

Green Potatoes: The Problem

[It also needs to be noted that all members of the botanical family *Solanaceae* produce glycoalkaloid toxins, not just potato. Two common examples are tomatine from tomato and nicotine from tobacco. Some members of this family are historically notorious such as belladonna and deadly nightshade.]

Light contains ultra-violet radiation as well as visible rays. Ultra-violet and visible light in the blue-violet region promotes the formation of glycoalkaloids, steroid-like compounds, and, for potatoes, most notably "solanine" in tubers. When tubers are exposed, the solanin content in the peel may increase as much as ten times. Toxic levels for people are about one-hundredth of an ounce for 200-pound person. This 200-lb person would need to eat about 20 lb of normal potatoes in a day to reach this level. But, with UV light-exposed tubers in which solanin had increased ten-fold, only 2 lb could be dangerous. A large baked potato frequently weighs close to a pound but common sizes are six to 11 ounces in restaurants. Potatoes containing more than 0.1% solanine (.01 oz/10 oz potato) are considered unfit for eating. Cooked potatoes cannot turn green nor produce solanine because the enzyme mechanism for their production is destroyed by heating at cooking temperatures. But, note the chlorophyll and solanine already produced before cooking will remain after cooking.

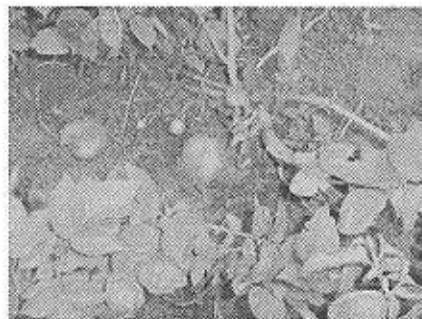


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Green Potatoes: The Solution

The green indicates an increase in glycoalkaloids. When the potato is green, chlorophyll and solanine levels dramatically increase. Chlorophyll's presence results in an appearance undesirable by consumers and solanine's increase may result in a health hazard. Greening is the result of exposure to light and this can occur in the field when potato tubers poke out of the ground. It can also occur in potato storage cellars, on the store shelf and at home on the counter. Since this can be a major marketing and retailing problem, how can greening be prevented or inhibited. The bottom-line is *AVOID LIGHT*.

Field Considerations



Picture 3. Russet Norkotah tuber sticking out of ground and turning green.

Many factors play a role in greening, 'sunburn,' of potato tubers in the field. Exposure to light in the field occurs when potato tubers protrude from the ground (picture 3). Sometimes associated with light exposure in the field is heat necrosis, a hollowing of the center of the tuber caused by exposure to high temperatures (picture 4). Therefore, maintaining a sufficient soil cover above the potato seed piece and keeping a wide enough hill for new tubers to expand underground are absolutely essential.

1. Choose potato varieties that set tubers deeper not shallow. But, if a shallow-setting variety such as Russet Norkotah is grown, make the hills high. Plant deep; six inches (15 cm) is a common recommendation.

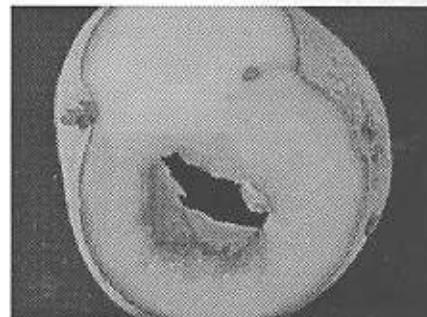
2. Although fertilization does not directly affect solanine content, excessive and late application of nitrogen can result in higher solanine content due to its affect on growth and maturity.

3. Immature tubers contain higher levels of solanine than mature tubers. Therefore, don't harvest too early unless planting was early. Vine desiccate and allow tubers to mature before harvesting.

4. The ideal hill structure is trapezoidal giving a wide and flat cropping row. This gives room for the new tubers to grow without sticking out.

5. Avoid planting on ridges where rows can be exposed to dry soil conditions and wind which may erode or blow-off the row exposing the seed and making the hill too small to cover new tubers. If such an erosion occurs early enough in the season and herbicide application permit it, re-hill and build the row back up.

6. Drought in itself does not have effect greening but will promote blow-off and will promote ground cracking. During the season, avoid excessive tillage. If the ground cracks during the end of the season, tubers near the surface may be exposed to light penetrating through the cracks. Avoid drying out of the soil especially after vine desiccation. It is often recommended in dry climates to irrigate just before desiccation. Not only will this avoid ground cracks but will make chemical vine desiccating more effective.



Picture 4. Internal heat necrosis in Russet Norkotah tuber exposed to light at ground surface in July.

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Storage Considerations

Basically, avoid exposing the pile to light. Use low-wattage incandescent light and don't leave it on longer than needed. Once potatoes turn green, it is irreversible. Sort out green potatoes before going to market. Not only will the buyer complain less but the lot grade will be higher.

Don't wash the tubers going into storage. Dirt remaining on potato tubers will offer some protection against exposure to light and greening. Several reports have shown that washed potatoes will green more readily than unwashed.

Retail Considerations

Note all commercial potato varieties grown in No. America are bred to have low levels of solanine. With thin-skinned varieties, whites and yellows, greening is easier to see, but russet and red varieties will also green. As in the field and storage, the key is *AVOID LIGHT*. Keep potatoes in the dark. Greening usually occurs at the retail level.

1. Shut lights off at night over the potatoes, or cover them with burlap sacks or brown paper bags at night.
2. Watch for the start of greening and cover displays or bag the potatoes.
3. Locate potato displays in sections with low light intensity. Do not locate at front window or on sidewalks.
4. Use a canopy or some decorative overhang to lower exposure to direct sunlight.
5. Use incandescent light bulbs which release much less ultraviolet light than fluorescent ones. Do not use spotlights on potato display.
6. Keep them as cool as possible without freezing (below 40F, 4C).
7. Package potatoes in dark paper or dark plastic (vented) bags for this reason. Bags with green cellophane for viewing will inhibit greening and not promote solanine formation. Remember plastic bags must be vented else soft and wet rots will break down the tubers in the bag and you'll have "mush."
8. Don't keep potatoes wet when displayed under light since wetness may magnify the light intensity on the skin.

Home Considerations

1. At home, store the potatoes for short periods in a dark cupboard preferably in a cool part of the house such as a basement.
2. Wash potatoes only before cooking.
3. Green areas, especially the peel, may be cut away and cook the rest for safe eating. But, if you have a tendency toward allergies, it's best to throw the whole potato tuber away to be safe. If the potato tastes bitter, throw it away.
4. There has been a report that putting potatoes into a 3% dishwasher detergent solution for 30 minutes will protect them from light for 2 to 10 days, depending on the temperature, light intensity, etc.
5. Waxes have not shown to be useful in retarding greening and they can promote tuber breakdown as unvented plastic bags can.

Do People Know About Genes?

It's been more than 120 years since Gregor Mendel's pioneering discovery that characteristics are passed from generation to generation in what we call now genes. A recent survey conducted by Hoban and Miller (Eurobarometer) makes one wonder if this message has gotten through to people yet.

True or False?

"Ordinary tomatoes do not contain genes while genetically-modified ones do."

In the U.S., only 45% of the consumer responses correctly identified this statement to be false while 10% thought that it was true; the remaining 45% didn't know. These percentages get even worse when asked to consumers in several European countries. For example, in Germany, 44% of the consumers thought that this statement was true, 29% in France and 22% in the U.K.

True or False?

"By eating a genetically-modified fruit, a person's genes could also be changed."

Only 61% of U.S. consumers realized that this is a false statement while 9% thought it was true and 30% didn't know. The percents of consumers, who thought this erroneous statement was true, were 30% in Germany, 23% in France and 15% in the U.K.

Trend?

Surveys were conducted by the Food Marketing Institute on U.S. consumers' willingness to buy produce with altered genes. In February, 1999, 77% of consumers would buy GMO produce to lessen pesticide use; in October of that year, the percent was lowered to 67%. In February, 1999, 62% would buy GMOs if they tasted better or fresher; in October, the percent dropped to 51%.

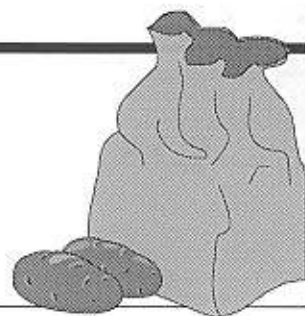
**The Nebraska Potato Eyes is on
the WWW at:
[www.panhandle.unl.edu/
peyes.htm](http://www.panhandle.unl.edu/peyes.htm)**



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POTATO EYES



Green Potato Article References

- Akeley RV, GVC Houghland and AE Scharck. 1962. Genetic differences in potato-tuber greening. *Am Potato J* 39:409-417.
- Brown E and W Riley. 1976. Greening of potato tubers: Varietal responses to controlled exposure to light. *J natn Inst agric Bot* 14:70-76.
- Gosselin B and NI Monday. 1989. Effect of packaging material on the chemical composition of potatoes. *J Food Sci* 54:629-631.
- Griffiths DW, H Bain and MFB Dale. 1995. Photo-induced changes in the total chlorogenic acid content of potato (*Solanum tuberosum*) tubers. *J Sci Food Agric* 68:105-110.
- Gull DD and FM Isenberg. 1960. Chlorophyll and solanine content and distribution in four varieties of potato tubers. *J Am Soc Horticultural Sci* 75:545-556.
- Isenberg FM and DD Gull. 1959. Potato greening under artificial light. *Cornell Ext Bull* #1033.
- Larsen EC. 1949. Investigations on cause and prevention of greening of potato tubers. *Idho Ag Exp Sta Research Bull* # 16.
- Liljemark A and Widoff. 1960. Greening and solanine development of white potato in fluorescent light. *Am Potato J* 37:379-389.
- Percival G and G Dixon. 1994. Glycoalkaloid concentration of potato tubers following continuous illumination. *J Sci Food Agric* 66:139-144.
- Poapst PA, I Price and FR Forsyth. 1978. Prevention of post storage greening in table stock potato tubers by application of surfactants and adjuvants. *J Food Sci* 43:900-903.
- Reeves II AF. 1988. Varietal differences in potato tuber greening. *Am Potato J* 65:651-658.
- Salunkhe DK, SS Kadam and SJ Jadhav (Eds.) 1991. *Potato: Production, Processing and Products*. Publ. CRC Press, Boston.
- Sinden SL. 1971. Control of potato greening with household detergents. *Am Potato J* 48:53-56.
- Valkonen JPT, K Keskitalo and U Vasara. 1996. Potato glycoalkaloids: a burden or blessing? *Critical Reviews Plant Sci* 15:1-20.
- Yamaguchi M, DI Hughes and FD Howard. 1960. Effect of color and intensity of fluorescent lights and application of chemical and waxes on chlorophyll development of White Rose potatoes. *Am Potato J* 37:229-236.