

Table 3 Temperature and Time Requirements for Killing Moths in Stored Clothing*

Storage Temp, F	All Eggs Dead After, Days	All Larvae Dead After, Days	All Adults Dead After, Days
0-5	1	2	1
6-10	2	21 ^b	1
10-15	4	1	1
15-20		1	1
20-25	21	67	4
25-30	21	125 ^c	7
30-35		283 ^d	

* Table taken from AMS-57, USDA.
^b 50-95 percent of larvae may be killed in 2 days.
^c A few larvae survived this period.
^d Larvae survived this period.

permeated with red pigment, and some natural luster has disappeared.

Bread—See Chapter 34

Candy—See Chapter 50

Carrots

Carrots are best stored at 32 F with about 95 percent rh. Like beets, this vegetable is subject to rapid wilting if the humidity is low. For long storage, carrots should be topped and free from cuts and bruises. If in good condition when stored, they should keep 4 to 5 months.

Bunched carrots are stored like topped carrots. The containers should be stacked to allow air circulation between them, otherwise they are likely to heat. The storage life is 10 days to 2 weeks. Contact icing is recommended. Packaged carrots can be held 3 to 4 weeks at 32 F.

Cauliflower

Cauliflower may be stored for 2 to 3 weeks at 32 F with a relative humidity of about 90 to 95 percent. Successful storage depends on retarding the aging of the head or curd, preventing decay marked by spotting or water-soaking of the white curd, and in preventing yellowing and dropping of the leaves. The crates should be handled carefully to avoid bruising of the heads or leaves, and should be stacked with the heads down to avoid bruising the curd and arranged to permit air circulation.

Celery

Celery is a relatively perishable commodity and for long storage it is essential that a commodity temperature of 31 to 32 F be maintained. The principal decay is watery soft rot which develops at as low as 34 to 35 F. The relative humidity should be high enough to prevent wilting (90-95 percent). Considerable heat is given off due to respiration and for this reason the stacks of crates should be separated and dunnage used to allow circulation under and over the crates and between the bottom crates and the floor. Forced air circulation should be provided, otherwise there may be a 3 to 4 F deg temperature differential between the top and the bottom of the room. Celery should not be piled more than 4 crates high. If it is necessary to pile them higher, a very careful check should be kept, especially on the top commodity temperatures, to avoid overheating.

Cucumbers

Cucumbers can be held only for short periods of 2 to 3 weeks at 45 to 50 F with a relative humidity of 85 to 90 per-

cent. Cucumbers held at 45 F or below for longer periods develop surface pitting or dark-colored watery areas appear. These blemishes indicate chilling injury. Such areas soon become infected and decay rapidly on removal of the cucumbers to warmer temperatures. Slight chilling may develop in 2 days at 32 F and severe chilling injury within 6 days at 32 F. Waxing is of some value in reducing weight loss and giving a brighter appearance.

Dairy Products—See Chapter 32

Dried Fruits—See Chapter 50

Eggs—See Chapter 49

Fish—See Chapters 31 and 40

Frozen Fruits and Vegetables—See Chapter 38

Frozen Fruit Juice Concentrates—See Chapter 39

Furs and Fabrics

Cold storage has been used for many years as an effective means of protecting furs, floor coverings, garments, and other materials containing wool against insect damage. The commonly used cold storage temperatures do not kill the insects but inactivate them and thus prevent insect damage while the susceptible items are in storage. However, if insects are present, the article is susceptible to damage as soon as it is removed from cold storage.

It is advisable to free the articles of any possible infestation before they are placed in cold storage. Those items that can be cleaned should be so treated. Others can be either fumigated or mothproofed as described in the *USDA Home and Garden Bulletin 24*.

The most commonly used temperature range for cold storage of furs and garments is 40 to 42 F. This low temperature not only inactivates fabric insects but it has the added advantage of preserving the vitality and luster of furs and the tensile strength of fabrics. Continuous storage below the 40 to 42 F range is needless and a wasteful expense as far as protection from insect damage is concerned.

Table 3 contains data relative to the effect of cold temperatures on the webbing clothes moth.

There are temperatures and humidity levels at which many commodities can remain for a considerable length of time without deterioration or loss of quality. Furs and fabrics seem to deteriorate less rapidly and can be best preserved and protected when the temperature is between 32 to 40 F and 45 to 55 percent rh. Some storage firms maintain constant temperatures in their fur storage vaults of between 14 and 32 F and claim excellent results. However, no evidence as the result of research has been presented to indicate temperatures in this range are required for the storage of dressed furs or fabrics. Some importers of raw skins request 0 F or below. No harmful effects have been noted when skins are stored at from 0 to 20 F. Other reasonable, safe and dependable methods of protection of fabrics from clothes moths are discussed in *USDA Home and Garden Bulletin 24* and in the *USDA AMS Report 57*.

Grapes—See Chapter 47

Grapefruit—See Chapter 48

Honey

Both extracted (liquid) and comb honey can be held satisfactorily in common dry storage for about a year. The slow darkening and flavor deterioration at ordinary room temperatures becomes objectionable after this time. Although

Commodity Storage Requirements

cold storage is not necessary, temperatures below 50 F will maintain original quality for several years and retard or prevent fermentation. The range between 50 F and 65 F should be avoided if possible, as it promotes granulation; this increases the probability of fermentation of raw (unheated) honey. As storage temperature increases in the 80 to 100 F range, deterioration is accelerated; temperatures constantly above about 85 F are unsuitable, and above 90 F quite damaging.

Honey for European export is best kept in cold storage, since the half-life for honey diastase at 77 F is about 17 months.

Raw honey of greater than 20 percent moisture is always in danger of fermentation; the likelihood is much less at or below 18.6 percent moisture. Below 17 percent moisture, raw honey will not ordinarily ferment. Granulation increases the possibility of fermentation or raw honey by increasing the moisture content of the liquid portion. Properly pasteurized honey will not ferment at any moisture content. Granulated honey can be reliquified by warming to 120 to 140 F.

Comb honey should not be stored above 60 percent rh to avoid moisture absorption through the wax, leading to fermentation.

Finely granulated honey (honey spread, Dycs process honey, honey cream) must not be stored above about 75 F. Higher temperatures will in time cause partial liquefaction and destroy the texture. Any subsequent regranulation by lower temperatures will produce an undesirable coarse texture. For holding more than about 4 months, cold storage is required.

Lard—See Chapter 41

Lemons—See Chapter 48

Lettuce

Soon after packing, lettuce is generally vacuum-cooled to approximately 33 F and immediately loaded into refrigerator cars with full bunkers of ice and about 2 percent salt. At destination the lettuce may be stored at 32 F with 90-95 percent rh and, if in good condition, can be expected to keep at least 4 weeks.

Maple Sirup

Maple sirup, packed hot (at, or within a few degrees of its boiling point) in clean containers, promptly closed air-tight and the containers laid on their sides or inverted to self-sterilize the closure, and then cooled, will keep indefinitely at room temperatures without darkening or loss of flavor. Cold storage is not necessary. However, once opened, the sirup in a bottle, can or drum may become contaminated by organisms in the air. Mold or yeast spores which may be present in improperly pasteurized sirup, though unable to germinate in full-density sirup, may grow in the thin sirup on the surface caused by water of condensation. Small packages not completely sterile, containing spores, can be kept free of vegetative growth by periodically inverting the containers to redispense any thin sirup on the surface caused by condensation of water. Maple sirup should never be packaged at temperatures below 180 F. After pasteurizing, the sirup should be cooled as quickly as possible to prevent stack burn which darkens the sirup and causes a lowering of its grade.

Meat—See Chapters 31 and 41

Melons

Cold storage is little used for most kinds of melons except to avoid, temporarily, adverse market conditions. To avoid

injury by chilling, most melons are stored at 45 to 50 F.

Persians should keep at this temperature range for up to 2 weeks; *Honey Deas* for 3 to 4 weeks; and *Cassabas* for 4 to 6 weeks. It is reported that these melons will be definitely injured in 8 days at a temperature as low as 32 F.

Cantaloupes harvested at the hard stage (less than full slip) can be held about 15 days at 36 to 40 F. Lower temperatures may cause chilling. Full slip cantaloupes can be held 5 to 10 days at 32 to 35 F.

Watermelons are best stored at 36-40 F and should keep from 2 to 3 weeks.

Mushrooms

Mushrooms are usually processed or sold in a retail market within 24 to 48 hr after they are harvested. They keep in good salable condition at 32 F for 5 days, at 40 F for 2 days, and at 50 F or above for about 1 day. In retail stores mushrooms should be displayed in refrigerated cases, rather than at ordinary room temperatures.

Mushroom spawn made with rye grain deteriorates in 2 to 3 days at 70 F after it is removed from the culture bottle for delivery to the grower. It will, however, keep in good condition for 2 weeks when stored in well ventilated containers at temperatures of 32 to 40 F.

During the growing period the temperature in mushroom houses must not exceed 65 F. For summer growing in eastern Pennsylvania, about 10 tons of refrigeration capacity is required for each double house (with cinder block walls) containing 6000 to 10,000 sq ft of bed space.

Nursery Stock and Cut Flowers

The temperature and approximate storage life given in Table 4 for cut flowers allow for a reasonable shelf life after removal from storage; therefore, the storage period may at times be extended beyond that recommended here.

Low temperature (31 F) and dry packaging prevent, or at least greatly retard, flower disintegration and extend the storage life. These conditions, while not widely used commercially, are recommended. Proper dry packing requires a moisture-vapor-proof container in which flowers can be sealed. No free water is added because the package prevents almost all water loss.

Flowers which are held in water should not be crowded in the containers and should be arranged on shelves or racks to allow good air circulation. Forced air circulation should be provided but the flowers should not be in a direct draft.

The optimum temperature for storage of many cut flowers is 31 F. Many kinds of nursery stock can also be stored at temperatures ranging from 31 to 35 F. It is advisable to open packages and *harden* flowers before marketing if the blooms have been stored for long periods. Flowers that are conditioned at about 50 F following storage will regain full turgidity most rapidly. The ends of the stems should be cut or crushed and then be placed in water or a food solution at 80 to 100 F for 6 to 8 hr.

Many kinds of cut flowers and greens are injured if stored in the same room with certain fruits, principally apples and pears, which give off gases such as ethylene during ripening. These gases cause premature aging of blooms, and may defoliate greens. Greens should not be stored in the same room with cut flowers as the greens, acting in the same way as fruit, can hasten bloom deterioration.

Greens, bulbs, and certain nursery stock are usually packaged or crated when stored. Some bulbs and nursery stock are packed in damp moss or similar material, and low temperatures are required to keep them dormant. Polyethylene wraps or box liners are very effective for maintaining quality