

Avoiding Boron Deficiency In Pansy Production

New research from North Carolina State University examines some of the environmental factors that may lead to plants' inability to extract adequate amounts of boron out of the substrate.

**By Brian Krug,
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and Jonathan Frantz**

It is time again to begin preparing for fall pansy crop production. Among the many things to think about is boron deficiency. Boron-deficient pansies exhibit a variety of symptoms: aborted growing tips; fast-growing auxiliary shoots; strapped, crinkled and thickened leaves; stunted leaves; and upward cupping of leaves. Symptoms typically occur on the newly developing leaves and stem. Symptoms can also be noticed on roots; symptomatic plants will have shorter-than-normal and densely branched roots. Often the symptoms on pansy plugs are already evident on plugs within two weeks of seeding, stages 2-3. Advanced conditions of boron deficiency can result in death of the growing point and, therefore, auxiliary shoot growth.

Looking For Symptoms

Symptoms of boron deficiency can be confused with calcium deficiency. Both boron- and calcium-deficiency symptoms occur on plants' top-most growth because both are considered immobile nutrients; sufficient quantities of boron or calcium cannot be moved from older leaves to newly forming leaves. You can, however, train your eye to discern the difference between the two.

Plants deficient in boron will have shorter internodes, causing a rosette growth pattern, and the leaves will be thicker. In studies at North Carolina State University where boron or calcium deficiencies were induced, plants with calcium deficiency developed necrosis on the leaf tips while plants with boron deficiency never turned necrotic.



Typical symptoms of boron deficiency in pansies are A) malformed apical meristem; B) crinkled, strap-like leaves; and C) malformed, thickened, brittle leaves.

consequences of boron deficiency are more prevalent later in the crop cycle. As the plants continue to grow, the symptoms become more pronounced, and there is no recovery for plants once they become affected visibly by boron deficiency.

The real economic effect can be noticed when plugs are transplanted

into packs or pots with multiple plants. One symptomatic plant can cause increases in losses by decreasing the overall quality of the flat or pot. Growers must then decide to either discard problem packs, flats, or pots or use expensive labor to remove symptomatic plants and replace them with healthy plants.

Preventing Boron Deficiency

For most crops, the critical value of boron in dry tissue is 20 ppm. Pansies are heavy feeders of boron, and the critical value can be as high as 80 ppm. There are several commercial fertilizers available that provide extra boron for crops like pansies, ▶



Proliferating auxiliary shoots.

When plants show signs of a nutritional deficiency, the symptoms are typically consistent across the entire crop, bay or greenhouse. A phenomenon with boron deficiency is that there is no apparent pattern. Symptoms may be present on only a percentage of plugs in a tray and appear randomly throughout the tray. To add to this, the symptoms often appear sporadically throughout the growing season.

Boron-deficiency symptoms can be very subtle while the plants are in plug trays. Because the symptoms are not always noticed in the plug tray and with the majority of transplanting done mechanically, the



Pansy seedlings that are A) boron deficient and B) calcium deficient.

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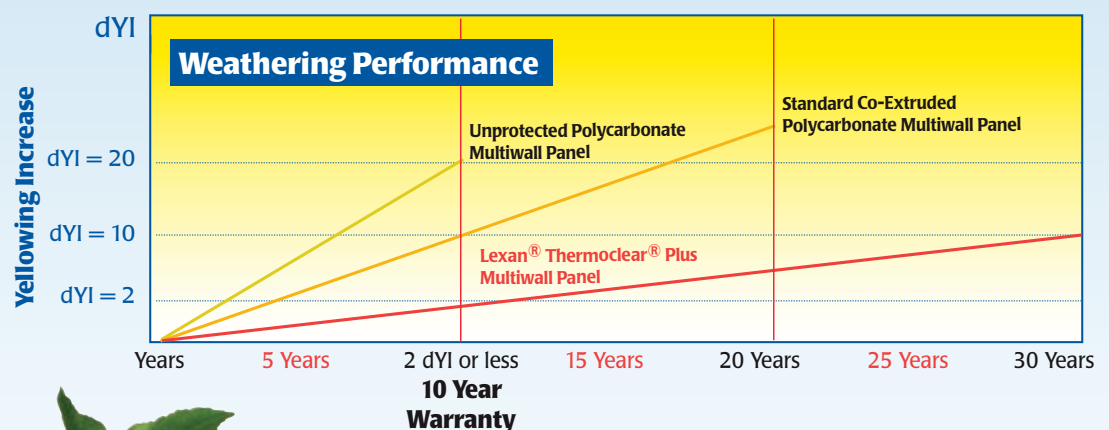
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but even this is not enough to prevent boron deficiency in all cases. This suggests that boron deficiency

is not caused by too low of application rates of boron. Common practices in fall pansy plug production

including frequent irrigations due to high temperatures, leading to leaching of boron, which can com-



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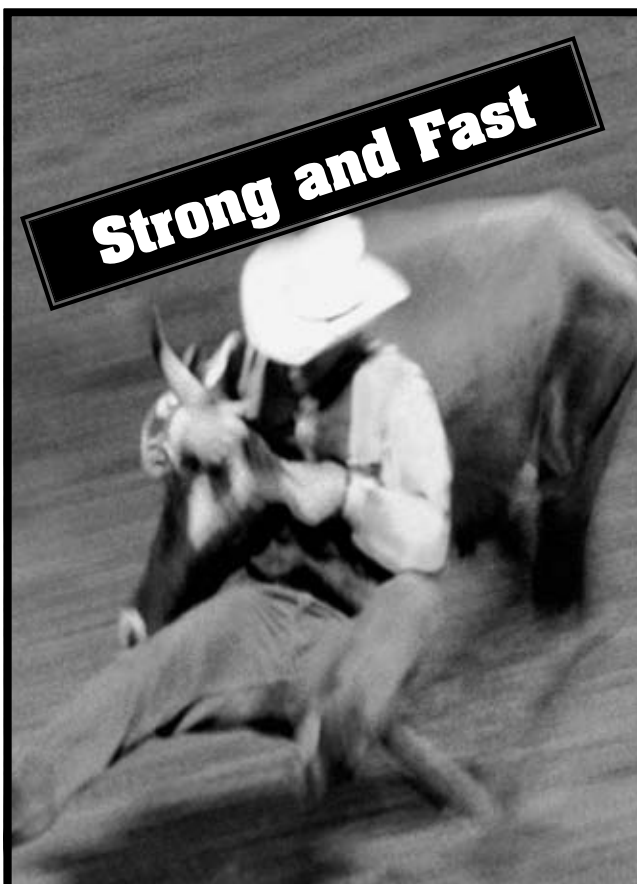
Top: A 288-plug tray with boron-deficient plants mixed with healthy plants. **Bottom:** The symptoms of boron deficiency can be subtle while in the plug flat.

pound factors leading to boron deficiency.

Boron becomes less available as the substrate pH rises. Growers should monitor substrate pH and maintain an acceptable range between 5.5 and 5.8. High levels of calcium in the substrate may also antagonize the uptake of boron by the plant.

Boron is very dependent on the plant's ability to transpire to take in boron through the roots. Environmental parameters that affect plant transpiration, high

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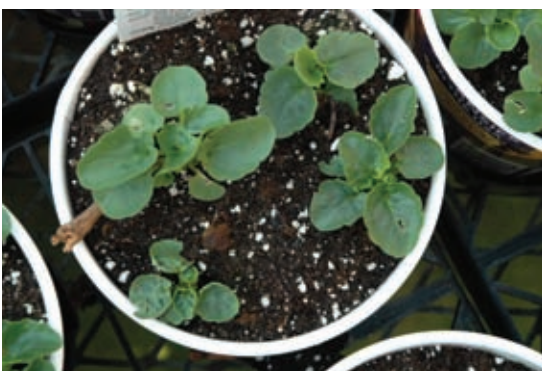
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Top to bottom: As boron-deficient plugs are transplanted and continue to grow, they can dramatically affect the quality of a flat or pot.

humidity and low air flow can also limit the amount of boron taken up by the plant.

Recommended Solutions

As part of a Fred C. Gloeckner Foundation grant and a partnership with the United States Department of Agriculture-Agriculture Research Service, we at North Carolina State University have been conducting research on boron deficiency on pansy plugs as well as petunias and gerbera daisies. Primary areas of focus have been environmental factors that may lead to plants' inability to extract adequate amounts of boron out of the substrate.

Until research is completed, our recommendations for preventing boron deficiency in pansy plug crops are to apply supplemental boron using Solubor (0.25-0.48 oz. per 100 gals.) or Borax (0.5-0.85 oz. per 100 gals.). Increasing the transpiration by increasing air flow in your greenhouse using horizontal air flow fans and decreasing the relative humidity may also be benefi-

cial. When receiving plugs from a supplier, carefully inspect plants for symptoms and discard them before transplanting. **GPN**

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