Goal Residues and Implications for Carryover

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Background on Goal

- Goal 2XL and Goal Tender (4F)
- It is a diphenylether
- It is a protox inhibitor that thereby disrupts normal photosynthetic activity
- This causes a chain reaction that results in accumulation of free radical oxygens that cause lipid peroxidation and membrane destruction – the end result is similar to paraquat

Background on Goal

Other herbicides used in this area with the same mode of action include:

- **Chateau**
- **Shark**

Registered Uses

- **Pre transplant on cole crops and post emergence on broccoli* and cauliflower***
- **Onions* – post emergence**
- **Perennial crop (i.e. Artichokes) – post directed**
- **Fallow beds prior to many crops**

*** Takes advantage of the waxy cuticle**

Background on Goal

- It is readily absorbed by the leaves of plants and rapid bleaching and desiccation occur around the sites where the spray droplets were deposited
- Necrosis occurs in 1-2 days
- Translocation in the plant is very limited
- Little is absorbed by roots

Behavior of Goal in Soil

- **Strongly adsorbed to soil and not readily desorbed**
- **It is adsorbed by the clays and organic matter**
- **Its solubility in soil water is 0.1 ppm (extremely insoluble)**
- **Therefore does not leach or move much in soil – except for sandy soil**
- **It acts by forming a barrier at the soil surface**

Behavior of Goal in Soil

- **Degradation in soil**
  - **Photodegradation is an important means of breakdown**
  - **Microbial degradation is slow**
- **Persistence**
  - **Half life is 35 days (30-40 days)**
    - **Will depend on the moisture and temperature**

Behavior of Goal in Soil

- **Fallow Bed Rates**
  - **For lettuce and other leafy vegetables**
    - **0.25 lb a.i./A (0.5 pint Goal Tender) 90 days**
    - **0.50 lb a.i./A (1.0 pint Goal Tender) 120 days**
- **Prior to planting fallow beds need to be thoroughly worked to at least 2.5 inches**

Symptoms of Goal Damage

- **The breakdown of Goal in the 90 – 120 time frame can be incomplete, and if the beds are not thoroughly worked, Goal can damage sensitive crop seedlings**
- **The breakdown of Goal residues can be affected by the weather**
- **Carry over issues are most frequently seen on 80-inch beds because they are more difficult to adequately work sufficiently**

Middle of the bed is more difficult to thoroughly work and can have more Issues with carryover

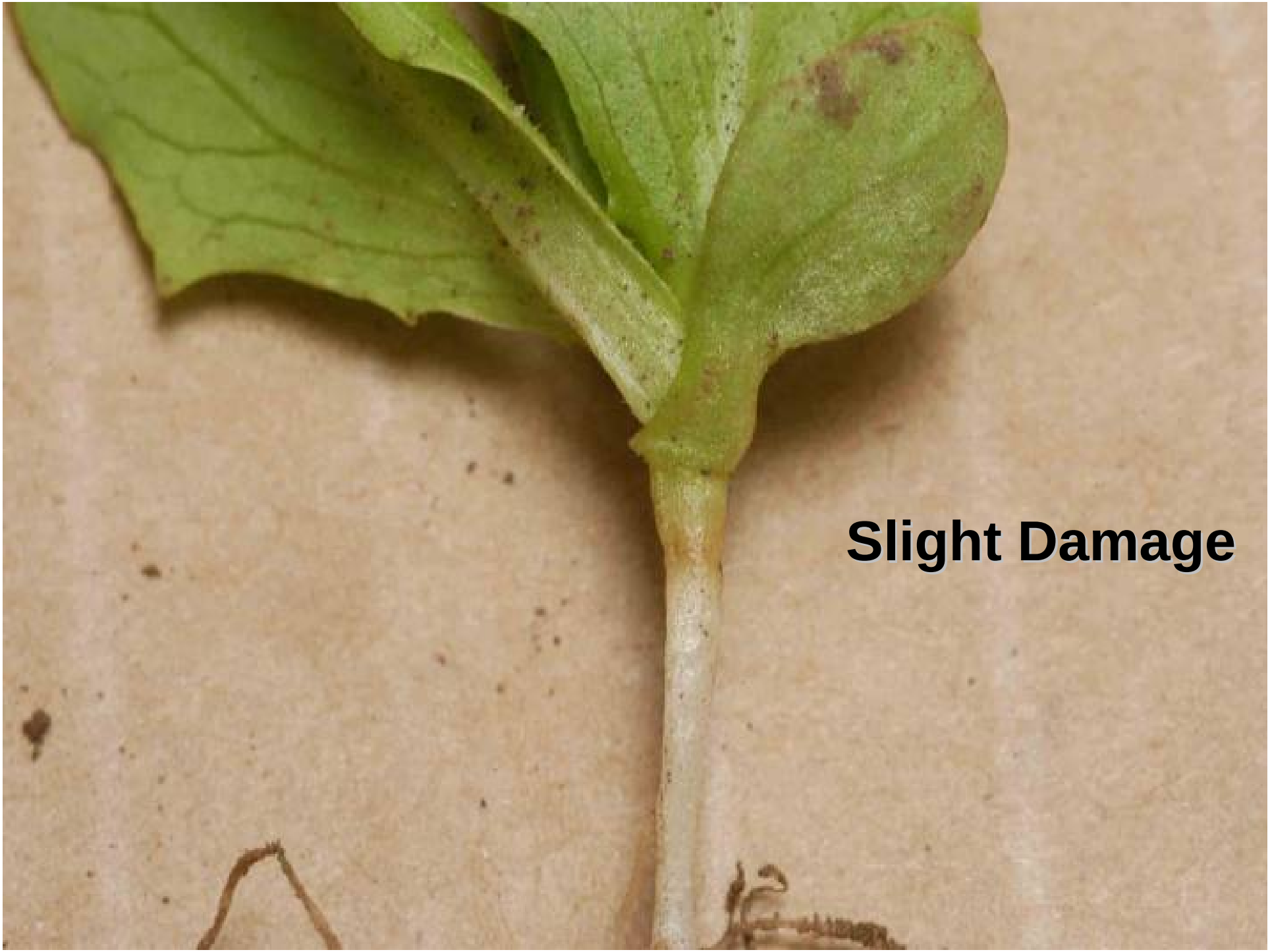
Symptoms of Goal Carry Over on Seedlings

- Symptoms include stunting of the seedlings, leaf distortion, necrotic spots, curling and cupping of the leaves and burning of the hypocotyle at the soil line
- Interestingly, even though the soil may have Goal residues, we have not seen Goal symptoms on the roots

Goal Damage on Lettuce Seedlings


No Damage

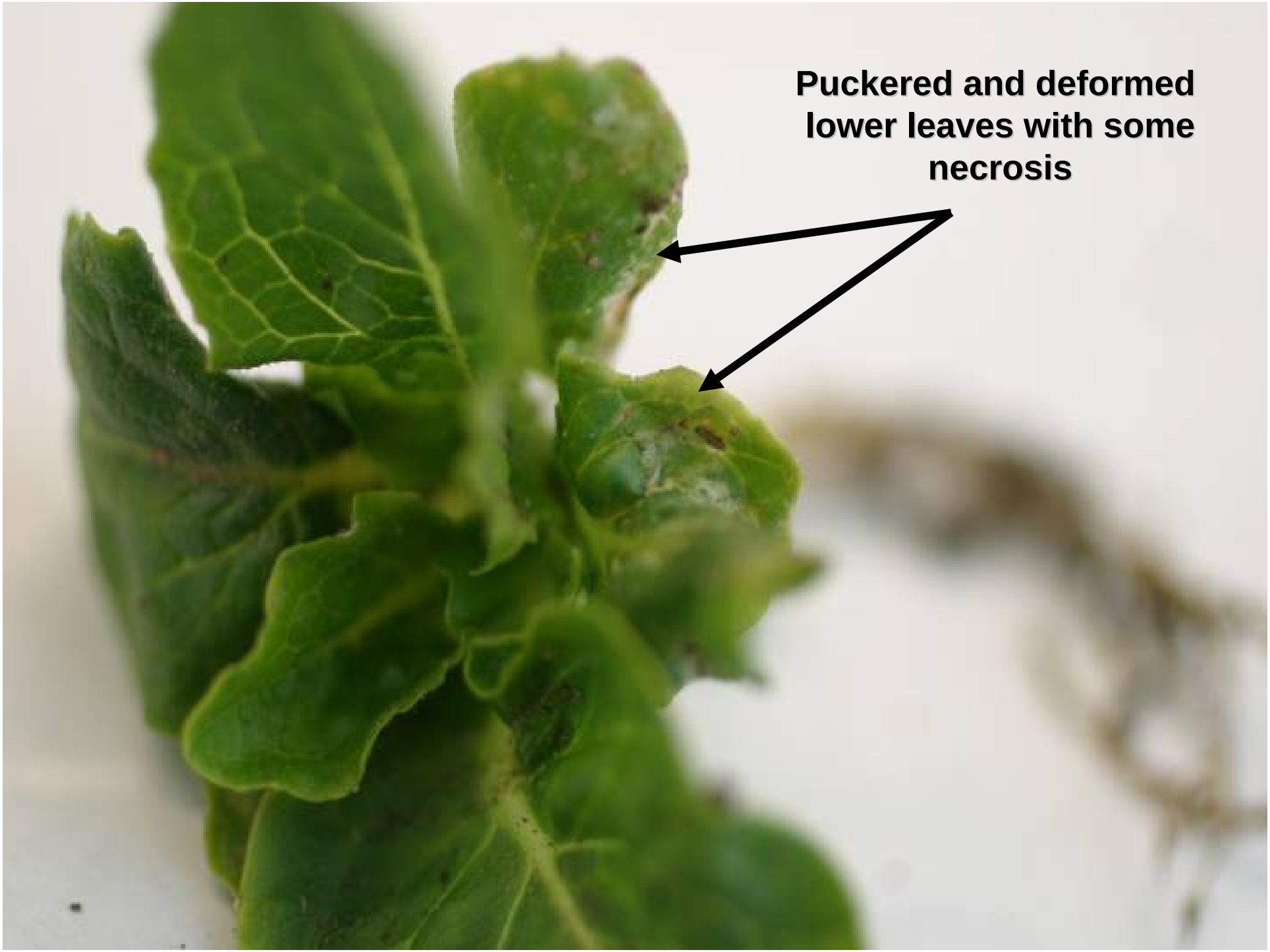

No Damage


Slight Damage


Slight Damage


Increasing Damage

Severe Damage


Puckered and deformed lower leaves with some necrosis


Close up of underside of
Crinkled leaf

Size range of affected seedlings:

Normal **moderate** **severe**

Goal Damage on Spinach


RoNeet Damage

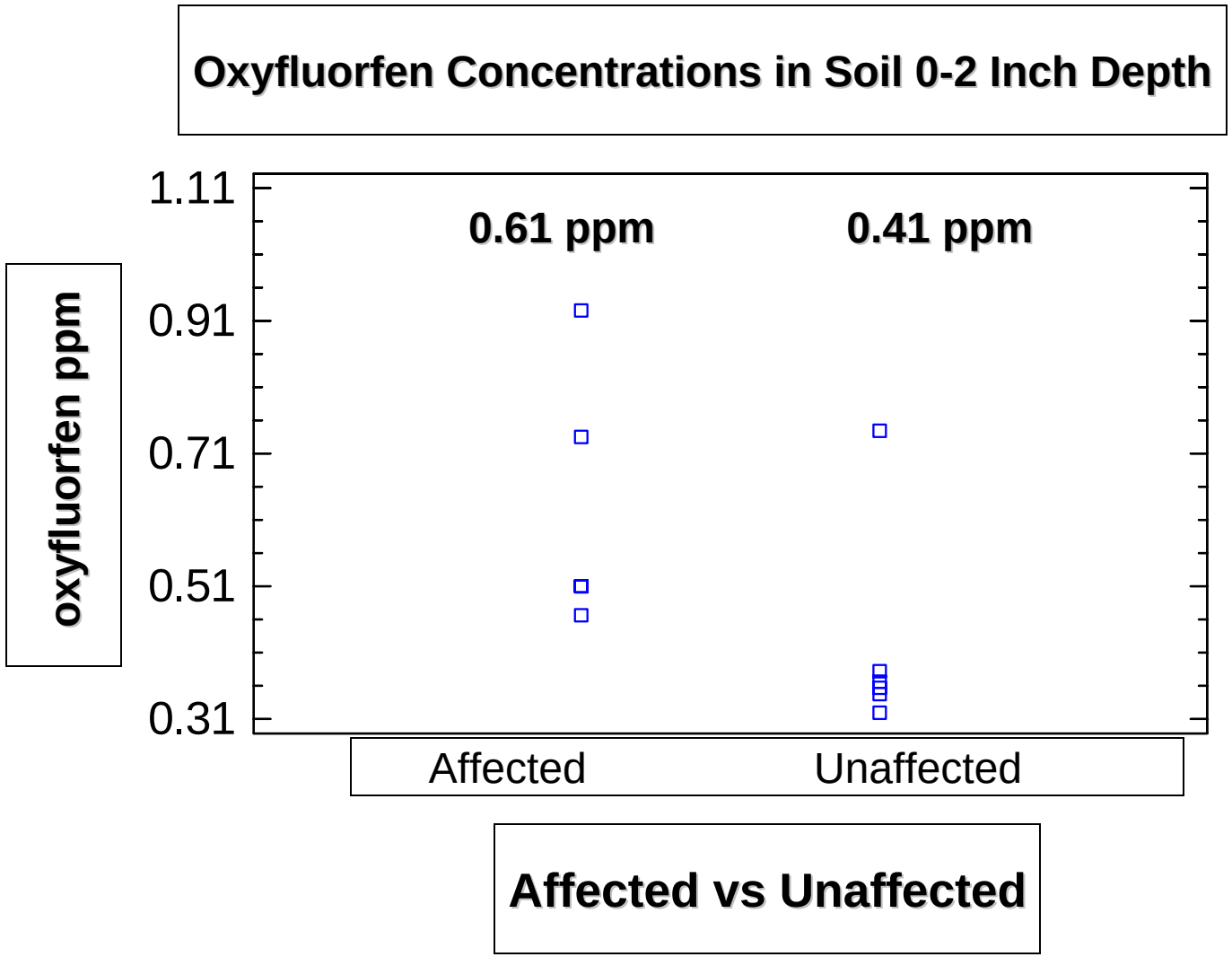

Goal Damage

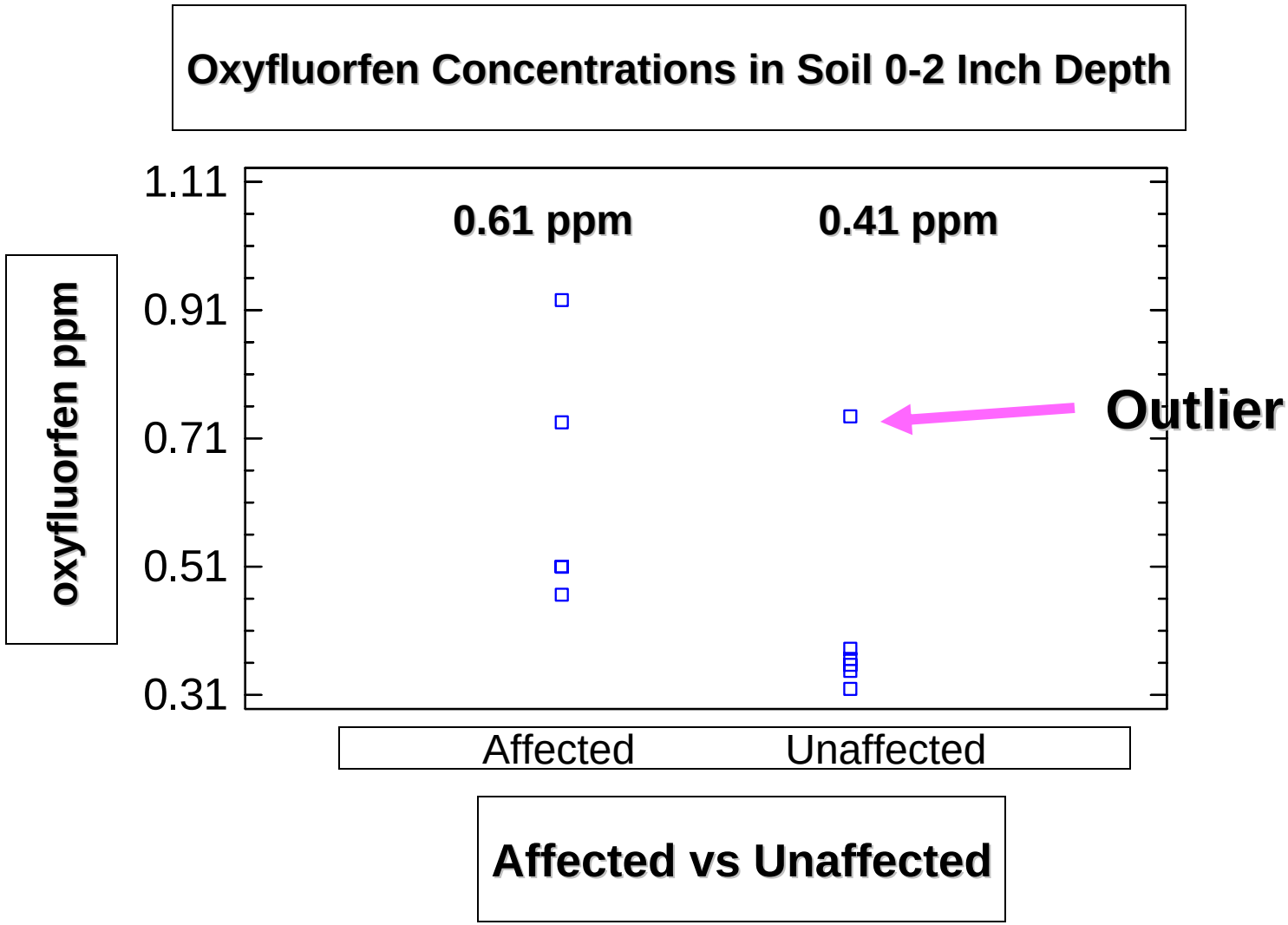
Problems with Carry Over

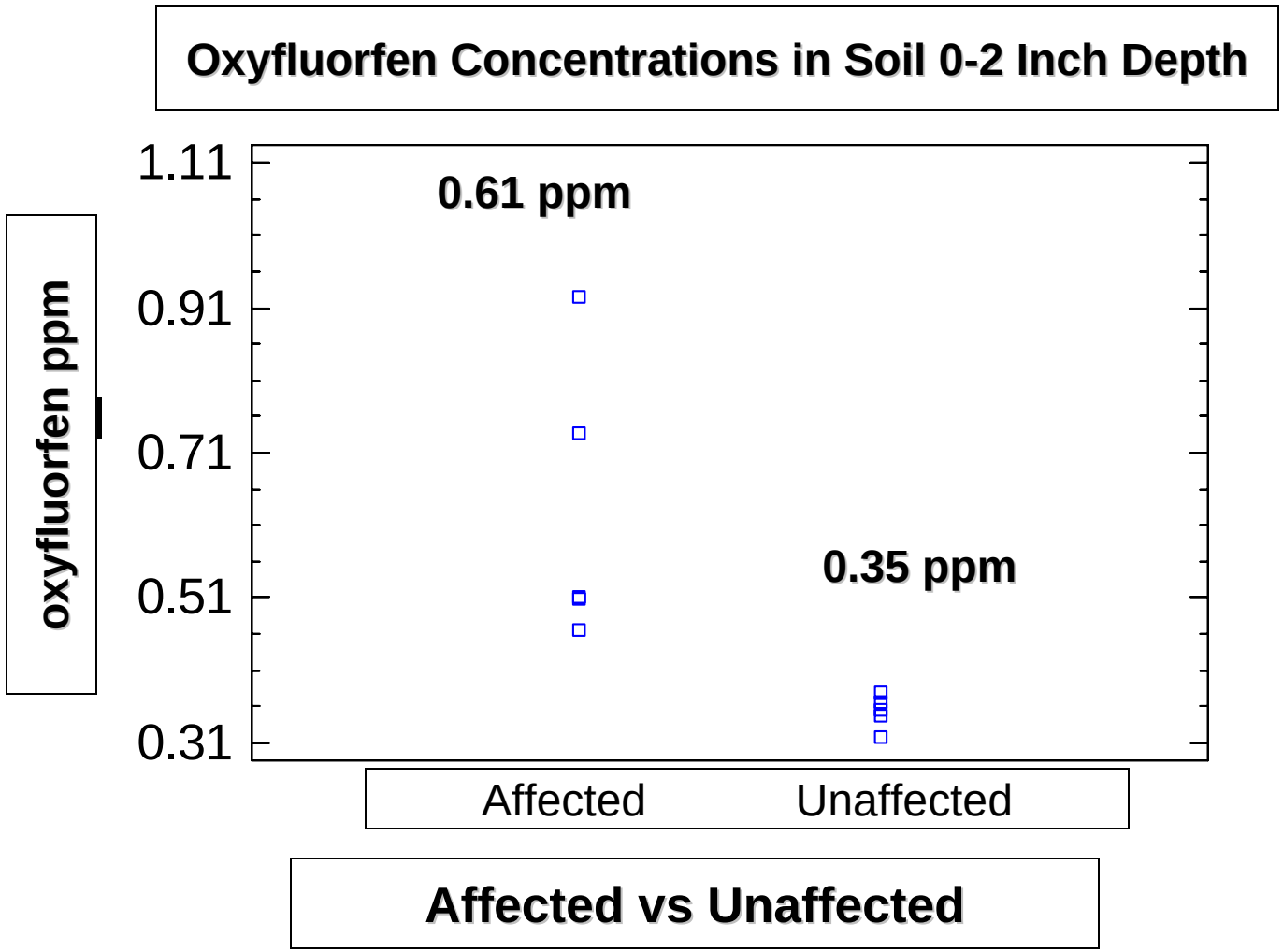
- It is possible that in some years there may be more carry over from fallow bed use due to low moisture and temperature conditions the prior winter
- The 2006-07 winter was cold (at least for 2 weeks in January) and mostly dry
- This may have affected the normal rate of breakdown of this material

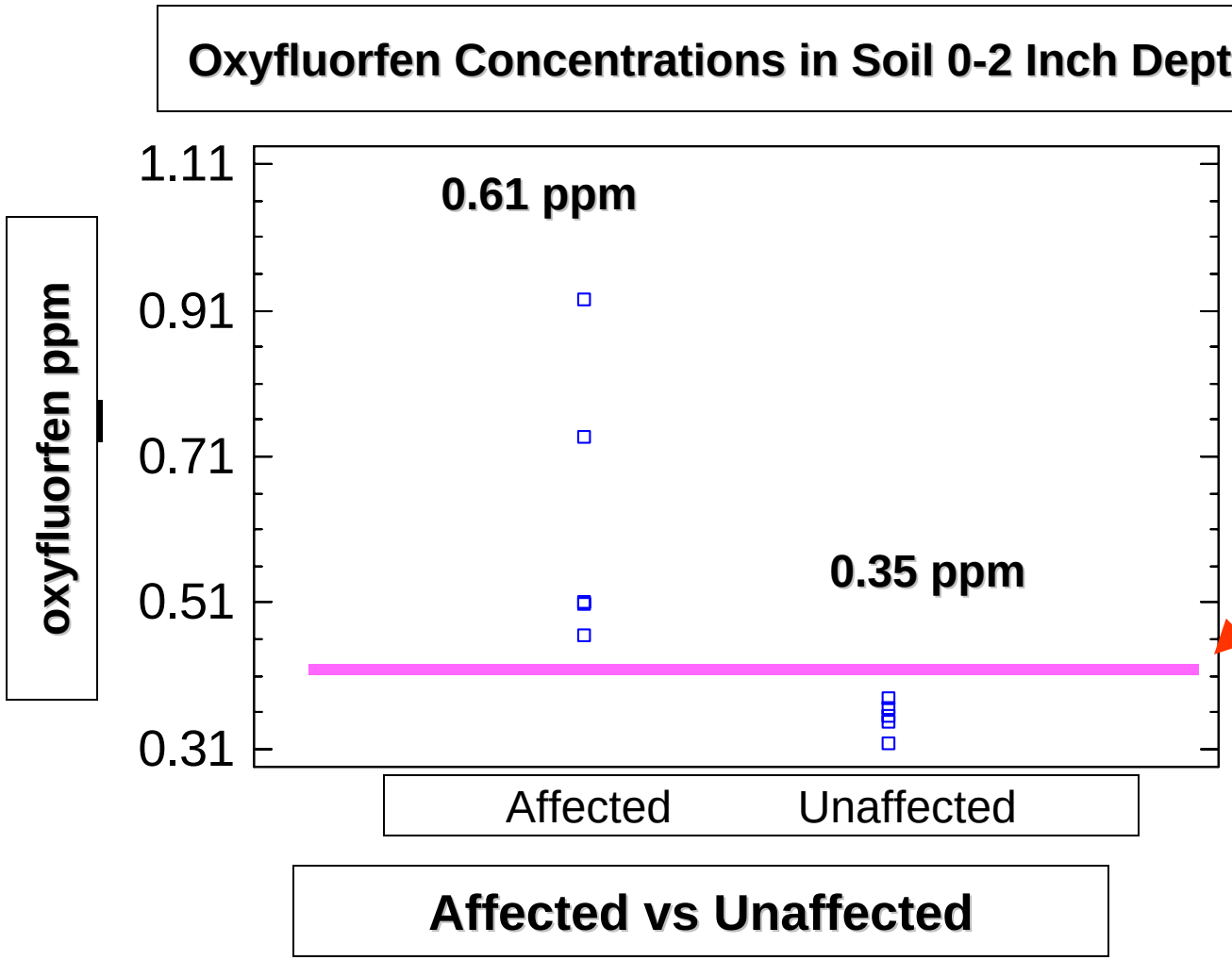
Problems with Carry Over

- As a result, in the spring of 2007 we saw more issues with carry over of Goal
- It was associated with 80-inch beds, but not exclusively
- It also may have been associated with sandier soils


Oxyfluorfen Concentrations in Soil 0-2 Inch Depth
oxyfluorfen ppm
1.11
0.91
0.71
0.51
0.31
0.61 ppm
0.41 ppm
Affected
Unaffected
Affected vs Unaffected

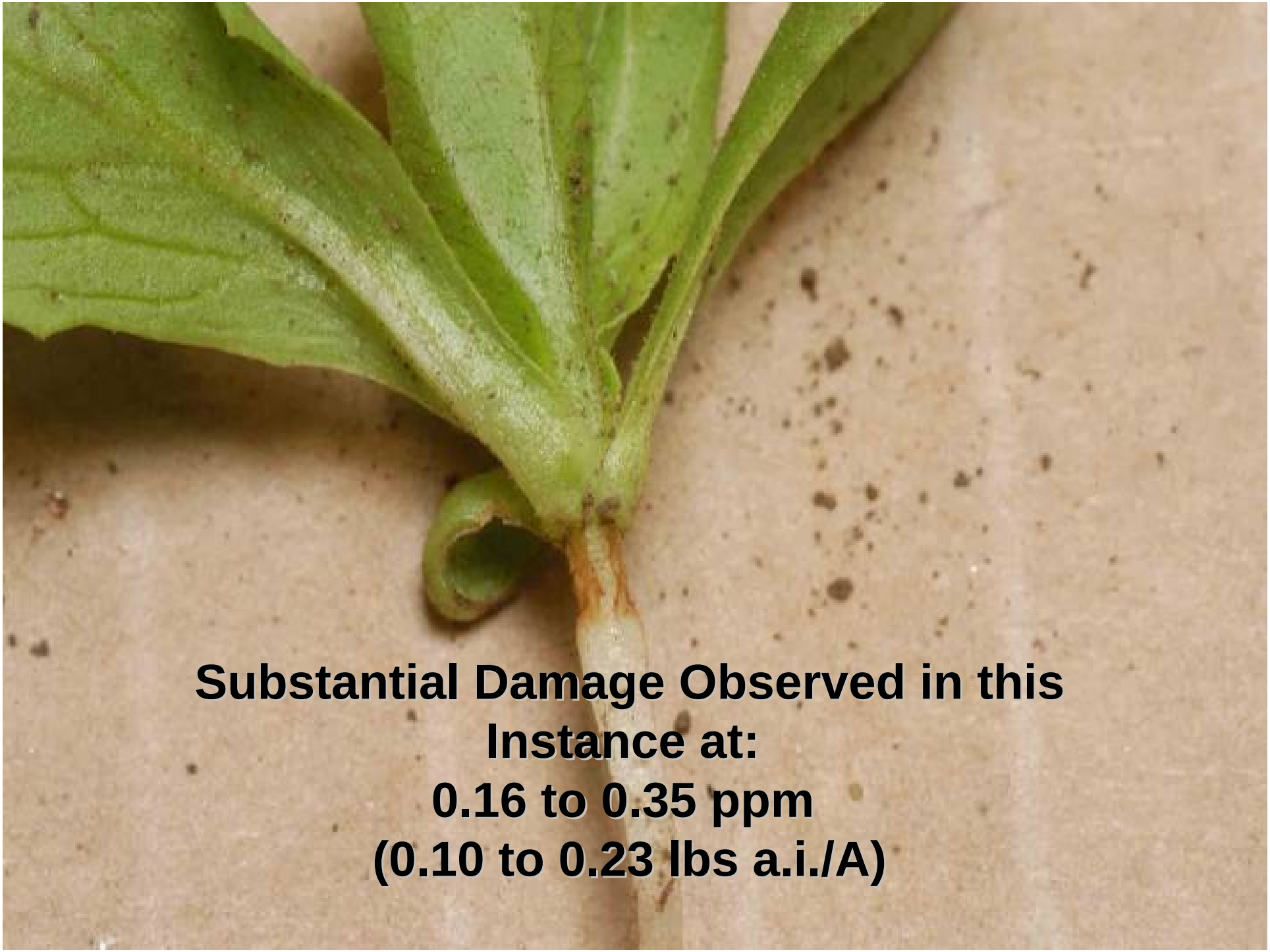

Oxyfluorfen Concentrations in Soil 0-2 Inch Depth
oxyfluorfen ppm
1.11
0.91
0.71
0.51
0.31
0.61 ppm
0.41 ppm
Outlier
Affected
Unaffected
Affected vs Unaffected

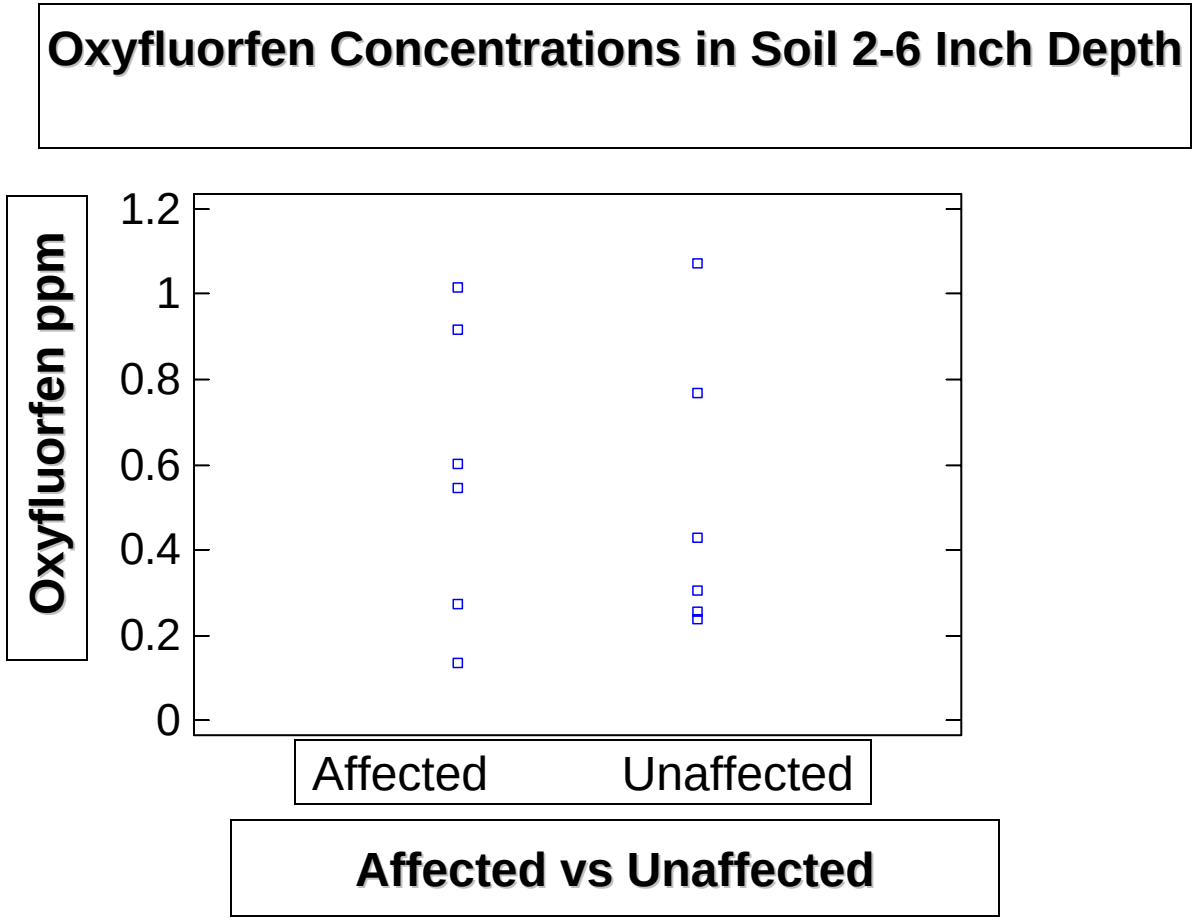

Oxyfluorfen Concentrations in Soil 0-2 Inch Depth
oxyfluorfen ppm
1.11
0.91
0.71
0.51
0.31
0.61 ppm
0.35 ppm
Affected
Unaffected
Affected vs Unaffected



Ideally we would like to be able to establish a soil concentration threshold. In this instance it might look like we were onto something but it did not turn out to be quite right

- **The concentrations observed in this example can be converted to pounds of active ingredient/A**
  - **Affected: 0.61 ppm = 0.40 lbs a.i./A**
  - **Unaffected: 0.35 ppm = 0.23 lbs a.i./A**
- **These are high levels, considering application rates vary from 0.25 to 0.50 lb a.i./A**


Substantial Damage Observed in this Instance at:
0.16 to 0.35 ppm
(0.10 to 0.23 lbs a.i./A)


Oxyfluorfen Concentrations in Soil 2-6 Inch Depth
Oxyfluorfen ppm
1.2
1
0.8
0.6
0.4
0.2
0
Affected
Unaffected
Affected vs Unaffected


With Charcoal
Without Charcoal

What is the Take Home Message From this Study

- These examinations indicate that the levels of Goal at the soil surface are the most important factor
- We did not identify a threshold for soil concentrations below which there would be no damage
- Goal concentrations deeper down in the soil are not the issue

How to Avoid Issues with Goal Carry Over

- The label stipulates the rate, days before planting and details about working the bed
- Working and mixing the soil in the beds is key as it is critical to reduce the concentration of this material on the soil surface
- Exercise extra caution in cold, dry winters
- Exercise extra caution on 80 inch beds and sandy/gravelly soils