



Tools for Strategic Resistance Management Maintaining Susceptibility

Donnie Powers 2023

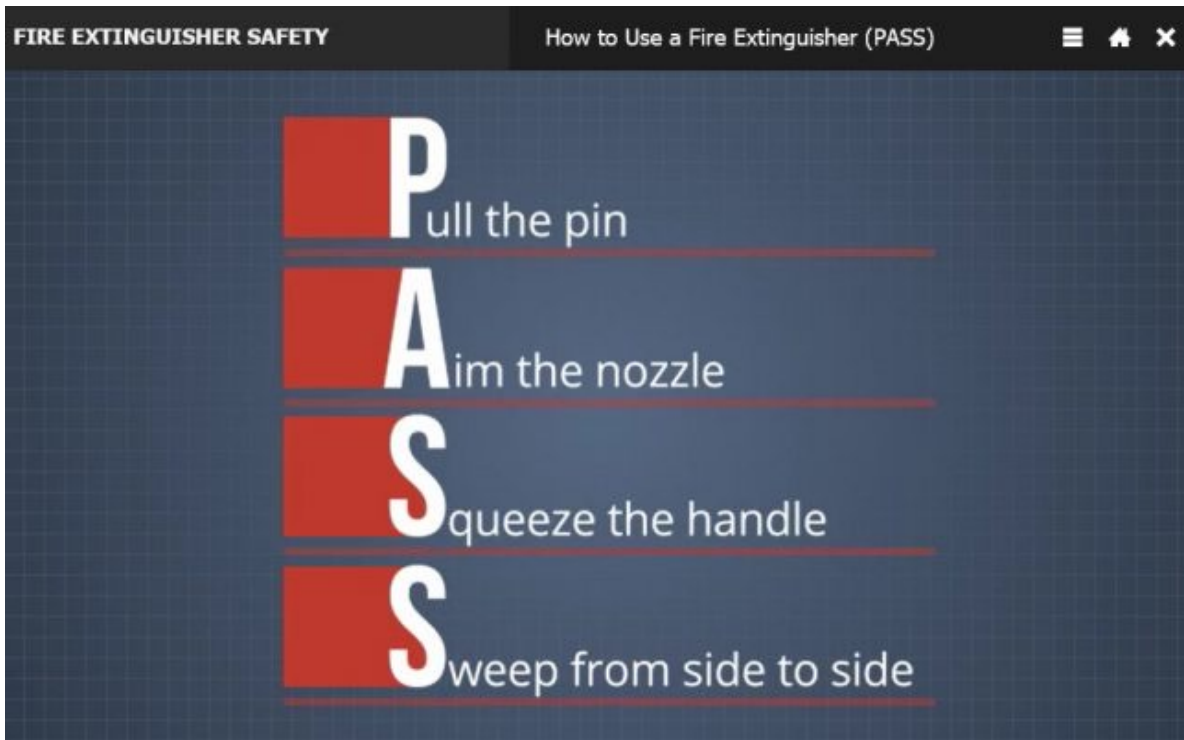


Household Fire Extinguishers - ABC

- **A:** Wood, paper, cloth and other basic material fires
- **B:** Oils (including paints with oil) and gasoline fires
- **C:** Electrical fires caused by small appliances, circuit breakers, wiring and other small electrical items.

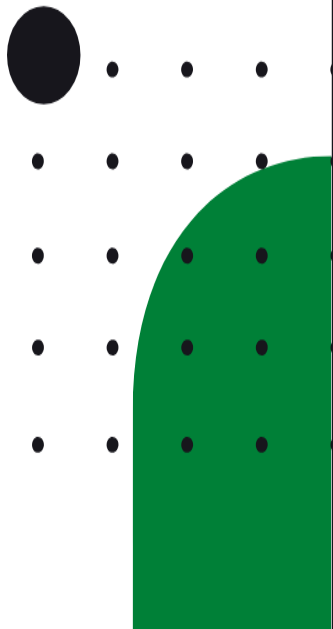


Applying the Proper technique



Where does
resistance
come from?

- Environmental exposure >
- Prolonged exposure to the same MOA
 - Genetic selection
- Local populations
- Sub-lethal doses
- Ineffective applications



Maintaining Susceptibility (Pesticide Stewardship)

- Strategic “**Class to Class**” Rotation
- CDC Resistance testing protocol
- Protect all chemistry.
 - Resistance
 - Regulatory
- Where will we be in 5, 10, 20 years?
- Next Generation





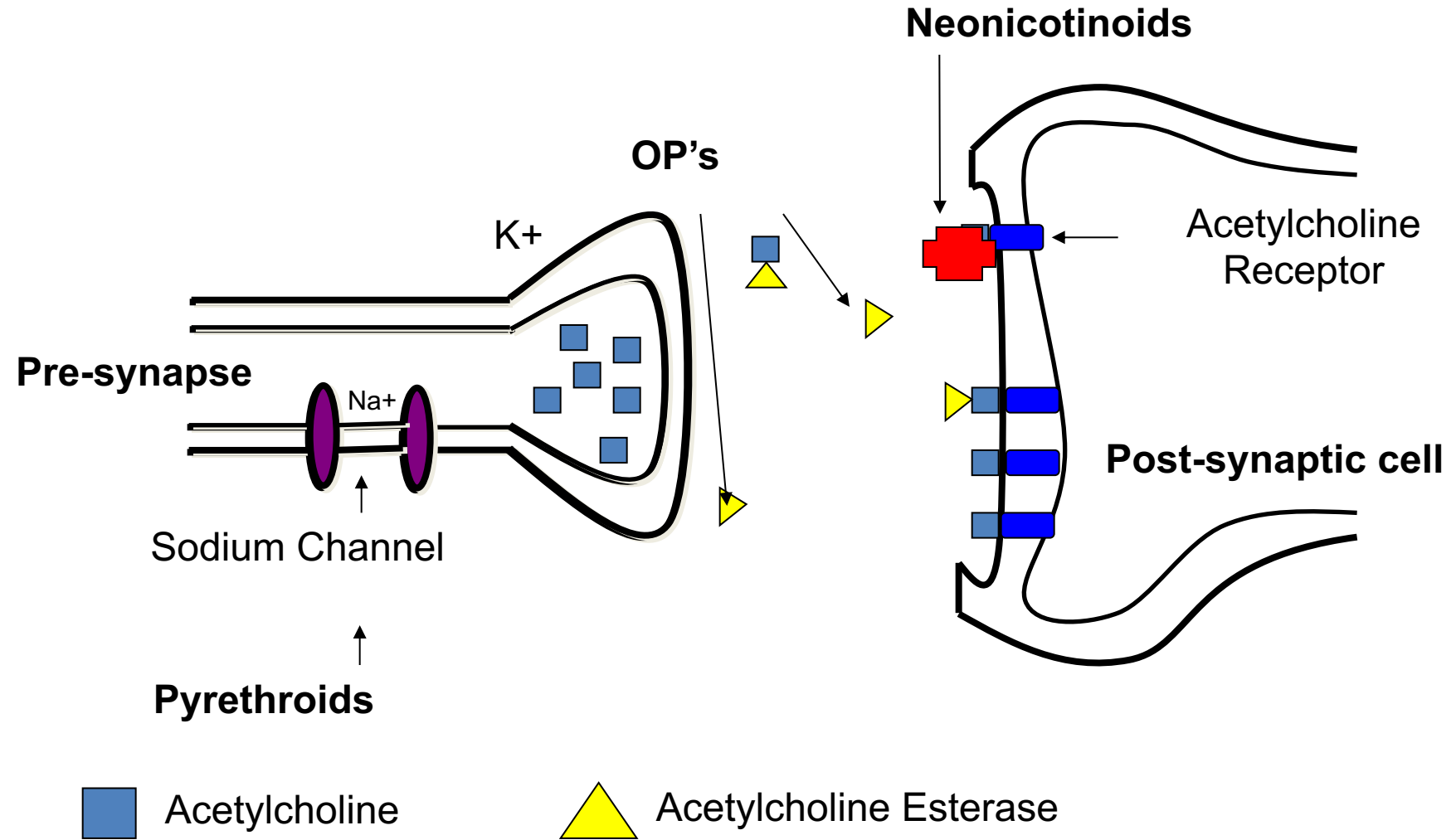
–Mode Of Action–

a functional or anatomical change, resulting from the exposure of a living organism to a substance.

- Mode of action to be only at the cellular level.
- Mechanism of action describes such changes at the molecular level.

- **Cholinesterase inhibitor**
- ***Sodium Channel Blocker***

Insecticide Modes-of-Action



-Classes-

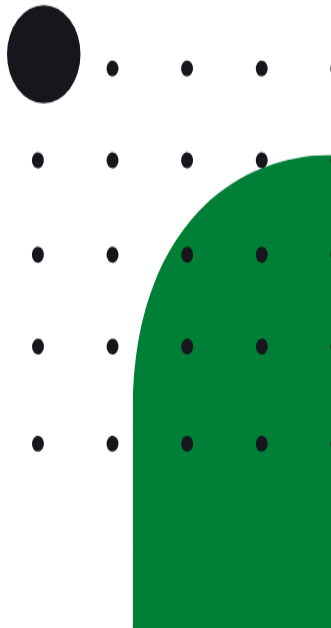
- **Pyrethroids**
 - Permethrin
 - Deltamethrin
 - Sumethrin
- ***Organophosphates***
 - *Malathion (Ground ULV/Aerial)*
 - *Chlorpyrifos (Ground ULV/Aerial)*
 - *Naled (Aerial)*



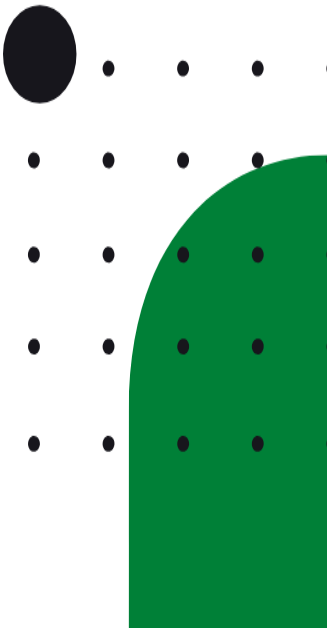
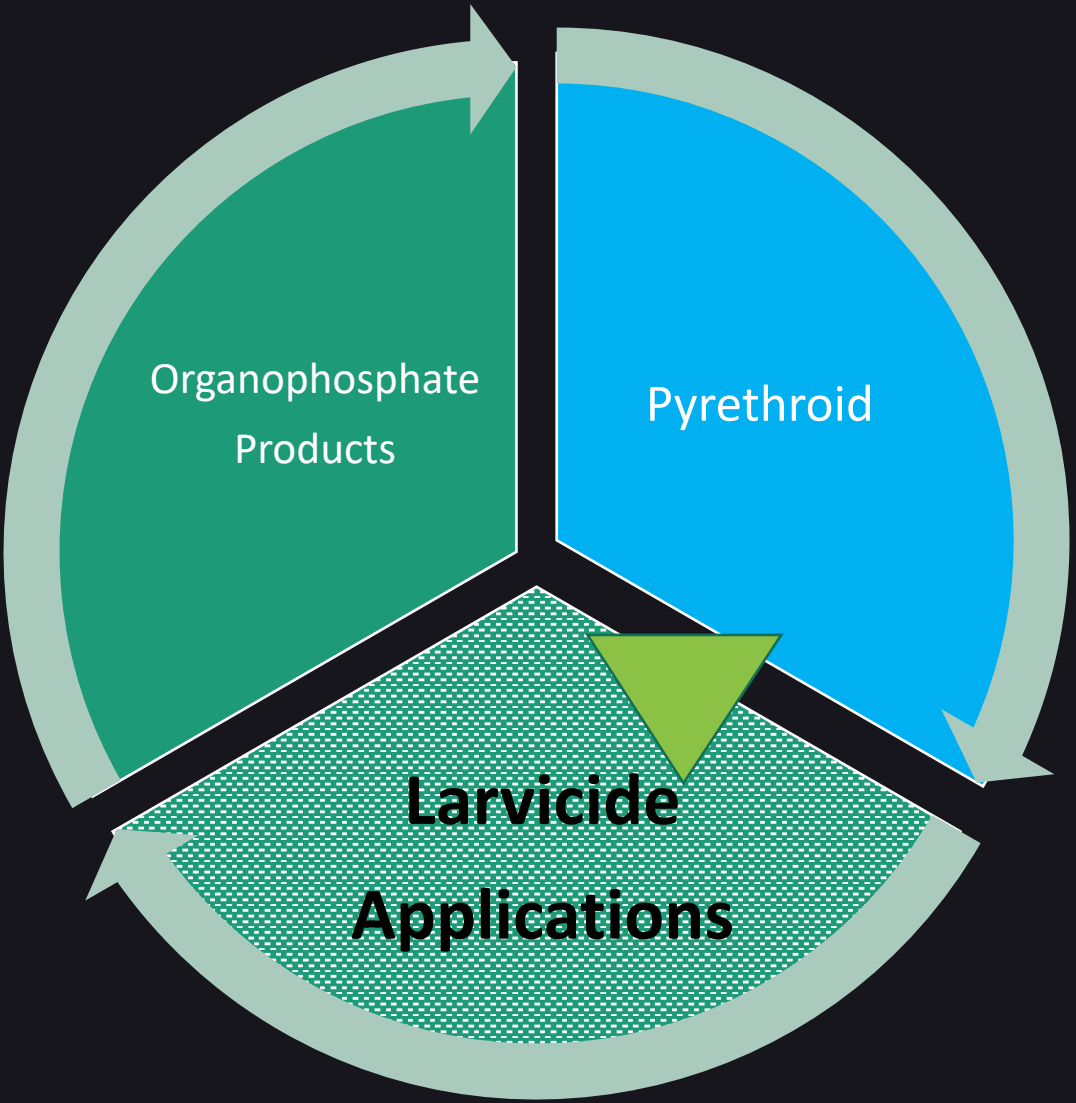


Active
Resistance
Management

- Comprehensive program
 - Strategy
 - Actions
- Measurement and monitoring
- Application rates
- Calibration



Elements of a comprehensive program



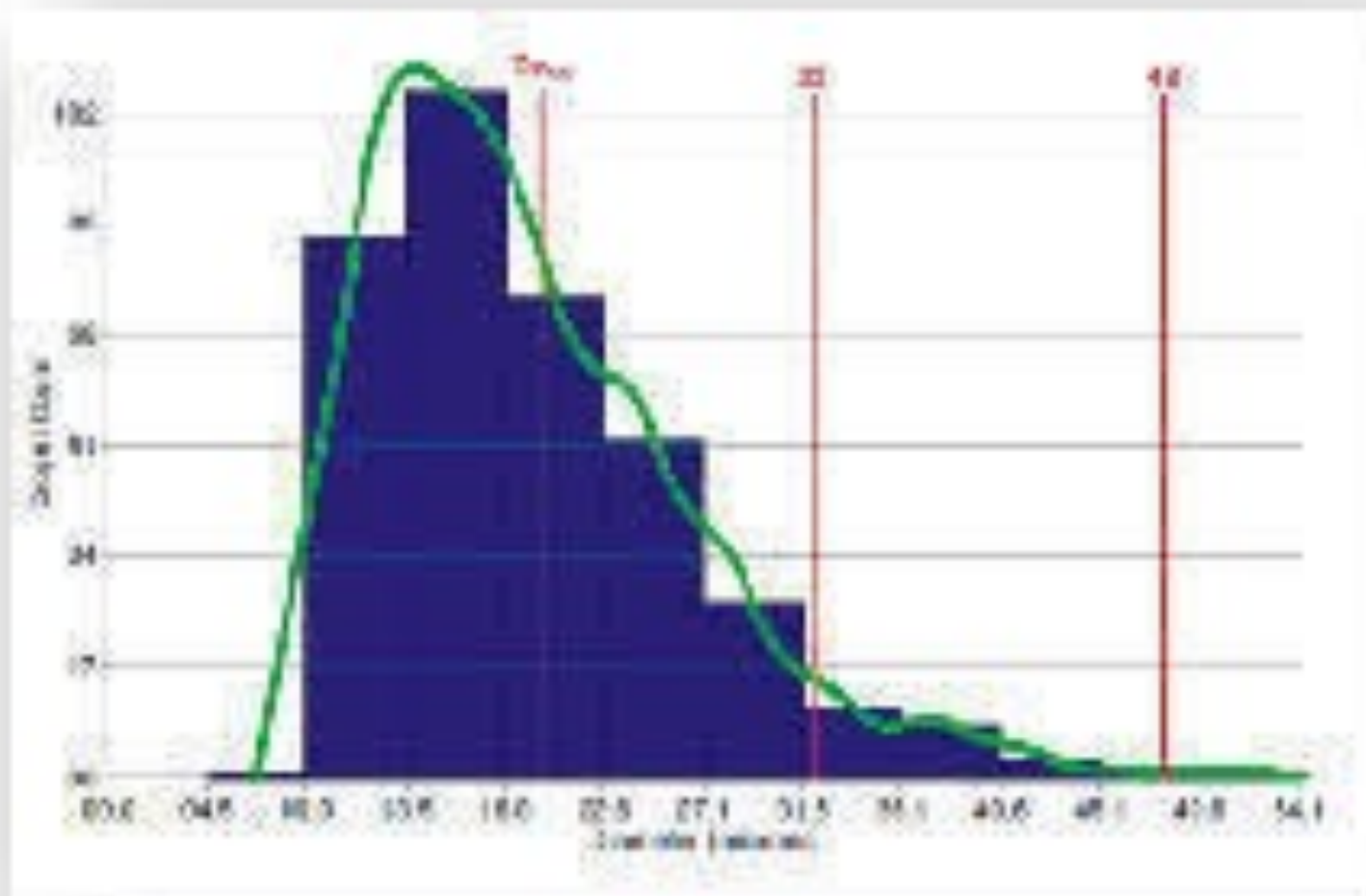


Rotational Strategy

50/50 RULE

- 50% → Primary Chemistry
- 50% → Rotational Chemistry
 - **STOP** using Primary Chemistry during rotational period
- Testing and Monitoring
 - Mode of Action
 - Bottle assays and field testing

DROPLET OPTIMIZATION



Optimization

Calibration

- Rates – up to .70 oz./acre
- Droplets **DV50**
 - ULV 15-20 microns
 - EW 15-25 microns
- Droplets
 - **DV10** 8-10 microns
 - **DV90** <35 microns

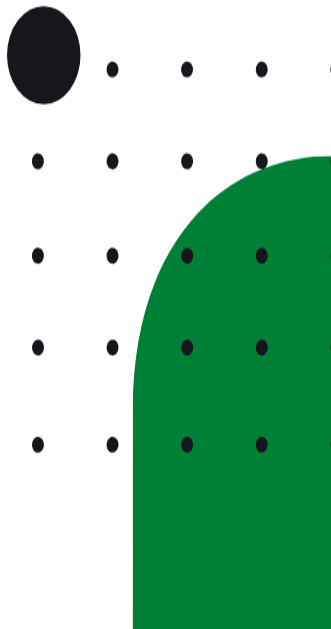


FMC

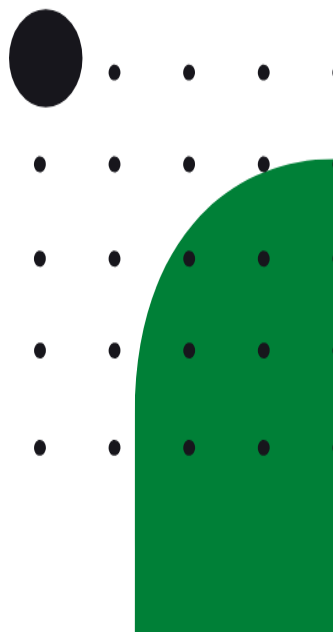


Challenges
and concerns

- Opposition to OP(s)
- Odor
- Calibration (re-calibration)
- Dealing with public perception



How dare you
spray that in
my
neighborhood.

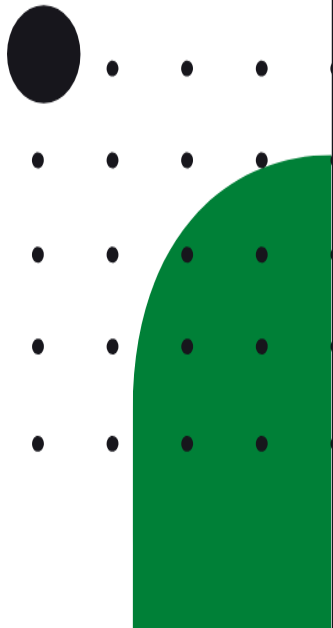




Sun Tzu The Art of War

The supreme art of
war is to subdue the
enemy without
fighting.....

Sun Tzu



Concerns and complaints are opportunities to communicate. >

- Safety
- Effectiveness
- Minimize pesticide use
- Relative toxicity to common products

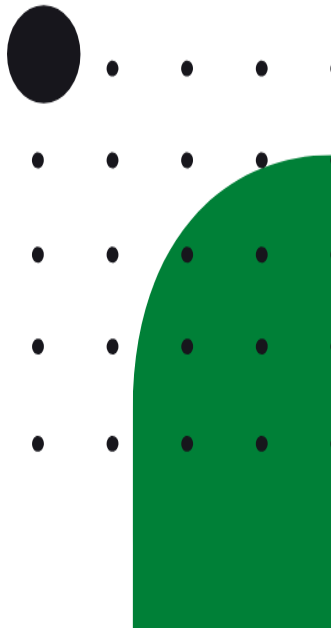
Stewardship- SAFETY

Product	LD50 (Rat, oral)
Table Salt	3000
Nicotine	50
Aspirin	815
Iron (III) 1000 PPM	3250
Malathion	????



Information to address concerns

- World Health Organization WHOPES protocol
- Medical use
- Fyfanon ULV is the first and only adulticide with clear directions for use in areas where Endangered species are present



FMC

Come back to *Fyfanon*

Donnie Powers

205-299-2954

Donald.Powers@fmc.com

Chemical Profile – Environmental Fate

- Degradation in Soil**

Study Citation	Soil Type	Soil Half-life (hours)	Malaoxon detected?
Knoch, 2001a (MRID 46769501)	Sand	4.4	No
	Silt-clay	4.0	No
	Silty-loam	6.1	No
	Silty-loam	6.0	No
Blumhorst, 1990 (MRID 41721701)	Blackoar-loam	< 6.0 *	1% declining to 0.1% at day 3**
Nixon, 1995 (MRID 43868601)	Sand	14.3	Not evaluated
	Sandy Loam	2.1	
	Loam	0.5	
	Silty-clay	0.9	
Rice, et al, 1990a (MRID 41748901)	Loamy-sand	Dissipation < 24*	No
Rice et al, 1990b (MRID 42058401 and 42058402)	Sandy-loam	Dissipation < 24*	No


* Earliest time point measured in the study. The actual half-life is somewhere less than this value.

** Malaoxon detected in this study was likely an impurity in the radio-labeled test material used in this study..

Chemical Profile – Toxicology

Malathion – Acute Toxicity Profile (Source: 2009 RED)

Study Type - Species	MRID	Results	EPA Toxicity Category
Acute Oral – Rat	00159876	LD50 = M: 5400 mg/kg F: 5700 mg/kg	IV
Acute Dermal – Rat	00159877	LD50 = > 2000 mg/kg*	III
Acute Inhalation – Rat	00159878	LC50 = 5.2 mg/L	IV
Eye Irritation – Rabbit	00159880	Slight conjunctival irritation, cleared by 7 days	III
Skin Irritation – Rabbit	00159879	Slight dermal irritation	IV
Dermal Sensitization – Guinea pig	00159881	Not a skin sensitizer	N/A



Maintaining Susceptibility (Pesticide Stewardship)

- Strategic “**Class to Class**” Rotation
- CDC Resistance testing protocol
- Protect all chemistry.
 - Resistance
 - Regulatory
- Where will we be in 5, 10, 20 years?
- Next Generation



Fyfanon ULV

Mosquito Adulticide

- >60 year history of use in US
- Economical cost per acre
- Effective at lower rates
- Safety Factors
- LER Aerial rate 1.0oz. /Acre

The Right Tools for the Job

- **Application equipment**
- **Proper chemical control**
- **Calibration and testing of equipment**
- **strategic rotation of product**



CDC Testing Protocol



Summary of Aerial Trials Supporting Fyfanon 1 fl oz/A (0.08 lb ai/A) Use Rate (2014- 2016)

Trial	Location	Species Tested	Aircraft	Nozzle Type
1. Florida	Manatee County	<i>Aedes aegypti</i>	Hughes 500-D helicopter	PJ20 Bete
2. California	Placer County	<i>Culex pipiens quinquefasciatus</i> <i>Culex tarsalis</i>	Cessna 188 AgTruck	Micronair AU-5000 rotary
3. Louisiana	Allen Parish	<i>Aedes aegypti</i> <i>Anopheles quadrimaculatus</i>	Piper 23-A Aztec	Micronair AU-4000 rotary
4. Florida	Manatee County	<i>Aedes taeniorhynchus</i> <i>Culex quinquefasciatus</i> <i>Anopheles quadrimaculatus</i>	Hughes 500-D helicopter	PJ20 Bete
5. Florida (0.75 fl oz / A)	Manatee County	<i>Aedes taeniorhynchus</i> <i>Culex quinquefasciatus</i> <i>Anopheles quadrimaculatus</i>	Hughes 500-D helicopter	PJ20 Bete
6. Delaware	Chorman's Airport	<i>Aedes aegypti</i> <i>Culex quinquefasciatus</i> <i>Anopheles quadrimaculatus</i>	Twin Beech Model AT-11	Micronair AU-4000 rotary

Stewardship and Sustainability

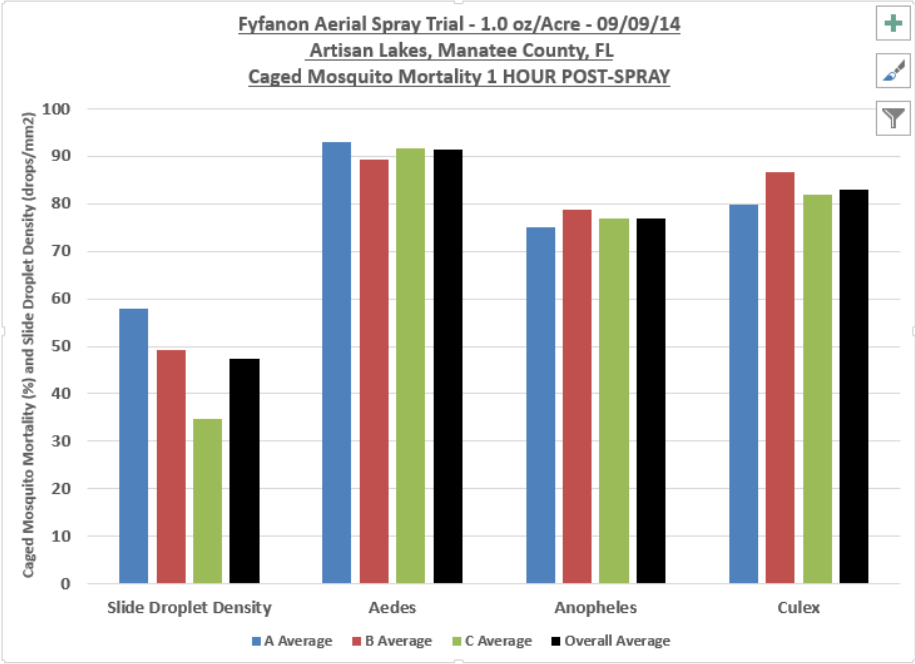


**Perform field trials in
conjunction with bottle bio-
assays**

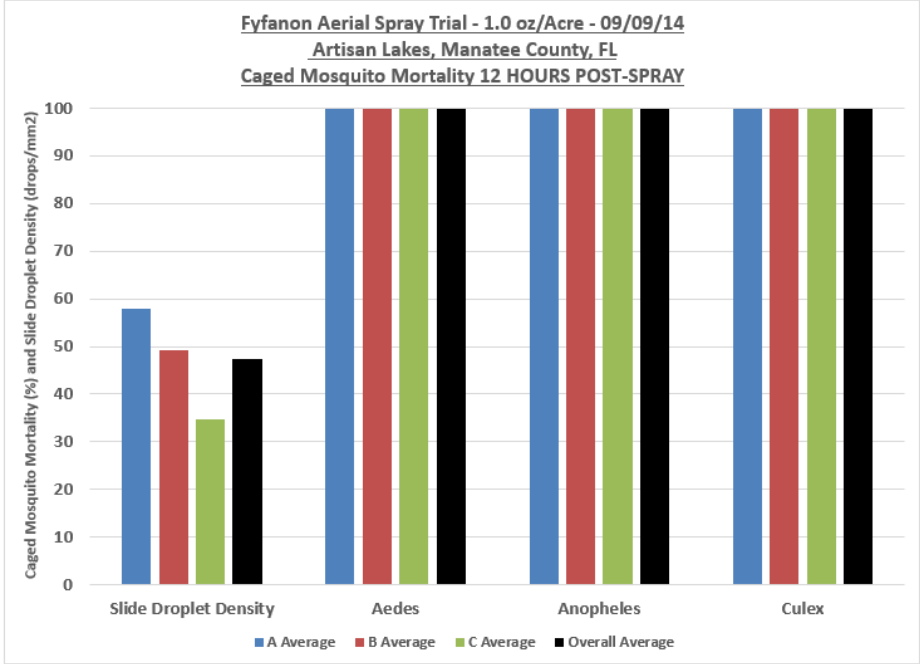


Efficacy - The tools tell the story

Fyfanon Aerial Spray Trial - 1.0 oz/Acre - 09/09/14
Artisan Lakes, Manatee County, FL
Caged Mosquito Mortality 1 HOUR POST-SPRAY



Fyfanon Aerial Spray Trial - 1.0 oz/Acre - 09/09/14
Artisan Lakes, Manatee County, FL
Caged Mosquito Mortality 12 HOURS POST-SPRAY



Chemical Profile – Toxicology

Least Toxic



Most Toxic

Category	IV	III	II	I
Acute Oral	Malathion	Permethrin	Naled, Chlorpyrifos	
Acute Dermal		Malathion, Permethrin	Naled, Chlorpyrifos	
Acute Inhalation	Malathion, Permethrin		Naled, Chlorpyrifos	
Eye Irritation		Malathion, Permethrin	Chlorpyrifos	Naled
Dermal Irritation	Malathion, Permethrin, Chlorpyrifos			Naled

Chemical Profile – Environmental Fate

- Degradation in Soil**

Study Citation	Soil Type	Soil Half-life (hours)	Malaoxon detected?
Knoch, 2001a (MRID 46769501)	Sand	4.4	No
	Silt-clay	4.0	No
	Silty-loam	6.1	No
	Silty-loam	6.0	No
Blumhorst, 1990 (MRID 41721701)	Blackoar-loam	< 6.0 *	1% declining to 0.1% at day 3**
Nixon, 1995 (MRID 43868601)	Sand	14.3	Not evaluated
	Sandy Loam	2.1	
	Loam	0.5	
	Silty-clay	0.9	
Rice, et al, 1990a (MRID 41748901)	Loamy-sand	Dissipation < 24*	No
Rice et al, 1990b (MRID 42058401 and 42058402)	Sandy-loam	Dissipation < 24*	No

* Earliest time point measured in the study. The actual half-life is somewhere less than this value.

** Malaoxon detected in this study was likely an impurity in the radio-labeled test material used in this study..

Stewardship

