e-GRO Alert

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Volume 14 Number 12 March 2025

Beware of Boron Deficiencies in Young Plants

Growers are reporting distorted growth on calibrachoa, gerbera, petunia, and pansy young plants. What exactly are the symptoms? They include moderate to severe distortion or abortion of the shoot tip; stunted leaves; cupping of leaves; fast-growing auxiliary shoots; and strapped, crinkled, twisted, and thickened leaves. Given the cold and cloudy weather that most of the country experienced this winter, calcium (Ca) and boron (B) deficiencies are the first suspects. Before jumping to conclusions, learn how to differentiate between Ca and B deficiencies.

Whether you are producing young plants or are getting ready to transplant them, keep a close eye on your crops as nutrient deficiencies are common this time of the year, especially in Northern locations.

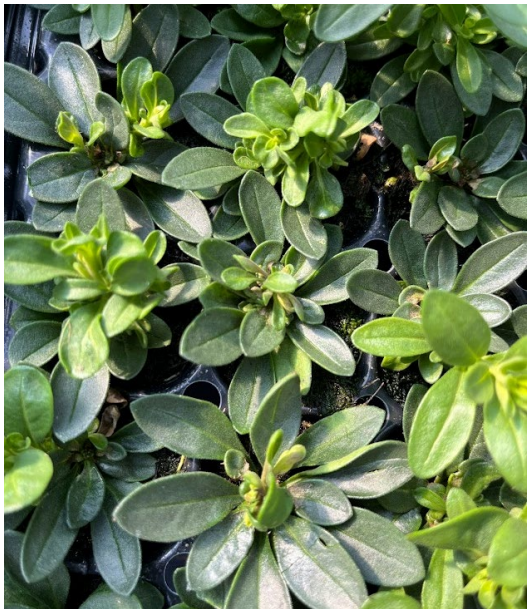

Figure 1. Calibrachoa exhibiting abortion of the shoot tip, proliferation of lateral shoots and thickened leaves.

These symptoms generally appear when young plants are grown under low-light conditions that limit transpiration (water uptake) including high-humidity [low vapor pressure deficits (VPD)], over misting or excessively dry substate, cold-substrates, little to no air movement, and excessively low or high air temperatures.

Symptoms are appearing on the newly developing leaves and stems of calibrachoa, gerbera, pansy, and petunia propagated from seeds and/or cuttings with some cultivars being more susceptible than others (Fig. 1).

The first signs appear as stunted growth, followed by crinkled, twisted, thickened, and leathery leaves to terminal growing tip abortion and poor rooting (Fig. 1). Once the shoot tip aborts, lateral branches may develop, giving the appearance the young plants were pinched or a “witch’s broom”, while in some cases laterals do not develop (Figs. 2, 3, and 4). Most notably, depending on the severity of the deficiency these plants may not grow after transplant and will eventually die.

How can we determine if it is a calcium (Ca) or boron (B) deficiency? Although Ca is a macronutrient and B is a micronutrient, both are immobile, meaning that they are passively taken up as plants transpire water. Therefore, these elements cannot be reallocated to other portions of the plant. As with other immobile nutrients, symptoms of both Ca and B typically appear in areas with rapidly growing cells such as the growing points and on new leaves. Many of the same environmental conditions favor deficiency in both Ca and B, and symptoms can be similar. In addition, leaf distortion can be caused by other factors such as pesticide phytotoxicity, or damage by mites, aphids, and thrips. Therefore, in addition to visual symptoms, we recommend a tissue analysis by a horticulture laboratory to help diagnose the issue. Calcium plays a central role in cell walls and membranes, which is essential for cell structure, and it stimulates the development of new tissues such as leaves and roots. Therefore, when it is deficient, the cell walls in new

Figure 2. Petunia young plants with and without boron deficiencies (Photo by Brian Krug).

Figure 3. Pansy transplant exhibiting extreme symptoms of boron deficiency (Photo by Brian Krug).

Figure 4. Plug tray of gerbera seedlings with different symptoms of boron deficiencies.

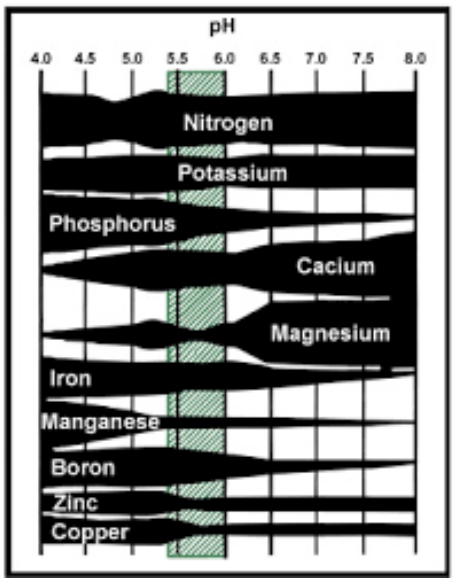

Figure 5. The relative nutrient availability of macro- and micro-nutrients as a function of substrate pH. Availability of boron is related to root-zone pH in soilless substrates.

Figure 6. Sodium borate (20.5% boron) can be applied as a drench to improve boron deficiencies when changes in environmental or cultural practices are not effective.

developing tissues such as young leaves, root and shoot tips are not normal and cause visual distortions. Similarly, B is needed for cell wall formation, as well as sugar transport and carbohydrate synthesis within the plant. One method to differentiate between a Ca and B deficiency in young plants is that cuttings exhibiting a Ca deficiency will not form lateral shoots after the shoot tip aborts, whereas young plants with a B deficiency may produce a proliferation of lateral shoots (Figs. 3 and 4).

The new branches and leaves that develop are often distorted, thick, and brittle (Figs. 2 and 3). Additionally, leaves can turn yellow and develop colored spots or scattered yellowing (ie. mottled chlorosis) and will eventually abort if B continues to be deficient. Additional symptoms that indicate a B deficiency include short and stubby roots and random deficiency symptoms across a crop, section, or even within a plug or liner tray or container (Figs. 1 and 2).

Beyond the environmental and cultural conditions that can limit transpiration or B update, there are other contributing factors that can lead to micronutrient deficiencies of young plants as they are grown in a very limited substrate volume. Low amounts of B in your irrigation water or fertilizer solution, nutrient imbalances (ie. high Ca levels in the substrate can inhibit B uptake), substrate compaction, or high substrate pH. Given that calibrachoa, gerbera, petunia, and pansy are susceptible to iron, manganese, and boron deficiency at high pH, maintaining a pH between 5.5 to 5.8 will help prevent deficiencies of all these micronutrients (Fig. 5).

While plants that exhibit B deficiency symptoms may recover if corrective measures are taken as soon as the symptoms appear, the time required for recovery does not occur overnight and plants are likely to be non-uniform with a delayed crop time. Most often, B deficiency occurs after seedlings have unfolded a few leaves or after cuttings begin to root and symptoms are subtle and go unnoticed.

Symptoms become obvious as the young plants begin actively growing. Therefore, it is important to follow proactive environmental and cultural practices to prevent B deficiency from developing, especially for crops with a history of B deficiency. Cultural practices that can help prevent B deficiency from developing include not overwatering plugs and liners, frequent air exchanges to reduce humidity levels, using HAF fans to promote air movement, or providing warmer air or root-zone temperatures.

A drench application of a product containing B can be used as a preventative and corrective measure. However, use extreme caution when applying supplemental B as plants only require a small amount and over application can lead to a B toxicity. For the majority of greenhouse crops, the critical value of B in dry tissue is 20 ppm. Some crops such as pansy require much B and their critical value can be as high as 80 ppm in dry tissue.

Supplemental B drench rates of 1 to 2 ppm B applied one to two times can improve B nutrition.

• Soluble Trace Element Mix (S.T.E.M.) at 1 to 2 ounces per 100 gallons (supplies 1 to 2 ppm B plus other trace elements)

• Borax (11.5% Boron) at 0.125 to 0.25 ounces per 100 gallons (supplies 1 to 2 ppm B)

• Solubor (20.5% Boron) at 0.07 to 0.14 ounces per 100 gallons (supplies 1 to 2 ppm B).

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