



Beekeeper Insights on Honey Bee Nutrition Supplements

Summary Report of Beekeeper Interviews
April 2017



**HONEY BEE
HEALTH
COALITION**

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POLICY CENTER

Table of Contents

Executive Summary: Beekeeper Insights on Honey Bee Nutrition Supplements.....	3
Recommendations for Collaborative Actions	4
Introduction	6
Summary of Interviews	8
Supplemental feeding: Importance, objectives, and defining success.....	8
Natural forage	9
Key influencers of feeding strategies.....	10
Supplemental feed choices	11
Information sources and needs	12
Key research needs	13
Conclusion.....	14

Executive Summary: Beekeeper Insights on Honey Bee Nutrition Supplements

As part of its forage and nutrition priority area, the Honey Bee Health Coalition aims to advance pre-competitive solutions and research addressing honey bee nutrition. The Coalition conducted the Beekeeper Insights on Nutrition Supplements project to identify critical beekeeper knowledge, perspectives, and objectives related to nutrition supplements. The project focused on commercial beekeepers with extensive industry knowledge. Conversations conducted with 43 beekeepers in person and by phone between December 2016 and February 2017 underscore a demand for cost-effective commercial supplements that better mimic the unique properties of natural pollen, whether as “complete” diets or as targeted diets responsive to specific seasons, geographies, life cycle stages, and commercial beekeeping objectives. These products should be accompanied by transparent ingredient and nutrition information and backed by easily-accessible, field-validated, peer reviewed, independent research with results-oriented outcomes to help inform feeding strategies. This assessment’s findings reflect the experiences, opinions, and perceptions of participating beekeepers and were collected qualitatively through interviews.

Importance of supplemental feeding

Interviewed beekeepers generally agreed that it is necessary to provide bees with supplemental food sources. Participants emphasized the loss of bee forage and habitat, including due to the expansion of corn and soybean in the United States and Canada, which has replaced other crops and wild plants that previously provided natural forage for honey bees. As a result, beekeepers have increasingly provided supplemental feed throughout the year, causing increases in feed and labor costs. Respondents varied in how they perceived the importance of fine-tuning supplement choices to improve overall bee health.

Feeding strategies

Factors including geography, primary role in the industry (e.g., honey producer, pollinator, queen producer, or package producer), concerns about disease, and availability and costs of products influence a wide spectrum of supplemental feeding strategies. Practices range from proactively planning seasonal feeding to reactively feeding hives that appear weak. Some beekeepers use supplements to build up their colonies at specific times of year, while other beekeepers use supplements to maintain general nourishment for their bees throughout the year.

Supplemental feed choices

Most beekeepers now purchase a commercial supplement product to save time and labor costs; some beekeepers still use their own “home brew” (homemade) protein patty recipes. All beekeepers utilize sugar syrup. Some beekeepers desire companies to offer pollen patties that address specific regional, seasonal, and/or life cycle challenges and objectives. Beekeepers also cited availability and cost as key drivers of supplemental choices. Some would like to see more transparency of ingredients from the companies.

Defining success for supplements

Participants emphasized two primary drivers for beekeepers to feed protein supplements: to stimulate colonies to produce more brood at certain times of year, and to offer nourishment when natural pollen flow is lacking. Most respondents linked success of a nutrition supplement to two main factors: whether the bees consume the supplement, and if the colony has increased its brood laying after the supplement has been fed. However, some beekeepers did not agree with consumption as a measure of success, arguing that the supplements that are most attractive to bees do not necessarily contain the best

nutrition. Beekeepers also cited a longer bee lifespan and high bee energy levels as determinants of a successful supplement.

Key research needs

Beekeepers are interested in research to discover the key component(s) of natural pollen that could be used to transform pollen supplements into real pollen substitutes that compete with natural pollen. Beekeepers are also interested in research to develop supplements that prevent disease and strengthen the bee immune system. Finally, beekeepers want to see comparative field efficacy testing of supplement products. Respondents varied in how interested they were in the specifics of nutrition supplement research vs. results-oriented information to improve feeding strategies. *The research priorities identified by respondents have not been compared against existing research.*

Information sources

Participants overwhelmingly cited their beekeeper colleagues as their primary source of information regarding nutrition supplements. Although many beekeepers also read bee journals and online articles, they cite a need for independent research studies; they do not trust research funded by supplement supplier companies. Some beekeepers receive nutritional information from their local supplier. Beekeepers want better access to unbiased, results-oriented information on best feeding practices and products.

Recommendations for Collaborative Actions

Through the analysis and synthesis of beekeeper responses, the Honey Bee Health Coalition offers the following recommendations for collaborative actions. These are the recommendations of the Coalition and are not intended to represent consensus of interview respondents. These recommendations, in no particular order, are as follows:

- Create pathways to catalyze innovation in honey bee nutrition supplement research, development, and outreach among a broad range of stakeholders.
- Facilitate the improvement of nutrition communication channels, with the goal of assisting commercial beekeepers in navigating the abundance of information available regarding bee nutritional needs, nutrition supplement research, and new products on the market. Communication mechanisms should allow beekeepers to easily access transparent and unbiased research and resources to help them make well-informed decisions about nutrition for their colonies. This process should encourage more robust interaction between researchers and commercial beekeepers. A resource guide on nutrition may be useful in facilitating communication on research relevant to bee dietary needs, supplement ingredients, feeding strategies, and supplement effectiveness.
- Encourage research directed towards the areas of strong interest to beekeepers that addresses issues related to both supplement content and feeding strategies.
 - a. *To the extent that research addressing the topics below may have already occurred or is underway*, ensure this research is communicated effectively to beekeepers consistent per the recommendation above.

- b. Identify the limiting nutrient(s) in natural pollen that would enable the development of a true pollen substitute for a “complete” diet.
 - c. Identify critical elements of geographic, seasonal, life-cycle, and objective (e.g., queen rearing) specific supplemental diets that may not be “complete” but can help address critical challenges and objectives.
 - d. Identify nutritional factors for strengthening the bee immune system and preventing disease using supplements, such as the growing availability and use of probiotics and prebiotics, the use of antibiotics (and how this may be impacted by the new Veterinary Feed Directive), the role of sugar syrups in influencing dysentery and/or *nosema*, and the relationship between autumn feeding, varroa mite levels, and winter colony losses.
 - e. Compare the nutritional and economic costs and benefits of “proactive” vs. “reactive” feeding strategies.
 - f. Conduct comparative field studies to test the efficacy of different commercial supplement products and feeding strategies.
 - g. Evaluate the indicators by which beekeepers define nutritional supplement success.
- Engage supplement supplier companies, developers, and commercial beekeepers to discuss how they can collaborate to best meet beekeeper needs and encourage quality product development. Key issues include transparency and consistency in communication of ingredients and nutritional values of supplements, as well as development of products to address specific feeding objectives and challenges.
 - Facilitate the development of a catalogue of natural pollen types, inclusive of information on regional forage species and their known nutritional attributes. Beekeepers have learned which types of pollen are best for their bees based on personal experience and learning from colleagues, rather than from any formal assessment classifying pollen. Creating a comprehensive catalogue of natural pollen types would assist commercial beekeepers in scouting for the best forage available in each season and would also assist researchers and supplement developers in identifying supplemental feeds to mimic the highest-nutrition pollens.

Introduction

Purpose

Honey bees, like all animals, require essential nutrients to survive and reproduce. The basic nutritional requirements of honey bees include the appropriate ratio of carbohydrates, lipids, amino acids, vitamins, minerals, and water to ensure survival and reproduction. However, honey bee nutrition is a rapidly evolving field of science with much yet to be understood about the ideal natural and supplemental nutrition for managed bees. Furthermore, agricultural, ecological, and economic forces that impact honey bee nutrition – including the commercial management and movement of colonies across vast geographies for pollination and honey production – create unique challenges for beekeepers seeking to provide optimal nutrition for their bees.

The Honey Bee Health Coalition is a diverse coalition that brings together beekeepers, commodity and specialty crop producers, agribusinesses, supply chain companies, NGOs, universities, and agencies to promote a vision of *Healthy Bees, Healthy People, Healthy Planet*. The Coalition's mission is to collaboratively implement solutions that will help to 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. The Coalition focuses on four priority areas: forage and nutrition, crop pest control, hive management, and outreach and education. The Coalition's Nutrition Working Group is comprised of leading honey bee health stakeholders including beekeepers, apiculturists, and nutrition researchers.

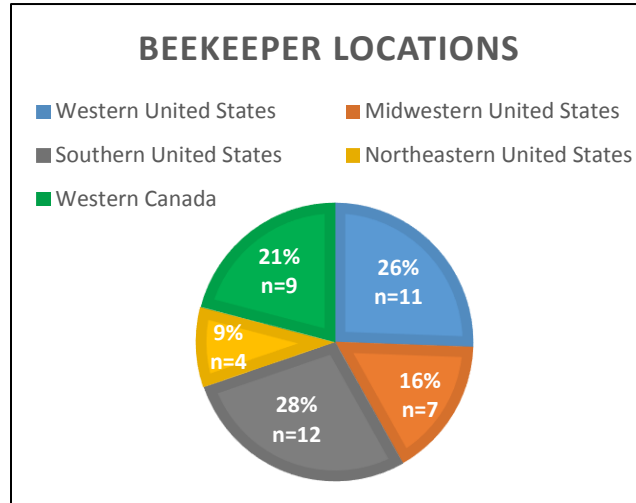
As part of its forage and nutrition priority area, the Honey Bee Health Coalition aims to advance pre-competitive solutions and research addressing honey bee nutrition. The Beekeeper Insights on Nutrition Supplements project was launched to identify critical beekeeper knowledge, perspectives, and objectives related to nutrition supplements. This project was undertaken as a preliminary stakeholder assessment – or stakeholder conversations – to inform future discussions and activities of the Coalition and the bee health community. The emphasis was on qualitative storytelling to uncover beekeepers' insights rather than quantitative data collection.

Interview Approach

The effort recruited commercial-scale beekeepers from a variety of geographies in the United States and Canada, representing a diversity of operations including: commercial almond pollinators, commercial pollinators of non-almond crops, commercial honey producers, commercial queen producers, and commercial package producers. The assessment focused on beekeepers with more than 300 hives, more than 10 years of experience in commercial beekeeping, and experience with nutrition supplements (commercial and/or home brew recipes). Several non-commercial scale beekeepers known to be leaders in the industry and in nutrition supplement science were also interviewed.

Between December 2016 and February 2017, 43 beekeepers were interviewed in person or over the phone. Most interviews were conducted in Galveston, Texas from January 10-14, 2017 at the North American Beekeeping Conference and Trade Show. Nine participants were Canadian beekeepers, and thirty-four were from the United States. Approximately one-third of United States respondents were based in the Western U.S. (mostly in California with one each in Arizona, Oregon, and Montana), one-third were based in the Southern U.S. (split between Louisiana, Texas, and Florida, with one in Georgia), and one-third were based in the Mid-West or Northeast (in North Dakota, Wisconsin, Minnesota, West

Virginia, Ohio, Pennsylvania, Kansas, New York, and Maine). All Canadian beekeepers interviewed were based in Western Canada (in Alberta, Saskatchewan, and Manitoba, with one in British Columbia).



For their primary roles in the beekeeping industry, approximately one-third of participants described themselves as primarily honey producers, one-third described themselves as primarily commercial pollinators, and one-third described themselves as both honey producers and pollinators. A little over one-third of respondents also sell packages or raise queens as a portion of their business.

The chart below indicates how many respondents were involved in each role in the beekeeping industry. Many beekeepers identified involvement with multiple industry roles; the total number of responses reflected in the table is thus greater than the total number of 43 beekeepers interviewed.

Beekeeping Industry Roles	Respondent in Each Role
Pollination	25
Honey Production	25
Queen Production	10
Package Production	6

The interviews asked open-ended questions about ideal forage and nutrition conditions, feeding strategies, desired attributes and objectives for supplements, how beekeepers assess the success of nutrition supplements, greatest challenges with using supplements, and additional information and research that is needed.

Results Analysis

Interviews were conducted and analyzed by the Keystone Policy Center (www.keystone.org), an independent, nonprofit organization that facilitates the Honey Bee Health Coalition. To protect individual respondent privacy, findings are reported in aggregate, without attribution of specific quotes or data to individual participants. All findings are based on qualitative feedback from participant interviews. Interview transcripts were analyzed using the qualitative data analysis software program Dedoose in order to code and organize the feedback for topical areas and themes.

In this report, the following terms are used to describe the *approximate* frequency of responses: the word “most” means approximately three-quarters or more of respondents; “many” indicates approximately half of respondents, “some” and “several” indicate approximately one-quarter of respondents, and “a few” indicates five or fewer respondents. Frequency estimates are based on qualitative analysis of themes of responses to open-ended interview questions rather than on selection of specific and consistent survey options; these themes are thus presented as approximations rather than as specific numeric counts.

Note: The responses summarized in this report represent the experiences, opinions and perceptions of the beekeepers interviewed, reported in aggregate. Participant views have not been compared against current research, information from commercial suppliers, or other sources. Participant views do not necessarily represent the opinions or advice of the Honey Bee Health Coalition.

Summary of Interviews

Supplemental feeding: Importance, objectives, and defining success

Importance and objectives of supplemental feeding

Beekeepers generally agreed that it is necessary to provide a supplemental food source for bees. Almost every beekeeper interviewed feeds nutritional supplements at some point in the year. There are two primary drivers for beekeepers to feed protein supplements: to stimulate colonies to produce more brood at certain times of year; and to offer nourishment when natural pollen flow is lacking. However, respondents varied in how they perceived the importance of fine-tuning supplement choices to improve overall bee health.

A few respondents said that they were content with their feeding strategies and the supplement options available to them. These beekeepers felt that further fine-tuning their supplement plans would not yield significant improvements to the health of their hives; they were more interested in research on other stressors like varroa mites.

On the other hand, a few respondents felt that nutrition is the key driver of bee health, believing that the bee diet influences hive vitality in multiple ways, such as disease vulnerability. These beekeepers are interested in having a detailed understanding of the dietary needs of the bee, and which food sources best fulfill those needs. These respondents tended to have a background in honey bee research, or were connected with a research lab in some capacity; they were also the beekeepers likely to conduct their own comparative testing of new products.

Most beekeepers interviewed fell somewhere in the middle of this spectrum. These beekeepers are interested in improving their feeding strategies to build brood more quickly, but are not as interested in the details of bee nutrition science. They are not sure if the supplements they use are actually targeting what the bees need. However, they expressed that they do not have the capacity to run their own comparative tests on different products, as they cannot risk losing colonies. These results-driven beekeepers are likely to change feeding regimens based on strong evidence from their colleagues that another product is more effective.

Measures of success

Most beekeepers judge supplements by how they impact brood levels; they want supplements to stimulate bees to quickly build more brood. Many beekeepers judge nutritional success by the physical appearance of the bees, specifically how fat the bees look and the level of energy the bee displays. Only a few beekeepers measure success of their nutrition supplement feeding strategies by how well their bees survive the winter. Another factor of success is consumption; an effective patty is quickly eaten by the bees, while ineffective patties are ignored or disposed of by the bees as “trash.” Beekeepers monitor how quickly patties are consumed, and if the patty has been removed from the colony instead of eaten. A few beekeepers said that they have switched commercial products after consistently finding patties being removed from colonies uneaten. Some beekeepers do not view consumption as a reliable indicator of a successful supplement: Since bees are strongly attracted to sugar, they are likely to consume any patty with a high sugar content, which is not indicative of the nutritional value of the patty.

Natural Forage

Ideal forage locations

Beekeepers seek a variety of pollen sources near their bee yards. Beekeepers widely believe that honey bees thrive on a diet from diverse pollen sources, and that pollens from certain crops and plants are more nutritious than others. Respondents listed a variety of tree, wildflower, and thistle pollens as valuable forage options; the most cited plants included basswood, clover, crocuses, dandelions, goldenrod, wild mustard, and willows. Commercial crops that beekeepers cited as offering good pollen to honey bees include alfalfa and canola. The commercial pollinators interviewed also agreed that their bees generally left almond pollination looking strong. In sharing their opinions on the most nutritious forage sources, the participants did not reference any specific research or other documentation to verify these perspectives. Beekeepers have learned which types of pollen lead to thriving bees based on their own trial and error. Several beekeepers mentioned that they no longer offer pollination services to certain crops because the pollen was so poor for their bees.

Climate also influences the quality of natural forage locations. Several respondents said that they look for locations with plenty of moisture. Regions prone to drought tend to have inconsistent natural forage available.

Changing forage conditions

Participants emphasized loss of natural forage – particularly due to a rise in monoculture across both the U.S. and Canada that has had a major impact on natural forage opportunities for bees. Almost all beekeepers who participated in the assessment have witnessed a change in natural forage conditions over the last few decades as farmers converted significant numbers of acres to corn and soybean crops.

Beekeepers have found that pollens from corn and soybeans are not strong sources of pollen for their bees. In planting mostly soy and corn, farmers have both replaced crops with more nutritional value for bees, as well as displaced wildflowers that used to grow in their fields. Beekeepers situated near such farms have increased their use of nutritional supplements to make up for the lack of diversity in forage, leading to increased feed and labor costs.

Key influencers of feeding strategies

Reactive vs. proactive strategies

When it comes to feeding strategies, beekeepers aligned with one of a few noticeable schools of thought. Few beekeepers give their bees protein patties throughout the entire year, either because it would be too expensive or because the beekeeper believes in relying on natural forage as much as possible.

Beekeepers tend to adopt either a proactive or reactive feeding strategy. Proactive beekeepers have a relatively fixed feeding regimen for the year, based on their feeding objectives. They plan exactly when and how frequently they will give protein patties and sugar syrup to their hives, and adjust for the next year based on hive health indicators. Reactive beekeepers have a less structured approach; they offer supplements to strengthen hives that are struggling, and make quick feeding adjustments as needed. More participants interviewed used a proactive feeding plan for at least part of the year than fed reactively for every season. Autumn feeding strategies had the most seasonal divergence among respondents; there is a debate among beekeepers over the choice to feed hives in the fall before the bees become dormant for winter. Some beekeepers fear that feeding in the fall will raise varroa mite levels going into winter, causing greater colony loss. Other beekeepers proactively feed during the fall because they want to ensure that hives have enough nutrients to survive the winter.

Geography

Geography plays a significant role in how frequently beekeepers feed supplements, and how beekeepers choose supplements. Regional differences influence nutrition due to the types of pollen naturally available, humidity levels, and probability of drought. Beekeepers leverage natural forage availability as much as possible. A few regions in the U.S. and Canada offer a natural pollen flow throughout most of the year. The three beekeepers based in Alberta, Canada agreed that the region was favorable for bees due to the abundance of wild bush that offers diverse natural pollen sources in the spring and summer. In the United States, beekeepers in the Southeast (Louisiana and Florida) said that their region has excellent natural forage for bees throughout most of the year. Most other regions experience a dearth of natural pollen at some point during the year, during which beekeepers will usually offer a supplemental source of food to their bees. Commercial beekeepers located in areas prone to drought feed more often during the year due to limited availability of natural forage. Several California-based beekeepers described how they have dramatically adjusted their summer feeding plans the last few years due to increased bouts of drought. Finally, regions with high humidity levels experience additional challenges. Protein patties in such climates grow mold much more quickly than drier regions. Also, beekeepers reported that colonies in regions of high humidity experience greater levels of hive beetle infestations, and hive beetles tend to burrow into protein patties to lay their eggs.

Primary commercial role of beekeeper

A beekeeper's primary role in the industry influences feeding objectives to a certain extent. Commercial pollinators aim to quickly build up their colonies directly prior to the California almond bloom in

February; they have a short window to stimulate queens to raise brood levels in preparation for almond pollination. These beekeepers tend to feed protein and sugar syrup heavily during January and February, and then follow the natural pollen cycle for the rest of the year, feeding when natural forage is scarce. Beekeepers focused on queen rearing also focus on a strong spring buildup of their hives, and concentrate heavy supplemental feeding during this season in preparation for selling queens. Commercial honey producers who do not pollinate almonds do not experience this early spring rush. They tend to feed for a slower spring buildup and to provide general nourishment when they feel hives aren't looking strong. Many honey producers avoid feeding supplements in the summer when harvesting honey, because they want to ensure that their honey is free of any chemicals included in supplements. Participants with multiple roles (e.g., both honey producer and queen breeder) generally did not distinguish among different roles when describing their feeding practices.

Cost and availability

Most respondents agreed that finding low-cost supplements was a priority in their feeding strategies. Based on responses from about two-thirds of participants, beekeepers' estimated annual supplement feed costs ranged from \$6 per hive to \$74 per hive, with an average of \$30 per hive. Participants were asked to roughly indicate their willingness to pay for improved supplements; respondents generally did not want to exceed their current expenditure on supplements unless the product was significantly more effective in accomplishing their feeding objectives. Beekeepers would want to see substantial evidence that a new supplement yielded impressive results for their operation before investing more money into supplemental feeding.

The market of commercial supplement products has grown substantially in the last decade or so, such that some beekeepers find it more cost-effective to buy premade protein patties from commercial suppliers, while others believe it is less expensive to continue to mix their own patties. Product availability can greatly influence costs. Beekeepers located near a commercial supplier facility face lower costs to acquire product than those that need product shipped across the country to their operation.

Supplemental feed choices

Commercial products and home brews

While many commercial beekeepers used to make their own "home brew" patties, most respondents have switched to buying pre-mixed patties to save time and labor. The three major protein patty suppliers are Dadant & Sons, Mann Lake, and Global Patties. Most of the Canadian beekeepers interviewed buy from Global Patties, due to availability. American respondents were fairly evenly split in their use of Dadant and Mann Lake products; many beekeepers have used products from both suppliers, and switch between them based on evidence of effective new products. Some beekeepers adopt a hybrid approach, purchasing patty product from one of the major suppliers but mixing in extra ingredients, such as canola oil, to provide higher fat content to their bees. Respondents who home brew their patties cited brewer's yeast as a staple ingredient for their recipes. Popular protein choices for home brews were soy flour or egg yolk/powder; beekeepers also often add essential oils such as lemongrass oil to their recipes.

Key patty components

Many beekeepers interviewed cited high protein content as the most important component of a high-quality patty, followed by the "attractiveness" of the patty to their bees as indicated by how quickly the bees consume the patty. There is no industry standard recipe for protein patties; both home brews and

commercial recipes vary in the percent protein, the types of protein, type of sugar, and additional ingredients added such as stimulants, probiotics, and oils. Many respondents also discussed the importance of including a feeding stimulant in patties to make the supplement more attractive to bees. The most popular commercial stimulant is Honey-B-Healthy, which includes essential oils.

Many beekeepers interviewed are interested in incorporating probiotics or antibiotics into protein patties to combat hive diseases. Several respondents listed this as an area of research interest; they said there is not enough information available on the impact of probiotics and antibiotics on bee health. One beekeeper expressed concern over how the changes in the Veterinary Feed Directive (VFD) will affect the usage of antibiotics and probiotics; the new law stipulates that a licensed veterinarian must administer the feeding of antimicrobial agents to bees. As a result, beekeepers will have less authority to experiment with including antibiotics and probiotics in their nutrition supplements.

Sugar syrup

All beekeepers interviewed feed some kind of sugar syrup to their colonies at different times of year. There were stark differences among respondents in their choice to use sucrose or high fructose corn syrup. Almost every Canadian beekeeper interviewed uses sucrose for their sugar syrup, while syrup choices were fairly evenly split between sucrose and corn syrup in the United States. A few beekeepers use a blend of sucrose and corn syrup. Respondents raised concerns regarding both high fructose corn syrup and sucrose. Proponents of sucrose said in their experience, they observed high fructose corn syrup causing dysentery; proponents of high fructose corn syrup said that sucrose can cause *nosema* in their hives.

Supplier information and support

There was a divergence of opinion over how satisfied beekeepers were with the service and information provided by supplement supplier companies. Several beekeepers cited their local supplier as their main source of information regarding nutritional supplements. Some respondents want the companies to provide more detailed information on the patty product packaging, specifically the ingredients, the date of manufacture, and the percentage of protein in the patty. Other beekeepers said that they are not concerned about detailed nutritional information, and are content with commercial products if they achieve the desired results. This spectrum of attitudes tracks with the varying interest levels beekeepers have in general towards detailed nutritional information.

As discussed, beekeepers feed to different objectives based on geography, their role in the industry, and their feeding “philosophy.” However, most beekeepers use the same patty whenever they feed during the year. Some respondents expressed a need for more nuanced patties designed for different feeding objectives. For example, commercial pollinators need supplements with high protein content in the spring to quickly stimulate the bees to build brood before almond pollination. In the fall, beekeepers want supplements to strengthen and nourish their hives without stimulating brood production in preparation for winter dormancy.

Information sources and needs

The majority of respondents use word-of-mouth from their colleagues in the industry as their primary source of new nutrition supplement information. There is a frequent exchange of information regarding effective new products and best feeding practices among commercial beekeepers, especially at conferences and conventions; one beekeeper also cited social media as an information source. Many of

these beekeepers also regularly read bee journals and online research; however, these remain secondary sources of reliable information for two major reasons: First, the amount of information available can be overwhelming and difficult to sort through; second, beekeepers do not know which studies and articles are credible and unbiased.

Beekeepers seek unbiased information that they can directly apply to their operations. Many respondents were hesitant to trust the studies they read in bee journals and online because they may be funded by product developers. With more and more products on the market each year, beekeepers are wary of advertisers who promise the next miracle supplement. Beekeepers are interested in trustworthy information regarding both what to feed their bees and how to feed their bees. As discussed above, there is divergence among commercial beekeepers over best feeding practices. These perceptions are often based on their own trial-and-error as well as anecdotal evidence from trusted colleagues, rather than from research studies. Beekeepers want access to field-tested, transparent information on best feeding practices.

A few respondents also expressed that they do not trust that research will be applicable to the specific context of their operation; factors such as geography and operation type create different conditions than those produced in bee labs. Commercial beekeepers are results-oriented, and therefore are more likely to trust anecdotal evidence from their peers that a product is effective in the field.

Key research needs

Turning pollen supplements into pollen substitutes

Of the beekeepers interviewed, the most important research concern is determining the “holy grail” of natural pollen, the unknown attribute(s) or nutrient(s) that makes natural pollen more nutritious than any supplement. Respondents agreed that current supplement options are not substitutes for real pollen; bees cannot survive well on a diet that does not include natural pollen. Beekeepers are in favor of continued research to discover those key components of natural pollen because they would greatly benefit from a supplement that can mimic nature. Introducing such a pollen substitute would reduce dependency on natural forage, which would be especially useful for beekeepers based in challenging climates and in areas of high agricultural intensity.

Disease prevention

Many respondents would like to see nutrition supplement research dedicated towards preventing diseases and boosting the bee’s immune system. Beekeepers want to better understand which nutrients help bees fight viruses, and which ingredients should be included in supplements to best build up the immune system. Disease prevention does not seem to be an area of focus for existing commercial supplement products; this assessment suggests that beekeepers would strongly support research and development into the link between nutrition and virus prevention.

There is also a trend of experimentation with antibiotics and probiotics among commercial beekeepers and supplier companies. Approximately one-third of the beekeepers interviewed are using or are interested in learning more about probiotics, especially. Beekeepers are interested in more solid research evidence of the effects of adding antibiotics or probiotics to nutrition supplements. Several beekeepers had concerns about certain protein patty products causing diseases in their hives. A few respondents suspected that poor pollen supplements had caused *nosema* or dysentery in their hives. Others believed that feeding protein supplements at certain times of year can increase varroa mite

levels. Therefore, research focused on disease could test these perceptions, researching any links between improper supplemental feeding practices and the onset of hive viruses.


Comparative field tests

A few participants run their own comparative tests of different nutrition supplements in their colonies. These beekeepers generally ran some of the largest operations, and had the capacity to test new products on a few hundred of their hives to compare efficacy against other supplements. Other beekeepers expressed an interest in conducting such field tests, but said that they couldn't risk any of their colonies collapsing due to an ineffective supplement; it wasn't economically viable to test new products.

As stated, many beekeepers are unsure if mainstream supplements really target the dietary needs of the bee. They choose supplements that they or their colleagues have seen to increase brood in their hive, but they do not know if these supplements are missing key ingredients that would optimize colony health. These commercial beekeepers would like to see independent entities conduct field efficacy testing for different supplement products, and for those tests to take place in multiple geographical regions to account for climate-related impacts. Comparative testing should develop metrics of success based on the key objectives emphasized by beekeepers, namely brood growth, the consumption of the supplement, bee energy levels, and bee lifespan.

Conclusion

The Beekeeper Insights on Nutrition Supplements project helped to identify critical beekeeper knowledge, perspectives, and objectives related to nutrition supplements. This assessment identified key trends, challenges, and approaches to supplemental feeding. The assessment identified that the research areas prioritized by beekeepers are discovering the key nutrients in natural pollen, using supplements to fight diseases, and field tests comparing nutrition supplements for efficacy. Beekeepers want better access to transparent, field-validated research with results that they can directly implement to improve their supplemental feeding strategies. Comparison of the views summarized here against completed and ongoing research may also reveal instances where relevant data already exist to address key questions, but opportunities remain to communicate such findings to beekeepers. Interviews also revealed that beekeepers have different interest levels in bee nutritional science, which should inform how research and other supplement information is communicated to beekeepers. Considering beekeeper insights is crucial when determining priorities for research, product development, and communications and outreach for nutrition supplements.



Learn more about the Honey Bee Health Coalition and its mission, members, and work by visiting honeybeehealthcoalition.org.

