



GRANDEVO[®] Best Practices and Pipeline Update

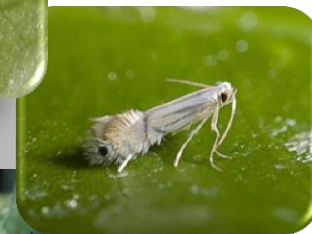
Carlos Reyes, Ph.D.
Vice President, Product Development
Marrone Bio Innovations

Ag Innovations Meeting
26 March 2014



GRANDEVO®—Selective, Cross-Spectrum Protection

- Cross-spectrum insecticidal/miticidal activity
- Naturally derived from *Chromobacterium subtsugae* and spent fermentation media
- Complex modes of action
- Activity includes repellency, reduced fecundity, reduced egg hatch, and death via ingestion
- Doesn't interfere with most beneficial insect activity
- 4-hour REI, 0-day PHI
- MRL tolerance exempt
- NOP compliant/OMRI approved
- Field or greenhouse, ground or aerial applications



GRANDEVO®—Mixing and Cleanup



- Fill tank with 3/4 of the desired amount of water.
- Start mechanical or hydraulic agitation
- Add the desired volume of GRANDEVO® to the mix tank
- Continue circulation while adding the remainder of the water.
- Maintain circulation while loading and spraying.
- Consider mixing a pre-slurry if standard instructions are not compatible with your equipment



Great For:

- general cleaning
- degreasing
- concrete
- machine shops
- body shops
- aviation
- metal surfaces
- boats / rv
- carbon cleaning
- dipping
- linoleum
- de-fogging glass/mirrors
- restaurants
- carpets
- vinyl
- mildew removal
- much, much more!

Citrus Clean, National Chemical Company

GRANDEVO®—Minimal, to No Effect, on Beneficials

- Non target LR₅₀
 - *Amblyseius californicus* – Minimal effect at labeled rates
 - *Aphidius colemani* – No effect at nearly 3x the high labeled rate
 - *Aphidoletes aphidimyza* – No effect at nearly 3x the high labeled rate
 - *Cryptolaemus montrouzieri* – No effect at nearly 3x the high labeled rate
 - *Orius insidiosus* – No effect at nearly 3x the high labeled rate
 - Parasitic wasps (e.g., *Diglyphus isaea*) - No effect at labeled rates
- Contact local Marrone rep for complete/latest list



GRANDEVO®—No Adverse Effects to Honey Bees



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL
AND POLLUTION

APR 23 2013

MEMORANDUM

SUBJECT:

Review of data to support specific statements from
the label of GRANDEVO[®] active ingredient
Chromobacterium subsp. EA4-1^T; PC Code 016329; EPA
Reg. No. 472382, DP Barcodes 409022 and
47107 and 931687; MRIDs 48998201,

FROM:

Dr. Jorge Borges, Lead Biologist
Microbial Pesticides Branch
Biopesticides and Pollution Prevention Division, 7511P

TO:

Jeannine Kausch, Regulatory Action Leader
Microbial Pesticides Branch
Biopesticides and Pollution Prevention Division, 7511P

Conclusion: ...adverse effects to honey bees were not observed in the study...

GRANDEVO®—No Adverse Effects to Honey Bees

- Research shows that GRANDEVO has no adverse effects on honey bee health, survival, or brood development
- However, the majority of honey bees will avoid treated plants for the first 48 hours after GRANDEVO application
- Manage your crop's flower biology in conjunction with the GRANDEVO application timing to maximize successful pollination when necessary

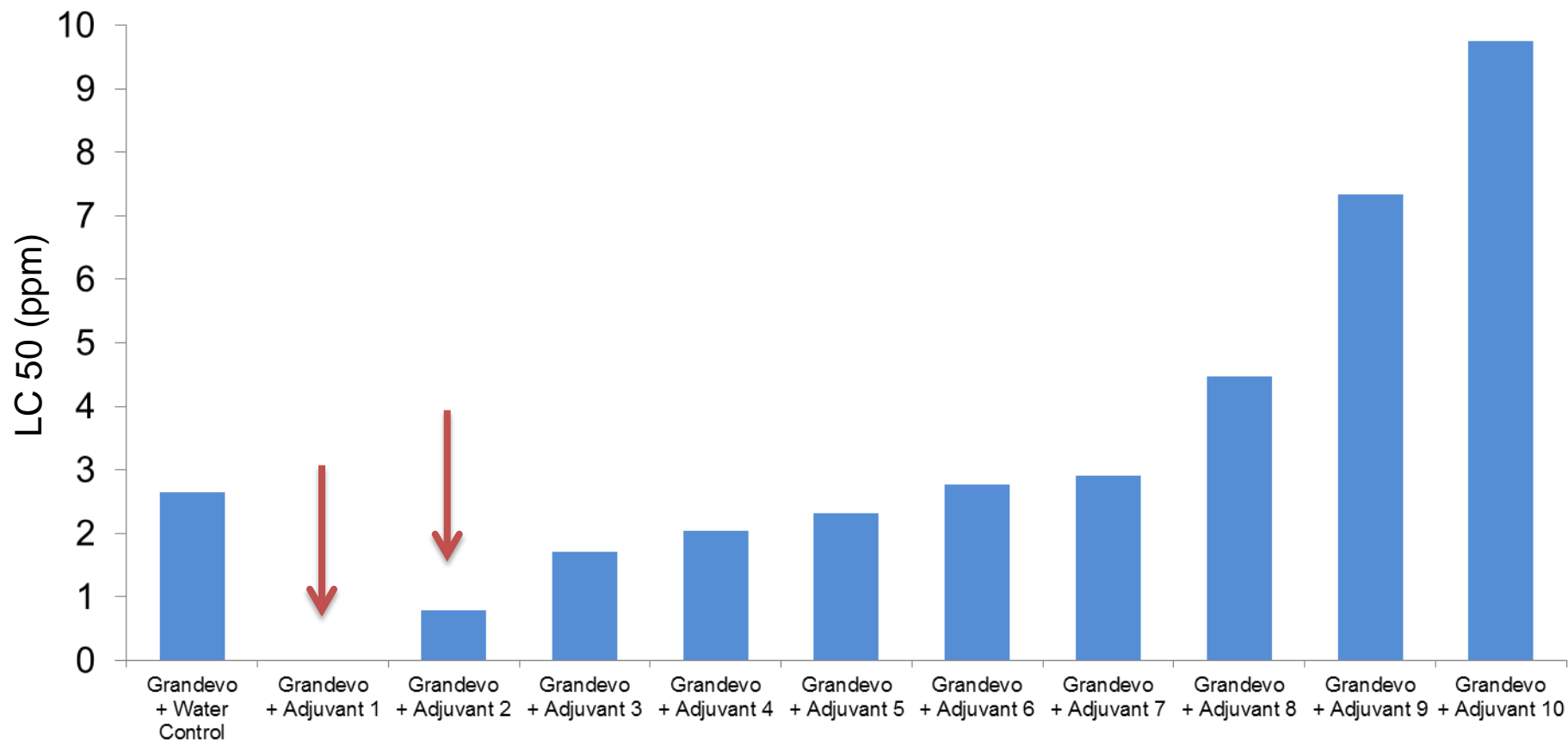




- Avoid carrier volumes and/or adjuvants alone or in combination that result in spray runoff or drip accumulation
- Use a carrier volume that balances between adequate spray coverage and spray solution concentration
- Some adjuvants have been shown to increase or decrease the effectiveness of GRANDEVO. Be sure to test before applications.
- Use of a quality surfactants is highly recommended.

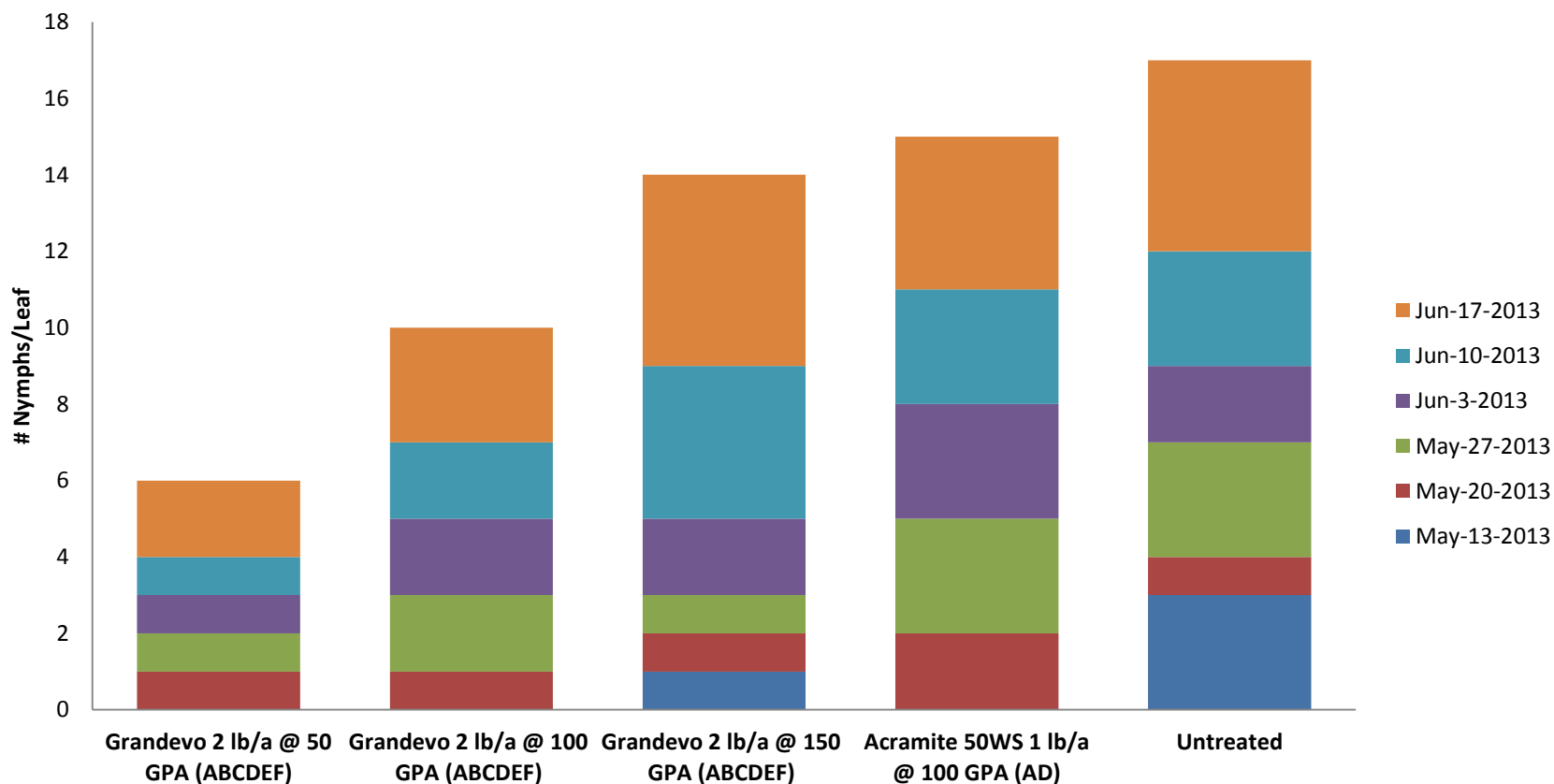
GRANDEVO® and the Effect of Adjuvants on Efficacy

Cabbage Looper Bioassay Test Results



GRANDEVO® and the Effect of Carrier Volume on Efficacy

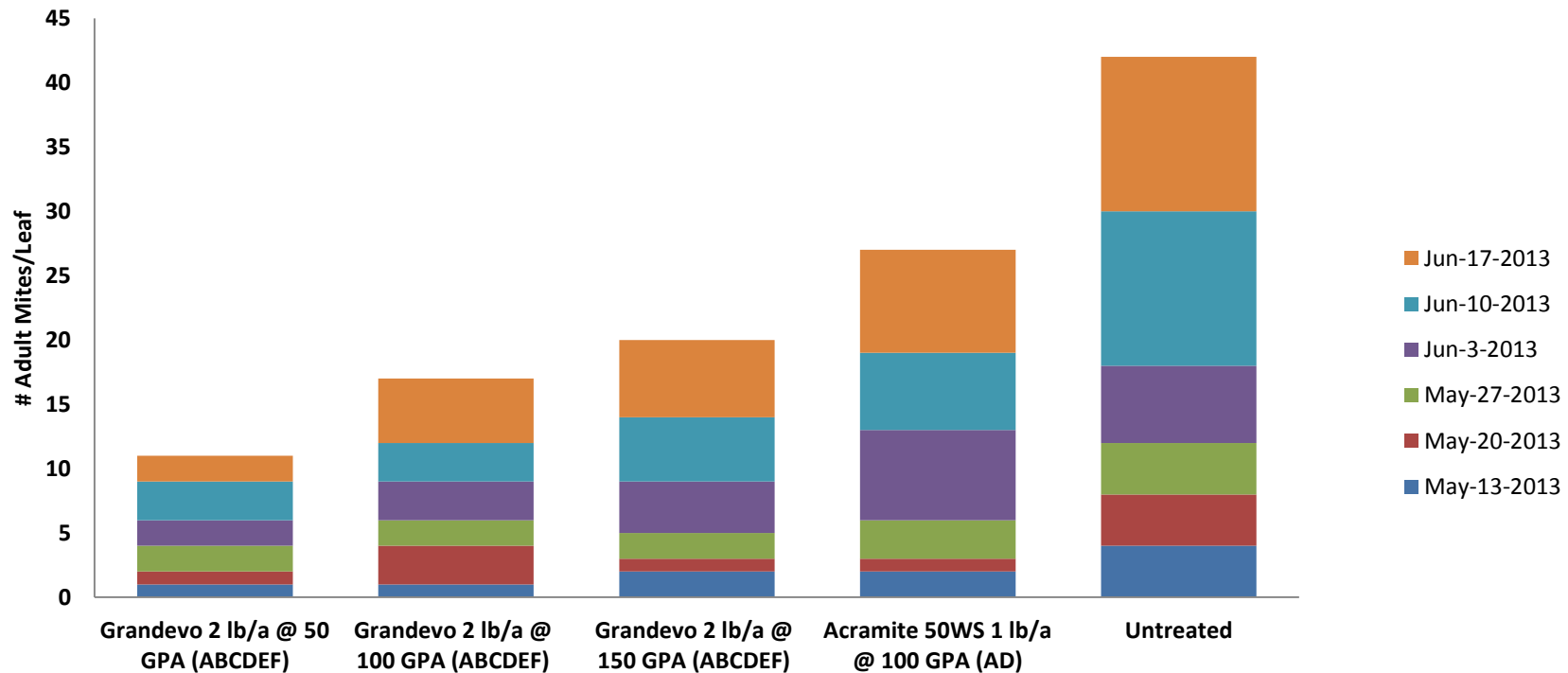
Twospotted Spider Mite in Strawberry (*Tetranychus urticae*) Mean Number of Nymphs per Leaf Biological Applied Research, Inc. NC, 2013



- Application Timing: May 6 (A), May 13 (B), May 20 (C), May 27 (D), June 3 (E), June 10 (F).

GRANDEVO® and the Effect of Carrier Volume on Efficacy

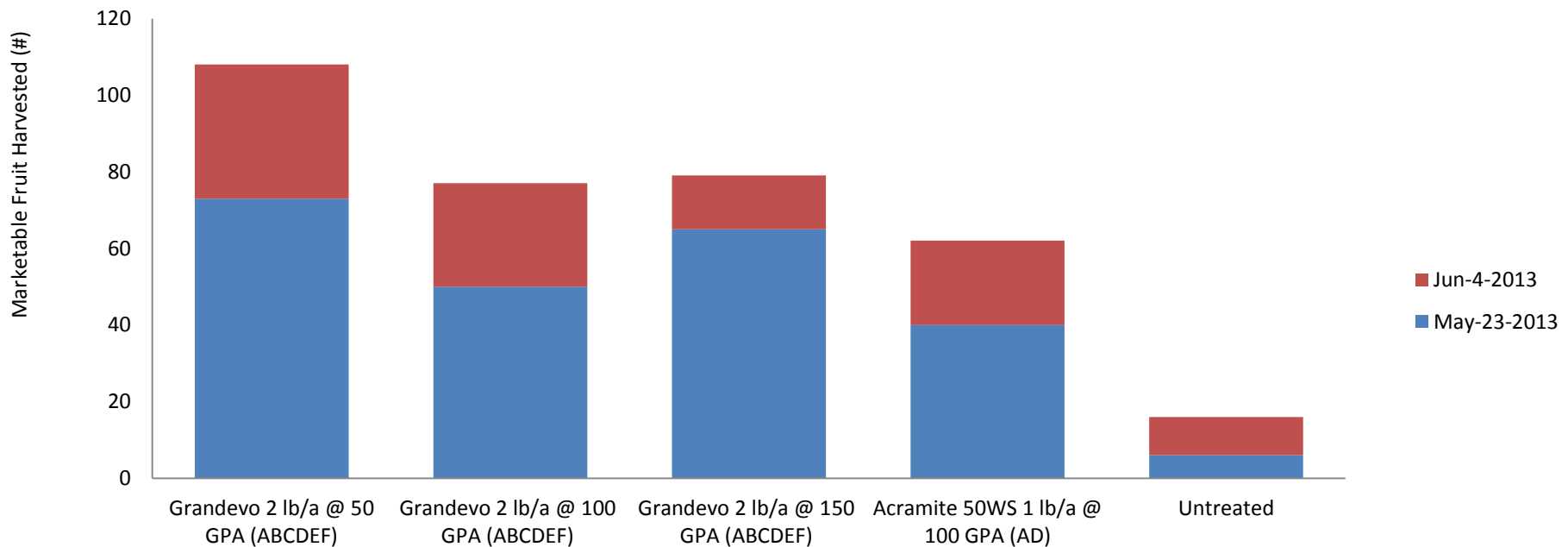
Twospotted Spider Mite in Strawberry (*Tetranychus urticae*) Mean Number of Adult Mites per Leaf Biological Applied Research, Inc. NC, 2013



- Application Timing: May 6 (A), May 13 (B), May 20 (C), May 27 (D), June 3 (E), June 10 (F).

GRANDEVO® and the Effect of Carrier Volume on Efficacy

Twospotted Spider Mite in Strawberry
(*Tetranychus urticae*)
Mean Marketable Fruit Harvested (#)
Biological Applied Research, Inc.
NC, 2013

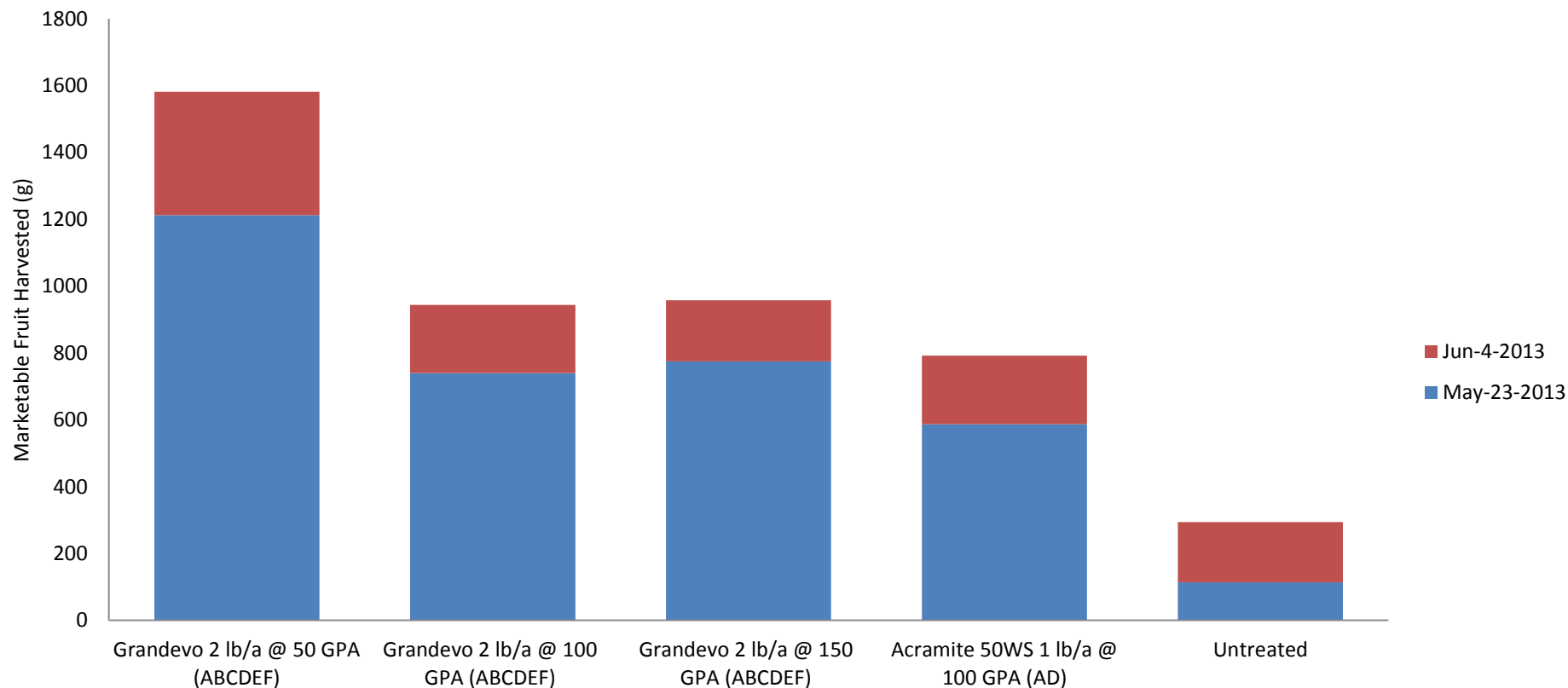


- Application Timing: May 6 (A), May 13 (B), May 20 (C), May 27 (D), June 3 (E), June 10 (F).

GRANDEVO® and the Effect of Carrier Volume on Efficacy



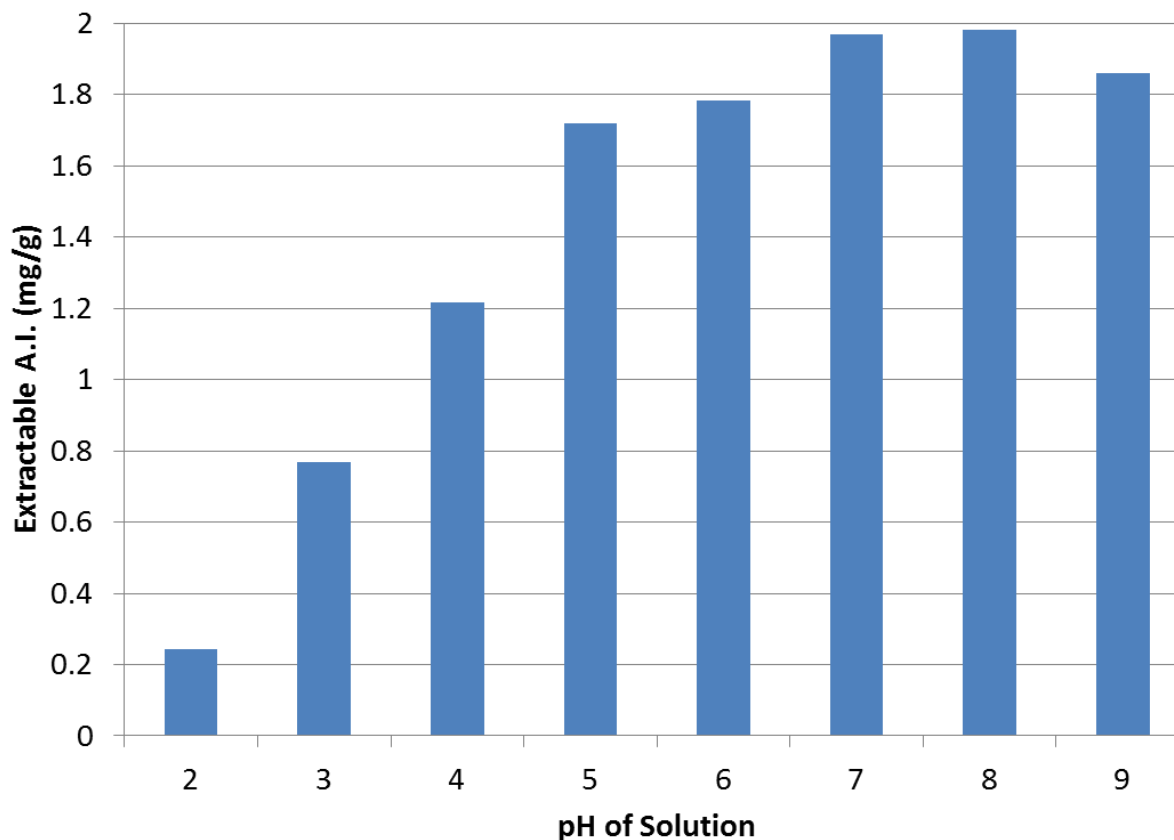
**Twospotted Spider Mite in Strawberry
(*Tetranychus urticae*)
Mean Marketable Fruit Harvested (g)
Biological Applied Research, Inc.
NC, 2013**



- Application Timing: May 6 (A), May 13 (B), May 20 (C), May 27 (D), June 3 (E), June 10 (F).

GRANDEVO® and the Effect of Spray Solution pH

- To maintain product properties, the optimal spray solution pH is between 7 and 8

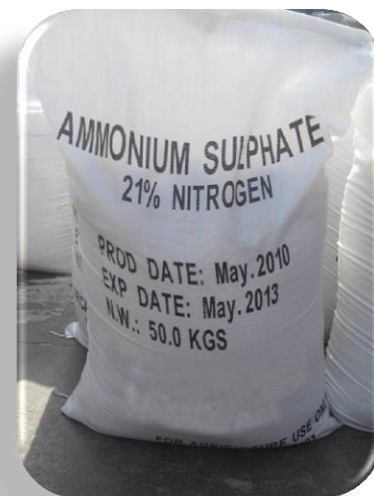


Effect of Water Hardness on GRANDEVO®



- Lab bioassays have shown that adding AMS (ammonium sulfate) at levels of 1-2% (w/w) or 8.5 to 17 pounds per 100 gallons of water helps maintain repellency in presence of hard water.

| Water Condition | Grandevo | % AMS | Aphid Count/Treated Leaf Disk |
|------------------|----------|-------|-------------------------------|
| Dionized | No | 0 | 21.3 |
| 300 ppm hardenss | No | 1 | 12.7 |
| 300 ppm hardenss | No | 2 | 4.7 |
| 300 ppm hardenss | Yes | 0 | 2.7 |
| 300 ppm hardenss | Yes | 1 | 2.0 |
| 300 ppm hardenss | Yes | 1.5 | 0.7 |
| 300 ppm hardenss | Yes | 2 | 0.0 |

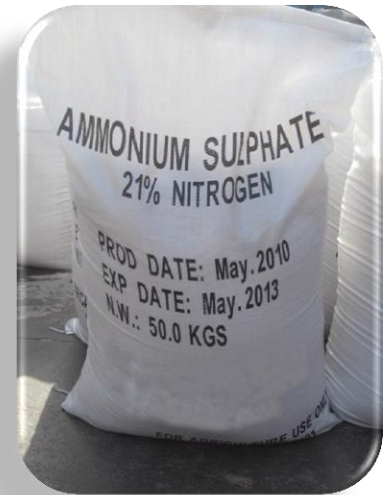
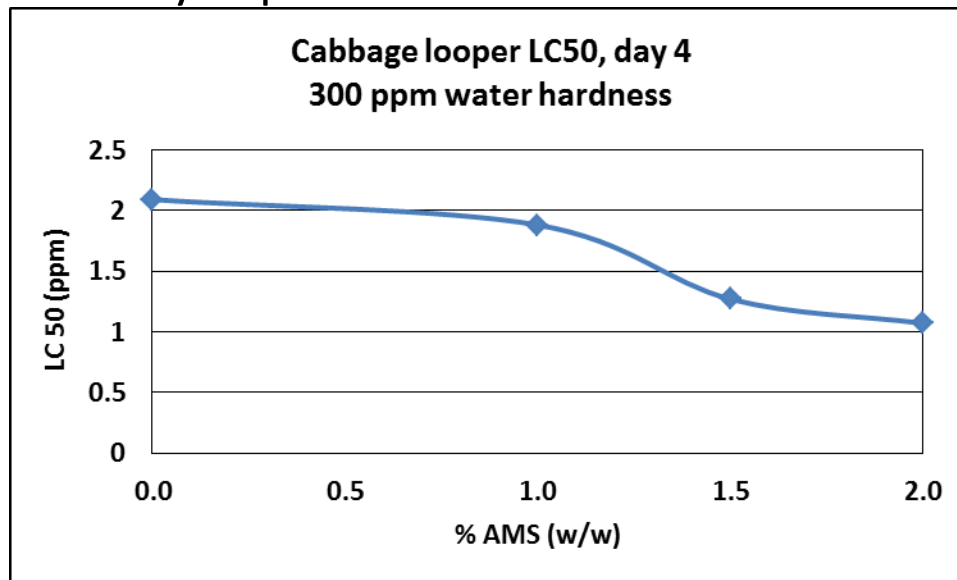


- If you know or suspect you have hard water, a spray test should be conducted to determine if your crop/variety is compatible with these AMS levels.
- Pre-test tank mixtures with nutrients containing elements associated with hard water

Effect of Water Hardness on GRANDEVO®




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Photos courtesy of: chinaserniorsupplier.com



VENERATE™ Bioinsecticide Product Overview

About VENERATE™



- Broad-spectrum protection against chewing and sucking insects, and certain mites
 - Multiple modes of action
 - Active via exposure and by ingestion
- Ideal partner in resistance management
- Several patent pending active compounds, different chemical classes, some novel, produced by the bacteria
 - Derived from new patent-pending species of *Burkholderia rinojensis*¹
- Nontoxic to fish, birds, and most beneficials ... including honey bees
- Easy-to-use liquid formulation
- Registered for conventional and organic production uses across a broad range of crops



¹No relationship to pathogenic *Burkholderia* species

Photos courtesy of: *Pepper weevil* Alton N Sparks, Univ of GA, Boxwood.org; *Beet armyworm* Clemson Univ. USDA Cooperative Extension Slide Series Bugwood.org; *Western flower thrip* Frank Peairs, CO St. Univ. Bugwood.org; *Cabbage Looper* RJ Reynolds Tobacco Company, Bugwood.org; *Twospotted spider mite* Clemson EDU

VENERATE™ - Key Features and Benefits



Ideal for IPM and insect resistant management programs

- Broad-spectrum protection against sucking and chewing insects and certain mites
- Activity against adults and nymphs
- Multiple modes of action
- Non-toxic to fish, birds, and most beneficial insects...including honey bees

Manage residues

- 0-day PHI
- MRL tolerance exemption

Convenient and easy to use

- 4-hour REI
- No spray buffer required
- Easy-to-use liquid formulation

Maximum operational flexibility

- OMRI approved and NOP compliant
- Approved for field and greenhouse applications
- Apply by ground or aerial

VENERATE™ Activity



Chewing insects

- difficulties molting
- loss of larvae exoskeleton integrity
- induces loose stools in larvae (potential feeding disruptant)
- stunting

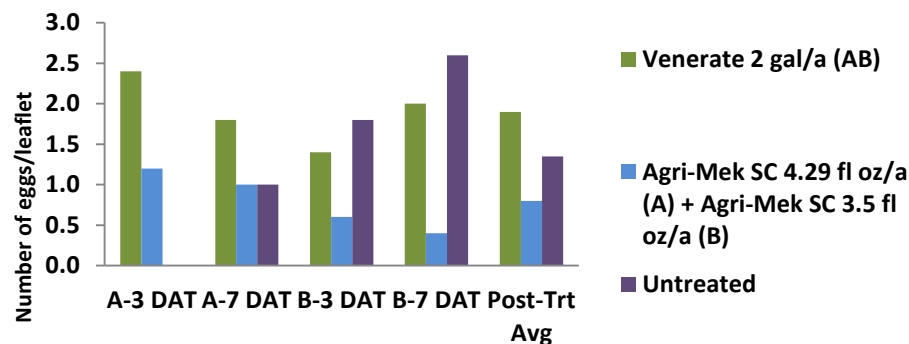


Piercing/sucking insects

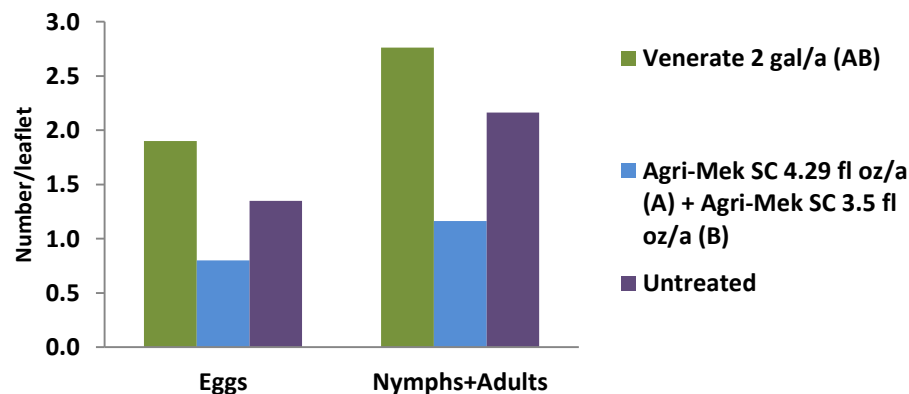
- loss of exoskeleton integrity

VENERATE™—Minimal to No Effect on Beneficials

Predatory Mite on Strawberry
Number of Eggs per Leaflet
 University of California Cooperative Extension, S. Dara
 Santa Maria, CA, 2013



Predatory Mite on Strawberry
Post-Treatment Average
 University of California Cooperative Extension, S. Dara
 Santa Maria, CA, 2013





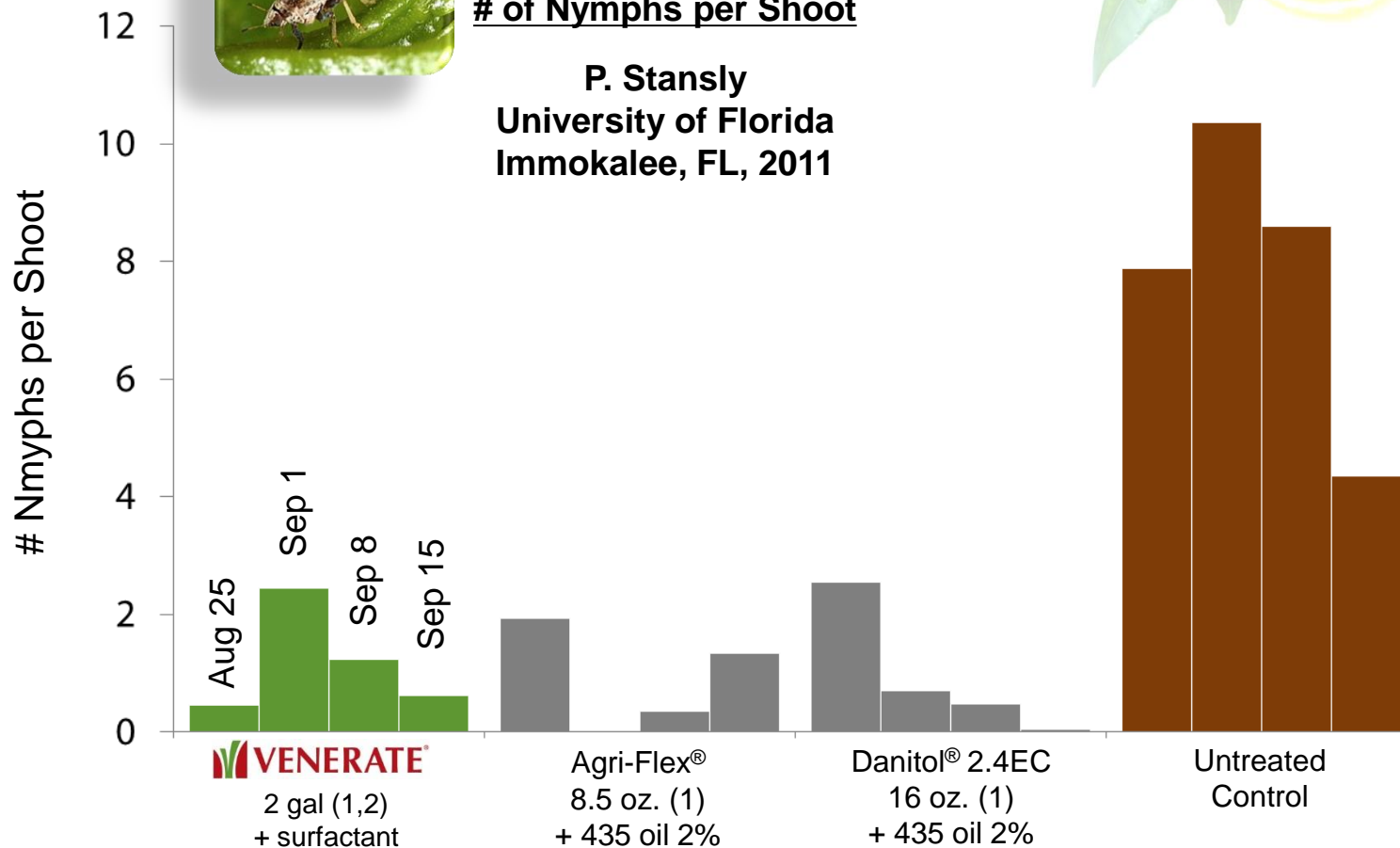
VENERATE™ Trial Results

VENERATE™ vs. Asian Citrus Psyllid



Asian Citrus Psyllid
(*Diaphorina citri*)
of Nymphs per Shoot

P. Stansly
University of Florida
Immokalee, FL, 2011

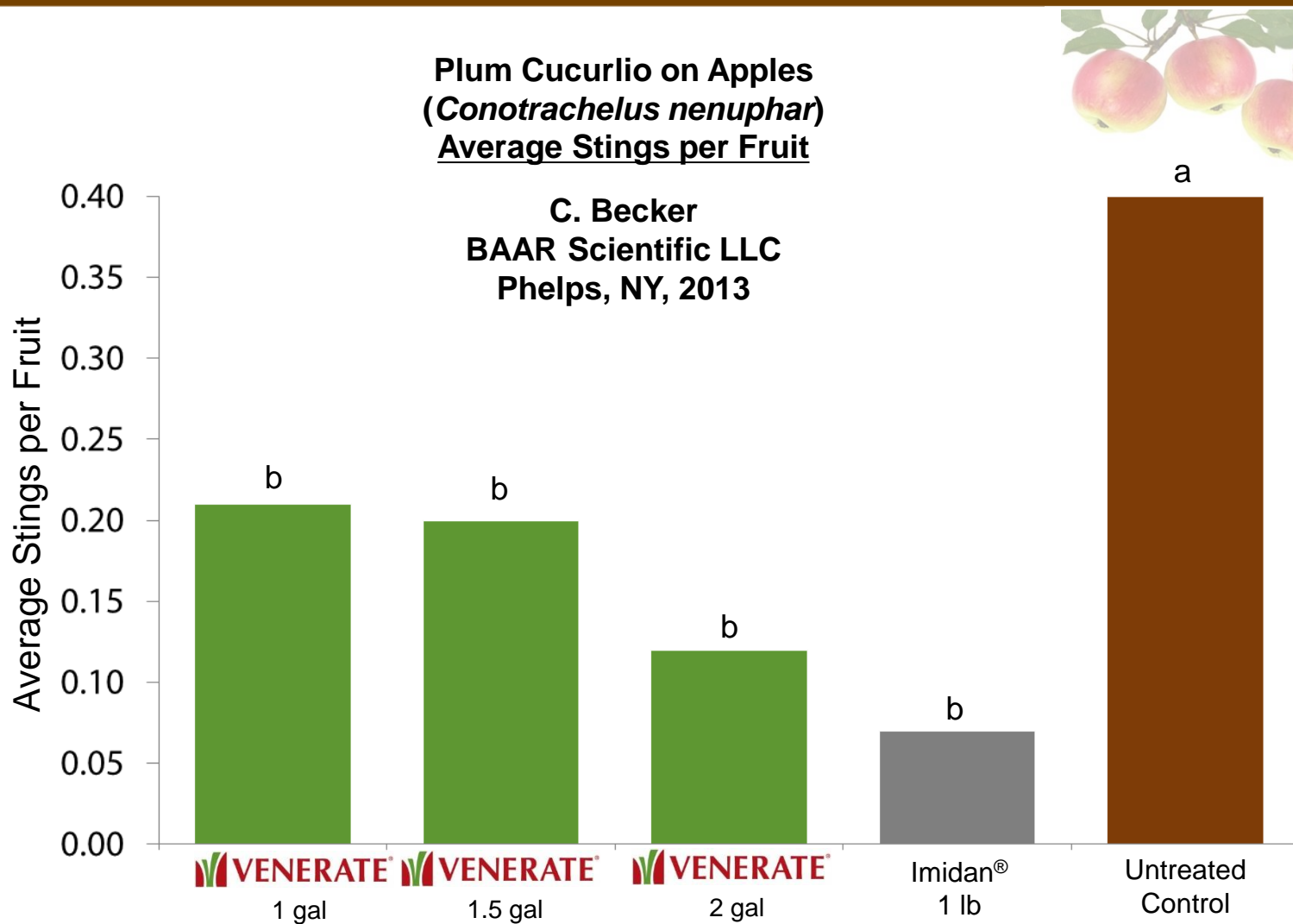


- Treatments applied 1= Aug 22 , 2= Sep 5.

- Treatments evaluated on Aug 25, Sep 1, Sep 8, Sep 15.

Log 184

VENERATE™ vs. Plum Cucurlio



- Treatments applied 3 times.
- Treatments evaluated on Jun 15.

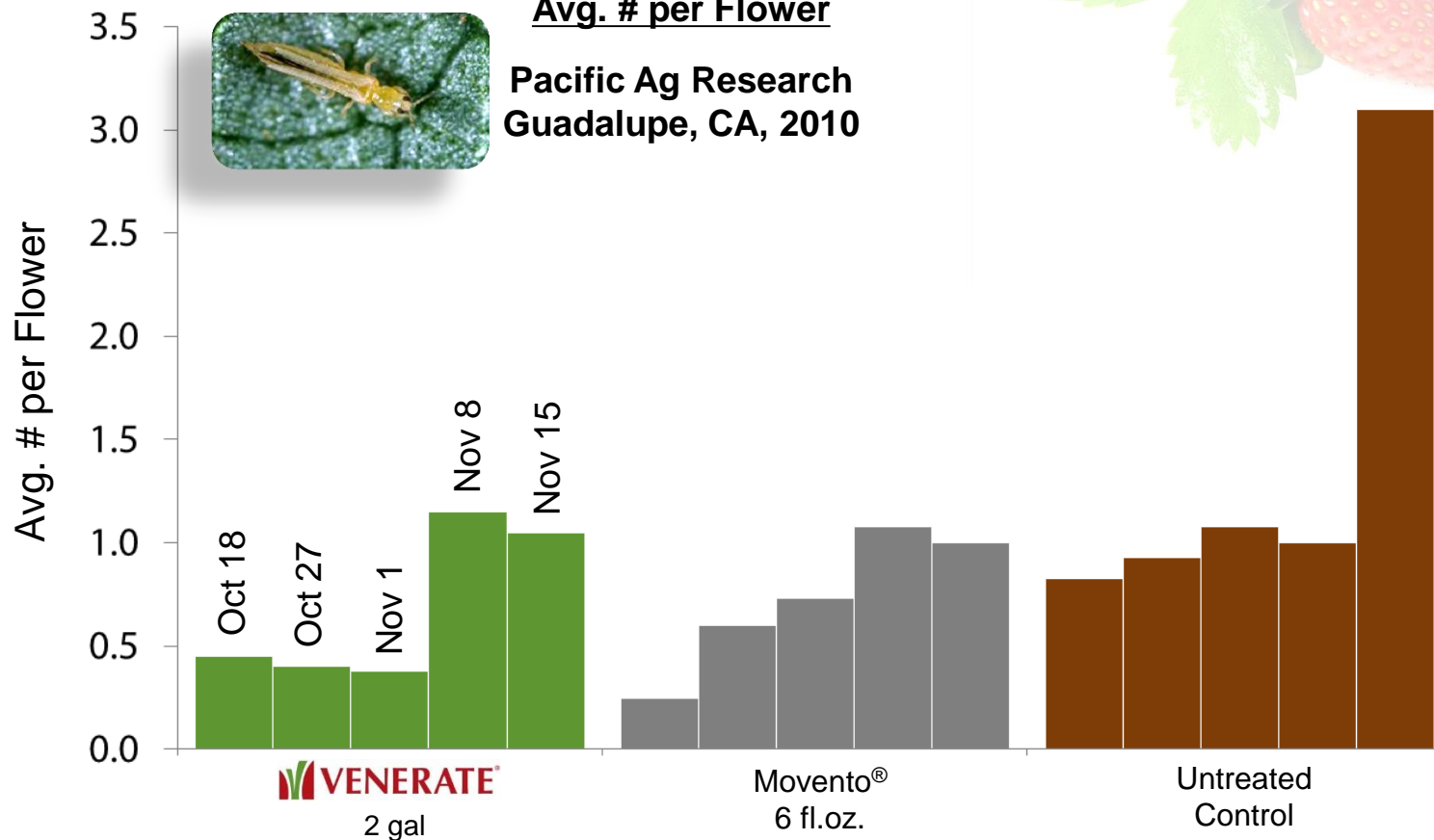
VENERATE™ vs. Western Flower Thrips



Western Flower Thrips on Strawberry (*Frankliniella occidentalis*)

Avg. # per Flower

Pacific Ag Research
Guadalupe, CA, 2010

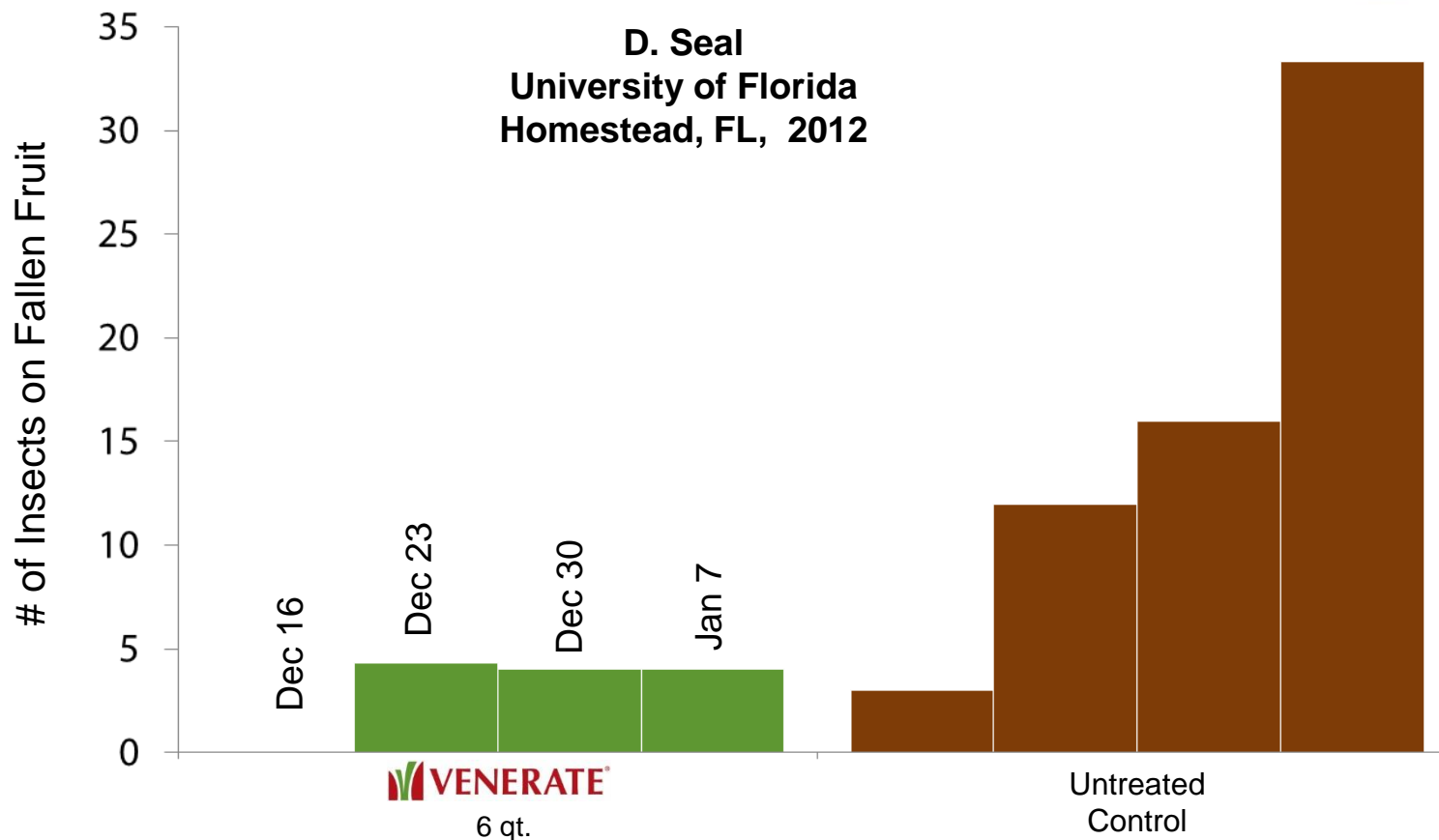


- Treatments applied 1= Oct 12 , 2= Oct 19.
- Treatments evaluated on Oct 18, Oct 27, Nov 1, Nov 8, Nov 15.
- All applications included surfactant Silwet L-77 at 0.05%.

VENERATE™ vs. Pepper Weevil



Pepper Weevil on Jalapeno Peppers (*Anthonomus eugenii*) # of Insects on Fallen Fruit

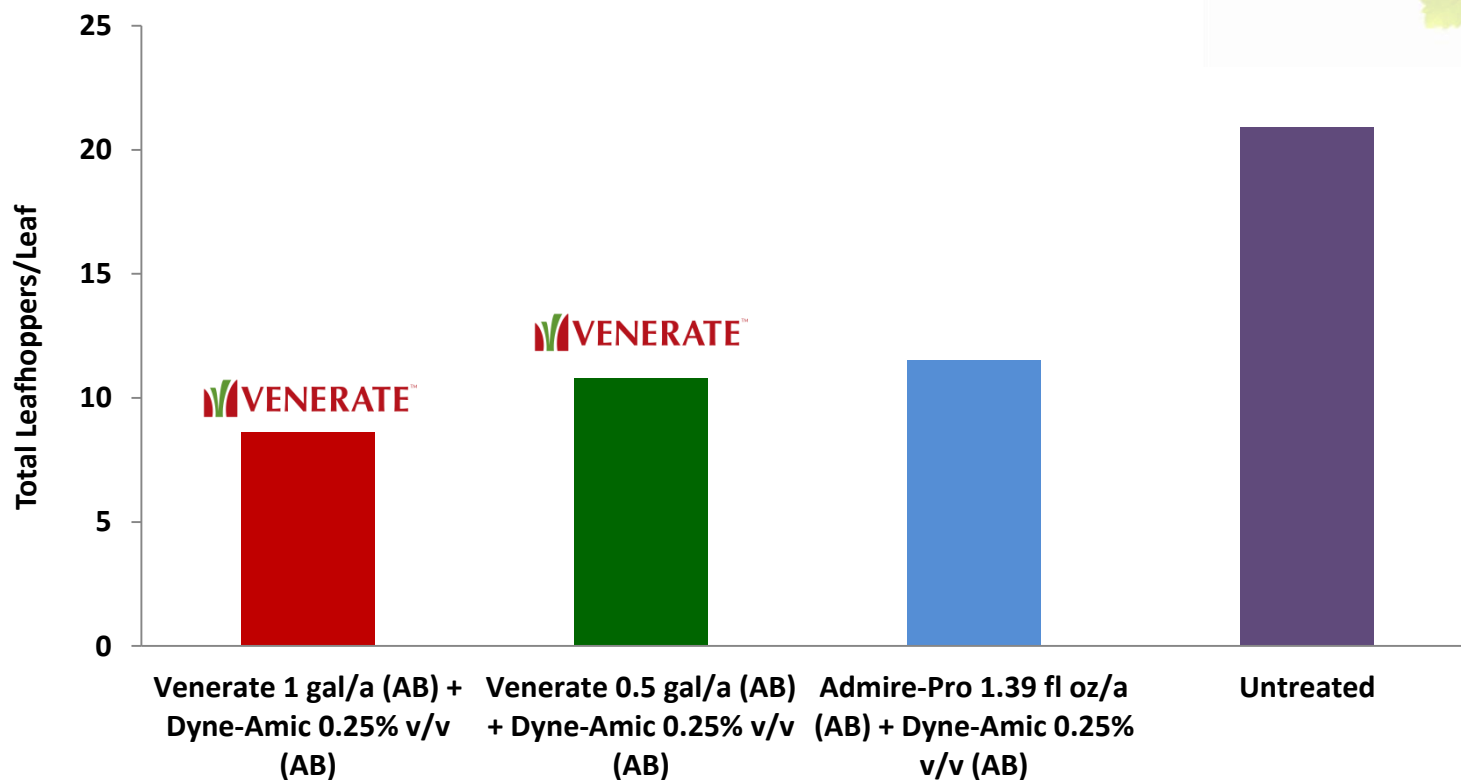


- Treatment applied Dec 14, Dec 21, Dec 28, Jan 5.
- Treatments evaluated on Dec, 16, Dec, 23, Dec 30, Jan 7.

VENERATE™ vs. Leafhopper



Leafhopper in Grapes
(*Erythroneura bigemina*)
Total Leafhoppers per Leaf
Agriculture Development Group
Eltopia, WA, 2013

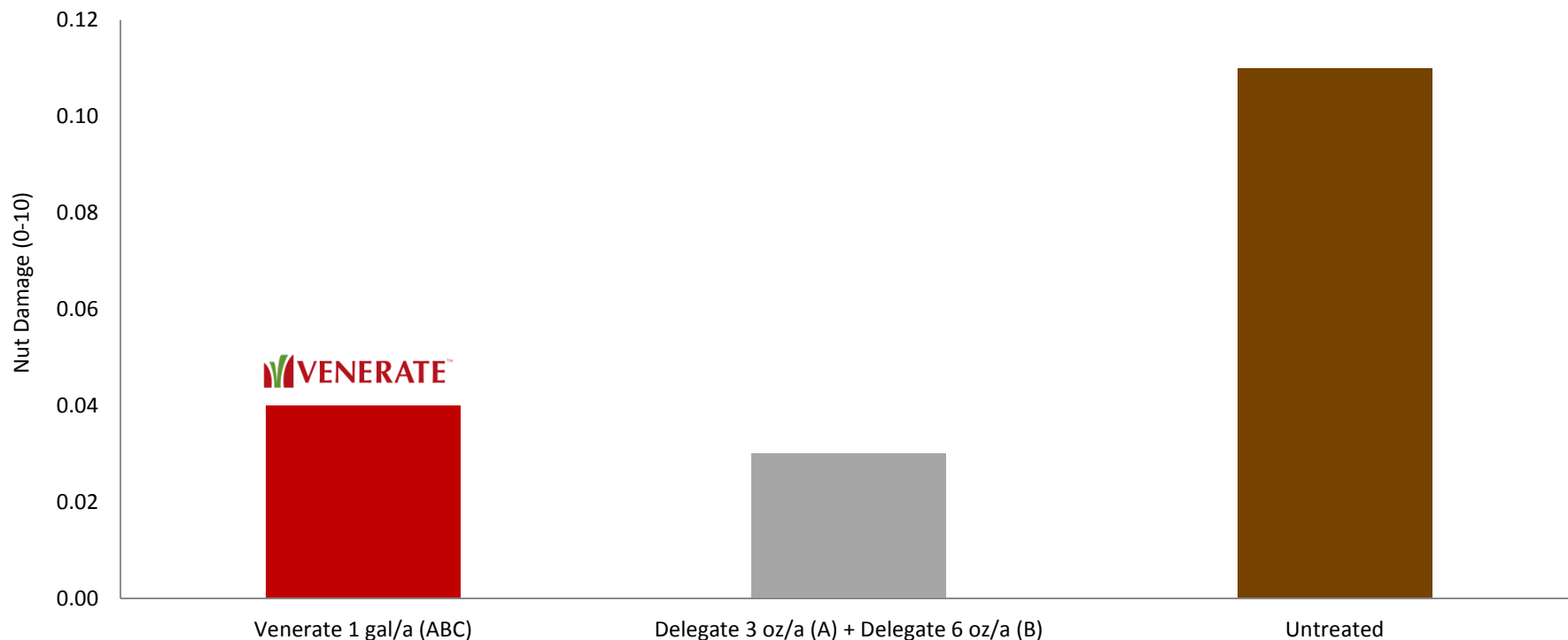


- Application Timing: Aug 27 (A), Sept 3 (B).

VENERATE™ vs. Navel Orangeworm



Navel Orangeworm in Nonpareil Almonds (*Amyelois transitella*) Nut Damage (0-10 scale) Pacific Ag Research Sanger, CA, 2013



- Application Timing: May 6 (A), July 12 (B), July 25 (C)
- All Applications included surfactant at 0.25% v/v
- Nut damage 0-10 scale, where 0 is undamaged and 10 is extraordinary insect damage

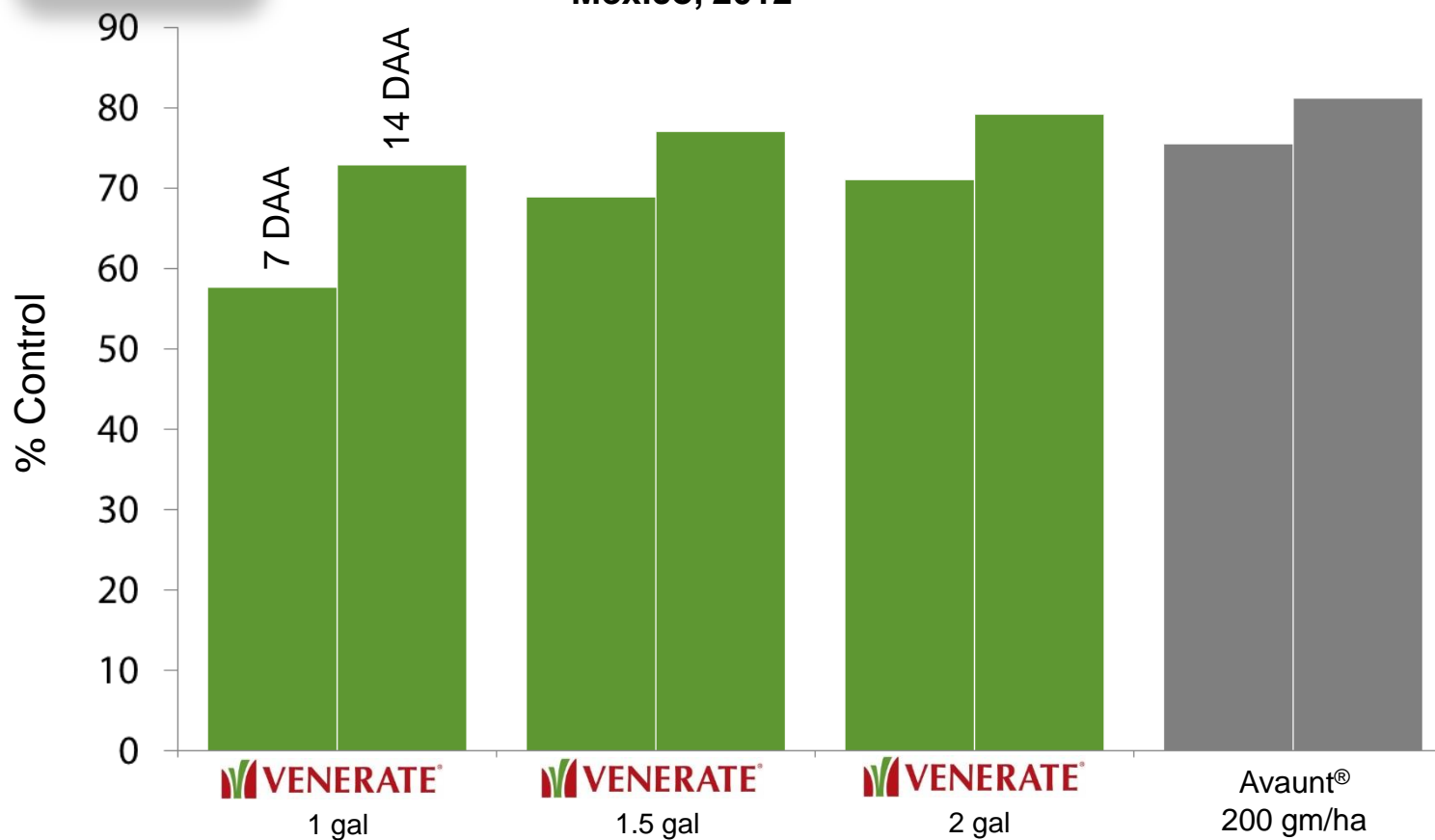
VENERATE™ vs. Armyworms



Beet and Fall Armyworm on Tomato
(*Spodoptera exigua* and *S. frugiperda*)
% Control



Mexico, 2012



Forward Looking Statement



This presentation may include forward-looking statements. These statements reflect the current views of the Company's senior management with respect to future events and financial performance. These statements include forward-looking statements with respect to the Company's business and industry in general, including statements regarding potential market size of Company products, anticipated product launches, target geographic markets, factors for the barriers to entry into the market, and strategies for growth. Statements that include the words "expect," "intend," "plan," "believe," "project," "forecast," "estimate," "may," "should," "anticipate" and similar statements of a future or forward-looking nature identify forward-looking statements for purposes of the federal securities laws or otherwise. Forward-looking statements address matters that involve risks and uncertainties such as the timing of and costs associated with the launch of products, the difficulty in predicting the timing or outcome of product research and development efforts and regulatory approvals. Accordingly, there are or will be important factors that could cause the Company's actual results to differ materially from those indicated in these statements. The statements made herein speak only as of the date of this presentation.



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NASDAQ: MBII

