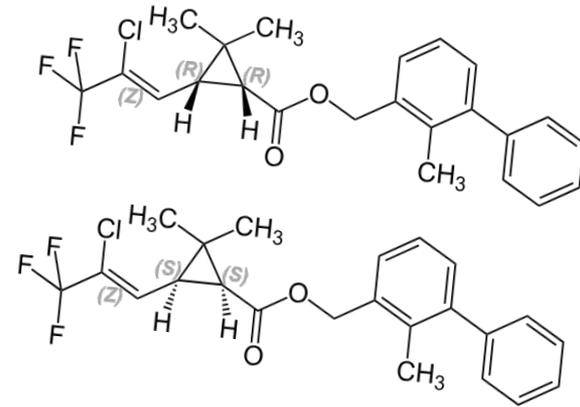


# **The Age of Pesticides:** An analysis of the neurotoxic effects of pyrethroid class pesticides on *C. elegans* and associated soil microbiota

Presented by Eren Sonmez; in collaboration with Kevin Carratu,  
assisted by Dr. Weeks and Dr. Palmisano

# What are pesticides?

- A type of chemical or substance that is commonly used in agriculture, commercially and or recreationally
- Protects against insects and other associated pests
- Many different types; made of main compound and ‘inert’ adjuvants
- Has seen increased use over the past few decades.



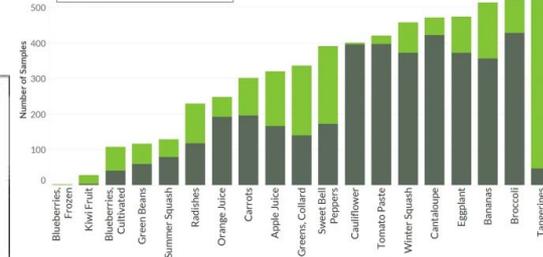
# By the numbers

Table 1. Pesticide Use Per Cropped Hectare

Country	Year	Metric Tons (MT)	Hectares ('000 Ha)	Intensity (Kg/Ha)
<i>Latin America</i>				
Belize	1992	993	57	17.40
Brazil	1990	67,000	61,350	1.10
Chile	1991	8,300	4,384	1.90
Colombia	1989	19,967	5,430	3.70
Costa Rica	1991	9,560	529	18.00
Ecuador	1990	6,200	2,750	2.30
Honduras	1992	8,147	1,855	4.40
Mexico	1989	48,000	24,720	1.90
Paraguay	1992	15,887	2,270	7.00
Suriname	1991	557	68	8.10
Trinidad & Tobago	1989	1,601	120	13.30
<i>Asia</i>				
Bangladesh	1989	4,500	9,137	0.50
China	1991	300,000	96,554	3.10
Hong Kong	1992	80	7	11.40
India	1991	72,094	169,500	0.40
Iran	1991	25,915	18,170	1.40
Jordan	1989	1,195	391	3.10
Malaysia	1992	44,721	4,880	9.20
Mongolia	1989	48	1,375	0.03
Myanmar	1992	357	10,039	0.04
Pakistan	1992	5,517	21,110	0.26
Papua New Guinea	1988	1,367	388	3.50
South Korea	1989	20,000	2,010	10.00
Sri Lanka	1992	4,633	1,903	2.40

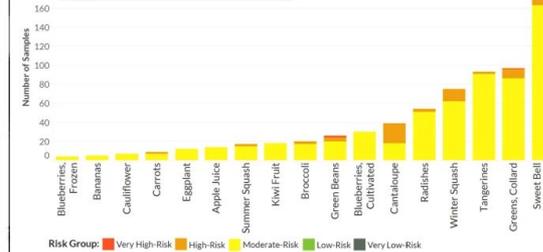
[pesticidesandimmunesystem\\_bw.pdf \(wri.org\)](#)

Figure 1A: Low and Very Low-Risk Groups  
n = 5783



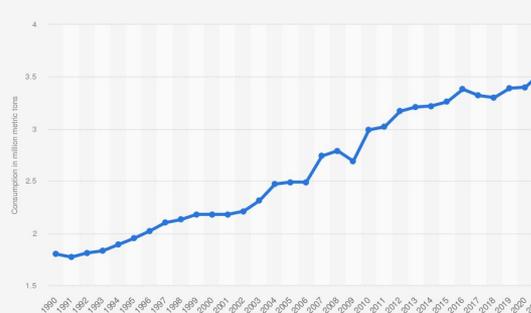
[Tracking pesticide residues and risk levels in individual samples—insights and applications | Environmental Sciences Europe | Full Text \(springeropen.com\)](#)

Figure 1B: Moderate, High, and Very High-Risk Groups  
n = 981



[Global pesticide consumption 1990-2021 | Statista](#)

Agricultural consumption of pesticides worldwide from 1990 to 2021 (in million metric tons)



Source: FAO, © Statista 2023

Additional information: Worldwide, FAO; 1990 to 2021

# Why *C.elegans*??

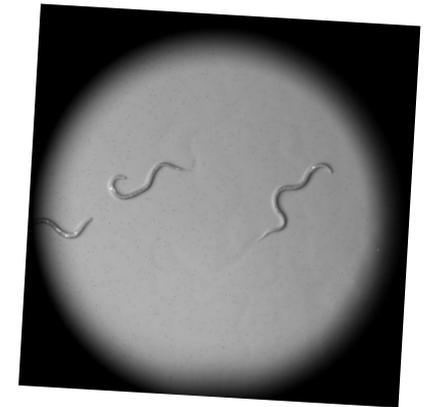
## Great Model Organism

- Fast generation time (about 48 hours)
- Hermaphroditic capacity
- Procedure compatibility



## Eukaryotic Basis

- Accurate representation of eukaryotic baseline
- Have a notochord, developing in the L3/L4 transition stage





The purpose of this study was to establish a foundation for studying the effects of pesticides on the health of eukaryotic systems and soil nutrition.

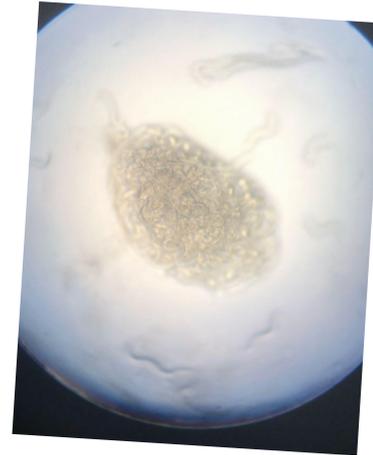
# Questions and Goals

- **What are the effects of the bifenthrin/zeta-cypermethrin OTC pesticide solution? On *C. elegans*? On associated bacteria?**
- **What kind of methodology can be used to limit the amount of confounding factors?**
- **Can the results be connected back to human health and or soil growth?**
- **Are the adjuvants or the main ingredient causing the issue?**
- **Observation and recording of any dramatic changes**
- **Generate new questions and follow-up studies based on obtained results**
- **Establish a valid, effective, and repeatable procedure**

# The Methodology

- ◇ Tested Ortho Home Defense OTC solution on **age-synched** N2 *C. elegans*, incubated at 25°C with 100 μL of **sterile filtered** OTC solution
- ◇ Using 6 well NGM agar plates, 10-20 worms at L3/L4 transition stage were seeded onto test and control wells
- ◇ Hypothesized that the OTC would have neurotoxic effect
- ◇ Seeded with **UV-killed** OP50 *E.coli*, preventing the transduction of the “Walmisano Principle”
- ◇ Evaluated at intervals of 3, 24, and 48 hours post-seeding; data and observations were recorded on the basis of three different biological aspects: viability, morphology and behavior

Composition of Ortho Home Defense Solution:  
-0.05% Bifenthrin  
-0.0125% Zeta-Cypermethrin  
-99.9375% other ingredients (adjuvants)





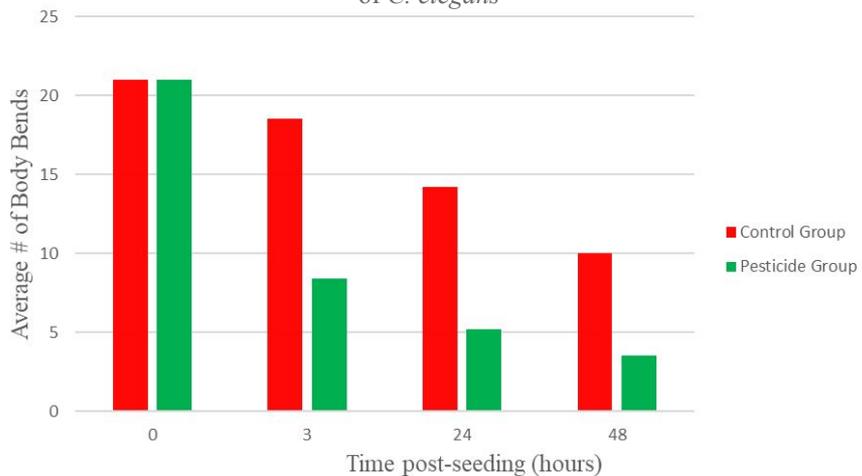
(a)

(b)

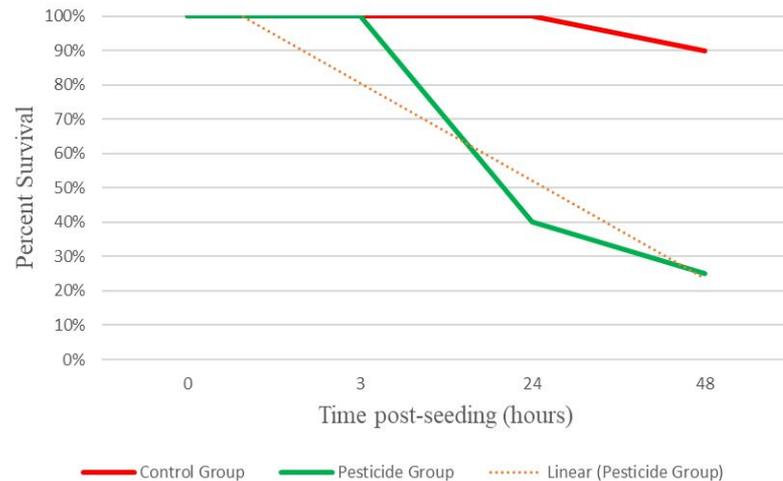
Figure 1: left side (a) depicts nematode in bifenthrin/cypermethrin pesticide plate whereas right (b) shows the control plate nematode, containing deionized water.

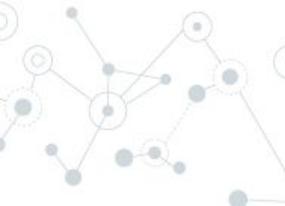
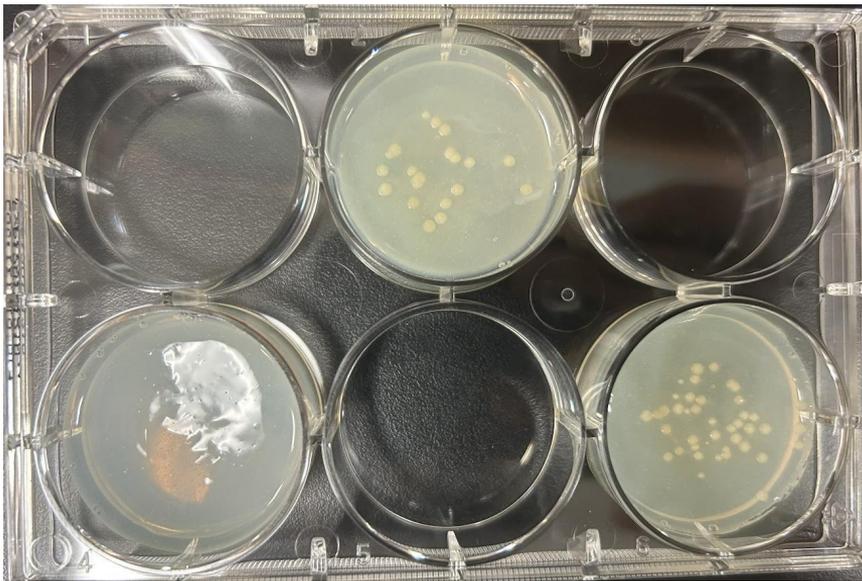


### Tracking of locomotion between pesticide and control groups of *C. elegans*



### Evaluation of viability between pesticide and control groups of *C. elegans*





## Preliminary Conclusions/ Generalized Trends

- ⊙ The OTC solution was found to be neurotoxic to eukaryotic organisms, decreasing their longevity and motility.
- ⊙ Lowered lipid storage in test nematodes and observance of behavior change through avoidance.
- ⊙ Had no effects on their reproduction or neurodevelopment due to presence of eggs and growth in test plate, respectively.
- ⊙ Potential contamination of pesticide stores, containing resistant bacteria.
- ⊙ Influence prokaryotic proliferation and potentially beneficial soil microbiota.



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