ment. Among them, INITIATIVE, a willingness to take on responsibility and DEDICATION to the pursuit of excellence.

A few aspects of propagation a newly employed college graduate should know upon getting into his career, would be: knowledge of rooting media, methods of environmental control, auxins, timing of cutting harvest, preparation of cuttings, direct rooting vs. bed rooting, ability to synchronize work for year round schedules, fertility control, pH needs, and disease control. There are many many others.

Other things which are considered by employers are poise, warmth, personality, business sense, dependability, skill and punctuality. These cannot be taught easily — usually they're learned away from the school environment. Just where it starts, I don't know, perhaps at home or by a teacher who ignites the fire.

The universities are contributing greatly to mankind, but the individual, if he or she is to succeed, must match it with personality, desire and determination.

TEACHING PLANT PROPAGATION LABORATORIES: VEGETATIVE PROPAGATION

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To be effective, plant propagation at the collegiate level must be designed as a lecture-laboratory course. The lecture-laboratory teaching mode enables students to acquire knowledge and become proficient with the fundamental skills and concepts involved in propagating horticultural crops.

Plant propagation in most universities is taught at the sophomore level, with few of the students having had the benefit of a practical nursery or propagation experience. In fact, more than 60% of today's undergraduate students are from urban backgrounds and may be experiencing propagation of plants for the first time. Consequently, laboratory projects must be designed to demonstrate the simplest concepts in regard to both asexual and sexual propagation.

Initially, the students need to become acquainted not only with the plants to be propagated, but also with the equipment needed. Secondly, by conducting simple projects on the evaluation of rooting media or the effects of juvenility, wounding, or leaf area on root regeneration, the learning process can be reinforced to compliment the lecture material. Thirdly, labóratory projects or exercises should provide the opportunity to develop the basic propagation skills such as cuttage, grafting, budding, layering, propagation of specialized structures, and tissue culture, which are practiced in the industry.

In addition to the laboratory projects conducted at the university, it is extremely beneficial to arrange a tour of a commercial nursery where many of the demonstrated skills and practices can be viewed firsthand. For the greatest benefits, this tour should be in the latter part of the school term.

In teaching plant propagation, I have traditionally begun by introducing students to the intermittent-mist system during their initial laboratory session. This has been coordinated with lecture material (generously illustrated with slides on the construction and design of an intermittent-mist system) which includes a description and discussion of the equipment required, such as strainers, solenoid valves, types of mist nozzles, and mist-controlling devices.

It has next been a practice to take these same students on a tour of the university propagation facilities to see firsthand the equipment in the intermittent-mist bed, only to find the students confused and bewildered. Lastly, inorder to reinforce the learning process and to be sure the students fully understand the concepts of the intermittent-mist system, I ask them to design and prepare an itemized cost estimate for installing an intermittent-mist system, given some standard information, such as the propagation bed dimensions and location of the nearest water supply. During the course of the laboratory project the student is asked to:

- Prepare a rough sketch of the proposed intermittent-mist system.
- Calculate the total cost of the delivery equipment, including pipe, elbows, tees, unions, caps, solenoids, nozzles, and strainers needed to complete the system.
- Calculate the total cost of the various electrical mist-controlling devices, including time-clock controls, mist-a-matic, and electronic leaf systems.

To complete the project, I supply catalogs from the major horticultural supply houses and have examples of the various component parts of the intermittent-mist system in the laboratory classroom for student use and inspection. Students are asked to

prepare an itemized list of equipment necessary to build the system, including source of supply, item number, description, price per unit, quantity, and total cost as one might expect in preparing a purchase order.

At the completion of the project, students are asked to indicate which of the control systems they might use in their own nursery or greenhouse operation and why. Generally students choose the system that provides maximum flexibility at the least dollar cost.

I have observed that following this laboratory project, the intermittent-mist propagation facility simply is not taken for granted, but that students have a measure of respect for the costs and sophistication of the technology involved in vegetative propagation of cuttings. While I would be the first to admit that the next logical step would be for the students to gain hands-on experience by building an intermittent-mist system, that has not been possible with propagation classes often exceeding 100 students.

Once such understanding of the intermittent-mist system has been achieved, a number of additional laboratory projects have been developed to acquaint students with the other aspects of vegetative propagation. For example, the following laboratory projects have been designed to illustrate factors influencing root initiation and development on cuttings.

- Influence of leaf area at the time of propagation on subsequent root development.
- Reduction of water loss in cuttings and its effect on root development.
- The effect of cutting size and type of wood on root initiation and development.
- The effect of tissue age on root initiation and development.
- The effect of growth regulator concentrations and duration on root initiation and development.

All of the above laboratory projects are designed to illustrate one or more factors that influence root initiation and development. In most of the projects, we use plants that root quickly, like chrysanthemums, coleus, ivy, forsythia, or firethorn, so the students can see a response clearly and quickly. This also allows students to complete the laboratory project within 2 to 6 weeks, thus quickly reinforcing the lecture material, which is extremely important when teaching propagation on the quarter system.

Lastly, a series of laboratory periods are devoted to demonstrating and giving students the opportunity to develop their skills in cutting propagation, grafting and budding, air-layering, propa-

gation of specialized stems, and tissue culture. The intent of all these laboratory projects and demonstrations is to acquaint students not only with the skills necessary to perform the task, but also to be sure they understand the terminology, the type of plant material used, the time of the year the task is performed, and the success rates that might be achieved.

It must be understood, however, that students completing a plant propagation course in 10 to 16 weeks are in no way highly skilled propagators. These laboratory projects are meant to acquaint them with the art and science of plant propagation, and to give them the knowledge that years of hard work lie ahead to become a highly skilled propagator.

As we do our job of teaching plant propagation, we hope more young men and women are encouraged to become involved in plant propagation as their life's vocation and avocation. There is, of course, no more noble profession!

TEACHING HERBACEOUS PLANT PROPAGATION LABORATORIES

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IMPORTANT PRELIMINARY CONSIDERATIONS

In teaching plant propagation laboratories, or for that matter, teaching laboratories of any sort, the objectives of the exercise must be clearly stated. Does the exercise teach a practical propagation technique? Does the exercise teach important priniciples of propagation? It is important that these objectives be clearly stated and that evaluation of the results be assessed in relationship to these objectives at the conclusion of the experiment.

Another important consideration is the students' preparation prior to beginning the exercises in question. It is important that they have adequate opportunity to learn fundamentals of plant science, including plant structure and functions. They should also have a reasonable knowledge of the equipment and materials required for completion of the exercise. These fundamental concepts can be taught through the vehicle of prerequisite courses or through the preliminary parts of the propagation course that precede these exercises.

For any exercise that is to be used, it is important that the instructor test it him/herself. It is important that the exercise