Modeling Plant Growth with Mathematical Functions

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In the agriculture industry and other fields dealing with significant crop management, mathematical functions can be utilized as a tool to aid users and to streamline the growing process. By using models that track and forecast crop growth, the user will have an advantage: identification. Identification is the first step towards solving any problems that might cause inefficiencies in the crop growth process. This may include: resource minimization (water, fertilizer, pesticides, etc.), disease identification, and yield forecasting. By implementing changes in these fields, users will face major economic and logistic advantages. To create this method, I devised two different phases. In the first phase, I collected plant growth data from 3 different legume plants: red kidney beans, black-eyed peas, and black chickpeas. I then combined averages of day-to-day height to compile a singular table. Using the data, I created logistic functions where the x-axis represented time while the y-axis represented plant height. Each plant had an individual sigmoidal growth curve. The growth curves included 3 sub-phases, which included the lag phase, log-phase, and the final stationary phase. This utilizes the number “e”, a resourceful tool when dealing with asymptotic properties. In Phase 2, I grew the same test plants under the same conditions to evaluate the accuracy of the growth curves. I compared predicted values to the actual values and determined that the average accuracy was at 91.56 %, leaving only an 8.44% error margin. By proving logistic growth curves to be a highly accurate forecasting method, I can move forward to create a tool to aid users by utilizing this new technique.