

Pesticides and the Environment



1

THE GOOD

•Pesticides must provide some benefit to society or why would we use them?



2

Malaria

- Panama: In 1898-1904, the use of draining and oiling water bodies, screening structures and using pyrethrum and sulfur, mortality of canal workers dropped from 6% to 1%.
- Malaria is spreading to areas previously free of the disease. **1960s - only 10% the world's population was at risk of contracting malaria. Risk is now 40%**
- 1 - 3 million die of malaria each year
- Malaria is responsible for as many as half the deaths of African children under the age of five.
 - 1,337 cases of malaria, including 8 deaths, were reported for 2002 in the United States, even though malaria has been eradicated in this country since the early 1950's.
 - Gates Foundation/Bayer implementing distribution of pyrethroid treated nets for use around beds. Big challenge.



Source: CDC and WHO

3

Scientists hail malaria breakthrough as bed nets prove deadly to mosquitoes

Clinical malaria cases in Burkina Faso drop by 12% after trial of nets treated with new chemical combination




▲ A bed net treated with pyrethroid insecticide and pyriproxyfen, an insect growth regulator, is seen hanging up in a living space in Burkina Faso. Photograph: Steve Lindsay/Durham University

A bed net designed to kill insecticide-resistant mosquitoes could prevent millions of cases of malaria across sub-Saharan Africa, scientists have found.

The Guardian

4

Medical and Economic Cost of Asthma



The New England Journal of Medicine

THE ROLE OF COCKROACH ALLERGY AND EXPOSURE TO COCKROACH ALLERGEN IN CAUSING MORBIDITY AMONG INNER-CITY CHILDREN WITH ASTHMA

DAVID L. ROSENSTREICH, M.D., PEYTON EGGESTON, M.D., MEYER KATTAN, M.D., DEAN BAKER, M.D., M.P.H., RAYMOND G. SLAVIN, M.D., PETER GERGEN, M.D., HERMAN MITCHELL, Ph.D., KATHLEEN McNEFF-MORTIMER, M.P.H., HENRY LYNN, Ph.D., DENNIS OWNEY, M.D., AND FLOYD MALVEAUX, M.D., Ph.D., FOR THE NATIONAL COOPERATIVE INNER-CITY ASTHMA STUDY* (1997)

~30 million affected,
~9 million children
~\$13 billion for related health care

5

Pesticides (baits) help reduce asthma

Journal of Allergy and Clinical Immunology
Volume 113, Issue 1, January 2004, Pages 109-114

Environmental and Occupational Disorders

Abatement of cockroach allergens (Bla g 1 and Bla g 2) in low-income, urban housing[†]: Month 12 continuation results

Samuel J. Arbes, Jr, D.D.S., MPH, PhD¹, Michelle Seaver, BS², Jigna Mehta, BA¹, J. Chad Gore, MS³, Corey Scha, PhD², Ben Vaughn, MS², Herman Mitchell, PhD², Corey C. Coates, MS² ▲


► Show more
DOI: 10.1016/j.jaci.2003.10.042 [Get rights and content](#)




Conclusions
Reductions in cockroach allergen concentrations achieved through the combined intervention of occupant education, insecticide application, and professional cleaning can be maintained with continued cockroach control. Surprisingly,.... [insecticide application alone significantly lowered allergen concentrations in the crossed-over control homes.](#)

6


Typhus – A disease from antiquity
Transmitted by the Human Body
Louse in close quarters



- 1489 – Granada War – Catholic Monarchs lost 3,000 to enemy action and 17,000 to typhus
- 1847 – 27,000 deaths in Canada – Irish immigrants held in “fever sheds,” quarantined.



Ferdinand and Isabella with their subjects


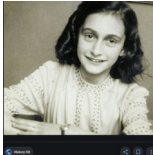


Source: Wikipedia

7

Typhus Disease

- WWI – 3 million Russian deaths
- WW2 – Thousands of deaths in German concentration camps (including Ann Frank)

8

DDT saved thousands of lives during WWII
Killed lice in Europe & mosquitoes in the South Pacific
 (typhus vaccine not introduced until mid-1943)






A U.S. soldier is demonstrating DDT-hand spraying equipment. DDT was used to control the spread of typhus-carrying lice.



9

Rocky Mt. Spotted Fever Outbreak AZ Tribal Lands, 2003-2014

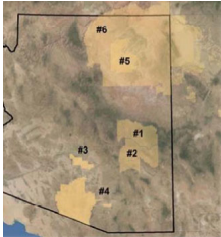
Between 2003 and 2012, there were 250 cases and 19 fatalities in AZ, most on six Tribal Lands and associated with free-roaming dogs and severe tick infestations. The incidence was 200x the national average.

Male (above) and Female (below) adult brown dog tick (Rhipicephalus sanguineus) – Photos by Centers for Disease Control (CDC)

2 The University of Arizona Cooperative Extension

10

Rocky Mt. Spotted Fever Outbreak AZ Tribal Lands, 2003-2014

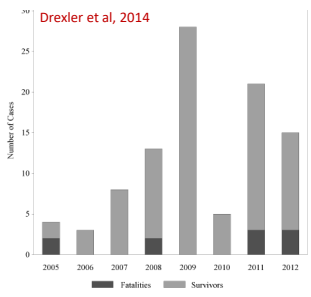


11

11

New cases of RMSF on “Reservation B” (580 households) in northern Arizona Relatively high mortality rate

Drexler et al, 2014



Year	Fatalities	Survivors	Total Cases
2005	2	2	4
2006	1	2	3
2007	1	6	7
2008	2	11	13
2009	2	26	28
2010	1	4	5
2011	3	18	21
2012	3	12	15

Figure 1. Human cases of Rocky Mountain spotted fever on Reservation B as reported by the Arizona Department of Health Services.
doi:10.1371/journal.pone.0112968.g001

12

Pesticide Community-wide Treatment Strategy

Treat yards & apply pesticide-treated-collars
(Seresto: neonic/pyrethroid)




USA Today

Photo Credit: Dawn Gouge

16

Reduction in Brown Dog Tick on Dogs

Drexler et al, 2014

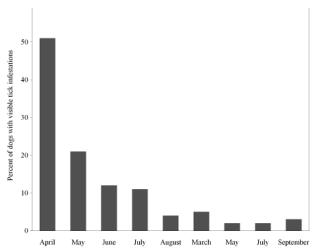
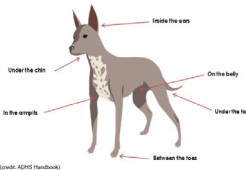



Figure 3. Percent of dogs registered in the RMSF Rodeo with visible tick infestations, assessed at routine monitoring.

17

Reduction in Brown Dog Tick at Traps

Drexler et al, 2014

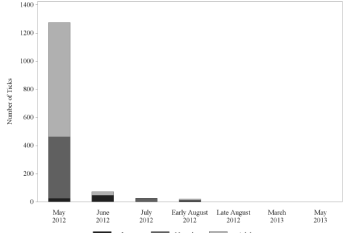





Figure 2. Observed ticks by life stage in CO₂ traps in the RMSF Rodeo community, n=5 homes, 3 traps per home.

18

Reduction in RMSV Cases at "Reservation B"
 From before treatment (April 2010-March 2012) to after treatment (April 2012-March 2014)

- New cases dropped 43% in the community-wide treatment area compared with a 27% drop in the non community-wide area
- Number of cases dropped from 1.2/1000 to 0.7 in the treated area
- 1.2/1000 to 0.9 in the non-treated area





Quora.com

19

Pesticide baits are critically important in controlling fire ants

**I recently published research in the Annals of Internal Medicine about the consequences of fire ants. These insects sting more than 50% of people living in fire ant prevalent areas....Many stings result in local discomfort, however, a small number of people experience severe allergic reactions, some of which are fatal.*


**Richard deShazo, M.D. Dept. of Medicine, Univ. of MS Medical Center*

20

Insect growth-regulator baits & conventional pesticides are the only effective control strategies for termites.

- Subterranean and drywood termites are the most economically important wood destroying pests in the U.S.
- Every year attack about 4 million homes in U.S., and cost >\$5 billion in property damage.
- Termites cause more damage each year than tornadoes, hurricanes, hail, flooding and windstorms combined




Source: Bayer Corporation

21

Golf Courses and Rapid Blight fungus

- Affects most golf courses (municipal and extremely private from Las Vegas to Phoenix to Southern CA).
- *Labyrinthula* is a fungus (slime mold type) that has attacked marine plant seagrass and turf. Took out 95% of seagrass along the European and N.American coasts in 1930s.
- The terrestrial species, *L. terrestris* (Rapid Blight) attacks turf as a saprophyte – discovered on turf in 1995 in CA.



31

Golf Courses, Rapid Blight, gray water, and fungicides




- *Labyrinthula* sp., Rapid Blight.
- Attacks turf compromised by high salinity – especially in the fall after over-seeding.

Fungicides kill Rapid Blight which confer vigor, allows the turf to survive, and provides a use for poor-quality recycled water.

32

THE BAD



- Human Toxicity
- History of Bioaccumulation
- Ozone Layer Destruction (Freon/MB)
- Waterway contamination from pyrethroids and heavy metals – (UC Berkeley Study, Elkhorn Slough)
- Pollinators (neonics, fungicides on pollen, Sivanto+fungicides)

33

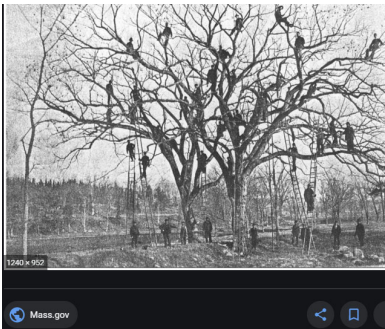
Pesticides
Where we've come from to where are today

Insecticides

- Arsenic – early 1900a
- DDT and organochlorines – 1943-1950s
- Methyl bromide – 1960s' present
- Organo-phosphates and carbamates – 1950s-1980s
- Pyrethroids – 1980s -present
- Neonicitnoids 1990 - present
- Spinosyns 2000
- Insect growth regulators 2000New chemistry-??

34

Pesticides
Where we've come from to where are today



Gypsy moth control
in the late 1880s

35

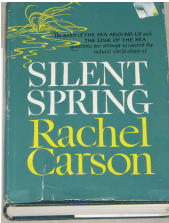

Pesticides
Where we've come from to where are today

Insecticides

- Arsenic – early 1900a
- DDT and organochlorines – 1943-1950s
- Methyl bromide – 1960s' present
- Organo-phosphates and carbamates – 1950s-1980s
- Pyrethroids – 1980s -present
- Neonicitnoids 1990 - present
- Spinosyns 2000
- Insect growth regulators
- New chemistry-??


36

Pesticide Environmental Effects
DDT

37

Pesticide Environmental Effects
DDT


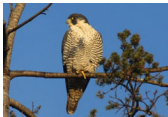


- Used in WW II to combat malaria (mosquitoes) and typhus (lice)
- Then used in agriculture
- 1950s - WHO launched a global malaria eradication program
- Initially highly successful – malaria eliminated in Taiwan, parts of the Caribbean, northern Africa, northern Australia, S.Pacific. etc.
- Millions of lives saved.
- Not applied in sub-Saharan Africa because of mosquito pressure and poor infrastructure.

38

DDT

- 1950s – 1960s – Resistance appeared (mosquitoes/malaria, agriculture)
- Environmental effects noted – thinning egg shells (peregrine falcons and other species)
- Carson noted human health effects studies, but this was dose related.
- 1972 – EPA banned ag use.
- But still used in vector control sparingly. (CA – bubonic plague program/fleas)
- Now pyrethroid-protective netting is being distributed, but Malaria is on the rise.(also resistance to drugs)
- New evidence of endocrine disruption






SUMMARY:
THERE WERE BENEFITS AND DETRIMENTS
REPLACED BY SAFER MATERIALS

39

Pesticide Environmental Effects Methyl Bromide

- Ozone Depleter
- "United Nation's Montreal Protocol on Substances That Deplete the Ozone Layer" – went into effect in 2005
- Eye and lung irritant
- Very toxic





40

Methyl Bromide: No comparable alternatives in Agriculture, but usage has been significantly reduced with new resistant varieties (but pathogens develop resistance fast – spinach/strawberries)

- Telone and chloropicrin – toxic
- Biologics?
- Soil composting ?
-

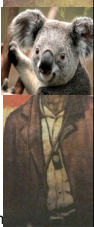
Cost	\$ (millions)
Applying buffer zones	3.2
Lost processing-strawberry sales	10.4
Additional fumigation time	10.0
Switch from bed to flat fumigation	2.4
Notification	0.125
Total	26.125



41

THE CUDDLY

Organic pesticides



- "Organic agriculture is an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony"USDA National Organics Standards Board...1991

42


Organic Pesticides

- Because they have been Generally Regarded as Safe, fewer tests have been required in the past.
- This is changing.

43

**Organic Pesticides
Substances allowed**

- Naturally derived products Generally Regarded as Safe
- Bacillus species
- Streptomyces derivatives
- Chenopodium derivatives (Regalia)
- Botanicals



Improve Your Disease Management Program
with Serenade, Serenade Soil, and Serenade

44

**Organic Pesticides
Substances allowed**

- Also synthetics:
- Sulfur
- Copper sulfate, hydroxide, oxide "provided that it is used in a manner that minimizes accumulation in the soil"
- Lime sulfur
- Oils, mineral and narrow range petroleum oils – dormant
- Tetracycline
- Recycled paper
- Petroleum based plastic mulches
- Alcohols, ethanol, isopropanol

45

Are Organics safer for the environment?



ENVIRONMENTAL HAZARDS
This pesticide is extremely toxic to fish and aquatic invertebrates. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwaters.

46

Are Organics safer for the environment?



47

Organic Pesticides The Challenges

- They require more frequent applications and then often don't perform as well.
- Yields are **lower**, but the growers receive a better price and this is passed down to the consumer.

48



Organic Pesticides

Where do they work where yields are comparable?

- In growing regions where the pest and disease pressure is unusually low.
- EX: Verde Valley grapes: No powdery mildew, no botrytis rot, no spider mites, thrips (?), nematodes?, no phyloxera, no viral diseases.
- EX: Chino Valley vegetable growers: Little disease and insect pressure.
- THE GROWERS ARE VERY LUCKY!!..for now.

- Where pest/disease pressure is apparent, if it intensifies as the crop matures, then harvest the crop before the pests occur. EX: spinach. The vast majority of the retail product is pre-packaged "Spring Mix" or "Baby Spinach."

- In scenarios, organic and conventional products are used in an integrated program.

49

Pesticides and Pollinators – Miscellaneous reflections

- Homeowner label rates are higher than agriculture labeled use rates and are more toxic to pollinators.
- Neonics are less toxic to bees than many other over-the-counter products.
- Soil-applied pesticides generally result in less exposure to pollinators.
- Many organic materials that may be relatively harmless to pollinators don't work very well on the targeted pests.
- Organic materials that work on worms are toxic to butterfly pollinators.

50

Pesticides and Pollinators

What to use?

- Read the label very carefully to see if the product is safe for bees and under what conditions (bloom, time of day, method of application) is the product safe?
- If you are concerned about Monarchs, then do not use any insecticides!

51

Misuse of Pesticides

- Spray drift – to another crop, body of water, non-ag property
- Spraying when it is windy or when there is an inversion layer
- Wrong rate
- Contaminated spray tanks going from one crop/ornamental where the product is registered to another where it is not.
- Spraying flowering plants while bees are foraging when the label prohibits it. Pest control companies and **Homeowners are guilty.**
- Blowing the dust of pesticide seed coatings when planting.

52

Misuse

"On June 17, 2013, the largest native bee kill ever recorded occurred in Wilsonville, Oregon. More than **50,000** bumble bees died when 55 blooming linden trees were sprayed with the pesticide dinotefuran (also known as Safari) in a Target parking lot. This loss represents potentially hundreds of wild bumble bee colonies." Xerces Society
THIS WAS AN ILLEGAL APPLICATION AT VARIANCE WITH THE LABEL



Trees outside the Target store in Wilsonville received a mesh covering after the bee deaths.

53



Read and follow the label:

Safari's Label:

This product is toxic to bees exposed to treatment for more than 38 hours following treatment. Do not apply this product to blooming, pollen-shedding or nectar-producing parts of plants during this time period, unless the application is made in response to a public health emergency declared by appropriate state and federal authorities.

54



Ways to minimize the detrimental effects of pesticides

- Don't treat on windy days.
- Wear protective clothing
- Keep the sprays and granules off sidewalks, driveways
- Don't treat plants are/will be flowering unless the pesticide is known to be SAFE for pollinators
- Take unused pesticides to a county sanitation facility that accepts pesticides

• **Read and follow the label**

55

56