

# Integrating Heat with Other Pest Management Tactics

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**[www.agr.gc.ca/science/winnipeg/cgs\\_e.htm](http://www.agr.gc.ca/science/winnipeg/cgs_e.htm)**

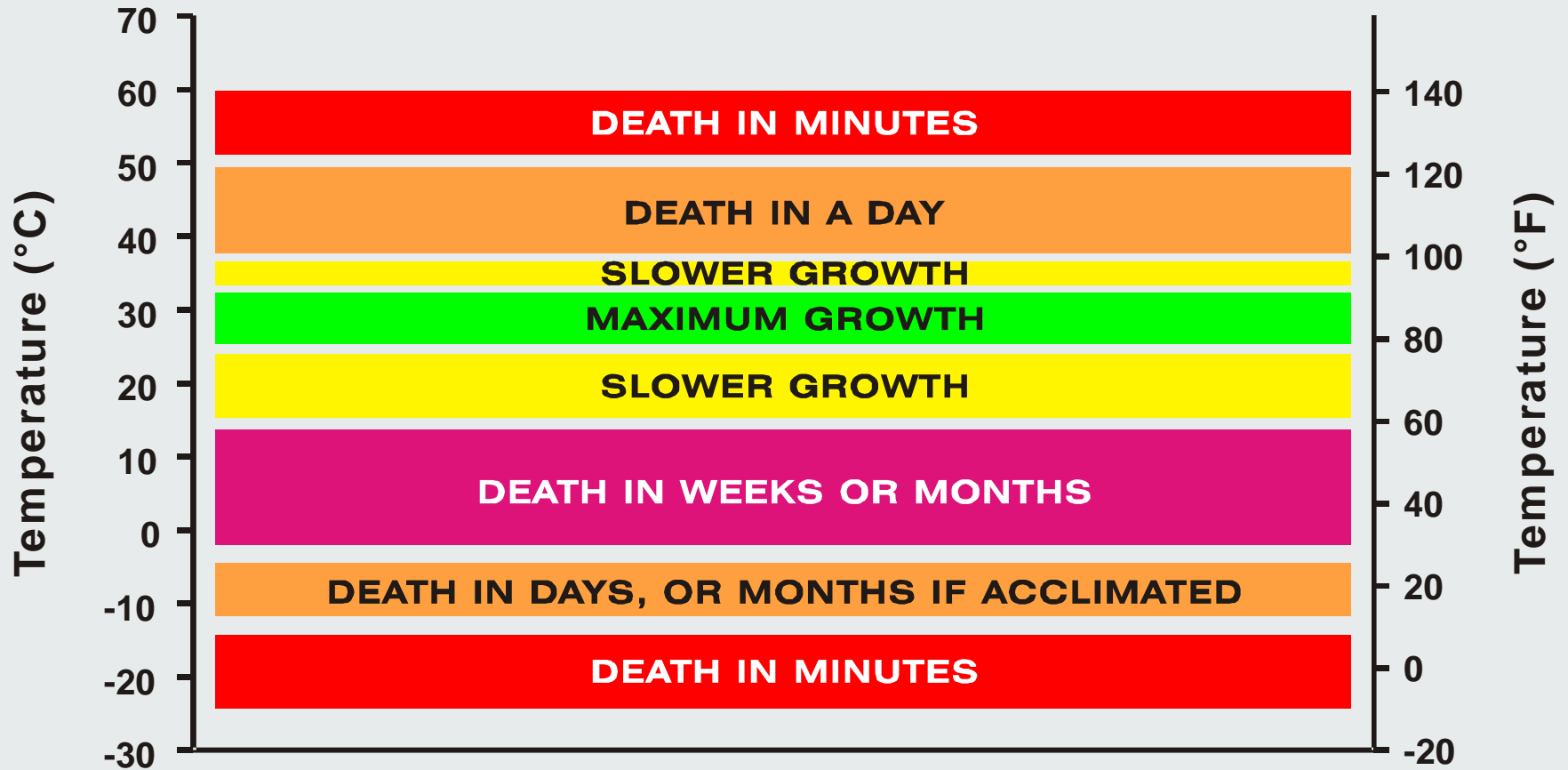


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# Temperature Effects on Insects



# Heat with Other Control Methods

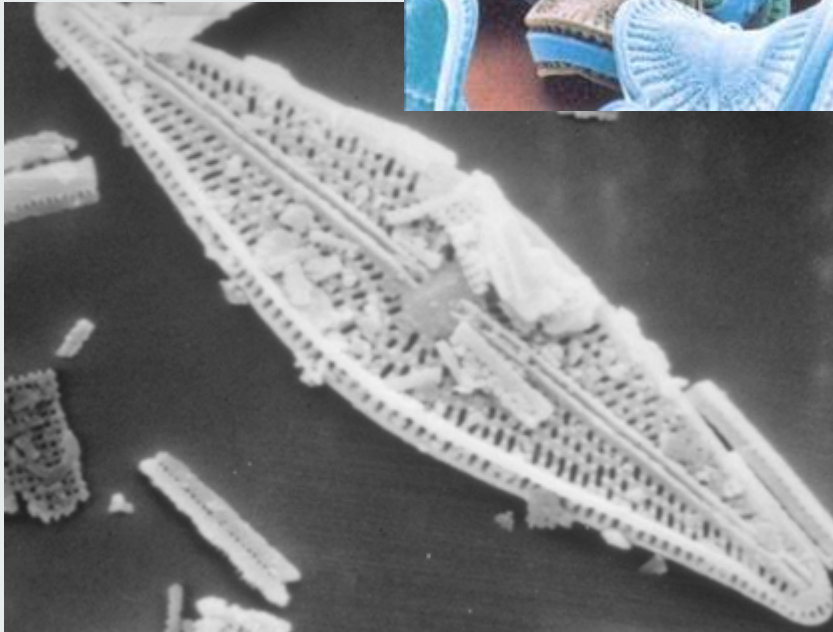
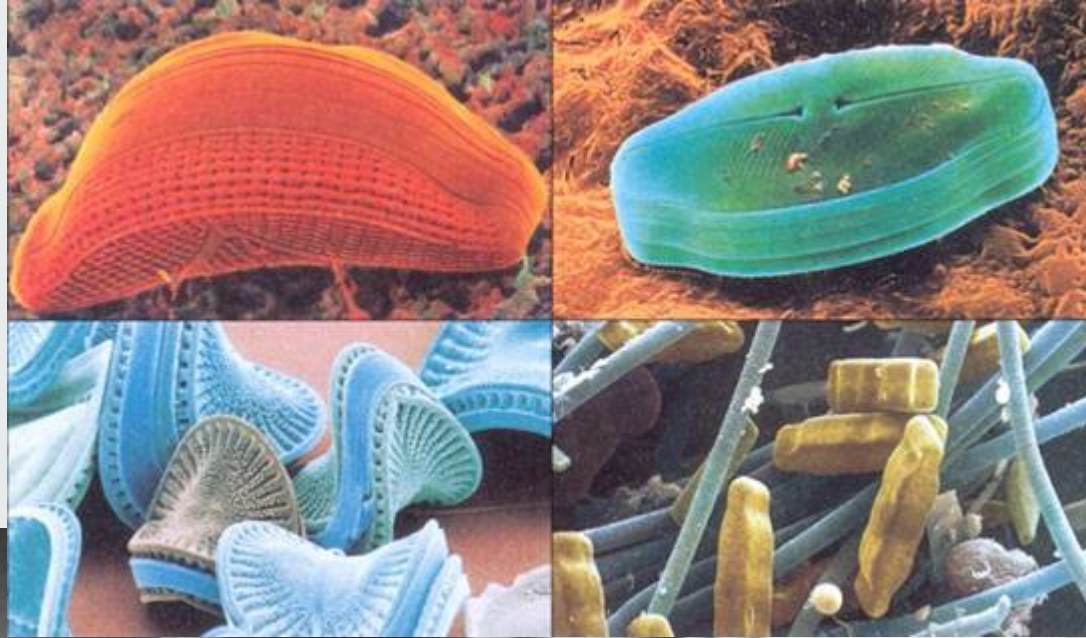
- Heat and DE
- Heat, phosphine and CO<sub>2</sub>
- Effect on contact insecticides

# Diatomaceous Earth (DE)

- Geological deposit of diatoms
- Fine dust, dusty to work with
- Efficacy varies with geological source
- Silicene dioxide
- Feed additive



# Diatomaceous Earth



# SEM of Insect Cuticles After Exposure to DE

LD<sub>50</sub>

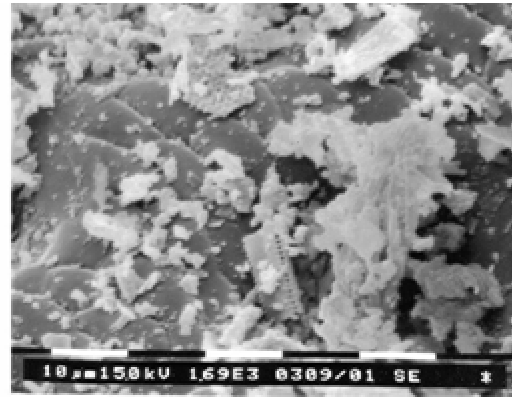
52 ppm



*C. ferrugineus*, 1 day, 507x

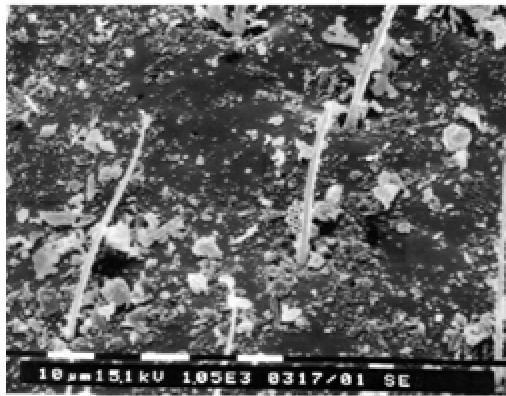
LD<sub>50</sub>

195 ppm



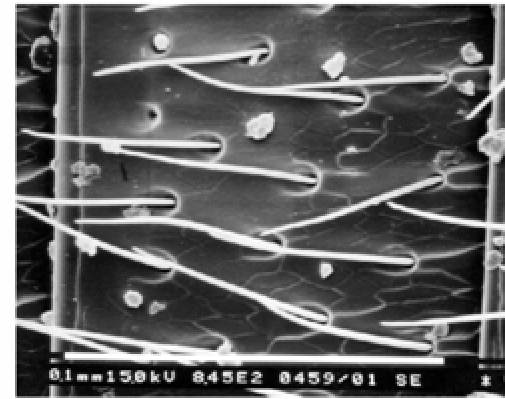
*S. oryzae*, 6 days, 1015x

338 ppm



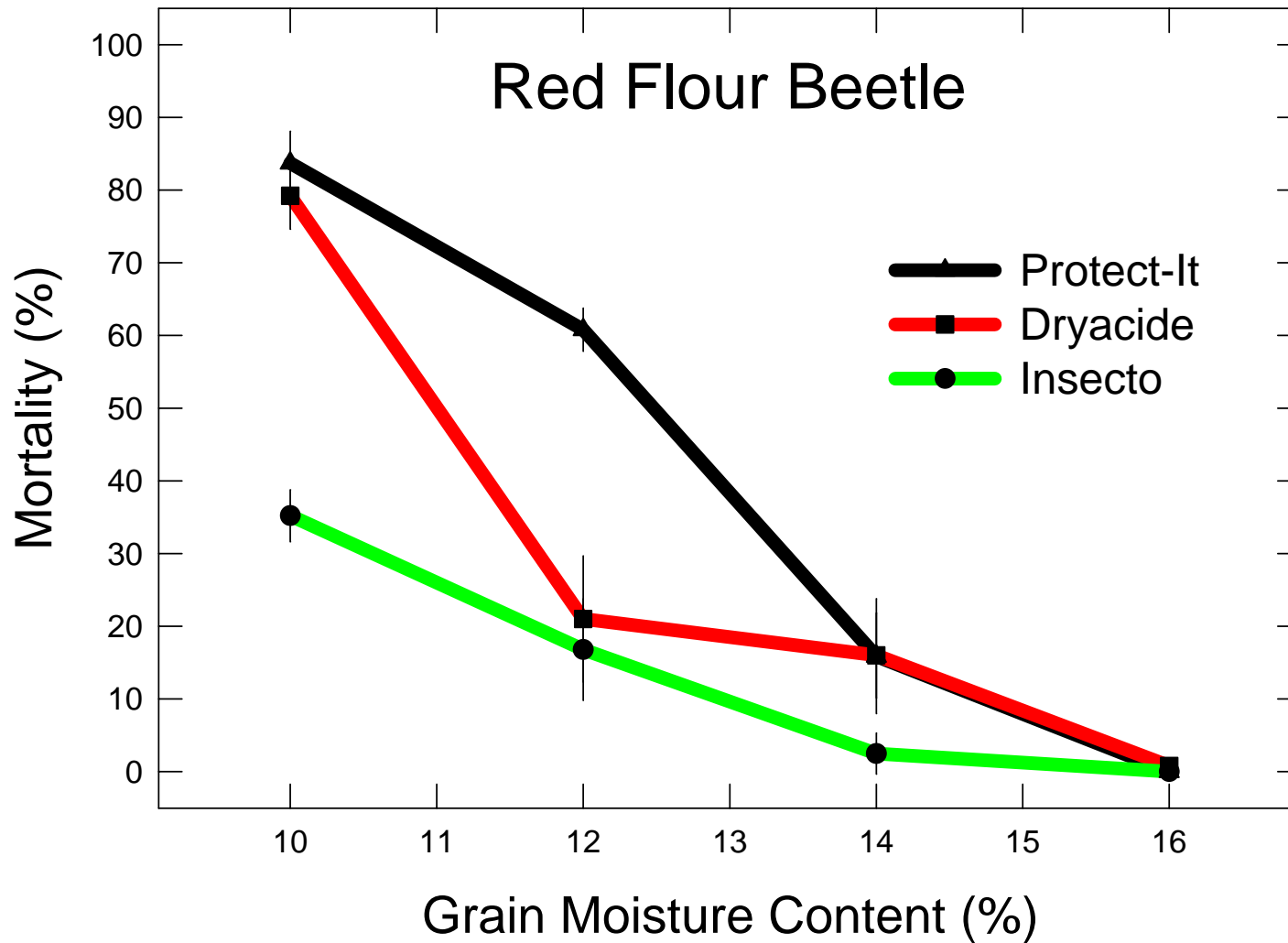
*R. dominica*, 6 days, 630x

298 ppm

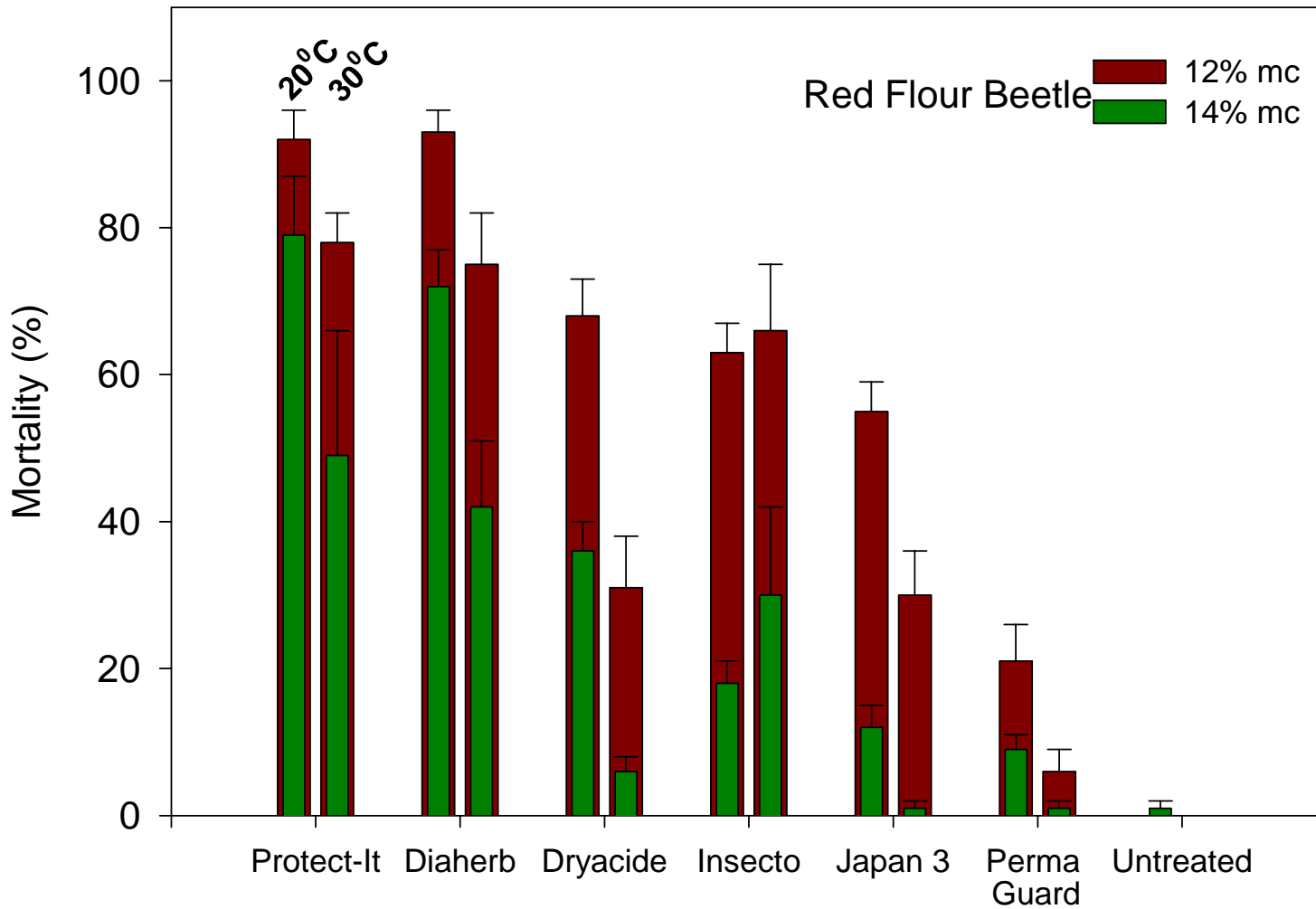


*T. castaneum*, 6 days, 507x

# Effect of Moisture on DE Efficacy



# Efficacy of Different DEs





**Can heat be made more effective  
with DE?**



# Application of DE



# Bioassay on Mill Floor

Placement before dusting



Rings ready for insects



Confused flour beetle



# Temperature (°C) at 50% Death of Confused Flour Beetle

Mill	Temperature (°C)	
	Heat Alone	Heat and DE
Quaker	46	38-40
KSU	48 +	39-43

# Survival (%) Of Confused Flour Beetle At End Of Heat Treatment

Mill	Survival (%)	
	Heat Alone	Heat and DE
Quaker	15	0
KSU	55	0

# Heat and DE

- Lowers temperature needed to control confused flour beetle by 5°C / 10°F
- Could be useful in difficult to heat areas
- Needs to be tested on larger scale

# Heat with Other Control Methods

- Heat and DE
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# Phosphine Fumigation and Temperature

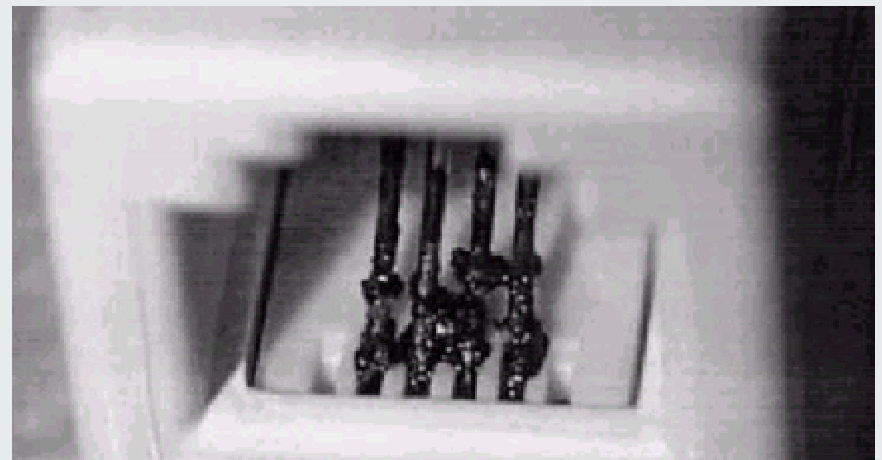
Temperature	Minimum exposure times (days) <sup>a</sup>	
	Tablets	Pellets
under 5°C / 41°F	No fumigation	No fumigation
5-10°C / 41-50°F	10	8
11-15°C / 52-59°F	5	4
16-25°C / 61-77°F	4	3
over 25°C / 77°F	3	3

<sup>a</sup>. 60% R.H., 12-13% mc for wheat



# Corrosion

- Major problem when fumigating mills with  $\text{PH}_3$
- Doses needed to quickly control insects also cause corrosion
- Remove or isolate sensitive equipment



# Heat, Phosphine and CO<sub>2</sub>

- Heat 30-38<sup>0</sup>C / 86-100<sup>0</sup>F
- Phosphine 50 to 100 ppm
- CO<sub>2</sub> 5-7%
- Duration 24-36 h
- Designed to minimize time and corrosion
- Over 50 fumigations in USA

# Heat, Phosphine and CO<sub>2</sub>

Contact:

David Mueller

Fumigation Service and Supply Inc.

Telephone: 317-896-9300

Email: [insectsltd@aol.com](mailto:insectsltd@aol.com)



# Heat with Other Control Methods

- Heat and DE
- Heat, phosphine and CO<sub>2</sub>
- Effect on contact insecticides

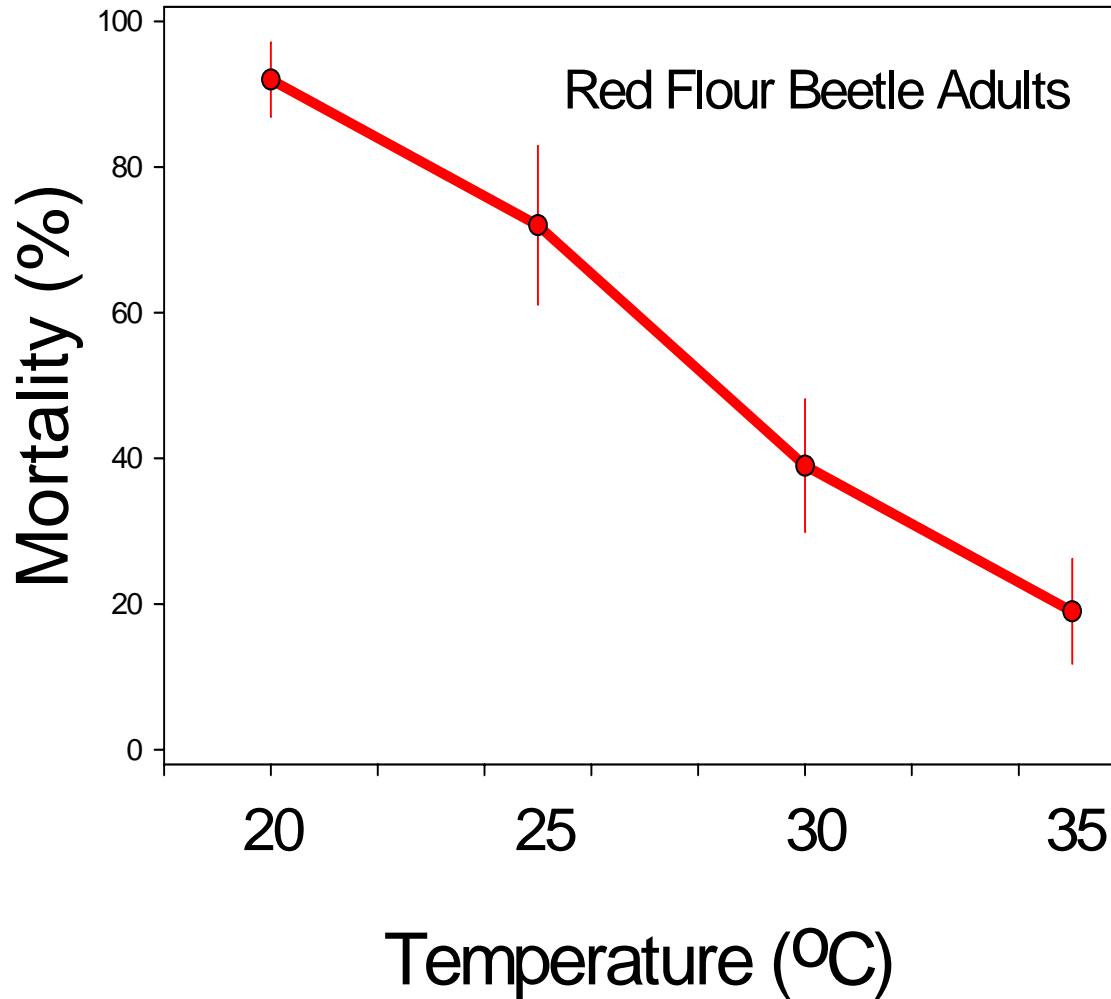
# Contact Insecticides

- Residues decrease faster at higher temperatures
- Organophosphates (Reldan, malathion) more effective at higher temperatures
- Pyrethrin and pyrethroids (cyfluthrin) more effective at cool temperatures

# Cyfluthrin efficacy

- Adult *T. castaneum* exposed for 0.5, 1, & 2 h on concrete treated with 20 mg
- Residual bioassays done every 2 weeks
- Greater efficacy at 20 than at 25-35°C

# *T. castaneum* adults exposed to cyfluthrin WP at 20 to 35°C after 14 days



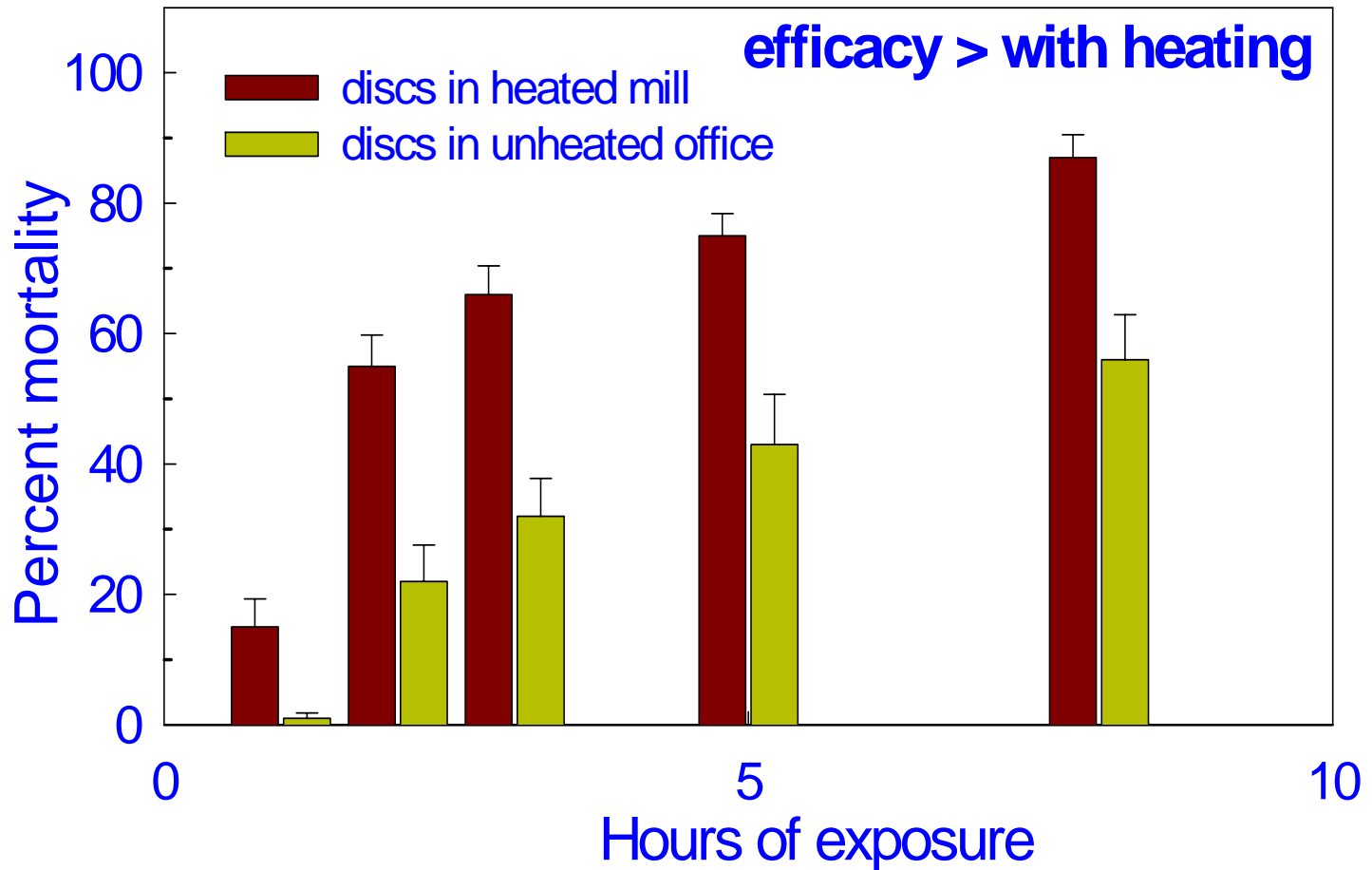
# Heat Treatments: Field Trials

Frank Arthur

- Concrete discs treated with pyrethroid cyfluthrin exposed in an actual field trial
- Companion set placed in unheated office
- Discs after treatment, adult *T. castaneum* exposed for different intervals



# *T. castaneum* exposed on concrete treated with 2 mg [AI] cyfluthrin/m<sup>2</sup>



# Conclusions

- No degradation or loss of activity because of heating
- Heat appeared to increase activity of cyfluthrin WP
- Results with this test at 10% of maximum label rate comparable to lab tests with full rate

Thank-you for  
your attention

