FEATURE ARTICLE

# The Effects of Primo on Penncross Creeping Bentgrass Root Growth

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The effects of any cultural practice or application of any product to a bentgrass putting surface is of concern to golf course superintendents. Of particular concern are the effects of any practice on bentgrass root growth. Of course, it is much more difficult for turfgrass managers to assess the effects of various chemical and cultural practices on root growth. In an effort to view root growth, most turf managers use a cup cutter or profile indicator, and take a slice to view the roots. While this can be helpful, it is not a good indicator of root biomass (root weight) but rather, is an indication of rooting depth. Root biomass may or may not correlate to rooting depth. Total root biomass is a better indication of root growth than root depth.

Measuring root biomass under field conditions is also very difficult for turfgrass scientists. The procedure generally accepted by turfgrass scientists is to take multiple cores, wash away as much soil as possible, dry the resulting root sample, obtain a weight, ash the sample at a very high temperature (usually around 900°F)—which removes all the root biomass—and then re-weighing the resulting material. Root weights are then determined from the difference in weight from pre-ashing and post-ashing. Such measurements are very labor intensive and are expensive. In addition, very small differences in root weights can be difficult to detect. Also, quantifying root weights in sand culture is more accurate than in finer-textured soils because it is easier to remove roots from sand-based soils than silt or clay soils.

The effects of trinexapac-ethyl (Primo®) and other plant growth regulators on bentgrass root growth is a much-debated topic among turfgrass managers and turfgrass scientists. And of course, any positive or negative effects on root growth affect the stress tolerance of bentgrass and other turf species. In fact, the manufacturer of Primo®, Novartis, contends their product will "condition" the plant to stress if applied prior to the stressful conditions. "Pre-stress conditioning" is the term most often used by the manufacturer. What is the basis on which they make these claims?

Before this can be addressed, it is important to understand the mode-of-action of Primo®. It is well documented that **Primo® is a foliar absorbed product that suppresses gibberellin biosynthesis in plants**. Gibberellins have several effects in green plants, such as cell and stem elongation. **Therefore, by suppressing gibberellin biosythesis in plants, Primo® and other plant growth regulators that have similar modes-of-action (paclobutrazol or TGR Turf Enhancer® and flurprimidol or Cutless®) result in a shorter, more compact plant**. This is the reason why the mowing requirement can be reduced with turf plant growth regulators that suppress gibberellin biosynthesis. Research has shown these products to be effective in reducing the mowing requirement of various turf species.

Previous studies have also shown that **a vast majority of Primo® remains in above-ground plant parts**. Therefore, the argument goes that Primo® only slows above-ground shoot growth and therefore photosynthates are redirected down into root systems, thereby increasing root growth. Does this really happen?

A hydroponics study was initiated at North Carolina State University to evaluate the effects of Primo® on root growth of "Penncross" creeping bentgrass. Because it is a soilless medium, root biomass can be easily quantified with a high level of accuracy and precision. Seven root-zone temperatures were utilized to determine if Primo® had a different effect when the root-zone temperature was altered. Root-zone temperatures were 57, 64, 72, 79, 86, 93, and 100°F (14, 18, 22, 26, 30, 34, and 38°C). Bentgrass plants were treated with Primo®, then exposed to the various root-zone temperatures, and allowed to grow for 2 weeks prior to harvest. The results of the effects of Primo® on bentgrass root growth are shown in Figure 1.

**Primo® had a significant positive effect on bentgrass root growth at 5 of the 7 temperatures**. Only at the 2 **extreme temperatures—57 and 100°F—did Primo® fail to increase root growth**. However, while root growth was enhanced, the resulting increase was very small. The increase in root growth was no more than 10% at any temperature. Therefore, the increase was so small one could argue that it has no biological significance and may not mean anything under field conditions. However, **the results of this study clearly indicate that root growth was increased, albeit very small**. Therefore, the debate continues.

Also note that **when temperatures exceeded 79°F, bentgrass root growth slowed**. At 93 and 100°F (34 and 38°C), bentgrass roots were severely injured and root death was obvious.

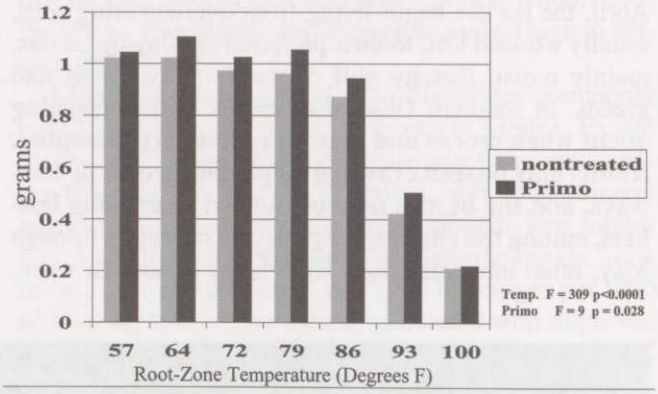


Figure 1. 'Penncross' bentgrass fresh root weights at various root-zone temperatures with and without Primo.