

## **History**

The migration of honeybees into Saskatchewan coincides with the coming of the first settlers from Eastern Canada and the United States. The first records of honeybees in the province date back to 1900. By 1922, there were about 85 beekeepers that produced 24,000 pounds of honey. Most of these beekeepers were located in the Southern and Eastern parts of the province. After World War I there was a growing demand for, and increasing price of honey; this caused an interest in the production of honey.

World War II caused a further expansion of beekeeping due to sugar rationing. By 1947, there were over 10,000 registered beekeepers in Saskatchewan. The Saskatchewan Honey Producers Co-operative Association was organized in 1939 and established its first packing plant in Yorkton.

## A Day in the Life of a Bee

A honeybee hive is far more than just a buzz of activity. In fact, the social organization inside a nest rivals that of the best-run corporations. Each bee and each cell possess a specific function.



#### Finding a New Hive

If a colony feels crowded in its current location, it may swarm. This is the honeybee's natural method of creating more colonies. The colony will raise new queens to head the old colony while the old queen and approximately half the bees leave with her. When investigating a potential site for a new hive, scout bees carefully check the cavity to ensure it meets certain specifications. It must be large enough to hold a volume of at least six and a half gallons. It must have a small entrance that has a maximum diameter of about one and a half inches and that lies near the base to facilitate removal of waste. Finally, it should face south for warmth, and it should lie high off the ground to protect against predators. Once they have identified a suitable site, honeybees scrape off any loose wood or other debris and coat the interior surface with propolis, or dried tree resin. They then start generating beeswax to build the combs.

### Gathering Nectar

A single colony typically contains 40,000 to 60,000 bees. At any one time, the colony gathers nectar using several thousand foraging worker bees that descend on flower patches spread over an area as wide as 40 square miles. The patches differ in size and richness and a colony must constantly gather information about flower patches and adjust its visitation strategy accordingly. Nectar can vary in sugar content from 4% to over 60%, depending upon plant species and climate conditions. Therefore, bees will have to gather and evaporate many more pounds of nectar than they produce as honey. The Saskatchewan colony produces an average of over 190 lbs/hive and the average nectar collected is around 700 lbs.



#### **Building the Combs**

Middle-aged worker bees are responsible for constructing the combs. Using wax secreted from their abdomens, they build the combs downward from the top of the hive. They attach each comb, which consists of two layers of horizontal, hexagonally-shaped cells, to the roof and walls, leaving small passageways along the walls to allow movement between combs. In a typical nest, the combs will have cells for storing honey up top, followed by a layer of pollen-storage cells. Beneath that are the brood cells for workers and, off to one side, drones. Finally, at the bottom, or off by themselves to the sides, hang the peanut-shaped cells that house infant queens.

A natural nest will have roughly 100,000 cells in half a dozen combs, whose total surface area will be about 27 square feet. It takes more than two and a half pounds of beeswax to create such a structure (not to mention about 15 pounds of honey to synthesize that wax). A colony needs those 100,000 cells to store the more than 100 pounds of honey it requires to survive a typical temperate winter and to provide nursery space for bees that the overwintering bees will rear in the spring. The bees will raise more than 20,000 bees in the spring. Spring and summer bees will only live about 35 days, and populations can easily reach 60,000 adults.

#### Waggle Dance

Honeybees communicate through dancing. A bee performs the waggle dance when she wants to inform other bees of a nectar source she has found. The waggle occurs on a special dance floor, which is conveniently located near the entrance of the hive to facilitate quick entry and exit of foragers. Only bees with news of highly profitable sources of nectar execute the dance. Arriving back at the nest, a bee with news to share immediately proceeds to the dance floor where other bees waiting for news gather around her. During the waggle, she dances a figure-eight pattern, with a straight "walk" in between the loops and a sporadic fluttering of her wings.

The worker communicates several key pieces of information during the dance:

- The longer she waggles (between one and 100 waggle runs per dance) the farther the flower patch lies from the hive. Every 75 milliseconds she prolongs the dance adds roughly another 330 feet to the distance.
- She shows how rich the source is by how long and/or how vigorously she dances.
- She indicates the direction of the source by the angle her waggle walk deviates from an imaginary straight line drawn from the dance floor to the sun at its current position.
- She shares the odour of the flowers with the other bees, who sample it with their antennae.

Other bees will watch only one waggle dance for a brief period before leaving the hive. In this way, the bee works for the good of the hive rather than for the good of herself. If she stayed for the whole dance, she would know exactly how rich the source is, for instance. But if all bees waited for the entire dance to take place, and then only went to the richest sources, the colony would not be maximizing its use of available resources.







#### Shake Dance

A worker does the "shake" dance when nectar sources are so rich that more foragers are needed. A worker arriving back from a foraging run will move throughout the hive and shake her abdomen back and forth before a non-foraging worker for one to two seconds before moving onto more nonforagers at the rate of between one and 20 bees per minute. The shake dance encourages these nonforagers to make their way to the waggle dance floor.

#### **Tremble** Dance

Finally, workers do the "tremble" dance when foragers have brought so much nectar back to the hive that more bees are needed to process the nectar into honey. Walking slowly around the nest, the dancer quivers her legs, causing her body to tremble forward and backward and from side to side. Lasting sometimes more than an hour, the tremble dance stimulates additional bees to begin processing nectar.

## PRODUCTION

#### Bees

Saskatchewan honey is produced in a clean, pristine environment free of heavy industry. Our honey is produced from canola, alfalfa, sweet clovers, and borage. All of these crops bloom at once so it is often impossible to separate the honeys. However, there are areas where unifloral sources of sweet clover, alfalfa, and borage honey can be produced. All of these honeys produce a mild-flavoured white honey which is used around the world for table honey and for blending with stronger honeys.

The growing season is short and intense; however, the dry climate and populous hives take advantage of the six million acres of canola and an equal amount of alfalfa to produce large surplus honey crops. There are significant acres of clover and borage grown for seed in areas of the highest bee concentration and this also contributes significantly to the honey crop. Saskatchewan's Northern latitude, the long day length, and warm summer days in June, July, and August, translate into immense honey flows with daily colony weight gains in excess of 20 pounds per day (sometimes over 30 pounds per day).



### Industry in Saskatchewan

Production: 20,240 thousands of pounds (2019)

Number of Producers: 1101 (2019)

Value to Economy: \$32,384,000 in production value (2019)

## Industry in Canada

Production: 80,345 thousands of pounds (2019)

Number of Producers: 10,344 (2019)

Value to Economy: \$173,036,000 in production value (2019)



During the winter, honeybees don't become dormant like many other insects, but rather create a warm microclimate inside the hive and subsist on the stored honey. The bees warm themselves and the nest as a whole by exercising their flight muscles - like revving the engine in neutral. They retain this precious heat by allowing only small openings in the nest, by using plant resins and gums (propolis) to seal holes and cracks, and by clustering into a round mass of bees. By doing so, they can keep the temperature of bees at the outermost limits of the cluster above 10°C; the honeybee's lower lethal limit. To maintain such a microclimate, the colony must consume more than two pounds of honey a week throughout the winter, hence the strenuous collection of nectar during the warmer months.

From late winter to early autumn, bees keep the temperature in the hive's nursery between about 32°C to 36°C to ensure proper development of the young. They rarely allow the temperature to vary more than 1°C in the course of a day. On steamy days, they cool the nest by fanning their wings or by spreading water on the comb to remove heat through evaporation.

Bees have a much greater armoury of defences against attacks than simply their stingers. For external threats, the bees rely, first and foremost, on their protective nest. Guard bees patrolling the single, tight entrance, quickly attack intruders, and when necessary, will join a massive counterattack synchronized by the release of alarm pheromones. For internal threats, bees have a bevy of defences as well. When building and maintaining the hive, they use propolis to varnish the interior walls which also has a floral herbicide and fungicide effect. Each colony has a specific odour that helps the bees distinguish between colony members and intruders. So-called "undertaker" bees are so assiduous about removing the carcasses of their dead fellows that, while a nest will suffer about 100 deaths of its members every day, it rarely will contain more than one or two dead adults at any one time.

#### Honey

In order to make pure honey the honeybee puts it's "proboscis" or long tongue down into the flower and sucks up the nectar as it travels from flower to flower. The bees tongue is built like a straw. When it sucks up the nectar it goes into the honeybee's sac where it mixes with enzymes (that only honeybees possess) in the honey sac. After the honeybee returns to the hive it passes the nectar from bee to bee and they store the nectar in the honey comb to ripen into the honey we can eat.

Foraging bees regurgitate the nectar to middleaged workers, which either distribute the nectar for immediate consumption or process it into honey and store it in honey cells. Sometimes foragers bring water rather than nectar. Nurse bees, those tending the brood of unborn workers, will use the water either to dilute honey to feed the brood or to cool the hive.





Returning foragers also bring pollen, which they carry in special pollen "baskets" on their hind legs. Pollen provides colony members with vital amino acids, vitamins, and fats. It is stored in pollen cells near the brood and fermented into a kind of bread consumed by the nurse bees who then produce royal jelly and worker jelly to feed developing larvae and the queen.

To produce a single pound of honey, the bees must bring in around 75,000 loads of nectar and then process it. This could take many, many days.

Bees are constantly going back and forth from plant to plant and then back to the hive. On their way back they are carrying 85% of their weight in nectar.

## Types of Bees

#### Queens

The queen bee is a bit larger than the worker bees. A mated queen is central to the well-being of the colony. She lays eggs that develop into worker bees, drones, and queens, and she produces biological chemicals called pheromones that help maintain colony cohesion, function, and purpose.

There is only one queen per colony and without a queen, the colony would fail.

If the queen appears to slow her pace of laying eggs or otherwise shows signs of weakening, the workers will raise more queen larvae. The workers will choose a slightly larger cell and feed the larvae food with higher sugar content. Food for worker larvae contains about 10% sugar, while food for aspiring queens holds about 35% sugar. New queens battle with one another until just one queen remains. The victorious queen spreads pheromones via her workers to let the nest members know she is alive and well, and to suppress reproductive behaviours among the workers. Soon after becoming an adult, a newly fledged queen, who is larger than all other bees in the nest, makes several mating flights. Typically, she will mate with 15 or more males. Since she is the only bee that will lay eggs, this ensures genetic heterogeneity in the hive (in other words, while all bees in the hive have the same mother, they have various fathers). After the mating flight, the queen stores millions of sperm in her body. These are good for up to three years; her potential lifespan.

#### Workers

Worker bees are all female and make up about 85% of nest bees. These bees generally live six weeks. They have three life stages, during which they have specific roles to fill. Young workers (one to 12 days old) clean cells, nurse the brood, and tend the queen. Middle-aged workers (12 to 20 days old) build the comb, store nectar and pollen brought by forager bees, and ventilate the nest. Guarding the hive entrance is done by worker bees ten to 20 days of age. Older workers (20 to 40 days, or more,) are primarily foragers who collect nectar and provide the enzymes needed for converting it to honey. Flying at a speed of about 24 kilometres per hour, each can travel more than five and a half kilometres from home on a single flight.





#### Drones

The males or drones are larger bees than worker bees, similar in size to the queen. Unlike worker and queen bees that develop from fertilized eggs, the drones develop from unfertilized eggs. This means that drones do not have fathers while workers and queens do. The drones have one purpose in life: to mate with the queen. Nature has given them extralarge eyes to ensure that they do not lose sight of the queen on the mating flight. At the appropriate time, drones meet at special mating areas far from the hive, where they attempt to mate with the queen at heights of up to 100 feet off the ground.

From birth, male bees have certain advantages over female bees. While emerging workers (females) have to climb out of their brood cells all by themselves, baby drones are helped out by nurse bees; and they don't have to do a single thing around the nest – they don't even have a stinger! But there are distinct disadvantages to being a male. When food supplies are low or when winter approaches, workers do not hesitate to kick dronesout of the nest, where they inevitably perish. And a male who is lucky enough to mate with a queen pays the ultimate price. During mating, his reproductive parts get ripped out of him, and he dies.

### Bees and the Environment

One third of all vegetables and fruits are pollinated by honey bees. Depending on the crop, some fruits would not develop without pollination from honey bees. With other crops, we might get fruit, but it will not be the amount or the quality we desire. Have you ever seen a lopsided apple or pumpkin? That is a sign of improper pollination. Without the honey bee, many things in nature would be "lopsided."



Some suggest that between 50 and 80% of the world's food supply is directly or indirectly affected by honey bee pollination. Whether it's pollination of apples, or pollination of the seeds to produce forage for livestock, the food chain is linked to honey bees.

In the past three years, Canada had lost approximately 35% of its bee colonies every year. Scientists are not yet sure what is causing the huge decline in bee numbers. Some say it may be caused by a number of factors including:

- Disease from mite and virus infections.
- Changing weather patterns; recent wet and cold summers have prevented bees from foraging for food and have affected the time of year that forage plants appear.
- Insecticides used to kill agricultural pests may harm bees if these are applied incorrectly or without care.



### Processing

Honey is harvested by removing the wax cappings, and spinning the combs filled with honey in a machine called a honey extractor. The honey is strained to remove wax particles and packed into 45 gallon drums for sale to packers or into small containers for sale to consumers. Nothing else is added to the honey. The empty combs can be

returned to the bees to fill with honey again.

### Nutrition

One tablespoon of natural honey contains 64 calories. Honey has a healthy Glycemic Index (GI), meaning that its sugars can be gradually absorbed into the bloodstream to result in better digestion.

Honey contains natural minerals and vitamins which help the metabolizing of undesirable cholesterol and fatty acid into the system, hence preventing obesity and promoting better health for us.

To be sure you are buying Canadian honey make sure the label says, "Product of Canada" or "Pure Canadian Honey." The label may say "Canada No.1 Honey," but actually be blended with honey from another country. This is only a grade, indicating quality (moisture, colour, particle-free, etc.), so make sure to read the fine print!

## **By-Products**

Honey and honey products produced in Saskatchewan have a variety of uses. In addition to being a wonderful food and food ingredient, it is also added to medicine, cosmetics, and food supplements. Honey by-products such as beeswax, pollen, propolis, and royal jelly offer additional spinoff opportunities.



## Careers

- Beekeeper
- Research and Development Marketer
- Processing Plant Worker