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QUÉBEC - CANADA

RT 3: Pesticides and Bees

REDUCING PESTICIDE HAZARDS TO BEES

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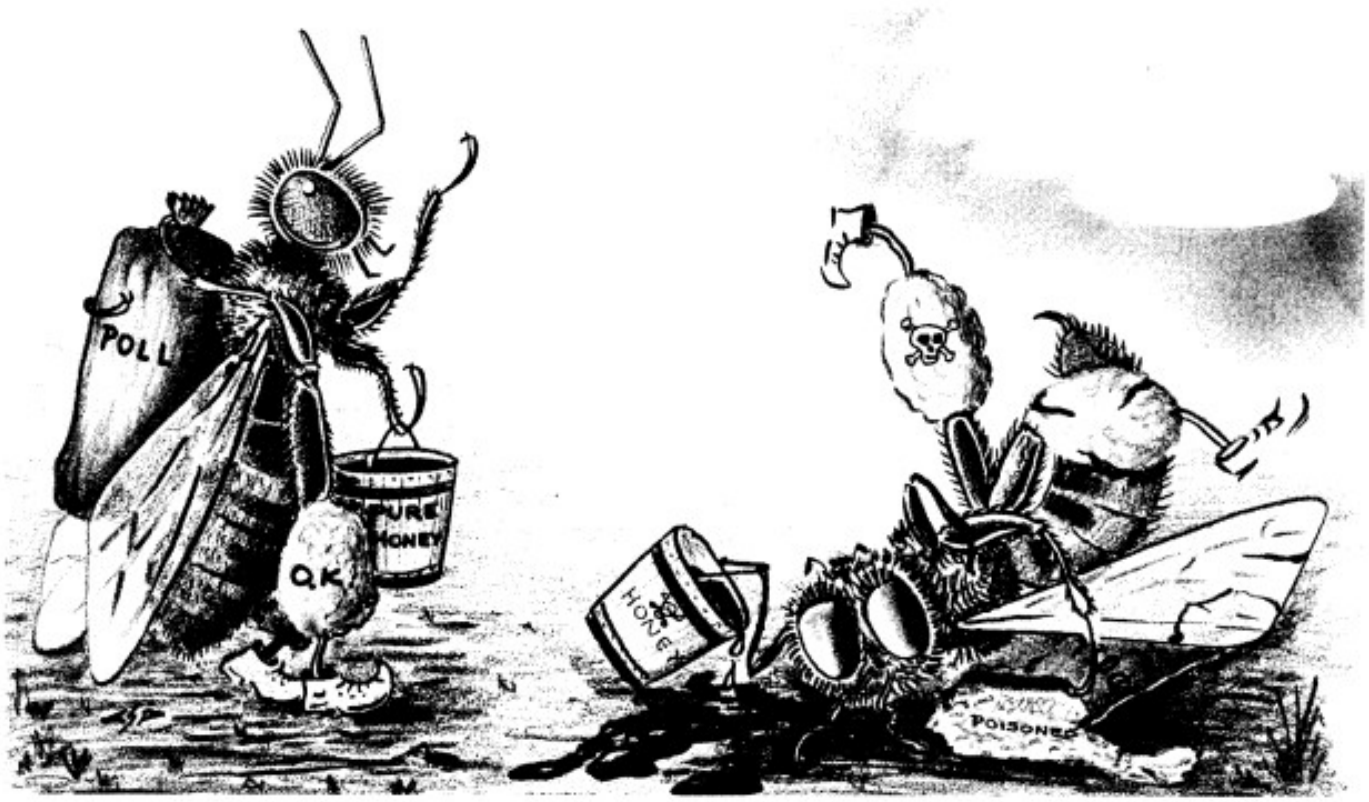
Reducing Pesticide Hazards to Honey Bees:

Mortality Prediction Techniques and Integrated Management Strategies



Anderson, L.D., and E.L. Atkins. 1966.

OLD PROBLEM …. NEW SOLUTIONS ???

OLD PESTICIDES ….. OLD monitoring methods ….. NEW PESTICIDES …. NEW SOLUTIONS ???

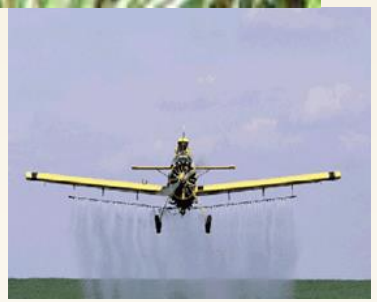
Toxicity of Pesticides and Other Agricultural Chemicals to Honey Bees

Anderson, L.D., and E.L. Atkins. **1966. 1965** Research on the effect of pesticides on honey bees. Amer. Bee Jour. 1 06(6):206-08. . **1968.** Pesticides in relation to beekeeping. Ann. Rev. of Ent. 13:213-38.

Anderson, L.D., E.L. Atkins, F.E. Todd, and M.D. Levin. **1968**. Research on the effect of pesticides on honey bees. Amer. Bee Jour. 108(7):277-79.

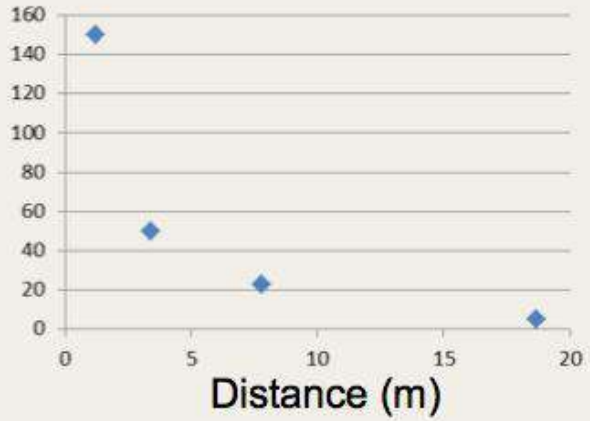
Accidental exposure to bees in agricultural areas are common.

- For each crop, its insecticide and for each insecticide, its route of exposure for the bee.
- Pesticides products are used in various ways :
- Application by land
- Aerial spraying
- Seed treatment



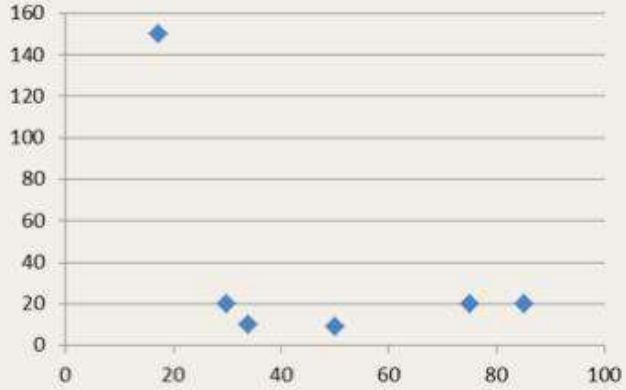
Lateral drift

- Insecticide (µg/cm2)



End of field drift

Insecticide (µg/cm2)



Spray parameters
Product dose: 27.5 g / liter
Application rate: 100 liters / acre
Pressure: 35 PSI
Speed of travel: 5 km / h

Treatments
A: Conventional nozzles and spray height of 50 cm
B: Anti-drift nozzles and spray height of 50 cm
C: Conventional nozzles and spray height of 1.20 m
D: Anti-drift nozzles and spray height of 1.20 m

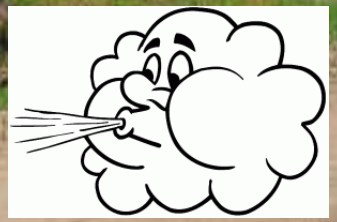
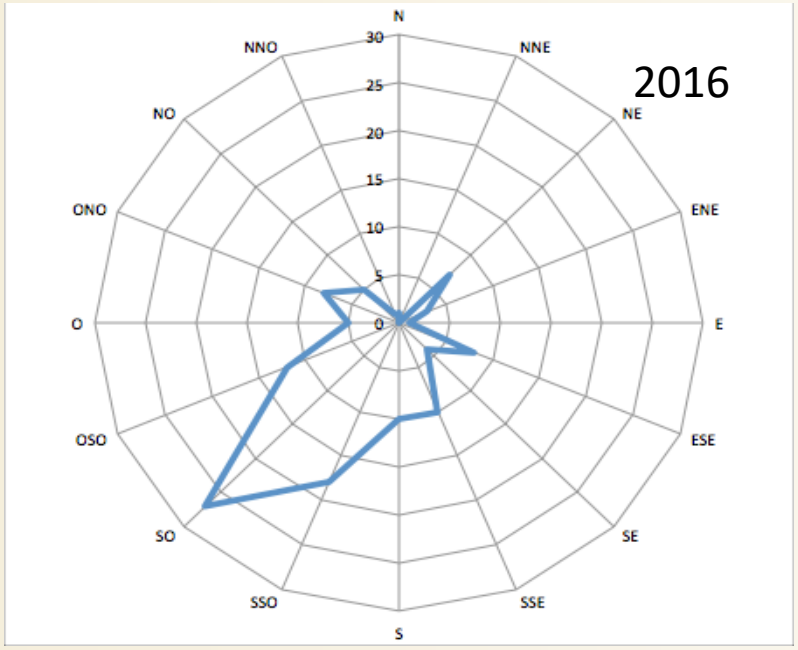


IMAGE ANALYZER:
Software (IMAGEJ)
All of the colored areas were combined to estimate the percentage of coverage of the spread product on the filter paper. Results ranged from 0% to 100%

All positions combined, the **anti-drift nozzles** and **lower spray** hight slightly reduced the drift distance when the wind was stronger.
(quantity was significantly lower)

Contrary to initial information, regional winds were at 55.85% South dominance (South West dominance of 22.5%) and not North West, as initially considered

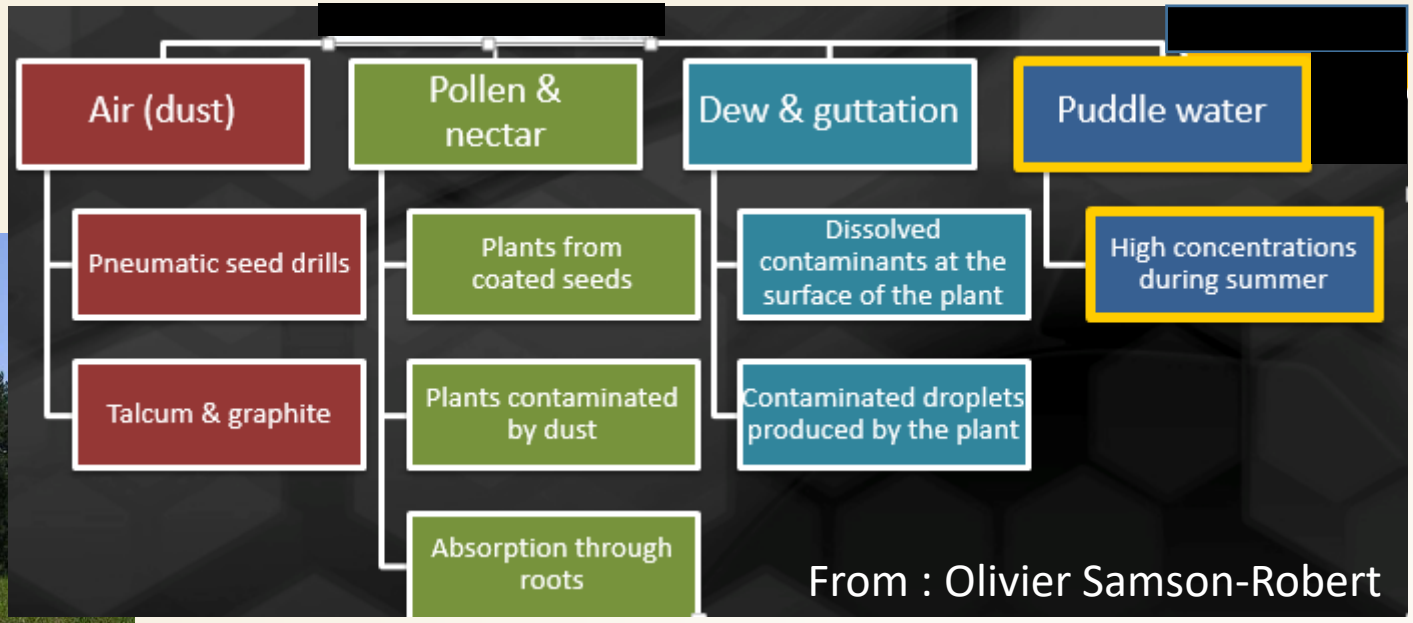


WIND DIRECTION

Effects of neonicotinoid pesticides on beekeeping

Neonicotinoids' many routes of exposure

(Boily et al, 2013; Krupke et al, 2012; Girolami et al, 2012; Marzaro et al, 2011)



Synergy
and sublethal effects

Vincent Doublet,[1*†] Maureen Labarussias,[1] Joachim R. de Miranda,[2] Robin F. A. Moritz[1,3] and Robert J. Paxton[1,3,4]

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[2]*Department of Ecology, Swedish University of Agricultural Sciences, Uppsala, Sweden.*

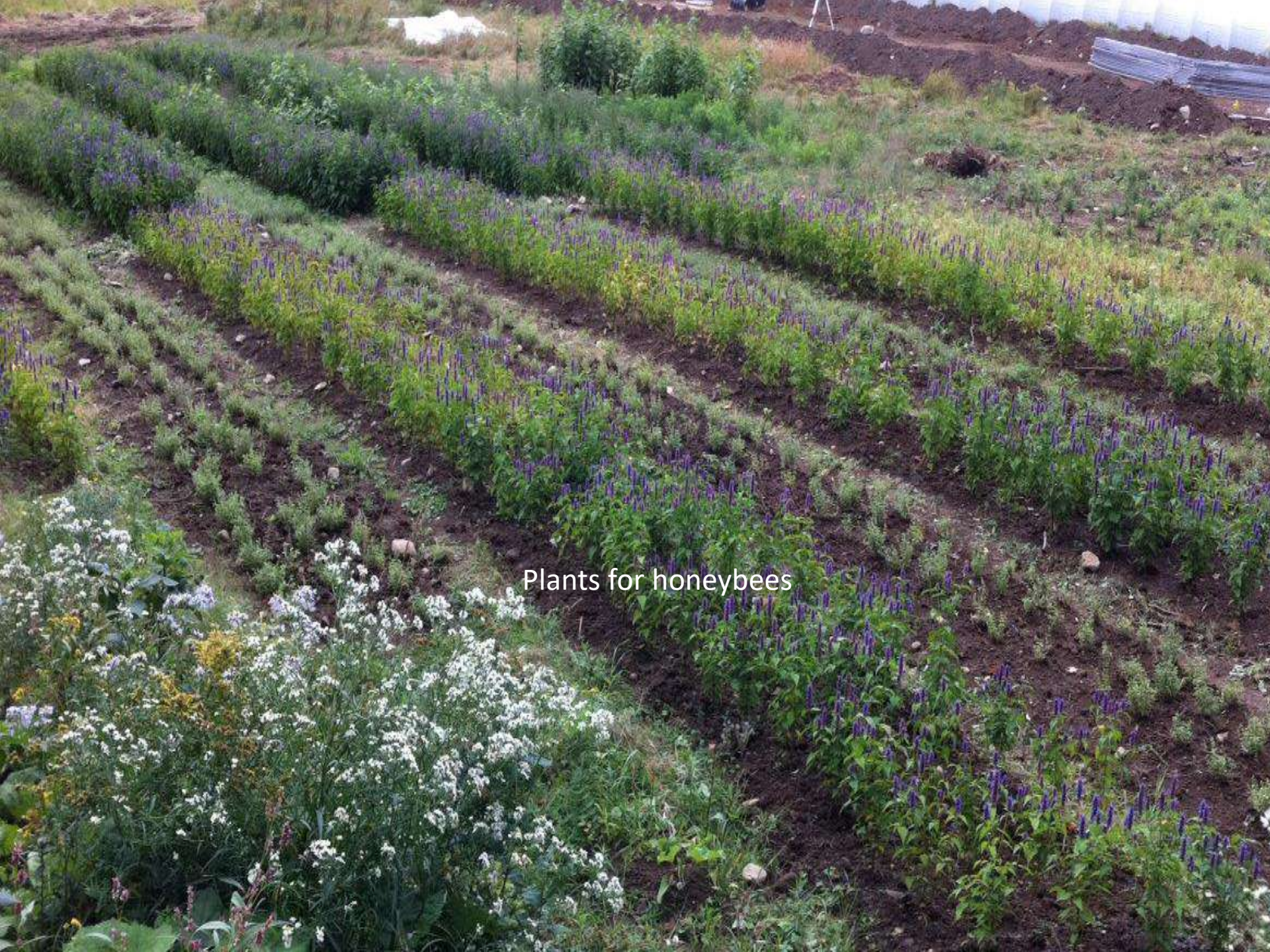
[3]*German Center for Integrative Biodiversity Research (iDiv), Halle-Jena-Leipzig, Leipzig, Germany.*

[4]*School of Biological Sciences, Queen's University Belfast, Belfast, UK.*

Bees under stress: sublethal doses of a neonicotinoid pesticide and pathogens interact to elevate honey bee mortality across the life cycle

Bee declines driven by combined stress from parasites, pesticides, and lack of flowers

- Dave Goulson, Elizabeth Nicholls, Cristina Henández Botías, Ellen L. Rotheray
- Published in Science 2015
- DOI:10.1126/science.1255957

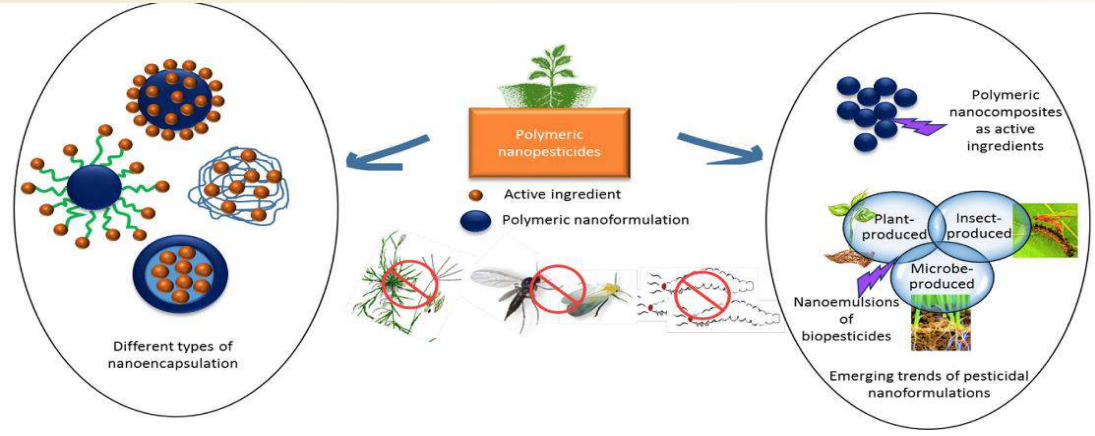

Plants for honeybees

New and Newer insecticides

Flupyradifurone (neonicotinoid)

A recent study has shown that flupyradifurone, combined with a common fungicide, has undesirable synergistic effects on the survival and behavior of bees (Tosi and J. C. Nieh, 2019)

Nano-based smart pesticide formulations:



Nanoparticles as active ingredients represent a new trend in pesticide nanoformulations.The effects of nanoparticles and nanomaterials on the environment and health are still unknown. Questions remain about the behavior of nanoparticles facing biological barriers (Kumar et al. 2019)

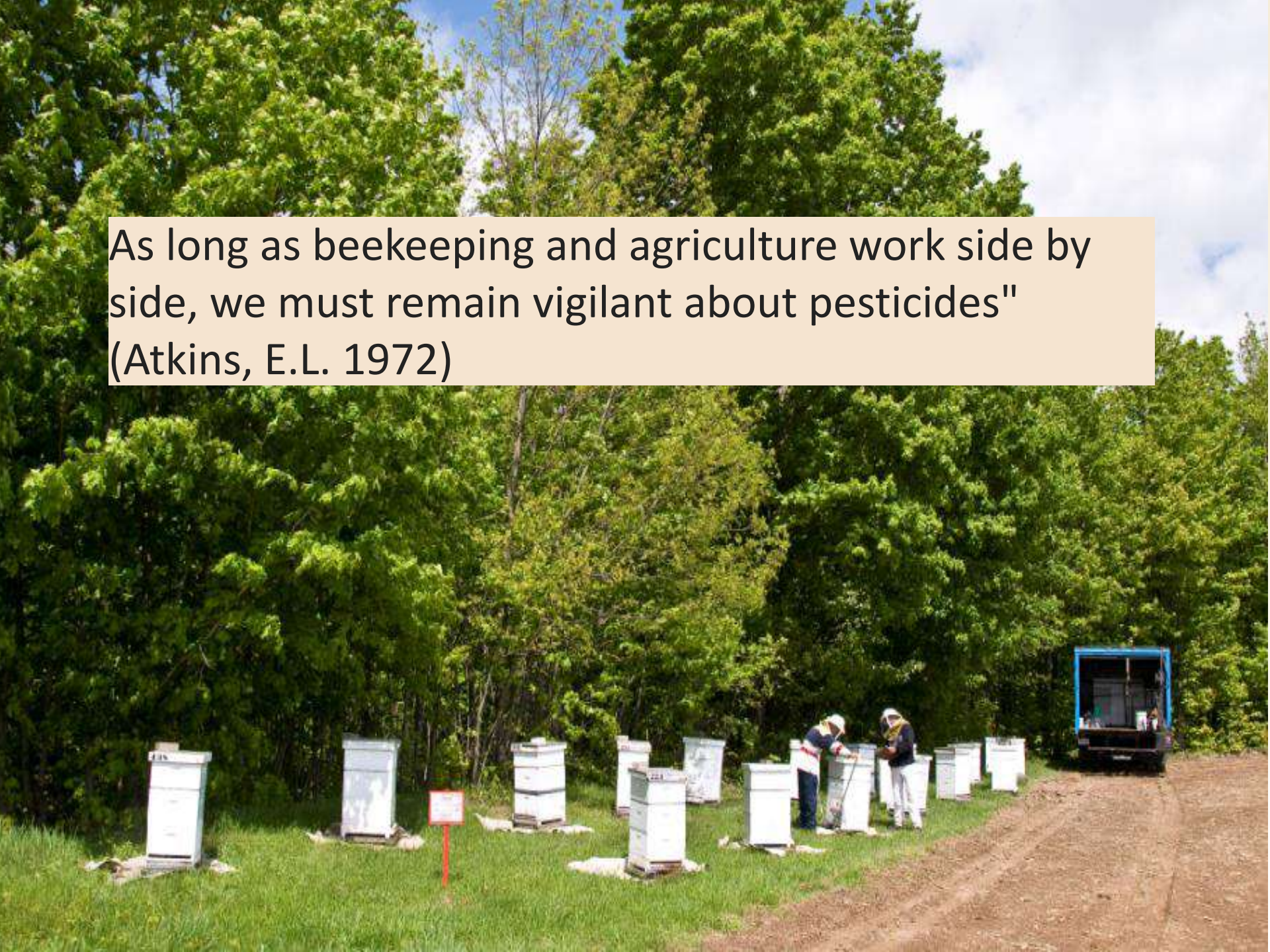
A study on wing damage
(as a clue of honeybee age)
showed that older forager bees
were absent from samples when
hives were placed in (or near)
neonicotinoid treated fields

Adapted method from Mueller & Mueller 1993

Confinement of colonies

Assessing

- CO_2 levels
- Bee mortality
- Behaviour


As long as beekeeping and agriculture work side by side, we must remain vigilant about pesticides" (Atkins, E.L. 1972)

THANK YOU

IMAGE:
https://cosmosmagazine.com/biology/honeybees-can-do-maths