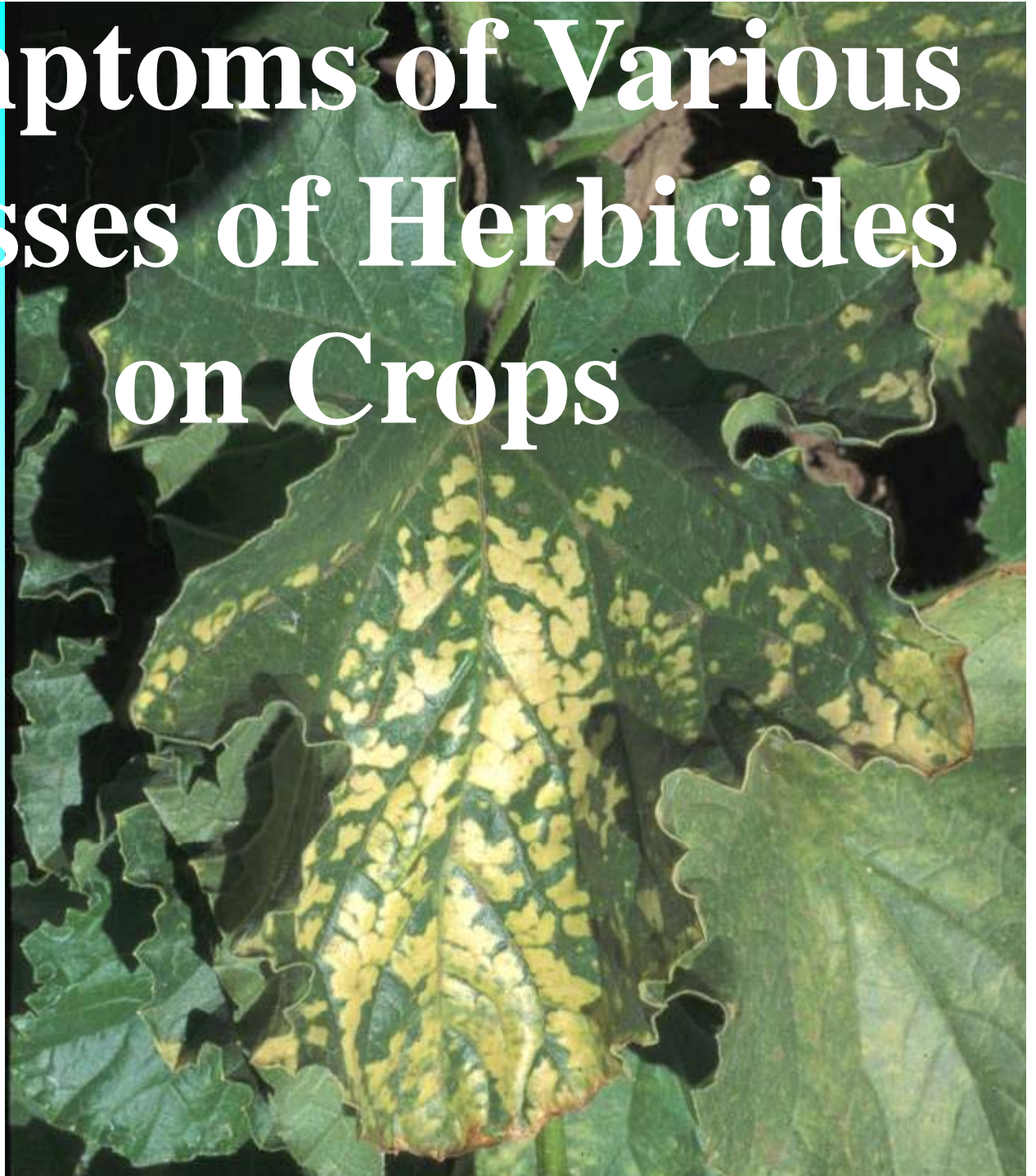


Symptoms of Various Classes of Herbicides on Crops

Tom Lanini
UC Davis



Common Herbicide Classes

- **ACCase inhibitors (1) – Poast, Fusilade, Select, etc.**
- **ALS inhibitors (2) – Sandea, Matrix, Raptor, etc.**
- **Photosynthetic inhibitors (7 or 5) – Karmex, Caparol, etc.**
- **PPO inhibitors (14) – Goal, Chateau, Shark, etc.**
- **Mitosis inhibitors (3) – Balan, Dacthal, Dual, Treflan, Prowl, Kerb, etc.**
- **Auxinic Acids (4) – 2,4-D, Garlon, Transline, etc.**
- **ESPS inhibitor (9) – Roundup**

Photosynthetic Inhibitors

- Princep (5)
- Metribuzin (5)
- Caparol (5)
- Hyvar (5)
- Velpar (5)
- Karmex (7)
- Lorox (7)

Photosynthesis inhibitors

- At low rates the symptoms will be on mature leaves. Princep or Sencor cause interveinal chlorosis. Caparol or Karmex cause veinal chlorosis.
- At high rates, new leaves may burn without the chlorosis first appearing.



Almond leaves with Princep symptoms

Sencor
@ 0.1 lb/a



Caparol injury to beans



Caparol



Untreated



**Karmex injury
on Fruitless
Mulberry**

**Note veinal
chlorosis**





**Diuron on
Melon**

Protoporphyrinogen Oxidase Inhibitors

- Goal
- Chateau
- Shark
- Ronstar
- Zeus/Spartan
- **Gramoxone (22)-**
Not a PPO inhibitor
but symptoms are
similar

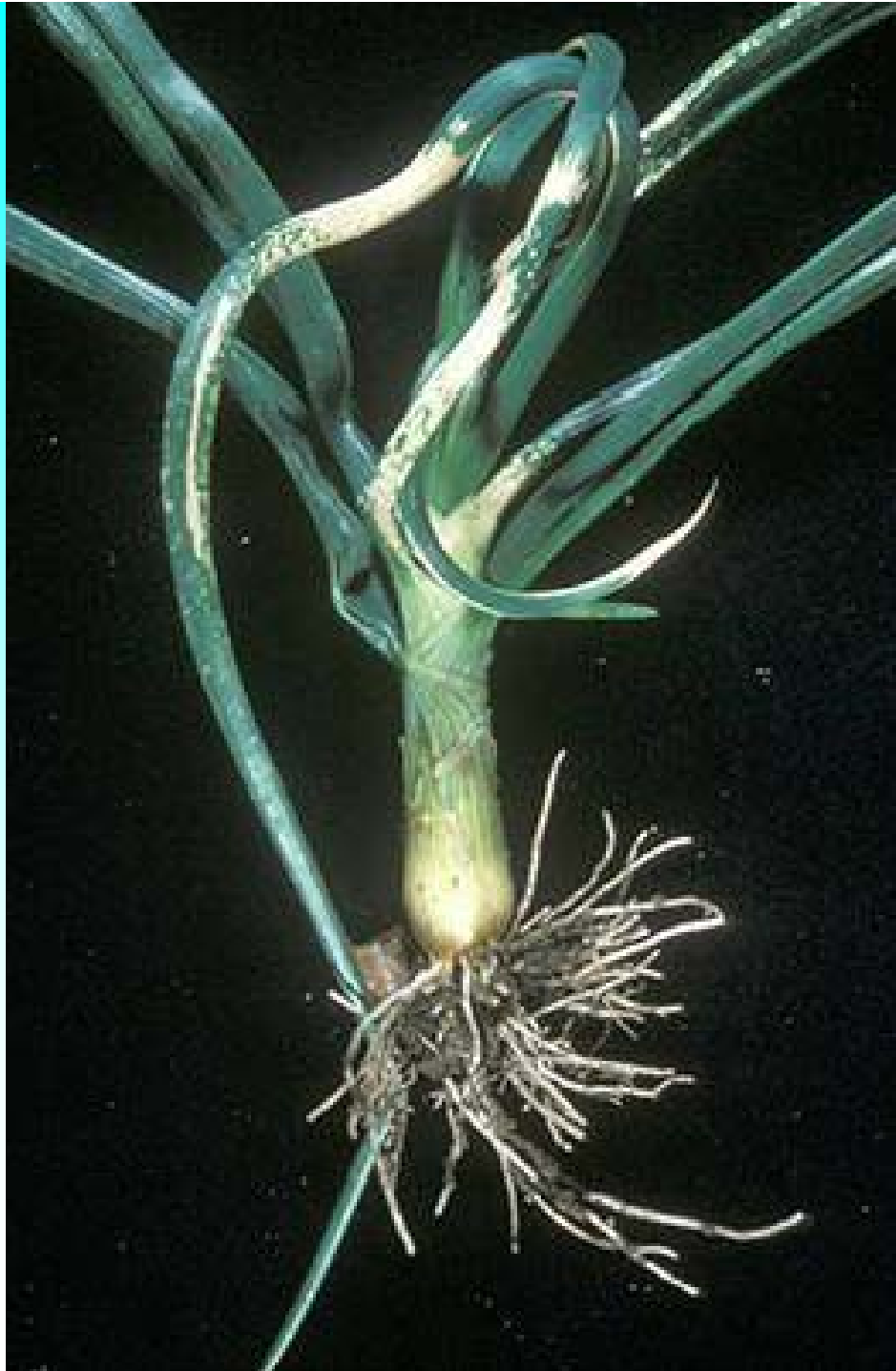
PPO Inhibitors

- Primarily spotting of leaves - new or old with new leaf growth being normal. Spotting may be necrosis or chlorosis.
- Will affect fruit by spotting or gumosis. If early enough in fruit development the fruit, or berries of grape will fall.
- Preemergence applications can result in stem girdling or leaf necrosis in emerging plants



Peppers with Goal injury

**Goal
symptoms
on onion**





**Goal Aerial Drift
on Spinach**

**Goal aerial drift
On Lettuce**



Paraquat aerial drift

for comparison





Cucumbers – Goal

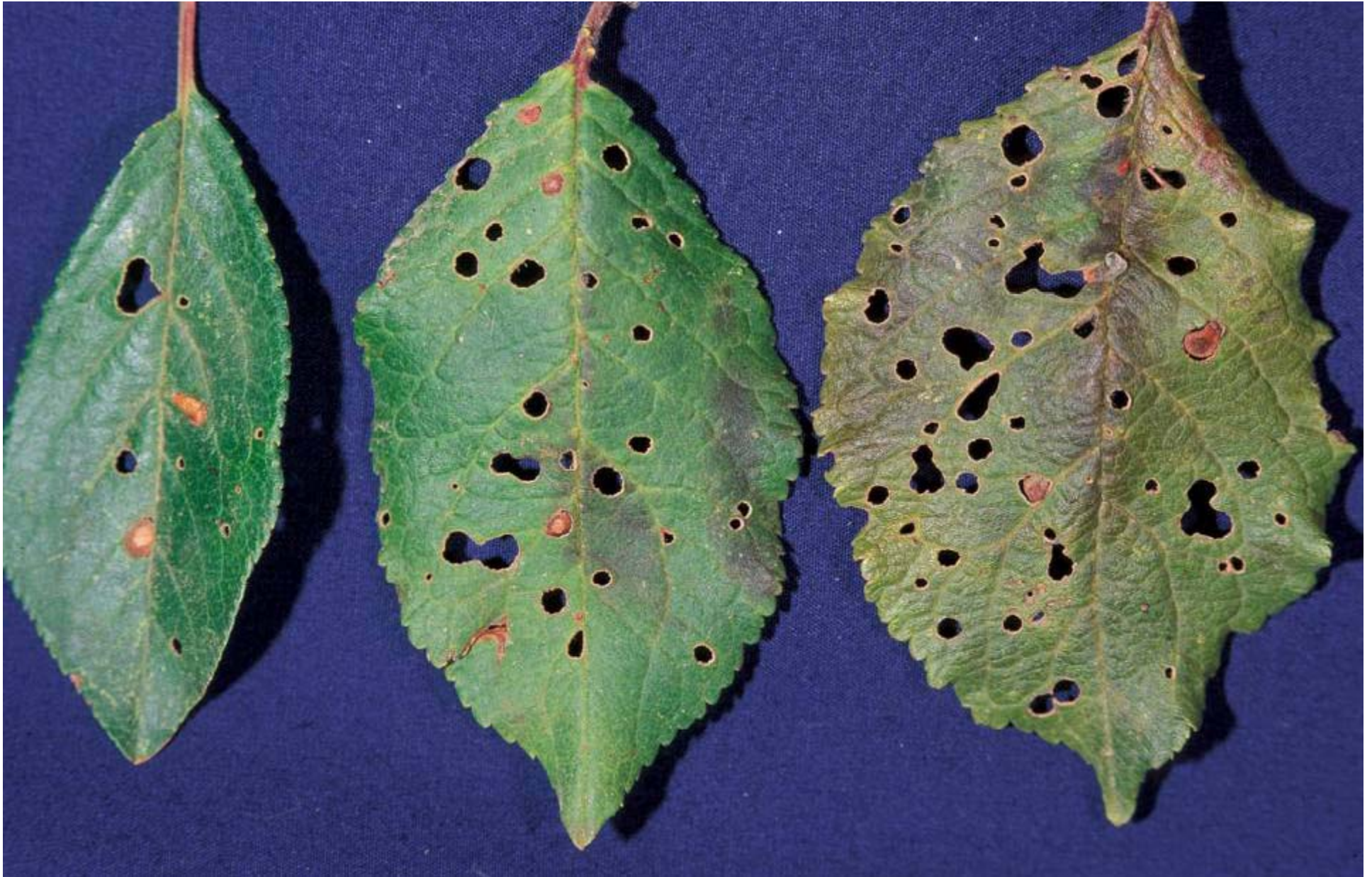
new growth OK

**Shark symptoms
on Photinia**



Shark on English Ivy



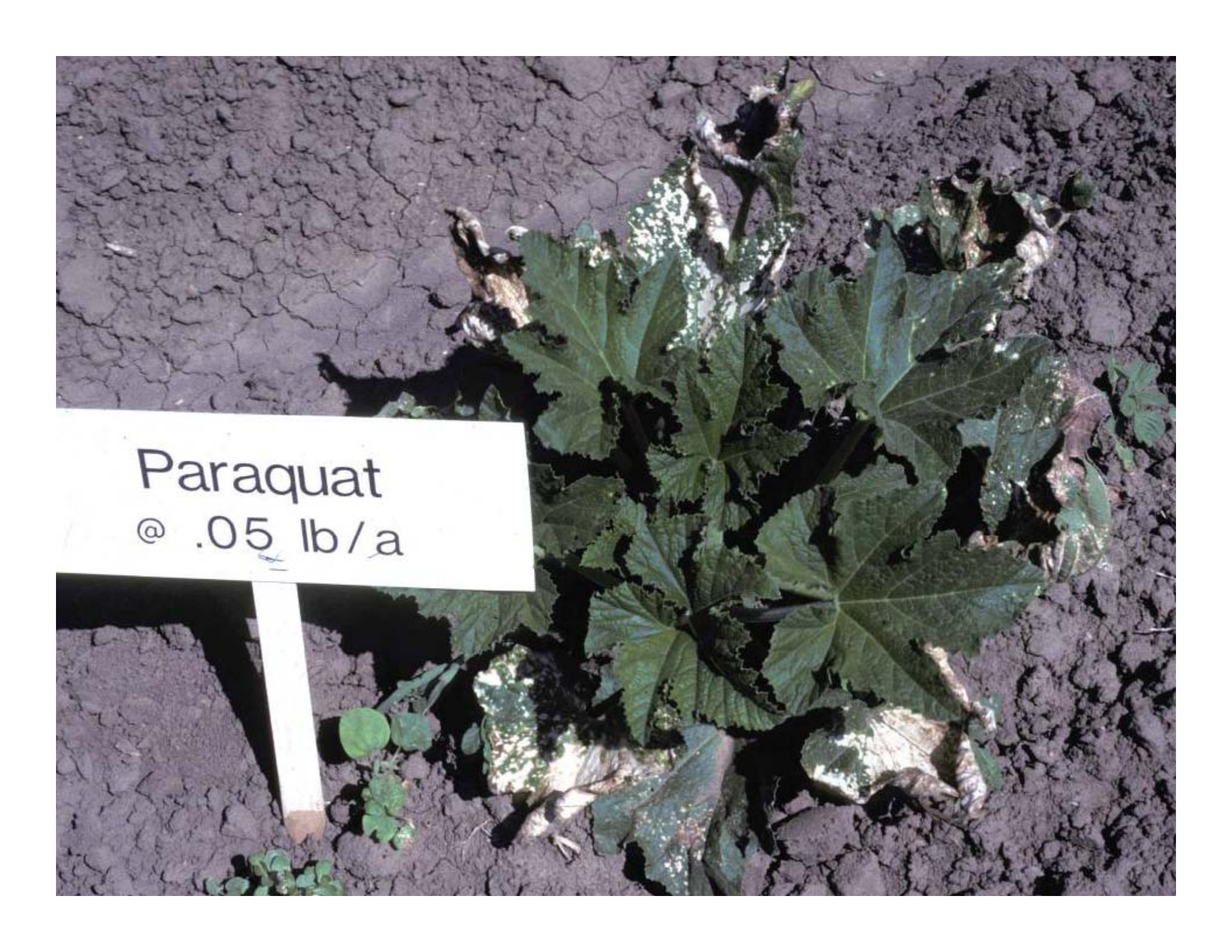


Prune injured by Shark drift





Gramoxone



Paraquat
@ .05 lb/a



No Damage





Slight Damage



Increasing Damage



Severe Damage

A close-up photograph of two young green plants growing in dark, sandy soil. The roots of both plants are visible, extending downwards. The roots of the plant on the right show a distinct dark, charred appearance at the soil line, indicating damage from soil burning. The plant on the left appears healthier. The text "Classic burning at soil line" is overlaid in yellow at the bottom right of the image.

Classic burning at soil line

Affected leaves often form a loop





**Splash from the soil
surface to the underside
of the leaf**

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**

Mitosis Inhibitors

- Prowl
- Treflan
- Balan
- Sonolan
- Surflan
- Dacthal
- Dual Magnum
- Devrinol
- Kerb

Mitosis Inhibitors

- Overall reduction in growth, no visual symptoms on leaves.
- Swelling of stems at the soil line with some herbicides; stems may be brittle
- Root suppression (roots enlarged at the tip), reduced lateral roots
- Interfere with cell division
- Mid-rib of leaves sometimes shorted
- Grass leaves fail to unfurl



Surflan injury to corn



**Treflan
injury to
Tomato**



Control

Treflan
1 lb.

Treflan
2 lb.

Treflan
4 lb.

ontrol



Treflan

1 lb



Treflan

2 lb



Treflan

4 lb







**Treflan on
tomatoes**



Treflan on Tomatoes







Poor root development with Kerb



Untreated

Metolachlor



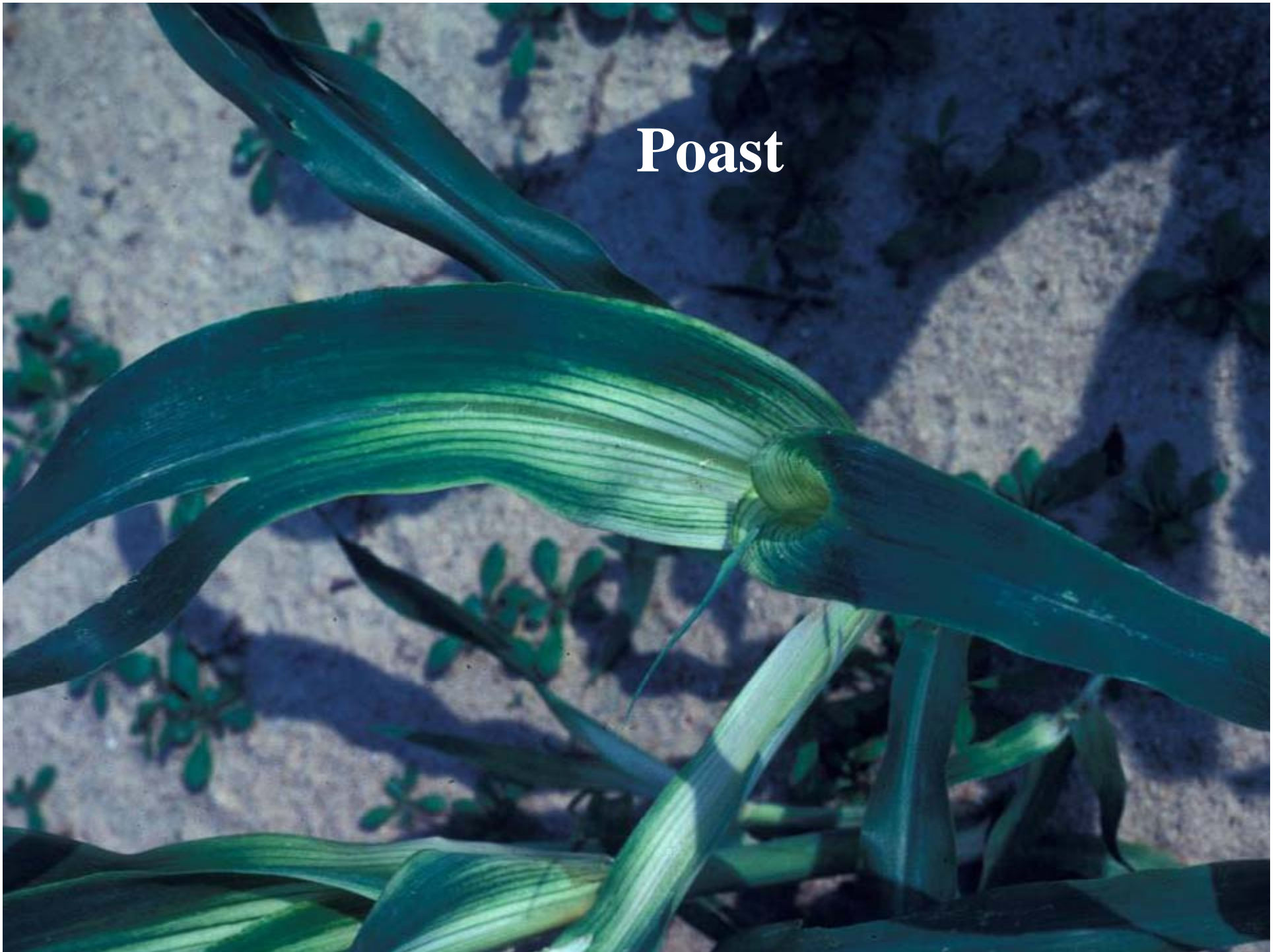
Lipid Biosynthesis Inhibitors

- Fusilade
- Poast
- Select/Prism

Lipid Biosynthesis Inhibitors

- Symptoms on grasses only
- Cessation of top growth
- Yellow and then purple leaves

Poast





Poast



ALS inhibitors

- Glean
- Londax
- Accent
- Sandea
- Oust
- Osprey
- Matrix
- Pursuit
- Raptor
- Regiment
- Staple

ALS Inhibitors

- Symptoms on new foliage
- Shortened internode length
- Chlorosis and necrosis of meristems
- Symptoms from drift or soil residual



Matrix symptoms on Sunflower

PURSUIT

@

0.010 lb/A

+

0.25% COC

UNTREATED

Roundup Ultra

@

0.1 lb/A



Matrix on lettuce





**Oust on
Corn**

Oust drift
onto almonds





Sandea drift onto prunes



Sandea drift





Londax symptoms on squash



Shadeout
0:006 LB ai/A
+0.25% NIS



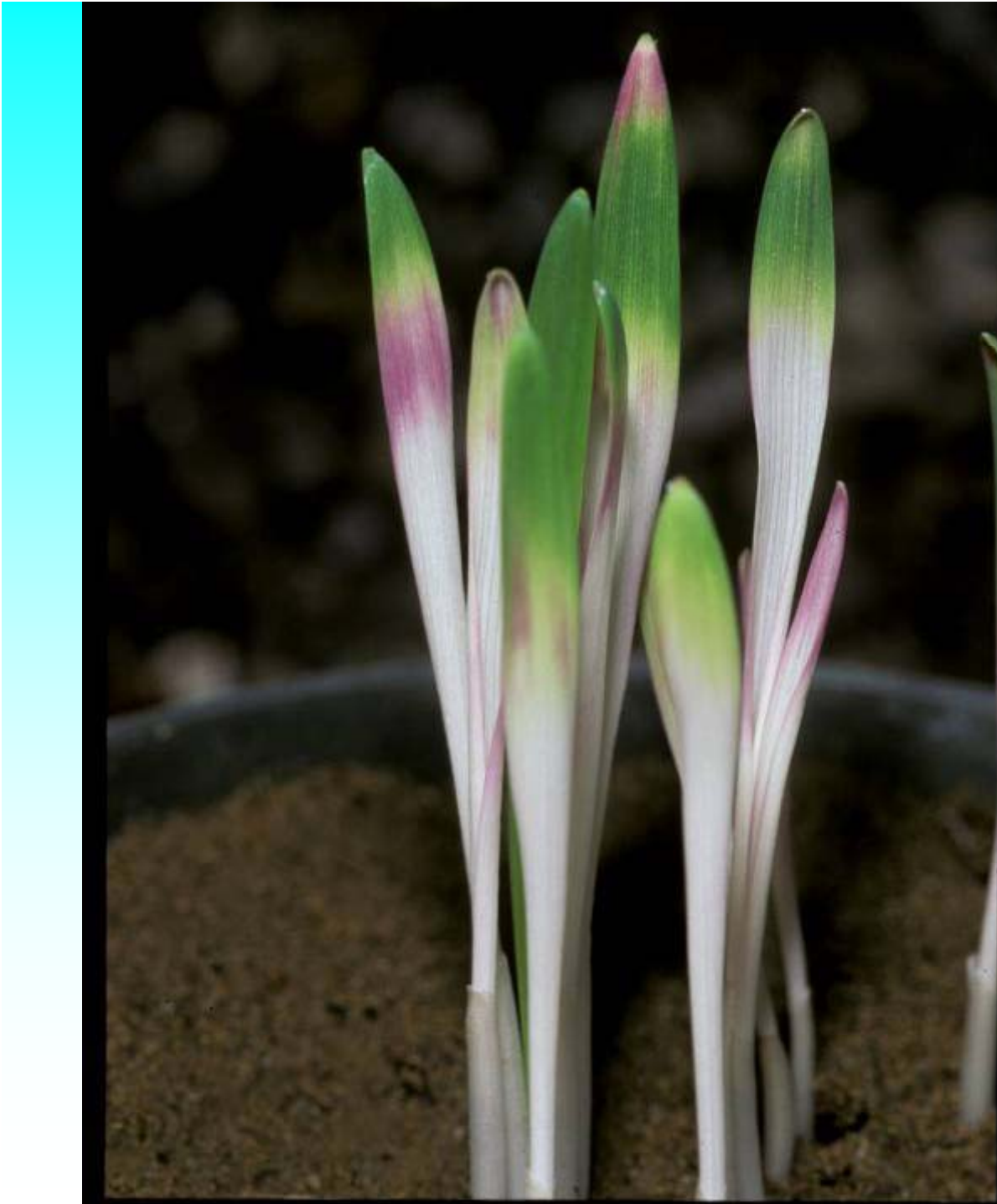
Cotton injured by Pursuit



Pumpkin injured by Raptor drift

Carotenoid Biosynthesis Inhibitors

- Pigment synthesis inhibition
- Veinal whitening → necrosis
- Symptoms appear shortly after emergence



Solicam symptoms
on oats





Solicam injury on almond leaves

Command



Command



ESPS Inhibitor (Glyphosate)

- Blocks amino acid synthesis
- Spring / summer symptoms: reduced size of new growth, feathering of new growth, yellow new leaves, shortened internode length, bud breaks in the leaf axils, new leaf growth may be puckered with prominent veins, may have chlorotic spots
- Fall symptoms: old leaves may not show symptoms or they may have chlorotic spotting, if there is new growth it may be distorted.

Glyphosate applied in the fall to almond



**Glyphosate applied
in the fall to peach**

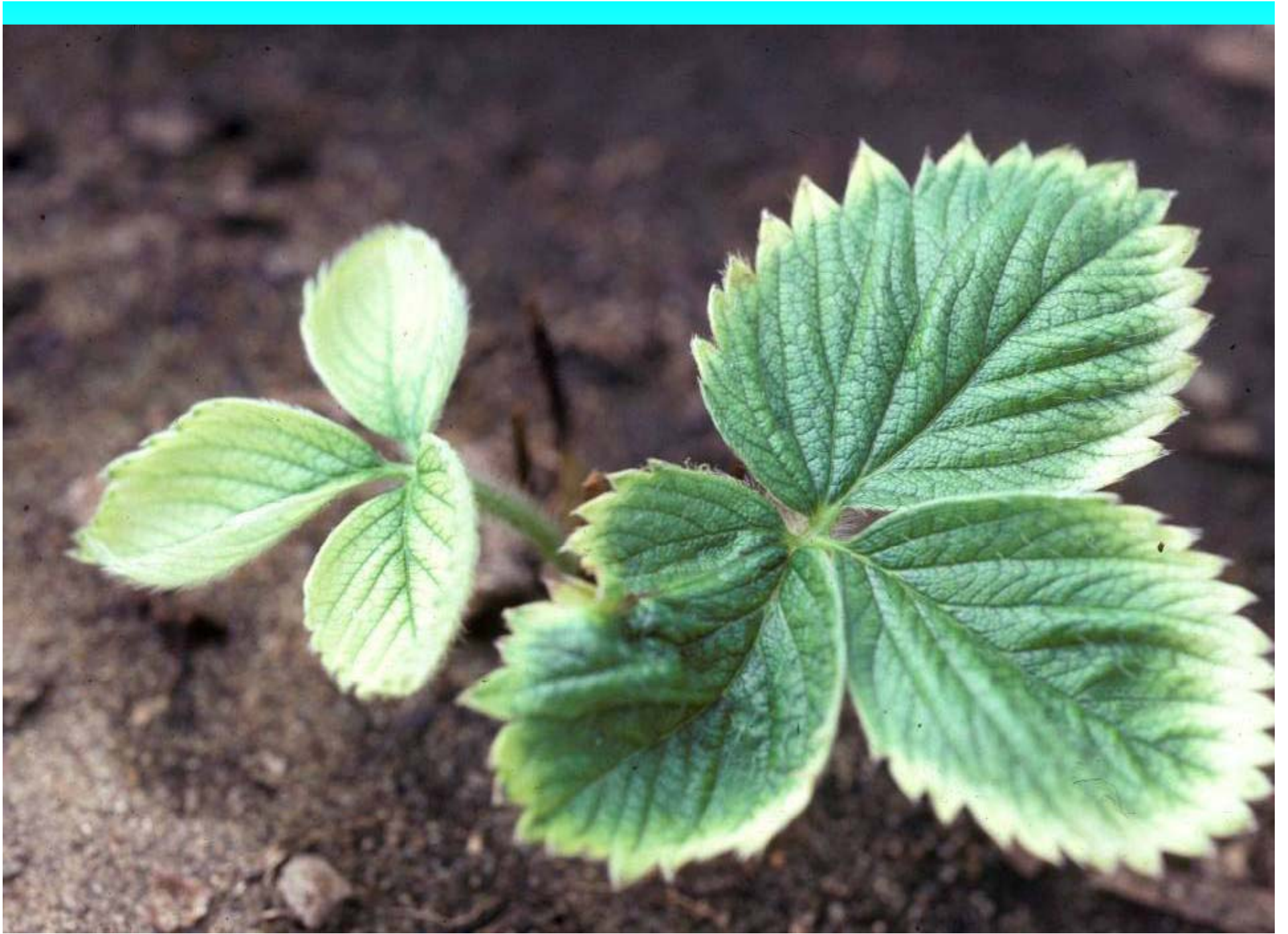




**Almond limb with chlorosis
from glyphosate drift**



Glyphosate drift on to almonds





Tomato leaf with Glyphosate symptom

Roundup on Broccoli



Roundup



Auxinic Acids

- 2,4-D
- MCPA
- MCPP
- 2,4-DB
- Clarity
- Garlon
- Transline
- Milestone

Auxinic Acids

- Petiole twisting, tendril twisting, malformed leaves
- Symptoms mostly on new growth, little effect on mature leaves
- Stem cracking and node enlargement, “root primordia“ or callus-like tissue may appear in cracks



Dandelion twisted by 2,4-D

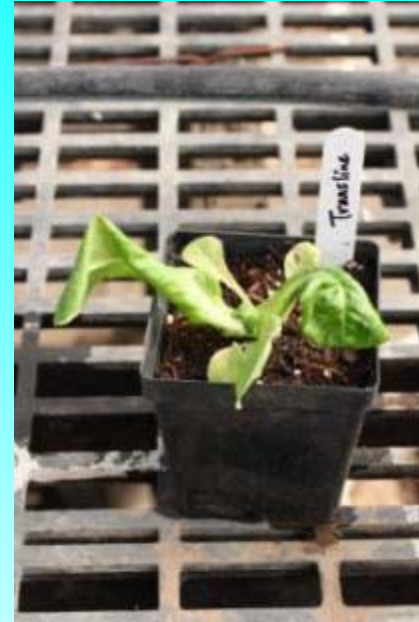


Watermelon twisted by Garlon



Cotton leaves cupped by Garlon

Transline





**2,4-D on
Grapes**





Cotton – “strap” leaves caused by 2,4-D



Cotton with “strap” leaves from MCPA drift



Garlon on grape



Garlon on tomatoes



Transline injury on sunflower



**Cupping
caused by
Transline**



Symptoms in plants may be caused by many factors

- **Abiotic factors**

Nutrient deficiency or excesses

Water excess or drought

Wind (sand or soil particles with wind)

High or low temperatures

Mechanical damage

Pesticides (herbicides, fungicides, insecticides)

Conclusions

- **Many factors can cause abnormal crop growth**
- **Take pictures**
- **Compare symptoms to those observed on other plants**



Questions