

# **Managing Mites in Apples**

**Celeste Welty**

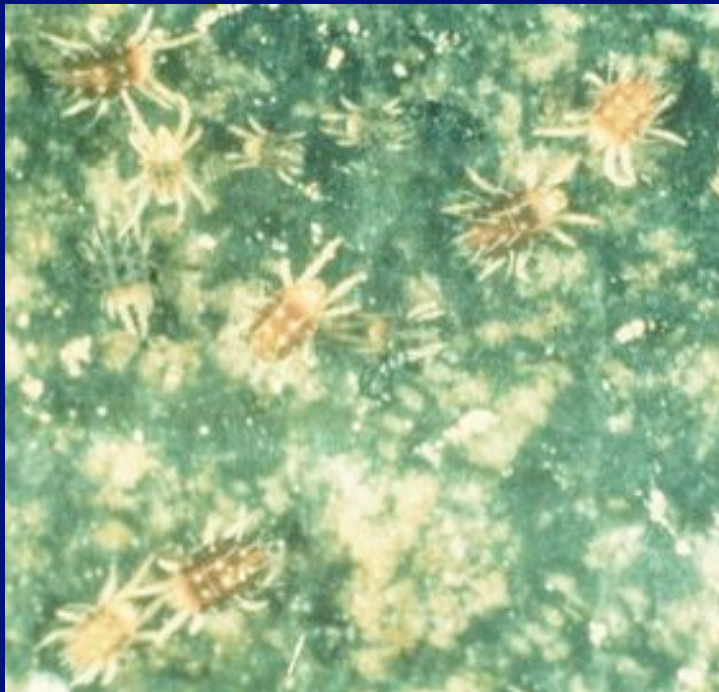
**Extension Entomologist**

**Ohio State University**

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# European Red Mite

- A tiny pest
- Mites suck sap from leaves
- Trees tolerate some but not lot of mites



Mites



Healthy leaves

Mite-damaged  
leaves

# Managing Mites

- **Integrated biological & chemical control**
- **Components:**
  - **Miticide choices**
  - **Deciding when miticide needed**
  - **Biological control**

# Managing Mites

## Key principles:

- Each miticide has a time when most effective
- To avoid resistance, miticides must be rotated
- Predatory mites should be encouraged to survive to allow biocontrol



**How do miticide products  
compare in how well they  
kill the target pest?**

# Efficacy on Pest Mites

<i>Product</i>	<i>European red mite</i>	<i>Two-spotted spider mite</i>	<i>Apple rust mite</i>
Savey, Apollo	E	E	P
AgriMek	G	F	G
Nexter(Pyramite)	G	F	E
Acramite	F	G	G
Zeal	E	E	F
FujiMite	E	G	G
Kanemite	G	G	P
Envidor	E	E	G

**E = excellent; G = good; F = fair; P = poor**

**How do miticide products  
compare in how well they  
avoid killing the good  
predatory mites?**

# Effect on Predatory Mites

<i>Product</i>	<i>White (Phytoseiids)</i>	<i>Yellow (Stigmaeids)</i>
<b>Savey, Apollo</b>	slight	slight
<b>AgriMek</b>	moderate	moderate
<b>Nexter(Pyramite)</b>	moderate	harsh
<b>Acramite</b>	slight	slight
<b>Zeal</b>	moderate	harsh
<b>FujiMite</b>	moderate	harsh
<b>Kanemite</b>	slight	??
<b>Envidor</b>	moderate	mod./harsh



**What timing is most effective for each miticide product?**

# European Red Mite Development

APPLES	MITES	ACTION
1/2" green	winter eggs	good for oil
tight cluster	winter eggs	best for oil
pink	larvae	none
bloom	protonymphs	none
petal-fall	deutonymphs, few new adults	best for Carzol
1 <sup>st</sup> cover	adults, summer eggs	best for Savey, Apollo, Zeal, Envidor, Agri-Mek
summer	mixed stages	Nexter, FujiMite, Kanemite, Acramite

# Changes in recommended timing of miticides on Apples

- **Savey & Apollo:**
  - From 1995-1999, only for pre-bloom
  - Now allowed post-bloom
    - Savey: PHI 28 days, since 2001
    - Apollo: PHI 45 days, since 1999
  - Work best post-bloom
- **Nexter (=Pyramite):**
  - Commonly used mid-summer
  - Does best at petal-fall

**How to decide on a mite  
management program?**

# Orchard Variability

- Mite problems can vary among blocks due to:
  - Different cultivars
  - History of predator presence
- In orchards with more than 1 block, consider 2 categories of management

## 2 Management Categories

- **Blocks where miticide usually is needed every year:**
  - Apply miticide at petal-fall to 1<sup>st</sup> cover
  - Use a 3-year rotation of miticides
- **Blocks where miticide usually not needed every year:**
  - Use oil at delayed-dormant
  - Apply miticide in summer only if threshold exceeded

**If miticide needed every year:  
3-year rotation of  
early season miticides**

<b>Year</b>	<b>Product</b>	<b>Timing</b>
<b>1</b>	<b>Agri-Mek</b>	<b>1<sup>st</sup> cover</b>
<b>2</b>	<b>Savey or Apollo or Zeal</b>	<b>1<sup>st</sup> cover</b>
<b>3</b>	<b>Envidor</b>	<b>1<sup>st</sup> cover</b>

# If miticide needed every year: What to apply later in the unlikely event that mites exceed threshold

Year	Early season		Summer treatment (at threshold)
	Product	Timing	
1	Agri-Mek	1 <sup>st</sup> cover	<b>Savey or Apollo</b>
2	Savey or Apollo or Zeal	1 <sup>st</sup> cover	<b>Nexter or Fujimite</b>
3	Envidor	1 <sup>st</sup> cover	<b>Acramite or Kanemite</b>



# If miticide NOT every year

- Use **superior oil**, delayed dormant
  - Best: 1% at tight cluster
  - OK: 2% at half-inch green
- Use **Savey** or **Apollo** when summer threshold exceeded
  - **Savey PHI = 28 days**
  - **Apollo PHI = 45 days**
- If threshold exceeded 2 years in a row, alternate with Nexter or FujiMite

**How to know if the mite  
population exceeds the  
threshold?**

# Scout for European Red Mite

- **Goal: make a decision**
  - **'Treat'**
  - **'Do not treat'**
- **Use presence / absence sampling**
- **Sample size:**
  - **minimum = 20 leaves**
  - **maximum = 100 leaves**
- **Based on seasonal thresholds**
  - **Early summer: fewer mites tolerated**
  - **Late summer: more mites tolerated**

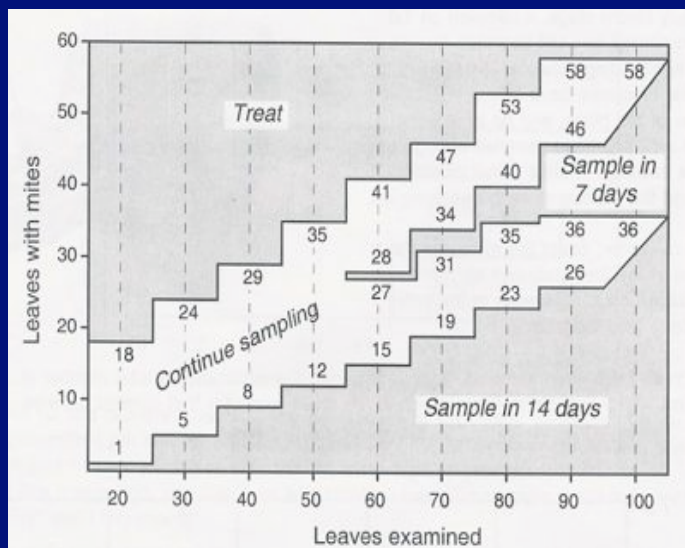


# Scout for European Red Mite

Time Threshold  
(average number  
of mites per leaf)

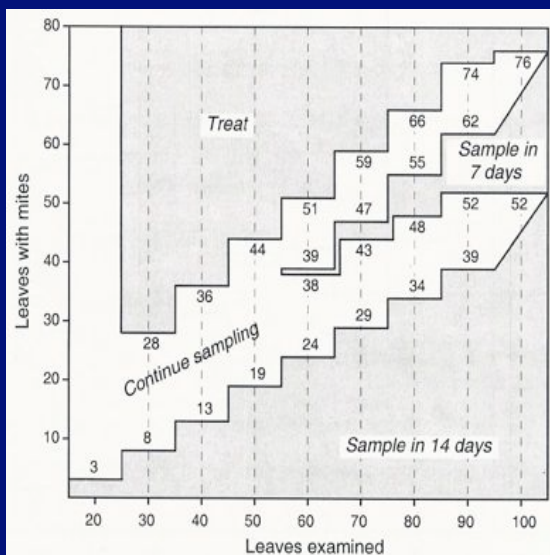
Mid-May to mid-June	2.5
Mid-June to mid-July	5.0
Mid-July to mid-Aug.	7.5

# Scout for European Red Mite



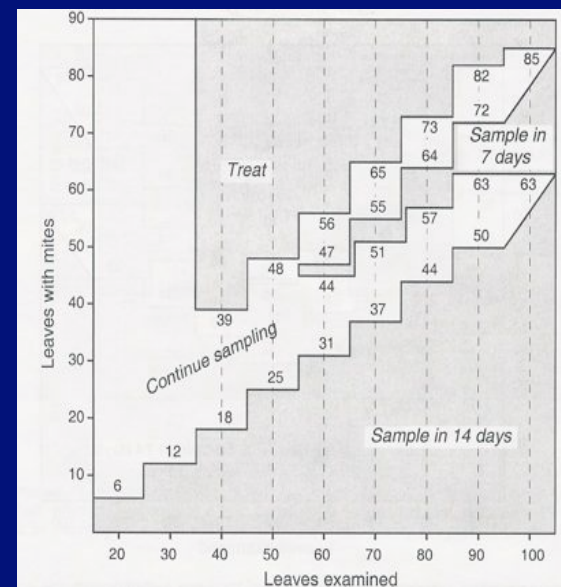
**Early summer  
(mid-May to  
mid-June)**

**Threshold =  
2.5 mites/leaf**



**Mid-summer  
(mid-June to  
mid-July)**

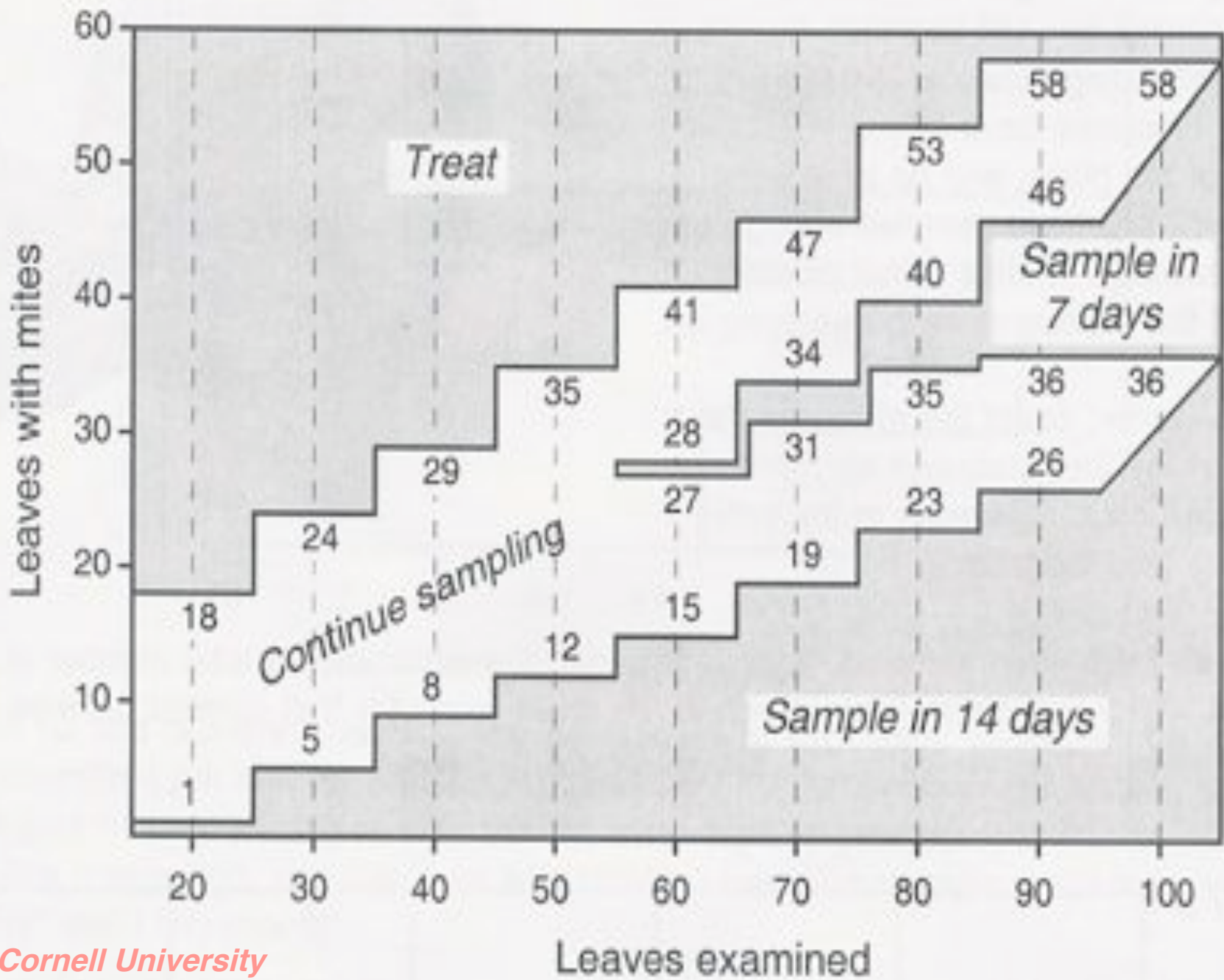
**Threshold =  
5.0 mites/leaf**



**Late summer  
(mid-July to  
mid-Aug.)**

**Threshold =  
7.5 mites/leaf**

*Source: Cornell University*



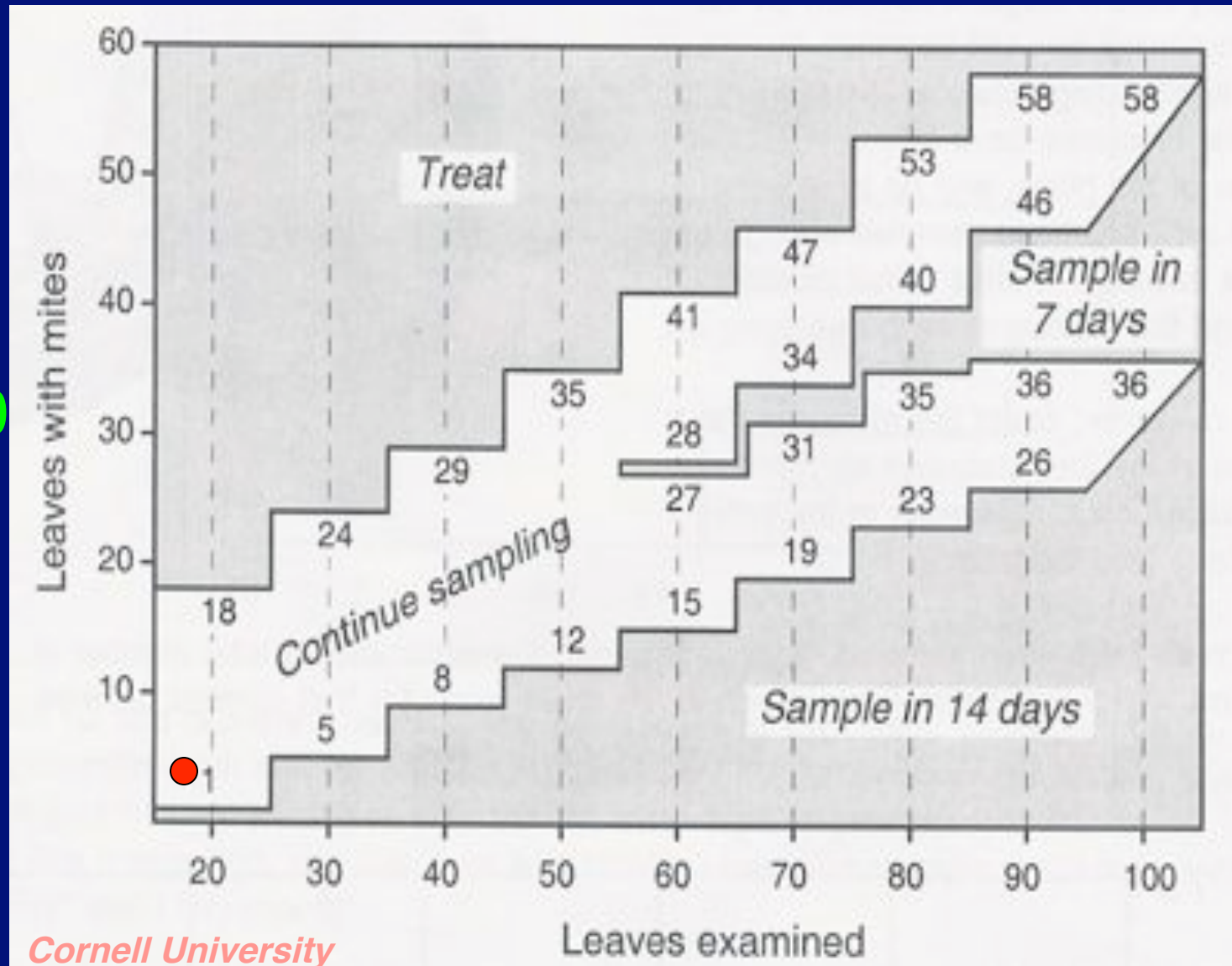
# Scout for European Red Mite

## Steps:

- 1) take **4 leaves** from each of **5 trees**
- 2) rate each as infested or not
- 3) get **total** number infested leaves (of 20)
- 4) **plot** the number infested on chart
- 5) see which decision zone the point is in:
  - ‘**Treat**’
  - ‘**Do not treat; resample in 7 days**’
  - ‘**Do not treat; resample in 14 days**’
  - ‘**Continue sampling**’

# Mite Scouting - early summer

example:  
In first 20  
leaves,  
3 are  
infested





# Scout for European Red Mite

- If you need to **continue** sampling:
  - take 10 more leaves
  - rate each
  - get new total
  - plot new point
  - check decision
- If you **still** need to continue :  
take 10 more leaves at a time, add to total, plot, until decision reached

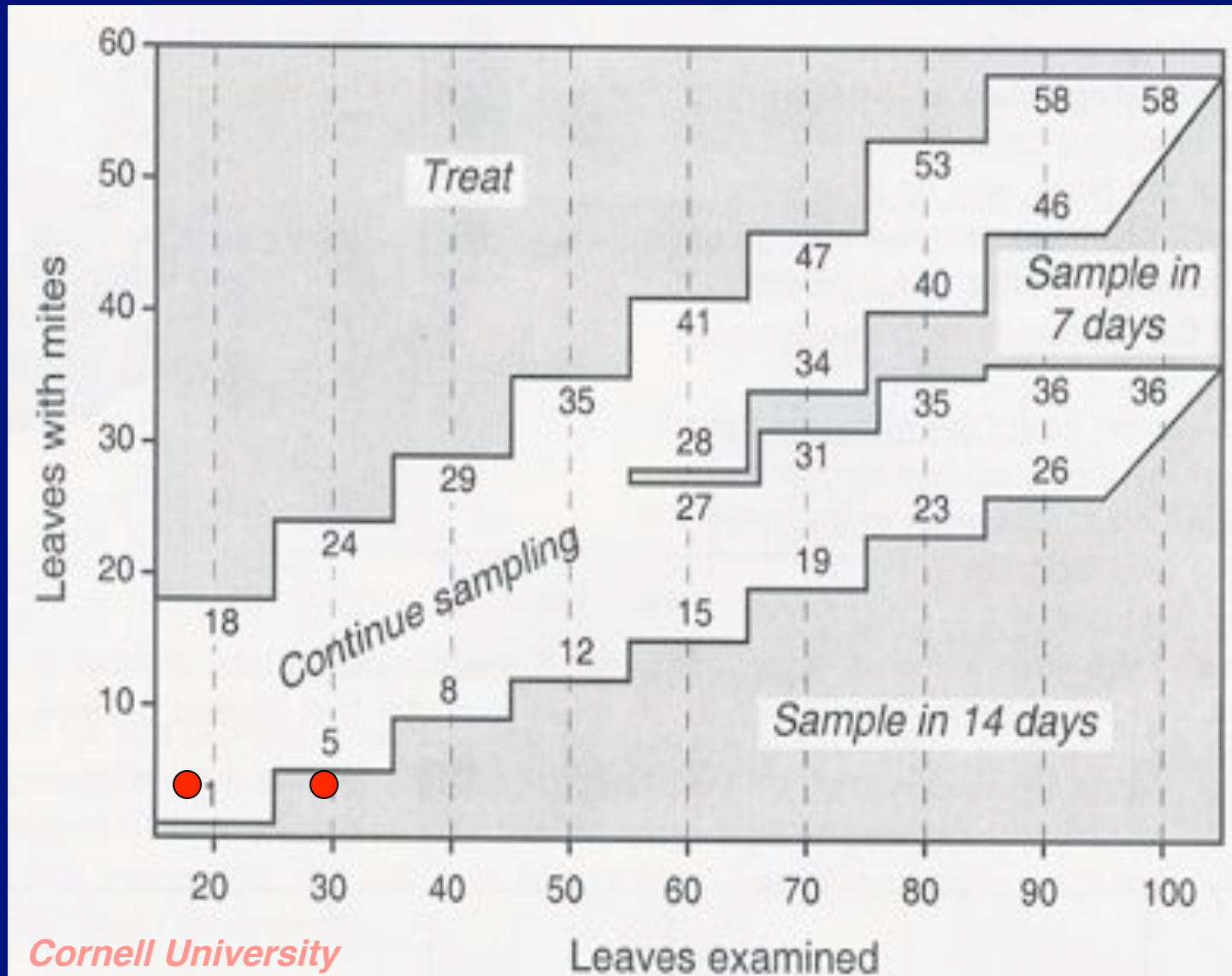
# Mite Scouting - early summer

example:

In next 10 leaves, 1 is infested.

$3 + 1 = 4$

Decision: do not treat; resample in 14 days



Cornell University

**What are predatory  
mites and how are  
they used?**

# Predatory mites in orchards

- **Fast white mites (Family Phytoseiidae)**

- *Neoseiulus fallacis*  
(=*Amblyseius fallacis*)

- *Typhlodromus pyri*



- **Slow yellow mites (Family Stigmaeidae)**

- *Zetzellia mali*

- *Agistemus fleschneri*



# White Predatory Mites



- ***N. fallacis*:**
  - most common natural predator in Ohio
  - high feeding rate (good)
  - not abundant until July/August (bad)
- ***T. pyri*:**
  - not found naturally in Ohio
  - lower feeding rate (bad)
  - active earlier than *N. fallacis* (good)
  - can survive on pollen etc. (good)
  - congregate in flowers (convenient)

# *Z. mali*, yellow predatory mite

- Abundant in Columbus research orchard since 1996
  - the only predator species, April & May
  - the dominant predator, July & August
  - providing biocontrol of European red mite where Imidan used
  - also tolerates pyrethroids
- Feeds on all stages, but prefers eggs and young nymphs



# Biocontrol Research

- Is *T. pyri* (white predatory mite) from western New York suitable for use in Ohio?
  - Unimproved strain, via flower transfer, 1996, to Licking County
  - Pyrethroid-resistant strain, via trunk bands, 1999, to Franklin Co.
- How can local populations of *Z. mali* (yellow predatory mite) be built up to provide biocontrol?



# Research, White Predator Mites

## *Objectives:*

1. Can *T. pyri* become established in Ohio?

**Yes.**

**Seems to tolerate our hot summers.**



# Research, White Predator Mites

## *Objectives:*

2. Does *T. pyri* do a better job than *N. fallacis* in controlling European red mite?

**Yes.**

**Not only because of better (earlier) timing, but it tolerates Pyramite better.**

# Research, White Predator Mites

## *Objectives:*

3. How does *T. pyri* affect native predators?

It displaces *N. fallacis*.

It suppresses *Z. mali* but does not displace it.

# Research, White Predator Mites

## *Objectives:*

4. How quickly does *T. pyri* spread?

Within 3 years of light seeding, within  
2 years of heavier seeding.

# Research, White Predator Mites

## *Objectives:*

5. Is the pyrethroid-resistant strain good enough at controlling mites that pyrethroids can be used for insect control?

Yes, at least at the low end of rate, in a variety not highly susceptible to European red mite.

Concern about flare-up of San Jose scale (parasitoid seems to be killed).

# Research, yellow predator mite

- What orchard chemicals can *Z. mali* tolerate?
- Can *Z. mali* be transferred to an orchard where it is not found naturally?

# Research, yellow predator mite

- **Slide-dip Bioassays:**
  - **Mites stuck on glass slide**
  - **Dip for 5 seconds**
  - **24-hour mortality reading**
- **Products tested in 2000 & 2001:**
  - **Insecticides & miticides (29)**
  - **Fungicides (19)**
  - **Plant growth regulators (10)**

# Research, yellow predator mite

Highly toxic to *Z. mali*:

- **Insecticides:** Thiodan (100% mortality)
  - Pyramite (100%)
  - Vendex (100%)
  - Omite (100%)
  - cyhexatin (97%)
  - high Danitol (81%)
  - Kelthane (74%)
  - high Asana (63%)
- **Fungicides:** Sulfur (100%)
  - Lime sulfur (74%)

# Research, yellow predator mite

## Orchard transfer trial:

- **Trunk bands**
  - Paper tree wrap with burlap liner (Oct. - Jan.)
  - Seeded in commercial Fuji 4/26/01 & 5/17/02
- **Branch transfer**
  - 31 July 2001 in Fuji
  - 23-25 July 2002 in Fuji & 2 Red Delicious blocks





# Research, yellow predator mite

## Orchard transfer trials, 2001 & 2002

- Mite counts, mid-July to mid-Sept.
- Results, was *Z. mali* established?
  - No from trunk bands in April
  - Yes from branches in July
- Conclusions:
  - Trunk bands work well for *T. pyri* but not for *Z. mali*
  - Better luck with branch transfer

# Future Research

- Update survey of predatory mite species
  - Last done 1992
  - Yellow mites more common since '95/96?
    - Omite no longer used
    - Thiodan used less since Provado
  - Might be need for conservation not seeding
- Additional seedings of *T. pyri* especially where pyrethroids needed