GROWERTALKS

Culture Notes

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Ammonium Toxicity: Avoid Getting Burned This Winter

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When plants absorb ammonium substrate pH decreases as plants release protons to maintain a stable root pH. Therefore, ammoniacal nitrogen forms are useful to growers that need to decrease substrate pH. Fertilizer manufacturers use various combinations of the three nitrogen forms to help growers match fertilizer choice to their pH and water alkalinity conditions.

What causes ammonium toxicity?

When plants take up nitrogen, they may absorb more than they need to support current growth. Extra nitrogen is stored in case fertilizer levels become lower later on. Nitrate can be safely stored by the plant, but when plants take up and store too much ammonium, it can cause damage to cells.

Toxicity occurs when ammonium has built up to excessive levels in the substrate and plants absorb harmful amounts of it. Luckily, under normal growing conditions of warm temperatures and a well-aerated substrate, ammoniacal nitrogen forms are converted to nitrate by naturally occurring bacteria called nitrifiers. In this case there is little worry about excess ammonium building up in the substrate unless the grower supplies very excessive amounts of a high ammoniacal fertilizer.

However, certain growing conditions, such as low temperatures (less than 60F/15C average daily temperature), wet or low oxygen soils, and low media pH will suppress the function of nitrifying bacteria and cause ammonium to build up to toxic levels in the substrate. That is, under cool, wet conditions typical in winter and early spring, ammonium toxicity has the highest likelihood of occurring.

Symptoms of ammonium toxicity

In bedding plants and plugs, symptoms appear first in younger leaves. Leaves exhibit yellowing (chlorosis) between the veins. This can progress to scattered brown (necrotic) spots. On more mature crops, mid to older leaves are affected. Depending on plant species, the edges of leaves may curl upward or downward. Root growth is impeded and root tips may die, which becomes an entry point for root diseases.

Sympt



oms of ammonium toxicity in New Guinea Impatiens (left) and tomatoes (right). Photos: Cari Peters

Prevention and solutions

Preventing ammonium toxicity following appropriate cultural practices is easier than solving the disorder after it has developed. When growing temperatures are warm and the substrate is not waterlogged, but occasionally leached, ammonium toxicity rarely develops. With the high cost of heating greenhouses, there is a strong temptation to grow plants cooler than before. Follow these steps to avoid ammonium toxicity when growing cooler:

- Don't over-fertilize so that nitrogen inputs are not too high.
- Reduce the proportion of nitrogen in the ammoniacal form. This should not be more than 40% and in really cold, dark conditions should be even less. For example, switch to a 15-0-15 "Dark Weather Formula" or similar low ammoniacal fertilizer source. You may return to your normal formula when growing conditions improve.
- Don't overwater; nitrifying bacteria that helps you avoid ammonium build-up needs plenty of oxygen in the root-zone.
- Avoid low substrate pH, which also inhibits nitrifying bacteria. Maintain pH on the high-end of crop recommendations (ex. pH 6.2-6.5).
- Work with a soil-testing laboratory to periodically monitor substrate ammonium levels.

If ammonium toxicity has occurred, raise greenhouse temperatures for the time being, discontinue the current fertilizer and leach the substrate. Ammonium does not easily leach, but it's important to leach out what you can. Re-water with a nitrate-based fertilizer and hold to this fertilizer until conditions improve. Under conditions of severe ammonium toxicity, gypsum ($CaSO_4 \cdot 2H_2O$) additions can be made to facilitate better ammonium leaching. Apply one tablespoon of gypsum top-dressed to a 6-in. pot and water in with clear water. Follow with a 50-ppm drench of calcium nitrate 2 hours later. The ammonium binds with the sulfate from gypsum and becomes highly soluble, which allows it to flush easily out of the media.

In summary, to avoid ammonium toxicity this winter steer clear of adding excess ammoniacal-nitrogen and pay special attention to watering and growing conditions when it's cold and dark outside. **GT**

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