

# Onions and Onion Sets

Revised 2018

## Thermal Properties

	Onion		Dehydrated Flakes	
	English	Metric	English	Metric
Moisture, %	89.69	--	3.93	--
Protein, %	1.16	--	8.95	--
Fat, %	0.16	--	0.46	--
Carbohydrate, %	8.63	--	83.28	--
Fiber, %	1.80	--	9.20	--
Ash, %	0.37	--	3.38	--
Specific Heat Above Freezing	0.94 Btu/lb*°F	3.95 kJ/(kg*K)	--	--
Specific Heat Below Freezing	0.45 Btu/lb*°F	1.87 kJ/(kg*K)	--	--
Latent Heat of Fusion	129 Btu/lb	300 kJ/kg	6 Btu/lb	13 kJ/kg

## Storage Conditions

	Temperature		Duration	Relative Humidity or Packaging	Freezing Point	
	°F	°C	Months		°F	°C
Fresh						
Bermuda	32	0	1-2	65 to 70%	28 to 30	-2.2 to -1.1
Globe	32	0	6-8	65 to 70%	28 to 30	-2.2 to -1.1
Spanish	32	0	3-6	65 to 70%	28 to 30	-2.2 to -1.1
Sets	32	0	6-8	65 to 70%	28 to 30	-2.2 to -1.1
Green Onions	32	0	1	95 to 100%	28 to 30	-2.2 to -1.1
Frozen						
Whole, sliced	0	-17.8	12	Gas-tight packaging		
Rings, breaded	0	-17.8	6 to 12			
Dehydrated						
Any type	50	10	3 to 6	Vacuum packaging		
	36	2.2	12			

## Fresh Onion Storage

Onions should not be stored unless adequately cured (dried) either in the field or by artificial means. It is necessary to dry the neck tissues and outer scales until they rustle when handled, otherwise the bulbs will

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rot in storage. They can be artificially cured by blowing heated air at 110 to 115°F (43.3 to 46.1°C) through mesh bags for 8 to 12 hours or longer. The cold storage of Bermuda-type (higher moisture) onions often has been a very hazardous undertaking, due mainly to the unpredictable behavior of the field-cured onion.

Onions are held in 60-lb (27.2-kg) sacks, slatted crates, in pallet boxes holding about ½ ton (454 kg) of loose onions, in bins, or in large bulk storage. When in sacks, these should be loaded cross-wise or "air-stacked" 5 to 6 sacks high. The stacks should be set on floor racks. Individual stacks should be separated a few inches to allow free air circulation. Airflow of 1 cfm (cubic feet per minute) for each cubic foot of product (0.0167 cubic meters per second per cubic meter of product) is adequate. Onions in crates or pallet boxes can be stored one on top of the other to make full use of the storage space. Onions should be held at 32°F (0°C) for maximum quality and shelf life. Storage of dry onions at ambient temperature may be acceptable for short periods (1 to 1.5 months) depending on the variety.

Sprouts, or top growth, are an indication of too high storage temperature, whereas root growth indicates too high relative humidity (RH). Of the two, top growth is the more objectionable because once started it is most difficult to check. Field applications of maleic hydrazide are used for reducing sprout growth in storage. If onions are to be dehydrated in a short period, they should be held at 86 to 95°F (30 to 35°C), since the flakes from such onions retain more color.

A comparatively low RH of 65 to 70% is recommended for successful storage of dry onions. Higher humidity, at which most other vegetables keep best in storage, dispose onions to rot, surface mold, and root growth and can reduce the storage period by half. Relative humidity is not a factor in dehydrated onion storage because of sealed containers.

Handling of green onions, commonly called scallions, differs from other onions in that they are much more perishable. Green onions should be precooled to at least 39°F (3.9°C) within 4 to 6 hours of harvest and can be stored for only 1 month at 32°F (0°C). Hydrocooling, forced-air cooling, and vacuum-cooling are used to cool these onions. Green onions benefit from a RH of 95% or higher. They are often packed with crushed ice in waxed cartons for distribution in order to maintain low temperature and high RH.

Onions can freeze at temperatures between 28 to 30°F (-2.2 to -1.1°C) depending on the solids content. Warehouse personnel should examine and note the condition of the different lots of onions as they arrive for storage. Sometimes onions are damaged by more or less severe freezing in the field, and this condition might be mistakenly laid to mismanagement in the storage. Also, onions, particularly those of the Sweet Spanish type, sometimes develop a physiological condition (translucent scale) resembling freezing injury when harvest is preceded by hot weather. After storage, this has been mistaken at times for freezing, and claims have been made for damage because of it. Prompt curing and prompt cold storage after harvest and curing is an effective control for translucent scale.

The mild or sweet Bermuda-type onions, such as Granex, grown in Georgia and other locations, can usually be held at 32 to 34°F (0 to 1.1°C) for 1 to 4 months. If the tops and roots are removed and the onions are cured for 2 weeks at room temperature before storage, they can be stored 4 months or longer. Best quality retention of these sweet onions is in a controlled atmosphere (CA) of 3% O<sub>2</sub> plus 5% CO<sub>2</sub> at 32 to 34°F (0 to 1.1°C). The sweet onions stored under CA conditions remained less pungent than those stored in air. Jumbo-size onions have poorer storage potential than medium-sized onions.

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Onions should not be stored with any commodities that have a tendency to pick up odors, as, for instance, dried fruits or apples, and certainly not with shell eggs; moreover, the optimum RH is different for these products. Onions may be stored with garlic. However, both of these products can cause odor transfer problems with other products and could possibly cause odor contamination to the storage area.

When onions are removed from storage during warm weather, especially if they are to be shipped to southern points where warm, humid weather prevails, precautions should be taken to prevent them from becoming wet with moisture condensed on the bulbs from the outside air, which will saturate the loose scales and the bag material and be very difficult to dry out. In this damp condition, mold and decay will soon follow. The best procedure to prevent this is to 'step-up' the temperature gradually. When the onions are warm enough, condensation will not occur. If it is not convenient to warm the storage room, the lot to be removed should be transferred to a temperature of about 50°F (10°C) for 24 to 36 hours before removal to the outside atmosphere. Unless the outside temperature and humidity are very high, onions from 50°F (10°C) should not become damp on removal, especially if packed together tightly.

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The conditions for the satisfactory cold storage of onion sets resemble those for large onions. Because of their small size, the sets tend to pack closely, so good air circulation is necessary at a low RH of 65 to 70%, such as is used for onions. They are stored in shallow trays that permit ventilation, are handled in 25-lb (11.3-kg) bags and should be stacked to allow as much air circulation is possible.

## Diseases and Injuries

<b>Bacterial Soft Rot</b>	Occurs most commonly in onions harvested during warm, rainy seasons. Can usually be detected only by pressing the onion, which may force a mushy mass out of the neck. Outer scales may become mushy and outer dry skin and may slip during handling.  <b>Control:</b> Better curing procedures and field sanitation. Prompt refrigeration after curing, with adequate ventilation.
<b>Black Mold Rot</b>	Black powdery spore masses of the fungus on or between outer scales. Spreads in storage by contact through bruises and wounds or aerial dissemination of spores. Under moist conditions, the scales may be destroyed by the disease.  <b>Control:</b> Maintain low humidity and low temperature.
<b>Fusarium Bulb Rot</b>	Semi-watery to dry decay progressing up scales from the base. Decay usually covered with dense, low-lying white to pinkish mold. Advanced stage shriveled mummies.  <b>Control:</b> Field sanitation. Do not store badly affected lots. Cull out infected onions in slightly affected lots before storage. Maintain low temperature and humidity.
<b>Gray Mold Rot</b>	Neck tissue infected at harvest time. Initial softening and water-soaking of scales, becoming grayish and finally gray-brown, covered with dense layer of white mold growth and grayish-brown, powdery masses of spores. Colored varieties less susceptible than white ones.

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	<b>Control:</b> Cull out severely infected lots. If onion necks are moist and curing is slow, artificial drying with warm air will help significantly.
<b>Sun Scald</b>	Affected areas become soft and slippery, lose moisture very readily, and change to bleached, sunken, leather-like areas. Opens way for decay invasion, especially bacterial soft rot. Immature and moist onions usually injured most severely. Caused by high temperature and intense sunlight at harvest time.  <b>Control:</b> Avoid direct exposure to the sun in the field. Secondary invasion by decay organisms is controlled by prompt and adequate refrigeration.
<b>Translucent Scale</b>	Occurs usually after 4 to 6 months of storage. Can affect all scales in severe cases, but usually confined to outer 2 or 3 edible ones. Mostly a problem with large bulbs.  <b>Control:</b> Place onions into cold storage immediately after curing is completed. Avoid prolonged storage for onions exposed to very high temperatures during last 2 months before harvest.

## Preparation for Processing

Dried or dehydrated onions have been available for many years, and whole, chopped, sliced, and rings have become important frozen vegetables in recent years. Since the characteristic pungency and flavor of onions are developed by an enzyme reaction which occurs when the onion is crushed or eaten, and since the enzyme involved would be destroyed by blanching, it is fortunate that un-blanching frozen onions are relatively stable. White varieties of onions are preferred for freezing and drying.

Onion sizing is important; for the diced and chopped styles, large onions are preferred because of the economy of peeling; for boiling, onions a diameter of 0.75 to 1.25 inches (2 to 3 cm) is preferred; and for stew vegetables a diameter of 1.5 inches (4 cm) is customary. Roots and tops may be removed before or after peeling.

For diced onions, a dicer set to cut 1/8 to 1/4-inch cubes may be used. Diced onions may be either individually quick frozen (IQF) or broken up after freezing, but prior to packaging, to make them free flowing. Plastic bags are usually used for packaging. Fresh diced and sliced packaged onions need to be stored at 32°F (0°C).

Pearl onions are a special variety of onions that develop small white bulbs desirable for pickles and for specialty items. In recent years they have been incorporated into several of the increasingly popular gourmet-type frozen vegetables such as "green peas and pearl onions."

Onion rings are usually prepared from large Spanish or Bermuda onions, cut into ¾ in. slices and separated into rings which are dropped into a batter of whole eggs and milk, drained, evenly coated with flour, and deep-fat fried. Package in greaseproof, paper-lined cartons.

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## **Freezing**

For all onion products, the more rapid the freeze, the better the product keeps in storage, but conventional quick-freezing procedures are adequate for satisfactory quality for 1 year. A possible exception is breaded onion rings in which fat breakdown may cause rancidity, and excessive crumb burn-off may cause bitterness in products that are conventionally frozen and stored at little below 0°F (-17.8°C) for longer than 8 to 10 months. Frozen onions present a much lower possibility of odor transfer to other products than fresh onions. However, the possibility of odor transfer exists if the onions are put in the freezer in an unfrozen state and are not properly packaged.

## **Dehydration**

Large quantities of onions are dehydrated, and substantial quantities are imported. To retain quality, it is important to dry the onions down to not more than 5%, preferably 4% or less, moisture content and to package in water vapor barrier containers, preferably with a vacuum. This can be done in ovens at 260°F (127°C) for 1½ hours and 212°F (100°C) for 3 hours. Alternately, they can be sun dehydrated at 115°F (46°C) for 8 to 9 days.

Although used primarily as a flavoring ingredient, dehydrated flaked onions can make substantial contributions to nutrient requirements. One ounce (28.3 g) can provide 10% of the recommended dietary allowance of iron and vitamin C and 3 to 6% calcium, protein, vitamins B1, B2, and niacin.

Even if vacuum packed, dehydrated onions will not maintain freshly processed quality for much longer than 1 month if stored at usual room temperature. To retain quality and nutritive value for as long as 6 months, storage temperatures should be reduced to 46°F (7.8°C). If storage of 1 year or longer is contemplated, storage temperature should be reduced to 36°F (2.2°C) or lower.

If the dehydrated onions are not vacuum packed, they should be stored at low RH and/or low temperatures near 32°F (0°C).

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