Herbicide Site of Action Key for Crop Injury Symptoms

To help you determine which herbicide(s) may be responsible for suspected injury on crops, this key uses the herbicide’s site of action (SoA) and respective Weed Science Society of America group number; herbicides within the same SoA can cause similar symptoms. After reaching a specific SoA, you can check if any of the herbicides from that group are the source of crop response. Herbicide control (selectivity) is specified for broadleaf and/or grass weed species and remember to also observe weeds for injury symptoms.

**Injured at emergence:** The plant absorbs the herbicide from the soil either as soil-applied herbicide or carryover. The roots are normal with damaged shoots or the roots are damaged resulting in stunted plants.

**Injured after emergence:** The herbicide has contact activity with the older leaves, resulting in injury, or the herbicide translocates (systemic activity) to the growing points (root tips or meristems) with new tissue showing injury.

### INJURED AT EMERGENCE: SOIL-APPLIED HERBICIDE OR CARRYOVER

#### Roots Normal, Damaged Shoots

- **Chlorotic / necrotic leaf margins**
  - Broadleaves most sensitive
  - Photosynthesis II Inhibitor (5&7)
  - Atrazine, Diuron, Metribuzin, etc.

- **Burning / interveinal chlorosis**
  - Burned cotyledon / hypocotyl
  - Broadleaves more sensitive than grasses
  - PPO Inhibitor (14)
  - Authority, Flexstar, Valor, etc.

- **Leafing out / buggy whipping**
  - Drawstring
  - Grasses more sensitive than broadleaves
  - Long-chain Fatty Acid Inhibitor (15)
  - Dual, Outlook, Zidua, etc.

- **Malformed new leaves**
  - HPPD Inhibitor (27)
  - Balance, Callisto, Laudis, etc.

- **Deformed leaves**
  - Grasses and/or broadleaves affected
  - HPPD Inhibitor (27)
  - Balance, Callisto, Laudis, etc.

#### Roots Damaged, Stunted Plants

- **Clubbed root tips**
  - Grasses most sensitive
  - Microtubule Inhibitor (3)
  - Prowl H2O, Treflan, etc.

- **Root proliferation**
  - Short, thickened roots
  - Broadleaves more sensitive than grasses
  - Synthetic Auxin (4)
  - 2,4-D, Dicamba, Status, Stinger, etc.

- **Pruned roots**
  - Short, slender lateral roots
  - Grasses and/or broadleaves affected
  - Synthetic Auxin (4)
  - 2,4-D, Dicamba, Status, Stinger, etc.

Note that a low rate of glyphosate can also cause white, bleached leaves on seedling corn.

This key is based on two traits of injury symptoms that can be used to distinguish different herbicide SoA:

- Injured at emergence: The plant absorbs the herbicide from the soil either as soil-applied herbicide or carryover. The roots are normal with damaged shoots or the roots are damaged resulting in stunted plants.
- Injured after emergence: The herbicide has contact activity with the older leaves, resulting in injury, or the herbicide translocates (systemic activity) to the growing points (root tips or meristems) with new tissue showing injury.

Note that the nematicide/fungicide Fluopyram (Levo) can mimic PPO injury symptoms (halo effect) on soybean cotyledons.
**INJURED AFTER EMERGENCE:** POSTEMERGENCE APPLICATION, TANK CONTAMINATION, DRIFT

**CONTACT ACTIVITY:** Older leaves injured, new leaves not injured

- Broadleaves more sensitive than grasses
- Nonselective

**TRANSLOCATING HERBICIDE WITH SYSTEMIC ACTIVITY:** New leaves (meristem) injured, older leaves not injured

- Leaf cupping, epinasty, leaning
- New leaves chlorotic/reddish, plants stunted
- White, bleached leaves

- Chlorotic, crinkled leaves, shortened internodes
- Variable injury, chlorosis, purpling, necrosis
- Grass meristems rot

- Chlorosis, reddened veins
- Nonselective

**Photosynthesis II Inhibitor (5, 6 & 7)**
Atrazine, Basagran, Buctril, etc.

**PPO Inhibitor (14)**
Aim, Cobra, Flexstar, etc.

**Glutamine Synthesis Inhibitor (10)**
Glufosinate, Liberty, etc.

**Photosystem I Electron Diverter (22)**
Diquat, Gramoxone, etc.

**Leaf cupping, epinasty, leaning**

**New leaves chlorotic/reddish, plants stunted**

**White, bleached leaves**

**Chlorotic, crinkled leaves, shortened internodes**

**Variable injury, chlorosis, purpling, necrosis**

**Grass meristems rot**

**Chlorosis, reddened veins**

**Nonselective**

**EPSP Synthase Inhibitor (9)**
Glyphosate, Roundup, etc.

**Grasses and/or broadleaves affected**

**HPPD Inhibitor (27)**
Callisto, Impact, Laudis, etc.

**Nonselective**

**ACCase Inhibitor (1)**
Assure, Poast, Select, etc.

**Grasses and/or broadleaves affected**

**ALS Inhibitor (2)**
Accent, Classic, Harmony, Resolve, Pursuit, etc.

**Transforming HERBICIDE WITH SYSTEMIC ACTIVITY: New leaves (meristem) injured, older leaves not injured**

**Broadleaves more sensitive than grasses**

**Synthetic Auxin (4)**
2,4-D, Dicamba, Status, Stinger, etc.

**Grasses and/or broadleaves affected**

**ALS Inhibitor (2)**
Accent, Classic, Harmony, Resolve, Pursuit, etc.