Herbicide Modes and Action and Symptoms on Plants

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Herbicide Modes and Action and Symptoms on Plants

• Discuss various classes of herbicides and their modes of action

• Show examples of the types of symptoms that various herbicides cause on plants
  - From excess rate or inappropriate rate to certain soil types
  - From mistakes in application to the wrong crop
  - From carryover from prior applications, or inadequate soil preparation, etc.
  - From drift
Herbicide Modes and Action and Symptoms

- Plant growth regulators
  - 2,4D – hay, turf
  - dicamba (Banvel) - hay
  - triclopyr (Garlon) – turf, woody plant control
Herbicide Modes and Action and Symptoms

- Lipid and amino acid synthesis inhibitors
  - sethoxdim (Poast) – grass selective, does not affect broadleaf plants
  - cycloate (RoNeet) - spinach
  - EPTC (Eptam) – beans (effective on yellow nutsedge)
  - bensulide (Prefar) – lettuce, cole crops, onions, cilantro, etc.
  - glyphosate (Roundup)
  - rimsulfuron (Matrix) - tomatoes
Herbicide Modes and Action and Symptoms

- Cell division and cell wall inhibitors
  - Pronamide (Kerb) – head lettuce
  - DCPA (Dacthal) – broccoli, onions
  - trifluralin (Treflan) – tomatoes, rapinni
  - s-metolachlor (Dual Magnum) – spinach, beans
  - Dimethenamid (Outlook) – onions (controls yellow nutsedge)
Herbicide Modes and Action and Symptoms

- Photosynthetic & pigment synthesis inhibitors
  - Oxyfluorfen (Goal) – cole crops
  - Paraquat (Gramaxone) – burn down, prior to planting
  - linuron (Lorox) – celery
  - prometryn (Caparol) – celery
  - simazine (Princep) – grapes
Plant growth regulators

- 2,4D
- dicamba (Banvel) – hay
- triclopyr (Garlon) – turf, woody plants
  - Commonly used in turf to control broadleaf weeds (e.g. clover)
  - Issues mostly seen from home owners
  - Issues in agriculture not seen much in this area because this class of chemistry in totally incompatible with lettuce production (occasionally in Hollister – hay growing area)
Plant growth regulators

- 2,4D
- dicamba (Banvel) – hay
- triclopyr (Garlon) – turf, woody plants
  - Symptoms often include:
    - exaggerated growth
    - twisting
    - deformity
    - straped shaped leaves
Plant Growth Regulator Symptoms on Lettuce

Transline symptoms
Carryover in compost

Dicamba
Drift from hay
Probable Phenoxy Symptoms on Peppers
Plant Growth Regulator
carryover in potting soil
Plant Growth Regulator
carryover in potting soil
Lipid and amino acid synthesis inhibitors

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Lipid and amino acid synthesis inhibitors

- Lipid inhibition symptoms:
  - A wide variety of symptoms including deformity of leaves
  - stunting
  - shiny leaves (removal of cuticle)
- Amino acid inhibition symptoms:
  - Yellowing
  - deformity (strap shaped leaves)
Lipid synthesis inhibitors
Prefar symptoms in winter are more severe than the summer.
RoNeet Overdose on Spinach

too high a rate for soil type
RoNeet Overdose on Spinach
Note deformity of cotyledons, stunting and death
RoNeet carryover from an aborted spinach crop on lettuce, light soil (the lettuce grew out of these symptoms very well later in the season)
RoNeet Damage on Broccoli

note the lack of waxy cuticle
Amino Acid Synthesis Inhibitors
Roundup

Yellowing symptoms occur on the growing point of the plant.
Roundup
Symptoms on broccoli and artichoke
Roundup on Rose
Roundup Symptoms on Onion

note thickening of base of plant
Matrix on Lettuce
Amino acid inhibitor, symptoms similar to Round up
Cell division and cell wall inhibitors

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Cell division and cell wall inhibitors

- Most of these materials are soil applied and affect the roots or are absorbed by the shoot as the plant emerges through the soil.

- Common symptoms include:
  - Poor root growth
  - “clubbing of the root”
  - Stunting
  - Poor stand of plants
  - Can also cause deformity of the tops of the plants
Poor root development with Kerb

Untreated
Classic haloing of cotyledons from Kerb on lettuce usually seen in the early spring.
Kerb affect on the roots of other crops

Spinach

Broccoli
Accidental application of Dacthal on lettuce
Dual carryover on romaine
Dual Magnum overdose on Celery
Dual PPI on Celery

note poor emergence of the roots from the plug in the treated zone
Dual PPI on Celery
Dual Magnum over-the-top to Peppers
Outlook on carrot seedlings
severe stunting and poor growth

Standard weed program

Outlook
Herbicide Modes and Action and Symptoms

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Herbicide Modes and Action and Symptoms

- Photosynthetic & pigment synthesis inhibitors
- Symptoms can be dramatic
  - Burned areas or spots on the plant
  - Yellowing
Dramatic Examples of Photosynthetic Inhibitors

Command on Squash and Beets
Goal aerial drift
On lettuce
Paraquat aerial drift on lettuce
Residues of goal in the soil and their impact on lettuce seedlings
No Damage
No Damage
Slight Damage
Slight Damage
Increasing Damage
Moderate damage
Splash from the soil surface to the underside of the leaf.
Splash from the soil surface to the underside of the leaf

Rusty color on vein

Bleaching/bronzing of the lower epidermis
Puckered and deformed lower leaves with some necrosis
Affected seedlings can be stunted and set back.
Typical sign of Goal residues on 80 inch wide beds. Winter applications of Goal cannot be worked at thoroughly as 40 inch wide beds and therefore the residues are not inactivated and can cause thinning out of the stand, particularly in the middle of the bed.
Edge of bed looks good. It is worked more aggressively.

Middle of the bed is more difficult to thoroughly work and has more issues with carryover.
Classic burning at soil line
Affected leaves often form a loop
RoNeet Damage

Sickle shaped and burned off at tips, no burn at soil line.

Goal Damage

Can look similar to RoNeet but with burn at the soil line.
Goal residues in the Soil and Symptoms on Spinach Plants

Oxyfluorfen Concentrations in Soil 0-2 Inch Depth

Oxyfluorfen ppm

0.61 ppm
0.35 ppm

Affected  Unaffected
Substantial Damage Observed in this Instance at:
0.16 to 0.35 ppm
(0.10 to 0.23 lbs a.i./A)
At application, 0.50 lb a.i./A of Goal is concentrated in the top 1/8 to 1/4 inch
Incorporating Goal to 2 inches dilutes it by a factor of 8-16.
Incorporating Goal to 4 inches dilutes it by a factor of 16 - 30
Impact of Organic Matter/Carbon

With Charcoal

Without Charcoal
Use of Goal on Onions and Broccoli

with their thick waxy cuticles,
they shed the herbicide and are less
damaged than the weeds
Flag and 1\textsuperscript{st} true leaf

2\textsuperscript{nd} true leaf
Goal burn on onions

Goal 2XL

Goal Tender

1st true leaf
Goal Applied to Broccoli

Note burned areas on leaf