Salt Damage to Seedlings

Judson Reid, Cornell Cooperative Extension, Cornell Vegetable Program

This spring we’ve seen significant crop loss to high salt levels in potting soils, although we are still trying to understand the origin of the salts in these cases. High salt levels in potting soils can lead to stunted growth, and in high levels, plant death. Other symptoms include slow root growth, or none at all, nutrient deficiencies and marginal burning.

Contrary to popular thought, soluble salts found in soils and potting media aren’t just sodium (Na), but also other cations such as potassium (K⁺), calcium (Ca²⁺) and magnesium (Mg²⁺). (Cations are positively charged ions.) This salinity decreases water uptake in plants. Seedlings just forming roots are more susceptible to damage than established plants. Excess salts that are taken up by the plant can cause cell damage, often evidenced by marginal burning.

Potting soils and irrigation water can be tested for salinity with an electrical conductivity (EC) test. By measuring EC, we can get to a salt level, as salts conduct electricity through solution. We use the unit millimhos per centimeter (mmhos/cm) when looking at EC. Acceptable ranges for a 1:2 soil to water extract are around 0.5 mmhos/cm for seedlings. Values above 1.25 mmhos/cm can kill seedlings, although established plants can generally tolerate these values.

Where do salts come from?
The most common source of salts in greenhouse production is from soluble fertilizer applications. Fertilizer salts are an effective way to maintain plant nutrition, so how can they lead to high EC? With

continued on page 3
New Resource! Example NY Employee Handbook

Reprinted from Cornell Agricultural Workforce Development, 2/10/2022

We’re introducing a new resource on Cornell Agricultural Workforce Development’s Employee Handbook page. We’ve posted an example employee handbook customized for New York farm employers. Starting with a Michigan State example from 2014, our team worked to develop an example farm employee handbook that New York farm employers can use either as a starting point to develop their own handbook or as a tool for comparison with an existing handbook. There was much to add, including information about sexual harassment prevention, sick leave, and other matters. We collaborated with Attorneys Michael Sciotti and Megan Bahas from the Barclay Damon firm in Syracuse to help make sure the handbook was current with existing laws. Of course, this example handbook is provided for educational purposes only, employers are responsible for ensuring that their handbook is compliant with state and federal laws and regulations.

To access the example:
1. Click on Employee Handbook. This will open the file as a preview in the Box file storage site.
2. Click the “Download” button in the upper right corner of the page.
3. Typically, the downloaded file will appear at the bottom of your screen. You can then open the file, edit, and save on your computer.

When you commit to preparing and distributing a written employee handbook it’s important to follow through and implement policies consistently. You must also plan to update the handbook on a regular basis, at least annually, to make sure it is accurate and compliant with law. I’ve seen situations where an employer copied an old printed handbook for many years, unfortunately, legal changes in the course of time caused many of those written policies to be out of compliance with current law. The resources we provide can help you get started, but it’s always a good idea to have an employee handbook reviewed by appropriate legal counsel before putting it into effect.

Special thanks to Lucas Smith, a senior in Cornell’s College of Agriculture and Life Sciences. Lucas has worked with our program for several years and he did a great deal of work on this project!
over-application (too high of a fertilizer rate), or lack of regular leaching, salt levels in potting media accumulate and reach a higher EC than the original fertilization level, or soil level. Irrigation water can be salty even without the addition of soluble fertilizers. In these cases, suitability for greenhouse use can be a challenge.

<table>
<thead>
<tr>
<th>Component</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>Very Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>Buffer pH</td>
<td>Organic Matter</td>
<td>%</td>
<td>CEC</td>
</tr>
</tbody>
</table>

A value over 1.5 mmhos/cm resulted in seedling death for several vegetable crops. This is a quick, inexpensive lab test.

**What do we do about high salt potting soils?**

The immediate solution is a simple one: leach through the containers thoroughly and regularly. This can be a challenge during cloudy weather but watch for chances to leach through at least once a week, to reset EC levels within the container. Now, look for the source of the salts. All greenhouse water should be tested for EC (and many other parameters). In addition to EC, another indicator of native salts in irrigation water is Total Dissolved Solids (TDS). Even in cases where the EC/TDS are high, leaching water through the soil is better than using too little of problematic water. Commercial fertilizers should list a Salt Index to help growers choose a product with a lower value, particularly if irrigation water is already high in EC/TDS.

A pH/EC meter is a valuable tool for greenhouse growers to manage salts, as well as calibrate fertilizer applications. A calibrated meter can rapidly read the EC of irrigation water, both pre and post fertilizer injection. This is useful as many fertilizers will indicate the EC of their product at a given ppm of nitrogen. In this way, we can double check the accuracy of our own mixing and injector performance.

A handheld meter can also help us understand the salt levels within potting soil. The Pour Through method requires the full leaching of a container and then sampling the leachate. A description of this method is available from Purdue: [https://www.extension.purdue.edu/extmedia/HO/HO-285-w.pdf](https://www.extension.purdue.edu/extmedia/HO/HO-285-w.pdf) (For a print version, contact your local CCE educator).

Handheld EC meters can be purchased from greenhouse supply companies. Prices begin around $200; a real bargain compared to the cost of restarting hundreds of tomato plants after salt injury!

**Freeze Damage to Peas**

Gordon Johnson; reprinted from the University of Delaware Cooperative Extension, Weekly Crop Update, April 1, 2022

Some pea fields were planted in early March and may be susceptible to freeze damage over the next several weeks. Peas are very cold hardy and can tolerate freezing temperatures down to the low 20s. Lower temperatures (below 20°F) or a combination of high winds (gusts over 30 mph) and freezing temperatures (below 25°F) can cause damage to pea plants, sometimes killing them to soil level. Peas that are germinating or just cracking the ground will have little damage. If pea tops are frozen to the ground level, they will develop new stems from dormant buds below ground. There will be 1-3 new stems that develop. This will be seen within a week after the frost. These stems will develop and flower later than undamaged plants. Generally, freeze damaged peas will yield 5-20% less due to the differences in maturities in the field and having weaker plants. For peas, the more sensitive stage to freeze damage is flowering which usually occurs late enough in the spring to avoid freeze risk.
Aphid Control in Transplants
Elizabeth Buck, Cornell Cooperative Extension, Cornell Vegetable Program

Aphids seem to be a common concern in transplants this spring. Peppers can be especially attractive to aphids. Here’s a quick review of control options.

Prevention
- Clean up the weeds beneath your benches and in the corners of the greenhouse.
- Avoid growing flowers with your veg transplants.
- Scout your flowers for aphids, catch populations early before they migrate.
- Sticky cards can help in scouting.

Aphids seem to have a real penchant for sweet potato vines, particularly the lime ones. Don’t get me wrong, they like all sorts of things, but the sweet potato vines should definitely be monitored.

Biological Control
Lucky for us there are so many biocontrol options for aphids. The right match will depend on your crops, your greenhouse conditions, and your population. The supply companies have excellent technical resource people you can talk with to work out the best choices. Follow directions about release procedures and stocking density to have the best effect.

- Aphidius
- Aphidoletes
- Aphelinus
- Assassin bugs
- Minute Pirate bugs
- Lacewings
- Lady beetles
- Hoover flies
- Beauveria bassiana, marketed as Botegha, Mycotrol, etc.
  - *Beauveria* is an entomopathogenic fungus. Long word meaning bug-infecting, so basically your aphids get a fatal case of fungus. Not the best material to be using with beneficials since the fungus can attack a range of soft-bodied insects. Check with your beneficial or *Beauveria* supplier for the compatibility of the material with your beneficials. Also, this is a live fungus, so treat it kindly. Keep the container stored at the right temperatures and don’t put it into a spray tank that was recently used for a fungicide.

As always, biocontrol works best when populations are low and infestations limited. Remember that there is a lag between release and beginning to see pest populations stabilize or decrease, often a week or more. So, if your population level is moderate to high by the time your beneficials arrive, consider doing a clean up spray first to knock the population back to manageable levels and allow the beneficials to work maintenance duty.

Soft Knock Down Sprays
- Horticultural Oil
- Insecticidal Soap
- Neem oil (specific type of horticultural oil)

These oils and soaps can burn, so please read the labels for cautions regarding application to flowers in bloom AND do a test round on 1 or 2 plants before going and treating a whole house of blooming ornamentals! That said, these materials have been safely used for a very long time on a broad variety of flowers and vegetables. These are best used when the crops have a strong cuticle protecting the foliage. Strong cuticles develop under sunny, stressful conditions. Cuticles tend to be thin after cold, gray, wet weather.

As for less soft sprays, NYS regulation is that a pesticide can be used in a greenhouse setting so long as the label does not contain a greenhouse use prohibition statement. Check your favorite aphid material used outside for this statement, it is usually in the first few sections before you get to any crop-specific spray information. When using these insecticides, you need to make sure that:
- The material is allowed indoors.
- You only treat crops on the label. This may mean using different strategies for different crops.
- You wear all label specified PPE. I’m serious, spraying indoors is no joke, wear your respirator!
- Strictly follow the re-entry interval for the whole house, not just the treated section.
- You apply the material as specified on the label. Don’t fog something or send it through the water if it is meant to be applied as a spray!

Recording Available: Success with Laser Scarecrows in 2022
The recording of the virtual workshop, Success with Laser Scarecrows in 2022, is now available on YouTube at https://youtu.be/6tiJw6GGBTg. In the workshop, research and on-farm experience was shared using the University of Rhode Island laser scarecrow which utilizes a constantly moving green laser beam to scare birds away from fields. The workshop featured a presentation by Dr. Rebecca Nelson Brown from the University of Rhode Island about the history and utility of laser scarecrows. David Brown detailed the University of Rhode Island device with vast improvements made for 2022 to improve laser adjustments and overall reliability in the field. Cornell Cooperative Extension Educators Chuck Bornt and Julie Kikkert shared their experiences with set up and testing the devices on New York farms.
Food Safety in High Tunnels Can Have Co-Benefits

Robert Hadad, Cornell Cooperative Extension, Cornell Vegetable Program

We talk a lot about reducing risk of bacterial contamination for produce inside of wash/pack facilities at great length. There is also discussion on reducing risk in the field. Let’s not forget to mention reducing risks in high tunnels.

Bacterial contamination can enter the high tunnel in a number of ways. First there is bringing in manure or manure-based compost that hasn’t gone fully through the composting process. These get tilled into the soil but depending on how “fresh” the manure is and how thoroughly these soil amendments are turned into the soil can pose a threat. Touching the soil then the crops, especially before harvest can pass contaminants.

Solution: Use manure that has gone through a composting treatment. Use manure only for long season crops like tomatoes or peppers or with staked/trellised crops like tomatoes, peppers, eggplant, and cucumbers. Use fully composted soil amendments. Use mulch to reduce the chances of hands touching the soil and then plants. Avoid fresh manure when growing short season crops or crops close to the ground like greens.

Co-Benefit: Reducing touching the soil then touching crops can reduce plant diseases.

Soil preparation when using fresh manure or manure-based products can spread contamination under certain conditions. If the soil and the soil amendments are dry, tilling can kick up a lot of dust. The dust could carry contaminants that can land on food contact surfaces inside the tunnels (much more of a problem if harvest containers are stored inside tunnel or if there is a wash/pack set-up in the tunnel).

Solution: Cover harvest bins and other food contact surfaces before tilling. Wetting down soil a day or two before tilling might also reduce the dust kicking up. Do the soil prep earlier in the morning or later in the day when it isn’t too hot out and keep the tunnel sides rolled down to prevent wind from blowing dust around. Rinse off tunnel interior plastic with hose or power washer to remove dust after soil prep. Spraying on a sanitizer after the water rinse might be helpful too. Removing algae is also helpful.

Co-Benefit: Reduces organic matter on plastic which might be less attractive for snails to eat climbing up on the tunnel walls and ceilings. Removing algae can reduce slug/snails from climbing sides/ceiling and also lets more light in when late season sun is less intense already.

If soil preparation occurs later in the year, such as getting ready for late season/winter greens production, contaminated dust can stick to the tunnel plastic (interior). There is concern that condensation dripping from the ceiling can carry contamination onto the greens below.

Solution: Hose down interior tunnel plastic with hose or power washer. Removing algae is helpful. Spraying a solution of sanitizer can be an extra step.

Co-Benefit: Reduces organic matter on plastic which might be less attractive for snails to eat climbing up on the tunnel walls and ceilings. Removing algae can reduce slug/snails from climbing sides/ceiling and also lets more light in when late season sun is less intense already.

Reducing snail and slugs inside the tunnel. Snails and slugs that comes into contact with manure may carry contamination onto plants and spread it onto tunnel plastic. From the plastic, contamination may fall off possibly contaminating crops below.

Solution: Remove vegetation from around outside/inside perimeter of high tunnels. Don’t store anything on the perimeters of the tunnels where snails/slugs can hide. Use slug/snail bait along the perimeter of the tunnel. Remove mulch from the inside perimeter of the tunnel. Be sure to pull away any manure from the tunnel edges and incorporate into the soil.

Co-Benefit: Snails and slugs feed on crops causing damage. This opens crops to disease. Feeding damage reduces the quality of the crops lessening the market value.

Prevent contamination from rodents entering the tunnel and taking up residence. Rodents can carry a variety of pathogens. Especially in the late fall through the winter when food is scarce, a high tunnel can be attractive to voles, mice, and rats.

For more information on farm food safety practices, contact Robert Hadad at rgh26@cornell.edu, 585-739-4065.
Mustang Maxx and Hero Now Labelled for Cabbage Maggot on All Brassicas Including Cabbage

Christy Hoepting, Cornell Cooperative Extension, Cornell Vegetable Program

The New York Department of Environmental Conservation (NY DEC) recently granted a FIFRA 2(ee) Label Expansion for insecticides Mustang Maxx and Hero for use on both head and stem, and leaf brassicas for control of cabbage maggot.

Mustang Maxx is one of our top picks as an alternative to Lorsban/chlorpyrifos for control of cabbage maggot (see article on the Cornell Vegetable Program website: Lorsban is Banned: How to Control Cabbage Maggot in Brassicas Now?). In a 2021 Cornell insecticide trial in Riverhead (Long Island), Mustang Maxx 4 fl oz/A applied 4 times as a directed spray (DS) at the base of cabbage plants (5 days after transplanting, then weekly for 3 weeks) resulted in 72% reduction in CM-infested plants compared to the untreated, which had 57% infested (Table 2). At ~$1/fl oz, four applications of Mustang Maxx 4 fl oz would cost ~$16/A, which is by far the most affordable alternative to Lorsban for the level of control it provides.

The disadvantage of Mustang Maxx is that multiple foliar applications are required for effective control. A study in Michigan in turnips showed a reduction in cabbage maggot control when Mustang Maxx was applied twice during peak spring flight of CM compared to when it was applied 6 times weekly from first to last emergence of overwintering flies (as indicated by a predictive growing degree day model). Since cabbage can tolerate more CM feeding than turnips, because any feeding deems turnips unmarketable, perhaps less than 4 apps would be sufficient for adequate CM control in cabbage. Two vs. 4 apps will be trialed by Cornell researchers in 2022.

Hero is a pre-mix of the active ingredient in Mustang Maxx, zeta-cypermethrin and bifenthrin (active ingredient in Capture), both pyrethroids.

A directed spray at the base of the plant that applies the insecticide in a 4-6 inch band is highly recommended for most effective control of cabbage maggot with Mustang Maxx and Hero. Rate of water volume (40 vs. 80 gpa) will be trialed by Cornell researchers in 2022.

<table>
<thead>
<tr>
<th>Product Specifications</th>
<th>Mustang Maxx</th>
<th>Hero</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active ingredient(s)</td>
<td>zeta-cypermethrin</td>
<td>zeta-cypermethrin + bifenthrin</td>
</tr>
<tr>
<td>Rate per Application (product/A)</td>
<td>3.2 – 4 fl oz</td>
<td>8.3 – 10.3 fl oz</td>
</tr>
<tr>
<td>Maximum a.i. per crop</td>
<td>0.15 lb</td>
<td>0.112 lb (c-z) 0.336 lb (bif)</td>
</tr>
<tr>
<td>Maximum Rate of Product per year</td>
<td>24 fl oz</td>
<td>46.35 fl oz</td>
</tr>
<tr>
<td>Maximum No. of Maximum Rate Applications per year</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Pre-Harvest Interval (PHI)</td>
<td>1 day</td>
<td>7 days</td>
</tr>
<tr>
<td>Restricted Use</td>
<td>Federal &amp; New York State*</td>
<td>Federal &amp; New York State*</td>
</tr>
</tbody>
</table>

*All Federally Restricted Use pesticides are also restricted in New York State, and require a pesticide spray license to purchase and to apply. Pesticide handlers who do not have a spray license must be under the direct supervision of a licensed applicator.

Coragen transplant water application may benefit from additional directed spray at the plant base (DS) with Mustang Maxx or Hero. At ~$11/A, Coragen 5 fl oz/A is an affordable alternative to Lorsban, but is generally not as effective. Thus, overall CM control may be improved with a DS application of Mustang Maxx or Hero 14-21 days after planting. This will also be trialed in 2022 by Cornell researchers.

2(ee) labels for Mustang Maxx and Hero for cabbage maggot control must be in the possession of the applicator, along with the full labels. You can look up the labels at https://www.dec.ny.gov/nyspad/products/ or contact Christy Hoepting to have the 2(ee) labels for Mustang Maxx and Hero emailed or mailed to you. ●
2022 Cabbage, Dry Bean, and Processing Vegetable Crops Grants Awarded

Julie Kikkert, CCE Cornell Vegetable Program

The following projects were awarded by the respective industry funding programs for applied research and extension in 2022. Sincere thanks to the growers and processors who contributed to these funds and to those who served on the advisory committees/boards to review the project proposals.

### Cabbage Research and Development Fund

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Project Title</th>
<th>Award</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. Hoepting</td>
<td>Optimizing Herbicide Weed Control and Crop Safety in Transplanted Cabbage</td>
<td>$8,500</td>
</tr>
<tr>
<td>L. Sosnoskie</td>
<td>Evaluating Pyridate and Acetochlor Efficacy and Safety in Cabbage</td>
<td>$4,176</td>
</tr>
</tbody>
</table>

**TOTAL AWARDS** $12,676

### Dry Bean Endowment

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Project Title</th>
<th>Award</th>
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<tbody>
<tr>
<td>P. Griffiths</td>
<td>Breeding, Evaluation and Development of Dry Bean Varieties that are Highly Adapted to NYS Growing Environments and Markets</td>
<td>$8,500</td>
</tr>
<tr>
<td>S. Reiners M. Rosato</td>
<td>2022 NYS Dry Bean Variety Trial</td>
<td>$8,500</td>
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<tr>
<td>S. Pethybridge J. Kikkert M. Lund</td>
<td>Towards a Site-Specific Risk Model for White Mold in Dry Bean in New York</td>
<td>$6,000</td>
</tr>
<tr>
<td>A. Seaman M. Zuefle M. Lund</td>
<td>Improving Soybean Cyst Nematode (SCN) Sampling with the Use of Field Electrical Conductivity Mapping</td>
<td>$2,000</td>
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<tr>
<td>M. Lund M. Zuefle K. Wise</td>
<td>Determine the Magnitude and Distribution of Western Bean Cutworm and the Risk to Dry Beans, in the Major Production Areas in New York</td>
<td>$3,400</td>
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<tr>
<td>A. Hamlin</td>
<td>Cool School Food: Encouraging the Use of Dry Beans in School Lunches, and Promoting the Health Aspects of Dry Bean Consumption</td>
<td>$1,000</td>
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**TOTAL AWARDS** $29,400

### The New York Vegetable Research Association and Council (processing vegetables)

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Project Title</th>
<th>Award</th>
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</thead>
<tbody>
<tr>
<td>B. Nault</td>
<td>Improving Corn Earworm Monitoring and Control in Sweet Corn and Evaluating New Seed Treatment Control Options for Seed Corn Maggot</td>
<td>$29,855</td>
</tr>
<tr>
<td>S. Reiners M. Rosato</td>
<td>2022 NYS Processing Variety Trial Evaluations (English Pea, Snap Beans, Sweet Corn)</td>
<td>$56,872</td>
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<tr>
<td>L. Sosnoskie A. Taylor</td>
<td>Evaluating the Efficacy and Safety of Currently Labeled and Novel Herbicides in Vegetables</td>
<td>$24,707</td>
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<tr>
<td>S. Pethybridge J. Kikkert</td>
<td>Management of Table Beet Growth and Health Through Plant Growth Regulators: PHASE 3</td>
<td>$35,487</td>
</tr>
<tr>
<td>S. Pethybridge J. Kikkert</td>
<td>Manipulating Carrot Growth Through Plant Growth Regulators: PHASE 3</td>
<td>$25,127</td>
</tr>
</tbody>
</table>

**TOTAL AWARDS** $172,048
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Fresh market vegetables, weed management, soil health

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**Julie Kikkert, Team Leader**  |  585-313-8160 cell  |  jrk2@cornell.edu  
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**Margie Lund**  |  607-377-9109 cell  |  mel296@cornell.edu  
Potatoes, dry beans, and post-harvest handling and storage

**Judson Reid**  |  585-313-8912 cell  |  jer11@cornell.edu  
Greenhouses/high tunnels, small farming operations, fresh market veggies

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