The Biology Behind Preparing Honey Bee Colonies for Almond Pollination

Gordon Wardell, Ph.D.

HOSTED BY:
The Almond Board of Australia

SUPPORTED BY:
Horticulture Innovation Australia Ltd

17th Australian Almond Conference

Pullman Hotel Melbourne, Albert Park, Victoria
November 8th - 10th, 2016

Dr Gordon Wardell

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Director of Pollination Operations, **Wonderful Orchards**

Gordon earned his Ph.D. in Entomology with emphasis in Apiculture at Michigan State University in 1982. Following his degree he worked for 12 years in International Apicultural Development in regions from Nepal to Fiji, with most of his time spent in Indonesia, Malaysia and Thailand helping improve beekeeping potential.

In 1988 he joined the faculty of the University of Maryland as the extension apiculturist. After moving to Arizona in 1996 he established and managed a research and development company dedicated to implementing innovative solutions to entomological and apicultural problems including the development of the honey bee nutritional supplement, MegaBee®.

In 2009 Gordon accepted a position as Director of Bee Biology with Paramount Farming Company California's largest almond grower. His duties include overseeing honey bee health and nutrition, coordinating pollination efforts for the company's almond orchards and investigating the solitary bee, Osmia lignaria, as possible pollinator of almonds.

In addition, Dr. Wardell is currently the chairman of Project Apis m, a non-profit organization dedicated to improving honey bee health and funding innovative research. He is a science advisor to the Almond Board of California and a lecturer at California Polytechnic University.

The Scope of Almonds In California

- Spanning 500 miles (800 km) throughout the Central Valley
  - 2015: 445,000 ha
- 6,800 growers
- 105 handlers
  - 67% of operations are 100A or less*
  - >90% family-owned
- ~ 2 Million Honey Bee Colonies Required to Adequately Pollinate the Crop

Osmia lignaria, Blue Orchard Bee

Pollinators of fruit and nut trees

Wonderful Orchards

- Almonds 15,000 ha
  - 70,000 Colonies
- Pistachios 17,000 ha
  - Wind Pollinated
- Pomegranates ~ 5,000
  - 13,000 colonies

Training the Inspectors

Training the Inspectors

Colony Grading

- Four teams of inspectors
- Grade 14,000 colonies in 3 weeks

Colony Rental and Incentive

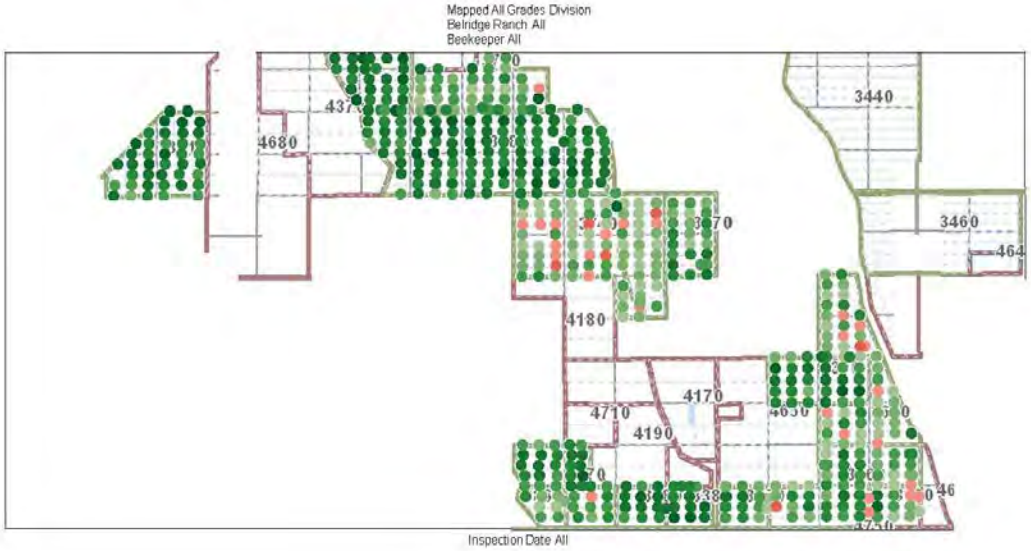
- Base Fee for an 8 Frame average
  - Five frame minimum
- Plus a Bonus Structure
- $7.50 bonus for frames 9 and 10
- $5.00 bonus for frames 11 and 12

- Total bonus for a 12 frame colony $25.00

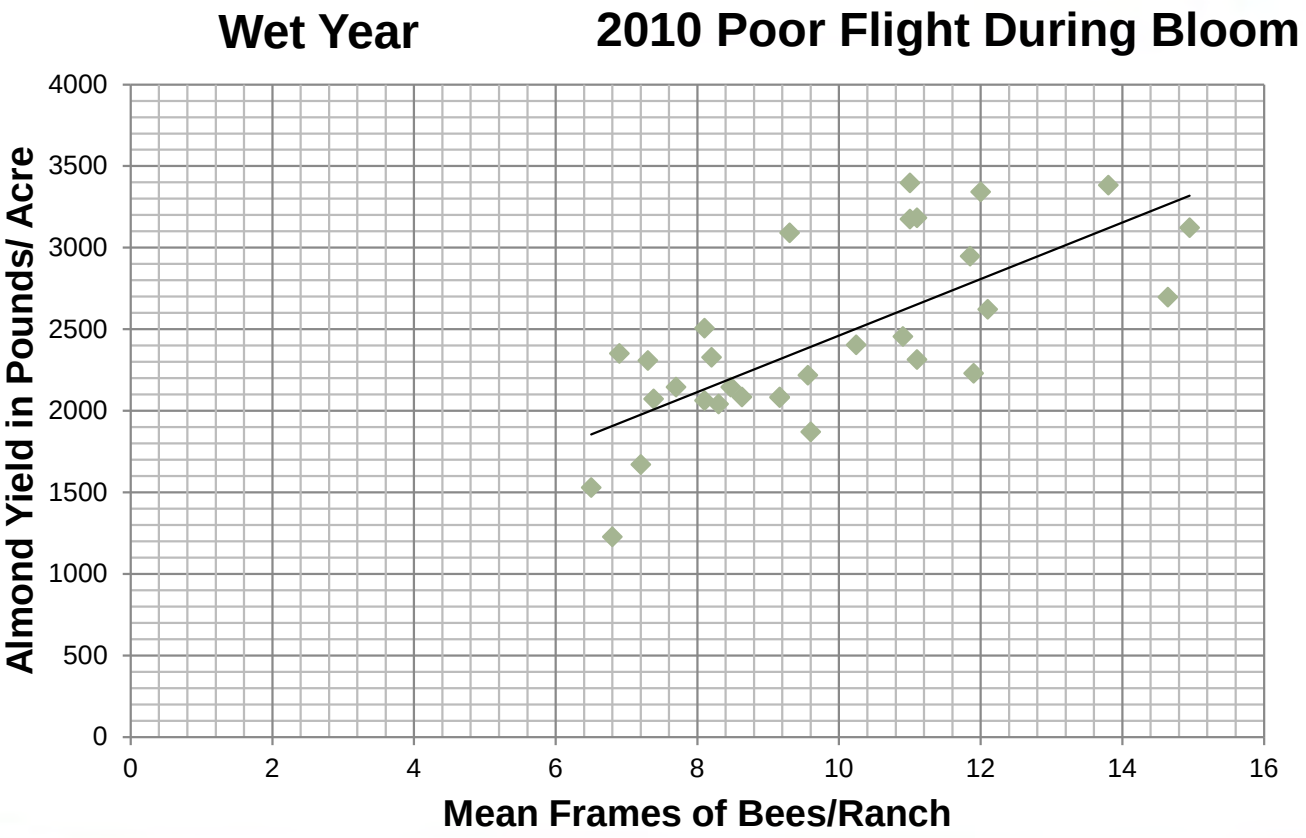
Hand Held Data Recording

Socket Data Recorder plus GPS

Grading Maps



Almond Yield vs. Colony Strength



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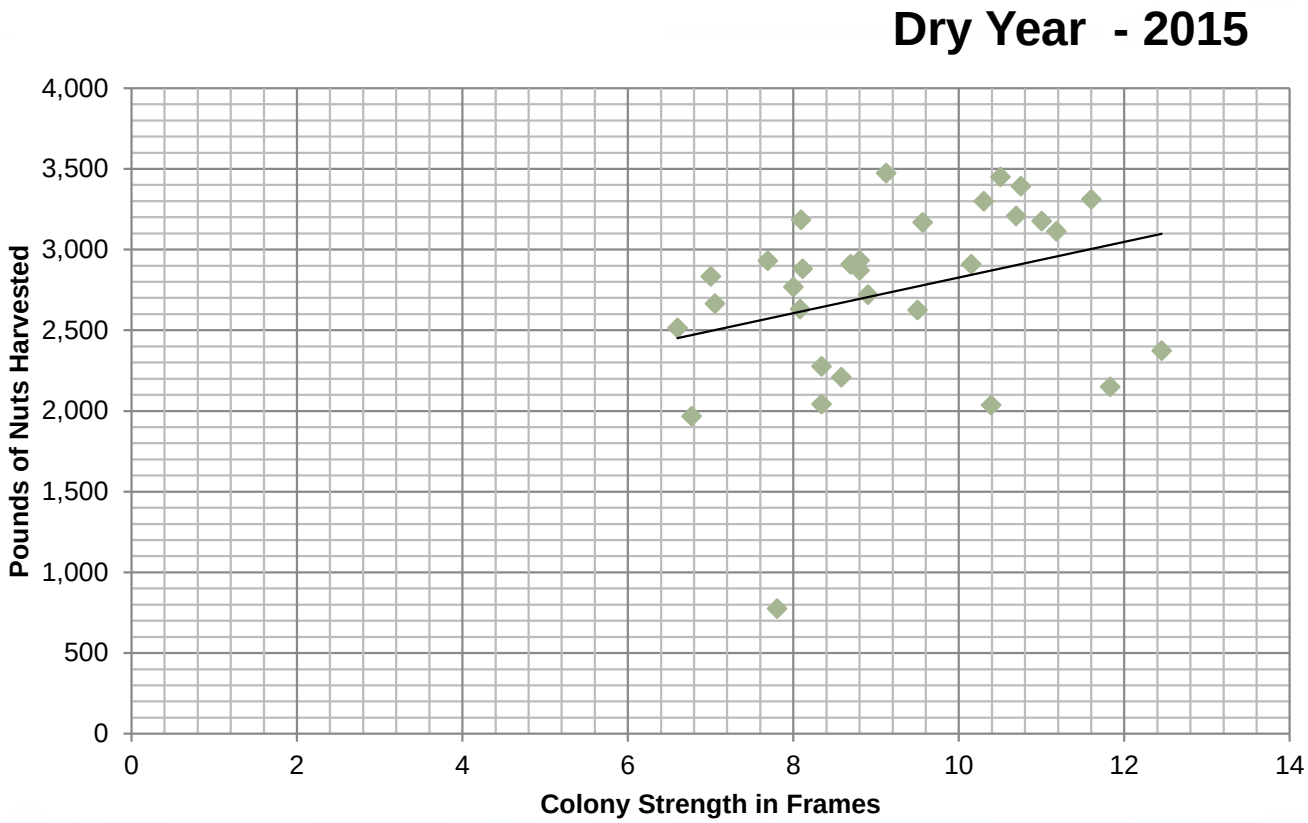

How Do We Get Robust Colonies In The Winter?

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australian almonds
ALMOND BOARD OF AUSTRALIA

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Pollen becoming bee junk food as CO_2 rises

Greenhouse gas threatens nutrition for pollinators

BY SUSAN MILIUS 7:00PM, APRIL 12, 2016

JUNK FOOD

Changes in Goldenrod, a Key Source of Honey Bee Nutrition

Rising carbon dioxide levels in the environment appear to be impacting protein levels in pollen

Lewis H. Ziska, USDA, Agricultural Research Service (ARS)
USDA Climate Hub, Beltsville, MD

Climate Change Impacts Our Bees

Rising atmospheric CO_2 is reducing the protein concentration of a floral pollen source essential for North American bees

Lewis H. Ziska, Jeffery S. Pettis, Joan Edwards, Jillian E. Hancock, Martha B. Tomecek, Andrew Clark, Jeffrey S. Dukes,Irakli Loladze, H. Wayne Polley

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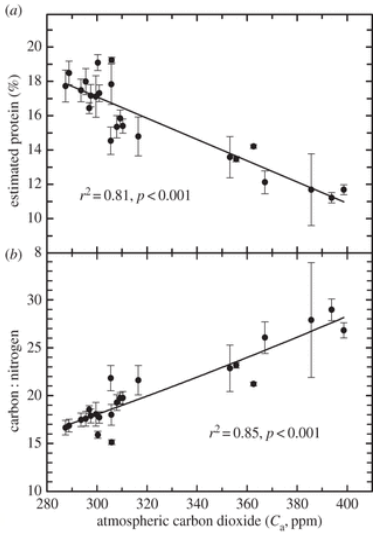


Collected: 1876

1913

2002

More Evidence – Protein Matters

RELATIONSHIPS BETWEEN CONSUMPTION OF A POLLEN SUPPLEMENT, HONEY PRODUCTION, AND BROODREARING IN COLONIES OF HONEYBEES APIS MELLIFERA L. I.

Keith M. DOULL 1980

TABL. 1. – *Relationships between consumption of a commercial pollen supplement and honey production in honeybee colonies. Means per colony of five colonies in each group.*

	Treatment Colonies	Control Colonies	L.S.D. $P = 0.05$
No. of bees reared	167,849	149,931	N.S.
Honey/colony (kg)	344.586	249.7	83.625
Honey/bee (g)	2.05	1.66	.35
Area of stored pollen (dcm^2)	394.56	299.6	N.S.
Supplement + consumed (mg/bee)	30.2	–	

So What's going on here?

Holding Yard Lost Hills, CA

Holding Yard Lost Hills, CA

Life in the Colony

A Little Bee Biology

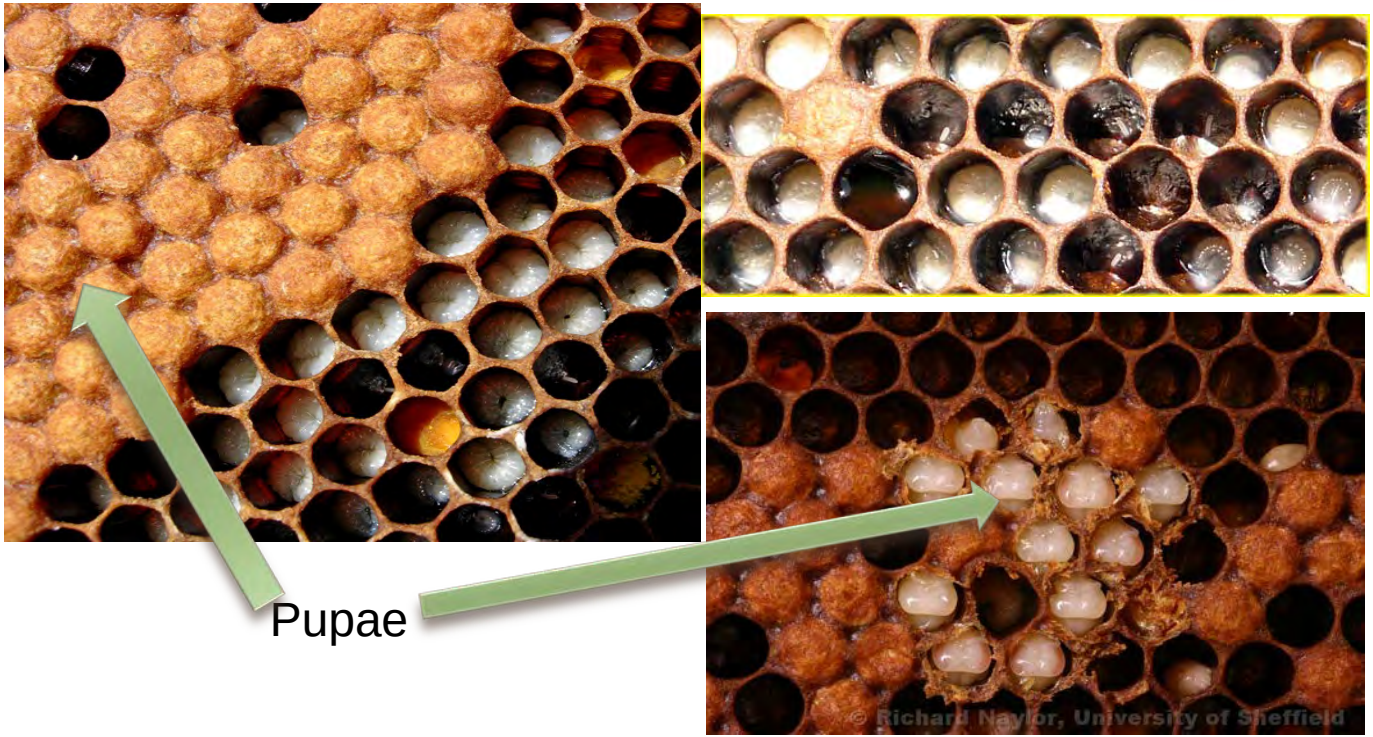
Three Distinct Populations in a Colony

- The Immature Bees (Brood)
  - Eggs, Larvae, Pupae
- The Hive Bees
  - Nurse Bees, Hive Cleaners, Wax Builders, Honey and Pollen Processers, Undertakers and Guards (stay in the hive ~ 4 weeks)
- Field Bees (Foragers)
  - Pollen Foragers, Nectar Foragers, Water Foragers, Propolis Foragers (live span ~ 2 weeks)

The Queen

Eggs and Larvae

Honey Bee Brood



Nurse Bees

Nectar Working Bees

Undertaker Bees

Guard Bees

Pollen Trap

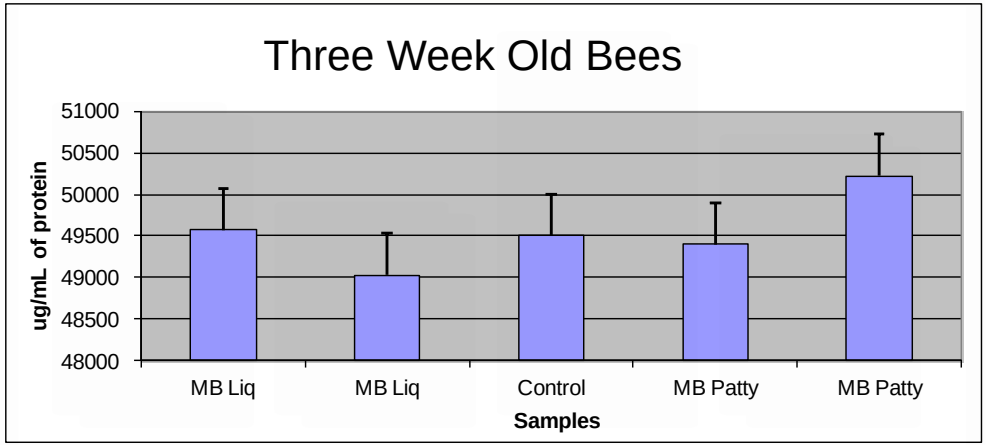
Bee Bread Stored Pollen

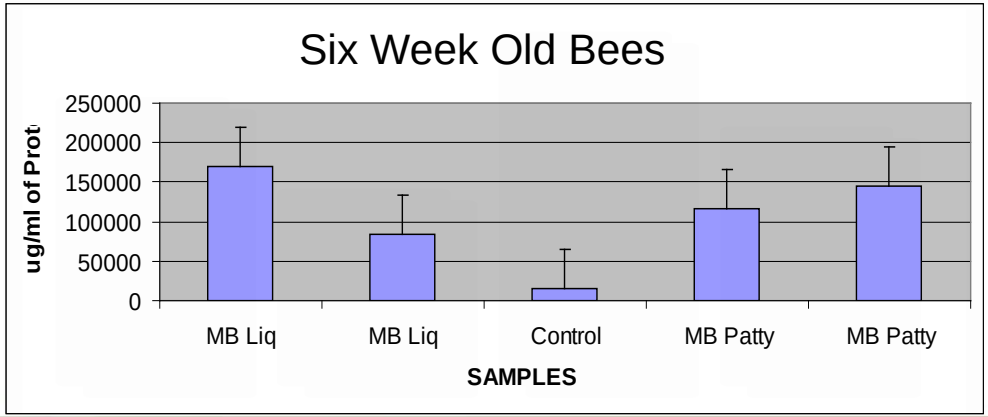
Field Bees

The Driving Force in the Colony

- Young Bees Consuming Protein and Producing Royal Jelly
  - Increases brood production
  - Greater pollen demand
  - Promotes longevity
  - Reduces the impact of the four P's

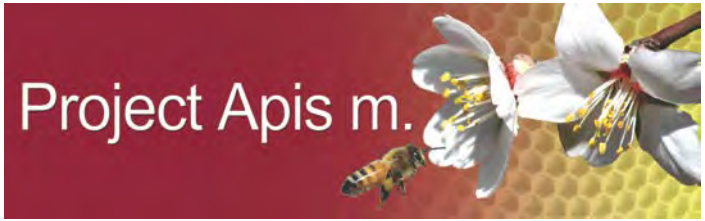
Protein Supplementation





Benefits for not just almonds

- Better forage means better bees for all bee-pollinated crops



Thank You