

Factsheet #410

NUTRITION AND ITS EFFECT ON BEE MANAGEMENT

The success of beekeeping depends on strong, vigorous colonies. Colonies can only develop large populations when the queen maintains a high egg-laying rate. She can only do so when there are adequate stores of pollen and honey. When these forage resources are not available, they must be provided. Supplemental feeding enables the colony to optimize its potential as a production unit, be it for honey production, pollination, or for the production of package bees, splits or nucs.

The amount of bee brood raised by a colony is dependent on the number of nursing bees present. When supplemental feeding is provided, there will be a delay until the population increases. A broodless colony such as a package, offered supplemental feeding, will require about 12 weeks to reach a population of 30,000 bees. When some brood rearing already took place at the time of feeding, such a population could be reached in 6 weeks.

Supplemental feeding may induce or stimulate brood rearing, but it can not induce colonies to respond faster than their biology permits. The beekeeper must therefore offer supplemental feeding well before maximum populations are required.

Other factors that determine populations development include egg-laying rate of the queen, worker longevity, management, freedom of disease, and environmental factors.

Type of Nutrition

There are three components to honeybee nutrition:

- carbohydrates
- protein, including fats, minerals, and vitamins
- water

In nature, the honeybee colony meets its carbohydrate requirements from nectar or honeydew. A shortage of carbohydrates may result in a reduction in brood rearing and in some cases, it may lead to starvation. Starvation is probably the single most important cause of colony death.

Protein is obtained from pollen. Prolonged shortages of pollen will result in the reduction or cessation of brood rearing. Colonies generally do not experience difficulties during short periods of pollen dearth.

Water is essential to the honeybee colony. Beekeepers often fail to recognize the importance of the availability of clean, fresh water nearby. This is especially important in BC's interior and areas with long, cold winters.

A. Carbohydrates

Honeybees collect nectar as their principal carbohydrate source. Nectar is a sugar solution consisting of between 5 to 75% solids with an average of about 25 to 40%. The major sugars in nectar are sucrose, dextrose (glucose) and levulose (fructose). Honeybees collect the nectar in their honey stomach where it is inverted through the enzyme invertase from sucrose to dextrose and levulose. Inside the colony, the processed nectar will be regurgitated and most of the water removed through evaporation. The final product is honey that generally consists of 17% water, 38% levulose, 31% dextrose, 1 % sucrose, and 13% other sugars.

In times of dearth, nectar substitutes can be fed to the colony. The most common substitutes are white table sugar (sucrose), or high fructose corn syrup (HFCS) which is a converted starch product. HFCS is currently only available in large bulk quantities, and not suitable for most beekeepers.

White sugar is the most common form of feed supplement. During the course of the year the beekeeper should be prepared to feed bees in fall and spring, and in case of emergency. Fall feeding is the most important time to feed bees, for several reasons:

- ***Produce strong colonies for wintering***
Late splits and small colonies to be wintered will be stimulated by the feeding, resulting in good age distribution of the bee population.
- ***Prevent winter starvation***
Honeybee colonies do not die of the cold, but starvation. With insufficient feed in the fall, the winter cluster may lose its access to food reserves and starve. Even with plenty of feed, the risk of starvation can never be completely eliminated. Some colonies may not conserve reserves well, especially when winter has been marked by frequent warm spells.
- ***Replace harvested honey***
Some beekeepers remove all honey in the fall and replace the reserves with sugar syrup. Unless labour is free and there is at least a threefold difference in the price of sugar and honey, the practice is not warranted. One should be aware that bees expend energy to process sugar syrup before storing. This task may require the consumption of as much as 25% of the sugar being fed.
- ***Eliminate spring feeding***
Adequate fall feeding will eliminate or greatly reduce spring feeding. It has been claimed that it takes as much feed to keep bees alive from early March to mid-April, as it does from October to April. Adequate stores of honey and pollen is the stimulus for brood rearing in the spring, not a dribble of syrup feeding. However, weak colonies respond favourably to sugar syrup in spring and feeding could be limited to those colonies only.

There are short periods in the early part of the season where a food shortage may develop; in late winter-early spring when stores may run low, and during the late spring-early summer dearth period. A shortage of food at these times may cause serious disruption in brood rearing, and subsequent population levels.

B. Protein

The presence of pollen in the hive plays a vital role in the productivity and well being of the colony. Pollen is the principal protein source to bees, but also provides vitamins, minerals and fats essential for the development of brood and young adult bees. The protein content of pollen can vary from 7 to 30% (by weight) with an average of about 22%.

Longer periods of insufficient protein will affect the entire colony resulting in reduced egg laying and brood development. Young nursing bees may not fully develop their hypopharyngeal glands causing insufficient production of brood food. This in turn may lead to spotty brood patterns that are often misdiagnosed as the result of a failing queen. To offset any pollen shortages, pollen supplements or substitutes can be given. Pollen supplements will not necessarily cause the bees to reduce pollen collection in the field.

The rate at which the bees consume the pollen supplement is influenced by its location in the hive relative to the brood cluster. It is important that the pollen supplement is readily accessible to nurse bees. The greatest consumption takes place directly above and to the sides of the brood area. Pollen substitutes (such as Brewer's Yeast, soya flour, etc) are more readily accepted when natural pollen is added.

Feeding Formulations

The most effective pollen substitutes and supplements are those that are most similar in chemical composition and physical consistency to stored pollen. Brewer's Yeast is very similar to the protein content of the average pollen and superior in vitamins. Yet, pollen substitutes are never as attractive and nutritious as the best pollens.

Soybean flour has serious vitamin deficiencies and must only be used with Brewers Yeast. Sugar or honey must also be added in preparation of the pollen substitute. Glucose requires moisture and tends to dry the mixture while HFCS would be good but may not be available in smaller quantities. The addition of pollen to the mixture will increase palatability to the bees.

Mixture #1:	- Brewer's Yeast	- 1.0 kg
	- Sugar	- 1.0 kg
	- Water	- 500 ml
Mixture #2:	- Brewer's Yeast	- 1.0 kg
	- Honey	- 1.5 kg
	- Water	- 20 ml
Mixture #3:	- Pollen	- 2.0 kg
	- Brewer's Yeast	- 5.0 kg
	- Sugar	- 8.5 kg
	- Water	- 2.2 liters

Instead of preparing pollen patties, it is also possible to feed pollen supplements in dry form outside the hive. Supplement feeding encourages foraging and during a time of low pollen availability, foraging bees may become a nuisance. Feeding dry Brewers Yeast supplements outside may attract the bees away from foraging in other areas.

When feeding in dry form, 10 kg of Brewers Yeast should be thoroughly mixed with 1 kg of icing sugar.