BY ERIK RUNKLE

Managing Light to Improve Rooting of Cuttings

The characteristics of a high-quality liner vary somewhat from crop to crop and intended use, but generally, the goal is to produce cuttings with a well-developed root system in a short period of time. Successful rooting of cuttings requires careful management of the environment, especially air and media temperature, humidity and light. Misting or fogging should be managed, based partly on light intensity, to ensure leaf surfaces don't dry before roots are established, and then the frequency should be decreased as the root system develops.

Light and temperature primarily drive the rate of root development. In a previous column, I discussed managing temperature during propagation (www.gpnmag.com/article/managing-temperature-during-propagation). Managing light is at least as important because inadequate light delays rooting while too much light can excessively increase leaf temperature and cause plant stress. Managing light in a greenhouse is also more challenging because solar radiation is always changing. Many growers can improve the rooting of cuttings by more closely managing light during propagation.

Figure 1. The successful rooting of liners requires careful management of light on both an instantaneous and cumulative basis. In northern locations and from autumn through spring, use of retractable shade curtains and supplemental lighting, usually operating at different times, elicit the best results.

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Manage light on an instantaneous basis. Light provides the energy for callus formation and the subsequent generation of adventitious roots. At the same time, light increases plant temperature and accelerates the drying of leaves, which can quickly dehydrate cuttings. (Under LEDs, this would be less of an issue.) Therefore, the instantaneous light intensity during the early rooting phase should be quite low (but not dark) and then increased as roots develop. Managing instantaneous light levels is especially important during the first week of propagation because of the vulnerability of unrooted cuttings, and also because this first week strongly influences the ultimate success of producing high quality liners.

A suggested maximum light intensity is between 100 to 150 $\mu mol \cdot m^{-2} \cdot s^{-1}$ from the time cuttings are stuck until the initial roots form (a few millimeters in length), which is usually the first five to seven days of propagation. A retractable screen is best so that it can be opened during cloudy conditions. Supplemental lighting that delivers 50 to 70 $\mu mol \cdot m^{-2} \cdot s^{-1}$ for up to 18 hours per day is recommended during low-light conditions. Therefore, both shading and supplemental lighting are often needed from fall through spring, usually operating at different times (Figure 1). The frequency of misting or fogging should be adjusted based on the light levels, with greater frequency under higher light and vice-versa. Identifying this mist/light relationship can greatly improve rooting.

Once roots have begun to form, light intensity can be increased to a maximum of 200 to 300 $\mu mol \cdot m^{-2} \cdot s^{-1}$ for the next four to seven days as the roots develop. Plants can tolerate even more light when half of each liner cell is rooted, approximately 10 to 14 days after stick for many herbaceous crops. When other factors are closely managed, most herbaceous cuttings can be well rooted within three weeks.

Don't ignore the daily light integral (DLI). During propagation, light should be primarily managed based on the instantaneous intensity, but the DLI should also be considered. Research at Michigan State and Purdue universities has shown that rooting of many crops is delayed when the DLI is less than about 4 or 5 $mol \cdot m^{-2} \cdot d^{-1}$. Therefore, monitor the DLI to ensure crops are receiving enough light on a cumulative basis.

During propagation, light should be diffuse. Light intensity should be as uniform as possible during propagation, which can be accomplished by diffusing sunlight. Diffuse light creates a more uniform light environment both horizontally and vertically within a liner tray. Light can be diffused by application of a shading compound to the glazing or by a shade curtain. Other glazing materials such as double poly already scatter the light, although the degree of diffuseness varies from one material to another. To determine how well light is scattered in your greenhouse, use a light sensor and watch the values change as you walk around the propagation area on a sunny day. If the values change by more than 25 percent or so, or if you can see shadows in your greenhouse, consider a method to scatter sunlight to make the light environment more uniform without excessively shading the crop. This will eliminate bright "hot spots" and improve the uniformity of rooting. gpn