Rooting Regulators and Managed Cuttings Production

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INTRODUCTION

There is an increasing demand for plants of better quality and uniformity with customers demanding large consignments of uniform, visually attractive, and high-quality plants. Such requirements can only be met by growers who start out with high-quality raw materials — and the raw materials include cuttings. However, many growers encounter problems during rooting and growing-on that are a result of using poor quality cuttings. From my experience as a technical adviser I would say that more than 50% of the growing problems growers experience come from poor uniformity and poorly rooted cuttings.

It is of incalculable value for growers to have confidence in their raw materials. This reliability applies, of course, to pots, growing media, fertilisers, greenhouses, climate-control systems, heating, and so on. These items are well organised at most nurseries and, probably because they have traditionally been supplied by third parties, and in a competitive market, quality and price regulate themselves. The only raw material usually produced within the nursery itself is the cuttings so market forces have had less of an impact on quality and cost.

IMPORTANCE OF STOCK PLANTS

The starting point for high-quality cuttings has to be the parent plant or stock plant. Good quality cuttings cannot be obtained from plants growing in a strip of public landscaping along the highway or in a cemetery. Neither can they be obtained from the old plants or hedges growing around the nursery.

Top-quality stock plants need to be grown in a greenhouse especially devoted to their needs where the grower can regulate the growing conditions to provide the best possible environment for the production of cuttings.

The stock plants themselves should be grown from cuttings especially selected for the purpose, with this selection being based on rooting ability, vigour, susceptibility to disease, ornamental value, and so on. Such selection can be an ongoing process so that the stockplants are continually refined as new material becomes available. Your stockplants are, if you like, your "secret weapon" of production.

Another option is to start every year, or production season, with newly selected material that has been propagated by means of tissue culture.

Although outside our own industry, Dutch chrysanthemum (*Dendranthema*) propagation and selection nurseries are a good example of what can be achieved when appropriate attention is paid to stock plants. These nurseries are specialised in propagation from cuttings, each one producing hundreds of millions of cuttings on a year-round basis. In that industry, chrysanthemum parent plants are harvested twice a week to keep the cuttings uniform. If the cuttings are not needed, they are either stored temporarily or destroyed. For many cultivars, cooling and brief storage has a beneficial effect on rooting. The chrysanthemum parent plant ages quickly, and produces cuttings for only 17 weeks.

But is the Dutch way of growing cuttings really affordable? Well, for chrysanthemum cultivation, the price for a rooted cutting has been fairly constant for more than 25 years: between 10 and 15 Dutch cents. Yet the quality of the cuttings has continually improved.

When all the factors are accounted for, a properly produced cutting should not cost more than 10 to 15 cents unrooted. The advantage of improved rooting, faster growth, less susceptibility to disease, and less wastage makes it cost effective for every grower.

THE ROOTING PROCESS

Even a superior quality cutting produced as outlined above will have received only a limited supply of energy from the stock plant. Once separated from the parent plant, the energy required for basic respiration, plus the energy required for rooting, makes demands on the energy reserves stored in the cutting, together with whatever energy it can obtain through photosynthesis. The propagator's job is to provide the right conditions so that as much energy as possible goes into rapid root formation.

If subjected to variable or unfavourable conditions, the cutting will lose much of its valuable reserves in simply staying alive and have less energy available for rooting.

Important Factors for Rooting. The following factors need to be optimised to keep cutting stress to a minimum: temperature, oxygen, water, humidity, carbon dioxide, light, and rooting hormones.

Temperature. Soil temperature has an immediate effect on how fast the cutting roots. The higher the temperature, the faster the rooting, but a safe temperature is 20 to 25C. The temperature of the air may be 5C lower than the soil temperature during root induction. This reduces the activity taking place in the plant's aerial parts and makes all the energy available for the rooting process. It is also advantageous to lower the temperature 5C for 6 to 8 h at night. This reduces the respiration rate during the period when the plant cannot restore its energy levels through photosynthesis.

Oxygen. Oxygen is necessary for the cell division process at the base of the cutting during root formation. This means that propagators have to use a rooting medium with sufficient aeration to allow a constant supply of oxygen to support this cell division process. Sphagnum peat, particularly Finnish peat, is an example.

Water. Water is needed for the transport of minerals from the growing medium into the cutting; for the movement of assimilates of photosynthesis and plant hormones around the plant; for maintaining cell turgor; for temperature regulation; and as a raw material of photosynthesis. The availability of water is thus essential for root formation. A dry cutting substrate causes cell death and encourages black rot and excessive callus growth. The moisture must also be easily available since the cutting still lacks roots to absorb the water.

Humidity. Maintaining a high humidity prevents the cutting from losing moisture. It also allows the leaf stomata to remain open for maximum photosynthesis.

Carbon Dioxide. Carbon dioxide is the second raw material for photosynthesis and thus must be provided in measured amounts in the enclosed space being used for rooting activity. In general, a concentration of 500 to 800 ppm is sufficient.

Light. Light is essential to provide the energy for photosynthesis but light has a by-product, warmth. The propagator wants to maintain an air temperature of between 15 and 20C so it is important to screen out excess light during the day. However, as the optimal day length is 16 to 18 h, it will be necessary to use supplementary lighting.

Rooting Hormones. Using rooting hormones will quicken and improve rooting and will produce a more uniform rooted cutting.Uniform rooting is extremely important, as the propagator can then determine exactly when all cuttings are rooted. It also means the environment can be adjusted to time the crop.

Quick rooting is necessary because the cutting only has a very limited amount of energy.

Better rooting means more roots around the base of the cutting. The more stem vascular bundles that have their own root, the better the plant can develop.

NEW DEVELOPMENTS

To obtain more knowledge about the best possible conditions for the growth of plants, it's necessary to be able to take exact measurements and record them accurately. There are recording instruments and data loggers available that can measure and record every conceivable process going on, in, and around the plant. This information can be compared and interpreted in computer models. With this information, we can develop growth models to use for more efficiency in rooting and growing plants.

CONCLUSION

In the coming decades, the underdeveloped fields of cutting quality, and of rooting of cuttings, will have to be the focus of more attention. The lack of high-quality cuttings and good rooting environments are underestimated factors. New developments, however, are making it technically and economically feasible to construct environments where the best possible rooting of cuttings can take place.