

and unloading. Each will hold 96 flats.

These conveyers are housed in a 25,000 square foot glass-covered house. Above these loading conveyers are automatic carousel basket facilities with a total capacity of 15,000. Glass covering gives this facility a dual purpose. During peak season it is used as a load-out facility; off season it is used as a grow-out area.

The 88 ten-inch conveyers move flats up automatically on demand. Across the unloading end of the conveyers are three conveyor belts each going to a different truck that is being loaded. Load-out crews remove the required number of flats to fill the order and place them on one of the three belts going to the trucks. These three conveyers pass under a water-down facility, then transfer flats to a boom-type unit. This unit will extend into the hallway of shelved trucks enabling it to carry the flats to the front of that truck. Flats are then hand placed on the shelves. Approximately 20,000 flats can be moved through this system in one day.

Automation will save labor, increase plant quality and, if correctly designed, increase volume. However, a system must allow for seasonal fluctuations to remain an economical unit for operation.

USES FOR COMPUTERS IN PLANT PROPAGATION¹

DEWAYNE L. INGRAM AND THOMAS H. YEAGER

*Ornamental Horticulture Department
Institute of Food and Agricultural Science
University of Florida, Gainesville, Florida 32611*

Computers can be an effective tool in management of information and control of "real-time" events or processes. Common limiting factors to expansion of a plant propagation business are ready access to known propagation techniques for less common or difficult-to-propagate plants and the management and analysis of information gained through experience with particular plants. The optimum flexibility and management of environmental control devices may also limit the maintenance of an environment suitable for sensitive plant materials. Recent advancements in microcomputers can help in this area.

Computer programs have been written to assist in the calculation of rooting hormone formulations, calculation of dilution ratios for fertilizer injection into an irrigation system, and for storage and retrieval of propagation techniques for selected landscape plants.

¹The authors gratefully acknowledge the contributions of student programmers—YiWen Chow, Jason Goldman, Ivan Milman and Greg O'Rear, student assistants—Jane Foster, Mohammad Hamdon and Valorie Smith and systems analyst, Justine Wetherington.

Landscape Plant Propagation Information (LPPI) is an interactive computer application developed for retrieval of propagation information on several hundred landscape plants. LPPI has been written in S1032, a database manager that can be accessed through the Institute of Food and Agricultural Science (IFAS) Computer Network, available through Florida County Extension Offices. The user can list plants in the database and retrieve information on individual plants by entering all or part of the scientific or common name.

ROOTHORM is an interactive computer program that will run on IBM-PC compatible microcomputers. The user inputs a specific hormone, desired hormone concentration, and final volume. The program then calculates the ingredients needed and recommends procedures for liquid or talc formulation preparation. Specific concentrations of rooting hormones are required for optimum rooting of many difficult-to-root plants, and formulating these concentrations involves cumbersome calculations and conversions. This program eliminates the mathematical errors commonly made when calculating the volume and/or weight of ingredients in a rooting hormone formulation.

SOLUFERT and FERTDRY are also interactive programs designed to run on IBM-PC compatible machines. They both calculate the dilution ratios necessary to obtain the desired concentrations of nitrogen, phosphorus, and potassium in the irrigation water. FERTDRY is to be used when dissolving dry fertilizers for injection and SOLUFERT is used when fertilizers are purchased as solutions. These are production aids that allow the nursery operator to make error-free calculations that are performed routinely.

LANDSCAPE PLANT PROPAGATION INFORMATION RETRIEVAL SYSTEM

Propagation information has been collected from scientific publications, plant propagation publications, and communications with experienced nursery operators. The database contains general descriptive information on each plant, the primary and secondary means of propagating the plant and important techniques to consider in each suggested propagation method. Possible propagation methods include cuttings, seed, layering, grafting and budding, and division. The information on each plant may be incomplete but reflects information collected to date. The database will be continually updated as additional information is obtained. Allowing each user to access the latest version of the database is the primary advantage of a database within a computer network. The restricted access imposed by such a system is a disadvantage. However, when the database becomes more complete, the information may be distributed by other methods.

LPPI can be accessed from the Ornamental Horticulture Sub-

menu of the IFAS-VAX MENU. The program has been written to take advantage of the features of a DEC VT-100 terminal. If accessed by another terminal it should run but the presentation may be incorrectly formatted. A brief abstract is presented each time a user calls the program and the program is menu-driven.

The user may retrieve information by specifying the scientific or common name of a specific plant if the correct spelling is known. Otherwise, the user may elect to search for a plant in the database by entering a portion of the scientific or common name. A list of plant names with the sequence of letters entered will be displayed and the user may then enter the complete scientific name of the desired plant to obtain available propagation information.

CALCULATING ROOTING HORMONE FORMULATIONS WITH A MICROCOMPUTER

Although rooting hormones of various concentrations can be purchased, it is often desirable to formulate liquid or talc materials of concentrations different from those commercially available. Preparing-your-own may also be more economical if the nursery consumes large quantities of rooting hormones. This program allows the inclusion of IBA, the potassium salt of IBA, NAA, and the sodium salt of NAA. The program takes into consideration that IBA and NAA are relatively insoluble in water and must be dissolved in alcohol before adding water. ROOTHORM formulates concentrations of IBA and NAA of 8000 ppm or less in 25% alcohol and concentrations greater than 8000 ppm in 50% alcohol. These alcohol contents will allow the hormones to stay in solution at room temperature.

The salts of IBA and NAA are soluble in water and little or no alcohol is required. The salts are more expensive than pure compounds and contain less active ingredient on a weight basis. The potassium salt of IBA is only 75% as active as the pure compound and the sodium salt of NAA is 90% as effective as pure NAA. These facts are considered in the options and calculations provided in ROOTHORM.

Each time the user runs ROOTHORM the option of reading the abstract and general instructions is provided. The user must then choose to calculate a liquid or talc formulation and the specific hormone or combination of hormones and the desired concentration(s) to be included. The type of measuring equipment available differs widely from nursery to nursery. Therefore, the user may choose the units of measure for the weight of hormone to be included and the final weight or volume of the formulation. After the final volume or weight is entered into the program, the amounts of individual components are calculated and presented on the screen or they can be printed. A step-by-step preparation procedure is also given.

DILUTION CALCULATIONS FOR INJECTING FERTILIZERS THROUGH IRRIGATION

The user must know the analysis or grade of fertilizer or fertilizer component to be injected (example 16-4-8); the desired parts per million (ppm) of nitrogen, phosphorus or potassium, the amount of these elements occurring naturally in the irrigation water, the dilution ratio(s) of the injector and the total volume of the mixing tank. In addition, the weight/volume ratio of the solution fertilizer is required for the SOLUFERT program. This is simply the pounds of fertilizer per gallon of solution that can be obtained from the manufacturer.

FERTDRY allows the user to make calculation for injection of blended dry fertilizers such as Peters' or Miller's 20-20-20 or calculations may be made for dissolving individual fertilizer compounds such as ammonium nitrate and calcium nitrate for injection into irrigation water. A list of fertilizer compounds suitable for injection is provided in the program. The user simply chooses from this menu and enters the appropriate information as outlined above when prompted by the computer program.

In SOLUFERT, if the dilution ratio of the injector does not allow for the direct injection of the fertilizer solution into the irrigation system, the program will indicate how to dilute the concentrated fertilizer before injection. Step-by-step procedures are given to help the nursery operator implement the output from these calculations.

COMPUTER SOFTWARE AVAILABILITY

ROOTHORM, SOLUFERT AND FERTDRY can be purchased from the Editorial Department, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611. The current price for each software program and documentation is \$20. There are other software packages that have been produced by the University of Florida that might be of interest to nursery operators. A complete listing of those can be obtained by contacting the Editorial Department at the same address.