

Soluble Salts in High Tunnels – Causes and Remedies

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Soluble salts can build to levels in high tunnels that negatively affect the plant growth of some crops. This can occur whether inorganic fertilizers or composts are used.

You may wonder where the salts come from. Salts by definition are compounds that are a combination of a positively charged ion with a negatively charged one. In the case of fertilizers such as muriate of potash, which contains potassium chloride, potassium ions (K^+) are combined with chloride (Cl^-) ions. Epsom salts is magnesium (Mg^{2+}) combined with sulfate (SO_4^{2-}). Many sources of nutrients in inorganic plant fertilizers are salts of one kind or another, but composts, especially ones with manure as one of the components, may also be high in soluble salts.

In high tunnels, high soluble salt levels can occur for several reasons. First, there is little leaching of soluble salts from the soil profile, as would occur outdoors from rain and snow melt percolating through the soil. Evaporation does occur however, so salts accumulate higher in the soil profile where the roots are, subjecting them to higher salt levels. Second, some of the crops that are commonly grown, such as tomatoes, have a high nutrient requirement (and relatively high salt tolerance), so high rates of nutrients may be applied. Problems are often noticed when a less salt tolerant crop (strawberries, for example) are grown after a more salt tolerant crop. In addition, high summer temperatures and a dry soil surface potentially serve to move the flow of nutrients, and thus salts, upward resulting in salts accumulating on the soil surface. This isn't generally a problem until the ground is worked and the salts are incorporated. The bottom line is that with all of these processes in place, salts in tunnels tend to accumulate, and since high tunnel plastics are kept on many tunnels year-round for about 4 years, salts accumulate before being leached from the soil.



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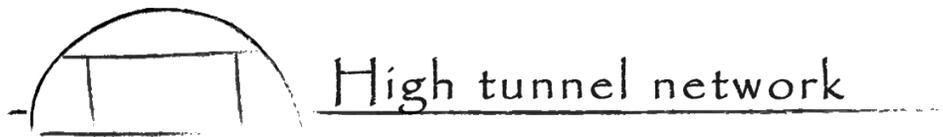
*Photo: Penn State Dept. of
Plant Science*

So, what can you do to minimize problems with salt buildup and damage in high tunnels? First, you should be aware of the salt level in your high tunnel soil as this will tell you what crops you can safely grow and whether the salt level in your high tunnel is approaching a risky level. A soluble salts test is generally offered by labs that do standard soil analyses. Second, if using inorganic fertilizers, *(Continued on page 2)*

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use ones that have a low salt index per unit of nutrient applied, or if using compost, have it tested and make sure it is sufficiently aged to have allowed salts to leach from it, especially if it is animal-based. Third, consider using either plastic or organic mulch to minimize evaporation of applied water from the soil, and to keep the soil moist so crops don't experience a higher concentration of salts in the root zone. Fourth, watch the order in which you grow crops to avoid damage. Most labs that do a soil soluble salts test provide a list of crop tolerance to salt, and this information can also be found online. Fifth, if you do see crop damage from salts, which will generally appear as a burning of the leaf edges, it is possible to leach salts from the root zone by applying enough water. If plastic-mulched raised beds are used, it is possible to move salts into the row middles from which the water will evaporate. We did this by trickle irrigating for 8 hours per day on 5 different days, effectively moving the salts away from the crop root zone. Last, when it's time to replace the plastic on your high tunnels, remove it in the fall, and let the rain and snow leach the salts from the soil through the winter and spring. This will reduce soluble salt levels by half or more. With a combination of relatively simple practices, difficulties with salt buildup can be minimized or eliminated.

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