VIRGINIA AGRICULTURAL EXPERIMENT STATION
EASTERN SHORE AGRICULTURAL RESEARCH AND EXTENSION CENTER
VIRGINIA TECH

Virginia Cooperative Extension
Virginia Tech • Virginia State University

Key Pests of Strawberries

Lorena Lopez, Ph.D.
Virginia Tech | Department of Entomology
Eastern Shore Agricultural Research and Extension Center

Strawberry Pests Menu

Clipper Beetles

Aphids

Thrips

Sap Beetles

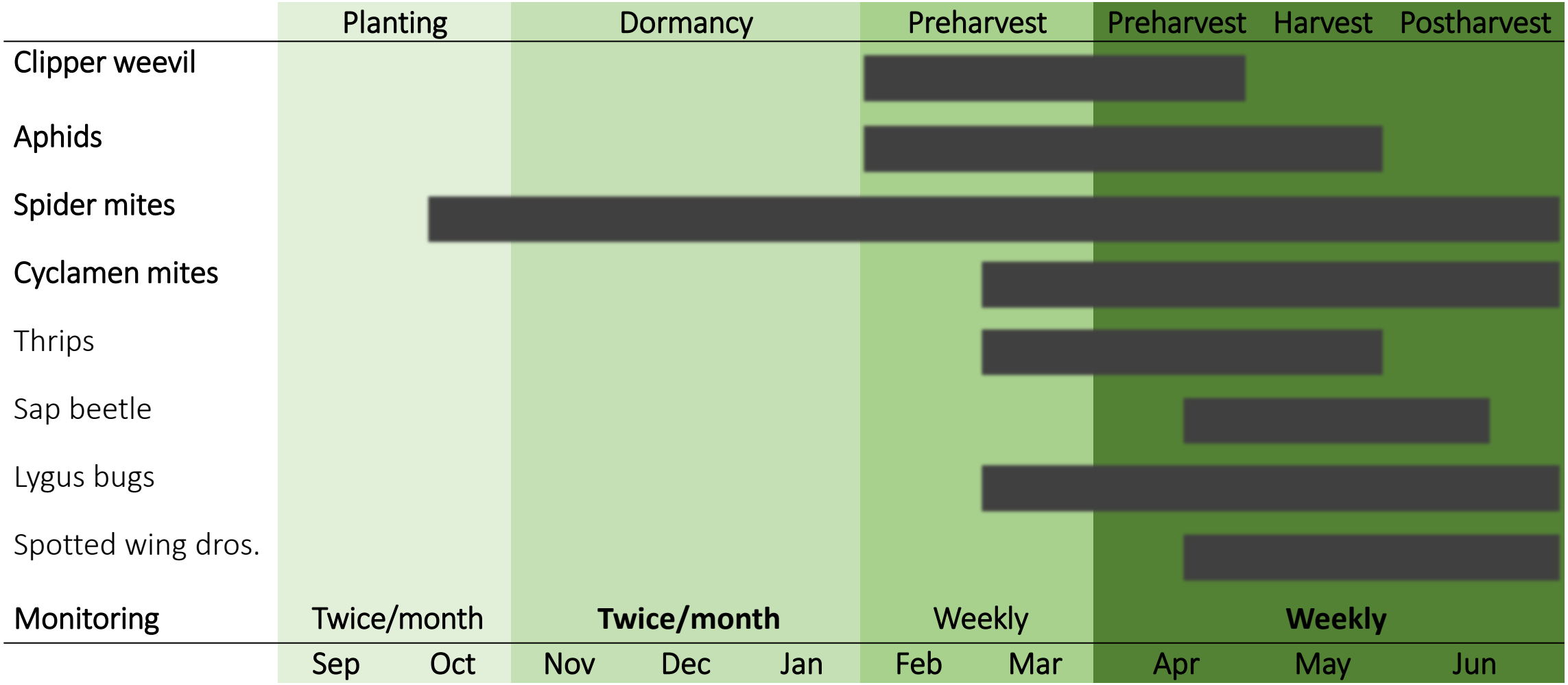
Two-Spotted Spider Mites

Cyclamen Mites

Slugs and Snails

Pesticide tools

Strawberry Pests in VA



Integrated Pest Management in Strawberries

Monitoring

- Thresholds

Pesticides

- Insecticides and miticides

Biological control

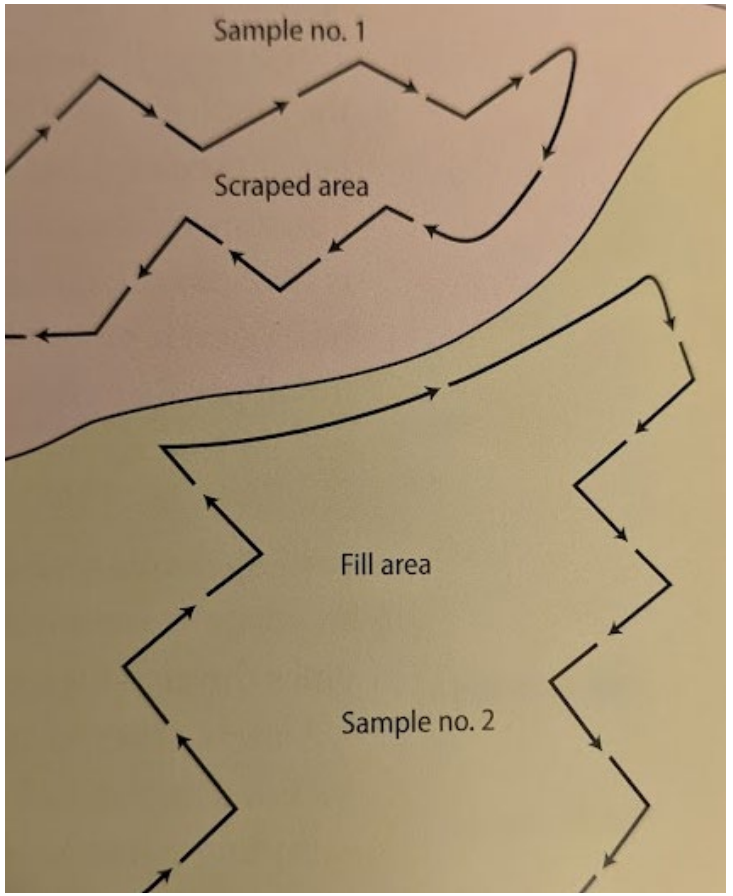
- Predatory mites

Cultural practices

- Sanitation
- Water and weed management

Monitoring

- **Backbone of all pest management programs**
- Follow the economic thresholds (if any)
- Thresholds changed based on pest management tactic (insecticide ≠ biocontrol)



Examples of systematic sampling

	Planting		Dormancy			Preharvest		Preharvest	Harvest	Postharvest
Monitoring	Twice/month		Twice/month			Weekly		Weekly		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun

Summary: Be Prepared!

Spider mites

- Various miticide options available
- At least one miticide application before covering during the winter
- Check mature leaves
- Rotate miticides (all season)
- Monitor closely ‘Chandler’ and ‘Albion’

Cyclamen mites

- Few miticide options available
- Recommended one miticide application in the fall and when in the spring
- Check folded growing leaves
- Keep runners at bay
- Damage appears early in spring
- Predatory mites can reach folded leaves
- Monitor closely ‘Ruby June’

	Planting		Dormancy			Preharvest		Preharvest	Harvest	Postharvest
Monitoring	Twice/month		Twice/month			Weekly		Weekly		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun

Summary: Be Prepared!

Clipper beetles

- Severe infestations are rare
- Beetle damage is compensated by the plant
- Check flower buds in early spring

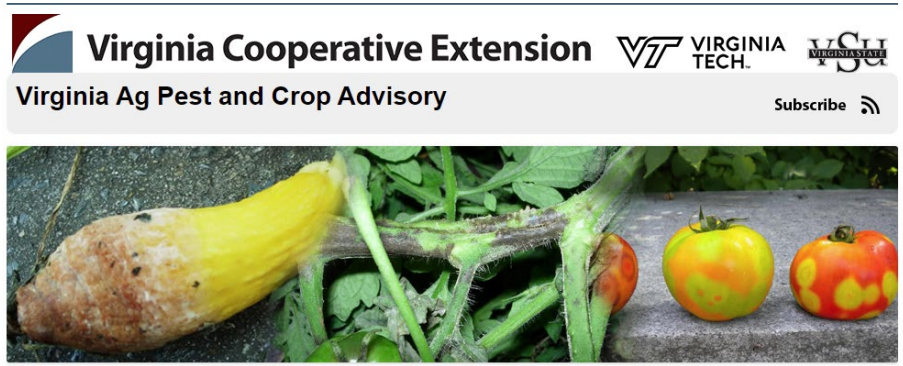
Aphids

- Severe infestations are rare
- Infestations can be exacerbated when row covers are used
- Check the young leaves inside the crown
- Avoid the use of pyrethroids to prevent outbreaks

	Planting		Dormancy			Preharvest		Preharvest	Harvest	Postharvest
Monitoring	Twice/month		Twice/month			Weekly		Weekly		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun

Virginia Ag Pest Advisory

- https://blogs.ext.vt.edu/ag-pest-advisory/



THANK YOU!

lorelopezq257@vt.edu

(954) 529 9042 (call/text)

@lorelopez257

@ESARECEntomology

@VirginiaTechVIPRLab

VIRGINIA AGRICULTURAL EXPERIMENT STATION
EASTERN SHORE AGRICULTURAL RESEARCH AND EXTENSION CENTER
VIRGINIA TECH

Virginia Cooperative Extension
Virginia Tech • Virginia State University

Clipper Beetle

- Bud weevil, *Anthanomus signatus* (Coleoptera: Curculionidae)
- Overwinters: active in late spring
- Larvae development 3-4 weeks
- Adults feed on pollen
- Summer aestivation
- 1 generation/year

Adult (T. Murray)

Larvae (H. Burrack)

	Planting		Dormancy			Preharvest		Preharvest	Harvest	Postharvest
Clipper weevil										
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun

Clipper Beetle

Monitoring:

- Threshold= ~15 damaged buds/3 feet

- Plants can compensate for beetle damage

Management:

- Brigade, Danitol, Azera (3A), all pyrethroids

- Beware of aphid outbreaks!!

- Carbaryl is preferred

Damage caused to the flower buds (K. Lynch, L. Lopez)

Aphid Complex

- Strawberry aphid (*Chaetosiphon fragaefolii*)
- Potato aphid (*Macrosiphium euphorbae*)
- Green peach aphid (*Myzus persicae*) (Hemiptera: Aphididae)

- Multiple species can attack strawberries
- Sap-sucking feeders
- Winged and wingless forms

Winged green peach aphid (USDA-ARS)

Wingless strawberry aphid nymph (M. Bertone)

How can aphids hurt your crop?

- Most abundant in the underside of leaves
- Reproduce asexually very quickly
- Nymphs to adult: ~2 weeks
- At very high densities on young plant tissue, cause water stress, wilting, and reduced plant growth

	Planting		Dormancy			Preharvest		Preharvest	Harvest	Postharvest
Aphids										
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun

How can aphids hurt your crop?

- Sooty mold growth
- Contamination of fruit with aphids

Severe aphid infestation (L. Ingwell)

Vectors of plant viruses

- Single-virus infections= asymptomatic
- Problematic= second-year fields or nursery stock
- High infestations are “rare”

Sooty mold caused by severe aphid infestation (UF/IFAS)

Aphid Management

Monitoring:

- Threshold= ~30% field infestation (CA)

Management:

- Carbaryl, Sivanto, Admire Pro
- Beware of aphid outbreaks due to pyrethroid applications!!

Severe aphid infestation (L. Lopez)

Pyrethroids

Pros

- Relatively low mammalian toxicity
- Very effective on a number of pests
- A broad-range of affordable products including generics

Cons

- Negative effects on other non-target organisms
- Overreliance has led to resistance development
- Not IPM compatible

Including at least 1 or 2 pyrethroid sprays in the rotation is not a bad idea

What else are you killing with pyrethroids?

Thrips Complex (*Frankliniella* spp.)

- Western flower thrips (WFT, *Frankliniella occidentalis*) = dominant species in strawberries (except for protected structures)
- Eggs laid in the leaves
- Larvae found mostly on flowers and calyx of flowers
- Pupate in the soil
- No virus transmission reported in strawberries
- Feeding can cause misshapen blossoms, flower abortion, petal browning, and distorted, bronzed fruit near the leaf cap

Thrips Management

- Thrips populations rarely require treatment in strawberries
- Populations may increase when spraying broad-spectrum insecticides (pyrethroids)
- Recent history of spinosad- and spinetoram-resistant WFT populations
- **Threshold** (CA) = >10 thrips per blossom
- Few alternative insecticides are available: Assail, Exirel, Mycotrol (*Beauveria bassiana*)
- Exirel and Mycotrol can be used under protected structures

Thrips Management

- **Weed management is key**: morning glory, carpetweed, and Amaranthus are good hosts for thrips
- Crop rotation using non-hosts (soybeans or corn)

Biocontrol agents effective against thrips adequate insecticide sprays

- *Neoseiulus cucumeris*
- *Stratiolaelaps scimitus*
- *Amblyseius swirskii*
- *Orius* spp. (Minute pirate bug)

Sap Beetle Complex

- Strawberry sap beetle (*Stelidota geminata*)
- Dusky sap beetle (*Carpophilus lugubris*)
- Four-spotted sap beetle (*Glischrochilus quadrisignatus)*
- Overwinter in wooden areas
- Females attracted to ripen fruit
- Larvae feed on the fruit and pupate in the soil

Adult S. geminate
(J. Gallagher)

	Planting		Dormancy			Preharvest		Preharvest	Harvest	Postharvest
Sap beetles										
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun

Sap Beetle Complex

Larvae on fruit

- Sanitation is key!
- Remove overripen and rotten fruit
- PYO system more susceptible to infestations if not cleaned after consumers
- Buckets with rotten fruit as bait= **Monitoring tactic**

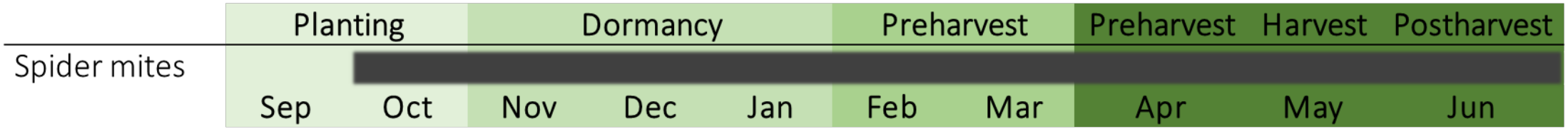
Fruit damaged caused by sap beetles (N. Hummel)

Two-Spotted Spider Mite (TSSM)

- *Tetranychus urticae* (Acari: Tetranychidae)
- 0.4 mm long
- Overwintering females
- Hot and dry conditions are optimal
- ~2 weeks from egg to adult
- Adults' life span 2-4 weeks

White form of TSSM and egg

Red form of TSSM and eggs (D. Cappaert)



Two-Spotted Spider Mite

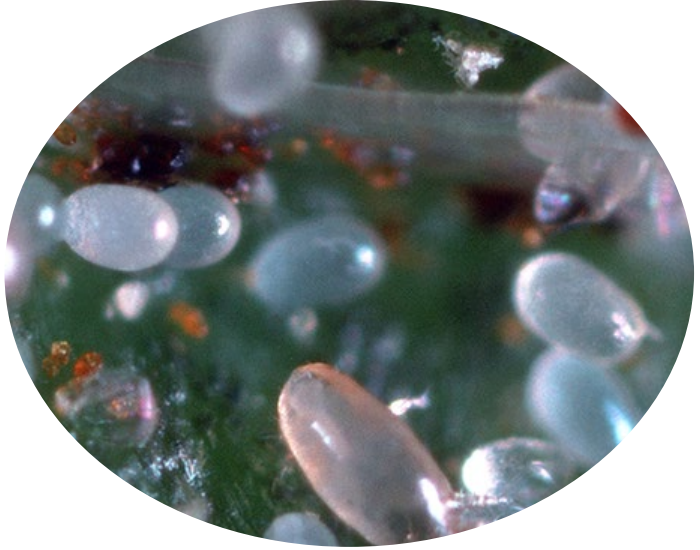
- Injury= stippling pattern
- Threshold= ~60 mites/trifoliate
- Many miticide products available but resistance is quickly developed
- Predatory mites can suppress TSSM populations

TSSM severe infestation (Bugwood)

Leaf injury caused by TSSM (L. Lopez)

Cyclamen Mite

- *Phytonemus pallidus* (Acari: Tarsonemidae)
- 0.25 mm long
- Not usually seen with the naked eye
- From egg to adult in ~3 weeks
- Establish on new folded leaves
- Check transplants!



One female and multiple translucent eggs (UC-IPM)

Adult female and egg (P. Fisher)

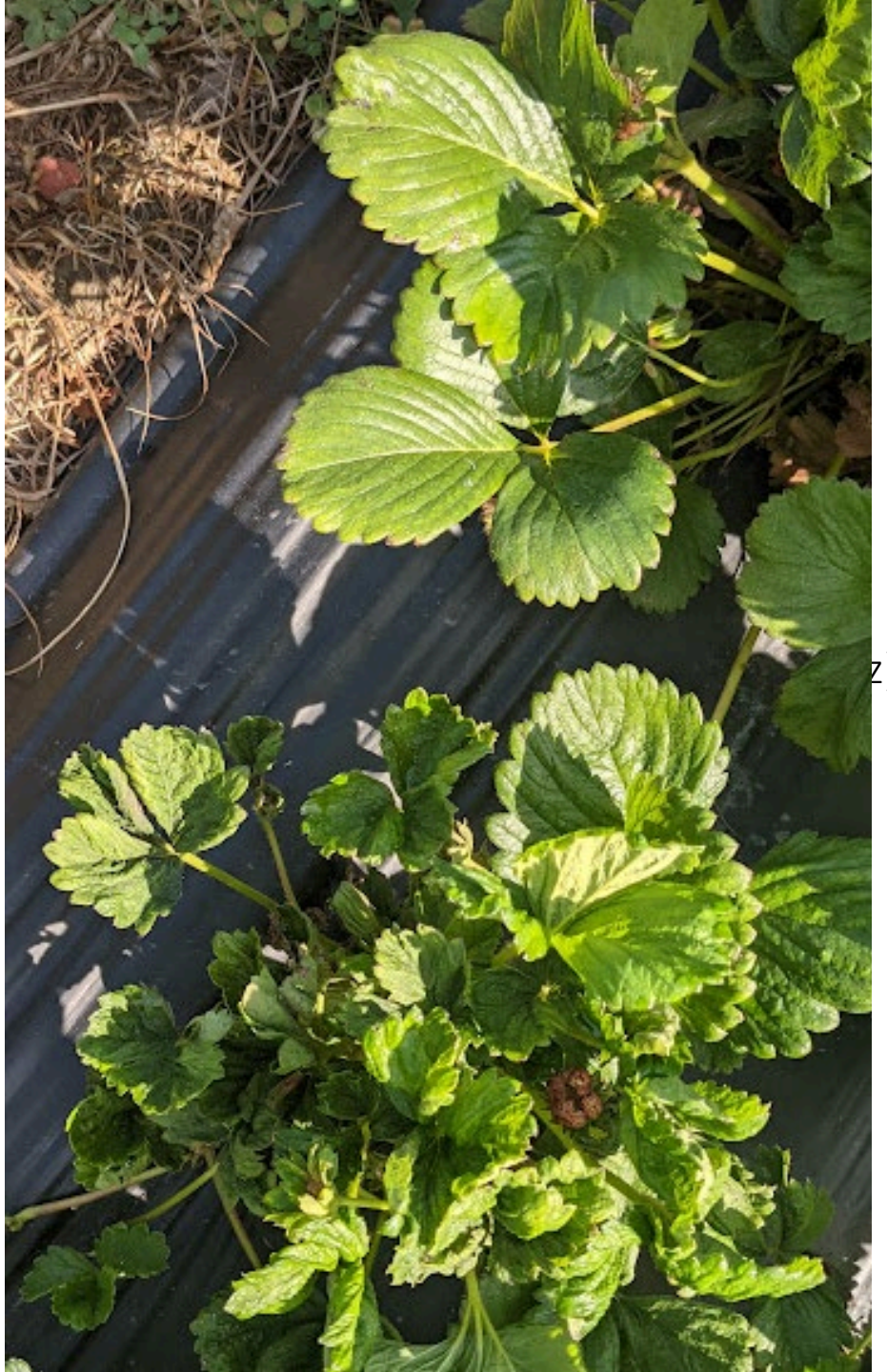
	Planting		Dormancy			Preharvest		Preharvest	Harvest	Postharvest
Cyclamen mite										
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun

Cyclamen Mite

- Usually originating from contaminated nursery stock
- Symptoms appear = too late to limit damage
- Crinkled leaves and stunted plants

Monitoring:

- Threshold= One leaf in 10 shows cyclamen mites (NC)



Stunted z)

Cyclamen Mite

Monitoring:

- Check folded leaves in the crowns
- ‘Ruby June’ mostly affected

Management:

- Prune runners!
- Few miticides available for con
- Predatory mites can comple
  the use of miticides

Cyclamen mite infestation (L. Lopez)

Predatory mite and cyclamen mites (L. Lopez)

The Insecticide Toolbox: four groups (MOAs)

Pyrethroids (3A) cheap, broad spectrum and effective

BRIGADE® WSB INSECTICIDE / MITICIDE

DANITOL® 2.4EC SPRAY

Sevin® 4F brand Carbaryl Insecticide

Carbamates (1A) – ovicidal, no residual activity, high oral and eye toxic concerns

Diamides (28) **neonicotinoids** (4D) - Narrow spectrum, effective, longer residual, inconsistent alone under high pressure

CORAGEN®

BAYER SIVANTO® prime

EXIREL® INSECT CONTROL

Radiant® SC

Entrust® SC NATURALYTE INSECT CONTROL

Spinosyns (5) – expensive, will not alone control CEW under high pressure

Insecticide/Miticide Options

Brand name	Active ingredient	MOA	Clipper weevil	Aphids	Spider mites	Cyclamen mites	Thrips	Sap beetle	Lygus bugs	Spotted wing drosophila
Sevin	Carbaryl (ovicidal)	1A	+						+	
Brigade WSB	Bifenthrin*	3A	+	+	+			+	+	
Danitol 2.4 EC	Fenpropathrin	3A	+		+				+	+
Exirel	Cyantraniliprole	28					+			+
Platinum, Assail, Admire Pro	Thiamethoxam, Imidacloprid (syst)	4A*		+						
Sivanto	Flupyradifurone (syst)	4D		+			+			+
Entrust	Spinosad	5					+			+
Radiant SC	Spinetoram (trans)	5					+			+
Rimon	Novaluron	15					+	+	+	
M-Pede	Potassium salts of fatty acids	UN		+	+					

+ = labeled for that pest, level of efficiency is not included

*toxic to pollinators, beware during applications

Safer insecticides to consider on crops

Assail (acetamiprid)
– 100X less toxic to bees than other neonics
***New SC liquid formulation in 2022**

Some neonics can be drip-irrigated = Keeping pollinators and natural enemies safe

Sivanto (flupyridifurone)
– Similar MOA as neonic but also far less toxic to bees
IRAC Group 4D Butenolide

Miticide Options

Brand name	Active ingredient	MOA	REI (hours)	PHI (days)	Applications/ year	Spider Mites	Cyclamen mites
Brigade WSB	Bifenthrin	3A	12	0	2	+	
Danitol 2.4 EC	Fenpropathrin	3	24	2	2	+	
Agri-Mek SC	Abamectin	6	12	3	2-7	+	+
Kanemite	Acequinocyl	20B	12	1	2	+	
Magister	Fenazaquin* (ovicidal)	21A	12	1	1	+	+
Portal	Fenpyroximate	21A	12	1	2	+	+
Oberon	Spiromesifen	23	12	3	3	+	
M-Pede	Potassium salts of fatty acids	UN	12	0	Multiple	+	
Savey 50 DF	Hexythiazox (ovicidal)	10A	12	3	1	+	
Oils	Horticultural oils	UN	12	0	Multiple	+	

+ = labeled for that pest, level of efficiency is not included

*toxic to pollinators, beware during applications

Miticide Alternatives: Predatory mites

Phytoseiulus persimilis

- Obligatory predator of spider mites
- It can consume 20 eggs or five adults daily
- Most common predator and preys on all stages of mites

Phytoseiulus persimilis

Immature predatory mite (L. Lopez)

Neoseiulus californicus

- Generalist predator
- Feeds on both TSSM and cyclamen mite
- Option to establish early in the season

Neoseiulus californicus

Miticides Alternatives: Predatory mites

- Bran/vermiculite mixed with predatory mites
- ~50 mites/ml of bran
- Sprinkle on the leaves or based of the plant
- Chose trustworthy providers!

Advantages:

- Reduce insecticide use
- Preventive control of TSSM, cyclamen mite, and thrips

Spical	preventive	light curative	heavy curative
Rate	25/m²	100/m²	200/m²
m²/unit	1.000	250	125

Ongoing Research (2nd year)

- Combined effect of releasing predatory mites and standard grower techniques
- Fungicide compatibility with the generalist predatory mite *Neoseiulus californicus*

Upcoming Research (2023)

- Nontarget effects of miticides, insecticides, and fungicides on predatory mites

Slugs and Snails

- Can damage small plants and fruits
- Dry mulches between beds, logs, or debris can serve as a reservoir for slugs
- Also found under the plastic mulch
- Active at night and early morning

Slugs and Snails

- **Metaldehyde baits** (various): 10-25 lbs/ac
- **Iron phosphate bait** (Sluggo): 22-44 lbs/ac
- High mammalian and bird toxicity
- Expensive (high rates)
- Do not work in the rain or cool weather
- Insecticides do not work against them