Simulation-based Decision Support System in Cost Estimation for Vegetable Grafting Propagation

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In this talk, we present a simulation-based decision support system (DSS) used to estimate the grafted vegetable seedling cost (i.e. labor cost, utility cost, material cost and amortized capital investment). The proposed DSS consists of four components: 1) generic grafting propagation simulator, 2) MS Excel-based user interface, 3) input database and 4) output database. As the core component of the DSS, the simulator mimics the major stages of grafting propagation, including seeding, germination, pre-sorting grow-on, sorting, pre-grafting grow-on, grafting (i.e. manual, semi-automated and fully-automated grafting), healing, cold storage, post-grafting grow-on, and related logistics activities. The user interface allows users (e.g. propagators) to define various scenarios in terms of their facility location, facility construction cost rates, equipment models, demand pattern, and labor salary rate, as well as displays of the simulation outputs. The input and output databases are designed to store the default scenario parameters as simulation inputs and outputs from each simulation run, respectively. The proposed DSS has been validated against the empirical data, and scenario-based analyses have been conducted to estimate 1) the grafted seedling cost, 2) monthly variable cost (i.e., labor cost, utility cost, and material cost), 3) capital investment payout period, 4) the capacity of grafting department, and 5) the marginal conditions where the automated grafting economically outperforms the manual grafting. The analysis results are provided to demonstrate that the proposed DSS can be effective to help propagators evaluate different grafting propagation designs under various conditions.