature the convergence of these physical laws with specific examples in the biological sciences. Consideration of the four laws of thermodynamics provides a fresh perspective to plant growth and development. However, the botanical literature historically shrouded references to energy transformation and utilization that are useful for thermodynamic interpretations. Discussions of resource allocation, resource partitioning, source-sink relations, remobilization, compensation, adaptation, and hardening all consider energy flux. Energy enters / leaves plant systems as heat, chemical bonds, and electromagnetic radiation. Plant growth regulators, signaling molecules and minerals modulate the passage and utilization of energy plant systems. Evaluation of temporal changes in temperature (delta T) and changes in pressure (delta P) during the growing season reveals that the delta T is largest in the spring, narrows as the season progresses and inverts near harvest. Subtle refinements in delta T that occur in vivo during the season link directly to delta P. Likewise, the magnitude of delta P starts high with winter soil moisture and spring rains, and narrows as the season progresses. We propose a functional relationship of the tenants of thermodynamics for each of the major PGRs and then extend this concept to specific minerals for the major phases of plant growth. This paper assembles clear examples of each thermodynamic law in plant physiology and further proposes by example, a rational approach to the use of these laws for intervention and manipulation of plant growth, development, reproduction, and maturation.