The Neem Tree

- Native to India, Bangladesh, Pakistan and surrounding geographies of the Middle East
- Mahogany Family
  - Similar to Chinaberry
- Evergreen
- Very Fast Growing
- Drought resistant
- All parts of the tree are utilized including the kernel, bark, leaves and roots
Biopesticide Discovery

• Neem’s ability to repel insects was first reported between 1928 & 1929 by two scientists in India.

• Real significance was not demonstrated until 1962 in a field trial where it was noted that locust that landed on neem plants refused to consume any of the foliage.

• Bioactive compounds are found throughout the tree however the seed kernels contain the highest concentration of actives.
Bioactive Properties

• Over 150 biological active compounds
  • Major constituents are known as limonoids
• At least 9 limonoids are highly active, they include
  • Azadirachtin, salannin, meliantriol, nimbin, nimbidin, nimbinin, nimbolides and fatty acids (oleic, stearic, palmitic)
• Azadirachtin, Salannin & Meliantriol play a key role in insect management
  • Repel and disrupt insect growth & reproduction
  • Potent feeding deterrents & growth regulators
    • Repel & reduce the feeding of many insect species including nematodes
    • Azadirachtin can break the metamorphosis life cycle of an insect. The insect will not molt.
• Systemic Activity – varies by plant & insect species and formulation
  • Only xylem available to deeper feeding insects such as hoppers
• Nimbin, Nimbidin and other limonoid activities have fungicidal and antiviral activity
• Neem Oil offers the complete package – Fungicide, Insecticide, Nematicide
The Neem Oil Extraction Process

- Methods
  - Cold Press Method
  - Water extraction,
  - Solvent/heat extraction such as: Hexane, Pentane, Alcohol

- Cold Press is Best
  - Some actives in neem are sensitive to heat/solvent based extraction methods therefore Cold press is the Best at preserving the actives

- Solvent/Heat processing impacts oil/active composition
  - Important to know how your oil was extracted
  - Solvent extraction using Hexane results in high oil variability. This oil finds its way to the soap making industry
  - The azadirachtin content can vary depending on the extraction method and quality of the neem seed

© 2018 Terramera | www.terramera.com
How To Build A Better Mouse Trap

• Willing to think outside the box
  • Innovation is key
• Willing to take a risk
• Willing to invest
  • People
  • Time
  • Money
• Terramera is committed to innovation that benefits agriculture
Challenges with Neem

• Consistency in field performance
  • High end spray solution that provides targeted coverage

• Consistency in the tank
  • Ease of mixing
    • Reasonable agitation
  • Stays in solution (Mixing Stability)
    • In the tank and on the leaf
Rango™ – 70% Cold Press Neem Oil built on a new inert chassis

- Superior Formulation
  - “Farmer Friendly”
  - Easy to mix
  - Stays in solution
  - Consistent coverage
  - Consistent efficacy

0 hours

Rango™

48 hours
Rango™ – Field Trial Results

• First Year of Field Evaluations
• Superior Formulation
• Outstanding Efficacy – Exceeded the Expectations!
• EPA Registered – Will have all states by March 1 except California which is scheduled for 2ndQ
• OMRI Listed
Rango™ General Information

• What is the Signal Word and Personal Protective Requirements for Rango™?
  • Rango™ is a Category 4 “Caution” material which is the safest classification a material can receive from the EPA.
  • The PPE requirements are minimal:
    • Long sleeved shirt and long pants
    • Shoes plus socks
# Rate Information

<table>
<thead>
<tr>
<th>Pest Type</th>
<th>Crop Type</th>
<th>Rate Range</th>
<th>Maximum Rate/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insects</td>
<td>All Crops</td>
<td>0.625 to 1.8% v/v</td>
<td>3 quarts</td>
</tr>
<tr>
<td>Mites</td>
<td>All Crops</td>
<td>0.625 to 1.8% v/v</td>
<td>3 quarts</td>
</tr>
<tr>
<td>Diseases</td>
<td>All Crops</td>
<td>1.25 to 1.8% v/v</td>
<td>6 quarts</td>
</tr>
</tbody>
</table>
## INSECTS

<table>
<thead>
<tr>
<th>Aphids</th>
<th>Grasshoppers</th>
<th>Psylids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beetles</td>
<td>Leafhoppers</td>
<td>Scales</td>
</tr>
<tr>
<td>Borers</td>
<td>Maggots &amp; Grubs</td>
<td>Thrips</td>
</tr>
<tr>
<td>Caterpillars/Moths/Worms</td>
<td>Mealy Bugs</td>
<td>True Plant Bugs</td>
</tr>
<tr>
<td>Flies &amp; Gnats</td>
<td>Mites</td>
<td>Wireworms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Whiteflies</td>
</tr>
</tbody>
</table>

## FOLIAR & SOIL FUNGAL DISEASES

<table>
<thead>
<tr>
<th>Alternaria</th>
<th>Botrytis</th>
<th>Powdery Mildew</th>
<th>Stem Mildew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracnose</td>
<td>Downey Mildew</td>
<td>Rust</td>
<td>Southern Blight</td>
</tr>
<tr>
<td>Blight (early, late, leaf)</td>
<td>Molds</td>
<td>Scab</td>
<td>Sour Rot Grapes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fusarium Oxyporum</td>
<td>Pythium</td>
<td></td>
<td>Rhizoctonia Solani</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Apple Powdery Mildew – Washington

• Trial Setup:
  • 6 apps: April 4, 13, 24, May 3, 14 & 24
  • Air blast conventional sprayer 100 GPA

Ave Severity (%)
Powdery Mildew
60 Days After Final Application
Braeburn var. (PM susceptible)

Ave Severity (%)
Powdery Mildew
60 Days After Final Application
Gala var. (Phyto Sensitive)
Tomato Powdery Mildew – Escalon, CA

- Trial Setup
  - 5 apps: July 16, 26, August 6, 16 and 27
  - CO2 Sprayer 3-nozzle, 35 GPA

**Average Severity (Leaf, %)**
Powdery Mildew - September 21 2018
Processing Tomato Field Trial - Escalon, CA - 2018
Spinach Downy Mildew – Escalon, CA

**Downy Mildew Incidence (Leaf, %)**
November 16, 2018
San Joaquin County, CA

**Downy Mildew Severity (Leaf, %)**
November 16, 2018
San Joaquin County, CA

Mean Disease Incidence ...

Mean Disease Severity (%)

Downy Mildew Incidence (Leaf, %)
Downy Mildew Severity (Leaf, %)
Broccoli Insecticide Field Trial – Escalon, CA

- 7 weekly applications September to October 2018
- CO2 Sprayer 3-nozzle, 40 GPA
- Pest: Cabbage Looper, Beet Armyworm, Diamondback Moth, Imported Cabbage Worm, Turnip Aphids, Silverleaf Whitefly

Overall Feeding Damage (All insects) on Leaves per Plot (Scale 1-10)
November 9th, 2018 Evaluation
23 Days after Last Application

- UTC
- Spinosad 22.5% 4 fl oz + Adjuvant
- Rango 1.2% (v/v)
- Rango 1.8% (v/v)
Ave. Count All Worms per Plot
Oct 26\textsuperscript{th}, 2018 Eval

<table>
<thead>
<tr>
<th>Average Individual Worm Count</th>
<th>UTC</th>
<th>Spinosad 22.5% 4 fl oz + Adjuvant</th>
<th>Rango 1.2% (v/v)</th>
<th>Rango 1.8% (v/v)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>15</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
Rango™ - Conclusions

• Superior Formulation
  • “Farmer Friendly”
  • Easy to mix
  • Stays in solution
  • Consistent coverage
  • Consistent efficacy
  • California Registration 2ndQ

Thank You!