

## Creamed Honey - Theory

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Creamed honey is one of the finest hive products available. It has a mild flavor, spreads like butter at ordinary room temperature, and unlike liquid honey, it doesn't drip. Creamed honey is really crystallized or granulated honey. Well-made creamed honey possesses a creamy texture because the crystallization process has been precisely controlled. Unfortunately, creamed honey is usually one of the least promoted products in a beekeeper's product line. This situation can be traced, in part, to the fact that most crystallized honey is produced through a natural or uncontrolled process that usually results in large, coarse crystals that are hard, difficult to spread, and not especially palatable. Professor Elton J. Dyce, while at Cornell University, learned to control the crystallization process and to produce an extremely fine-grained creamed honey. Here, I recount the essentials of Professor Dyce's method for producing creamed honey. You can apply these principles to any size creamed honey operation.

### Honey Crystallization

Two processes determine the quality of creamed honey. The first is crystallization. Nearly all honey crystallizes – some while still in the comb, others within a few days, weeks or months after being extracted. A few honeys, like Tupelo, remain in the liquid state for years after being extracted. Natural crystallization is an uncontrolled process that generally produces a coarse product with a high tendency to ferment. Unfortunately, this is also the type of crystallized honey with which most people are familiar. Successful marketing of crystallized honey requires that the final product consist of extremely fine crystals. Therefore, if you wish to produce high quality creamed honey, you must first acquire a basic understanding of the process of crystallization.

Honey consists of two principal sugars – glucose and fructose – in solution with water. Crystallization is a process in which the glucose molecules form crystals with some of the water molecules. Crystallization is affected by three major factors. One is the floral origin of the nectar. Generally, honeys with a high glucose/fructose ratio, like goldenrod and goldenrod-aster blends, will crystallize more rapidly than honeys with a relatively low glucose/fructose ratio, like Tupelo.



Honey crystals (Kountoupes)



Crystallized honey as seen with polarized light (Kountoupes)

## Honey Fermentation

The second process that can affect the quality of your creamed honey is fermentation. All honeys contain sugar-tolerant yeasts that can cause them to ferment or spoil if their moisture content is too high. The moisture content of well-ripened honey is 18.6%, or less, and this suppresses the growth of the yeasts. Honeys with higher water content are susceptible to fermentation, and considerable loss from fermentation occurs during years when bees are having difficulty ripening their product. Crystallization and fermentation are closely related. During crystallization, the glucose molecules separate from the liquid phase as solid glucose hydrate crystals containing 9.09 % water. Since liquid honey is generally between 17 and 19% water, crystallization frees up quite a bit of water and that increases the moisture content of the remaining honey. This creates an environment favorable for the growth of the yeast. Even well ripened honeys may ferment if they crystallize.

The most satisfactory method for controlling honey spoilage is pasteurization – a process in which the honey is heated rapidly to 145 °F for 30 minutes - or 150 °F for 15 minutes - and then rapidly cooled. The elevated temperature destroys the yeast, thereby preventing fermentation. The rapid heating and cooling process is essential to minimize damage to the honey from heating. Many people prefer not to heat their honey to such a high temperature; however, heat related damage to honey is cumulative and should be kept in perspective. Honey stored at 77 °F for 40 days will incur as much damage as honey heated to 145 °F for 60 minutes. The take-home message is simple – heat your honey for adequate control of crystallization and fermentation, cool it as rapidly as possible, then store it at 70 °F or less. While pasteurization eliminates fermentation, honeys heated to this temperature usually begin crystallizing again in a few weeks or months. The crystals that form after pasteurization are invariably large and coarse and make the resulting crystallized product undesirable for table use. Therefore, liquid honey must be creamed immediately after it has been pasteurized.

## The Dyce Method for Creamed Honey Production

Inadequate control of fermentation and crystallization of honey were serious obstacles to the successful marketing of crystallized honey until a method commonly known as the Dyce Process (after its inventor, Professor Elton J. Dyce) was developed at Cornell University in 1928. One of Professor Dyce's contributions to our knowledge of honey was his discovery that one could control the crystallization process by controlling the quality of the seed crystals used to initiate the crystallization process. A second contribution was his discovery that the temperature of the honey during the crystallization process greatly affects both the rate of crystallization and the texture of the final product. A temperature of 57 °F is the optimal temperature for crystallization. Of course, in the process of making these discoveries, Professor Dyce learned a great deal about the properties of honey, and the serious creamed-honey producer is referred to Professor Dyce's original texts on the subject for greater detail (see Suggested Readings).

The heart of the Dyce Process is the control of the crystallization process. Control is achieved by the careful adherence to a series of steps:

- 1) Blend the honey to the desired color, flavor and moisture content.
- 2) Pasteurize the honey you wish to crystallize. First, heat the honey to 120 °F, then strain it to remove large impurities, especially wax particles. Following this initial straining, heat the honey to 150 °F for 15 minutes to dissolve remaining crystals and kill any yeast cells. Strain the heated honey through a 100-mesh/inch (40-mesh/cm) screen to remove fine impurities.
- 3) Cool the honey as rapidly as possible to between 60 and 75 °F in preparation for the addition of seed crystal. Rapid cooling is essential, as honey raised to 150 °F for 15 minutes and left to cool slowly on its own will be damaged and yield an inferior product. The finest-grained honey is produced when the seed crystals are added to honey that is between 60 and 75 °F.
- 4) Prepare an intermediate batch of seed crystal from a starter batch of previously crystallized honey. The starter batch is ground to a suitable fineness, then added to 10-20 times its weight of pasteurized and strained honey. Using less than 5% seed crystal to seed a new batch of honey results in a coarse product. Adding more than 10% seed crystal is wasteful. The seed crystals and honey are thoroughly mixed, being careful not to incorporate air into the honey, then covered and placed in a cold room at 55 °F for one week. This intermediate batch of seed crystal is prepared in a wide mouthed container so that it can be easily removed once it has crystallized.

5) After the intermediate batch of seed crystal is completely crystallized, you must process it before you can use it as seed for the main batch. Remove it from the cold room, bring it to a temperature of 70 °F, and grind it to a fine consistency. After grinding, the intermediate batch of seed crystal is added to 10-20 times its weight of pasteurized and strained honey, and mixed thoroughly, again, paying attention not to incorporate air into the honey. The container in which you mix the seed crystal and honey for your production run must be equipped with a 2" gate to facilitate the flow of the relatively cold honey. The length of time that the honey and seed crystal are mixed also affects the rate of crystallization and the grain of the final product. The optimal time for stirring will depend on the specific equipment used. Caution! Over-stirring can raise the temperature of the honey and damage the seed crystal.

6) Creamed honey must crystallize in the containers in which you sell it. You cannot re-pack it after it has crystallized. So, immediately after blending your seed crystals with your liquid honey, dispense it to smaller jars for crystallization and retail sale. Place the jars in the cold room at 55 °F and leave them undisturbed for one week. After crystallization is complete, store the honey below 70 °F, and preferably below 50 °F.

### **Firmness of the Product**

Dyce found that he could control the firmness of creamed honey by carefully selecting or blending the honey for the proper moisture content. The moisture content of honey used for production of creamed honey in the southern states in the summer should be between 17 and 17.5%. The moisture content of honey used in the southern states in the winter or the northern states in the summer should fall between 17.5 and 18.0%. The moisture content of honey used in the northern states in the winter should be between 18 and 18.5%. The best way to adjust the moisture content is to blend honeys of varying moisture content. Use a refractometer to determine the moisture content of honey.

### **Quantity of Seed Crystal**

The relationship between the amount of seed crystal and the grain of the final product is a consequence of the nature of the crystallization process. Crystallization proceeds from the surface of a seed crystal outward, until contact is made with another growing crystal. If you use too little seed crystal, the crystals you do use will grow too large before they contact other crystals, and the resulting product will be coarse. Too much seed crystal is simply wasteful. Professor Dyce recommended that a producer use 5-10% finely ground seed crystal.

### **Temperature of Honey**

Professor Dyce determined that the temperature of the honey to which the seed crystal is added affected the coarseness of the final product. The optimum temperature is between 60 °F and 75 °F. If the temperature is below 60 °F, the resulting product will not be as fine-grained as it could be. As the temperature rises above 75 °F, the seed crystals begin to melt and the resulting product becomes progressively coarser.

### **Packaging Problems**

Packaging is another area that can greatly affect consumer appeal. One problem with crystallized honey is the incorporation of air bubbles that can occur when you cool the honey by stirring or when you mix seed crystals with the main batch of honey. The air may rise to the surface as the honey cools, producing a layer of foam. This will give the pack a bad appearance and may cause a consumer to reject it. Another appearance problem arises from the fact that glucose crystals are pure white. This means that honey becomes lighter in color as it crystallizes. This may create a problem if the honey is not thoroughly strained, since any specks of comb, especially dark comb, become readily visible. Honey shrinks slightly upon crystallization and has a tendency to pull away from the side of the jar if it is packed in glass. Here, the white crystals that are visible may appear as mold. Some buyers have rejected crystallized honey for this reason, believing that something is wrong with the product. Several contemporary producers of creamed honey maintain the highest standards of purity and pack highly attractive products in glass containers, but they wisely use wrap-around labels.

### **Crystal Size**

People often ask how one determines the best size crystal for Dyce Processed Honey. There have been no taste tests made recently as far as I know, but those conducted by Professor Dyce many years ago indicated that the crystals should be too small to be felt by the tongue. Not all beekeepers agree with that thought, and many make their crystallized honey with larger crystals.

### **The Dyce Patent**

The Dyce process was patented (Patent No. 1, 987, 893) shortly after the inventor developed it, and the proceeds were donated to Cornell University. The Cornell Research Foundation administered the patent until its expiration in 1952. Licenses were granted to a few of the largest packers who were willing to spend the money to install the necessary equipment and to follow instructions to insure a quality pack. Only a token royalty was charged, and the money derived from the patent is invested in honey bee research. A similar patent was taken out in Canada (Patent No. 332,685) and the proceeds were donated to the Province of Ontario. No royalty was charged, and no effort was made to restrict the use of the process. This resulted in inferior crystallized honey appearing on the market. To correct this situation, the Canadian Government restricted the use of the process and granted licenses only to packers who were properly equipped to pack a quality product.

Creamed honey offers the producer a product with considerable market potential. You can cream nearly any honey; and while creamed honey can be made by other methods, there is no question that by carefully following the methods outlined by Professor Dyce, you can be sure of consistently producing the highest quality product. Experiment with small batches using the methods outlined. Keep good records of how each batch is made, so that you can repeat your success when you get it the way you want it. In light of the abundant supply of honey in the country today brought about by under-priced imports, high-quality, value-added products like creamed honey present beekeepers a more profitable outlet for their honey.

### **Suggested Readings:**

Dyce, E.J. 1975. Producing finely granulated or creamed honey. In: Honey (edited by Eva Crane). Crane, Russak and Company, Inc. NY

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