Boron Deficiency of Fall Pansies

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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 (Figure 1). 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 2 weeks of seeding, stages 2 to 3. Advanced conditions of boron deficiency can result in death of the growing point and therefore auxiliary shoot growth (Figure 2).

Symptoms of boron deficiency can be confused with calcium deficiency. Both boron and calcium deficiency symptoms occur on the top most growth of the plant because both are considered immobile nutrients; sufficient quantities of boron or calcium can not be moved from older leaves to the newly forming leaves. You can however, train you eye to discern the difference between the two (Figure 3). 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.

Typically, when plants show signs of a nutritional deficiency the symptoms are 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 (Figure 4). 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 (Figure 5). Because the symptoms are not always noticed in the plug tray and with the majority of transplanting

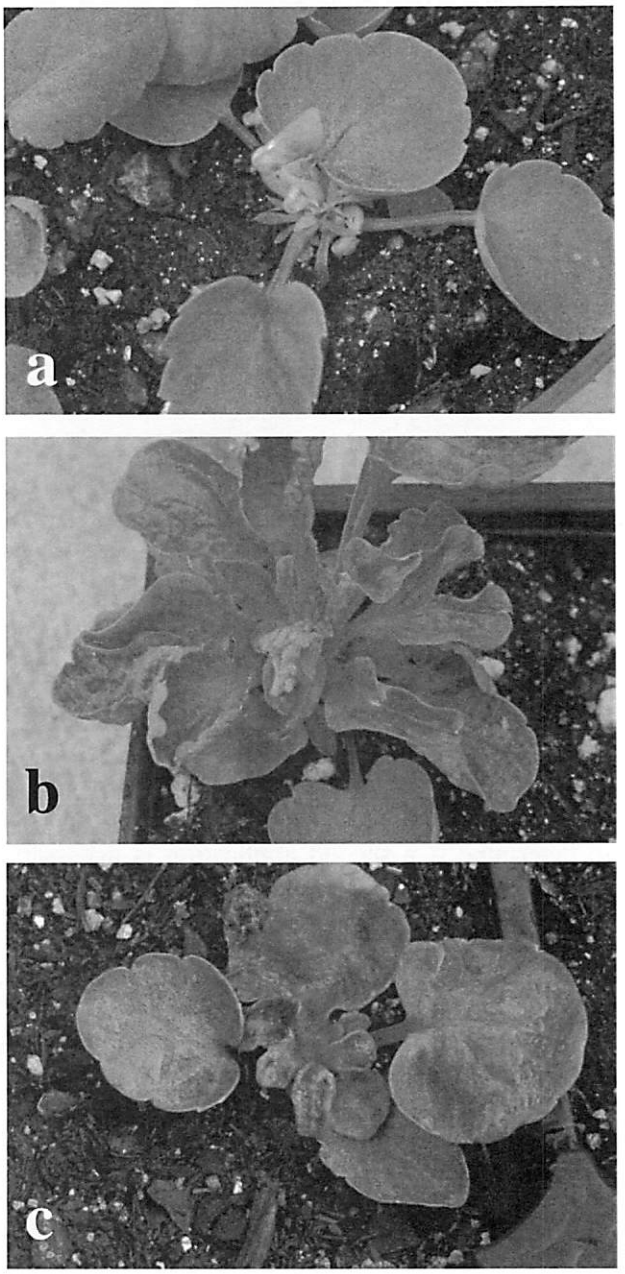

Figure 1. Typical symptoms of boron deficiency in pansies. A) Malformed apical meristem, B) crinkled, strap-like leaves, and C) malformed, thickened brittle leaves.

Figure 2. Proliferating auxiliary shoots.

done mechanically, the 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 visibly affected by boron deficient. The real economic effect can be noticed when plugs are transplanted into packs or into pots with multiple plants. One symptomatic plant can cause increases in losses by decreasing the overall quality of the flat or pot (Figure 6). Growers must then decide to either discard effect packs, flats, or pots or use expensive labor remove symptomatic plants and replace them with healthy plants.

For most crops the critical value of boron in dry tissue is 20 mg/kg (ppm). Pansies are heavy feeders of boron and the critical value can be has high as 80 mg/kg. There are several commercial fertilizers available which provide extra boron for crops like pansies, 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, can compound factors leading to boron deficiency.

Boron becomes less available as the substrate pH rises. Growers should monitor substrate pH and maintain an acceptable pH 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 effect plant transpiration, high humidity and low air flow, can also limit the amount of boron taken up by the plant.

As part of a Fred C. Gloeckner Foundation grant and a partnership with USDA-ARS, we at North Carolina State University have been conducting research on boron deficiency on pansy plugs, as well as petunia and gerbera daisies. Primary areas of focus have been environmental factors which may lead to the 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/100 gal.) or Borax (0.5-0.85 oz/100 gal.). Increasing the transpiration by increasing airflow in your greenhouse using HAF fans and decreasing the relative humidity may also be beneficial. When receiving

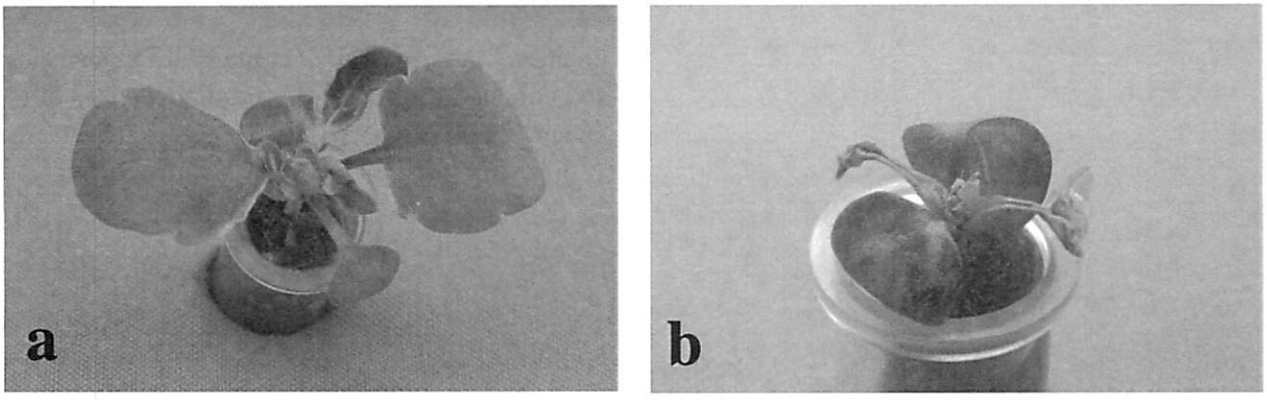

Figure 3. Pansy seedling which is A) boron deficient and B) calcium deficient.

▶ plugs from a supplier, carefully inspect plants for symptoms and discard them before transplanting.

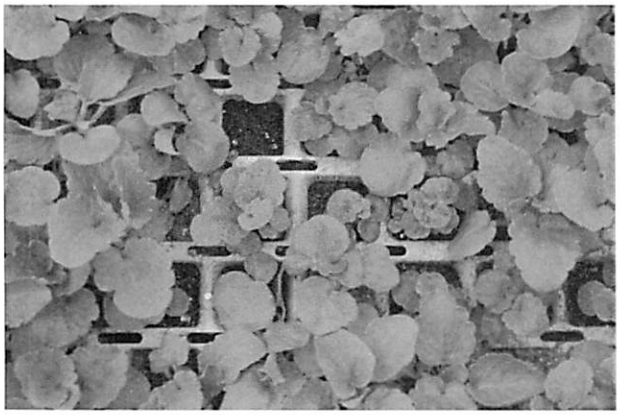

Figure 4. A 288 plug tray with boron deficient plants mixed with healthy plants.

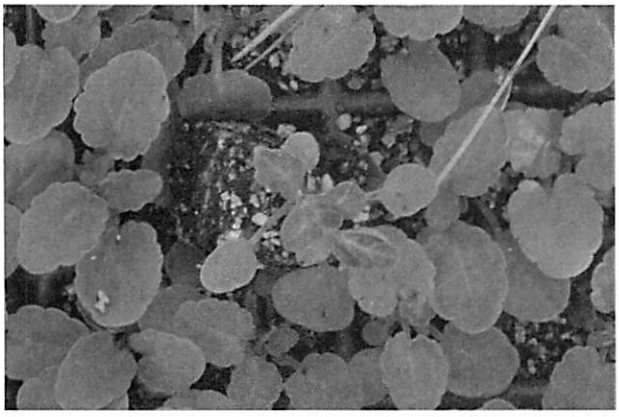

Figure 5. The symptoms of boron deficiency can be subtle while in the plug flat.

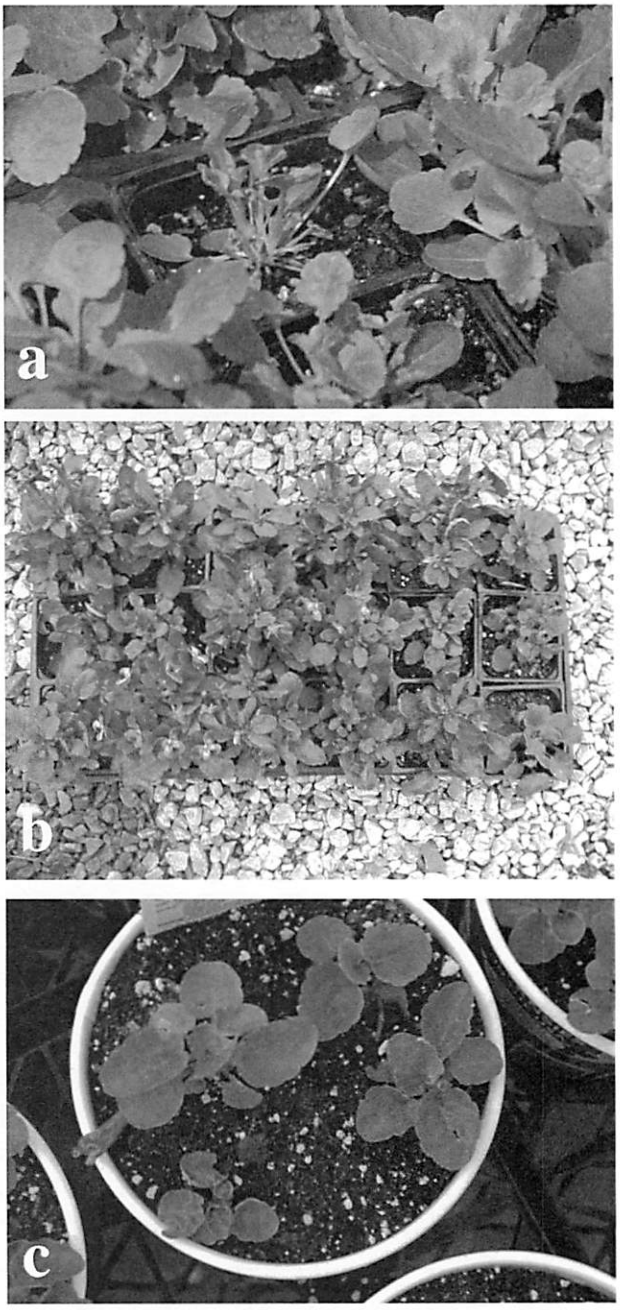

Figure 6. As boron deficient plugs are transplanted and continue to grow they can dramatically affect the quality of a flat or pot.