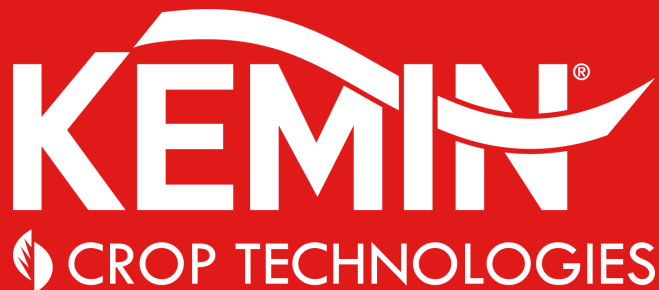


Product Updates

IR-4 Industry Technology Session
July 20, 2023

Emily Fuerst and Michael Hull



Tril-21

Thyme Oil-based
Fungicide & Bactericide



KEMIN[®]
CROP TECHNOLOGIES



Tri-21 Contact, Foliar-Applied Fungicide-Bactericide

Experimental Product Profile

Active Ingredient	Thyme oil
Mode of Action	FRAC BM01/F7: Cell membrane disruption
Crops	All crops, indoor and outdoor
Target Pests	Broad spectrum fungal and bacterial foliar plant pathogens
Application Rate	32-128 fl oz/100 gal (0.25%-1%)
Number of Applications	3-5 applications
Spray Interval	3-7 days, pressure dependent
FIFRA 25(b)	0-hour REI, 0-day PHI



Registration Progress

- OMRI certification approved!
- State registrations are in progress

APPROVED

- AL
- AZ
- CA
- FL
- GA
- HI
- ID
- IL
- LA
- MA
- MI
- MN
- MO
- NJ
- NM
- OH
- OR
- TX
- WA

PENDING

- AK
- AR
- CO
- CT
- DE
- IN
- IA
- KS
- KY
- ME
- MD
- MS
- MT
- NE
- NV
- NH
- NY
- NC
- ND
- OK
- PA
- RI
- SC
- SD
- TN
- UT
- VT
- VA
- WV
- WI
- WY



Tril-21 Current IR-4 Trials

Environmental Horticulture

- Complete
 - 22-009 Pythium aphanidermatum
 - 22-010 Phytophthora palmivora
 - 22-012 Myrothecium roridum
 - 22-022 Botryosphaeria
 - 22-023 Botrytis
 - 22-026 Pythium aphanidermatum
- Pending
 - 23-009 Pythium
 - 22-010/23-010 Phytophthora
 - 23-011 Fusarium
 - 23-012 Myrothecium roridum
 - 22-013/23-013 Rhizoctonia
 - 23-014 Phytotoxicity
 - 21-016/23-030 Root Knot Nematodes/Nematodes

Food – Integrated Solutions

- Complete
 - IS0344 Powdery Mildew and Downy Mildew on Organic Cucurbits
- Pending
 - IS00332-23 – Botrytis in Caneberries
 - **Potential Options:**
 - IS00100-23 – Brassica black rot (Xanthamonas)
 - IS00425-23 – Peach bacterial spot (Xanthamonas)



Tri-21 IR-4 Trial Results Update

Environmental Horticulture

- All rates were at 64 fl oz/100 gal water

Protocol	Researcher	Pathogen	Crop	Method	Application	Result
22-009	Hausbeck	Pythium aphanidermatum	Snapdragon	Drench	-3, 3 and 10 DAI or 7 and 14 DAI	Poor ; plant stunting, no phytotoxicity
22-010	Meadows	Phytophthora palmivora	Snapdragon	Sprench	-3, 3 and 10 DAI or 7 and 14 DAI	Poor ; plant stunting, no phytotoxicity
22-012	Norman	Myrothecium rodridum	American Evergreen	Foliar spray	-3, 3 and 10 DAI or 7 and 14 DAI	Poor ; disease onset, no phytotoxicity
22-022	Beckerman	Botryosphaeria	Dogwood	Sprench	3 DAI, 7 d interval	Inconclusive ; Low disease pressure, no treatment stats, Tri-21 similar to uninoculated control, no phytotoxicity
22-023	Hausbeck	Botrytis	Geranium	Foliar spray	-3, 3 and 10 DAI or 7 and 14 DAI	Poor ; disease onset (high humidity), no phytotoxicity
22-026	Baysal-Gurel	Pseudomonas syringae	Lilac	Foliar spray	-3, 3 and 10 DAI or 7 and 14 DAI	Excellent ; significant reduced severity, no phyto



Tri-21 IR-4 Trial Results Update

Food – Integrated Solutions

- All rates were at **128** fl oz/100 gal water

Protocol	Researcher	Pathogen	Crop	Method	Application	Result
22-IS0344	McGrath	Powdery mildew	Pumpkin	Foliar Spray	Every 7 days (6x)	Good ; significantly reduced severity and good fruit quality compared to negative control
21-IS0344	McGrath	Downy mildew	Cucumber	Foliar Spray	Every 7 days (6x)	Mediocre ; reduced incidence, better performance alone vs combo with Kocide 3000-O



Efficacy on Citrus Black Spot

GOAL: Evaluation of efficacy of Tril-21 compared to an industry standard fungicide program on citrus black spot in susceptible Valencia sweet orange

DESIGN:

- Randomized complete block design, 5 replicates, 3 trees/replicate plot (900 sq ft)
- Citrus black spot, caused by the fungus *Phyllosticta citricarpa*

APPLICATION RATES:

- Untreated Control
- Treatment – Tril-21 at 240 fl oz/125 gal (1.5% v/v) alternated with Kocide 3000 at 3.5 lb/a
- Grower Standard – Headline at 15 fl oz/a alternated with Kocide 3000 at 3.5 lb/a

APPLICATION METHOD:

- Applications were initiated prior to anticipated disease pressure.
- Treatments were applied with a handgun at 200 psi with water volumes of 125 gal/acre to ensure complete coverage.
- The treatments were applied were May 24-26, June 23-25, July 20-22, August 23-25, September 22-24, and October 18-20, 2022.

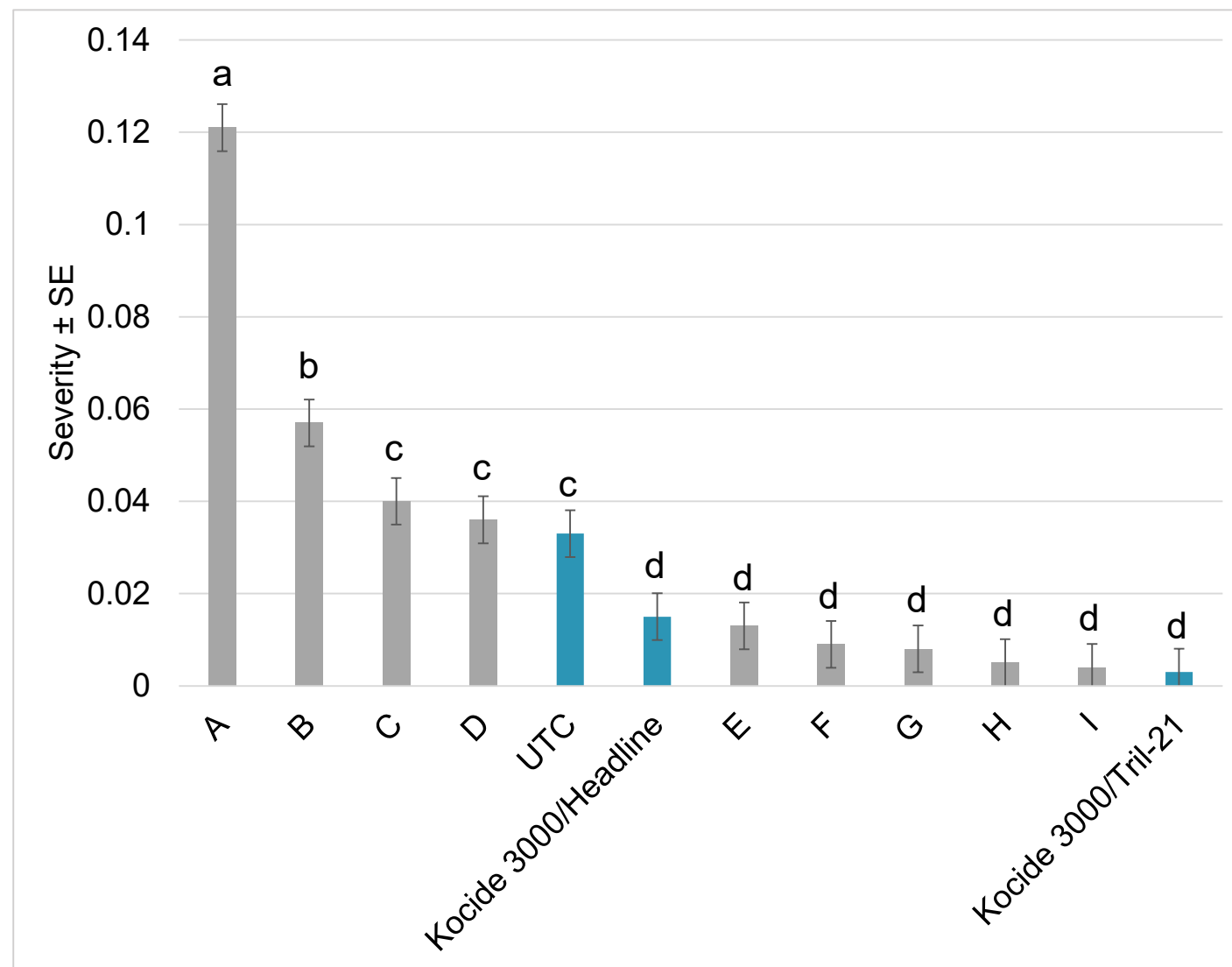
EVALUATIONS:

- Plants were assessed for incidence and severity by examining 50 fruits per tree.
- The natural log transformed scores were analyzed with an ANOVA. Because there was a disparity in the starting disease rate for untreated and treated groups, the data was analyzed using PROC GLIMMIX in SAS to reflect categorical data analysis rather than a transformed rating scale. This provided an odds ratio for comparison of the treatment relative to either the untreated control or the grower standard control for efficacy comparison.



Efficacy on Citrus Black Spot

- Tril-21 alternated in rotation with Kocide 3000 provided the most significant control of citrus black spot in citrus compared to all other treatments in a grower rotation.
- Tril-21 alternated in rotation with Kocide 3000 was:
 - **11.8 times less** likely to have citrus black spot disease compared to the untreated controls.
 - **4.78 times less** likely to have citrus black spot disease compared to the grower standard of Kocide 3000 alternated with Headline.



Tri-21 Contact Fungicide-Bactericide

IR-4 Request

Application Information:

- Apply before or when environmental conditions for pest development are high
- Foliar spray providing complete coverage of the leaf and plant surfaces, apply to run off
- Make 3-5 consecutive applications 3-7 days apart depending on pressure
- Rates:
 - 64 fl oz/100 gal (greenhouse/indoor high pressure)
 - 128 fl oz/100 gal (outdoor high pressure)
- Apply early in the morning or late afternoon when temperature is under 90 °F

Testing Needs:

- Field and greenhouse **efficacy trials** on all foliar/fruit surface plant pathogens





TetraCURB™ MAX

Botanical Contact
Miticide-Insecticide

KEMIN®
CROP TECHNOLOGIES



New FIFRA 25(b) Exempt Miticide-Insecticide



Active Ingredients

- Castor oil, 20%
- Rosemary oil, 10%
- Clove oil, 3%
- Peppermint oil, 2%

Target Pests

- Mites, spider mites
- Small, soft-bodied insects such as: aphids, whiteflies, thrips, mealybugs, lygus

Application

- Contact
- Foliar
- Standard spray equipment, high volume sprayers, booms, hydraulic-air assist

Application Sites

- All crops
- Indoors and outdoors



Multiple Modes of Action

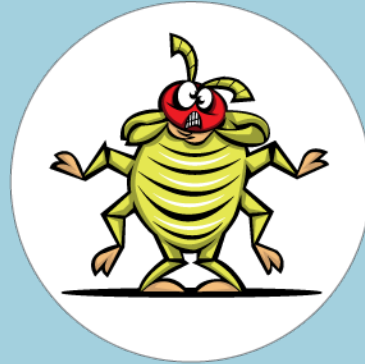
NEUROTOXIC EFFECT



PARALYSIS

The botanical oil active compounds affect the octopamine receptors specific to insects, disrupting its nervous system, causing paralysis followed by its death

CONTACT EFFECT



SUFFOCATION

The castor oil provides true pest suffocation by blocking air from entering the spiracle, leading to the pest death



DESICCATION

The formula degrades/disrupts the waxy cuticle allowing the active ingredients to quickly penetrate and induce water loss in mites, resulting in desiccation and death

REPELLENT EFFECT



REPELLENCY

The vapor exposure to the botanical oils interferes with the pest's sensing faculties, inducing hyperactivity and avoidance behavior thus keeping them away and limiting chances of their establishment on crops.



✓ Quick knockdown



✓ Slow the chance of pest resistance development



Registration Progress

- OMRI certification approved!
- State registrations are in progress



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- WY



TetraCURB™ MAX Current IR-4 Trials

Environmental Horticulture

- Complete
 - 22-005 Mealybug
 - 22-006 Scale
 - 22-025 Western Flower Thrips
- Pending
 - 23-007 Phytotoxicity
 - 23-025 Thrips
 - 23-030 Eriophyid mite

Food – Integrated Solutions

- Complete
 - Nothing in 2022
- Pending
 - 2023 trials needed!
 - **Potential Options:**
 - IS00376-23 – Grape leafhopper
 - IS00386-23 – Hemp aphid
 - IS00408-23 – Strawberry mites
 - IS00425-23 – Tomato thrips
 - IS00430-23 – Cabbage aphid
 - IS00431-23 – Lettuce thrips
 - IS00435-23 – Onion bulb mites
 - IS00437-23 – Citrus flat mite
 - IS00438-23 – Tomato WFT



TetraCURB™ MAX IR-4 Trial Results Update

Environmental Horticulture

Protocol	Researcher	Pest	Crop	Method	Application	Result
22-005	Chong	Mealybug, striped	Azalea	Foliar Spray	256 fl oz/100 gal; Every 7 days (3x)	Good ; 88% control and statistically similar or better than the industry standard; no phytotoxicity
22-005	Gilrein	Mealybug, Madeira	Coleus	Foliar Spray	256 fl oz/100 gal; Every 7 days (3x)	Good ; 81% control with significant reduction of eggs; no phytotoxicity
22-005	Nansen	Mealybug, citrus	Coleus	Foliar Spray	256 fl oz/100 gal; Every 7 days (3x)	Mediocre ; 73-90% control of eggs, 68-84% control of crawlers, 56-79% control of mobiles; no phytotoxicity
22-006	Dale	Scale, brown shield	Coontie palm	Foliar Spray	128 fl oz/100 gal; Every 3 days (5x)	Good ; 91% control by 14 DAT; no phytotoxicity
22-025	Gilrein	Western flower thrips	Marigold	Foliar Spray	128 fl oz/100 gal; Every 7 days (3x)	Poor ; 69% control of adults, up to 50% control of larva; no phytotoxicity
22-025	Nansen	Western flower thrips	Marigold	Foliar Spray	128 fl oz/100 gal; Every 7 days (3x)	Good ; Significant reduction with up to 95% control of adults and 64% control of immatures; not phytotoxicity

Efficacy on Hemp Russet Mites

GOAL: Evaluation of efficacy of TetraCURB MAX compared to control standards on hemp russet mites

DESIGN:

- Randomized complete block design, 9 replicates, greenhouse growing conditions (June-August 2021)
- Hemp russet mites (*Aculops cannibicola*), ~50 mites/leaf for heavy infestation

APPLICATION RATES:

- Untreated Control
- Treatment – TetraCURB MAX at 128 fl oz/100 gal applied 3 times at a 7-day interval
- Control Standards (not currently approved for hemp)
 - Abamectin at 8 fl oz/100 gal applied 2 times at a 10-day interval
 - Etoxazole at 6 fl oz/100 gal applied 1 time
 - Fenpyroximate at 48 fl oz/100 gal applied 1 time

APPLICATION METHOD:

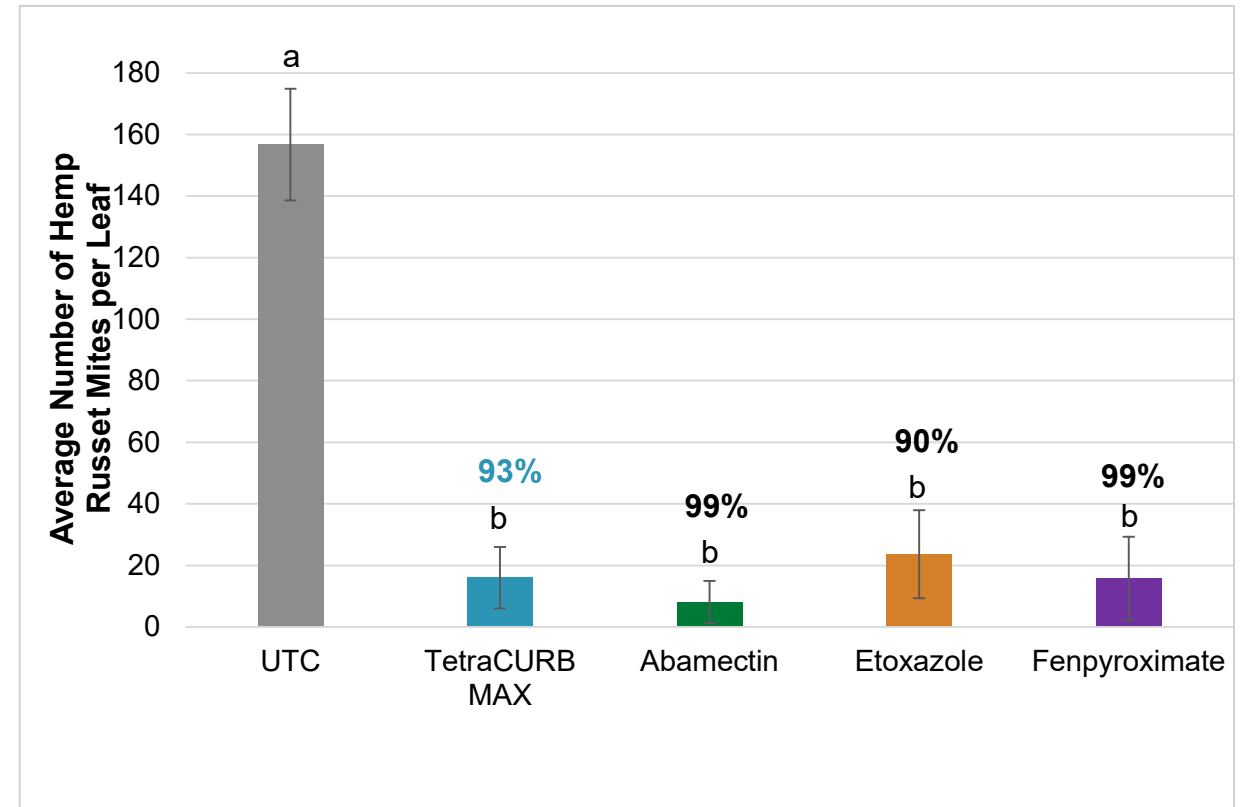
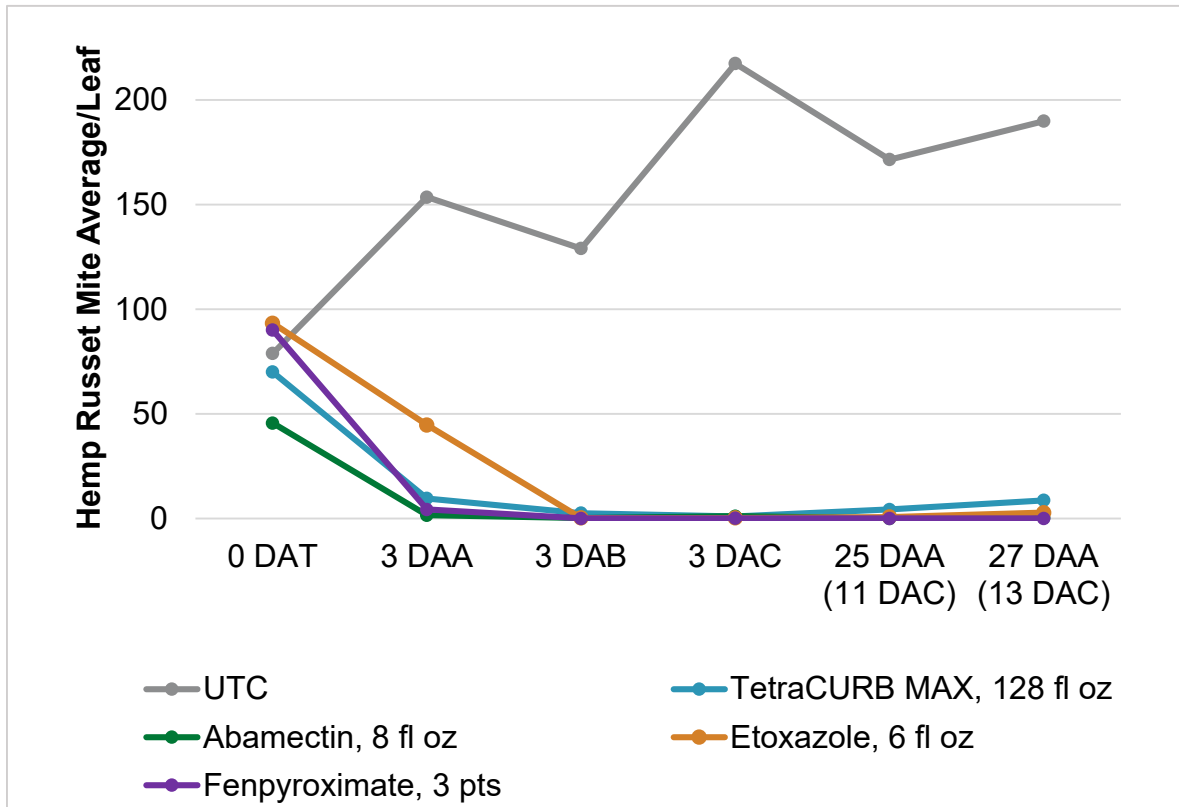
- Treatments were applied with a backpack sprayer at 32 psi with water volumes of 100 gal/acre to ensure complete coverage

EVALUATIONS:

- Hemp russet mites were sampled 5 times at 7-day intervals following initial treatment.



Efficacy on Hemp Russet Mites



- 99% control of hemp russet mite population following 3 applications of 1% TetraCURB MAX
- Equivalent efficacy to control standards
- No phytotoxicity was observed



TetraCURB MAX Contact Insecticide/Miticide

IR-4 Request

Application Information:

- Apply when pest population first appears and before economic threshold is reached
- Complete coverage of the leaf and plant surfaces, apply to run off
- Make 2-3 consecutive applications 5-7 days apart
- Rates:
 - 64 fl oz/100 gal (moderate infestation)
 - 128 fl oz/100 gal (high infestation)
- Apply early in the morning or late afternoon when temperature is under 90 °F

Testing Needs:

- Field and greenhouse **efficacy trials** on all small, soft-bodied insects and mites



Thank you!



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