

## **Proper refrigerator settings are important**

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Lately, I've been taking a look at the effects of freezing on various food materials. One of the important points is the damage that freezing can cause to the structure of produce with a high moisture content. What I really wanted was something so obviously catastrophic that there would be absolutely no doubt about what was happening.

With this in mind, I bought a head of iceberg lettuce and proceeded to show what happens when it is frozen. Iceberg lettuce is about ninety-six percent water on a weight basis. Before putting it in the freezer, I inserted a temperature probe into the cut end and hooked it up to a digital display unit – it looks a lot more scientific if you do something like that.

Based on the thermometer readings, it took about eight hours for the lettuce to freeze. After about twenty-four hours, the lettuce was definitely frozen solid and really didn't look all that bad. The next thing to do was to see what happened when the lettuce was thawed. That's where things got a whole lot more interesting - or messy, if you prefer.

As the frozen lettuce thawed, the once-firm leaves began to sag under their own weight. Water began to ooze out of the leaves and collect in the foil plate that was under the lettuce. As time went on, more and more water collected and the head of lettuce began to resemble a mass of soggy green mush. In the end, the lettuce had shed over one-third of its original weight as water, and was totally inedible.

So, what's the message here, and how does it apply to real-life?

It's highly unlikely that any of you will cheerfully put a head of lettuce in your freezer, but there is a lesson to be learned here.

When high moisture content produce is frozen, ice crystals form in its cellular components such as the leaves, stems, and fruit. Typically, freezing is a slow process and the ice crystals grow with time. As they grow, they damage, or rupture, the cell membranes of the material and allow the watery contents of these cells to escape. Of course, this is something that you generally want to avoid. However, it can happen inadvertently.

If you have your crisper or vegetable storage drawer in your refrigerator set too low, you can actually freeze the produce stored there. As it goes through several freeze-thaw cycles, there can be an appreciable water loss that reduces the quality significantly. Making sure that you do not give your produce frost-bite in the crisper may take a bit of fiddling with the temperature settings, but it's something you should be doing.

Sometimes, freezing fruits to damage the cell structure can be a good thing. Cranberry growers may freeze and thaw the berries before extracting the juice from them. During the freezing process, ice crystals that grow inside the berries rupture the juice sac membranes. Once thawed, there is a substantial increase in the yield of juice during the pressing process compared to a similar procedure with non-frozen cranberries.



**Freezing can cause damage to the cellular structure of produce such as lettuce and destroy its quality after thawing.**