Disease, Insect, Herbicide, Nutrition: What is going on?

Ajay Nair
Department of Horticulture
Practical Farmers of Iowa 1-18-2020
Proper identification is the key

- Make the best use of your smartphone
- Keep a tab on daily activities carried in and around your crop
- Are the symptoms localized in the field?
- Is there a pattern?
Identification is critical for a timely and effective response.
Anything noticeable in this picture?
Adult moth: hornworm
Tomato hornworm

Dipel (Bt formulation) @ 1 lb/A (2 teaspoons per gallon)

Two sprays in 3-4 day interval
Septoria Leaf Spot: Spots are circular, about 1/16 to 1/4 inch in diameter with dark brown margins and tan to gray centers with small black fruiting structures.
Possible causes

- Long periods of high relative humidity, temps of 60–80 degrees F, leaf wetness
- Pathways
  - The fungus overwinters on infected tomato debris or on weeds in nightshade family
  - The fungus can also survive on equipment such as plant stakes and cages
  - Spores may be spread by windblown water, splashing rain, hands and clothing of pickers, insects such as beetles, and cultivation equipment
Prevention / What to do

- Remove infected leaves
- Improve air circulation
- Do not work around plants when they are wet
- Mulch around the base of the plant, control weeds
- Do not use overhead watering
- Rotate nightshade family
- Last resort: Use a fungicidal spray
  Apply [chlorothalonil](https://en.wikipedia.org/wiki/Chlorothalonil), maneb, makozeb, or a copper-based fungicide, such as copper hydroxide
Symptoms / ID Presence:

- Large dark brown to black leaf spots with concentric rings that develop in the spot forming a bull’s eye.
- The leaf area around each target spot turns yellow, and soon the entire leaf turns yellow and drops.
- Can also produce stem cankers.
- Infestation during flowering stage causes the blossoms to drop.
Possible causes

- Develop quite rapidly in mid to late season and is more severe when plants are stressed by poor nutrition, drought, warm humid weather with heavy dews or rain
- Overcrowded plants
- Too much moisture during cool and warm weather
Serenade Max™ (*Bacillus subtilis*), Garlic, neem oils and seaweed extract have shown some effectiveness.
- Late blight
- spreads quickly in fields and can result in total crop failure
- [https://usablight.org/](https://usablight.org/)
- TomCast from Cornell
- **Leaf mold**
- Can be managed by improving air movement
Sunburn in pepper
Salt burn symptoms - pepper
Electrical conductivity (EC)

- Measure of the ability of the solution to conduct electricity
- Based on saturated paste extract method

< 2 mmhos/cm = optimum
2.1-4 = sensitive crops restricted; plants show initial symptoms
4.1-8 = Growth affected; many crops restricted
> 8.1 = detrimental; most crops restricted
Relative salt tolerance of fruit and vegetable crops

<table>
<thead>
<tr>
<th>0-2 mmhos/cm*</th>
<th>3-4 mmhos/cm*</th>
<th>5-7 mmhos/cm*</th>
<th>8-16 mmhos/cm*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nontolerant</td>
<td>Slightly Tolerant</td>
<td>Moderately Tolerant</td>
<td>Tolerant</td>
</tr>
<tr>
<td>blueberries</td>
<td>apples</td>
<td>broccoli</td>
<td>asparagus</td>
</tr>
<tr>
<td>carrots</td>
<td>cabbage</td>
<td>beets, table</td>
<td>Swiss chard</td>
</tr>
<tr>
<td>green beans</td>
<td>celery</td>
<td>cucumbers</td>
<td></td>
</tr>
<tr>
<td>onions</td>
<td>grapes</td>
<td>muskmelons</td>
<td></td>
</tr>
<tr>
<td>radishes</td>
<td>lettuce</td>
<td>squash</td>
<td></td>
</tr>
<tr>
<td>raspberries</td>
<td>peppers</td>
<td>tomatoes</td>
<td></td>
</tr>
<tr>
<td>strawberries</td>
<td>potatoes</td>
<td>spinach</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sweet corn</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Salt burn symptoms – sweet corn
Robust and healthy plants can withstand many abiotic and biotic stresses. That leads to the importance of maintaining soil quality and health.
Characteristics of healthy soil

- Good tilth
- Sufficient depth
- Good water storage and drainage
- Less compaction

- Sufficient supply, but not excess of nutrients
- Proper balance of nutrients
- Optimum pH, EC
- Low weed pressure

- Organic matter
- Biologically active soil
- Diversity of soil microorganisms
Factors affecting soil quality

INHERENT SOIL QUALITY
Resulting from the natural and soil forming process

INTERACTION

DYNAMIC SOIL QUALITY
From changes due to human use & management

### Story County, Iowa (IA169)

<table>
<thead>
<tr>
<th>Map Unit Symbol</th>
<th>Map Unit Name</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>Nicollet clay loam, 1 to 3 percent slopes</td>
<td>1.0</td>
<td>5.6%</td>
</tr>
<tr>
<td>107</td>
<td>Webster clay loam, 0 to 2 percent slopes</td>
<td>2.9</td>
<td>16.8%</td>
</tr>
<tr>
<td>138B</td>
<td>Clarion loam, 2 to 6 percent slopes</td>
<td>6.3</td>
<td>36.5%</td>
</tr>
<tr>
<td>138C2</td>
<td>Clarion loam, 6 to 10 percent slopes, moderately eroded</td>
<td>7.1</td>
<td>41.1%</td>
</tr>
<tr>
<td><strong>Totals for Area of Interest</strong></td>
<td></td>
<td><strong>17.3</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Interveinal chlorosis:
Magnesium deficiency

Fertigation with Cal-Mag and Epsom salt along with foliar sprays of Epsom
Old and mature leaves

Chlorosis

Uniform over leaf, small leaves
Nitrogen

Possibly S if symptoms are also on young leaves

Interveinal or blotchy

Magnesium

Tip or edge scorch, possibly interveinal yellowing or browning
Potassium

Necrosis

Interveinal or blotchy, varying shades of colour
Magnesium

Young leaves

Chlorosis

Uniform over leaf
Sulphur, Iron

Leaf edges purple, interveinal yellowing cupping
Sulphur

Zinc, Manganese, Iron, Copper

Interveinal or blotchy

Necrosis

Interveinal biotches, and leaf edge scorching
Calcium

Boron

Yellow to brown interveinal areas, red to brown-purple leaves, deformed, curled, torn leaves
Scorching of lower leaf edges

Nutrient deficiency: Potassium

Leaf symptom on cucumber
Green/Yellow shoulder
Green/yellow shoulder

- Physiological disorder
- Heat (high temperature; 95°F and above)
- Uniform color development requires more K+, than the amount required to sustain yield
Fields at a lower risk of producing fruit with YSD have the following soil properties

– pH between 6.0 and 6.8;
– organic matter above 1.5 %;
– exchangeable potassium above 400 lbs/ac (or 200 ppm) and,
– ratio of $K/\sqrt{Mg}$ above 0.35.
"Hartz" Ratio

To know if your soil is at low risk of YSD, enter the information below based on the standard test results of your soil.

Please enter the values for Phosphorus (P), Potassium (K), Magnesium (Mg), Calcium (Ca), Cation Exchange Capacity (CEC), and the units used by the laboratory.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Units</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>35</td>
<td>ppm</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mg</td>
<td>2000</td>
<td>lb/acre</td>
<td></td>
</tr>
<tr>
<td>Ca</td>
<td>2900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEC</td>
<td></td>
<td>Kg/ha</td>
<td></td>
</tr>
</tbody>
</table>

Calculate

The results are presented below. You can compare your results with the most desirable values for soils at low risk of YSD (values on right side in green).

<table>
<thead>
<tr>
<th>Your results</th>
<th>Course Textured Soil at low risk of YSD (Midwest, USA)</th>
<th>Fine Textured Soil at low risk of YSD (Midwest, USA)</th>
<th>Soil at low risk of YSD (California, USA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extractable K</td>
<td>0.266 (cmol/kg)</td>
<td>&gt;0.45</td>
<td>&gt;0.7</td>
</tr>
<tr>
<td>Hartz ratio</td>
<td>&gt;0.6</td>
<td>&gt;0.35</td>
<td>&gt;0.25</td>
</tr>
<tr>
<td>% Infl of CEC</td>
<td>&gt;4%</td>
<td>&gt;4%</td>
<td>&gt;2%</td>
</tr>
<tr>
<td>Cl/Na Ratio</td>
<td>&gt;2.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- Purpling of lower leaves
- Might see soon after transplanting; this is due to colder soils
Nutrient deficiency: Calcium
Irregular watering

Blossom end rot
Nutrient deficiency: Calcium
Irregular watering

Progression of blossom end rot
Blossom end rot in pepper
Water management

Soil Moisture

Deeply and infrequently

Tomatoes

Time

Slide: Courtesy Joe Hannan
Effect of emitter spacing

12" emitter spacing

8" emitter spacing

Source: Toro
Clues to chemical injury include uniformly distributed symptoms that appear **suddenly** in the entire field or within areas in the field and **absence** of plant pathogen signs (e.g. fungal mycelium, fruiting structures, or spores; or bacterial ooze)

**Herbicide damage could look like disease but..**
Sudden death
Cupping of leaves
Herbicide drift
Cupping of leaves
Paraquat damage
2,4-D damage on tomatoes

Tomato leaves cupping
Response could be cultivar specific

Scarlet Red

Jet Star
This is not herbicide drift. This is physiological leaf rolling.
Physiological leaf roll

Indeterminate cultivars of tomato are reported to be more sensitive to this disorder than determinate cultivars.

My recommendation would be to:
1. reduce stress on plants as much possible, 2. Don’t overfertilize and overwater, 3. Avoid severe pruning
Presumably 2,4-D drift on melons
Bleaching at the base of leaflets: Glyphosate damage
Bending and twisting: classic herbicide damage symptom

Sulfentrazone damage
Outgrowths on stem
Prodiamine damage
Dicamba damage
Spray drift from adjacent sweet corn plot: The product sprayed Lexar (Syngenta). Active ingredient: s-metolachlor, atrazine, and mesotrione.
Clomazone injury (Command® herbicide)
Physiological disorders can look like disease.
Tomato transplants in the high tunnel: Sudden death
Heat stress on tomato inside high tunnels: sides fail to open; 140°F; kill
Cat-facing

- Cold temperatures occurring just before flowering can increase the amount cat-facing
- Can also be caused by high Nitrogen fertilizer, improper pruning, heavy thrips infestation and exposure to herbicides
Viruses:
- After ripening, yellow rings or blotches may show,
- Discoloration is only on the surface and center of fruit will ripen normally
- Thrips usually transfer viruses
Take home message

- Proper identification is the key
- Do some investigative work
- Weather data: mesonet.agron.iastate.edu
- Pictures of individual plants and the entire field
- Communicate with neighbors
Here we go!