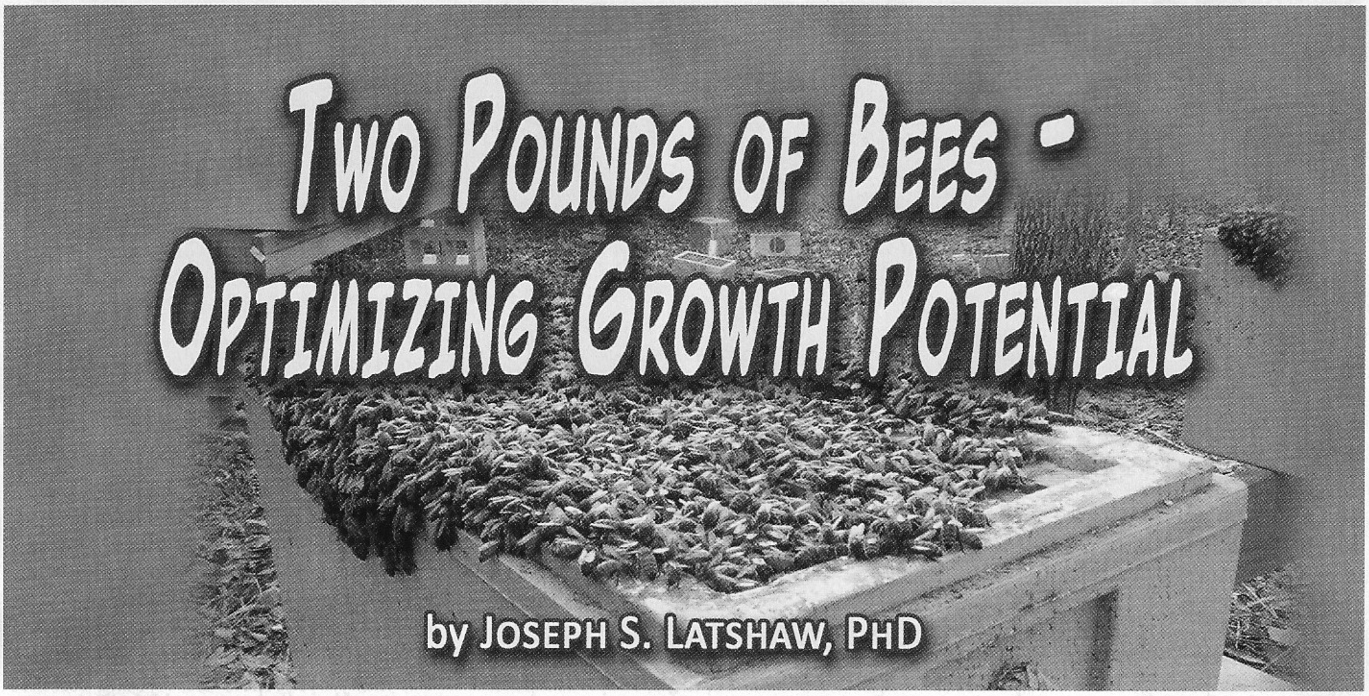


Two Pounds of Bees - Optimizing Growth Potential

by Joseph S. Latshaw, PhD

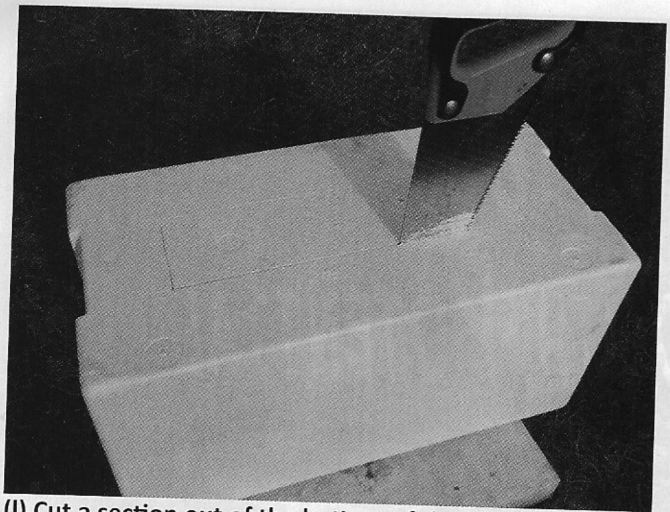
Every so often we encounter a concept that leaves a lasting impression. In an animal genetics lecture, the professor placed the equation, G+E=P, on the board. G represents "genetics", the influence the maternal and paternal contributors brought to the performance of the animal. E represents "environment", the external influences that helped shape the contribution made by "G". P represents the combined influence of both G and E, the physical attributes that were visible such as growth and productivity. This was impressive; how could such a complex concept be distilled to such a simple form? In my mind, the equation continually begs the question of how can this be applied to honey bees and what types of factors are most responsive to modification by the beekeeper for optimal productivity?

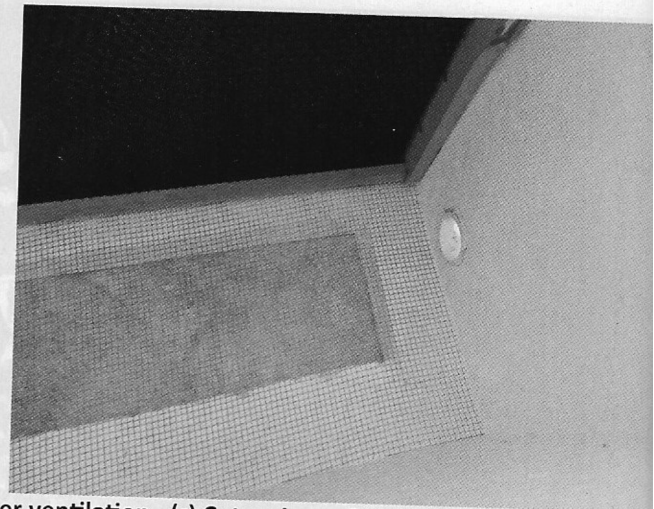
A number of years ago, I began working on honey bee nutrition with my father, who is an animal research nutritionist. The initial objective was to develop a pollen supplement, called *Bee Food*, that was based on the nutritional profile of composite pollen samples. In order to test and evaluate *Bee Food* formulations and varying nutrient levels, nucleus colonies were established very early each season using two-pound packages. The packages allowed for a more or less uniform start to the developing colonies, and they could be started very early in the year before natural pollen was available to the bees. From the onset it was important to minimize variation with the packages and identify those factors that could be controlled to provide optimal growth potential for the young colonies. The "genetic" influence was at the mercy of the package producer and therefore, emphasis was placed on "environmental" influences that could be controlled through beekeeping management practices. Three primary environmental influences were identified: temperature, Varroa levels, and food - honey/syrup and pollen supplement. The remainder of this article will attempt to illustrate those management practices and to explain the reasoning behind each step in an effort to provide an adaptable system for other beekeeping operations.

In order to help the early spring packages conserve their heat and energy, 5-frame polystyrene nucs developed by Dave Tegart of Canada were selected (http://tegartnuc.com/). The nucs were purchased from Simpson's Bee Supply without predrilled entrances and hardware (Nucs are also available directly from Betterbee, the US supplier). For the nucs, a front entrance was installed by drilling a hole in the nuc and inserting a 1" piece of PVC. A screened bottom was made by cutting out a section of the bottom approximately 3.5"x 16"and cutting a piece of #8 hardware cloth to drop down in the bottom of the nuc. From earlier field trials, it was found the screened bottom was beneficial to colony thermoregulation and moisture build up later in the season. It also makes the nucs easy to move in the cool parts of the year and makes the nucs "stackable" when the screen is removed. Polystyrene nucs are not essential but provide a great benefit to the developing colony. To further conserve the colony's heat in the early spring, a small piece of reflective insulation was slipped under each nuc to essentially close the screened bottom until the extra ventilation was needed later in the season.

Prior to package installation, each nuc was prepared with five drawn combs consisting of approximately 2.5 frames of honey and 2.5 empty frames. The honey was placed on the outside to keep the middle space open for brood rearing. Providing ample food in the form of honey was another primary management factor that was essential for rapid growth. It should be noted that a 5-frame nuc provides enough space for the 2 pound package to fill nicely, but not completely. Matching the package size to the appropriate box size ensured the heat was more evenly distributed, especially when night time temperatures were below freezing. The goal was to provide an optimal nest size to keep the bees from clustering in order to promote rapid expansion of the broodnest. The real value in the two pounds of bees was to produce the next generation of offspring as quickly and effortlessly as possible. Providing an optimal environment for the young colony to raise brood was essential.

Another advantage of using package bees is the concept of a "clean slate" or "all in all out", a common practice used in other agricultural systems. There was no brood in the colonies, the queen was confined in a queen cage and the workers were confined to the package. It was an ideal time to reduce and equalize mite levels using a soft treatment of oxalic acid drizzle when the packages were installed. Phoretic mites (mites on the bees) are an ideal target. Reducing Varroa levels was the third primary management practice that was used to provide a healthy environment for the growing colony. Using a very small amount of a soft treatment at an optimal treatment time will pay dividends for this season and the following season. An oxalic acid treatment modified from Aliano and Ellis (2009) was used. A 3.5% oxalic acid solution was prepared. Queen cages were removed from the package, the sides of the package were sprayed using a small hand held pump spray bottle. The package was then jarred to drop the cluster and the feed can was removed and the bees sprayed through the feeder can opening. Only a small amount of oxalic solution was used for each package, approximately 4-5 sec-





(l) Cut a section out of the bottom of the nuc for added summer ventilation. (r) Cut a piece of #8 hardware cloth to drop in the nuc box to serve as a screened bottom board. Also note the entrance hole is reinforced with 1" PVC pipe.

onds of spray, enough to mist the bees, not soak them. Queen cages were then installed between the center frames and the treated bees from the package were dumped over the top of the frames in the nucs and allowed to crawl down between the frames.

Once the bees settled into the nucs, the lids were closed and allowed to remain undisturbed for 5-7 days. Following the 5-7 day settling in period, a quick inspection was performed to see that queens were released. *Bee Food* patties were added at this time. Small amounts of patties were initially added as initial consumption was low and closely tied with brood development. Another concern was for small hive beetles. Small hive beetle larvae can develop quickly in unconsumed portions of the patties. A second round of inspections was completed 7-10 days later to replenish patties and inspect for the presence of brood. Colonies without brood were checked more closely for a queen. Colonies with poor or

The queen cage is removed from the package and placed between the frames prior to spraying the package of bees with oxalic acid solution.

absent queens were simply combined with the closest nuc.

Approximately 5-6 weeks after the packages were installed, the nucs were inspected to determine which nucs were in need of additional space. Development of the young colonies really varied from year to year and appeared to be influenced most by external temperatures during the first few weeks of development. During the coldest springs, a second 5-frame polystyrene box was added under the existing box. This placed the cluster in the second story and helped to conserved heat. The bottom box contained the same assortment of frames, approximately 2.5 frames of honey and 2.5 empty frames. If the spring was warm, or the original nuc was strong, the new box of frames could be placed on top, but this was the exception. The idea is to keep the bees warm and well fed, but not subject them to the temperature extremes of spring weather. By keeping the cluster high in the box, heat was conserved. The primary goal was to keep the broodnest intact and generating brood. Bee Food patties were replenished as needed and supplemental syrup was provided. The syrup used was a thin syrup approximately 20-30 percent sugar. The syrup was intended to mimic a nectar flow, providing carbohydrates, but also a source of water for the growing colony. Top feeders or open feeding was used, depending on the weather.

The third box was almost always placed on top as temperatures were beginning to moderate and the colonies were growing rapidly. As frames of brood were emerging in rapid succession, a seemingly adequate nuc was overflowing with bees in a matter of days. A good gauge was to watch the fronts of nucs. Even in the cool spring weather, crowded nucs clustered around the entrances late in the evening. This was usually a good sign that another box was needed.

By the time the two pounds of bees grew into three story nucs, the spring nectar flow was just getting started and the temperatures were warming. A word of caution, three story nucs are subject to toppling over in strong winds. There was always some variation in the development of the nucs, so the strongest nucs were identified and marked. For many beekeepers these young colonies would have made a great honey producing unit for the season, but there was a greater value in the young colonies, more than just one year's honey crop!

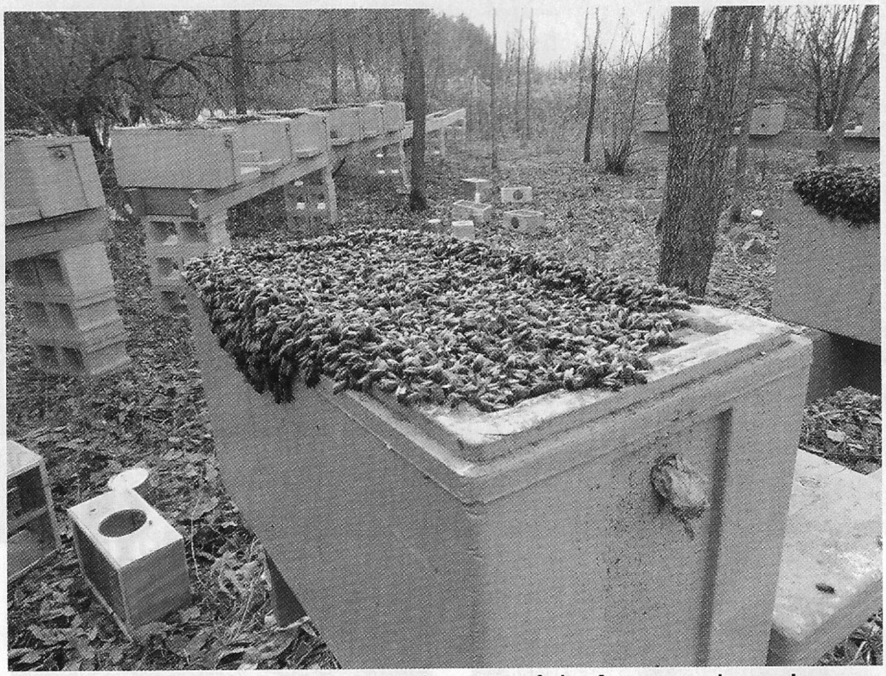
In our region, May and June are great months to make splits or nucs to grow and overwinter for the following year. One solid frame of brood and bees, plus an extra frame of honey or syrup and a queen will easily grow into 10 frames or more going into winter. Arguably, the greatest use and value for a young healthy colony, with very low Varroa levels is to be broken up into many smaller colonies that will overwinter and become production colonies the following year. Once you have invested the time and energy into developing a strong colony, the concept of very low Varroa levels becomes key. Utilize the source of bees to make more

Spray each side of the cluster inside the package and through the feeder can hole just prior to dumping the package of bees.

colonies with very low Varroa levels. Use this to the bee's advantage!

Once the nucs reach three stories, 15 frames, they are ready for breaking down into small splits. Keep in mind, timing is critical. The proper timing is regional, weather dependent and most importantly, based on colony development. Again, the 5-frame polystyrene nucs provide insulation for the small developing colonies. To make the new splits, nucs are prepared ahead of time with three empty combs, a frame of honey and an empty space for the frame of brood and bees. Typically the open space is against one of the sidewalls with the frame of honey next, followed by the three empty drawn combs. This way, the developing colony has direct access to the honey. New splits are made very early in the morning so that most of the bees for the colony are still present before foraging really begins. Start in the top box and work your way down through the colony. If you are confident in your queen finding skills, check the frames as you go, but if in doubt, locate the queen before moving any frames of bees and brood. Marked queens really help in this regard! Place one frame of bees and brood in each new split and place the top on to keep the bees in the nuc. Make sure the entrance is plugged and the screened bottom will provide ventilation for the small amount of bees in the cool spring. You may use your discretion to distribute partial frames of honey and brood. The goal is to make up as many splits as possible from the top two stories of the existing nuc. The bottom story is left in place with the old queen once all of the splits are made. If the original nuc was strong and populous, 6-8 new nucs may be generated for the first round. If the original nuc was very strong, you may also remove a frame or two of brood from the bottom box. As soon as the nucs are finished being stocked, it is important to move them to a new yard so that bees will remain in the nuc. An empty yard is ideal, one free from other colonies and most important, other mites that may re-infest your healthy splits. Once the new splits are placed in their new location, add a caged queen if you have them or a queen cell. It is important to provide feed if necessary. Each area, year and flow will be different. The frame of honey will last a little while if no other resources are available, but syrup and supplement may be necessary before too long. Again, the key is to provide a warm environment with plenty of food to help the young colonies grow.

The original nuc can really benefit from stimulative feeding as well. With some care and feeding, you will be able to re-grow and re-split your original package for another round. Again, when feeding the colonies in early spring, the idea is to mimic a nectar flow to encourage brood rearing. Nectar provides two primary components to growing colonies, water and sugar. The water is essential to developing brood. A light syrup 20-30% is ideal in this situation to encourage growth. If the young colonies are confined for extended periods of time to inclement weather, the benefits of stimulative feeding are even more pronounced. The colony will grow on its own without supplemental feeding, but providing unlimited resources accelerates growth. By this time the weather is generally warm enough that additional boxes of comb can be added to the top of the original package colony as needed. Once the colony reaches 2-3 boxes again, it can then be broken down into another round of splits. This process may be replicated as many times as you and your colonies are able complete during the season. In my region I attempt to finish this process before our dearth begins in July. The later the splits are made, the more challenging it becomes for them if resources are not available.



Once the package of bees is dumped on top of the frames and caged queen, they are allowed to settle in to their new home. A little smoke may be used to move them along a little faster before gently placing the lid on top.

Honey bees have an amazing potential for growth. It has been a real joy and learning experience to go from G + E = P to dissecting the factors that ultimately influence the final outcome of "P" in terms of colony growth and productivity. By actively managing bees and removing environmental barriers their true growth potential can be realized. Based on our trials three factors that showed great potential were providing a warm environment or a nest cavity volume that was most beneficial to the developing colony, relief from Varroa predation by reducing initial infestation levels, and ample food in the form of water, carbohydrates and protein. There are undoubtedly other inputs that would influence colony development, but the three discussed here are certainly significant. What initially began as a series of nutritional studies grew in to an overall evaluation of management inputs. It was interesting to learn the timing and application of management tools to conservatively grow a two-pound package into 10-15 colonies to be overwintered for production the following season. With increased management and input the number of colonies produced could be even higher. It is our hope that some of the management techniques described will be adaptable to other beekeeping operations.

Reverence

Aliano NP and Ellis MD (2009). Oxalic acid: A prospective tool for reducing Varroa mite populations in package bees. *Experimental and Applied Acarology* 48, pp. 303–309.