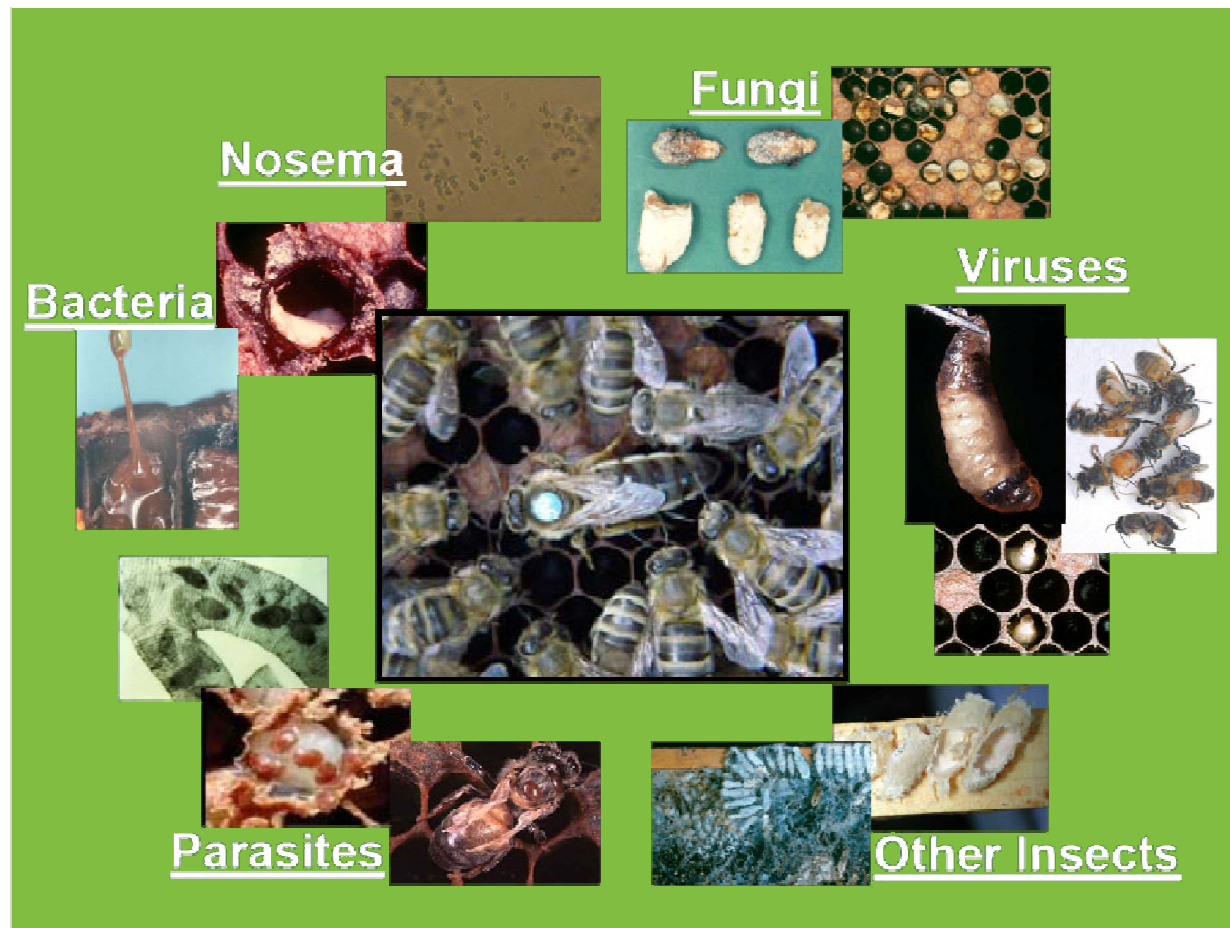


5 Million Colonies

2 Million Colonies

Apiary Industry Under Siege From Pests, Diseases and Now Something Called CCD



Honey Bee Colony Mortality

2006 – 2007	32%
2007 – 2008	36%
2008 – 2009	29%
2009 – 2010	31%
2010 – 2011	30%
2011 – 2012	25%
2012 – 2013	31%
2013 – 2014	23%

Agricultural Acres Planted With Pollinator Dependent Crops Has outpaced the availability of Pollinators.



Colony Losses

- » Globalization and Homogenization of pests, predators, parasites, diseases and honey bees
- » Production Agriculture
- » Production Bee Keeping
- » Pesticide misuse
- » Eliminating “productive” locations to place honey bee colonies
- » Entomophobia
- » Low Honey Prices
- » Low Pollination Prices

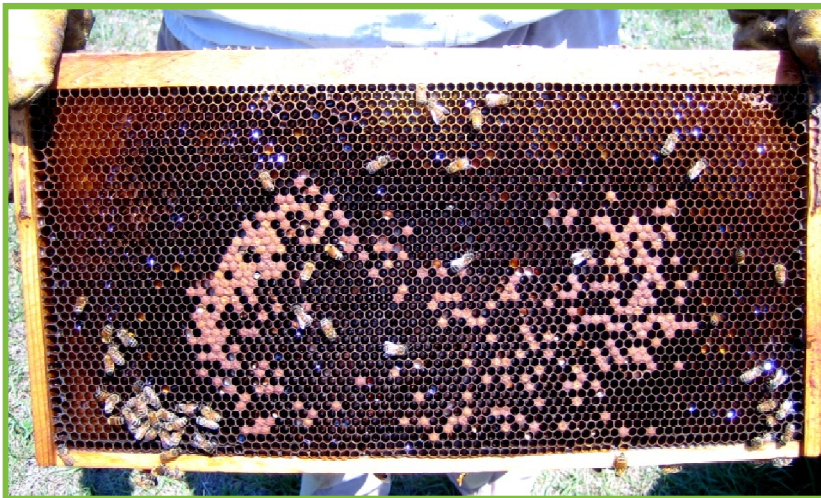
The CCD Factor



D. vanEngelsdorp



N. Rice



D. vanEngelsdorp



N. Rice

Symptoms CCD Colonies

- » The normal ratio of bees and brood in a Honey Bee colony is, in a rough general sense, 2 adult Honey Bees to 1 cell of sealed brood
- » When the ratio reverses to 1 adult Honey Bee to 2-3 cells of sealed brood...this is the latest definition of CCD

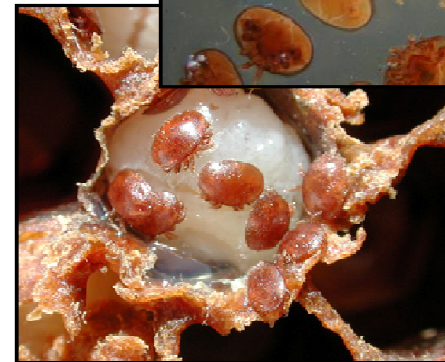
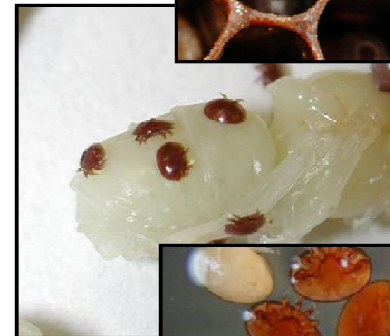
D. vanEngelsdorp



Symptoms CCD Colonies

- » The queen is always present
- » Have a very low number of varroa or absence of varroa tracheal mites are found in less than 10% of samples
- » Nosema is found in less than 50% of samples

The Parasitic *Varroa* Mite



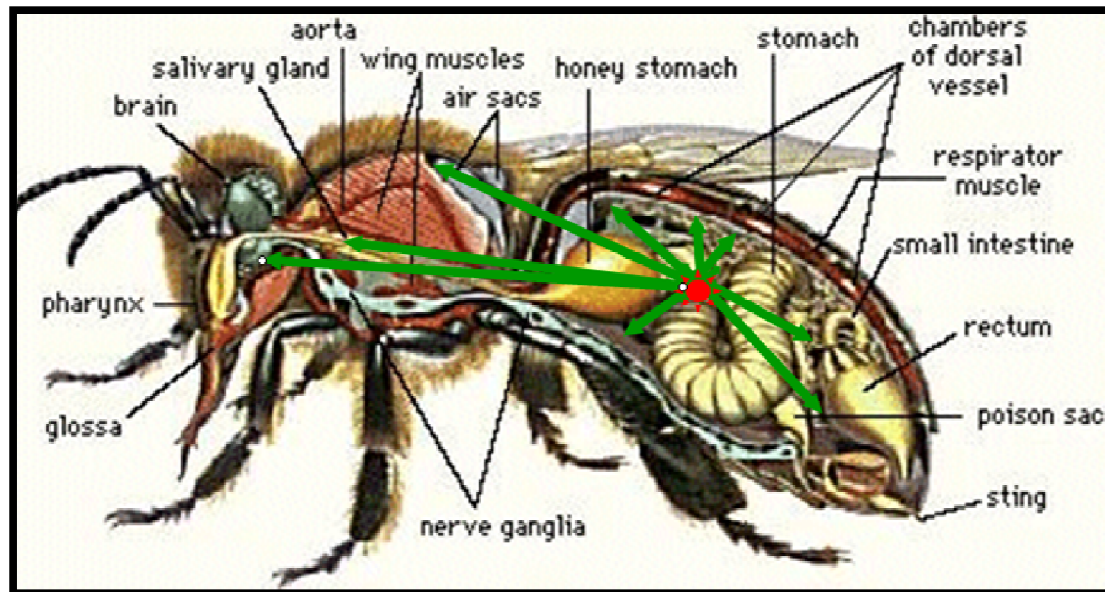
» Think of Varroa as a dirty needle



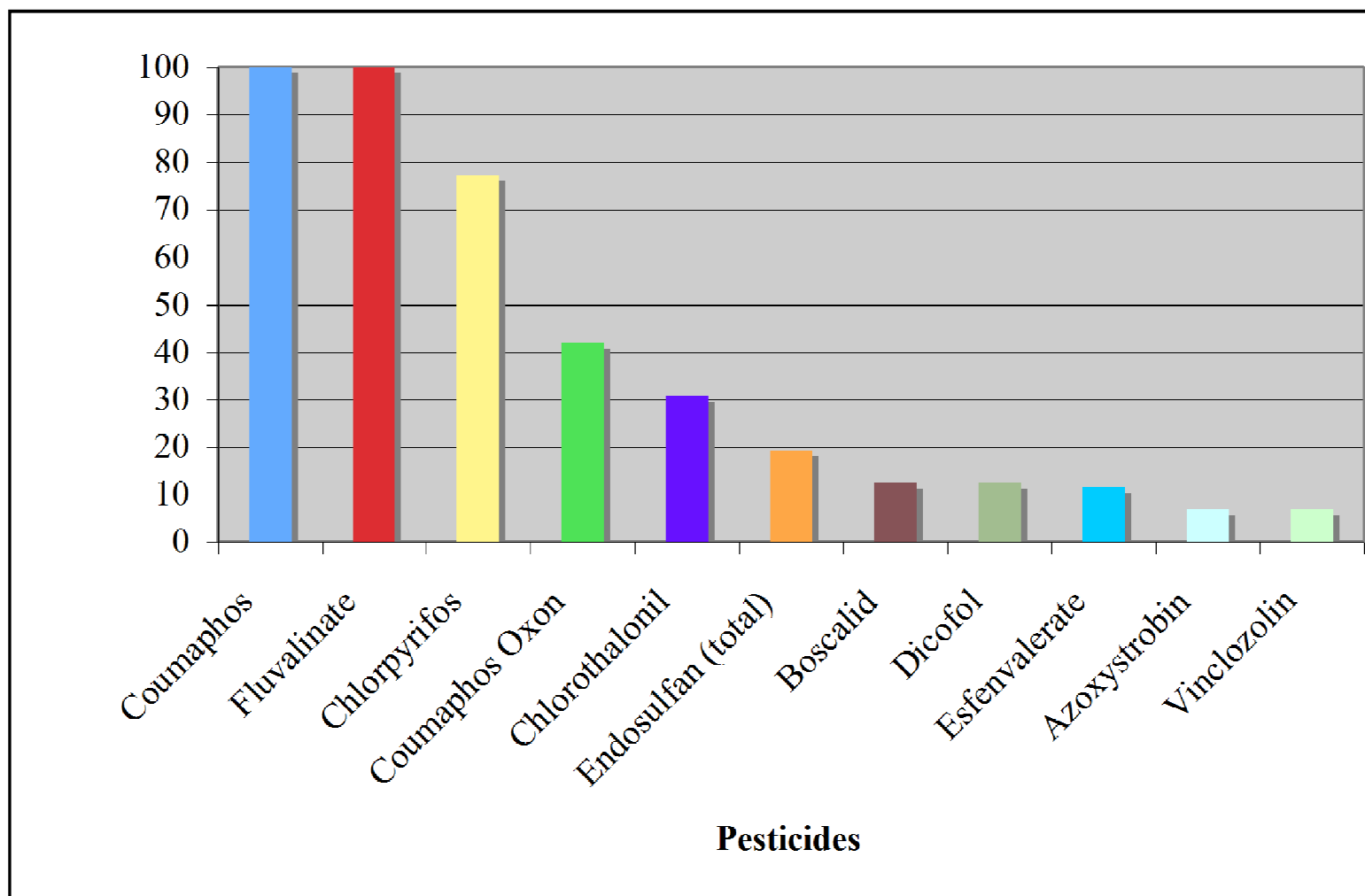




Beekeeper Chemicals



Chemical Residue in wax

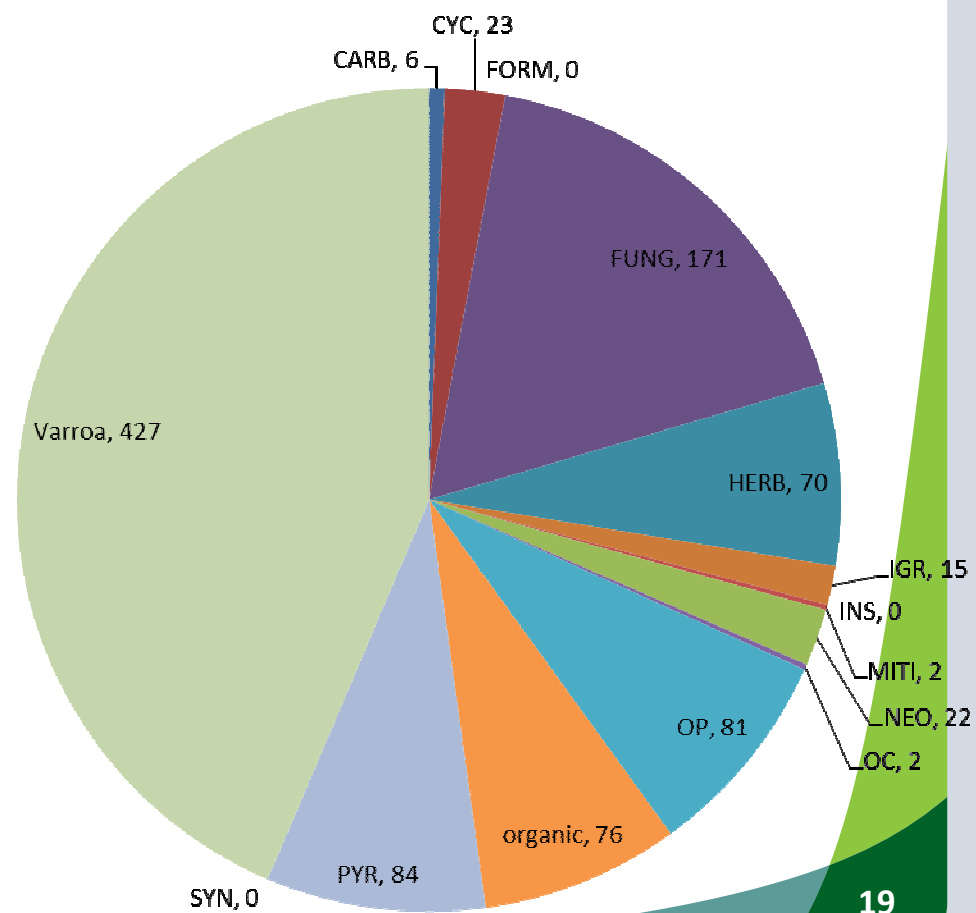


Honey Bees . . . Flying Dust Mops

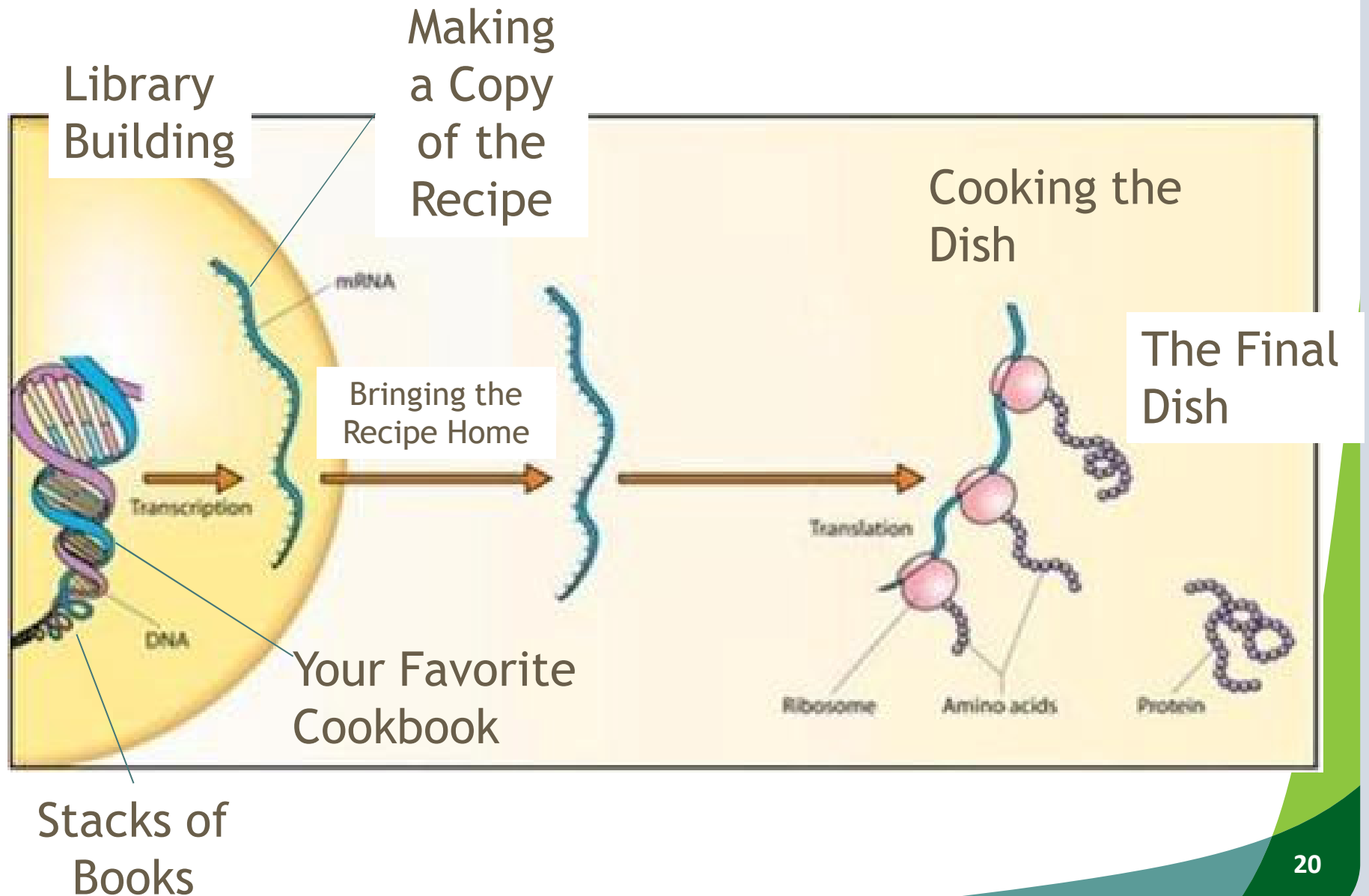




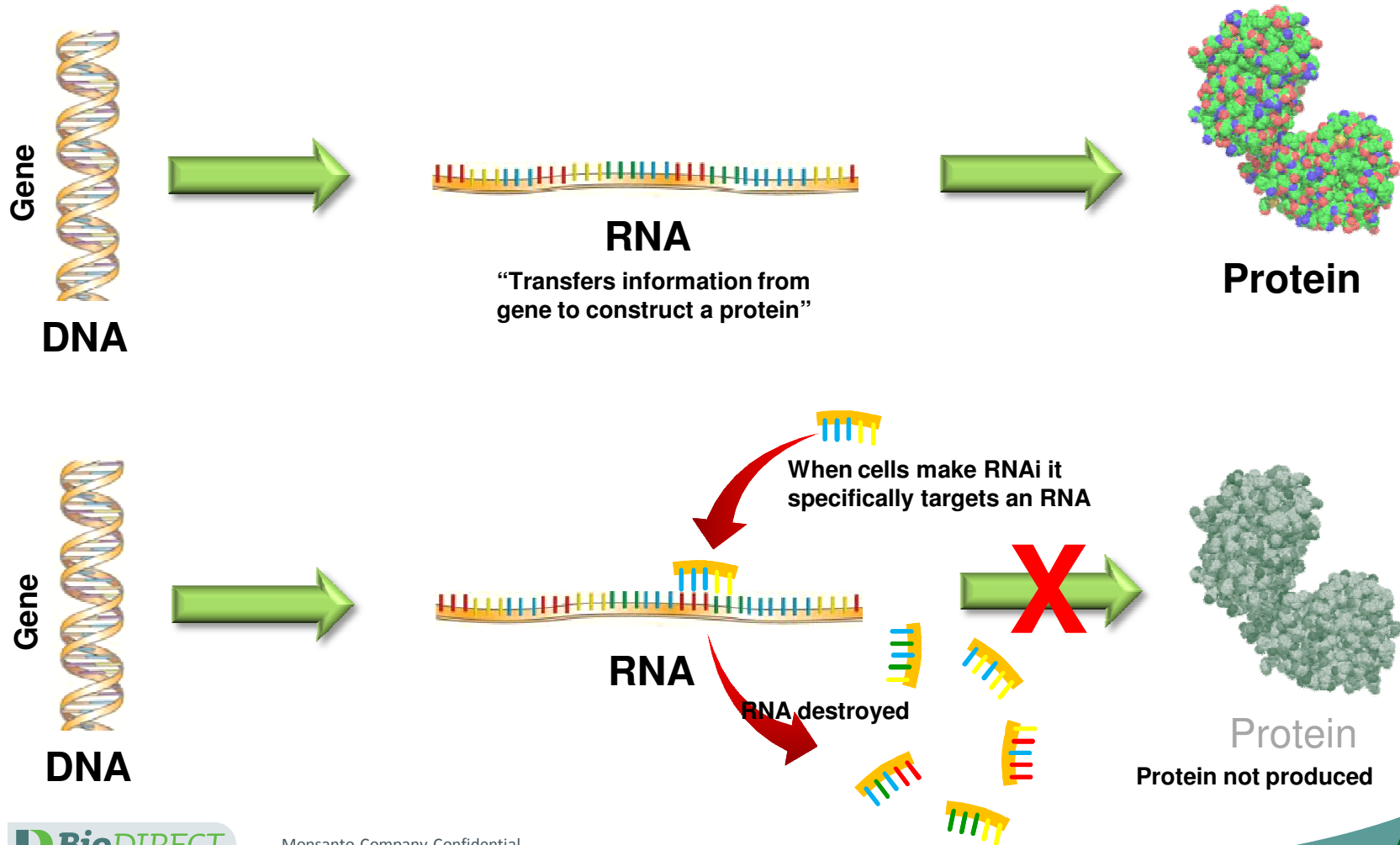
Pesticides



The Central Theme of Molecular Biology



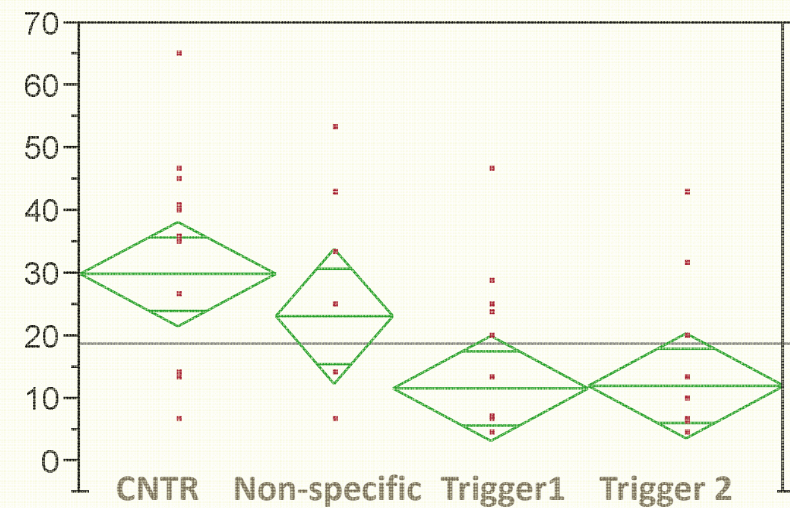
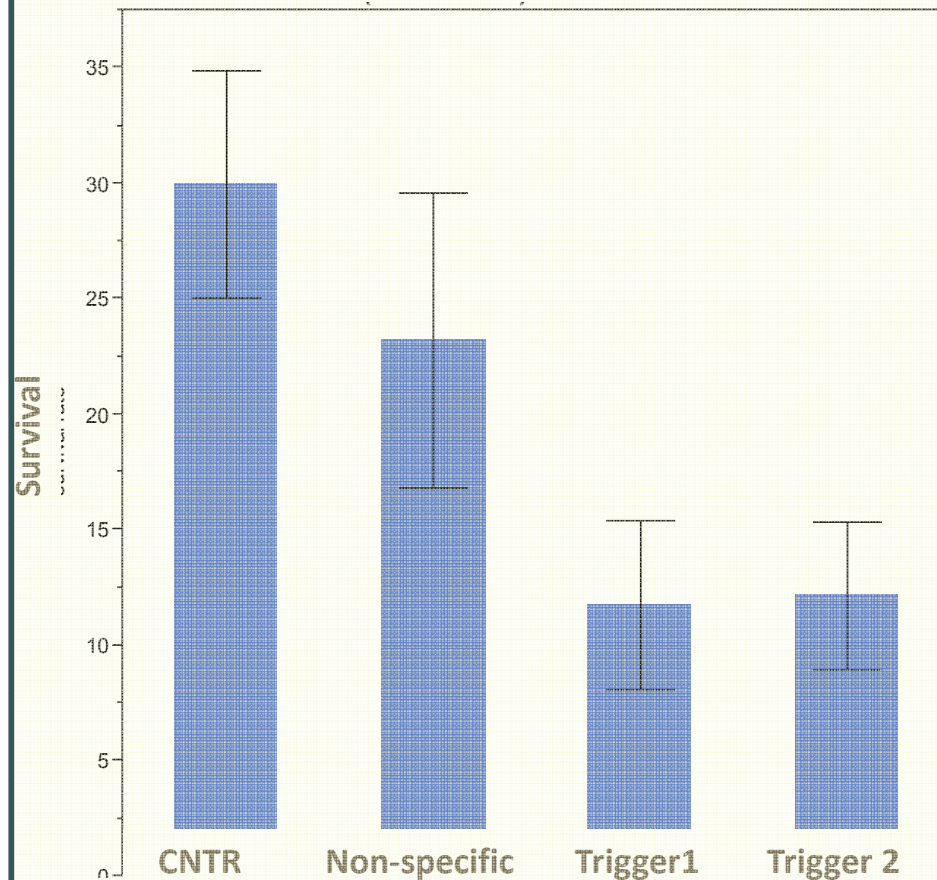
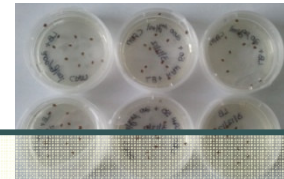
RNA Interference (RNAi) is a Natural Mechanism to Control the Expression of a Gene



BioDirect

Varroa mortality

Varroa mortality at 5 days



Area of Focus

Honey Bee Health Challenges

Primary Stress

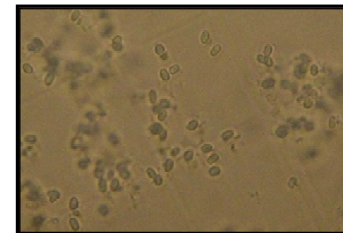


Varroa Mites



Management Nutrition Pesticides

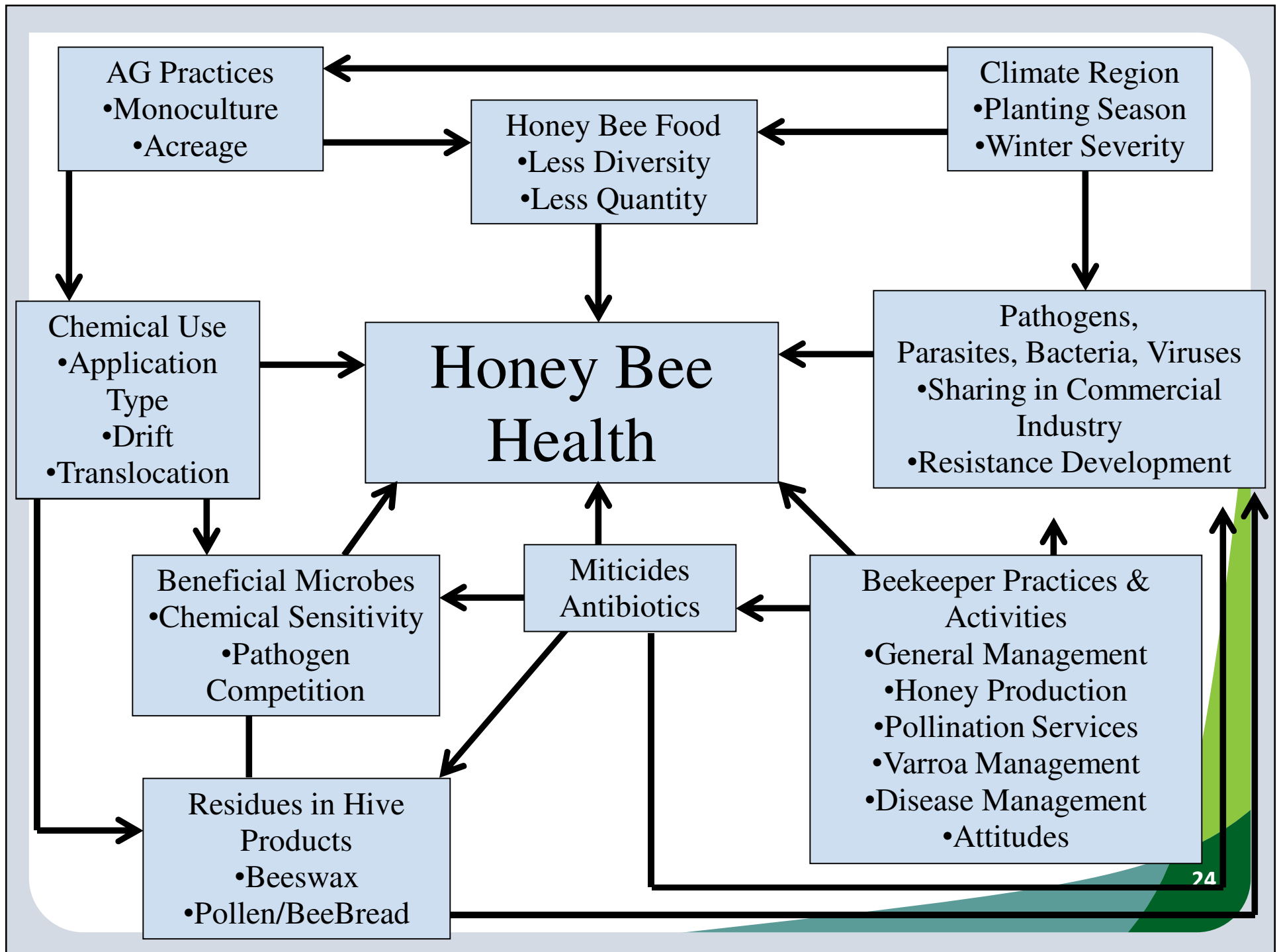
Secondary Pathogens



Nosema



Fungi





Ecosystems Stability

- Complex relationships
- Interconnected elements
species, water, soil
- All groups/guilds are important
and play critical roles
- Balanced equilibrium

ALSO

Dynamic; can change, respond
to and often recover from
negative inputs or damage

Honey Bee Colony

“Ecosystems”



S. Camazine

- Complex relationships
 - Interconnected elements
 - queens, workers, comb, food resources
 - Groups/castes play critical roles
- Balanced equilibrium

ALSO

Dynamic; can change, respond to
and often recover from negative inputs





Monsanto's Honey Bee Advisory Council (HBAC)

- » Dr. Dennis Van Engelsdorp, University of Maryland
- » Dr. Diana Cox-Foster, Penn State University
- » David Mendes, Commercial Beekeeper, Past Pres. ABF
- » Gus Rouse, Honey Bee Queen Breeder, Pres. Kona Queens
- » Larry Johnson, Commercial Beekeeper
- » Pete Berthelsen, Pheasants Forever



Project Apis m.



MONSANTO



The PAm-Monsanto
Partnership on
Honey Bee Forage
Update Oct 26, 2012

© 2012 Heintz

Honey Bee Health Summit

- 70 Leaders in;
- PAm
- HBAC
- Research
- Industry
- Nat. Association
- USDA
- EPA
- University's
- Big Ag.
- Production Agriculture



Go to <http://beeologics.com> to see all the Summit Presentation Videos

Monsanto Announces Clinton Global Initiative Commitment on Honey Bee Health

Oct 10. 2013

» Monsanto Announces Clinton Global Initiative Commitment on Honey Bee Health

- » ST. LOUIS--(BUSINESS WIRE)--Monsanto recently announced its commitment to honey bee health at the 2013 Clinton Global Initiative Annual Meeting. The multi-stakeholder coalition will include individuals involved in honey bee health as well as new stakeholders, which include agriculture commodity groups, industry groups, government agencies, environmental NGOs, and agriculture companies, all focused on improving honey bee health.
- » **The coalition will have four priority areas of focus: 1) improving honey bee nutrition; 2) providing research investment in novel technology for varroa and virus control; 3) understanding science-based approaches to studying pesticide impacts on honey bees and increasing awareness of pesticide best management practices among growers and beekeepers; and 4) enabling economic empowerment of beekeepers.**
- » “One-third of our diet is made up of vegetables, fruits and nuts that depend on pollinators like honey bees,” said Jerry Hayes, Monsanto’s Commercial Bee Health Lead. “Honey bees play an essential role in ensuring crop yields – a critical need for global food security. The coalition will take an action-oriented approach to improve and sustain honey bee health.”
- » A significant decline in the honey bee population is posing a threat to agricultural sustainability and food security, as well as to ecosystem health and biodiversity. In the United States, beekeepers have seen an average winter loss of more than 30 percent of honey bee colonies every year since 2006 as a result of CCD (Colony Collapse Disorder), a phenomenon in which bees disappear abruptly from an otherwise healthy colony. The low survival rate of honey bee colonies is leading to a significant decline in the overall honey bee population. Historically, approximately 6 million colonies existed in the United States; today approximately 2.5 million colonies exist.
- » Monsanto has been involved with bee research since 2011 when it acquired Beeologics, an organization focused on researching and testing biological products to provide targeted control of pests and diseases in order to provide safe, effective ways to protect the honey bee. Monsanto also has collaborated with PAm to assist in forage projects in order to provide more nutritious food for bees, and is doing extensive research on the varroa mite, which may be one factor in the decline of honey bee health.
- » Additional information about the challenges facing honey bees and Monsanto’s commitment to improving honey bee health can be found on Monsanto’s. www.beeologics.com



Honey Bee Health Coalition

» *Healthy Bees, Healthy People, Healthy Planet*

Honey Bee Health Coalition

Our mission is to **collaboratively implement solutions** that will help achieve a **healthy population of honey bees** while also supporting healthy populations of native and managed pollinators in the context of **productive agricultural** systems and **thriving ecosystems**.

We're working toward:
HEALTHY BEES, HEALTHY ENVIRONMENT, HEALTHY PEOPLE

Honey Bee Health Coalition Members

Coalition members work across the full food value chain.



AGRICULTURAL RETAILERS ASSOCIATION

ALMOND BOARD OF CALIFORNIA

AMERICAN BEEKEEPING FEDERATION

AMERICAN HONEY PRODUCERS ASSOCIATION

AMERICAN SEED TRADE ASSOCIATION

BAYER CROPSOURCE

BROWNING HONEY COMPANY

CANADIAN HONEY COUNCIL

CANOLA COUNCIL OF CANADA

CROPLIFE AMERICA

CROPLIFE CANADA

DUCKS UNLIMITED

DUPONT

EASTERN MISSOURI BEEKEEPERS ASSOCIATION

FLORIDA FRUIT AND VEGETABLE ASSOCIATION

LAND O'LAKES, INC.

MONSANTO COMPANY

* Denotes *ex officio* members

NATIONAL CORN GROWERS ASSOCIATION
NATIONAL ASSOCIATION OF STATE DEPARTMENTS OF
AGRICULTURE



OREGON STATE BEEKEEPERS ASSOCIATION

PHEASANTS FOREVER

POLLINATOR STEWARDSHIP COUNCIL

PROJECT APIS M.

SAINT LOUIS ZOO'S WILDCARE INSTITUTE CENTER FOR
NATIVE POLLINATOR CONSERVATION

SYNGENTA

UNILEVER

UNITED SOYBEAN BOARD

UNIVERSITY OF MARYLAND'S DEPARTMENT OF
ENTOMOLOGY

U.S. CANOLA ASSOCIATION

U.S. ENVIRONMENTAL PROTECTION AGENCY*

U.S. DEPARTMENT OF AGRICULTURE*

WESTERN APICULTURAL SOCIETY

Monsanto Company Confidential

Strategic Goals

- » Improve and sustain honey bee health at all levels of beekeeping
- » Identify and implement novel and proven solutions to major honey bee health challenges
- » Enhance effective communications and collaboration – among private and public sector, academic, and NGO stakeholders with vested interests in beekeeping, pollination, and agriculture production
- » Institute sound science and evidence for making decisions

Strategic Priorities

The Coalition is driving collective impact across the multiple factors that influence honey bee health:

- » **Hive Management:** Put the best available tools, techniques, and technologies in the hands of beekeepers so they can better manage their hives
- » **Forage and Nutrition:** Ensure honey bees – especially in and around production agriculture – have access to a varied and nutritious diet throughout their lives
- » **Crop Pest Management:** Control crop pests and safeguard pollinator health
- » **Outreach, Education and Communication:** Work together to improve honey bee health



Why is any of this effort important to the Beekeeping industry?

- » Honey bees play an essential role in agriculture as pollinators
- » Honey bees pollinate \$20 billion of crops in the U.S. and \$100 billion globally
- » 30 percent of U.S. honey bees lost every year during the past five years
- » Monsanto supports the development and commercialization of a solution for improving the health of honey bees
- » With the acquisition of Beeologics, Monsanto is committed to supporting the development and commercialization of products that improve honey bee health
- » Monsanto's experience in managing complex pipeline projects will be helpful in bringing Remebee products to market

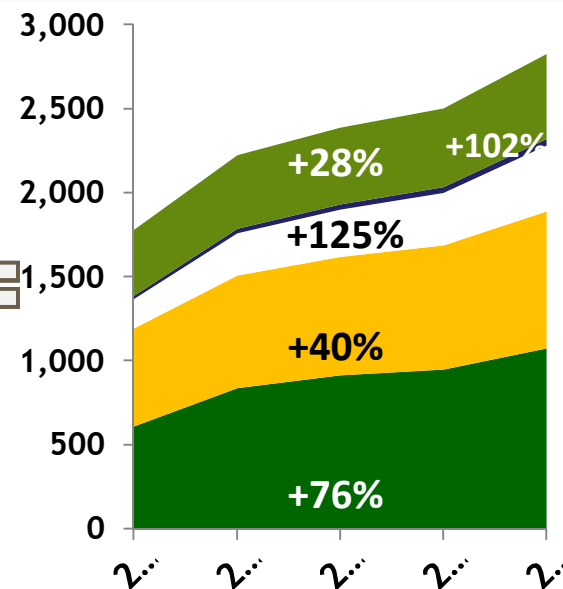
The Future: A Simple Equation with Complex Solutions

BY 2030...



TODAY + **1.4 B** + **100%** + **30%**
PEOPLE **INCREASE** **INCREASE**

■ Corn ■ Wheat ■ Soybeans ■ Cotton ■ Rice



**GLOBAL GRAIN
DEMAND (M MT)**



Monsanto Company Confidential

Source: IHS Global Insights, Agriculture Division

But Does Any of This Matter?

- » “You, Me and all of your Neighbors know food comes from the grocery store.”

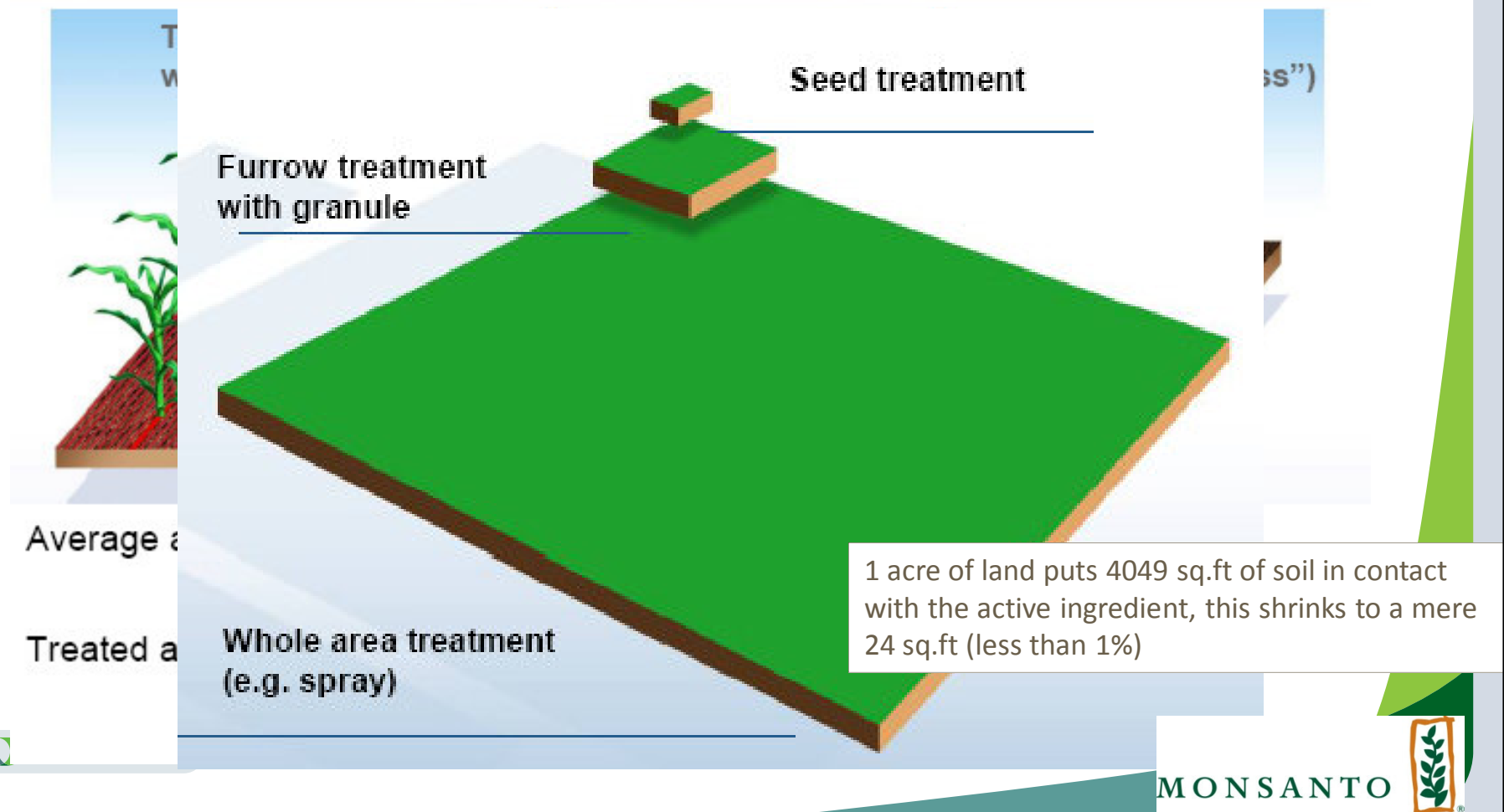


Thank You

Jerry Hayes
Honey Bee Health Lead
gerald.w.hayes.jr@monsanto.com

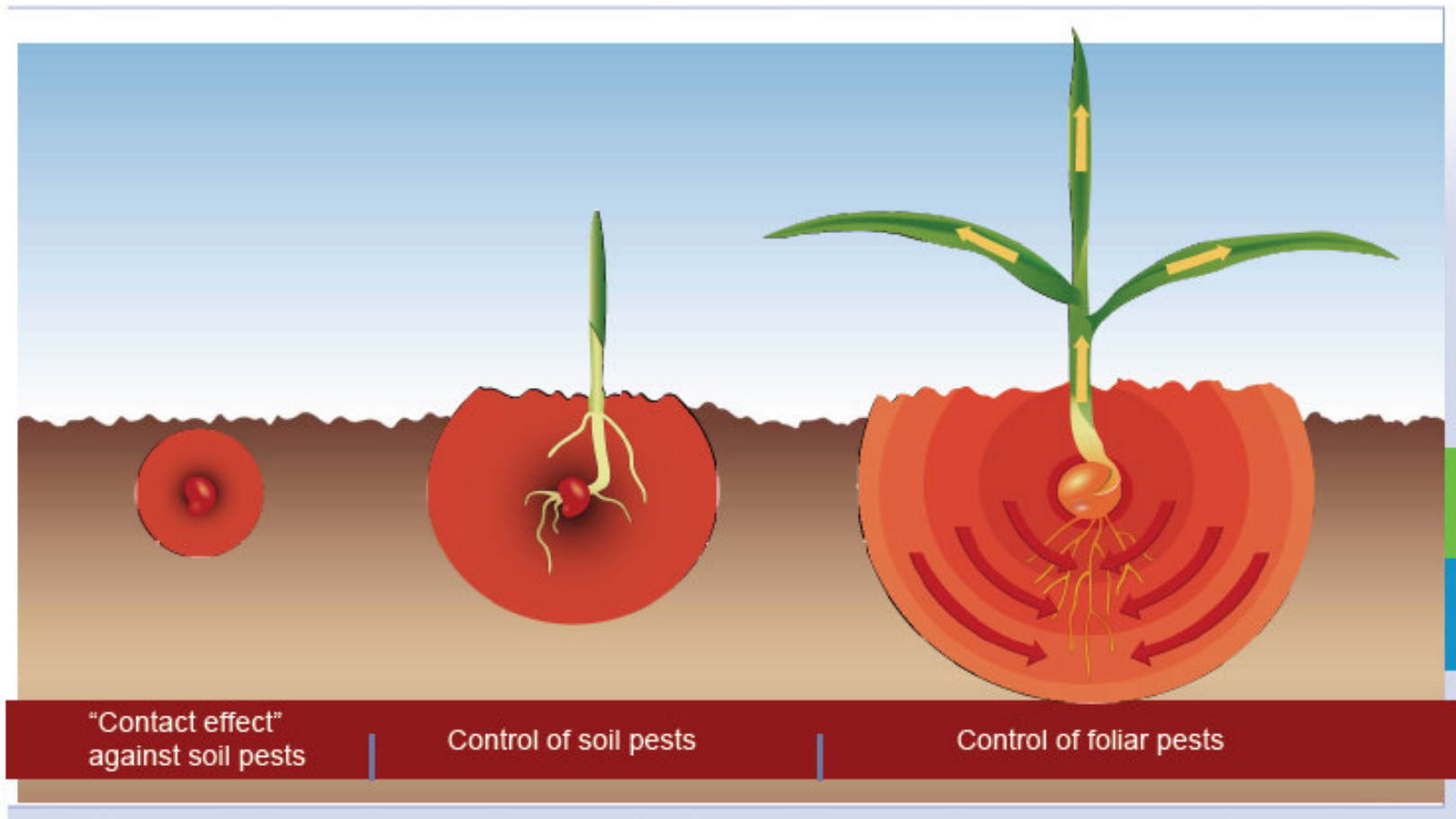
Seed Treatment Overview

Reduction in Rates and Treated Area



Seed Treatment Overview

Targeted application below surface



Acute Toxicity vs. Chronic Effects

- » **No credible scientific data demonstrates a causal link between neonicotinoids and chronic effects in bees**
- » **Acute incidents do occur and lead to increased public concern**
 - April 2008: 11,500 bee colonies suffered losses in Upper Rhine Valley in Germany
 - Application quality and use of polymer was substandard leading to higher dust levels
 - Most of the pneumatic vacuum planters used in the Upper Rhine Valley exhaust emissions upward or to the side
 - Later than normal planting window
 - Small field sizes (<10 acres) in close proximity to flowering canola crops
 - Dry weather and windy conditions led to dust drift
- » **Recent publications have again raised public concern**
 - Indiana – waste talc
 - Italy – flying through exhaust dust clouds
 - France – sugar water



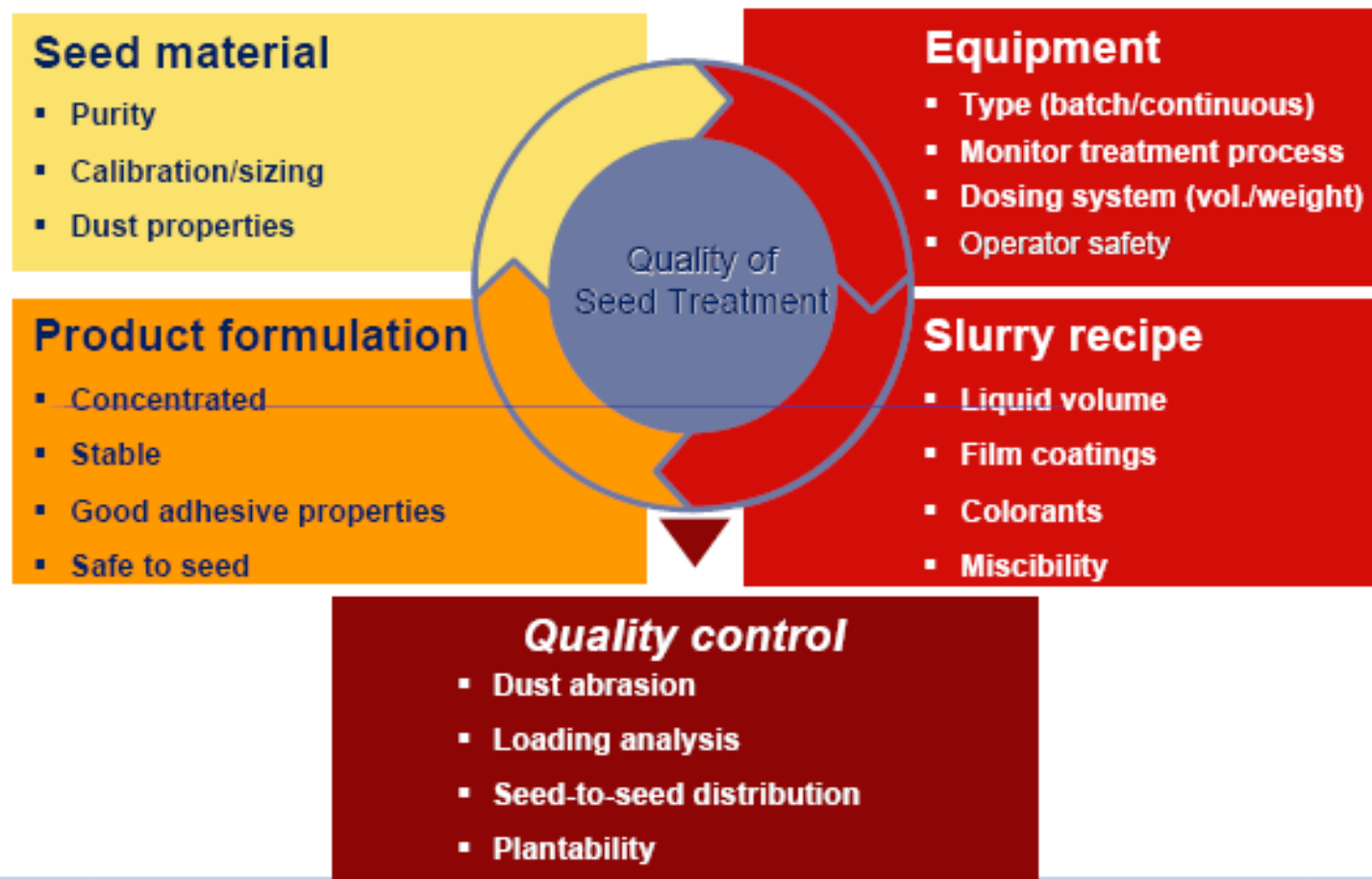
Seed Treatment Quality & Stewardship

» All aspects of the process require quality controls and appropriate stewardship

- Treatment of seed
- Testing of seed
- Seed treatment equipment
- Labeling of seed bag tags
- Transport of treated seeds
- Planting
- Disposal

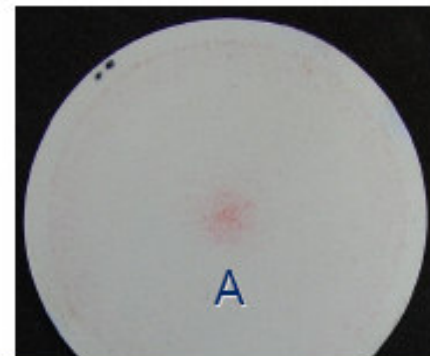


Factors Influencing Seed Treatment Quality



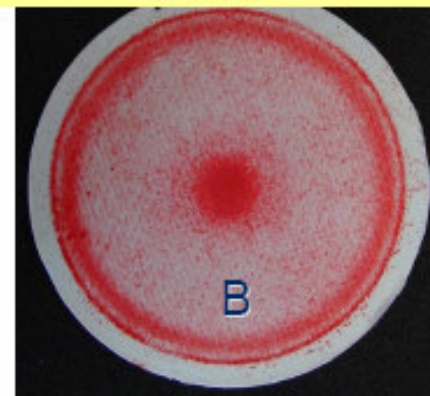
Standard Test for Dust-Abrasion

Heubach Test



A: Good ST quality sample (BCS recommended resin)

B: Bad ST quality sample from affected area in SW-Germany

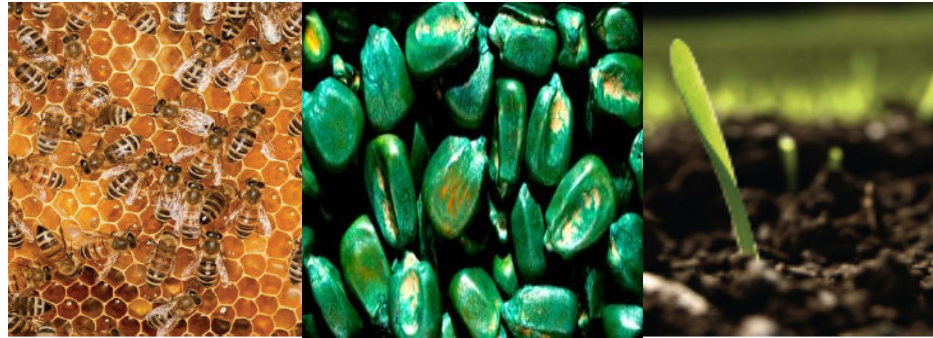


At Planting

- » Avoid off-site movement of dust from treated seeds during planting. Be aware of wind speed and direction
- » To protect birds and mammals, treated seeds must be incorporated into the soil at proper planting depth, in particular at row ends and field corners
- » Be aware of the presence of flowering crops in or adjacent to the field which could attract pollinators
- » Take appropriate precautions by following best management practices



Conclusions



- » Seed treatment is an invaluable tool in modern agriculture with many beneficial attributes
- » The assumption by many individuals that pesticides, including seed treatments, are the leading cause of colony losses and CCD is not supported by the science
- » Bee health is declining due to multiple factors
- » Seed treatment quality and good stewardship are essential to protecting seed treatments as valuable crop protection tools and the health of honey bees
- » Industry is committed to working with beekeepers, growers, government agencies and other stakeholders to improve bee health

