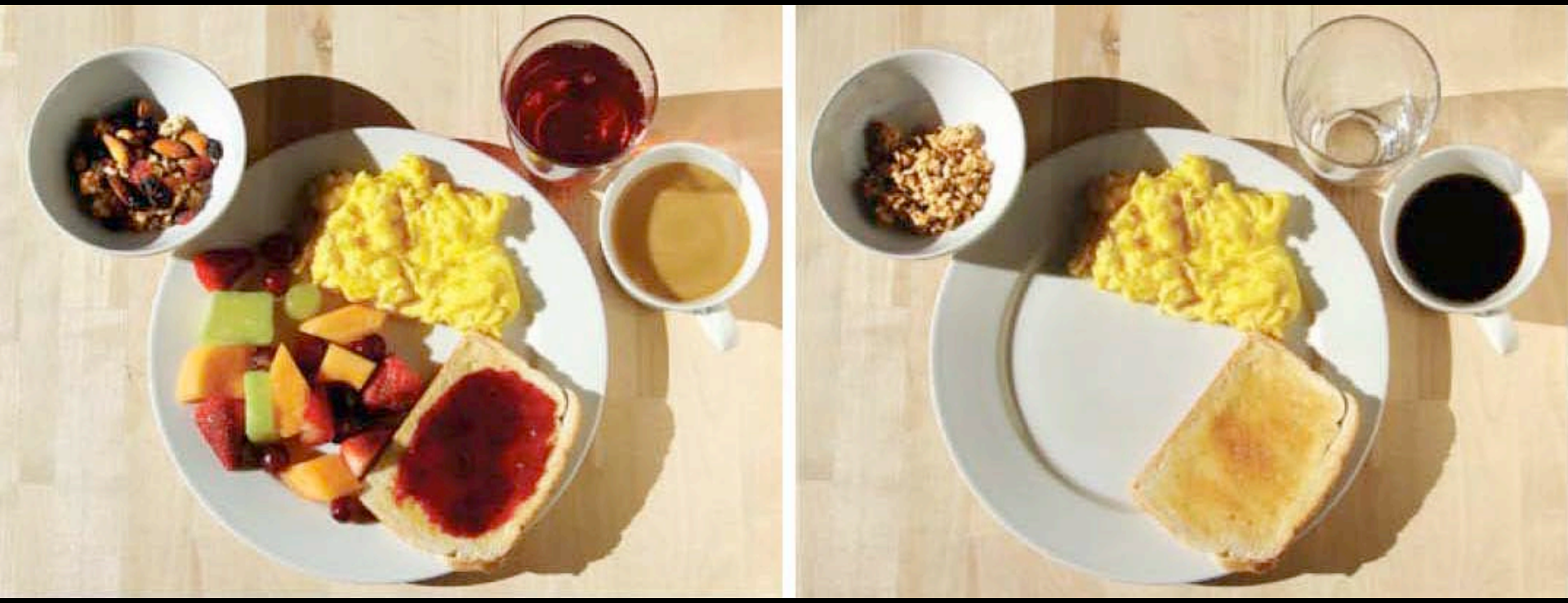
Bees: Protecting our Pollinators

Marla Spivak, University of Minnesota
www.beelab.umn.edu

Your breakfast without bees



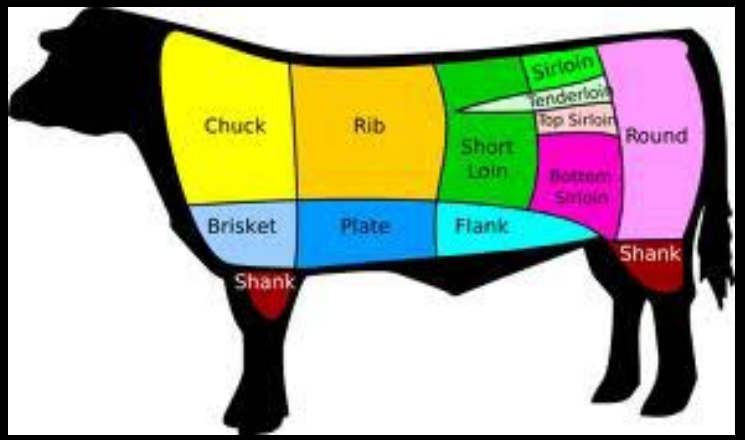
Scientific American April 2009

Value of crops in US that depend on pollination:

>$18.9 billion

$217 billion worldwide

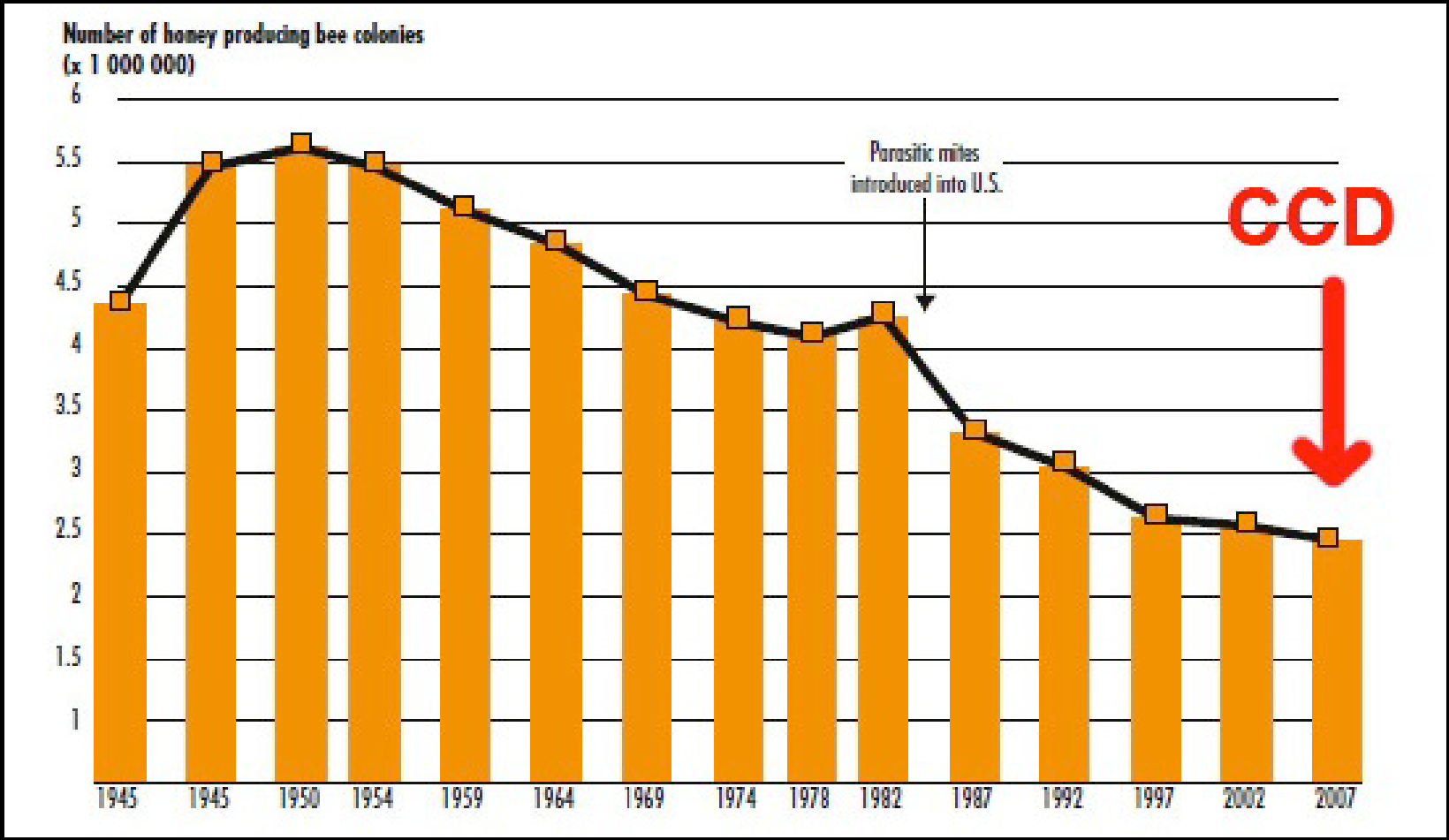
Alfalfa Hay – Bee Pollination – Dairy and Beef



Your grocery store without bees

Honey Bees

Decline in U.S. honey bee colonies 1945-2007



Since 2007, 30-40% of all honey bee colonies die annually

Beekeepers struggle to replace losses

Wild Bee Pollinators Also in Decline

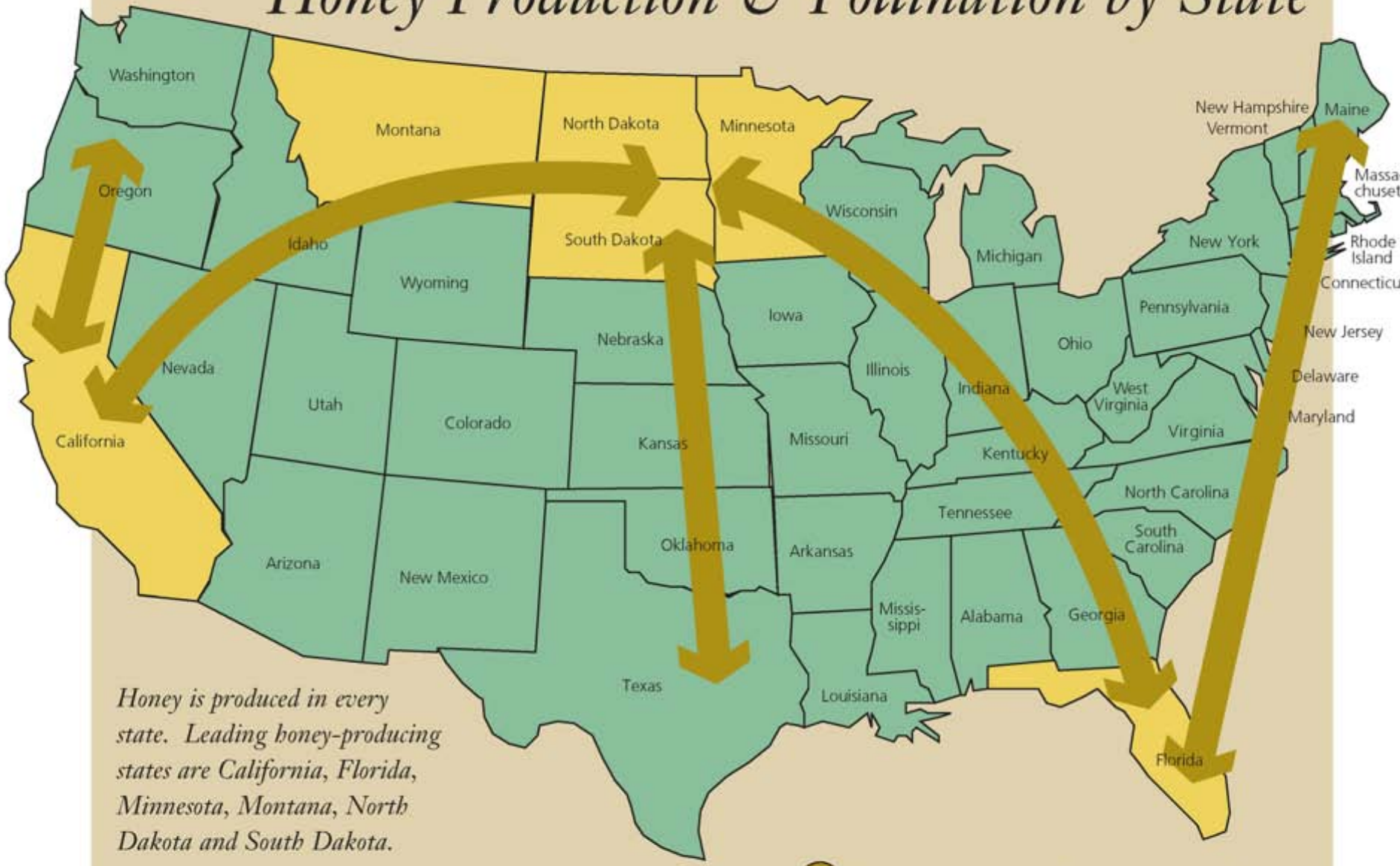
Wild Bee Nests

Ground-nesting (~70%)

Photo: Matthew Shepherd

Tunnel-nesting (~30%)

Honey Production & Pollination by State



Honey is produced in every state. Leading honey-producing states are California, Florida, Minnesota, Montana, North Dakota and South Dakota.

About half of the nation's full-time beekeepers migrate with

Major Migratory Routes of Honey Bee Colonies for Pollination

California almonds require 1.5 million honey bee colonies from January through March each year; that represents almost half of all managed colonies In the U.S.

750,000 acres of almonds in Central CA requires 1.5 million colonies of honey bees for pollination

72,000 acres of blueberries across U.S. requires 150,000 colonies of honey bees for pollination

Colonies trucked in and out because after bloom there are no flowers and many pesticide applications

Every pollen load a honey bee brings home has at least 4 detectable pesticides

- Pyrethroids
- Organophosphates
- Carbamates
- Neonicotinoids
- Insect Growth Regulators
- Organochlorines
- Chlorinated Cyclodienes

Varroa destructor: mite parasite

Feeds on bee blood
Circulates bee **viruses**

What are the symptoms of Colony Collapse Disorder (CCD) as first described in 2007?

Healthy colony

CCD colony

- Rapid disappearance of adult bees from colony
- Queen, brood (larvae, pupae), and food stores remain

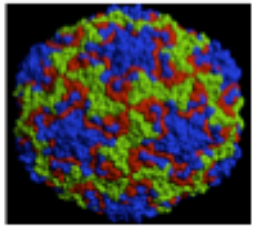
- Since 2006-07, 30% of all honey bee colonies die every winter, on average
- Of the 30% loss, small percentage have CCD symptoms
- In operations that report CCD symptoms, % mortality is high (50-80%)

vanEngelsdorp et al., 2009, 2010, 2011, 2012

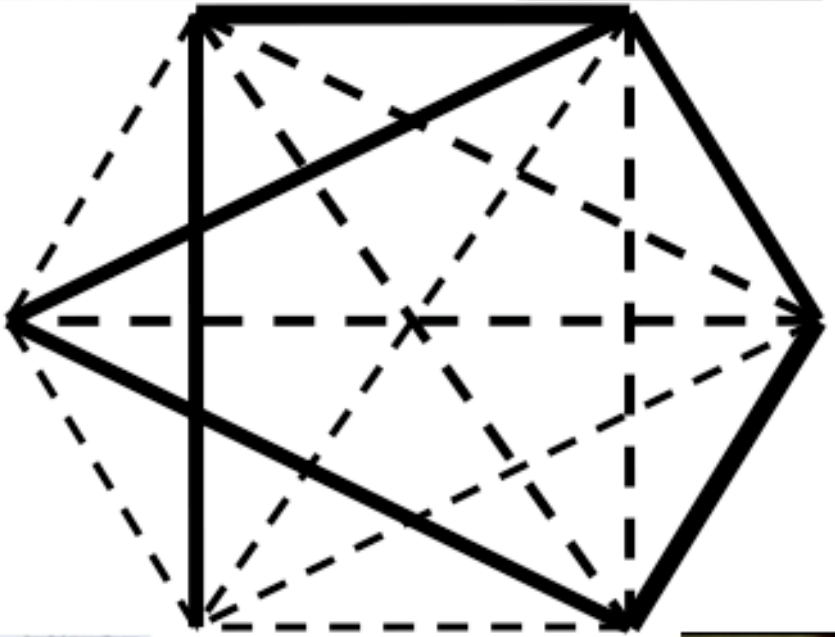
Why are colonies dying?
A puzzle of interactions

Lack of flowers - poor nutrition

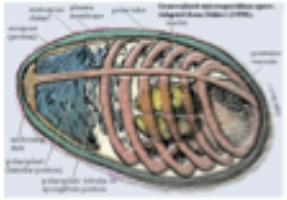
Environmental Pesticides



Viruses



In-Hive Pesticides



Gut pathogen: *Nosema*

Mite parasites

Protect Bees from Pesticide Kills

If there are flowers blooming, there will be bees foraging

What bees eat

- Pollen - protein
- Nectar – carbs
- Water

Pollination Happens

“Bee” Flowers

Major Honey Plants
- Clover
- Alfalfa
- Basswood
- Buckwheat

Wildflowers/ weeds
- Mustards
- Vetch
- Dandelion
- Goldenrod
- Sumac

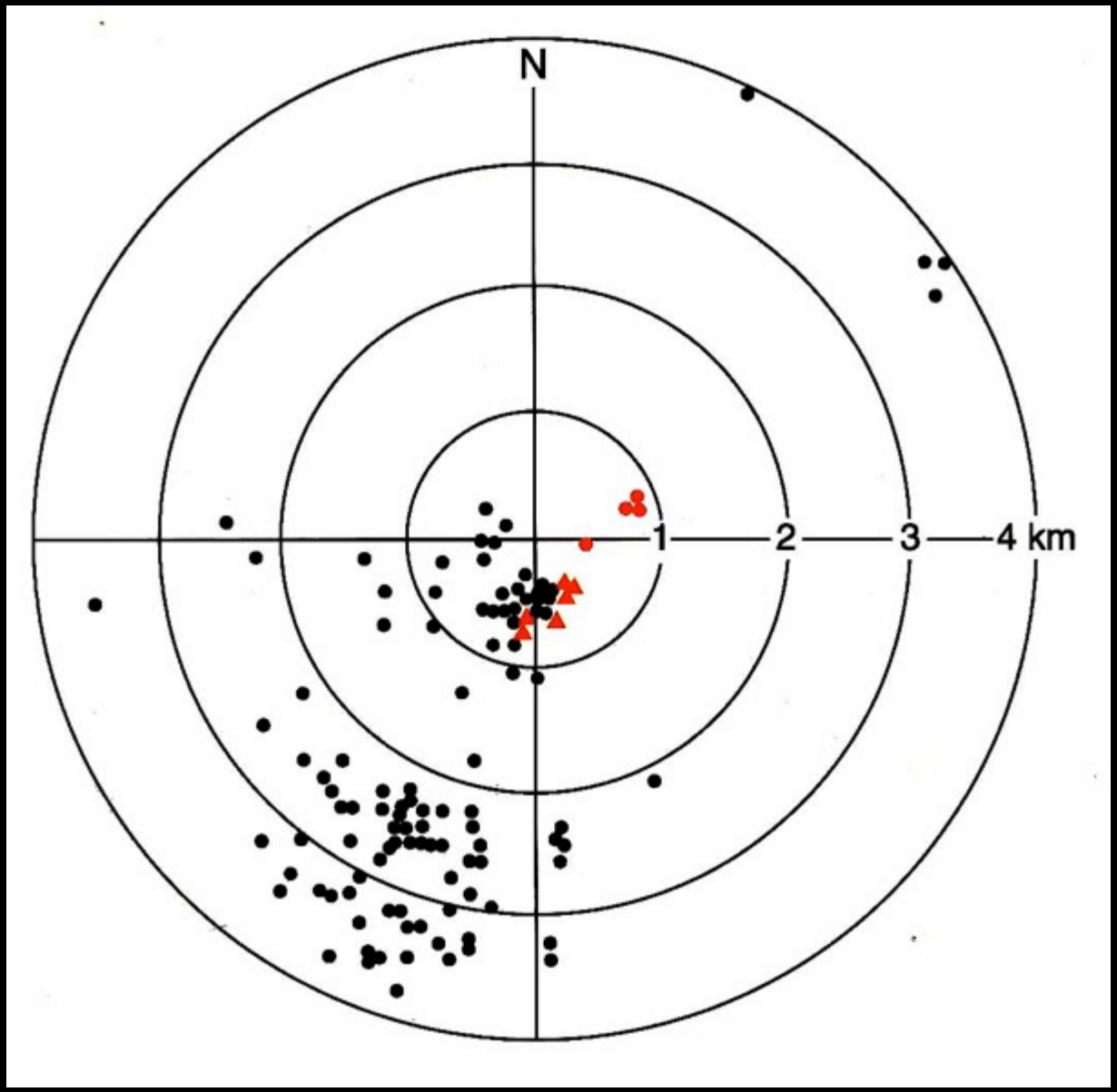
Trees - pollen
- Maple
- Willow
- Oak

Gardens/ fruit trees
- Vine crops
- Berries
- Canola
- Apple

Bees collect corn pollen but only when hungry (low protein content)

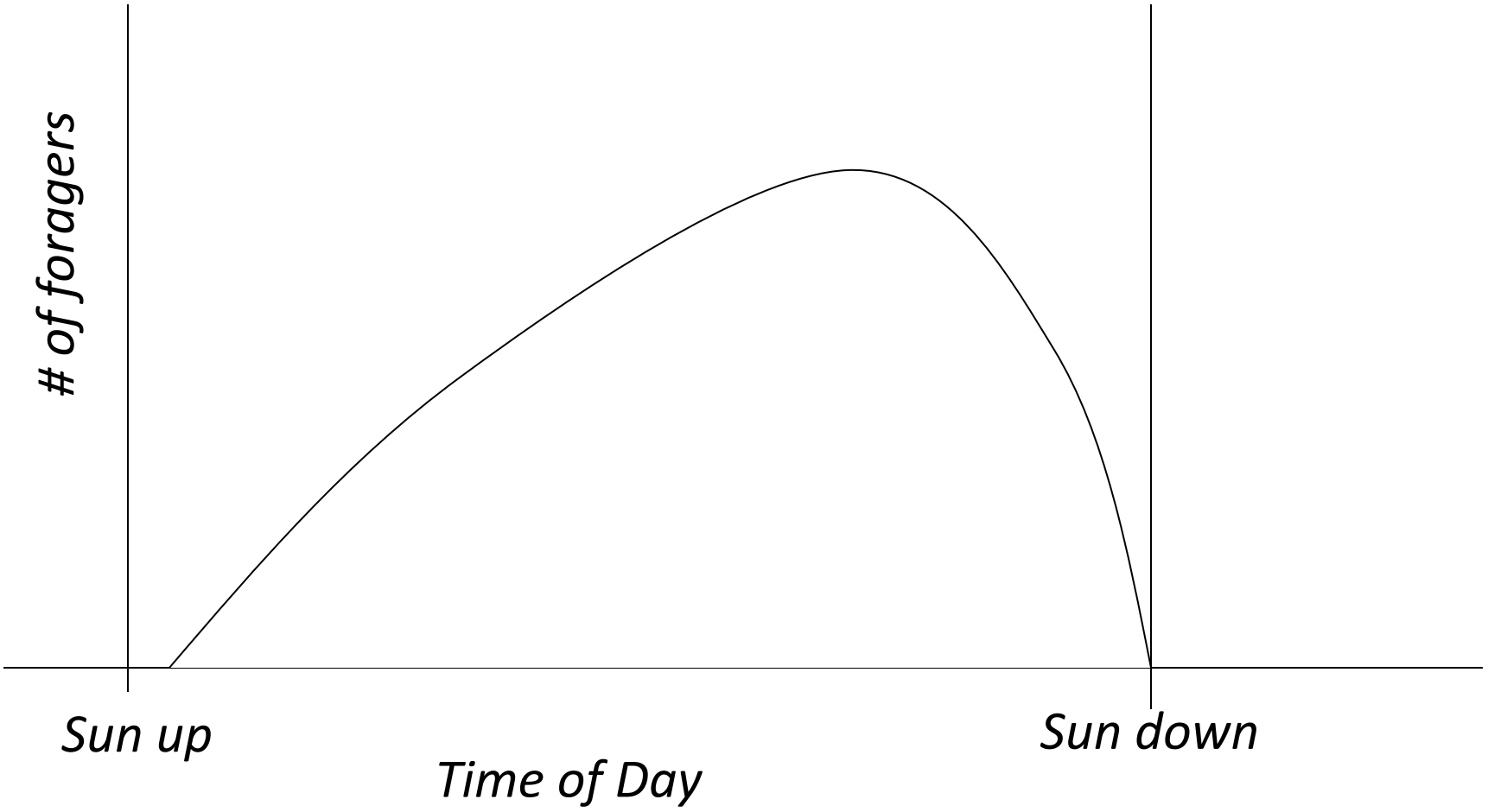
Bees may collect nectar from soybeans in MN only when hot and humid

Bees forage 2.5 miles from colony, on average

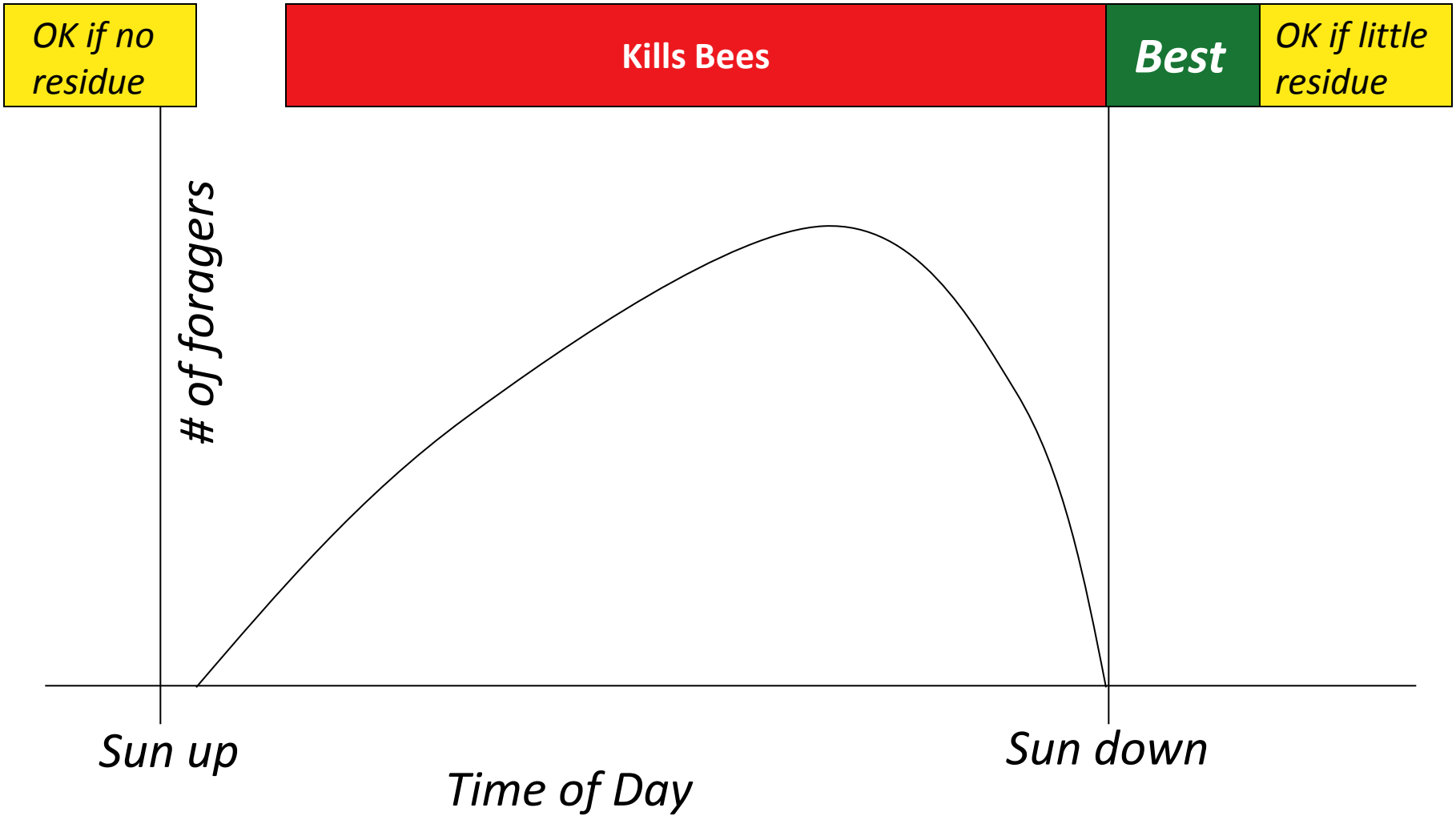


Number of foragers vs. Time of day

Bees forage sun up to sun down,
unless it's raining



Best time for pesticide application: Dusk to Dawn



Pesticide Kills

Foragers can be killed from direct application or residue

Older pesticides and toxicity

Carbamates

Pyrethroids

OPs

- Most organophosphate and carbamate insecticides are highly toxic to bees
- Pyrethroids tend to be less harmful in the field due in part to shorter residual effect and repellency

Some pesticides carried back with pollen (or as dust) and stored in hives.

Residue kills bees in colony later on (Penncap, Sevin)

Restricted Entry Intervals - REI

The shorter the REI, the better for bees

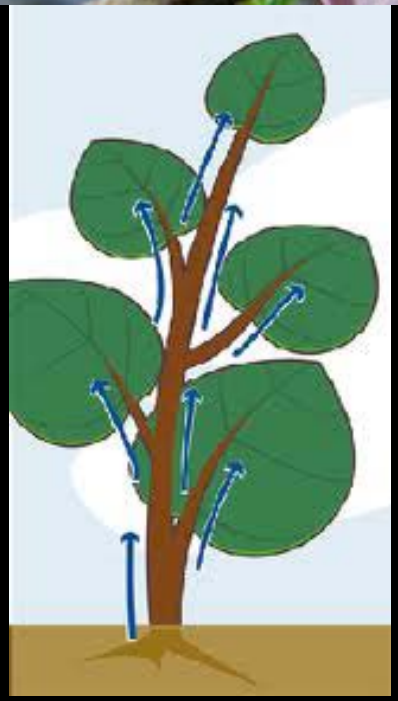
Ambush, Asana, Pounce (pyrethroids)	12 h
Furadan, Lannate (carbamates)	48 h
Penncap-M (OP)	4 days
Lorsban (OP)	24 h

Toxicity

- Unusually low temperatures at time of application may cause insecticides to remain toxic up to 20 times longer than during warm weather.

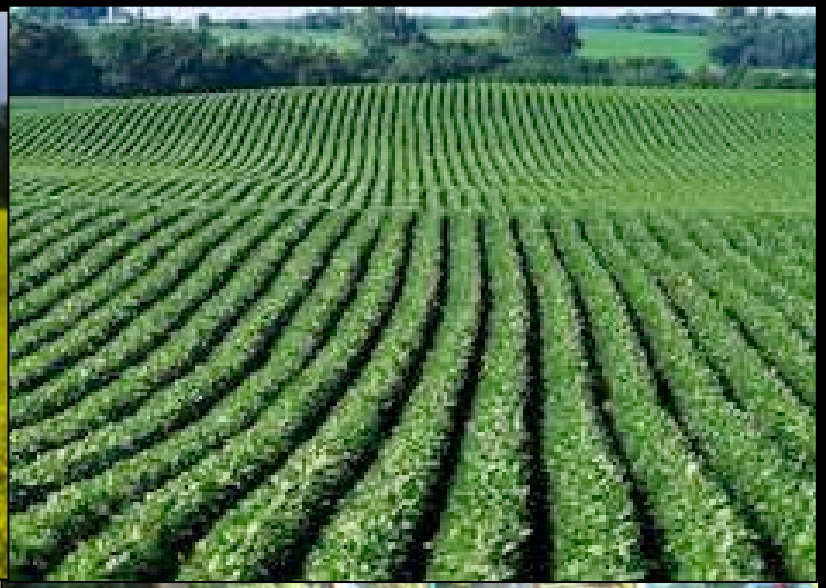
- Cloud cover also may increase residual activity due to lower levels of ultraviolet light which breaks down many pesticides.

New class of insecticide: *Neonicotinoids*



Neonicotinoid systemic insecticide

Neurotoxin: binds to and stimulates nicotinic acetylcholine receptors



Neonicotinoids

Chemical	Trademark Names Agricultural Use
imidacloprid	Admire, Gaucho, Imicide, Provado, Macho, Malice, Sepresto, Widow, Wrangler
thiamoxetham	Actara, Adage, Cruiser, Centric, Platinum
acetamiprid	Assail, Tristar
clothianidin	Arena, Poncho, Clutch, Belay,
thiacloprid	Calypso
dinotefuran	Venom, Scorpion

Neonicotinoid Application

- Seed treatment
- Foliar spray
- Soil application
  - Granular (urban)
  - Ground drenches
- Chemigation
- Tree injections

Are neonicotinoids killing bees?

A Review of Research into the Effects of Neonicotinoid Insecticides on Bees, with Recommendations for Action

Xerces Society for Invertebrate Conservation

www.xerces.org

Label is the Law

However……

- Current labeling does not necessarily protect bees

- Use caution

Honey Bee Toxicity Groups and Cautions

Toxicity Group	Precautionary Statement if Extended Residual Toxicity is Displayed	Precautionary Statement of Extended Residual Toxicity is not Displayed
I Product contains any active ingredient with acute LD50 of 2 micrograms/bee or less.	This product is highly toxic to bees exposed to **direct treatment or residues** on blooming crops or weeds. **Do not apply** this product or allow it to drift to blooming crops or weeds **if bees are visiting** the treatment area.	This product is highly toxic to bees exposed to **direct treatment** on blooming crops or weeds. **Do not apply** this product or allow it to drift to blooming crops or weeds **while bees are actively visiting** the treatment area.

Honey Bee Toxicity Groups and Cautions

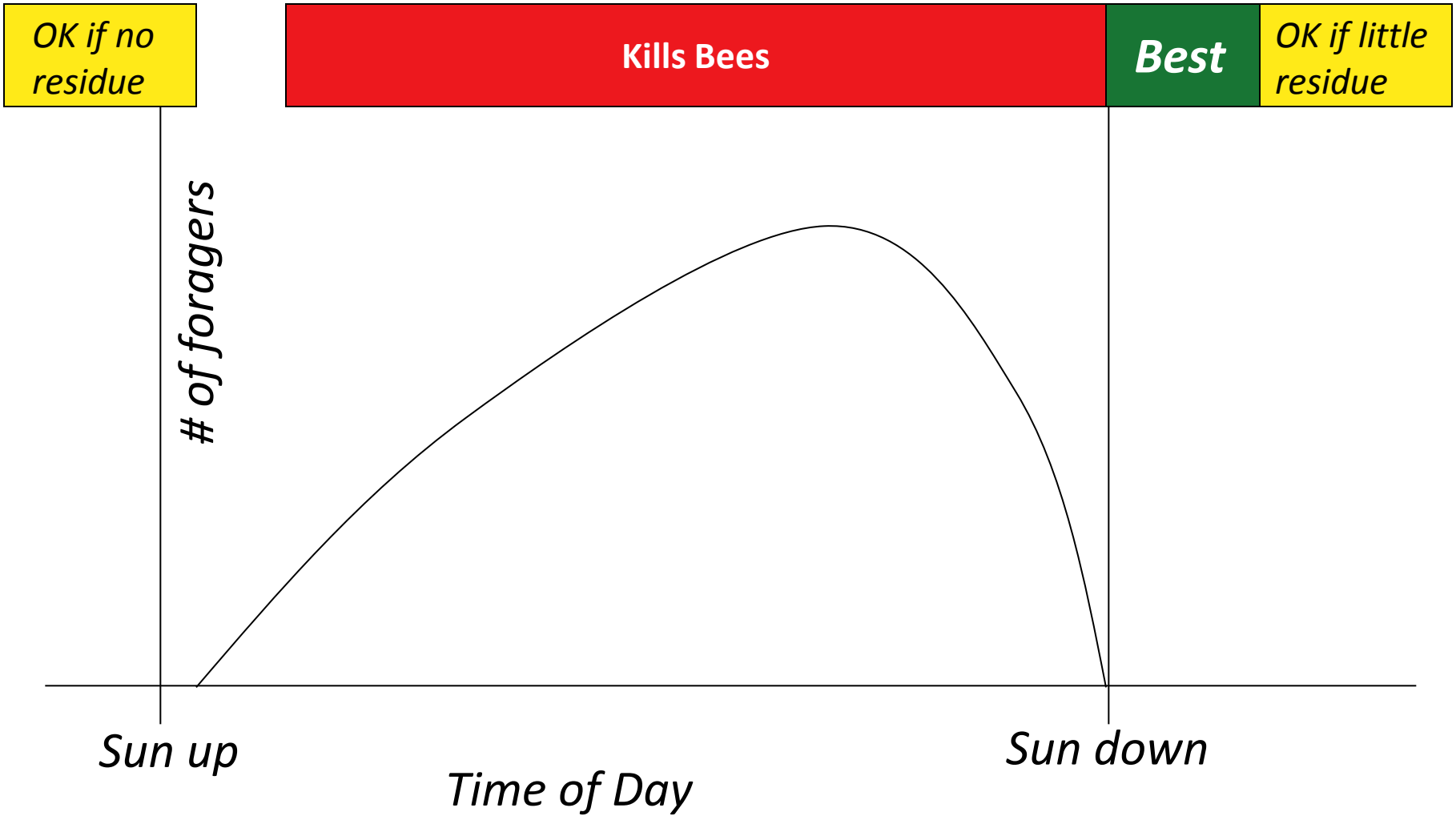
Toxicity Group	Precautionary Statement if Extended Residual Toxicity is Displayed	Precautionary Statement of Extended Residual Toxicity is not Displayed
II Product contains any active ingredient(s) with acute LD50 of greater than 2 micrograms/bee but less than 11 micrograms/bee.	This product is toxic to bees exposed to direct treatment **or residues** on blooming crops or weeds. **Do not apply** this product **if bees are visiting** the treatment area.	This product is toxic to bees exposed to direct treatment. **Do not apply** this product **while bees are actively visiting** the treatment area.
III All others.	No bee caution required.	No bee caution required.

Reducing bee kill

- Choose pesticides with LOW toxicity and LOW residue
- Do not spray on blooming plants while bees are foraging
- Do not allow spray to drift on blooming plants
- Pay attention to use and dose of neonicotinoids
- It is best to spray in evening or early morning

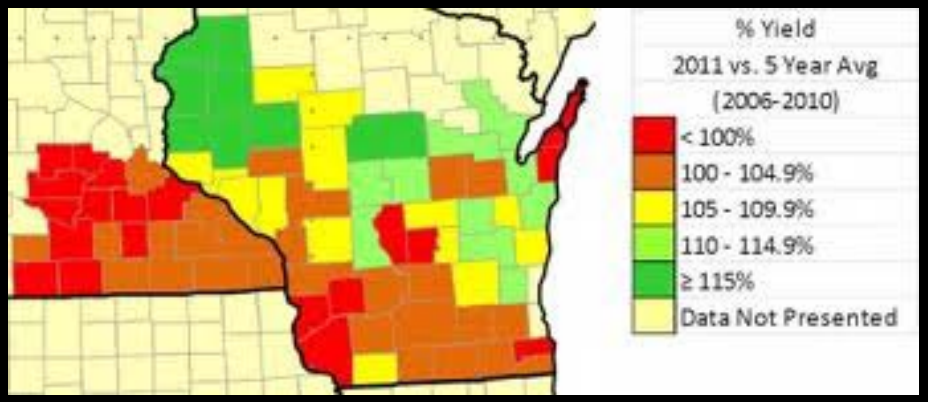
Application times

Dusk to Dawn, unless it's raining



Communication and Cooperation

- Beekeepers in MN do not like to reveal apiary locations
- Bees fly over 2 miles
- Beeekeepers working on a “heat map” to indicate number of colonies per county and list of contacts



Driftwatch.org

Registry of Pesticide-sensitive Areas

*Drift*Watch(TM) is a tool to help protect pesticide-sensitive crops and habitats from the drift that sometimes occurs during spray operations.

afari File Edit View History Bookmarks Window Help

DriftWatch Minnesota – Map

http://minnesota.agriculture.purdue.edu/applicators.html

Google

One Stop Home | Healthy Bees course | Entomology | Bee Lab | library | Bookmarks | News | Apple | Google Maps | YouTube | Wikiped

print screen – spiva001@umn.edu... | University of Minnesota – Calendar | DriftWatch Minnesota – Map

Locate Field by address, town, or zipcode

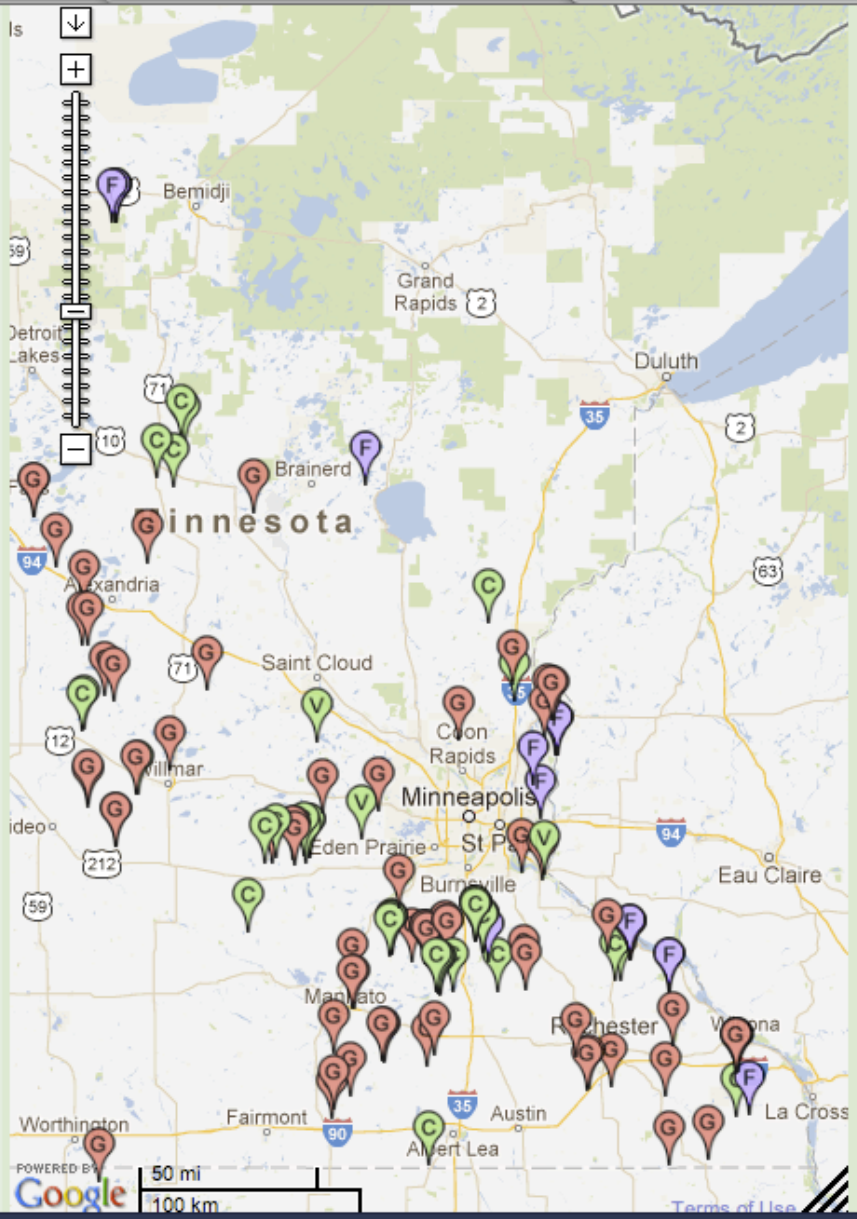
Search

These data are meant to facilitate communication between applicators and growers.

Note: bounding lines indicate approximate positions of sensitive lands submitted to the site, not property lines. Disclaimer

Map Data Layers

- ☐ Display county lines.
- ☐ Display Wisconsin DriftWatch



Specific Crops:

- ☑ Fruits
- ☑ Vegetables
- ☑ Grapes
- ☑ Pumpkins or Melons
- ☑ Tomatoes
- ☑ Certified Organic
- ☐ Christmas Trees

☐ All

What can the public do?

Plant flowers!

www.xerces.org/pollinator-conservation/

- Pay attention to neonicotinoid systemic insecticide use, especially in urban landscapes!
- Plant bee gardens
- Encourage roadside plantings of flowers
- CRP land: put legumes in mix