Fertilization of Bedding Plants: Constant Fertilizer Concentrations Versus Constant Growing Medium EC

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Index Words: Petunia, *Petunia xhybrida*, Begonia, *Begonia xsemperflorens*, Fertilizer, Electrical conductivity, EC

Nature of Work: In recent years, there has been a change in the approach to fertilization of bedding plants. Traditionally, recommendations for fertilization of bedding plants have focused on which concentration of fertilizer to apply. Recently, the focus of fertilization guidelines has shifted from applying optimal fertilizer concentrations to maintaining the electrical conductivity (EC) of the growing medium within an optimal range. The optimal EC of the growing medium is likely to be much less sensitive to environmental conditions than the optimal fertilizer concentration (Kang and van Iersel, 2001). The disadvantages of trying to maintain a constant growing medium EC are that it requires regular measurements of growing medium EC, which can be time-consuming, and that fertilizer concentrations may have to be changed periodically to maintain the EC within the required range.

Surprisingly, there has been no research comparing the effects of these two fertilization strategies (constant fertilizer concentration and constant growing medium EC) on the growth of greenhouse crops. Therefore, the objective of this experiment was to determine whether maintaining a constant growing medium EC results in better growth than constant fertilizer concentrations.

Plug seedlings of wax begonia ‘Cocktail mix’ and petunia ‘Gnome white’ were received from Speedling Greenhouses on April 4, 2002, and transplanted into 4" pots filled MetroMix 300 growing medium. The seedlings were placed on 4' x 8' ebb-and-flow benches, where they were subirrigated daily with a solution of water-soluble fertilizer. Fertilizer solutions were made with Peters 20-10-20 Peat-lite special water-soluble fertilizer with an EC of 0.5, 1.5, 2.5, 3.5, 4.5, or 5.5 mS/cm (corresponding to approximately 50, 200, 350, 500, 650, and 800 ppm N). The EC of the fertilizer solutions was measured weekly and adjusted as needed.

Plants were either subirrigated with the same fertilizer solution throughout the growing period or we tried to keep the EC of the growing medium constant at 0.5, 1.5, 2.5, 3.5, 4.5, or 5.5 mS/cm. To do this, leachate EC of two (begonia) or three (petunia) plants per experimental unit was measured twice weekly, using the pour-through method. Plants were moved to another bench with higher or lower fertilizer EC, if necessary to keep the leachate EC within the desired range.

Dry weight of the plants was measured at regular intervals throughout the growing period. The experimental design was a randomized complete block with a split-plot (constant fertilizer of growing medium EC), six treatments (EC levels) and two replications. The data were analyzed by regression analysis. To determine the effect of fertilizer or growing medium EC and plant age on the dry weight (DW) of the plants, a polynomial model, including an interaction term, was used:
$DW = \beta_0 + \beta_1 xEC + \beta_2 xDAT + \beta_3 xEC^2 + \beta_4 xDAT^2 + \beta_5 xEC^3 + \beta_6 xECxDAT$,
where: β_0, ..., β_6 are regression parameters, EC is either the EC of the fertilizer solution, or the target EC of the growing medium, and DAT is days after transplanting. This regression equation was used to estimate the EC resulting in maximum growth.

Results and Discussion: The EC of the growing medium of petunias fertilized with constant concentrations of fertilizer increased throughout the experiment, if the fertilizer EC was 2.5 mS/cm or higher, was stable in the 1.5 mS/cm treatment, and decreased in 0.5 mS/cm treatment (Fig. 1). An increase in EC indicates that more fertilizer was added to the growing medium than was taken up by the plants, while a decrease in EC indicates either that the plants were taking up more nutrients than were applied, and/or that the nutrients in the growing medium accumulated in the top layer of the growing medium. Stratification of salts in subirrigated plants is common, because salts accumulate in the top layer of the medium, as water evaporates from the medium surface. In treatments where we tried to keep the growing medium EC constant, the EC generally was close to the target EC, and averaged over the experimental period, was within 0.2 mS/cm of the target value. Treatment effects on the growing medium EC of begonias were similar (not shown).

Dry weight of the plants increased rapidly during the experiment, and was greatly affected by the EC of the fertilizer solution or growing medium. When plants were fertilized with constant concentrations, a fertilizer solution EC of 0.52 and 1.24 mS/cm were estimated to be optimal for begonia and petunia, respectively. When the growing medium was maintained at a constant EC, 1.0 and 1.7 mS/cm were estimated to be optimal for begonia and petunia, respectively. One clear difference between using a constant fertilizer concentration and maintain-

ing the growing medium EC at a constant level occurred at higher than optimal EC. Growth was reduced much more by high EC of the fertilizer solution than by high growing medium EC. This difference probably occurred because higher than optimal fertilizer concentrations resulted in very high growing medium EC (up to 10.5 mS/cm for petunia and 12.5 mS/cm for begonia), which in turn inhibited growth.

Significance to Industry: High quality bedding plants can be grown successfully either with constant fertilizer concentrations, or by maintaining the growing medium EC at a constant level. However, growth of both begonia and petunia is greatly inhibited when high fertilizer concentrations cause accumulation of soluble salts in the growing medium. Periodic measurements of growing medium EC will help prevent this accumulation, and are therefore a valuable tool in fertilizer management. The optimal growing medium EC is approximately 0.8-1.2 mS/cm for begonia and 1.5-2.0 mS/cm for petunia.

Literature Cited:

1. Kang J.G. and M.W. van Iersel. 2001. Interactions between temperature and fertilizer concentration affect growth of subirrigated petunias. J. Plant Nutr. 24:753-765.

Days after transplanting

Figure 1. The effect of constant fertilizer concentration (top) or management of the growing medium EC on leachate EC. Data shown are for petunia. Trends were similar for begonias.

Days after transplanting

Figure 2. The effect of constant fertilizer EC (left) or management of the growing medium EC (right) on the dry weight of begonia (top) and petunia (bottom) throughout their development.