



## IN THIS ISSUE:

### *Herbicides & Herbicide Symptomology* by Ron Vargas

## UPCOMING MEETINGS:

*Cotton Growers/PCA Meetings - 12:00 noon*  
*Thurs., June 13, 2002*  
*Thurs, August 2, 2002*  
*Minturn Cooperative Gin*  
*Red Top*  
*22742 Road 4*  
*Chowchilla, CA*

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## *Herbicides and Herbicide Symptomology*

Because herbicides are pesticides applied to kill or injure weeds or unwanted plants, injury or death to desirable plants or crops occurs all too often. The causes of herbicide damage or symptoms can happen in a number of different ways including:

- **Misapplication**  
Use of the wrong rate, timing, or incompatibility with adjuvants and other herbicides when tank mixed.
- **Calibration Errors**  
Nozzle size, pressure and speed all have to be measured correctly. Many times there is confusion over band vs. broadcast applications.
- **Sprayer Contamination**  
Poorly rinsed and cleaned sprayers are often the cause of injury, especially in the case of hormone herbicides such as 2,4-D.
- **Incorrect Herbicide**  
Selecting the improper herbicide.
- **Residual or carryover in soil**  
Soil residues of herbicides from applications to the previous crop.
- **Soil Type**  
Herbicide injury with soil residual herbicides occur much more frequent in sandy soils, low in organic matter compared to clay or clay loam soils.
- **Irrigation**
- **Drift to non target crops**

When assessing the impacts of herbicide injury keep in mind that symptoms occurring on leaves, stems or roots are merely signs of a problem whereas plant injury occurs when the problem is severe enough to cause yield or quality loss.

Herbicides are classified in a number of different ways, but an understanding of classification by mode of action can help determine which herbicide or at least what group of herbicides may be responsible for the damage. Keep in mind that other factors such as:

- < Plant diseases,
- < Nutrient deficiencies/excesses,
- < Water stress,

- < Salts,
- < Temperature, (high and low)
- < Insecticides,
- < Fungicides,

can also cause symptoms similar to those caused by herbicides.

### **Herbicides: How Applied, Mode of Action and Common Symptoms**

#### **GROWTH REGULATORS:**

- # 2,4-D
- # MCPA
- # Clopyalid (Stinger)
- # Triclopyr (Garlon, Turflon)
- # Dicamba (Banvel, Clarity)
- # Picloram (Tordon)
- # 2,4-DB

#### **How Applied:**

Most foliar applied, some soil activity.

#### **Mode of Action:**

Mimic natural plant auxins causing abnormal growth and disruption of the transport tissue.

#### **Common Symptoms:**

Twisted malformed leaves and stems, callus-like growth on young woody stems.

#### **PHOTOSYNTHESIS INHIBITORS:**

- # Atrazine (Aatrex)
- # Simazine (Princep)
- # Metribuzin (Sencor, Lexone)
- # Cyanazine (Bladex)
- # Diuron (Karmex, Diurex)
- # Linuron (Lorox)
- # Bromacil (Hyvar)
- # Tebuthiuron (Spike)

#### **How Applied:**

Systemic and move primarily with water and nutrients in the xylem.

#### **Mode of Action:**

Inhibit photosynthesis by binding to a protein in the electron transport system thus effectively blocking energy transport and causing a build up of destructive high energy products.

#### **Common Symptoms:**

Yellowed, chlorotic leaves which may turn necrotic with excessive herbicide.

#### **PIGMENT INHIBITORS:**

- # Norflurazon (Solicam, Zorial, Evital)
- # Fluridone (Sonar, Brake, Pride)
- # Clomazone (Command)
- # Amitrol (Amino Triazole)

#### **How Applied:**

Soil applied, water applied (floridone) or foliar (amitrol)

#### **Mode of Action:**

Prevent the production of the yellow carotenoid pigments. The carotenoid pigments of plants protect or buffer the green, photosynthetic plant tissue from overloads of light energy. When light is absorbed by the leaves and the carotenoid pigments are not present to protect the chlorophyll, high energy products build up and the chlorophyll is destroyed. When chlorophyll is destroyed and there is no underlying yellow pigment, the remaining leaf tissue is white.

#### **Common Symptoms:**

Albino or bleached appearance to foliage.

#### **AMINO ACID SYNTHESIS INHIBITORS:**

- # Glyphosate (Roundup, Aquamaster, Accord)
- # Sulfosate (Touchdown)
- # Imazethapyr (Pursuit)
- # Sulfmeturon (Oust)
- # Chlorsulfuron (Glean)
- # Pyriithiobac (Staple)

#### **How Applied:**

Glyphosate and sulfosate are foliar applied while the others are mainly soil applied but do have foliar activity.

#### **Mode of Action:**

These herbicides inhibit enzymes critical to the production of certain amino acids. Amino acids are important building blocks in the production of proteins. Proteins are important structural components, constituents of cell membranes and as enzymes are regulators of metabolic processes. When amino acid production stops, plant growth decreases and finally is stopped.

**Common Symptoms:**

Because so many plant processes are affected, many symptoms can be produced including stunting, chlorosis, reddening, and distortion of terminal growth.

**HERBICIDES WHICH AFFECT SEEDLING GROWTH – INHIBITORS OF CELL DIVISION**

- # Trifluralin (Treflan)
- # Oryzalin (Surflan)
- # Benefin (Balan)
- # Pendimethalin (Prowl, Stomp)
- # Prodiamine (Endurance)
- # Thiazopyr (Visar)
- # Dithiopyr (Dimension)
- # Napropamide (Devirrol)
- # Bensulide (Prefar, Betasan)
- # DCPA (Dacthal)
- # Pronamide (Kerb)

**How Applied:**

All of these herbicides are soil applied with limited movement in the soil

**Mode of Action:**

Most herbicides in this group disrupt mitosis and produce stunted plants with swollen root tips. Napropamide, bensulide and pronamide stop cell division before mitosis resulting in limited root growth.

**Common Symptoms:**

Stunting and swollen growth tips, sometimes swollen stems.

**HERBICIDES WHICH AFFECT SEEDLING GROWTH – INHIBITORS OF SHOOT GROWTH**

- # EPTC (Eptam)
- # Pebulate (Tillam)
- # Cycloate (Ro-Neet)
- # Ethofumesate (Progress, Norton)
- # Molinate (Ordram)
- # Butylate (Sutan)
- # Triallate (Avadex)

**How Applied:**

These herbicides are soil applied and somewhat volatile.

**Mode of Action:**

The mode of action is unclear but they affect developing leaves in the growing points of susceptible seedling plants.

**Common Symptoms:**

Stunting and distortion of seedling leaves.

**HERBICIDES WHICH AFFECT SEEDLING GROWTH – INHIBITORS OF BOTH SHOOTS AND ROOTS**

- # Alachlor (Lasso)
- # Metolachlor (Dual, Pennant)
- # Butachlor (Machete)

**How Applied:**

Soil applied.

**Mode of Action:**

These herbicides interfere with protein synthesis and normal cell division.

**Common Symptoms:**

Stunting and distortion of seedling or developing leaves.

**CELL MEMBRANE DISRUPTERS – OILS, ACIDS & SALTS**

- < Oils
- < Acids (Sulfuric, pelargonic)
- < Salts

**How Applied:**

Foliar applied

**Mode of Action:**

These herbicides directly dissolve or destroy cell membranes causing rapid desiccation of sprayed plants.

**Common Symptoms:**

Water soaked appearance followed rapidly by necrosis and death of the sprayed plant parts.

**CELL MEMBRANE DISRUPTERS – BIPYRIDYLIUM HERBICIDES**

- # Paraquat (Gramoxone)
- # Diquat

**How Applied:**

Foliar applied

**Mode of Action:**

These herbicides intercept the energy of the photosynthetic process and produce disruptive compounds which result in membrane disruption and plant desiccation.

**Common Symptoms:**

Water soaked appearance followed rapidly by necrosis and desiccation of leaves and stems, may cause chlorotic spots in dilute concentration.

**CELL MEMBRANE DISRUPTERS –  
DIPHENYLETHER HERBICIDES**

- # Acidfluorfen (Blazer, Tackle)
- # Oxyfluorfen (Goal)
- # Lactofen (Cobra)

**How Applied:**

Soil and foliar applied with limited movement in the soil.

**Mode of Action:**

Oxyfluorfen, lactofen and acidfluorfen cause membrane disruption through lipid peroxidation.

**Common Symptoms:**

These herbicides cause necrosis of leaves and stems.

Further information and pictures of herbicide injury symptoms developed by Barry Tickes, Cooperative Extension, University of Arizona, David Cudney and Clyde Elmore, Cooperative Extension, University of California can be found on the University of California's weed research and information center web site at: <http://wric.ucdavis.edu>.

Sincerely,

Ron Vargas  
Farm Advisor

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