

# **Strategies and Examples For Diagnosing Plant Problems**

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# Problems of Crop Plants

- **Biotic:** pathogens (fungi, bacteria, viruses), nematodes, arthropods, and vertebrate pests – their presence can often be confirmed with laboratory assays
- **Abiotic:** nutritional, physiological, genetic mutations, chemical damage, and environmental extremes

# **Abiotic Disorders of Plants**

- **There are well known causes for some abiotic disorders**
- **However, there are many more problems that we encounter in the vegetable industry that are difficult to diagnose**
- **Some are routine problems to do with issues such as spray burn, nutrient imbalances, frost damage, etc**
- **Others are more complex and perplexing**

# Abiotic Disorders of Plants

- **The causes are often difficult to know with 100% certainty**
- **This is because we frequently do not have a diagnostic tool to identify the cause of the problem**
- **The first step in diagnosing the problem is to start collecting as much background information as possible**

# What is the Pattern in the Field

- What is the pattern of the problem in the field?
- Is it uniformly distributed, scattered, along the edge of the field, in linear patterns, associated with poor drainage, a change in soil, etc?



- Probable fertilizer burn occurred in this circular area
- Patterns can also be linear or regular

# What Part of the Plant is Affected

- What are the symptoms on the plant and what part of the plant do they occur?
- Is it most pronounced on older tissue or younger tissue?



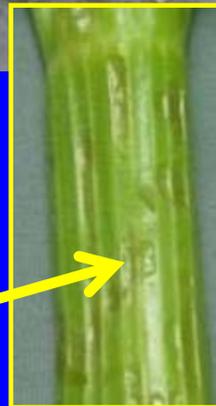
Salt burn on oldest leaf tissue margins

# Is a Group of Tissue of the Same Age Affected

- Is the affected tissue of the same age group
- Was this group at the same level of exposure or susceptibility when the injury occurred?



Shallow sunken lesions  
Tissue affected 1-2 cells thick



- Probable chemical burn
- Oldest (hardened off) and youngest tissue (possibly protected) were not affected

# How Quick Was the Onset of Symptoms

- Did the symptoms develop suddenly or did they slowly get worse?
- Are the symptoms uniform in the part of the plant that they are affecting?
- Does the stunted size of the plant give a clue as to when the incident occurred?



- Symptoms occurred at same depth
- Coincided with an application

# Soil Conditions, Drainage, Weak Areas of the Field

- What are the soil conditions at the site?
- Is it at the bottom edge of the field or along a sprinkler line?
- Does the pattern suggest an area of compaction, poor drainage, excessive drainage, etc?



- Purpling on broccoli (N deficient)
- Along bottom end of field & areas with more water or more drainage

- Is there a possible overspray or drift by an herbicide or other chemical?
- What is the pattern in the field?
- What is the pattern of the spotting on the leaves:
  - Is it in fine speckles
  - Is it larger blotchy areas
  - Is it along the margin
  - Are there symptoms on the weeds

## Burn/Drift



Goal burn on lettuce

# Burn/Drift



**Fertilizer**



**Paraquat**

Not always possible to distinguish, but looking at the pattern of the problem may help, also information on spray/fertilizer applications

# Herbicides

- Any carryover of a soil active herbicide
- What is the crop history?
- What types of symptoms do the plants show?
- Could it be due to too high a dose of the registered herbicide?
- Many herbicides show characteristic symptoms



**Dual Magnum carry over  
on Romaine**

Lab tests of tissue and soil can be helpful in resolving herbicide as a causal agent

# Is the Problem Nutritional

- Is there stunting?
- What is the soil pH?
- Do any of the symptoms look nutritional?\*

  - Deficiency
  - Toxicity



\* Restricted to Older/younger

Manganese toxicity from low pH soil - 3.5

# Environmental Extremes

- Environmental extremes include cold, heat, high light, low light and other factors

Blind broccoli  
low light conditions?



Adventitious buds  
on transplanted broccoli roots  
sprouting (due to heat?)



# Environmental Factors can affect the Physiology and Nutrition of Plants

- What were the weather conditions in the days (weeks) prior to the onset of the problem?
  - Frost
  - Foggy and cold
  - Heat spell



**Tipburn of Romaine  
(Physiological, nutritional  
& weather related)**

## Various looks of frost damage

Deformity,  
Necrosis



Death of leaf tip

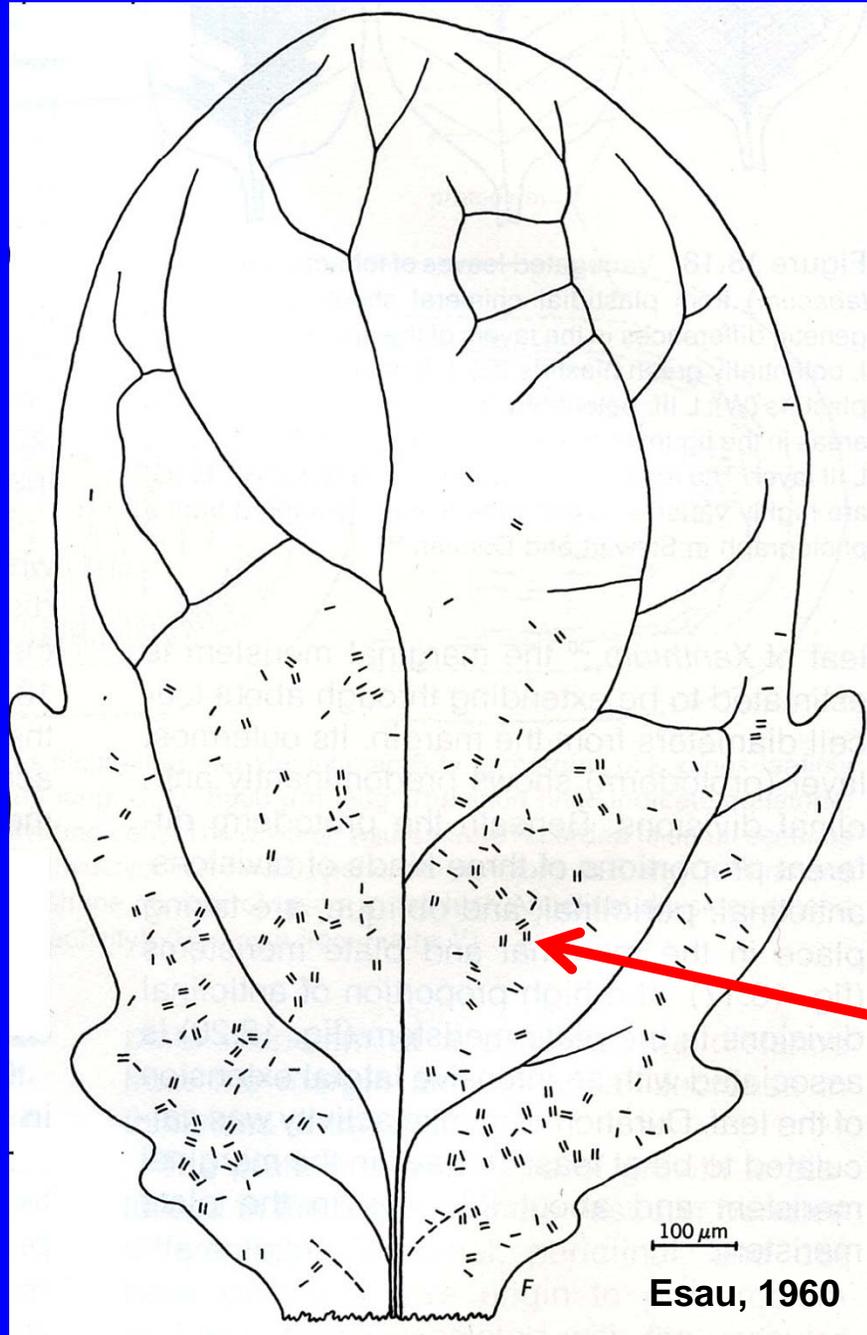


Leathery leaf  
texture



Rolling of leaf  
margins





- Meristematic activity concludes at the tip first as the leaf develops
- It continues lower down on the leaf later into its growth and development cycle

Lines indicate dividing chromosomes

# Is the Problem Related to Variety

- What is the affected variety?
- Are other varieties in the field not affected or less affected?
- Are there off types in the field?



- Marginal yellow spotting of romaine
- May be a nutritional issue
- Varieties differ in susceptibility

# Diagnosing Problems

- **Each of you are diagnosing problems each day**
- **Your experience and knowledge base facilitates this process**
- **Everyone gets stumped and that is probably when samples turn up at our door**

# Diagnosing Problems

- Working with your samples is a team effort
- Once it has been determined that the cause of the problem is not biological, we begin the process just described, trying to collect information that may help us to better understand factors that may have contributed to the problem

# Diagnosing Problems

- **Sometimes it is very difficult to say with any certainty what may have caused the issue**
- **At times the best approach is to attempt to recreate the symptoms based on our best estimate of what may be the prime suspected causes**

# Recreating Symptoms

- **This process is tricky because we cannot recreate all of the factors**
- **We can apply treatments, but are not able to recreate the weather conditions which may also have contributed to the problem**

# Recreating a deformity that was suspected to be greenhouse related

- We worked with the producer and sprayed transplants with the same materials that they used to produce the celery
- We used a 1x and 10x rate to try to reproduce the worst case scenario



## Glyphosate Symptoms on Celery



**Classic Yellowing of  
New Growth**



**Unexpected Deformity  
Showed Up 10 Days Later**

# Herbicide Issues

- **There are many issues that arise from the use of herbicides:**
  - **Rate vs soil type**
  - **Unusual weather conditions**
  - **Application rate mistakes**
  - **Residue left in tanks**

# Classic Kerb Overdose on Lettuce Seedling



- Stunting
- Yellowed "haloing" cotyledons



- Inhibition of lateral root growth

All mitotic inhibitors



**Kerb**

(no yellow on cotyledons)



**Dimension (Dithiopyr)**



**Prowl H2O**



**Dimension (Dithiopyr)**

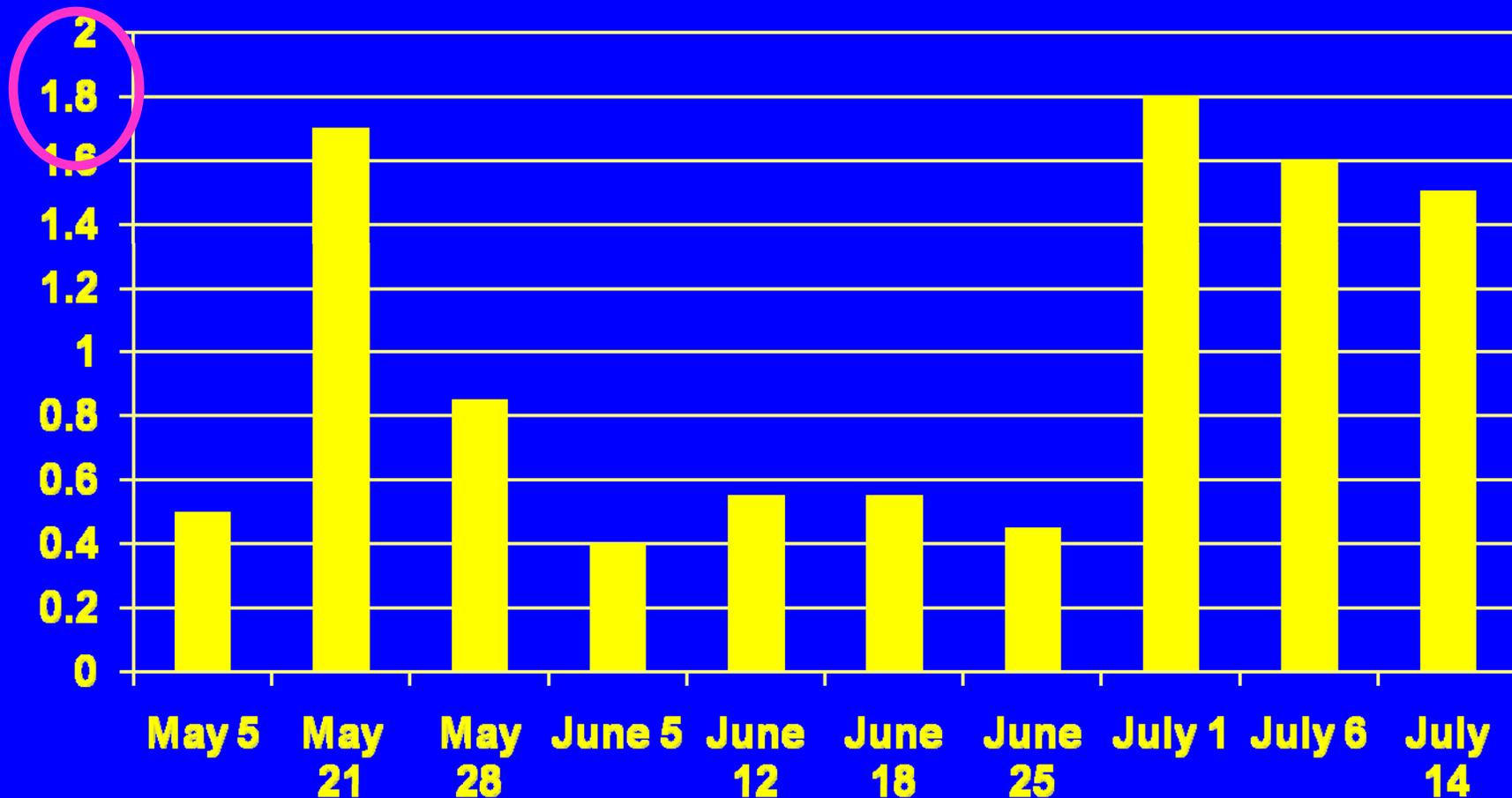
# Nitrogen Toxicity



- Ammonium toxicity can occur in cold soils in the spring as nitrification of ammonium to nitrate is slow and pools of ammonium build up in the soil
- We get samples with “ammonium toxicity” like symptoms in June and July, but typically levels of ammonium in the summer months are very low

# Summer Soil Ammonium Levels

2009 weekly soil sampling commercial head lettuce



# Nitrogen Toxicity

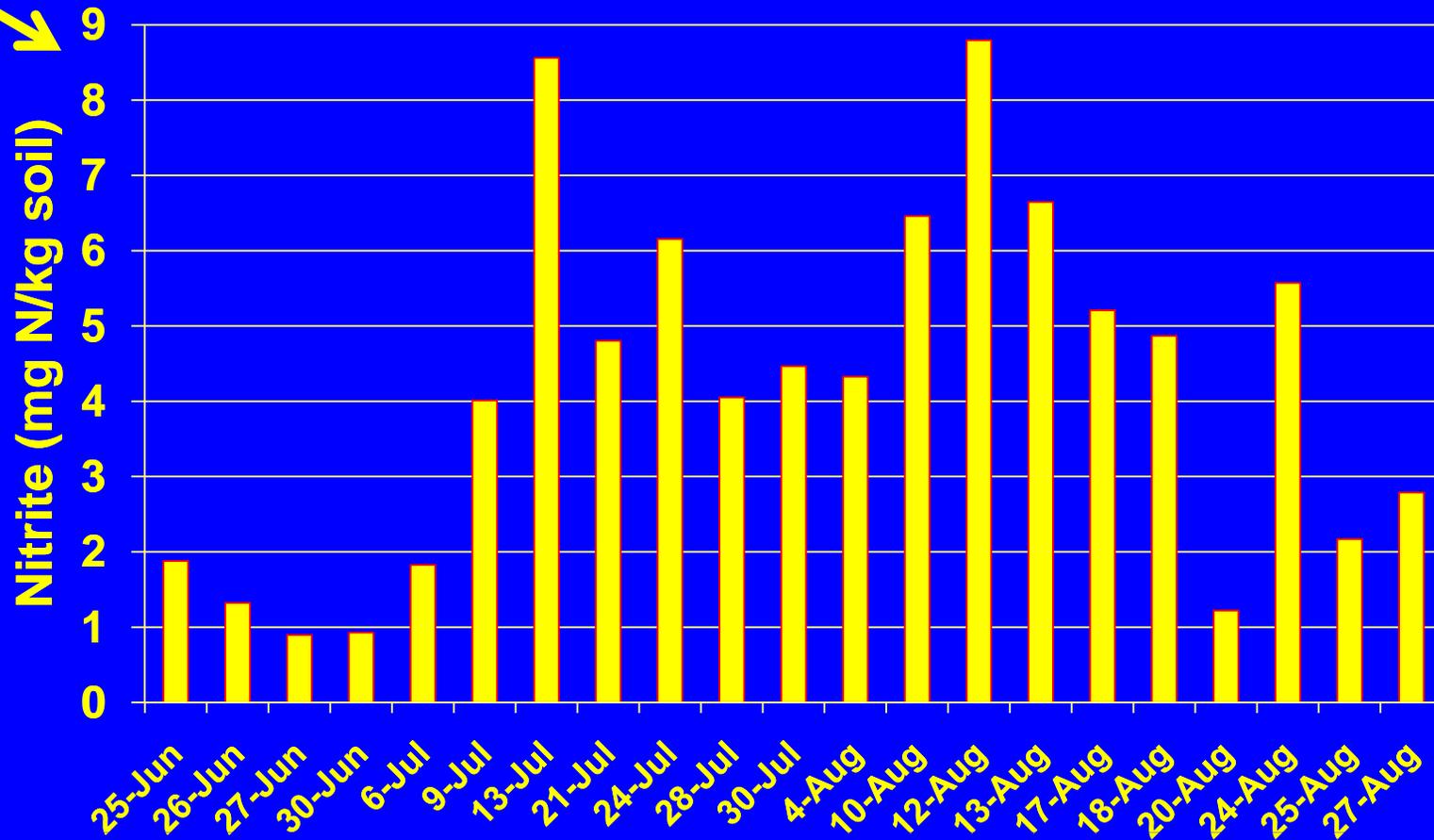
- In the last two years, we observed levels of soil nitrite in the summer in certain situations:
  - Immediately adjacent to and below to fertilizer beads
  - In leachate



Nitrite toxicity on lettuce

# Nitrite Levels in Leachate

Mean of 150 & 225 lbs N/A Treatments



# Nitrogen Toxicity

- **Nitrite is toxic to lettuce with symptoms similar to ammonium**
- **It is unstable in soils and is rapidly transformed to nitrate in aerobic conditions**
- **This study is still underway and we cannot conclude a cause and effect relationship at this point, but it shows an example of the type of research and serendipity that goes into understanding plant symptoms and production issues**

# Summary

- **Diagnosing field problems in crops is a challenging activity**
- **By thinking broadly and asking many questions it is possible to move towards the possible cause of the problem**
- **Being a careful observer can be helpful in assisting in the process**
- **Working with others and discussing problems is very helpful**

**Thank you for your attention**

