Successfully Propagating **Yellow Petunia Cultivars**

Finicky yellow petunias require ample nutrition through aggressive fertilizer use during propagation.

by **ROBERTO G. LOPEZ, CHRISTOPHER J. CURREY** and **JASON FATTEN**

EACH year, greenhouse growers are challenged with propagating and growing hundreds of new bedding plant cultivars released by plant breeders worldwide. Over the past several years, growers have experienced challenges propagating and finishing a number of vegetatively propagated petunia cultivars, specifically those with yellow flowers. Cuttings of these cultivars would often root well but toward the end of liner production, they lose vigor, turn yellow, develop necrotic (brown) shoot tips and/or die (Fig. 1).

Furthermore, during the finish stage, a small percentage (5 to 10 percent, sometimes more) of the plants would appear stunted, have low vigor and most often had to be removed from the combination planters or cell packs (Fig. 2). These unexpected problems posed significant losses for both greenhouse growers and breeding companies.

Observations in commercial greenhouses strongly suggested nutrition during propagation could play a significant role in reducing the yellowing, necrosis and loss of vigor of these cultivars during propagation. In order to investigate if this was indeed the case, research was conducted at Ball Horticultural Co. in West Chicago, Ill., and at Purdue University through the support of the Fred C. Gloeckner Foundation.

Purdue Research

Unrooted cuttings of eight yellow flowering petunia cultivars were shipped from Ball Horticultural Co., the Dümmen Group, Fides-Oro, Proven Winners and Syngenta Flowers to Purdue University.

Cuttings were stuck in 105-cell liners containing a mix of 50 percent soilless substrate and 50 percent perlite with 0, 5, 10 or 15 $g \cdot L^{-1}$ (corresponding to 0, 8.4, 16.9 or 25.3 $lbs \cdot yd^{-3}$) controlled release fertil-

Figure 1a. Growers have found that cuttings of some yellow petunia cultivars often root well, but toward the end of the liner rooting stage, they can lose vigor, turn yellow, develop necrotic (brown) shoot tips and/or die.

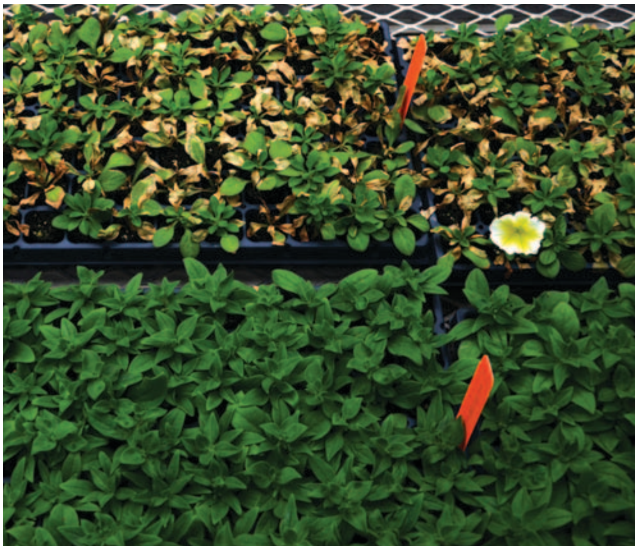

Figure 1b. Trays of yellow petunia cultivars exhibiting extreme symptoms (top) compared to other colored cultivars (bottom).

Figure 2. Growers have also found that after transplant, some rooted yellow petunia cultivars can appear stunted, have low vigor and most often have to be removed from the combination planters or cell packs.

izer (CRF; Everris 15-9-12 Osmocote Plus with micronutrients) incorporated into the rooting substrate immediately preceding sticking.

Additionally, one group of cuttings with no CRF in the substrate was provided mist consisting of acidified tap water that was supplemented with a complete water soluble fertilizer (WSF; Jack's LX 16N–0.94P–12.3K Plug Formula for High Alkalinity Water; J.R. Peters, Inc.) and micronutrient supplement (Compound 111; Scotts Co.) providing with each misting event: 60 ppm N, 6 ppm P, 47 ppm K, 11 ppm Ca, 6.24 ppm Mg, 0.25 ppm B, 0.123 ppm Cu, 1.528 ppm Fe, 0.347 ppm Mn, 0.091 ppm Mo and 0.211 ppm Zn.

During callusing and rooting, cuttings were grown under a daily light integral of 5 and 7 $mol \cdot m^{-2} \cdot d^{-1}$, respectively, provided by high pressure sodium lamps from 6 a.m. to 10 p.m. and substrate temperatures of 73°F.

Ball Research

In the spring, after seeing leaf yellowing of petunia cuttings at grower operations during the rooting process, we decided to ship cuttings of three cultivars to Ball's West Chicago facility for testing. We stuck the cuttings in a standard soilless rooting substrate with a pH of 6.3 and E.C. of 1.0, and placed them into our propagation greenhouse. Mist in this greenhouse has calcified reverse osmosis water, controlled by vapor pressure deficit set to minimize leaching of the substrate, which is really important during propagation.

Tissue samples of cuttings were harvested at stick (day zero) and two, six, eight and 13 days after sticking cuttings. Shoot tips, including the youngest leaves and growing points, and mature leaves were separated and sent for tissue nutritional analysis to Quality Analytical Laboratories in Panama City, Fla.

Research Findings At Purdue

As the amount of CRF incorporated increased from 0 to 15 $g \cdot L^{-1}$ or 60 ppm WSF was applied, the visual quality of rooted yellow petunia increased from se-

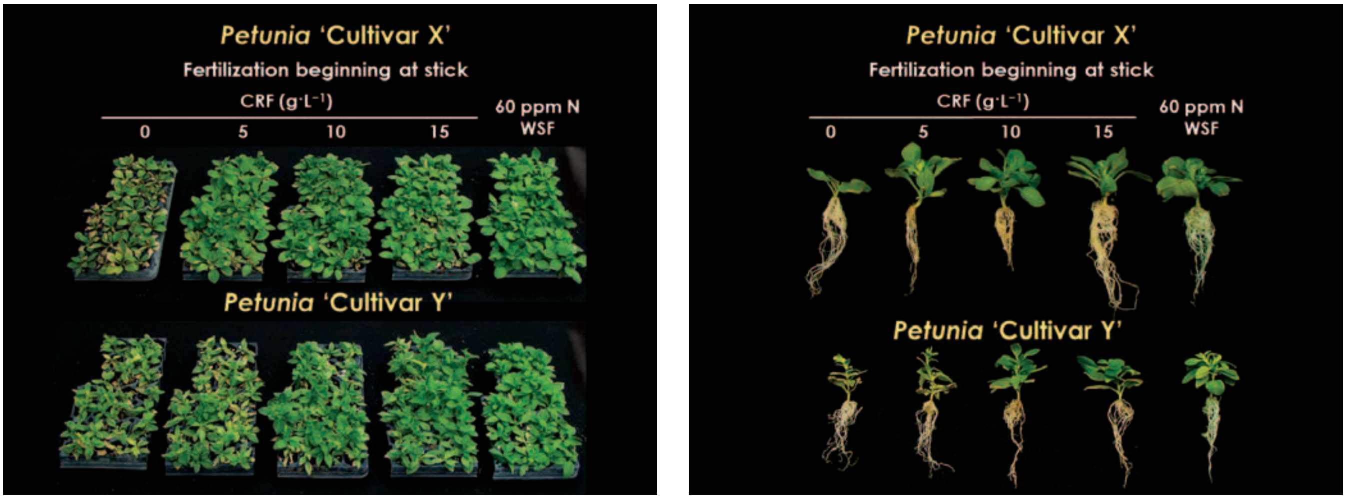

Figure 3a and b. As substrate incorporated with controlled release fertilizer increased from 0 to 15 $g \cdot L^{-1}$ or 60 ppm water soluble fertilizer, the visual quality of rooted yellow petunia increased from severe necrosis or death to green, little or no yellowing or necrosis. Photo taken three weeks after sticking.

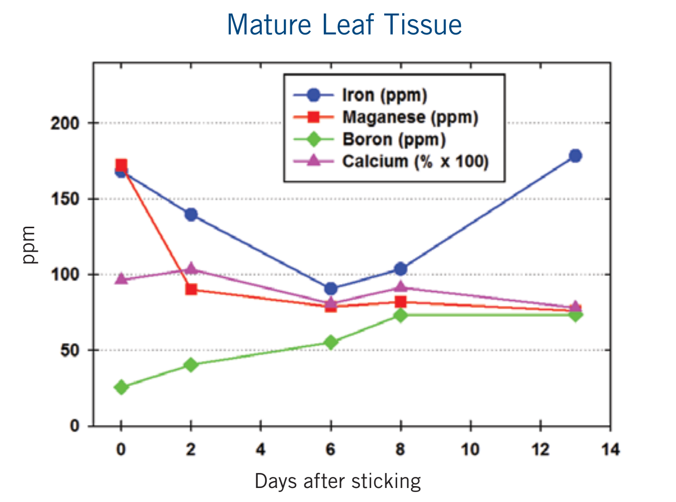

Figure 4. **Petunia cutting mature leaf tissue iron (Fe), manganese (Mn), boron (B) and calcium (Ca) at stick (day zero) and up to 13 days after stick. Note that Fe and Mn content decreases in cuttings after sticking, and begins to increase after roots begin to form.**

vere necrosis or death for unfertilized to green cuttings with little or no yellowing or necrosis (Fig. 3). While shoot dry mass increased with fertilization, root dry mass either remained the same or decreased slightly with increasing fertility during propagation. However, the fertilized cuttings were still considered well-rooted.

One of the main effects of increasing the amount of CRF in the propagation mix was the enhanced development of side shoots. Yellow petunias propagated with high rates of CRF either maintained the growth of the main growing point or greatly enhanced the development of side shoots to compensate for an aborted stem tip.

Research Findings At Ball

Within the first couple of days after sticking, nutrient content of the unrooted cuttings quickly decreased. For example, nutrients such as iron, manganese and calcium (Fig. 4 and 5) fell drastically from stick (day zero) to day two in both mature leaves and shoot tips. After the cuttings had callused and began to form roots (day six), they were then able to uptake nutrients from the substrate. In this case, it took eight to 13 days to match or exceed the nutrition content of unrooted cuttings.

Although many nutrients are necessary for successful rooting and plant development, we will focus on the role of just a few of them. First, iron and manganese are important in growing petunias. High pH will limit availability of these nutrients and iron or manganese deficiency can cause chlorosis. It has often been thought that iron deficiency is the cause of yellowing; however, we found the ratio between iron and manganese is critical. We found cuttings appeared healthy with an iron to manganese ratio of 1:1. We also found that manganese was generally deficient more frequently than iron.

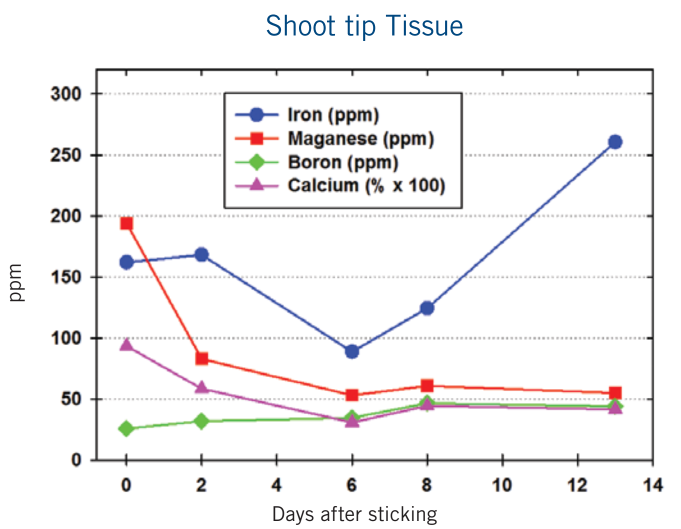

Figure 5. **Petunia cutting shoot tip tissue iron (Fe), manganese (Mn), boron (B) and calcium (Ca) at stick (day 0) and up to 13 days after stick. Note: Tissue boron increases in shoot tips signifying transpiration is taking place while calcium is decreasing in shoot tips after sticking. Calcium, which is needed for cell growth, is limited in shoot tips after sticking.**

Additionally, boron and calcium are essential for shoot tip and leaf development. Boron and calcium are only mobile in water and can be indicators of problems related to water uptake and transpiration. It is not uncommon for propagation areas to maintain warm temperatures and high humidity while outdoor light levels are low (i.e. during the winter and early spring). To promote transpiration and uptake of mineral nutrients, HAF fans should be used in propagation areas while maintaining high humidity or low vapor pressure deficits to maintain cutting turgor and avoid wilting.

Provide Ample Nutrition When Rooting Yellow Petunias

The research at Ball and Purdue highlight the apparently challenging nutritional requirement of yellow petunias in propagation. We can conclude that petunias, especially challenging cultivars, should have ample nutrition available in the substrate between days four to six when roots begin to form, in order to avoid the problems we have illustrated. Therefore, cuttings of yellow petunia cultivars should be rooted using an aggressive fertilizer program that supplies not only higher levels of nitrogen but micronutrients, as well. **GG**

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