Controlled Humidification as an Aid to Vegetative Propagation

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Many factors are involved in the successful propagation of plants by cuttings. As a basis for the consideration of the factor of humidity, some discussion of the over-all picture of vegetative propagation by cuttings is apropos. Perhaps it can be said that all dicotyledonous plants can be rooted from cuttings, providing the right combination of internal and external factors is attained. Successful rooting of cuttings is dependent upon the careful manipulation of external conditions to fit the internal conditions.

The important internal factors for successful rooting of cuttings can be divided into two groups, anatomical and physiological. The anatomical factors are the healing of the wound made in making the cutting and the presence of root initials or the ability to form them. Roots on softwood cuttings of many plants follow definite patterns, which should be considered in making cuttings. The important physiological factors are food supply, consisting mostly of starches, sugars and amino acids; hormones; water, and some unknown or unclassified factors which can be designated as factor X.

Both the anatomical and physiological factors are variable in plants. The successful propagator realizes this fact and tries to select and handle cuttings in such a way as to offset deficiencies that exist or may develop.

External factors involved in the rooting of cuttings can also be divided into two groups, environmental and cultural. The important environmental factors are water of the rooting medium and of the atmosphere, oxygen, temperature and light. Some of the cultural factors are rooting mediums, leaf reduction, the use of synthetic growth substances and the position of the basal cut. While these and other cultural factors are important, it is probable that they are not so often limiting to successful rooting as the environmental factors.

HUMIDIFICATION CONTROL

Of the environmental factors, water has been the most difficult to control. It is important in all physiological processes. Normally, water is absorbed by the roots and travels through the stem to the leaves, where ninety-five to ninety-seven per cent is lost by transpiration. With cuttings, little water is absorbed from the rooting medium. This amount may be only a few cubic centimeters per cutting until the cuttings are rooted. Since little water is absorbed, it is highly important to prevent water loss from the foliage. The best method of preventing this water loss is by maintaining high humidity. It is also necessary to maintain a moist medium to prevent drying of the base of the cuttings after they are stuck. An optimum moisture content of the rooting medium appears to be about fifteen to nineteen per cent.

Several types of humidifiers have been used to increase humidity. These humidifiers may be classified into several groups, such as mechanical centrifugal atomizers powered by electric motors or water turbines, water under pressure, both air and water under low pressure and compressed air for the atomization of the water.

Atomizers of the centrifugal type operate on the principle of a turntable revolving at high speed, which throws off droplets of water against a baffle, thus producing a fine mist. Electrically driven units cost from $50 to $150 each. If the cost of pipe, strainers, humidistats and installation is added, it would run the cost of this equipment to approximately 25 to 55 cents per square foot of greenhouse floor area. Some of these units use from one to two quarts of water per hour, while others, of the turbine type, may use eight to ten gallons per hour.

Humidification may be obtained by forcing water under pressure of sixty to seventy pounds from nozzles. With some types, the water from the nozzles is forced against a baffle plate, which breaks it into mist form. Nozzles of the first type, with connections, will cost about 10 cents per square foot. A large amount of water is used by nozzles of the first type. Equipment which forces water against a baffle uses around two and a half to three gallons of water per hour under seventy pounds' pressure.

Humidification may be obtained by using both air and water under low pressure. From one to twelve gallons of water per nozzle per hour is used, depending upon the size of the aperture.

At Ohio State University use has been made of the so-called Binks system of humidification. The operating principle of the Binks system is merely the passing of a stream of compressed air over a column of water, so that the water is picked up and distributed in the form of a fine mist from a Binks nozzle No. 164. These nozzles are available from the Binks Manufacturing Company of Chicago, Illinois.

Nozzles along the air pipe are placed about fifteen feet apart. In a 10-foot-wide house one line is sufficient. Under fifty pounds' pressure about two and one-half quarts of water per nozzle per hour is used. With humidistatic control, the humidity can be held fairly constant at medium or high percentages. Details of the installation can be obtained by writing to the Department of Horticulture, Ohio State University, Columbus, Ohio.

A commercial company recently installed the Binks system in two greenhouses, 25x100 feet, at a cost of approximately 22 cents per square foot of greenhouse floor area. This cost included equipment, humidistats and expense of installation. The system is somewhat expensive for small installations because of the cost of the compressor.

Limited tests at Ohio State University have shown that a constant humidity of seventy-five to eighty per cent is satisfactory for evergreen cuttings handled in greenhouses during the winter. Eighty-five to ninety per cent humidity is about optimum for softwood shrub cuttings handled in greenhouses during the summer. Optimum humidities will vary with different varieties and species of plants and with the rooting medium used.

The benefits of controlled humidification can be enumerated as better rooting, less loss of cuttings from disease, less labor involved in making and managing the cuttings under high humidity and the commercial propagator can use his greenhouses for softwood cuttings of shrubs during the summer months.

Chairman Scanlon: Thank you Chad. We will now proceed to the final paper on the program. It is a pleasure to introduce Dick Fillmore of the Arnold Arboretum.