**Texto que deve ser traduzido**

In plant cells, mitochondria play a central role in energy production through the process of cellular respiration, converting organic molecules into adenosine triphosphate (ATP), which is essential to fuel a variety of intracellular functions. In addition, they are involved in regulatory and antioxidant functions, adjusting their activity to tolerant conditions and participating in the synthesis of crucial molecules such as amino acids and lipids. In summary, mitochondria are pivotal in plant cells, ensuring an energy supply and contributing to vital regulatory functions for healthy cellular activity.

**Texto para destacar as principais ideias**

For over a century, ecotoxicological studies have reported the occurrence of hormesis as a significant phenomenon in many areas of science. In plant biology, hormesis research focuses on measuring morphological, physiological, biochemical, and productivity changes in plants exposed to low doses of herbicides. These studies involve multiple features that are often correlated. However, the multivariate aspect and interdependencies among components of a plant system are not considered in the adopted modeling framework. Therefore, a multivariate nonlinear modeling approach for hormesis is proposed, where information regarding correlations among response variables is taken into account through a variance-covariance matrix obtained from univariate residuals. The proposed methodology is evaluated through a Monte Carlo simulation study and an application to experimental data from safflower (Carthamus tinctorius L.) cultivation. In the simulation study, the multivariate model outperformed the univariate models, exhibiting higher precision, lower bias, and greater accuracy in parameter estimation. These results were also confirmed in the analysis of the experimental data. Using the delta method, mean doses of interest can be derived along with their associated standard errors. This is the first study to address hormesis in a multivariate context, allowing for a better understanding of the biphasic dose-response relationships by considering the interrelationships among various measured characteristics in the plant system, leading to more precise parameter estimates.