New chemistries

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New chemistries for greenhouses

- cyflumetofen; Sultan (BASF; 2014)

- cyantraniliprole; Mainspring (Syngenta; 2015, 2016)

- flupyradifurone; Altus (Bayer; 2017)

- Coming soon - afidopyropen; Ventigra (BASF; 2019)
Topics du jour

- Introduction to new chemistries
  - mode of action
  - pest spectrum
  - my trial results
- Integration into your program
- Compatibility with biological control
Topics du jour

• Introduction to new chemistries
  mode of action
  pest spectrum
  my trial results

• Integration into your program

• Compatibility with biological control and other non-targets
<table>
<thead>
<tr>
<th>IRAC #</th>
<th>A.i.</th>
<th>Trade name</th>
<th>Use site</th>
<th>REI</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>abamectin</td>
<td>Avid, Lucid, Sirocco</td>
<td>L, N, G</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>melbemectin</td>
<td>Ultiflora</td>
<td>N</td>
<td>12</td>
</tr>
<tr>
<td>10A</td>
<td>clofentezine</td>
<td>Ovation SC</td>
<td>N, G</td>
<td>12</td>
</tr>
<tr>
<td>10A</td>
<td>hexythiazox</td>
<td>Hexygon DF</td>
<td>L, N, G</td>
<td>12</td>
</tr>
<tr>
<td>10B</td>
<td>etoxazole</td>
<td>TetraSan (Beethoven TR)</td>
<td>L, N, G (G)</td>
<td>12 (24)</td>
</tr>
<tr>
<td>12B</td>
<td>fenbutatin-oxide</td>
<td>ProMITE</td>
<td>L, N, G</td>
<td>48</td>
</tr>
<tr>
<td>13</td>
<td>chlorfenapyr</td>
<td>Pylon</td>
<td>G</td>
<td>12</td>
</tr>
<tr>
<td>20B</td>
<td>acequinocyl</td>
<td>Shuttle O (15SC)</td>
<td>N, G (L)</td>
<td>12</td>
</tr>
<tr>
<td>20D</td>
<td>bifenazate</td>
<td>Floramite, Sirocco</td>
<td>L, N, G</td>
<td>12</td>
</tr>
<tr>
<td>21A</td>
<td>fenazaquin</td>
<td>Magus</td>
<td>L, N, G</td>
<td>12</td>
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<tr>
<td>21A</td>
<td>fenpyroximate</td>
<td>Akari</td>
<td>N, G</td>
<td>12</td>
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<tr>
<td>21A</td>
<td>pyridaben</td>
<td>Sanmite</td>
<td>N, G</td>
<td>12</td>
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<tr>
<td>22</td>
<td>spiromesifen</td>
<td>Savate (aka Judo) (Forbid)</td>
<td>N, G (L)</td>
<td>12</td>
</tr>
<tr>
<td>25</td>
<td>cyflumetofen</td>
<td>Sultan</td>
<td>N, G, L</td>
<td>12</td>
</tr>
</tbody>
</table>
• a.i. = cyflumetofen (IRAC # 25; mitochondrial complex II electron transport inhibitor)
• Use site: G, N, L, I
• REI: 12 hours
• Rate: 13.7 fl oz/100 gal
• Against spider mites only.
• Against eggs, nymphs and adults.
• Quick knock-down.
• Contact activity.
• Residual longevity = 28 days.
• Compatible with predatory mites.
Efficacy at various application rates

- Target: Twospotted spider mite (TSSM)
- Host: Marigold
- Site: Greenhouse
- Year: 2012
- Treatments (per 100 gal):
  - Sultan @ 7.0 fl oz
  - Sultan @ 9.0 fl oz
  - Sultan @ 13.7 fl oz
  - Floramite @ 4.0 fl oz
  - Water check

Photo: JC Chong
Application rates
Chong, 2012
Application rates
Chong, 2012

![Graph showing the number of eggs per leaflet over days after treatment with different substances. The x-axis represents days after treatment, ranging from 0 to 28. The y-axis represents the number of eggs per 3 leaflets, ranging from 0 to 200. The graph includes data for Water, Cyflu, 7, Cyflu, 9, Cyflu, 13.7, and Floramite. Significant differences are indicated by asterisks (*) at certain data points.](image-url)
Why not below 13.7 fl oz/100 gal?
Efficacy at various application volumes

- Target: Twospotted spider mite (TSSM)
- Host: Butterfly bush
- Site: Outdoor nursery
- Year: 2013
- Treatments:
  - Sultann @ 13.7 fl oz 100 vs 50 gal/acre
  - Floramite @ 4.0 fl oz 100 vs 50 gal/acre
  - Water check
Application volume
Chong, 2013

Days after treatment

No. motiles/3 leaflets

-1  7  14  21  28

Water
Cyflu, 100 gal
Cyflu, 50 gal
Flora, 100 gal
Flora, 50 gal
Efficacy with the addition of an adjuvant

- Target: Twospotted spider mite (TSSM)
- Host: Butterfly bush
- Site: Outdoor nursery
- Year: 2013
- Treatments:
  - Sultan @ 6.5 and 13.7 fl oz
  - Sultan @ 6.5 and 13.7 fl oz + AirCover @ 8 fl oz
  - Water check
Adjuvant Chong, 2013

No. of motiles/leaf

Days after treatment

- Water
- Sultan, 6.5
- Sultan, 13
- Sultan + AirCover, 6.5
- Sultan + AirCover, 13

* Indicates significant difference.
Summary on Sultan

• Effective against spider mites (twospotted, southern red, Lewis, spruce)
  Nymphs and adults – within 3 days
  Eggs – 3 days

• Application rates
  13.7 fl oz, > 28 days
  9 fl oz, < 28 days
  < 7 fl oz, not recommended

• No difference between 50 and 100 gal (application volume) in greenhouses and outdoor.
• No difference with or without adjuvant.
• Compatible with predatory mites.
Compatibility of Sultan with biological control program

- Can results from laboratory studies be readily translated to the field?

- Spider mite is not the only pest. If another biological control agent is being used against another pest (e.g., *Amblyseius swirskii* against whiteflies and thrips), can Sultan be safely used and integrated into a IPM program?

- Sultan does not have translaminar activity. If a grower does not achieve full coverage, can *Phytoseiulus persimilis* be used to ‘clean up’ the remaining or hidden colonies of spider mites after Sultan treatment?

- Can a grower uses Sultan to reduce TSSM population before releases of *Phytoseiulus persimilis*? How long does he have to wait for release?
Standardized, multi-state study on the compatibility of Sultan to BC

- Three studies conducted at three states:
  Jim Bethke, San Marcos, CA
  JC Chong, Florence, SC
  Lance Osborne, Apopka, FL

- Same experimental protocol.

- Similar environmental conditions, only differ in location.

- This will make the studies comparable and the results can be translated readily to the growing conditions in greenhouses in the southern and western U.S.
Standardized, multi-state study on the compatibility of Sultan to BC

- **Target:**
  
  *Amblyseius swirskii*
  
  *Phytoseiulus persimilis*

- **Treatment:**
  
  Water check
  
  Sultan @ 13 fl oz/100 gal
  
  Sultan @ 6.5 fl oz/100 gal
  
  Avid @ 4 fl oz/100 gal (negative check)
  
  Floramite @ 4 fl oz/100 gal (positive)

- **Measure**
  
  Acute mortality (treatment at 24 hours after release)
  
  Residual mortality (release at 1, 3, 7 and 14 days after treatment)

Photos: Lance Osborne; UF
Lima bean

Untreated

Treatment

1 day

3 days

7 days

14 days

TSSM: 1 week
Whiteflies: 24 hrs

Remove adult whiteflies, then add *A. siwskii*. Add *P. persimilis*. 10 mites/plant.

Acute:
Forage for 24 hrs, then treat.

Residual:
No treatment.

Forage for 7 days, then count.

Supplements:
Pollen for *A. swirskii*. TSSM for *P. persimilis*.

Pred. mites

Whiteflies

Eggs or TSSM

Residual

Acute

Acute:
Forage for 24 hrs, then put an untreated.

Residual:
Forage for 7 days, then put an untreated.
How compatible is Sultan with biological control?

- Preliminary results from greenhouse tests in 3 states showed that Sultan is comparable to Floramite in its compatibility to *Amblyseius swirskii* and *Phytoseiulus persimilis*.

Acute toxicity:

Survival of predatory mite on plants treated with Sultan at 13 fl oz was similar to those treated with water and Floramite.

Growers can spray Sultan with minimal impacts to existing predatory mite populations.

Residual toxicity:

Survival on plants treated with Sultan at 13 fl oz was lower than those treated with water and Floramite at 1 and 3 DAT.

Growers should wait at least 7 days after spraying with Sultan before releasing predatory mites.
Tell me something about Altus and Mainspring...
Consequences of moving away from neonics...

- Increased pest issues with certain production systems.
- Increased need for alternative chemicals.
- Increased use of “oldies and goodies”.
- Increased use of biological control.
Systemic alternatives to neonics

- flupyradifurone (Altus) – 4D
  aphids, whiteflies, mealybugs, scales, thrips

- spirotetramat (Kontos) – 23
  aphids, whiteflies, mealybugs, scales, thrips
  mites

- cyantraniliprole (Mainspring) – 28
  aphids, whiteflies, scales, thrips
  beetles, caterpillars
Systemic alternatives to neonics

• Foliar – curative
  - Need to scout and find the pest populations in its early stage of build-up.
  - Alternatives are as effective as neonicotinoids.

• Drench – preventive
  - The alternatives are typically slower acting than neonicotinoids.
  - Drench before or as soon as the pest population shows up.
  - Only for crops and pests that are of constant problems.
  - Useful in some situations.
- a.i. = cyantraniliprole (IRAC # 28; ryanodine receptor modulator)
- Use site: G, N, L, I
- REI: 4 hours
- Rates:
  - aphids: 4-8 fl oz/100 gal
  - lace bug, beetles, caterpillars, thrips, whiteflies, leafminers: 2-8 fl oz/100 gal
  - soft scales: 8-12 fl oz/100 gal
- Drench: 8-12 fl oz/100 gal
- Contact and systemic activity.
• Compatibility with biological control (Koppert side effects)

  Swirski mite       Unknown
  Phytoseiulus persimilis  Harmless
  Minute pirate bug    Harmless
  Aphid parasitoid    Unknown
  Green lacewing      Harmless
  Whitefly parasitoid Unknown
  Bumble bee          Harmless
Mainspring vs whiteflies
2016 – Osborne, UFL- Apopka

Avg. # of Nymphs

Hibiscus plants grown in 4-inch containers
Drench treatment: 3 floz
Spray Treatment : Twice on 14 day interval w/ Capsil 6 floz
Six Replicates: Counts made on two leaves per plant
Mainspring vs whiteflies

2016 – Osborne, UFL- Apopka

Control

Mainspring 8 floz drench
Mainspring vs whiteflies

2016 – Osborne, UFL - Apopka

Untreated Control

Mainspring 8 floz drench
Chemical control of WFT

Systemic insecticides – Effective only against individuals feeding on foliage

<table>
<thead>
<tr>
<th>IRAC #</th>
<th>a.i.</th>
<th>Trade name</th>
<th>WFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4A</td>
<td>acetamiprid</td>
<td>TriStar (foliar)</td>
<td>P (P-E)</td>
</tr>
<tr>
<td></td>
<td>dinotefuran</td>
<td>Safari</td>
<td>P (P-E)</td>
</tr>
<tr>
<td></td>
<td>imidacloprid</td>
<td>Marathon, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>thiamethoxam</td>
<td>Flagship</td>
<td></td>
</tr>
<tr>
<td>3A + 4A</td>
<td>cyfluthrin + imidacloprid</td>
<td>Discus N/G</td>
<td>P</td>
</tr>
<tr>
<td>4D</td>
<td>flupyradifurone</td>
<td>Altus (foliar)</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>spirotetramat</td>
<td>Kontos</td>
<td>P (P-E)</td>
</tr>
<tr>
<td>28</td>
<td>cyantraniliprole</td>
<td>Mainspring</td>
<td>G (F-E)</td>
</tr>
</tbody>
</table>

WFT – western flower thrips
Aggregates of IR-4 trials. Efficacy: P < 50%; F = 50-75%; G = 75-95%; E > 95%
IDP832B4
Floret, 8 WAT

‘+’ = Capsil added
‘D’ = Drench
‘F’ = Foliar

Water check
Conserve SC, 11 fl oz, 3x F
Flagship 25WG, 8.5 oz, 3x F
Flagship 25WG, 8.5 oz, 1x D
Capsil, 6 fl oz, 3x F

Mainspring +, 4 fl oz, 3x F
Mainspring +, 8 fl oz, 3x F
Mainspring, 8 fl oz, 3x F
Mainspring, 12 fl oz, 3x D
Mainspring, 12 fl oz, 1x D
• a.i. = flupyradifurone (IRAC # 4D; nicotinic acetylcholine receptor competitive modulator)
• Use site: G, N, L
• REI: 12 hours
• Rates:
  aphids
  mealybugs, scales, thrips
  whiteflies
  Drench
• Contact and systemic activity.
  7-10.5 fl oz/100 gal
  10.5-14 fl oz/100 gal
  21-28 fl oz/100 gal
• Compatibility with biological control (Koppert side effects)

- Swirski mite: Moderately harmful
- Phytoseiulus persimilis: Moderately harmful
- Minute pirate bug: Unknown
- Aphid parasitoid: Harmless
- Green lacewing: Unknown
- Whitefly parasitoid: Unknown
- Bumble bee: Harmless
Altus and BotaniGard vs mealybugs

Untreated

Botanigard 4 x at 32 fl oz

Altus 2 x at 14 fl oz
Spray or drench?
Altus and Zylam vs mealybugs

<table>
<thead>
<tr>
<th>Days after first treatment</th>
<th>No. nymphs per leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>56</td>
<td>0</td>
</tr>
</tbody>
</table>

- Water
- Zylam, 14.5, 2x F
- Zylam, 58.2, 1x D
- Altus, 14, 2x F
- Altus, 28, 1x D
Spray or drench?

• **Purpose:**
  - Spray – Curative
  - Drench – Preventive

• **Tissues infected:**
  - Spray – Flower and older tissues
  - Drench – Actively growing tissues

• **Time to finish**
  - Spray – Quick result; closer to shipment
  - Drench – At least 2 weeks before treatment
Speed and longevity of systemics

• Speed
  Depends on the molecules, plant size and environmental conditions
  Neonicotinoids > Altus > Mainspring > Kontos

• Longevity
  In general 4-6 weeks.
  Older leaves are better protected than young leaves.
  “Yes, they are systemic but they don’t go back down the pipes.”
Pollinator protection

• Greenhouse & nursery:
  Follow instructions in the “bee box”
  Spray: No less than 2 weeks before ship/sale
  Drench: No less than 4 weeks before ship/sale

• Landscape & lawn:
  Follow instructions in the “bee box”
  Ornamentals: Do not apply during bloom.
  Turf: Mow and remove all flowering weeds before application.
Ventigra

- a.i. = afidopyropen (IRAC # 9D; chordotonal organ TRPV channel modulator)
- Same MOA as pymetrozine (Endeavor) and pyrifluquinazon (Rycar)
- Use site: G, N, L
- REI: 12 hours
- Rates:
  - aphids
  - whiteflies, scales, mealybugs
- Contact and translaminar activity
- Compatibility with biological control largely unknown, but likely similar to Endeavor and Rycar.
Ventigra

- a.i. = afidopyropen (IRAC # 9D; chordotonal organ TRPV channel modulator)
- Same MOA as pymetrozine (Endeavor) and pyrifluquinazon (Rycar)
- Use site: G, N, L
- REI: 12 hours
- Rates:
  - aphids: 1.4 fl oz/100 gal
  - whiteflies, scales, mealybugs: 4.8-7 fl oz/100 gal
- Contact and translaminar activity.
- Compatibility with biological control largely unknown, but likely similar to Endeavor and Rycar, i.e. very compatible.
Ventigra vs green peach aphid

<table>
<thead>
<tr>
<th>Product</th>
<th>Appl. rate</th>
<th>Method &amp; Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>-</td>
<td>Foliar; 2x</td>
</tr>
<tr>
<td>Ventigra</td>
<td>1.4 fl oz</td>
<td>1x; before</td>
</tr>
<tr>
<td>Ventigra</td>
<td>1.4 fl oz</td>
<td>1x; after</td>
</tr>
<tr>
<td>Ventigra</td>
<td>1.4 fl oz</td>
<td>2x; 7 days</td>
</tr>
<tr>
<td>Ventigra</td>
<td>1.4 fl oz</td>
<td>2x; 14 days</td>
</tr>
<tr>
<td>Ventigra</td>
<td>1.4 fl oz</td>
<td>2x; 21 days</td>
</tr>
<tr>
<td>Ventigra</td>
<td>1.4 fl oz</td>
<td>2x; 28 days</td>
</tr>
<tr>
<td>Mainspring</td>
<td>4 fl oz</td>
<td>2x; 14 days</td>
</tr>
<tr>
<td>Endeavor</td>
<td>5 oz</td>
<td>2x; 14 days</td>
</tr>
<tr>
<td>Marathon II</td>
<td>8.37 fl oz</td>
<td>1x; drench</td>
</tr>
</tbody>
</table>

- What we learned:
  - “Before infestation” treatment protected the calibrachoa.
  - Reapplication interval did not make much difference; one application should protect for 28 days.
  - Ventigra applied twice at 28 days can provide protection similar to that of systemic insecticides.
Ventigra vs sweetpotato whitefly

<table>
<thead>
<tr>
<th>Product</th>
<th>Appl. rate</th>
<th>Method &amp; Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>-</td>
<td>Foliar; 2x</td>
</tr>
<tr>
<td>Ventigra</td>
<td>4.8 fl oz</td>
<td>1x</td>
</tr>
<tr>
<td>Ventigra</td>
<td>6.8 fl oz</td>
<td>1x</td>
</tr>
<tr>
<td>Ventigra</td>
<td>4.8 fl oz</td>
<td>2x; 14 days</td>
</tr>
<tr>
<td>Ventigra</td>
<td>6.8 fl oz</td>
<td>2x; 14 days</td>
</tr>
<tr>
<td>Mainspring</td>
<td>4 fl oz</td>
<td>1x</td>
</tr>
</tbody>
</table>

- What we learned:
  - Ventigra at 6.8 fl oz achieved faster and greater knockdown than Ventigra at 4.8 fl oz or Mainspring.
  - One application of Ventigra at 6.8 fl oz was similar to two application of Ventigra at 4.8 fl oz and one application of Mainspring.
  - Efficacy increased with application frequency.