

SuperDFM – HoneyBee

The <u>original</u> probiotic supplement for honey bees.



Honey Bee Gut Microbiome - a collection of microbial species in the gut of honey bees



Hindgut

Nature Reviews | Microbiology

How do bees naturally get probiotics and how does the rest of the hive receive them?



Nature Reviews | Microbiology

SuperDFM – HoneyBee ingredients are compiled to mimic the honeybee's natural gut microbiome.

Lactic Acid Bacteria (LAB)

LAB's ferment sugars to lactic acid, aid in honey production, fight pathogens by lactic acid production, restore necessary microflora after antibiotic treatment and maintain healthy immunity; aid in vitellogenin formation

Enzymes

Amylase breaks down starches to glucose; Protease breaks down protein peptide bonds to free up amino acids; Beta glucanase breaks down glucans (parts of cell wall) to usable sugars; Cellulase breaks down cellulose to usable sugars



Yeast culture

Increase fiber digestion, reduce oxygen and provide necessary growth factors to LAB's; synthesize B-vitamins to aid bees health; mannan oligosaccharide prevents pathogen adhesion to intestinal wall

Spore Forming Bacilli

Consume oxygen and create a positive environment for LAB's, fight pathogenic yeasts and molds, and reduce effects of stress caused by heat or cold

All ingredients are on USDA (United States Department of Agriculture) /AAFCO (Association of American Feed Control Officials) GRAS (Generally Regarded As Safe) list and are safe to use at ANY TIME OF THE YEAR, even during the nectar/honey flow. It does NOT contaminate the honey. Continuous (currently 2.5 year) testing by Barkman Honey and Barkman Apiaries.

Probiotic bacteria suppress growth of *Paenibacillus larvae* that causes American Foul Brood



Above is a petri dish with selective media on which Paenibacillus larvae is cultured. P. larvae causes American Foul Brood. The probiotic bacteria is placed in the middle of the plate which start secreting particular anti-microbial substances such as lactic acid, hydrogen peroxide, anti-microbial peptides, bacteriocins, etc, that create a zone of inhibition. It does not kill AFB, but forces it to be pushed away. We are consistently observing the same effect in the bee and the bee hive.

SuperDFM - HoneyBee inhibits and prevents further outbreaks of chalkbrood caused by a fungus *Ascophera apis*

Day 1 – Chalkbrood infection

Day 12 – Pearl white larvae





Zones of inhibition SuperDFM – HoneyBee inhibits growth of *Ascophera apis*



SuperDFM-HoneyBee prevents outbreaks of Frischella perarra an opportunistic pathogen that is a precursor to nosemosis. Frischella perarra causes scarring of the gut mucosa, thus limiting absorption and digestion of nutrients.



Frischella perrara (see large white colonies below) was detected in extracted gut contents of euthanized adult honeybees (2-3 days old) from treated/control group. Centrol group (images below) receved no treatment. Honeybees were collected from an apiary in Ceresco, MI. The presence of *F*_ perrara is a natural occurrence. Honeybee's gut contents were diluted and cultures on BHA culture medium at 30 degrees C





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Without SuperDFM-HoneyBee = growth of F. perarra

SuperDFM-HoneyBee group received 10g of supplement 4 times per year. Honeybees were collected from the apiary in Ceresco, MI. The presence of F. perrara is a natural occurrence. Frischella perrara was NOT detected in extracted gut contents of euthanized adult honeybees (2-3 days old) from

treated group. Honeybee's gut contents were diluted and cutures on BHA culture medium at 30 degrees C



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With SuperDFM-HoneyBee = No growth of F. perarra

SuperDFM-HoneyBee reduces occurrences of *Nosema ceranae* and *Nosema apis* the root cause of nosemosis.



The above data shows correlation between lactic acid bacteria counts and average Nosema counts. The higher counts of lactic acid bacteria present, the lower counts of Nosema was observed.

ECONOMIC ANALYSIS OF HONEYBEE DIRECT FED MICROBIALS

Abstract

This data was collected from research bee hives located in multiple locations throughout the United States. Standard protocols were followed using control groups and statistically significant sample sizes. The analysis and the associated correlations were performed by Bee Informed Partnership (BIP) University of Maryland, Scientists (Microbiologists) from Strong Microbials Inc. (alumni of University of Wisconsin - Milwaukee WI and Marquette University) and last Apicultural Technical support was provided by EAS master beekeepers from Michigan. (Essential Honey Bees LLC, Ceresco MI).

Assumptions:

Direct Fed Microbials (Super DFM Honeybee) is a microbial source for beneficial bacteria, yeast and enzymes. Commercial grade SuperDFM - HoneyBee is t 3X standard concentration, five (5) grams of DFM directly applied to the Bee Hive Brood supplies over

seven and a half (7.5) billion (7.5 X 10^9) Colony Forming Units (CFU) to the target audience (Nurse Bees). The Nurse Bees will inoculate both the larva and young baby bees. Trophallactic sharing of food disperses the microbials to the benefit of the hive.

Lactic Acid Bacteria (LAB) stimulate the Honeybee immune system which correlates to elevated levels of anti-microbial peptides. Bacteria effects gene expression resulting in Juvenal Hormone (JH) suppression resulting in higher levels of Vitellogenin (fat bodies) stored in Winter Bees.

Microbialites (anti-microbial substances excreted by beneficial bacteria) suppress disease pathogens such as Chalkbrood caused by the fungus *Ascosphaera apis*; European foulbrood pathogen *Melissococcus plutonius*; American foulbrood AFB, caused by the spore-forming *Paenibacillus larvae* ssp and *Nosema ceranae* is a microsporidian, a small, unicellular parasite that mainly affects *Apis mellifera* honey bee. Along with *Nosema apis*, it causes the disease nosemosis, the most widespread of the adult diseases of adult honey bees.

Potential economic benefits of Direct Fed Microbials based on data and analysis

Elevated levels of LAB bacteria correlate to lower levels of Nosema Spores in research bee hives. (see graph) \circ Nosema spore reduction has direct relationship to longer living adult bees

- Lower levels of dead outs in December (10%) reduction from average
- o Stronger hives in January that grade better for Pollination (Grade 8 vs Grade 6) more winter bees
- More hives that are strong enough to split in Spring

Direct Fed Microbials directly suppress Chalkbrood - fungal pathogen

- $\circ~$ Reductions in brood stress allow faster buildup of hives
- Lower levels of chalkbrood infection reduces contaminating other hives
- Nucleus colonies thrive with reductions of Chalkbrood

Peptides suppress EFB and AFB foul brood larva infections

• Direct Fed Microbials reduce the need to use antibiotics – less

- cost \circ Fewer hives are removed from service because of foulbrood
- Less cross contamination because of smokers, hive tools and bee gloves
- $\circ~$ Bee hive inspections go faster because of no disease found

Summary

A well-managed, mature bee business should be able to *generate* annual gross *revenues* of at least \$200 *per* colony *per year*.

The assumption is each hive generates at least \$200 in revenue after fuel, labor and expenses are calculated.

Following the recommended cadence for DFM dose treatment. At 40 cents / treatment dose every 90 ninety days.

The Total annual cost per hive is \$1.60 per hive plus Labor.

The economic benefit from healthier bees is estimated at three (3) percent of total revenue. This estimate is based on three (3) years of microbial economic data (Michigan).

Revenue results from fewer dead outs and healthier / stronger hives.

Thus, 0.03 X 200 = \$6 dollars of economic benefit is derived from an input of \$1.60 dollars plus labor per bee hive.

EXAMPLE: 10,000 hives X \$6 = \$60K dollars. With an input cost of \$16K dollars in SuperDFM and \$16K dollars labor.

\$60K - \$32K = \$28K additional annual revenue per ten (10) thousand bee hives.

Estimate of 3% economic benefit generation:

Set factors to consider regarding hive health.

- 1. Strong genetics and quality of the mating of the queen greatly impact the hive performance.
- 2. The level of mite infestation has an even larger impact on the health and performance of the bee hive.
- 3. All pathogens, including viruses weaken the hives and contribute to colony loss and underperforming hives.

Therefore, there are three top factors that affect the performance and health of the hive that impacts revenue generation: Queen / Varroa / Viruses

Beneficial bacteria / yeast / and enzymes in the hive contribute to positive hive performance because of bacterial and fungal pathogen suppression.

Thus, the following is the credence to the calculations:

1 - During the three (3) year period of using SuperDFM the pollination hives have graded better for pollination revenue. Most hives grade 8 or better in Spring. Improvement in hive grading occurred every year, from grade 6 to grade 8. Average pollination fee was \$80 per hive.

80 X 0.02 = 1.6 (2%) positive impact because the hives were stronger on average, therefore allowing to raise the pollination fee.

From \$80.00 to \$81.60 dollars per pollination hive. Improvement in pollination revenue.

2 – During the three (3) year period of using SuperDFM winter loss decreased from 40% to about 25% average value.
Year 1 -- 20 % / Year 2 -- 30 % / Year 3 -- 25 % winter loss. Three (3) year averaging at 25% loss.
Varroa are still the biggest insect pathogen negatively impacting hive performance and revenue.

3 - A significant reduction in *Nosema ceranae* and *Nosema apis* has allowed for more splits to be performed in the spring.

Fewer packages of bees are purchased and fewer winter dead outs resulted in \$500 savings on reduced purchases of packages and earned \$500 more on spring splits.

Based on assumption of \$200 per hive profit for 100 hives the total annual profit is \$20,000

\$1000 (saved) / 20,000 = 0.05 (5%) positive impact

4 – During the three year period of using SuperDFM the price for nucs was raised during a time of increased competition. The strength of the nucleus hives with spring applications of DFM has significantly improved.

Price increases from \$150 to \$180 to \$200 dollars per five (5) frame nucs in a three (3) year period based on volumes purchased.

Earned more on shaking bees from strong colonies into nucleus hives.

\$800 total extra annual revenue from selling nucleus colonies.

\$800 / \$20,000 = 0.04 (4%) positive impact

(2% + 5% + 4%) / 3 inputs = 3.66% average. The safe assumption is 3% positive impact on revenue.

Conclusion: SuperDFM-HoneyBee is a very profitable probiotic supplement capable of inhibiting and preventing future outbreaks of bacterial and fungal pathogens that plague honey bee health. Using SuperDFM there's a profitability potential of additional 3% revenue per hive. The safety aspect of using SuperDFM is top of the line because this product can be used at any time of the year, to include nectar flow. Safe for bees, safe for beekeepers and produces clean, antibiotic-free honey. Highly promoted by Barkman honey and Barkman apiaries for clean and antibiotic-free honey production.

Barkman Honey

