

# Honey Bee Nutrition

## Things to consider

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# Topics for discussion

- Basic Nutrition of honey bees
- Food sources – nectar and pollen
- Supplemental Feeding
- Frequently Asked Questions

# Major Honey Bee Challenges

- #1 is Varroa mite – in 2000, this was occasional problem, today they affect all colonies.
- Nutrition is #2 problem – requirements poorly understood and challenging to determine.
- #3 viruses and bacterial infections
- #4 is current ag production => intensive monoculture cropping ; fewer weeds; human-defined ecosystems.
- #5 is pesticides, herbicides and fungicides.

# Nutrition

- Bees have the same nutrient requirements as all other species - water, amino acids, carbohydrates, lipids, minerals and vitamins.
- Quality and quantity does not always match the bees needs, esp single pollen sources.
- Lack of a single nutrient will affect colony population, shorten life span, and increase disease susceptibility.
- Sources of food – nectar, pollen, supplements.

# Nutrition

- Larvae vs nurse vs forager vs queen vs drone.
- Summer vs winter.
- Body composition, hemolymph, brood production, hypopharyngeal gland development
- Royal Jelly is high protein-honey-enzyme blend produced by bees for feeding queen and larvae (amino acid profile fairly well defined)

# Digestive Tract

- Mouth (limited grinding of food) => esophagus (food tube) <=> honey stomach (simple sugar digestion) => proventricular valve (honey stopper) => large stomach (digestion by enzymes and bacteria) => short intestine (nutrient absorption) => rectum (water resorption and feces storage) => anus (expel feces).
- Passage rate ~2.5-24 hrs. Feces is mostly empty intact pollen shells.

# Water

- Essential for life; medium for all biochemical and digestive processes in the body.
- Maintain body temperature and osmotic balance.
- Maintain hive temperature, humidity
- Dilution of thick honey.
- Needs to be available in some form at all times of the year – may be from patties and condensation in winter. Midwest US estimate is 5-6 gallons/hive/year.

# Amino Acid Nutrition

- Amino acids are the building blocks of protein.
- Requirements are not well defined, based on DeGroot 1953; Haydak 1970.
- Larvae and queen have higher amino acid requirements than workers and drones.
- If inadequate/imbanced amino acids, hypopharyngeal gland does not develop completely – can't make Royal Jelly to support larvae or queen egg development.



# Carbohydrates (CHO) Sources

- Nectar, Pollen
- Honey, Sucrose, HFCS
- Certain complex sugar compounds can be toxic to bees.
- Used for energy; making wax

# Fats (lipids)

- Energy source for larvae – energy for flight?
- Specific fatty acid requirements?
- Used in cell membranes, immunity and disease resistance.
- Lipids => sterols => hormones and pheromones (must have cholesterol source).
- Pollen lipids different from bee lipid profiles.

# Vitamins

- Larvae and queen have high requirements for certain B vitamins in Royal Jelly.
- Other vitamins?
- Pollen vitamin content is variable by source and season, pollen stores in the hive, intestinal bacteria, supplemental feeding.
- Requirements not well documented.

# Minerals

- Little info is documented.
- Sodium, potassium, calcium, phosphorus, magnesium, chlorine, cobalt, copper, iodine, iron, manganese, selenium, zinc.
- Water, pollen, supplements.

# Nectar

- Sweet watery attractant in flowers, 30-50% sugars; less sugar => less attractive to bees.
- Primary sugars are sucrose, fructose, glucose.

# Plant Pollens

- Protein varies from 6-40% - no single plant source provides adequate amino acids – diversity of sources is important.
- Fat varies 1 – 20% (average 4-6%).
- Pollen sources will vary over the growing season – depends on when plant blooms, weather conditions, soil conditions, fertilization, pesticides, herbicides, other factors.

# Pollen digestion

- Bees have no digestive enzymes to breakdown outer shell of pollen
- Inner portions accessed through pore areas that enzymes can breakdown.
- Intestinal bacteria.

# Pollen storage and use

- Pollen is packed into cells, mixed with honey stomach contents (bacteria=> acids), allowed to ferment => bee bread. Cell is capped for storage.
- Bee bread and pollen are the essential foods for larvae and adult bees.
- Increased consumption of pollen and bee bread in the fall. Should have 500-600 sq in of pollen stores going into winter for late winter/early spring rearing.
- Nurse bees need bee bread to develop hypopharyngeal glands to produce Royal Jelly.



# Supplemental Feeding

- Midwest hives need 50-60 lbs honey to survive average winter.
- Late fall and winter – concentrated syrup (2:1 sugar-water), high fructose corn syrup.
- Dry white granular cane or beet sugar (table sugar) – NOT brown or raw sugar.
- Candied sugar products.

# Feeding liquids

- Entrance feeders for active feeding periods, extra water, encourages comb making.
- Frame feeders for winter feeding.
- Top feeders for winter feeding
- Baggies – use 1 gal freezer bags, fill ½ full, use on top bars or inner cover.

# Liquid Feeding Options



Courtesy of Dadant's

# Supplemental Feeding

- Spring, summer, early fall – before pollen flow; when overwintering honey supply is short; cold spring weather; poor pollen flow during summer and fall, drought conditions.
- Feed to help colony survive.
- Stimulate brood building and egg laying activity.
- Build up colony in the fall
- New hives; new swarms; re-queening; or raising queens while low pollen availability.

# Spring Feeding

- Sugar syrup (1:1 w/w cane or beet sugar to water), HFCS (60/40 HFCS/water) + 1 tsp Honey-B-Healthy and 1 tsp Amino-B Booster/gal.
- **New hives may consume 1 quart or more of syrup/day – new brood areas => new bees.**
- May also use supplemental protein or pollen patties if pollen is late (cold wet spring)

# Summer Supplemental Feeding

- Sugar syrup (1:1 cane or beet sugar to water), HFCS (60/40 HFCS/water) + Honey-B-Healthy and Amino-B Booster.
- Hot dry summer with limited pollen.
- If frames in brood boxes are not full of honey by mid-August-mid September, provide supplemental feeding.

# Protein Patties

- $\frac{1}{4}$  -  $\frac{1}{2}$  lb patties wrapped in wax paper.
- Feed on top of frames (as close to brood as possible).
- Ideal temps/humidity for bees => ideal temp/humidity for mold and bacteria.
- 30-40% protein supplement powder, 60-70% sugar + water or HFCS to get peanut butter consistency. Roll out on waxed paper.

# Patty Feeding



Dadant



Dadant



Dadant



# Other feeding options



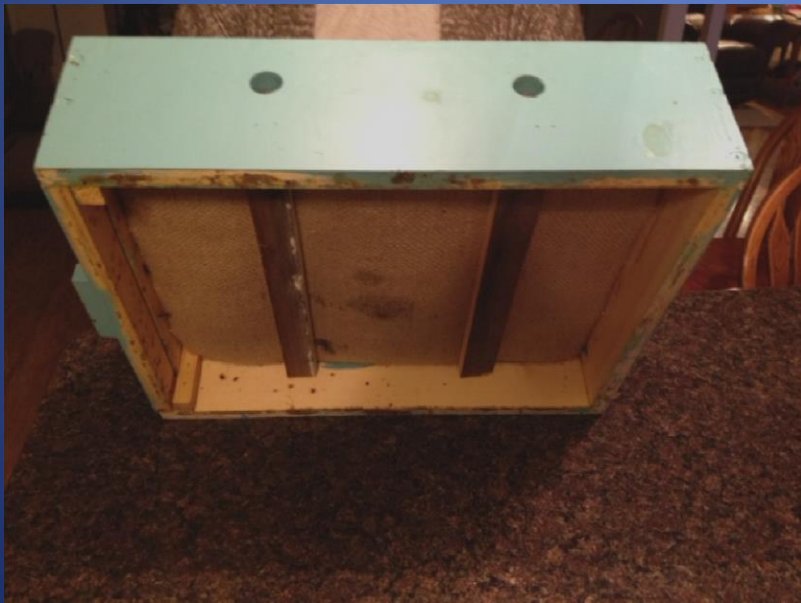
# Supplements

- Dry may be fed anytime supplemental feeding is needed, but mainly winter.
- “Mock” candy – use confectioners sugar with enough water to make a very thick paste – store in refrigerator or freezer, use as emergency food.
- Sugar Candy – make heated candy syrup, chill, whip and pour into shallow feeders (Penn St Extension). Double boiler - NO burnt sugars. Use these when syrup feeding is not practical
- Suggest using 10-20% protein powder in candy.

# Bee Facts

- Takes about 1 lb pollen to rear 4000 bees –
- Average hive rears ~200,000 bees/yr => 50 lbs pollen + pollens stored for winter/spring.
- It takes appx 50-60 lbs of stored honey/hive to survive winter in Central/Midwest US.
- Bees don't hibernate – form a cluster to keep warm in winter – inside hive temp always kept 90-95 degrees F. – HIGH CALORIE COST.





<http://beehivejournal.blogspot.com/2009/01/build-it-yourself.html>

# FAQs

- Can I feed if I am treating for Nosema, Foulbrood or mites?
- Can I feed patties if they are moldy?
- What benefit from pollen/pollen sub patties?
- How many patties at one time?
- How do I make patties more attractive to bees?
- Should I remove waxed paper from patties?

# FAQs

- Where should I place patties in the hive?
- Small hive beetles love protein patties – what can I do?
- Are ingredients all natural?
- Are ingredients domestic or imported?
- What can I do with extra pollen patties?

# Summary

- Basic Nutrition of honey bees
- Bee digestive tract anatomy
- Food sources – nectar and pollen
- Supplemental Feeding
- Frequently Asked Questions



Questions?