Final Feasibility Report

Feasibility Research Report for Insuring Honey Bees

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AgForce, Inc.
P.O. Box 1021
Perryton, Texas 79070
(979) 229-1481
(810) 885-0274 (Fax)

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Feasibility Research Report for Insuring Honey Bees

1.0: TABLE OF CONTENTS

2.0: Executive Summary

The following report addresses the feasibility and suitability of developing a crop insurance program for honey bee losses. Efforts were concentrated on changes in the industry since the RMA apiculture partnership was completed (2003). The team conducted independent research and collected comments from honey bee/apiculture producers from across the United States.

Apiculture continues to be one of the most dynamic and diverse industries considered for insurance under the federal crop insurance program. The dynamics within the hive and diversity within the industry present unique issues that must be overcome before a sound insurance program can be developed. The industry provides several products/commodities and services that are dependent on the colonies. Combine these with the fact that the industry is mobile, both in the locations of the colonies and the mobility of the stored products, presents several challenges that must be addressed.

The honey bee (*Apis mellifera*), is a member of the insect order Hymenoptera and apiculture is the management of honey bees for human benefit. Honey bees are considered social insects because they live together in well-organized groups. The American apiculture industry has three common and recognizable sectors which include honey production, crop pollination, and bee breeding. Honey is the most common sector and it is estimated that production is over $200 million a year. A successful honey bee producer must have an understanding of the unique and dynamic characteristics of the honey bee and the industry as a whole. Managing an apiculture operation has been described as a balance of both science and art. Careful bee, hive, and colony management is the key to any successfully apiculture operation/enterprise, with management decisions or neglect greatly influencing the health and production potential of an operation. But other significant risks, independent of management, may adversely affect individual apiculture enterprises and even the entire industry. These important perils include environmental conditions, pests, pathogens, and market forces, all of which may reduce returns on hive products and services.

Because RMA had completed a feasibility report of the apiculture industry in 2003, this report concentrates on the major changes in the industry since the 2003 RMA report was submitted and how they affect the ability to insure honey bee losses. The primary changes in the industry have been the increased reliance on pollination services by many of the commercial beekeepers and the problems caused by Colony Collapse Disorder (CCD). Pollination is an addition to the baseline honey income and is the cushion that has supported the industry for the past 5 years. Pollination services are greatly influenced by external market forces for early pollinated crops such as almonds. Honey bee pests, environmental conditions, and liability issues are major perils faced by the industry; however, the biggest threats continue to be climate/environmental variables and the recent issue of the extra-normal hive mortality attributed to Colony Collapse Disorder (CCD). The primary concern with CCD, from an apiculture management standpoint and from an insurance standpoint, is the fact that a definite cause of this disorder is not fully attributed at the current time.

The 2003 RMA report recommended a group type insurance program based on honey production and price as it did not focus solely on honey bee losses. However, there were concerns with the recommended program because of limited data, limited number of producers, inconsistency in data, and size of the recommended area. There were also concerns by other federal agencies related to data integrity. This resulted in the FCIC not adopting or implementing a pilot insurance program based on the feasibility report recommendation. Following the FCIC Board decision on the group plan recommended in the partnership, a private company submitted two 508(h) apiculture products (API-RI, and API-VI) that were first piloted in 2009. These apiculture insurance products are based on the design of the Pasture, Rangeland, Forage Rainfall Index (PRF-RI) and the Pasture, Rangeland, Forage Vegetation Index (PRF-VI) plans of insurance. These products utilize innovative technologies and methods to insure commodities based on an index correlated to honey production. An important point associated with the index products is that they are not a direct measure of production or individual operations. While many producers are pleased with the early performance of these index programs, there are producers that realize these programs only cover a portion of their apiculture operation. Apiculture producers can also participate in the Adjusted Gross Revenue (AGR) based crop insurance program currently in pilot in selected areas across the United States, if they qualify. However the current structure of the industry, producers, and the policy prevents this program from being a viable option for the majority of producers.

Consistent data sources and commodity dynamics, combined with the mobility of the industry, continues to be limiting factors in the feasibility and development of an insurance program for honey bee losses in addition to the apiculture industry. While there are sources on honey price and honey production, the data is considered limited due to the number of actual producers. In valuing the loss of honey bees, it is important to discern the price of honey and value of pollination to an operation. While there is data to establish a price for honey and possibly an insurance program, there are questions on whether this data is adequate for regional annual prices attached to an individual's production data. There are also issues of basing a program on individual colonies and the health of the bees. These types of programs are faced with simple logistic issues associated with the mobility of the industry, relative ease of transport of the product and colonies, and the cost and knowledge required to adequately adjust individual colonies. All of these issues raise serious concerns related to moral hazard, fraud, and abuse.

The final sections of the report provide details on the steps involved in evaluating various insurance programs and policies as well as the final recommendations. Many of the issues noted in the 2003 report are still present today. Based on the objectives stated in the Task Order and by RMA, in addition to the study's focus directed by the Food, Conservation, and Energy Act of 2008, the contractor determined that it is not feasible to develop a federal crop insurance policy that "covers loss of bees". However, during this project's research it is noted that a program covering an entire apiculture operation's revenue could potentially provide a producer acceptable level of coverage for honey bee losses. Conversely, it was agreed that the questions and possible risks associated with this type of a program were unquantifiable and ultimately unacceptable at the current time. A program for this industry must consider the dynamics of the industry and all the commodities and services of a typical apiculture operation before it would be acceptable to the industry.

3.0: Background

One of the most unique and important industry components in American agriculture is apiculture. Apiculture is the management of honey bees (*Apis mellifera*) for human benefit. The American apiculture industry encompasses three distinct sectors: honey production, crop pollination, and bee breeding. Honey production (~ $200 million annually) is the most recognizable form of apiculture; however, crop pollination provides the backbone of American agriculture by annually providing approximately $15 billion in value to United States crop production. The industry is unique in that many of the honey producing colonies are transported every year to points all across the United States providing pollination services and honey production. In fact, most beekeepers move their colonies several times a year to maximize production and revenue of the colonies.

While the apiculture industry encompasses such a diverse significance to American agriculture and conservation, the industry is continuing to be plagued by a number of perils including weather perils, exotic pests, and diseases. Most recently, the public sector has been informed of a peril affecting the honey bee industry: Colony Collapse Disorder (CCD). Of all the changes in the industry since RMA completed its last study, the impact of CCD is one of the greatest. The exact cause of CCD is still being debated among apiculture and industry experts, with numerous opinions attributing CCD to multiple factors, thereby creating a compound problem. While it is understood that the driving force behind this feasibility report is CCD, an insurance program should not focus solely on this peril as there are other risks and liabilities associated with the loss of honey bees.

The federal crop insurance program has provided a safety net for producers of major crops; however, risk management tools for honey bee (apiculture) producers and the industry have been limited. The current AGR based programs provide an option for insuring "bees", but because of the design and limitations associated with this program (as detailed later in this report), it is not a viable option for the majority of honey bee producers. In 2009, a new federal apiculture insurance product was piloted. These products are based on indices and provide coverage for a portion of an apiculture operation. Over the past several years RMA has received numerous requests for a honey bee/apiculture program. In addition, the Food, Conservation, and Energy Act of 2008 (Farm Bill) directed the Risk Management Agency (RMA) to "*offer to enter into a contract with a qualified entity to carry out research and development regarding insurance policies that cover loss of bees."* The contractors and/or their key personnel have worked on various honey bee/apiculture risk management issues with RMA and the honey bee industry since 2002.

The contractor's key personnel began working with private companies, industry experts, academia, producers, and RMA to determine the feasibility of providing a risk management option to these producers. As a result of this work two 508(h) products were submitted to the FCIC Board for consideration in April 2007. These products were approved and released for sale to apiculture producers, starting with the 2009 Crop Year.

Prior to the current apiculture insurance program, RMA performed an extensive study on the apiculture industry in 2003. The partnership included a detailed survey to determine the state of the apiculture industry in the United States. This survey was submitted/published in 2005 and included information about apiculture locations, colony and producer sizes, industry structure, producer income and expenses, pollinator activities, bee breeding, honey prices, and honey yields. This original feasibility report and the resulting survey provided a recommendation on a program design, but more importantly it provided producer and production related data that was not available prior to these projects. This information could be valuable if RMA moves forward with another insurance program.

In addition to the background information provided by the above research and insurance program implementation, there were other insurance programs both inside and outside the United States, reviewed during this feasibility study. Most of these programs are designed to compensate beekeepers for lost bees over the winter months or direct loss to other pests and insecticides. While each of the programs provides coverage and compensation for beekeepers and lost honey bees, there are some limitations to each of these programs. The primary concern with the programs reviewed was logistics and the potential for fraud, abuse, and moral hazard.

While there are sources of honey and beekeeper data available from federal and state agencies, the data is considered limited because of the number of producers and the mobility of the industry. Combined with this, is that fact that the agency and procedures for data collection has varied in the recent past, which leads to questions on the usefulness of this data for an insurance program. Price data faces the same issues as production data; however, there is adequate data to establish a price for honey production, as long as a program does not require a forecasted price in a revenue type program.

As instructed, this feasibility report is not designed to review and restate information RMA has received in previous feasibility reports and the apiculture 508(h) pilot submission. The original RMA apiculture feasibility report contained a complete description of the apiculture industry, perils, options, and a recommendation. The contractor has referenced the report as a source of additional details throughout this report. This reference was an attempt to prevent repetition between the products. While reference to these reports is important, the contractor's concentration of this report was to supplement, provide additional information, and highlight new information or industry changes, with an emphasis on losses of honey bees. However, because of the similarities between the two projects and to meet the requirements of the TO, there is some replication.

Based on research, there have been significant changes in the industry. One of the primary changes has been in the area of pollination. Based on comments collected from beekeepers, they now estimate that over 90% of commercial bee keepers (with 5,000 or more colonies) are involved in commercial pollination. This results in a change in operational income sources. It is estimated that honey now accounts for approximately 40 percent of the operation's gross income with pollination income now estimated at a 60 percent of gross. As a result, many beekeepers are now managing more for pollination rather than honey production. The driving force behind this switch has been the increase in pollination rentals. It is important to point out that pollination rentals are influenced by factors out of the apiculture producer's control. In 2004, the average pollination rental was around $42.00, while today the value is over $100.00 for almond

pollination (the largest crop utilizing and benefiting from honeybee pollination).

While pollination rentals have increased in importance, the other products and services remain important. Honey prices and honey production have remained relatively stable over the past several years with a slight decline, due to the loss of bee pastures. Again, many times the loss of bee pastures is driven by forces out of the control of the bee operator. The selling of bees or package bees and the queen industry is also an area that has remained strong. This is due to the other big change in the industry associated with CCD. If bee breeders can keep their bees healthy, then this portion of the industry should remain stable.

4.0 Honey Bees

Biology:

There is additional information and details on the biology, structure, development, and management in the RMA apiculture partnership (AgriLogic, 2003) report that is not repeated in this report.

Honey Bee Species and Subspecies:

The honey bee (*Apis mellifera*) was brought to this country by early settlers, for honey production and their pollination services. It is a member of the insect order Hymenoptera. Honey bees are characterized as having three body regions (head, thorax, and abdomen) and a pair of antennae that extend forward from the head (having a unique shape with an elbow-like angle) that bend at a right angle. The head also has conspicuous compound eyes which have a fair degree of visual ability including the detection of colors, movement, and distance (Basic Bee Biology, 2004).

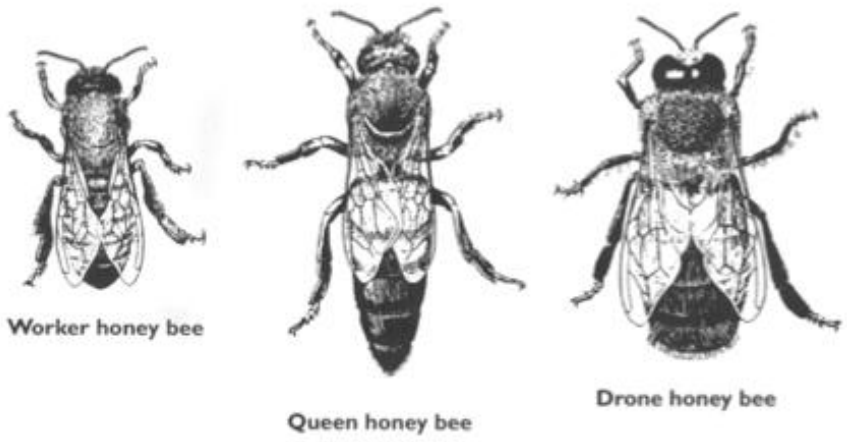
The honey bee is a relative of three other social bee species. These species include; the Dwarf honey bee or Red dwarf honey bee (*Apis florea*), which is one of the two small wild species of southern and southeastern Asia. The Asiatic honey bee (or the Eastern honey bee) (*Apis cerana*), which is also a small honey bee of southern and southeastern Asia. The third relative is the Giant honey bee (*Apis dorsata*).

There are multiple subspecies of the honey bee (*Apis Mellifera*); however, there are four commonly utilized subspecies: The A.m. ligustica (Italian bees), A.m. caucasica (Caucasian bees), A.m. mellifera (German bees) and A.m. carnica (Carniolan bees). These subspecies have had a notable impact on the American beekeeping industry. Many years of research and intensive breeding programs have resulted in several uniquely valuable honey bee strains that display resistance to parasites and pathogens, produce colonies which move quickly into exponential growth during early spring, are reluctant to sting, produce large honey stores, and provide other advantages (AgriLogic, 2003).

Honey bees are social insects living together in well-organized groups. These well-organized groups are considered social insects that are highly evolved because they engage in a variety of complex and organized tasks. Bees and the resulting colonies function through communication, nest construction and management, developed defense systems, and division of labor (Bee Keeping Basics, 2004).

Within the honey bee colony and social community there are three primary groups and distinct types of bees, these are the workers, queen, and drones (Figure 1). The total number of bees in a good healthy colony, during the production season, can typically range between 20,000 to 60,000 workers, 0 - 1,000 drones, and only one queen (Virginia Cooperative Extension. 2009).

Workers are female bees with undeveloped reproductive system. The workers have pollen baskets on their hind legs, and several specialized glands used for the secretion of scent, wax, and food for larval bees. The drones are male bees with large eyes that come together on the front of their head. These eyes and the larger heavy bodies distinguish these from the workers or queen bee. The queen bee has a well developed reproductive system and she lays all the eggs in the colony. The queen lacks many of the specialized glands and pollen baskets, and her jaw is too small for manipulating wax (Virginia Cooperative Extension. 2009). The queen and drone bees are responsible for reproduction. The worker bees take care of all of the hive functions.



Source: Bee Keeping Basics MAAREC: 2004.
Figure 1. Illustration of the distinct types of bees.

The social structure of the colony is maintained by the presence of the queen and workers, and depends on an effective system of communication. Each colony has only one queen, except during the period following swarming preparations. The queen is the only sexually developed female and produces both fertilized and unfertilized eggs. Egg laying is typically greatest in the spring and early summer and can reach as many as 1,500 eggs laid in a single day. Egg laying decreases in the fall and may actually stop during the winter. The queen is easily distinguished from other members of the colony. Her body is normally much longer than either the drone or worker bees, and her wings cover only about two thirds of the abdomen. The wings of both workers and drones nearly reach the tip of the abdomen when folded. A queen can live for several years; however, the average productive life is typically two to three years (Bee Keeping Basics, 2004).

The drones (male bees) are the largest bees in the colony and are typically in the colony only

during spring and summer. As mentioned, the drone's head is much larger than that of either the queen or worker. Drones have no stinger, pollen baskets, or wax glands. The drone's primary function is to fertilize the virgin queen during her mating flight. Drones become sexually mature about a week after emerging and die instantly upon mating. Although drones perform no useful work for the hive, their presence is believed to be important for normal colony functioning, as worker bees will expend energy and hive resources to feed and care for drones. With colder weather in the fall and when pollen/nectar resources become scarce, drones usually are forced out of the hive and left to starve (Bee Keeping Basics, 2004).

Workers are the smallest bodied adults and make up the largest group of bees in the colony. Workers are sexually undeveloped females and under normal hive conditions do not lay eggs. As mentioned, workers have specialized structures, which allow them to perform all the labors of the hive. They clean and polish the cells, feed the brood, care for the queen, remove debris, handle incoming nectar, build beeswax combs, guard the entrance, and perform air conditioning and ventilate for the hive during their initial few weeks as adults. Workers will live only about six weeks during the summer when the colony is the most active, while in the fall and winter workers may live for 6 months (Bee Keeping Basics, 2004). While worker bees are females with undeveloped reproductive systems, when a colony becomes queenless, and the queenless condition persists, then the ovaries of workers may initiate development. Though worker reproductive development is incomplete, and workers are incapable of mating, these workers begin to lay unfertilized eggs. However, these unfertilized eggs inevitably become drones and colonies with laying workers soon perish. Colonies with laying workers are recognized easily because there may be anywhere from five to fifteen eggs per cell and small-bodied drones are reared in worker sized cells (Bee Keeping Basics, 2004).

Honey bees (*Apis mellifera*) in the United States are a blend of several subspecies/races introduced from Europe, the Middle East, and Africa. Currently, the three major races favored by commercial beekeepers are: Italians, Caucasians, and Carniolans. However, those now present in the United States are not different from the original races. The following description of the major subspecies/races was based on information from the publication *Bee Keeping Basics* (2004).

Italian bees are the most popular race in the United States. First introduced in the mid 17th Century to replace the black or German bees introduced by the early colonists, the Italian bee is light yellowish or brown with alternating stripes of brown and black on the abdomen. Italian bees have a tendency to start brood rearing early in the spring and continue until late fall. This results in potentially large populations during the spring and summer. Large colonies are considered to have more production potential. This race typically requires more maintenance during the fall and winter. Italian bees are considered to be quiet and gentle on the combs. Disadvantages include weaker orientation compared to other races, which results in more bees drifting from one colony to another, and a strong inclination to robbing, which can aid in the spread of disease.

Caucasian bees are sometimes described as the gentlest of all honey bees. They are darker colored with grayish bands on the abdomen. They tend to construct burr comb and use large amounts of propolis to fasten combs. Because of their comb construction they are not considered suitable for producing comb honey, and they have a tendency of drifting and robbing; however, they do not exhibit excessive swarming. These colonies typically reach full strength in mid

summer and are better at conserving their honey stores compared to the Italians bees. They also forage at somewhat lower temperatures and under less favorable climatic conditions than do Italian bees.

Carniolan bees are becoming more common in the United States. They are dark bees, similar to Caucasians, except they often have brown spots or bands on the abdomen. These bees overwinter as small clusters but increase rapidly in the spring after the first pollen becomes available. Their major disadvantage is excessive swarming. Due to their small overwintering cluster size, they are economical in their food consumption, even under unfavorable climatic conditions, and overwinter well. They are not inclined to robbing.

The most recent *Apis mellifera* subspecies immigrant to the United States is the New World African type, *Apis mellifera, scutellata*. After its deliberate introduction into Brazil in 1957, Africanized honey bees moved steadily northward, crossing the Rio Grande in 1990. New World African bees are now a significant component of the feral honey bee population across the Southern and Western US. New World African bees exhibit several traits that are problematic for apicultural applications in the United States, including hyper-defensive behavior and a propensity to swarm multiple times each year. Nevertheless, extensive genetic variability in New World African bees and the possession of behavioral and physiological traits that may confer important benefits to colony productivity, such as resistance to pathogens and pests, may lead to the development of commercially viable New World African hybrids.

There are also several lines of hybrid bees that have been produced by crossing several lines or races of honey bees. As with other livestock species, hybrid crosses in bees are planned and designed to produce hybrid vigor. These crosses or commercial hybrids are bred in an attempt to maximize desirable traits such as gentleness, productivity, wintering, hygienic behavior, or resistance to disease and mites.

In addition to the honey bee (*Apis mellifera*), there are other species that are, in unique situations, used in agriculture enterprises; however, the use and management of these species differ from the honey bee. This TO does not include the feasibility of these species; however, we feel it is important to mention the primary species and note their existence to prevent confusion if a program is developed. There are two primary species that fall into this category, the cutter or leafcutter bees (*Megachile* spp.) and bumble bees (*Bombus* spp.).

Leafcutter bees (*Megachile* spp.) are native bees, which pollinate wild plants and are sometimes utilized in connection with alfalfa production. These species are approximately the size of honey bees, although they are darker with light bands on the abdomen. Leafcutter bees are solitary bees that exist in various habits. Bumble bees are members of the genus *Bombus* in the family Apidae. There are over 250 known species in the Northern Hemisphere. Unlike the leafcutter bees, the bumble bees are social insects and feed on nectar and gather pollen.

Honey Bee Behavior and Development:

The beekeepers have come to understand the unique and dynamic characteristics of the honey bee and the industry as a whole. Beekeepers know that there is both a science and art involved with understanding bee behavior, development of the colony, and most importantly the

apiculture business enterprise. The key element of this enterprise operation is to understand the bee (colony) dynamics, the different roles for each of the bee types (worker, drones, queen), and how those factors interact with the environment to influence production.

Understanding the nest and/or hive ecology has led to the ability to manage and utilize the services of the bee occupants. Current hive structures are based on this understanding. The natural nest and beekeeper hive has five primary features: 1) a sheltered dark enclosure, 2) a small defensible entrance, 3) adequate volume (in man-made hives this size can be adjusted based on the need), 4) hexagonal beeswax cells molded into parallel comb separated by a small bee space, and 5) a separate space for the brood and food (Basic Bee Biology for Beekeepers, 2004).

The report previously discussed the key adult bees that make up the colony. This portion of the report will provide additional details on the adult bees, the three immature stages of bees present in the colony, and their development. The three adult stages are the queen, the workers, and the drones. Queen and workers are females; however, they have different tasks. The drones are male bees and have their own tasks as well.

All adult honey bees go through three developmental stages before emerging as adults bees. The three stages are the egg, larva, and pupa. These three stages are commonly referred to the brood. The length of time for each of the stages differs depending on the type of adult bee. Table 1, taken from the Bee Keeping Basics (2004) publication provides the details for each stage depending on the cast or adult bee. The activities, resources, and needs of the hive influence the development of the immature stages in the hive. Unfertilized eggs become drones, while fertilized eggs become either workers or queens. The amount of nutrition is an important factor in the development of the two female groups of adult bees; immature (larvae stage) destined to become workers receive less royal jelly and more of a mixture of honey and pollen (Bee Keeping Basics, 2004).

Table 1. Developmental stages of the three castes of bees.

DEVELOPMENTAL STAGE	DURATION OF STAGES		
	QUEEN	WORKER	DRONE
	Days		
Egg	3	3	3
Larval stage	5 ½	6	6 ½
Pupal stage	7 ½	12	14 ½
Total developmental time	16	21	24

Source: Bee Keeping Basics, 2004.

The following is a brief description of the stages with information taken from the Bee Keeping

Basics (2004) publication. There is typically one egg laid in each cell by the queen. The eggs resemble small grains of rice. During the three days of this stage, the egg develops into a tiny grub, thus beginning the larva stage. The eggs that will develop into workers are fertilized, while the eggs that will yield drones are not fertilized (Basic Bee Biology for Beekeepers, 2004). Larvae are typically in the shape of a "C" on the bottom of the cell and when healthy will have a pearly white color. The larvae are visited 10,000 or so times during their development for inspection, feeding (placement of food not direct feeding), and eventually capping of the cells (Basic Bee Biology for Beekeepers, 2004). The cells are capped after the larvae are 5½ to 6½ days old (depending on the type of adult bee). The larvae are fed (which distinguish workers from queens) by the adult workers (nurse bees) while they are inside the beeswax cells. After the cell is capped, the larva grows in length and spins a silken cocoon. During this period the larvae remains pearly white in color.

Inside the capped cells the pupae begin the process of changing from the larval form to adult bees. During the early stages of this process the healthy pupae will retain a white color. The eyes of the forming adults are the first color changes and the first signs of the adult bees. Soon after the eyes become visible the rest of the body begins to take on the color of the adult bees. The adult bees emerge from 7½ to 14½ days (depending on the type of adult bee) after the cells are capped.

Healthy brood chambers are recognized when looking at the capped brood. Healthy frames of capped worker broods normally have a solid pattern with few cells empty or damaged. Because of development times, the brood should have varying ratios of eggs, larvae, and pupae. During the spring and summer, the highest ratio should be of pupae, then larvae, and then eggs. It is important to note that there are apparent differences in the capped cells of the larvae of the queen, workers, and drones.

The number of bees and the different adult types within the colony will fluctuate throughout the year and is influenced by factors such as the season, food resources, and the bee race or type. During favorable conditions and adequate food supplies, the colony may divide either by swarming or by supersedure (the replacement of an old or inferior queen bee by a young or superior queen). Worker bee populations fluctuate during the season while drone bees are produced when resources improve in the spring and are then eliminated in the fall. Typically the worker populations begin decreasing in December and January and reach their lowest levels in later winter or early spring (February or March in more moderate climates). With a healthy colony, the population will begin to increase in the spring with an increase in day length and available resources. At this time, the birth rate will exceed death rates and the colony population will increase. This continues through the spring and early summer, reaching a peak at the start of summer. Weaker colonies will have a lower peak population or will achieve the greatest number later in the season. As mentioned, available resources (nectar flow) and the type or race of bees is an important factor in the amount and timing of colony increase. In addition, some colonies will exhibit an increase in adult bee numbers in early fall before the numbers start the decline in fall and winter (Basic Bee Biology for Beekeepers, 2004).

Each group of adult bees (queen, workers, and drones) has an important function in the production and health of the hive/colony; however, there is a single queen that is responsible for

the egg laying and population of the colony. The queen usually lives for multiple years (typically one to two but up to five years) and is normally replaced only during times of adequate resources, and during times when drones are present in the hive. This usually occurs in late spring or early summer, but will occur during other months under unusual circumstances (Basic Bee Biology for Beekeepers, 2004).

With only one reproductive female in a colony there are special conditions and procedures followed when it becomes necessary to replace the current queen. With adequate resources and during favorable weather, the colony may attempt to divide either by swarming or replacement by supersedure. Swarmng is a process where the current queen and a group of workers will leave the colony and start the production of a new colony. Replacing the queen with another queen (from a queen cell in the brood) is referred to as supersedure. A third procedure is also utilized by the colony to replace the queen in an emergency situation. This procedure occurs when the queen dies, is in poor health, or if the beekeeper or manager removes the existing queen in an attempt to split the single colony. Splitting an existing colony is a common management practice.

The process of replacing the queen begins with the current queen laying a fertilized egg in a queen cup. These queen cups are special cups and are always present in a colony. Once the fertilized egg is laid in the queen cup the current queen may be killed. In the supersedure process the termination of the current queen can occur either before or after the emergence of the virgin queen. With swarming the current queen may initiate the swarming process and leave the colony with a group of workers before a virgin queen emerges (Basic Bee Biology for Beekeepers, 2004).

Management:

Careful bee, hive, and colony management is the key to any successfully apiculture operation/enterprise, and as with any agriculture operation management strategies and philosophy will differ depending on the objective of the operator. The foundation is understanding the biology. This portion of the report will highlight the basic management considerations of an apiculture operation (additional information is available in the 2003 RMA apiculture partnership report).

Successful management of an apiculture operation can be measured by the health of the bees and colonies, and more importantly the production and income received from the operations. An apiculture operation's primary commodities/products can include honey, beeswax, pollination services, and/or sells of bees. Management begins with an understanding of the biology, dynamics, and interactions of bees and their managers.

Management and handling of the hives/colonies occurs in seasonal cycles. Management tasks include; assisting bees in protecting against infection or diseases, protecting against predation by small and large predators, providing conditions for normal brood and population expansion, and ensuring adequate space for storage of reserves necessary for winter survival. If the management is successful, the operator harvests the commodities or utilizes their services. In doing this, the beekeeper must manage the hive/colony with adequate resources to continue normal colony operations (Basic Bee Biology for Beekeepers, 2004).

Equipment needs for an apiculture operation can vary greatly depending on the number of colonies, the operation and the type of honey, and other products produced or the services provided. The basic equipment will include hives and their separate parts, protective clothing/equipment, smoker and hive tools, and the equipment for extracting and handling the honey or other produces produced and sold. Over the years a wide variety of hives and materials have been utilized; however, today most hives are based on the Langstroth or ten-frame hive. A typical hive consists of a hive stand, a bottom board with entrance cleat or reducer, a series of boxes or hive bodies with suspended frames, and inner and outer covers. The hive bodies that contain the brood nest may be separated from the honey supers (where the surplus honey is stored) with a queen excluder (Bee Keeping Basics, 2004).

Beekeepers can increase the number of colonies they manage using several methods. The common methods include: splitting healthy colonies, buying existing operations, buying package bees, purchasing a nucleus (nuc) colony, collecting swarms, and collecting ferial bees. This last method has decreased in popularity due to the spread and existence of the Africanized strain of bees. There are also potential problems when a manager purchases bees and equipment (either nucleus colonies or existing colonies/operations), because of the potential spread and introduction of pests and diseases. A brief description of these methods is provided (the following information was taken from the Bee Keeping Basics publication):

- Buying Established Colonies or Entire Operations: This is a quick and effective method for increasing the number of colonies in an operation. There are potential problems of the introduction of pests and diseases with this method, and the buyer should inspect the bees and equipment carefully.
- Package Bees: Package bees are essentially swarms of bees produced by beekeepers having strong colonies and may harvest excess bee populations and place those bees along with a queen in special cages that are relatively light and easy to transport. Packages may be used to establish new colonies by installing the bees and the queen in a typical hive. Packaged bees may also be used to strengthen weak colonies. Packages are sold by the pound and can vary in size but 2, 3, and 4 pound packages are common. Each pound typically contains a new queen and ~3,500 bees; however, packages can be ordered with or without queens. Properly installed and managed package bees will result in productive colonies that may be used to pollinate crops or produce surplus honey the same year that they are hived.
- Nucleus (nuc) Colonies: Used to increase colony numbers. These nucleus colonies are basically a small colony in a small box. They typically contain bees in all stages of development, a reproductive queen and a small number of workers to manage the small hive/colony. These nucs are then placed in a normal size hive and given supplemental food. The advantage to this method is that with favorable conditions this colony can produce surplus honey the first year. There are issues with the introduction of potential problems into an operation; however, use of this method has increased in recent years.
- Making Splits: This method is basically dividing strong colonies. This management practices has several advantages, which include increasing colony numbers, and preventing or reducing the potential of swarming. With this method the current queen and approximately half the workers are removed from the hive. A new queen is then introduced or allowed to develop in the queenless colony/hive. With this method the colonies should be separated to prevent the bees from returning to the original colony.

- Collecting Swarms or Ferial Bees: While this method can be utilized to increase colony numbers, care and knowledge of the swarm is important. Swarming is a natural instinctive behavior of honey bees when populations of adult bees in the hive reach a critical threshold. But successful swarm management is essential for honey production. Several factors contribute to swarming: congestion in the brood area (related to population size and availability of space), production and distribution of chemicals (queen substance) secreted by the queen, weather conditions (when colonies are strong and developing rapidly, a period of good weather following a period of bad weather seems to contribute to swarming preparations), as well as factors related to that poor ventilation, a failing queen, genetic makeup, and an imbalance in the age structure of the worker bee population. As stated, a swarm typically consists of the old queen, a few drones, and 50–60 percent of the workers.

  Providing colonies with extra space is an important factor in swarm control (and honey production). One of the best ways to prevent strong colonies from swarming is to split them or take divisions from them in late April or early May (see "Making Splits). Colonies that have been split and parent colonies of those that have had frames removed to make up divisions will have sufficient space and will rarely swarm after such treatment.

With the current agriculture/crop production practices of today, many apiculture operations are considered a dynamic and mobile operation, with placement and location of colonies/hives an important management consideration. The resources required by the colony (i.e. nectar, pollen, fresh water, etc.) should be within a relatively short distance. Several experts estimate this distance to be approximately one mile. Pollen is critical for the brood and nectar, which is converted to honey as the food or energy source for the bees. In addition to nectar and pollen a source of fresh water is also critical. Water is used to alter the honey, feed brood, and maintain an adequate hive temperature. As mentioned, today's apiculture industry is mobile and mangers will transport their bees to various locations for honey production and to provide pollination services, but each of these require hive resources that must be readily available or provided to insure the health and success of the colony.

Management of the colonies and an apiculture operation differ by the season. The brief discussion of the yearly management activities is provided (based on information taken from the publication, Bee Keeping Basics 2004).

- Early spring management of overwintered colonies is primarily concerned with sufficient food stores and management of disease and mites. In February and early March, colonies should be assessed but not opened until the temperatures are above 40°F on a sunny day. Colonies with limited food supplies in late winter and early spring can cause problems, and supplemental feeding of sugar is not recommended, because it can add stress to the bees. The best option is to use surplus honey from healthy hives. Once the daytime temperatures increase, heavy sugar syrup can be fed to prevent starvation.
- During early spring the manager should inspect and clean up the colonies. This makes management during the remainder of the season easier. Inspections can begin when temperatures are above 50°F with little to no winds; however, thorough inspections and cleaning activities should not be conducted until temperatures reach 65°F. Repairs of the

hives and combs should occur during these activities. Brood combs should be culled and replaced on a regular basis to inhibit the build-up of disease organisms and to prevent a decrease in adult bee size due to smaller cell size in the brood. Mite control activities or assessment should also take place during these activities to ensure colony survival. Typically, colonies are treated for mites in the late summer or early fall. However, treating for varroa in the spring may be advantageous. Also, if colonies were not treated for mites the previous fall, they might need to be treated in the spring. However, genetic solutions to mite predation have been developed, and reliance upon genetically resistant line of bees is becoming part of some successful management.

- Late spring and summer management activities concentrate on maintaining favorable conditions for brood rearing, honey production, and honey storage. Honey harvest and extraction operations are conducted during the summer months in most regions. Mite and disease management are activities that also occur during the summer months. If left unchecked, pest and pathogen levels can accelerate during the summer honey production period leaving the hive weak and stressed as it enters the fall. Management activities should continue to monitor queen cells throughout the period to insure there is sufficient storage for honey and space for the bees.
- Fall management is primarily concerned with preparing the colonies for winter. The success of the colony and survival is dependent on the conditions in the fall. Historically and prior to the current mite situations, an operation should experience approximately a 10 percent winter loss. This occurred because of poor management, starvation, weak colonies, or other unexplained reasons. Since tracheal and varroa mites became widespread, winter losses have increased—some years exceeding 50 percent. However, winter losses can be reduced if colonies are well managed. As stated in Bee Keeping Basics (2004) many beekeepers consider the fall as the beginning of the beekeepers' new year, because the success of the colonies in the coming year will depend largely on how well they were managed in fall. Typical fall management consists of checking colonies for the proper arrangement of hive equipment, proper hive ventilation, adequate food stores, and adequate colony strength. Successful wintering largely depends on these factors coupled with the management of mites and diseases. Traditionally, fall mite treatment was considered adequate, and in most cases, part of the fall routine. Trends now favor a more integrated approach, which includes regular mite load sampling, the establishment of recognized treatment thresholds, and both "hard" and "soft" methods of treatment prescribed by the severity of the infestation.
- Other management activities initiated at various times depending on climate and ecoregion:
    - Re-queening: as mentioned, most queens have a two year maximum reproductive period, therefore, replacing queens to maintain productivity is a regular activity.
    - Feeding bees: honey is the bees' source of energy, while proteins, vitamins, minerals, and fats are obtained from pollen. Any time the natural food stores of a colony are low, supplemental emergency feeding is needed. Beekeepers routinely supplement hive food stores in times of dearth with a mixture of fructose and sucrose in order to maintain the health and population required to properly pollinate crops or produce maximum honey yields. As mentioned previously, colonies with short food supplies are difficult to manage.

Economic Importance:

In addition to harvesting honey and beeswax from beehives, beekeepers may also generate revenue through bee breeding and pollination services. Honey sales have traditionally been the largest source of revenue for most apiculture operations; however, pollination services have increased in importance for most operations, particularly since 2000. It is also important to note that the other services and products can be significant for individual producers. As with the bees themselves, the apiculture industry is dynamic. The importance of honey bees cannot be determined by simply looking at the annual honey production. The economic importance is tied to all products and services provided. The most valuable agricultural service the honey bees provide maybe the pollination of agricultural and non-agricultural plants in our environment.

As reported in the 2003 RMA report and continuing since that report, the number of beekeepers and colonies of bees have declined since World War II. The decline can be attributed to low prices, low production, increase in expenses, diseases, weather variables, conversion of land to nonagricultural uses, widespread application of herbicides, and more recently CCD. Honey production at the beginning of the 21st Century was estimated at approximately $130 million, while the value of crop pollination to the United States agriculture was approximately $15 billion. This value does not account for the value of pollination to plants in our world that are not considered agriculture commodities. At the end of the 20th Century it was estimated that beekeepers received approximately $55 million from pollination rentals and services, and another $27 million from bee breeding, sales of packages, queens, and queen cells (AgriLogic, 2003). Calderone (2006) stated that beekeeping is essential to modern agriculture, providing pollination for over 90 commercial crops in the United States, and the honey bee adds billions of dollars of value to agricultural crops each year.

Colonies in the United States peaked in the late 1940s (approximately 6.0 million colonies) and then began a decline to approximately 2.5 million colonies in the first part of the 21st Century. As with colonies and beekeepers, honey prices have gradually declined since the 1940s. While there are some inconsistencies with the agencies and data reported related to the apiculture industry, information estimates indicate there has been a 55% decrease in the number of honey bee colonies in the last 50 years, and a 22% decrease in the last 10 years. Again, at the start of the century and continuing today, almost 50% of the United States colonies are located in California, Florida, North Dakota, and South Dakota (AgriLogic, 2003). Other major states include Idaho, Minnesota, Montana, and Texas.

Honey is the primary commodity of the apiculture industry and the production varies widely among regions and from year to year, depending on resources and environmental conditions. Honey production for the United States has ranged from an estimated 150 million total pounds to an estimated 240 million pounds over the past several years. While honey production varies, recent prices for honey have remained relatively constant. As with honey production, honey prices vary by year, region, grade, color, floral source, container size, season, marketing strategy, location, etc. There are as many different honeys as there are floral varieties. Marketing strategies for honey is as varied as the types of honey. While there may be isolated situations where individual beekeepers may contract honey, this is not a common practice; however, many large beekeepers belong to co-op type organizations. The overall average national honey price has gradually increased since 1986, with a peak in 1996 (AgriLogic, 2003). Based on

information from our honey experts and a review of the data, honey prices have remained relatively constant since the partnership was submitted, with prices above $1.00/lb and near $1.50/lb. The final factor that has a tremendous impact on the value can be attributed to United States imports, exports, regulations, and lawsuits.

The majority of honey is produced and sold as extracted honey; however, honey is sold in five basic forms: section comb, cut-comb, chunk, finely crystallized or creamed, and extracted (liquid) honey. Equipment needs and management will vary depending on the type of honey produced and sold. While there are many different types and flavors of honey, the quality of honey is also affected by many different factors such as timing of removal, moisture content, foreign materials, impurities, air, pollen, amount of wax, and handling during extraction. While honey has an extensive storage life it is considered at peak quality just after it is sealed in the comb by the bees.

As mentioned, the honey bee and apiculture industry are important in the development and production of several fruits, vegetables, forage and non-agriculture crops. Without adequate pollination, many plants and their produce will not develop or will be misshaped and have lower quality. The apiculture industry is considered to be a mobile industry and one of the primary reasons is the pollination services provided. Bees are typically moved at night. Timing and placement of the colonies on the target crop is important to a successful operation.

In recent years the processing and selling of beeswax and trapped pollen has increased in importance for many beekeepers, though it still is not so important as it was during World War II. In the past, beeswax was not processed because beekeepers did not want to go to the trouble of melting and rendering the wax. This has changed in some markets because of the value of beeswax. Typically one to two pounds of wax can be collected from every 100 pounds of honey. Trapped pollen can be used by the beekeepers in their operations to be fed back to colonies in the spring or sold to specialty stores/suppliers. Pollen is collected by special equipment placed on the hive opening.

Other apiculture services include the selling of bees to other beekeepers. Some beekeepers devote their entire operation to producing and selling bees such as nucleus colonies, package bees, and queen bees, while many other operations provide their own internal bee breeding programs. The following is from the 2003 RMA report:

- The economic values attributable to bee breeding are not well-documented. In 1996, the USDA estimated that the sale of package bees and queens was valued at $27 million (USDA, NASS, 1996). In 2000, queens were replaced in approximately 55% of the colonies in the United States. Of the total apicultural income in 2000, bee breeding accounted for approximately 4% (Sartwelle, 2001).

The following is general unpublished estimates that we have received from actual beekeepers and our SMEs:

Economic Value of Honey Industry (Estimates)

- *Bee Breeding*
    - *Queens*
        - *2.2 million commercial colonies * 55% requeened at $15 each*

        - *Estimated Value = $18,000,000*
    - *Packages*
        - *200,000 @ $80 each*
        - *Estimated Value = $16,000,000*
- *Honey Production*
    - *150,000,000 – 200,000,000 pounds at $1.00/lb - $2.00/lb*
    - *Estimated Value = $225,000,000*
- *Pollination Services*
    - *600,000 – 1,200,000 colonies at $125 - $140 each*
    - *Estimated Value = $75,000,000 - $168,000,000*
- *Total Direct Economic Value of Industry*
    - *Estimated Value = $334,000,000 - $427,000,000*
    - *(Does not include value added to other production agriculture products: ~ $15 billion)*

When discussing this crop or commodity, it is hard to know what the future expectations are other than American agriculture depends upon the pollination of honey bees. As with a dynamic industry, many factors can affect the future of the industry. The following are some future expectations and some expected changes in trade and/or economic policy that may affect this crop.

- Several million acres of CRP will not be re-enrolled in the old program. Over the years, CRP land has been a prime source of nectar for honey production. Beekeepers are hopeful that new more pollinator friendly conservation programs, created in the 2008 Farm Bill, will replace much of the critical habitat loss suffered by the loss of CRP acres.
- Farmers are converting to cash crops and getting out of livestock. The consequence is that we are losing a lot prime nectar sources as alfalfa and pastures go under the plow. The bottom line is that bee pasture for honey production will be at a premium.
- Imports of queens and package bees. Currently, queens and packages are imported from Australia. This does have some effect on the supply and demand of American bee breeding products. If this is opened to other countries, it could also impact the industry.
- The anti-dumping order against China is up for review in 2012. It may be harder to win this round with China becoming a member of the WTO. If the American industry does not prevail, honey prices could fall below a dollar.
- Circumvented honey is still an issue. China is shipping through 3rd countries to avoid duties. There is proof of it happening and some importers/countries have been fined. With the support of Customs and Homeland Security, it should

eventually get stopped. But in the meantime, they are going to do a lot of damage to the honey market.

- Pollination is a big concern based on the availability of water for the orchards. Almond pollination is carrying the bee industry with pollination services. If a beekeeper can keep the bees healthy, it is correlated to making a profit in the bee business.
- CCD is still a big threat. There are reports of some heavy losses this year. Many thought there would be a surplus of bees for pollination this spring and prices would be down; however, it now appears there may be a shortage. Both beekeepers and growers are scrambling to cover their needs.

5.0: Other Programs

Since 1949 the price of honey has received some price support through federal government programs; however, these programs have varied and have not been continuous. Price support has ranged from approximately 8.0 cents per pound to almost 70.0 cents per pound. Other programs include, marketing assistance loans (marketing loans), loan deficiency payments, livestock payments, and the noninsured crop disaster assistance program (NAP). In addition to the federal programs, many states have other types of programs. These programs are primarily associated with monitoring and inspection services to assist in pest and disease control. Another program available for honey producers includes a commodity check-off funded by the National Honey Board. Additional details for each of these programs can be found in the original 2003 RMA report.

As previously mentioned, there are currently two 508(h) programs available to the apiculture producers that insure drought conditions. Both products that were developed, approved, and currently piloted are index-based programs. They are designed to correlate to an apiculture producer's drought losses; however, like all group type plans, they are not a direct measure of an individual's honey production and they do not cover actual losses to honey bees. The two programs were based on the Vegetation Index and Rainfall Index plans of insurance. These programs are similar to the Pasture Rangeland Forage programs and currently provide insurance coverage for beekeepers that is based on the correlation between honey production to either the vegetation or rainfall indices. During our contacts with beekeepers in connection with this project, it became evident that the producers that understood the programs realized the programs' limitations and were relatively satisfied with the products. They also noted that the current program only offered limited coverage against weather related perils and did not account for their total operation. This program was adopted because it was able to overcome the major underwriting and oversight obstacles facing an insurance program associated with this industry. Additional information regarding these policies is located on RMA's web site at www.rma.usda.gov.

In addition to the index programs, apiculture operators have been eligible to participate in the federal Adjusted Gross Revenue (AGR or AGR-Lite) crop insurance programs. The programs offer revenue coverage for "bees"; however, because of the maximum limitations on livestock and livestock products, and the dynamics of the majority of apiculture operations, producers typically are not eligible to participate or the programs are not a viable risk management option.

Prior to the current 508(h) programs, RMA performed an extensive study on the apiculture industry. In 2002, RMA formed a partnership with a private entity to research and develop an insurance program for apiculture. The partnership's goal was to determine the state of the apiculture industry in the United States and determine the feasibility for developing a program. The final report contained a recommendation on a program design. A survey was conducted in conjunction with this partnership and submitted in 2005. The survey included information about apiculture locations, colony and producer sizes, industry structure, producer income and expenses, pollinator activities, bee breeding, honey prices, and honey yields. The information from this survey could prove to be beneficial if RMA elects to develop a new honey bee/apiculture product. The feasibility report determined that apiculture insurance was feasible with honey as a proxy crop and on a production basis. A group type plan was recommended, but was never implemented. It was not implemented because RMA had the following issues:

- Insufficient data
    - Unique honey production practices
    - Low number of producers
    - Large geographic area
    - Lack of correlation to individual experience
- Credibility of data
    - NASS expressed concerns over how data could be manipulated

These same concerns must be considered with any new program recommendation.

In addition to the background information provided by the above research and insurance program implementation, there are other insurance programs, outside the United States. These programs were reviewed during this study. Summaries of these programs are provided.

Alberta Beekeepers (2009) provided an announcement on their website in 2009 that Agriculture Financial Services Corporation (AFSC) would be offering insurance for beekeepers. The insurance is set up to provide coverage loss resulting from adverse weather, disease, and pest infestation, as well as other naturally occurring perils. Each production area has two coverage levels with a deductible. Loss adjusters visit the apiaries and inspect the hives in the fall, with coverage attaching once the AFSC adjuster accepts the hives. The adjusters return the next spring to inspect and determine death loss, with insurance terminating on this inspection. Premiums for the program are determined by a based rate and the health and strength of hives during the fall inspection. A detailed summary and worksheet provided on the Agriculture Financial Services Corporation, website (http://www.afsc.ca/Default.aspx?cid=1268&lang=1, 2009) is provided in Appendix A.

The Saskatchewan Crop Insurance Corporation announced a different type of insurance/compensation program for beekeepers beginning in 2009. This program is referred as the Wildlife Damage Compensation Program. While not a true insurance program (no contracts are required and no premium is collected), the contractors believed it was worth noting in this report. This program provides compensation for damage caused by bears. The program is for bear damage to bee hives and huts, lost honey production, loss of honey bees, and loss of leaf cutter bee larvae. This program offers similar coverage for other crops and livestock. Beginning in 2009, producers receive 100 percent compensation for wildlife damage for any claim of $150

and over. With the program, the first 80 percent is cost-shared by federal and provincial governments; the provincial government contributes the remaining 20 percent. The estimated annual cost of this program improvement is $200,000.

There was also a plan for beekeepers and beehives developed in Eastern Europe. A report from the Hellenic Agricultural Insurance organization (ELGA) (2004) provided information on this insurance program. The livestock section (Section 5.1.2) of this report listed the perils and summary of the program. Perils/risks covered in this program include weather related risks, loss caused by wild animals (similar to the Saskatchewan plan), and disease. In general, the program design covers 80 percent of the total loss, minus the deductible.

The Farm Service Agency (FSA) administers the Noninsured Crop Disaster Assistance Program (NAP). NAP is a federally funded program that covers noninsurable crop losses and provides financial assistance to eligible producers affected by natural disasters. Drought, excessive moisture, excessive heat, hurricane, floods, earthquakes, and certain natural insect infestations are all considered eligible natural disasters. To qualify for assistance through NAP, a producer must have experienced one or more of these occurrences before or during harvest and the occurrence must directly affect the honey crop. As a result of NAP offering only a catastrophic level of coverage, producers only pay a service fee of $250 per producer per crop per county (up to $1,875 per producer with farming interests in multiple counties). Honey producers must lose 50% of their expected production, and NAP payments are made at 55% of an average market price established by an FSA state committee (USDA–FSA, 2001). The contractors have attempted to collect specific apiculture/honey bee NAP data for several years (during this feasibility the contractor even requested assistance from RMA), but to date have not been able to acquire this type of data.

While no official or verifiable documentation has been discovered to provide details, the United States government did have a honey bee indemnity program in the late 1970s (possibly into the early 1980s). The contractor confirmed this program and its details via conversations with apiculture producers during this study. These conversations indicate the program was started and then quickly canceled due to fears of fraud and abuse and reporting requirements. Many producers were quick to say they are still owed money from this program. Statements indicated that honey bee producers were compensated for lost bees. From the information gathered, government adjusters (currently agency equivalent is the FSA) would come and inspect colonies. The colonies were graded on a scale of: slight, moderate, significant damage. Many times, if the government agent found dead bees on the hive they would receive compensation/payment. Many of the interviews revealed that the government agents in many areas did not know anything about apiculture and simply made a determination without even looking inside the colonies. During these same conversations, individuals expressed concerns about this type of programs or similar type programs, because of the perceived abuse, and the fact mis-management may be the reason for bee losses. Some producers who participated feel that the fraud and abuse that occurred set back the industry in terms of other government programs, because of the negative perceptions and connotations that were derived.

While each of the programs discussed provides coverage and compensation for beekeepers and lost honey bees, there are some limitations to each of these programs. In reviewing the programs

there are concerns with insurance company logistics, data, potential fraud and abuse, and as stated, some of these programs are strict compensation programs and not insurance products, all of which limits their usefulness as an FCIC insurance program.

6.0: Data Availability

This section is designed to provide highlights on the available data associated with honey bees and the apiculture industry. This section will also summarize the advantages and disadvantages of the data sources as it relates to establishing a price or production for an insurance program.

There is not a consistent source of data related to the apiculture industry. NASS does not provide honey price and yield data for all states. Data related to producer numbers and dynamics is also limited. Data is available for the primary honey producing states; however, data is lacking for other states. In combination with the issue of limited data, there has also been a concern with the credibility of NASS related data if it is used in an insurance product. There were concerns that if an insurance program is developed that utilizes NASS data the integrity and credibility of the data will be compromised, because a limited number of producers. The concern is, theoretically producers participating in the insurance program would be providing the data the program uses to base their price, losses, and ultimately payments.

The data sources associated with the apiculture industry include:

- Honey production (national and selected states)
- Colony numbers (national and selected states)
- Honey prices (national and selected states)
- Number of beekeepers and number of farms (national and selected states)
- Pollination contracts and values (no consistent or timely source)
- Bee breeding services and value (no consistent or timely source)

The following provides a summary of the available data and the changes in the industry since the 2003 RMA report.

Beekeepers in the United States are currently grouped into three categories based on the number of colonies they own. At the end of the 20th Century and beginning of the early 21st Century there were approximately 90,000 beekeepers. Of this number only one percent was classified as commercial producers. Commercial producers are those beekeepers owning 300 or more colonies. The other categories are considered sideline and hobbyist beekeepers. Many hobbyist beekeepers (those with less than five colonies) are not actually reported in the data due to relatively recent changes in data collection techniques. The 2007 Census of Agriculture reports the number of colonies at almost 2.9 million colonies, which is actually an increase over the 2002 Census of about 550,000 colonies. During this same time period the Census reported an increase in farms with honey bees (1997 = 17,469 farms 2007 = 27,908 farms). However, the annual NASS reports only list the number of colonies at 2.3 million for 2008 and 2.4 million in 2007. This is probably due to different collection methods, but does show an internal inconsistency in the number of honey bee colonies reported by the same agency from two different reporting vehicles. This is probably some indication of the reliability of the colony count numbers themselves, with a variance of roughly 20-25% between alternate reports generated the same year (2007).

Another issue associated with long-term apiculture related data is consistency in the actual data and/or agency that collected the data. The value of colonies and their production has been collected by two separate agencies at different times with different consistency. From 1946 through 1981 NASS collected and reported values of producing colonies. From 1982 through 1985 NASS did not compile data, but there were estimates of colony number by the USDA's Agricultural Stabilization and Conservation Service (ASCS). Then in 1986, NASS again began compiling data and currently estimates honey-producing colonies. However, the data and reporting procedures have changed leading to questions regarding data comparability and accuracy. Utilizing the data sources it is estimated that there was approximately a 55 percent decrease in the number of honey bee colonies during the last half of the 20th Century, with a 22 percent decrease during the last 10 years of this period. This decrease rate has been reduced but has continued into the 21st Century with an eight percent decrease over the last 10 years. The reason for the decreases have remained unchanged than what was reported in the 2003 RMA report, with the exception of the CCD in recent years.

The data available for honey production and value face similar obstacles. Honey production is dependent on environmental conditions, and can vary from zero production to more than 200 pounds in a given year under similar management strategies. The important factor related to honey production and more importantly the issue of reporting honey production is the fact that honey can be stored for several years and is relatively easy to transport and move. This leads to issues in determining the exact year the honey was produced. As mentioned, honey production is variable. Over the past ten years, honey production has ranged from 148 million pounds to 221 million pounds.

Year	Honey Producing Colonies	Yield Per Colony	Production	Average Price	Value of Production
	1,000	*lbs.*	*1,000 lbs.*	*Cents*	*$1,000*
1999	2,688	76.4	205,250	60.1	126,075
2000	2,634	83.9	221,005	59.4	132,205
2001	2,506	74.0	185,461	70.4	132,225
2002	2,524	67.8	171,140	128.6	221,638
2003	2,599	70.0	181,727	138.7	253,106
2004	2,556	71.8	183,582	108.5	201,790
2005	2,413	72.4	174,818	91.8	160,428
2006	2,392	64.7	154,846	104.2	161,314
2007	2,443	60.7	148,341	107.7	159,763
2008	2,301	69.9	160,861	141.0	226,814

Source: USDA, NASS.

It has been said that American agriculture is dependent upon pollination by bees, and this service is a major income source for many beekeepers. Reports estimate that 80 to 90 percent of all commercial pollination is provided by honey bees. In fact, one of the changes in the industry

since the 2003 RMA report was submitted is the importance of pollination contracts to beekeepers and the apiculture industry. At the time the 2003 RMA report was submitted, the value of crop pollination to United States agriculture was estimated at almost $15 billion, while the beekeepers received approximately $60 million in pollination rentals. Today it is estimated that pollination rentals total more than $120 million (SMEs estimate that value might even be higher), while the percentage of the beekeeper's gross revenue has increased. While there are figures published in NASS reports, most estimates associated with pollination is a combination of reports and interviews with experts familiar with the data and industry.

Data sources related to the sale of breeding or replacement bees are also limited or non-existent. This is considered by many as a specialty product in the apiculture industry. From data and reports from beekeepers it is estimated that sales of breeding or replacement bees account for approximately eleven percent of the industries income, or $34 million. However, for those producers who are involved in this portion of the business the percentage of revenue to their operation is significantly higher than the industry average as a whole; in fact there are some apiculture operations that almost exclusively depend on this service for the majority of their income.

The other services or products (beeswax, apitherapy [health byproducts of honey bees, pollen, bee venom, propolis, and royal jelly]) are not typically significant for commercial beekeepers because of the intensive labor needed to collect the products. However, like many parts of the apiculture industry, these products have increased in importance to some individual apiculture operations. With this increasing importance to some operations, related data is again limited or non-existent.

Price:

Pricing a commodity for an apiculture enterprise is important to the success of a proposed program. The price is basically used to establish a guarantee, value inventory, calculation of the premium rate and more importantly used to convert a loss into qualifying indemnities. The guaranteed dollars of protection provided by a product will typically be multiplied by the premium rate to determine total premium.

One of the primary challenges in developing an apiculture production insurance program is determining the minimum and maximum dollars of coverage (protection) that is offered to qualified producers. A qualified producer must have a financial interest in an asset (apiculture) that has an insurable risk. As with any program design (discussed later in the report), there are always limitations. Designing a program for honey bees/apiculture faces more limitations than a traditional crop insurance program; however, the limitations are similar to other new specialty crop programs. A program price for the apiculture 508(h) programs has been successfully established; however, that product does not require real time prices published in a time sensitive manner like prices associated with many of the traditional crop insurance programs. The primary limitation with pricing this product and other specialty crop programs is the lack of overall data.

In addition to the limited data issues associated with pricing a new apiculture program, there is also the fact that none of the associated commodities are openly traded, and the data sources do not capture the diversity in apiculture operations. Following is a listing of available data sources

and a summary of their advantages and disadvantages (additional details are available in the Apiculture 508(h) Board submission and 2003 RMA report):

National Agricultural Statistics Service (NASS)

Currently the National Agricultural Statistics Service (NASS) annually produces state honey prices.

Advantages:

- Provides an annual published source of data for most states.
- Based on data retrieved by NASS.

Disadvantages:

- Data for some states are missing or incomplete.
- Limited by NASS sampling techniques (surveys).
- Larger producing state and national data may provide a better proxy for a national honey price. Most commercial producers typically market their honey on a spot price that is fairly uniform across the nation. Many of the smaller producing states' price data from NASS appears to be heavily influenced by hobby and niche markets that do not appropriately capture the commercial beekeepers' received price. These assumptions were confirmed with commercial beekeepers who served as Subject Matter Experts (SMEs) on the project.

While data is on the state level and may not capture all individual or localized variances, the data is sufficient for a group or index type program, at least for the honey prices. There is a significant level of confidence that the state prices actually reflect the price received by the typical agricultural producer/beekeeper. This system appears to be adequate especially when producers are allowed to select various production factors. Achieving a more exact value would be difficult. However, it is important to note that for commercial beekeepers a national honey price is a better reflection of realized prices.

Farm Service Agency (FSA) – NAP Pricing Methodology

Currently FSA administers the Noninsured Crop Disaster Assistance Program (NAP) for honey across the United States. The contractors have discussed the pricing methodology that FSA utilizes via a phone conversation with FSA personnel in Washington, D.C. The current methodology used by FSA for NAP is to utilize a five year Olympic average of state reported NASS honey prices. Because the FSA NAP methodology utilizes the NASS reported values, many of the advantages/disadvantages are similar to those previously discussed in the NASS technique.

Advantages:

- Provides an annual published source of data for most states.
- Based on data retrieved by NASS.
- Provides a methodology already accepted by a USDA agency.
- Captures possible annual pricing trends.

Disadvantages:

- Data for some states are missing or incomplete.
- Limited by NASS sampling techniques (surveys).
- Using the Olympic average may dilute recent pricing trends.
- Larger producing state and national data may provide a better proxy for a national honey price. Most commercial producers typically market their honey on a spot price that is fairly uniform across the nation. Many of the smaller producing states' price data from NASS appears to be heavily influenced by hobby and niche markets that do not appropriately capture the commercial beekeepers' received price. These assumptions were confirmed with commercial beekeepers who served as SMEs on the project.

Local Subject Matter Experts

Another method of determining apiculture values is to use Subject Matter Expert (SME) committees or groups to declare apiculture value in a particular area. This method utilizes the expertise of local beekeepers and specialists to determine the value of apiculture for a specific county or multi-county region.

An advantage of using local SMEs to determine apiculture value is their familiarity with the market value of honey in their area based on cash prices paid and received by producers. A major disadvantage, however, in using local SMEs is the large expense required to identify and convene them. In addition, the local SMEs would still have to make generalized estimates or calculations of honey value based on surrounding areas and, because of local pressure, may have a tendency to inflate actual values. It is, therefore, likely that the SMEs generalized estimates would not be significantly more accurate than NASS estimates.

Advantage:

- Provides excellent insight into local conditions and value.

Disadvantages:

- Logistics of convening with SME groups (in addition to shear number of groups).
- Difficult to implement nationwide.
- Subjective values and inconsistency across regions.
- Potential for individuals who will benefit from a proposed insurance program to influence the value, therefore providing a potential for moral hazard and possible fraud and abuse.

RMA Survey Data

Another method that became available as a result of the 2003 RMA report is use of survey data. RMA currently has a wealth of information that it collected during the Partnership. During the Partnership, surveys were collected from 627 beekeepers (123 commercial beekeepers). The following are highlights from that survey focusing on the commercial beekeepers:

- Mean size of respondent operations remained relatively constant at 2,500 – 2,700 colonies.
- Average honey prices reported by survey respondents were slightly higher than those reported by NASS.

- Reported honey yields averaged about 30% higher than NASS average yields. Probably due to NASS numbers' inclusion of reports from a disproportionate amount of hobby beekeepers.
- Survey yield and price trends followed NASS reports.
- Survey respondents represented 13.5% of total NASS estimates for total honey production in 2004.

Advantages:

- Provides good data on commercial beekeeping operations.
- May be the only source of price data for other income sources associated with the apiculture industry such as pollination services, and bee breeding services.

Disadvantages:

- Logistics/cost of conducting additional continued surveys.
- Potential survey respondents could benefit from a proposed insurance program influencing their response to questions.
- Survey results are over five years old.

Utilizing Honey Prices Established for the New Apiculture Index Programs.

The current approach uses a modified version of the FSA-NAP methodology. The methodology utilizes a five-year rolling Olympic average of NASS data; however, the state information utilized is yield data and the price data is based on the national average honey price for a given year.

Advantages:

- The price is already utilized in a federal crop insurance program.
- Rolling Olympic average captures value trend, while not being overly distorted by abnormal years; thereby, providing for near term price inflation (or deflation).
- Familiarity with method since FSA-NAP already uses this technique for their prices.
- Data reliability: NASS data is established, credible, and utilized for many other government programs.
    - State data is used for yield thereby reducing a beekeeper's influence on reported yields. For states with smaller production and fewer beekeepers, (i.e. states with no or incomplete reported data) national data is utilized to prevent undue distortion by a few beekeepers.
    - National data is used for price thereby reducing individual beekeeper's and hobbyist influence on reported prices.
- Utilizing state yield data allows for capture of local (regional) production capabilities.
- Easily implemented into other areas of the nation, if needed.
- Easily maintained.

Disadvantages:

- Price is for honey only and does not address the other products in the industry or for actual loss of honey bees.

- Since the data set is small, state and national values are utilized, which increases the beekeeper's basis risk in relation to the published County Base Value.
- While abnormal years are excused, effective capture of recent trends may be reduced by utilizing an Olympic average, which drops the highest and lowest values over the past five years.

Utilizing Contracts

The use of contract prices would be an effective method of establishing a value for a proposed insurance program; however, use of contracts for all of the commodities and services is not a common practice. Pollination service contracts are common, but are not known or negotiated until immediately before bees are placed in the fields. The value of other products and services would not benefit from this methodology.

As demonstrated by the new apiculture program, a price for the insurance can be established utilizing the available data. Price for a program using honey as proxy is available and currently utilized; however, pricing the other commodities and services would be difficult. Value of the pollination services could utilize contract prices, but the value of other services and products associated with a typical apiculture operation would be difficult.

Yield/Production:

If a program is designed based on yield and/or production data (or records) the consistency and integrity of the data is critical. The data must also be immune from manipulation from the individuals involved in a program. A third factor is a method to adjust or verify the production of an individual producer. If these basic conditions can be met, the production or yield data can then be used to determine loss. The production can be combined with the established price for guarantees and indemnities. One of the primary factors which leads to the development and implementation with the current apiculture 508(h) is the fact that it is not reliant on the limited data available associated with the apiculture industry. This program is used as an index/proxy that can correlate to potential lost production value from drought conditions.

Each of the factors listed above present challenges in developing a honey bee/apiculture insurance program, and while most new specialty crop programs are faced with challenges, the data and production challenges with the apiculture program could influence the program's integrity. The primary limitations with production data include, lack of overall data, limited number of producers that report data, mobility of the industry, diversity of the industry, knowledge of industry by loss adjusters, the ability to store production for several years, and the relative ease of moving production.

While there are multiple data source options listed associated with pricing the insurance, there are limited sources for production data. A solid source related to production is key to the program because of the relationship to the guarantee and the indemnity; however, losses in traditional programs are dependent on responsive production data either through an independent reliable and consistent source or through individual production data that does not create opportunity for moral hazard fraud and abuse. The following is a discussion of production data related to honey bees and apiculture.

National Agricultural Statistics Service (NASS)

Currently the National Agricultural Statistics Service (NASS) produces yield and production data for most states. This type of data is typically used for group or area wide insurance plans. However, the methodology would require the areas to be increased above the county level and in some instances above the state level. This creates issues of capturing an individual's risk and potential loss.

Advantages:

- Provides an annual published source of data for most states.
- Based on data retrieved by NASS.

Disadvantages:

- Data for some states are missing or incomplete.
- Limited by NASS sampling techniques (surveys).
- Potential issue with data integrity if an insurance program is based on data and information provided.
- Area of group would be increased above county and state level limiting its ability to be truly functional as a risk management tool.

Individual Producer Data

Use of individual producer data in an individual based insurance program is the preferred method of design and implementation of an insurance program by beekeepers. The report has noted the diversity of a honey bee operation and the apiculture industry, the use and availability of individual producer production related data is just as diverse. While most of the beekeepers collect and maintain records related to production, colony numbers, and honey produced, the consistency and use in a nationwide program could be difficult. The primary reasons for the difficulties are the type, consistency, and verification of production records/data. Combine these with the diversity, uniqueness, mobility, and storage life of honey, and the question presents itself as to whether individual data is truly an option for a sound program.

Advantages:

- Most beekeepers have records.
- These producers are accustomed to providing records to agencies.
- Provides individual data and excellent insight into the operators production .
- This is many beekeepers preferred method for a program.

Disadvantages:

- Consistency of individual records.
- Lack of independent sources to verify records.
- The industry, bees, and production are mobile.
- Honey can be stored for several years and the stored honey can be moved relatively easy compared to other federally insured commodities.
- An adjuster would have to have extensive knowledge of colony biology, dynamics, and operations to adequately adjust claims.

- The size, number of locations, and geographical range of commercial operations.
- Potential for manipulation of individual data sources.

The other issue a new program would face using individual data would be construction of a series of yields for prospective insureds who have an insufficient number of yields to determine an APH yield. While this could be accomplished with the available data, the accuracy of the series could be influenced by the mobility of the industry and the data reporting issues previously described.

Because of the issues addressed and provided in this section, the best set of individual data/ records available for a honey bee or apiculture operation is probably individual income/tax records. These records are consistent, and they account for the total operation, in addition their ties to the Internal Revenue Service should help reduce the potential for moral hazard, fraud, and abuse. However, there are disadvantages. One disadvantage is that many producers may not want to provide this information. A second disadvantage is the type of accounting system and financial management goals operators utilize for their income tax return. While the tax returns should accurately reflect yearly income, honey production can be stored and sold in future years. A proposed program would have to account for this common practice.

7.0: Risk

Pests and Perils:

Honey bees are extremely susceptible to damage and loss due to insects, pests, diseases, and misapplication of pesticides. In fact, these are major factors in the management of any apiculture operation. Because bees are sensitive to so many environmental and man-made variables this must be addressed when designing and determining the feasibility of any crop insurance program. In addition to this sensitivity, loss adjusters must be able to recognize and distinguish between natural losses and those influenced by management (or lack of management), which may be impossible under certain circumstances. The opportunity of moral hazard, fraud, and abuse may be the largest factors limiting the development options.

The first line of defense in protecting colonies and operations from pests is the ability of the manager to recognize problems early. Failure to recognize problems early can lead to decreased productivity, weak, and even dead colonies (Bee Keeping Basics 2004). The 2003 RMA report provides extensive details on the pests and perils that affect the apiculture industry and honey bees. Below is brief summary of the major pests and perils:

- Weather: Adverse weather continues to be one of the most significant perils that beekeepers have to face. There are different types of weather perils that will contribute to loss production and loss of honey bees. These include drought, cool weather, excessive moisture/rainfall, flood, frost, hail, and wind.
- Colony Collapse Disorder: This peril has consumed the industry and general public since the first reports. Of all the issues and changes associated with the apiculture industry over the past few years, CCD has had one of the greatest impacts. One reason for the impact is, because as of today, there is still no consensus by the experts as to what is causing and/or contributing to CCD. A CCD common characteristic is that entire colonies (bees)

simply disappear and/or die with no visible reason. The other concerning issue is that there is no distinct pattern, area, location, or modus operandi.

- American foulbrood (AFB)
- European foulbrood (EFB)
- Sacbrood
- Chalkbrood
- Stonebrood
- Parasitic Mite Syndrome (PMS)
- Paralysis
- Dysentery
- Varroa Mite
- Honey bee tracheal mite
- Miscellanous pest, such as ants, beetles, lice, moths, mice, skunks, opossums, raccoons, bears.
- Misapplication of pesticides.
- Price/Income
- Quarantines
- Legal issues associated with the operations.

Understanding, managing, and controlling the potential perils and pests are critical to a successful apiculture operation. This same understanding is critical when determining the feasibility of a crop insurance program to reduce the potential for fraud, abuse, and moral hazard. As stated, these issues (along with the logistics of loss adjustment commercial operation) and the potential they present may be the most limiting factor in designing and developing a new program for the industry. The success of the current Apiculture 508(h) index programs overcame these obstacles by designing a program that utilizes an insurance trigger independent of beekeeper or operator issues.

Classification of Perils:

As with all elements of the apiculture industry, classification of pests and perils as insurable or uninsurable is complicated. Technically all of the perils listed above, with the exception of legal perils, can be natural disasters (insurable) and cause losses even under proper management conditions; however, each peril can be initiated or worsened by simple poor management. While this is not totally unique to an apiculture operation, the primary difference is that in an apiculture operation the experts cannot distinguish or at least have difficulty determining if the losses are natural or an issue of poor management. While the majority of perils are and can be classified as insurable, the bigger questions are related to data availability and accountability, and can moral hazard, fraud, and abuse be controlled with a new program.

Grading Standards:

While the grading standards are not required by law, there are grading standards that have been established by USDA for extracted and comb honey. These standards are primarily used for inspections, sales, quality control programs, and determining loan values. Honey is primarily marketed by color with the lighter honey sold for table use because of the typically milder taste,

and the darker stronger flavored honey used in baking. Additional information and visual aids on grading standards are contained in the 2003 RMA report.

As documented in the 2003 RMA report, virtually none of the crop sold by commercial producers at wholesale carries a grade. Technically, if the grades are stated on the label, the honey must meet those requirements, but food authorities are more concerned with possible contamination than factors of grade (soluble solids [moisture content], flavor, absence of defects, and clarity). The following descriptions are an overview of the standards (Graham, 2000).

- U.S. GRADE A or U.S. FANCY is a honey which contains not less than 81.4% soluble solids (18.6% moisture content); possesses a good flavor for the predominant floral source or, when blended, good flavor for the blend of floral sources, is free from defects; is clear and scores not less than 90 points (Graham, 2000).
- U.S. GRADE B or U.S. CHOICE is a honey which contains not less than 81.4% soluble solids (18.6% moisture content); possesses a reasonably good flavor for the predominant floral source or, when blended, a reasonably good flavor for the blend of floral sources; is reasonably free from defects; is reasonably clear and scores not less than 80 points (Graham, 2000).
- U.S. GRADE C or U.S. STANDARD is honey for reprocessing which contains not less than 80% soluble solids (20% moisture content); possesses a fairly good flavor for the predominant floral source or, when blended, a fairly good flavor for the blend of floral sources; is fairly free from defects; and is of such quality as to score not less than 70 points (Graham, 2000).
- U.S. GRADE D or SUBSTANDARD is honey which fails to meet the requirements of U.S. Grade C or U.S. Standard (Graham, 2000).

Disaster Payments:

As previously provided (Tab 5.0: Other Programs) the Farm Service Agency (FSA) administers the Noninsured Crop Disaster Assistance Program (NAP), and specific data or details for honey or honey bee NAP payments is unavailable. There are other FSA Disaster Assistance Programs that beekeepers may utilize if they qualify and if the programs are offered or funded. An example is the current Emergency Assistance for Livestock, Honey Bees, & Farm-raised Fish (ELAP) program. The following is taken from the USDA FSA website (http://www.fsa.usda.gov):

- *[The program] provides Emergency relief to producers of livestock, honey bees, and farm-raised fish. Covers losses from disasters such as adverse weather or other conditions, such as blizzards and wildfires not adequately covered by any other disaster program. Current rulings and notices are contained in Appendix C.*
    - *Specific provisions for the ELAP will be implemented through separate rulemakings and announced at a later date.*
    - *Eligible physical losses of honey bees and honey bee hives, lost due to adverse weather or loss conditions are eligible under ELAP. Producers will be required to provide documentation of beginning and ending inventory of honey bee colonies when claiming a physical loss of honey bees or honey bee hives. Physical losses*

are compensated at 60 percent of the actual replacement cost of honey bees or honey bee hives.

- *ELAP can also provide compensation to producers that have documented losses of honey bees or honey bee hives due to colony collapse disorder. Documentation for bees or hives lost to CCD includes certification by registered entomologist or extension specialist of the quantities lost. Documentation will also be required to support the beginning and ending inventories of bees and bee hives.*
- *To be eligible for ELAP benefits, producers must file an acreage report on honey bee colonies.*
- *Producer eligibility for ELAP also requires that all crops in all counties have crop insurance coverage or NAP coverage for the crop year in which benefits are requested.*

8.0: Evaluation of a New Insurance Program for Honey Bee Losses

The first step in evaluating a new insurance program was to review the 2003 RMA report. The report provided a detailed description of needs, as well as the advantages and disadvantages of developing an insurance program for this industry. This report looks at the changes in the industry since the 2003 RMA report was submitted to determine if the options discussed in the report presented a more favorable option today in determining if it is feasible to develop a program for direct honey bee losses.

Issues:

Many beekeepers are still interested in a program to cover their entire beekeeping operation, not just the loss of honey bees. While some beekeepers express concerns that the index programs may not completely capture all the losses of their operation, many do feel the program does provide some protection from uncontrollable weather risks and did not want a new program to replace the existing pilot programs. As previously discussed, the major issues continue to include:

- Dynamic nature of the industry.
- Size of the industry.
- Production verification and storage of honey.
- Loss Adjustment: Loss adjustment for apiculture could be significantly different from that of other insured crops. Unlike traditional crops, colonies are mobile. This may result in some difficulty when adjusters are required to go to beekeepers' locations to determine the cause and extent of claimed losses (adding unnecessary burdens to the AIPs and compliance). Another issue related to the mobility of colonies, is that producers could relocate hives to indicate a greater loss than what was actually suffered.
- Insuring all hives (units).
- Price discovery for all products and services associated with an apiculture operation.
- Continuous participation.
- CCD: There is no industry or scientific consensus of the specific cause(s) of this disorder.

Program Coverage:

In addition to direct honey bee losses, the feasibility of developing an insurance program for honey bees/apiculture is evaluated in this report. To accomplish this, the contractor considered and then reviewed the different commodities and services the industry relies on for their income. The categories included sellable products (such as honey, beeswax, pollen, and possibly bees), pollination services, and the sale of breeding bees (queens, nucs, packages, etc.), or bee/colony numbers. Each of these categories were evaluated to determine if reliable, consistent, and adequate data was available, and whether a program can prevent or reduce moral hazard, fraud, and abuse. These are the key issues associated with a program associated with the apiculture industry.

- Sellable Products: There is data available on honey production and price; however, it is not geographically or annually consistent and issues have been raised by USDA on the quality of the data, if an insurance program is based on the data. If the issue related to honey production and yearly regional price could be resolved, there is still the issue of no (or limited data) data related to the other products. But more importantly is the issue associated with verifiable individual records, storage of honey, colony and honey mobility, and simple logistics.
- Pollination Services: This has become an important portion of commercial beekeepers enterprise, but there are no consistent published data on pollination services. These services cannot be tied with honey yields, and loss of contracts or services may be management issues and not insurable. While contracts are common with this service, the actual contract or lack of contracts cannot be the trigger for an insurance payment.
- Breeding Bees: As with pollination services, these are not consistent and reliable data sources and cannot be tied or related to honey yields. In fact, in many instances income from breeding bees may actually be higher when conditions are poor and other beekeepers (customers) have to purchase more replacement bees.
- Honey Bee (colony) Numbers: Other countries (Canada) are now offering insurance or insurance type products on actual honey bee or colony numbers. With this type of program a pre and post inspection of the hive is performed. An indemnity is paid if there is a decrease below the coverage level. This poses unique problems for a program. One set of problems is basically associated with the logistics of this problem, especially in the United States, which is more mobile. The expense and ability to view and inspect all the hives would be time consuming and costly to the insurance companies and the government during compliance. The next issue is verification of the numbers and health of colonies. A third concern is with the knowledge of adjuster. Adjusters knowledge of the dynamics of bees and healthy colonies could lead to misinterpretation of the true health, and many causes of loss again could be management and non-insurable. All of these issues could lead to misunderstanding and potential legal disputes (again economic hardship for the insureds, companies, and government), moral hazard, fraud, and abuse.

Policy Types:

The program or commodities associated with honey bees were then evaluated in combination with the various policy or program types. There are a number of different policy types explored for this feasibility report and the results were similar to those presented in the 2003 RMA report and the apiculture 508(h) programs. Program types include:

- Yield Policies: All policy types that base insurance on yield or a combination of yield and price were considered. While these policy types (individual or group) could potentially be adapted to honey production (or bee or colony numbers) this type of program does not account for other products produced, bee breeding income/services, or pollination contracts. There are advantages and disadvantages to this type of policy.
    - The primary advantages include:
        - easily understood
        - some individual production records exist
        - the ability to have an individual based program
    - The disadvantages and problems include:
        - all aspects of the industry not covered
        - difficulty in covering and accounting for honey bee losses
        - deficiency in company and government knowledge of honey bees, colony dynamics, operation sizes, and locations would make loss adjustment for individual plans difficult if not impossible
        - ability to verify production and storage of honey

The primary change related to these types of policies is that RMA now has a tremendous amount of data it collected from the survey conducted as a part of the partnership that would aid in developing this type of program. A group based yield program/policy would be able to overcome many of the concerns expressed or associated with a yield type policy; however, this type of program has already been rejected by the RMA and the FCIC Board because of issues, such as data integrity.

- Revenue Policies: Traditional revenue plans present similar advantages and disadvantages as outlined with yield based policies. The difference with this policy is the requirement to have adequate data to establish a timely yearly price forecast for each region. While there is adequate data to establish a price for an index and possible yield policy, the contractors do not feel the data is adequate for a true revenue based policy.

- Dollar Plan: While there have been issues with some of the dollar plans, this program type was evaluated. While these programs are typically associated with industries that lack data, there are concerns when this is considered in combination with the apiculture industry. The primary issues continue to be variation in costs by different producers, how these costs could vary from year to year, and all the issues associated with the apiculture dynamics. As previously discussed, a beekeeper may move colonies from honey production to pollination and back, depending on the variables such as: weather, price, and availability of fields/locations. The problem with production verification, storage, and loss adjustment is still present with this type of program.

- Index Based Program: This program was proposed because it was able to adequately account for the issues related to data, mobility, and loss adjustment. However, it is limited to coverage against a potential loss to honey production resulting primarily from drought conditions, and does not cover the other portions of an operation. As comments from producers note, the index programs provides a risk tool for a portion of their income, but there are other income sources in typical commercial apiculture operation, that cannot be covered in this type of program, because they cannot be correlated to the index.

- AGR or AGR-Lite: These type programs may have the greatest potential to provide a risk management option for the whole apiculture operation and may provide the best correlation to lost honey bees. The RMA and insurance companies are familiar with these program types. In addition, individuals should have adequate records (tax records), and it eliminates or accounts for the diversity or dynamics of the industry. However, there are concerns with the designs and limitations of the current AGR type programs when trying to design a program for commercial apiculture operations, as well as the fact these programs have experienced limited acceptance.

- A modification of the current whole farm products: The theory behind this type of program is proposed modifications of the current whole farm type policies. The team evaluated a modified whole farm program type to address the needs of the apiculture industry and if it would provide a level of coverage for lost honey bees via a proxy. This type of program could use some current policy documents and basic methodologies as a foundation; however, this program would be modified by removing the current limitations preventing apiculture producers from participating. This program design should be familiar to companies, and would provide whole farm coverage for an apiculture operation. The disadvantage would again be associated with the industry dynamics, providing tax records, accounting philosophy, a new concept, and possible issues and limits associated with providing federal crop insurance for livestock. Another disadvantage is that it does not reward producers who may increase costs to maintain a certain income level, thereby rewarding producers who are not proactive. The final disadvantage is that it uses a program philosophy that has not been well accepted.

As mentioned, there is an index based program that offers some coverage for the apiculture industry for drought related perils, and with any group or index based program there are pros and cons. Those producers that understand the index programs and its limitations feel it is a viable option. They also realize there is also a desire to provide coverage for the remaining portions of their operation. This confirmed the need to research other programs that might have the ability to cover all aspects of the industry in addition to the direct loss of honey bees. Each of the commodities and services presents unique situations and problems, which leads the team back to the conclusion that there is a possibility of developing and providing another insurance program for the honey bee/apiculture industry by creating a plan that covers the whole operation. While our team has been involved with evaluating insurance for this industry for several years, our objective continues to be determining if and what type of insurance program can meet the needs of this industry while maintaining the basic principles of a viable and sound insurance program. However, our team also realized that ultimately the recommendation must address the scope of the Act and TO of insuring honey bee losses.

The next section of the report will provide the summary and recommendation of developing/modifying and implementing a new insurance program for honey bees and the apiculture industry.

9.0: Summary and Recommendation

During the research for this feasibility report, the contractor found that while there have been changes in the industry, the issues are similar to those in the 2003 RMA report. While the index based insurance programs have provided a viable risk management option for some producers, there is still a need and desire for coverage of other perils. The onslaught of CCD has raised awareness for the beekeeping industry and the possibility of losing honey bees and ultimately the revenue stream they provide via pollination and honey production. The industry still faces unknowns including those associated with limited data, limited scattered commercial producers, mobility, storage of products, diversity, logistics of administering a program, and the potential of moral hazard, fraud, and abuse. A program strictly associated with honey bee losses faces these obstacles, combined with the fact that management, health, as well as natural causes will also affect the bees. However, the stated objective of this study is limited to determine if it is feasible to develop an insurance program for honey bee losses as livestock. The direct answer to this objective is that it is not feasible for RMA to develop an insurance program that covers honey bees losses. However, the contractors also believe that there might be some potential in developing a whole farm program that could indirectly indemnify producers for honey bee losses; however, because of the limits in the TO, dynamics of the industry, and limited data, there are too many unknowns and unquantifiable risks to USDA that prevent a full recommendation of this type of program at this time.

Insuring for honey bee losses presents many challenges, which have been stated throughout this report. However, the following highlights some of the issues that prevent insuring for honey bee losses:

- Dynamics of honey bee biology
    - Honey bee colonies are a very fragile ecosystem that requires expert management to maintain and thrive in an agricultural setting. However, this management or lack of management could be used to create losses where the cause of loss would be difficult to identify. Some examples include: excessive honey removal causing weak colonies, over worked colonies, not providing adequate supplemental feed, misuse of pesticides, and not moving the colonies when natural food sources decline are only a sampling of issues that management can undetectably influence.
- Colony density and logistics of loss adjustments
    - Commercial beekeepers manage colonies that cover a large and diverse geographic area. This presents a significant challenge during loss adjustments and would be very costly to insurance companies.
- Unknown causes of loss
    - Much of the publicity of honey bee losses recently has been centered on CCD. However, there is still not any scientific or verifiable validation as to the root cause of CCD. In essence, the bees just disappear. This creates significant moral hazard, fraud, abuse, and waste potential that is not prudent in any taxpayer subsidized insurance program.
- Mobility of industry

    - In addition to colony density, another problem with insuring honey bee losses centers around the mobility of the industry. For example, a colony might be located in one county or state one month, and then moved across the country the next month. This creates many problems with loss adjustments and verifying causes of loss.
- Adjuster knowledge
    - Insurance companies would probably have to hire additional loss adjusters who are well versed in the apiculture industry and honey bee biology. Most company adjusters are competent in the agronomic field crops; however, it would take substantial training for the loss adjustment of this industry. This training would be significantly more than any other current crop insurance program.
- Verification and validation of records
    - While many beekeepers might have individual records, there are not very many industry records which would provide a foundation for the insurance program.

In addition, there are two primary factors preventing a full recommendation for an apiculture whole farm type insurance program. These include:

1) Moral, hazard, fraud and abuse risk potential associated with this program (because of the industry dynamics) is more than the risk tolerance of other programs, which are noted above with the dynamics experienced with this industry. While there is no indication that the policy would encourage this potential risk, there is a definitely greater opportunity, while unquantifiable.
2) No clear assumption as to the marketability and ultimate participation in the program. While many beekeepers seemed to value the concept of the program (with well over 50% of producers contacted, stating they thought the program would be beneficial), an accurate participation prediction is not viable until the program is developed and piloted. This is evidenced in the current AGR programs where producers embraced the concept but sign up has not been significant. When beekeepers were asked if they would purchase this type of program they all stated "it depends on the rates and policy requirements".

The contractor received feedback from a producer during this feasibility that accurately summarizes many thoughts of the industry. Revenues may be the most feasible method of providing an effective program; however, this would have to be figured over a period of years. By using revenue from a beekeeper, he will not have to prove actual honey production, prices, pollination income, package bee income, causes of losses etc. He pays premiums on the income he needs and can reasonably expect.

The contractor realizes a modified or new whole farm based apiculture program would have to account for the dynamics of the apiculture industry for it to be a viable option to the producers. While this type of program is not specific or directly related to "honey bee losses" the program could account (indirectly) for some levels of honey bee losses in an operation. However, it must be noted that if the overall goal of RMA, FCIC Board, and the USDA is to provide payment for honey bee losses the current FSA ELAP program appears to be addressing this need.

Possible Design Options and Impact Analyses:

Based on the recommendation that it is not feasible to develop an insurance program for honey bee losses, there are no possible design options at this time. The impact of this recommendation and ultimately the decision of RMA is that this important industry has only limited access to the Federal Crop Insurance Program via the participation in one of the two index based (drought insurance) programs and/or the current AGR programs. While the research revealed a need and possibility for a whole farm type program, the contractor realizes that many of the risks are unquantifiable and cannot recommend moving forward with this type of a program.

Insurance Model and Design:

Guarantee and Unit of Exposure

Because insuring honey bee losses is not feasible, this section is not applicable.

Estimated Premiums

Because insuring honey bee losses is not feasible, estimated premiums are not applicable.

However, during research for this report, premiums were estimated for a whole farm apiculture program. Since a potential honey bee/apiculture program would be loosely based on the design of the AGR program, the first step in estimating premiums was to evaluate the current AGR rate for honey bees. The contractor requested information on the current AGR rating methodology and program information during the contract period but was unable to obtain this information. However, it was assumed that adequate and credible data was available and utilized by RMA in establishing the premiums associated with each of program's commodities. Since the design and formula information and methodology associated with the current AGR programs development was not able to be reviewed, a multiple phase approach to estimate the current honey bee rate was employed. The rate was estimated by conducting numerous example calculations with various crops in numerous locations. While there may be a slight rounding error in the calculations, the team is confident the process was adequate for estimating premiums. The calculations of estimated rates for bees in most counties were 0.036, 0.056, and 0.071 for coverage levels 65, 75, and 80, respectively. The only exception to the rates listed above was in Florida where the rates were higher for each coverage level.

After the current AGR rates for bees were calculated, estimated, and other factors related to the rates evaluated the next step was to determine if the current rates were appropriate for estimating premiums associated with the potential whole farm apiculture program. The first step was to evaluate the current data sources to determine if data was available for estimating an independent rate. As indicated throughout the document, data is limited; however, the team was able to use published data sources and individual survey data collected during the 2003 RMA report to estimate a gross rate for honey bees. Based on the calculations, the estimated premium/rate, from this data, was approximately 0.026 for the 65 percent coverage level. This is very similar to the 0.03 rate calculated for honey bees in the current AGR program. Assuming the contingency loads associated with other FCIC programs and the fact the rates would need to account for uncertainty due to limited data and issues associated with CCD risk, the current RMA rates appear to be appropriate for estimating premiums for a potential program and ultimately a pilot, if it was ever deemed feasible to develop.

Estimated Prices

Because insuring honey bee losses is not feasible, this section is not applicable.

However, it is important to note that a price for an apiculture insurance program can be established if a program that was deemed feasible. Methods that could be utilized include, producer income/revenue records, average prices for the commodities sold, price established in the apiculture 508(h) pilot insurance program, and use of available data sources.

Insurance Program Provisions

Because insuring honey bee losses is not feasible, this section is not applicable.

Program Integrity

As with any of the federal crop insurance program, there is a concern with the program's integrity. This concern is increased when looking at the feasibility of a program associated with honey bee/apiculture industry because of the issues discussed in this document. One of the major emphases has been to research a program that minimizes these risks. The major issues associated with this industry that are not common with other industries include: the mobility of the bees and products produced, the dependency on other crops for income, the multiple areas a single producers operates, logistics of inspecting colonies, accurately determining the health of a colony, the storage life of honey, and the relatively small storage containers and the ability to move or relocate stored honey. All of these issues would have to be addressed in the new/proposed program. The primary reasons for the recommendation of a program for insuring honey bees losses are associated with the overall program integrity, for the reasons previously listed.

Program Interest and Impact

Producers are concerned with the loss and disappearance of their bees and are interested in assistance with these losses. They are also concerned that an "insurance program" that would pay a producer for lost or dead bees would not be fiducially prudent. When this subject was presented at an SME meeting, producers were quick to discuss the problems with the indemnity program in late 1970s. At every producer meeting the contractors have held over the past several years, the first thing each group is quick to point out is that they are not interested in a program that would reward poor management.

Based on input from the team's SMEs, feedback collected from honey bee/apiculture producers, and experience with this industry, there is a desire for a federal crop insurance program to cover their entire apiculture operation. Even with this interest and desire, there are still questions and concerns associated with actual participation. Most of the questions center around the premium cost and the requirements of a program that would have to be implemented to curtail program integrity risks. While there are questions associated with the interest and impact of a program, there appears to be agreement among beekeepers that the preferred method for providing an industry type program would need to be associated with the income and/or expenses of a bee operation. This determination is based on the diversity of the apiculture operations, the tendency and ability to switch the emphasis of an operation between the different services (honey production, pollination, bee breeding, and other products), and the production, sell, and storage of the commodities.

There was not any indicated concern by the industry to provide tax records as a requirement of an insurance policy; however, each of the groups had questions associated with the sale of their products (i.e. would the value be realized at production or the sale). All of the interviewed groups stated that their yearly income levels remain relatively constant because they have the ability to hold production for multiple years and their policy is to sell to maintain income consistency. One concern/need that has been consistent with the various individuals and groups is the need for some type of disaster insurance program for those years when they experience a devastating decline in their operation income.

The current AGR based programs and index based programs were discussed with each of the groups. There is a consensus among the groups and individuals that the current AGR program is not applicable for the majority of apiculture producers. The limitations of the current AGR based programs are, apiculture producers are not typically diversified into other crops (their apiculture operations are diversified both in type of services and production locations), and the limitation on livestock operations/products or income limits. While some producers indicated the index based programs are not applicable for their operations, other producers did state support for the current index based program. Both groups expressed the limits of these programs in that they only provide protection against a single peril, drought.

A total operation (whole farm) based program would provide a risk management tool to the industry; however, indications are that producers would evaluate this program to determine if it would provide the type of risk management option needed in their individual operation. Other than the availability of a risk management option, the total operation coverage program identified as a potential for the industry should have no impact on producers or the apiculture markets. The largest potential for impact would be to the government (taxpayers). These impacts would be associated with the increased risks or opportunity for moral hazard, fraud, and abuse associated with the industry dynamics.

Pilot Implementation

Based on the recommendation that it is not feasible to currently develop an insurance program, pilot implementation and the resulting pilot area recommendation is not applicable. However, if a pilot were considered by RMA, a nationwide pilot area would be beneficial due to the mobility of the industry.

Summary

Based on the objectives stated in the Task Order and by RMA, in addition to the study's focus directed by the Food, Conservation, and Energy Act of 2008, it is determined that it is not feasible to develop a federal crop insurance policy that "covers loss of bees". However, during this project's research, it was noted that a program covering an entire apiculture operation's revenue could potentially provide a producer acceptable level of coverage for honey bee losses. Conversely, it was agreed that the questions and possible risks associated with this type of a program were unquantifiable and ultimately unacceptable to RMA at the current time. Many issues influenced this recommendation, with the primary concern associated with industry acceptance and potential for fraud, abuse, and waste. Simply, a program for insuring honey bees

is not a prudent expenditure of taxpayer funds. A program for this industry must consider the dynamics of the industry and all the commodities and services of a typical apiculture operation before it would be acceptable to the industry. As detailed in the report, many of the needs, desires, and issues noted in the 2003 report are still present today. While the current index based programs offer a level of insurance coverage, apiculture producers are still in need a program to protect their total apiculture operation and way of life. A revenue based program received support from both of the major bee and honey industry groups. As noted throughout this report, the apiculture industry is dynamic, mobile, and different than the traditional crop insurance commodity. These industry dynamics must be acceptable to the government before a true insurance program can be developed that will be acceptable to the industry.