



**Q:** I live in western Missouri and some of my soybeans matured early and the beans remained green. The local elevator is docking my neighbor's soybeans. What caused this and what should I do with my beans?

**A:** Although many soybean producers in Missouri harvested near record yields, farmers in west and southwest Missouri experienced two weather events that reduced yields and grain quality. The first weather event affected full season soybeans. Dry weather accompanied with 100+ temperatures occurred during mid- to late seed-fill. These temperatures greatly increased water evaporation from leaf surfaces. Because of dry soils, roots could not provide enough water to keep the leaves and other plant parts cool. High leaf temperatures caused denaturing (literally frying) of life-sustaining enzymes in the leaves and the plants quickly died. The other weather event damaged double-cropped soybeans. These plants experienced temperatures below 25 degrees. The temperature dropped quickly and ice crystals formed in the cells. Because water expands upon freezing, plants cells and their membranes were literally torn apart. As temperatures warmed and plant tissues thawed, cell contents leaked outside the cells and the plants quickly died.

In both instances, yield was reduced through reduced seed size, but just as important the seeds did not mature normally and remained green. Immature soybean seeds contain chlorophyll and are green because of this pigment. After plants reach physiological maturity, chlorophyll production in seeds ceases. Chlorophyll that is present in seeds and pods is broken down, partially by bleaching in sunlight, but also through natural metabolism. Premature death stops this natural degradation of chlorophyll and the seeds remain green. The extent of the green color depends on timing of premature death. If death occurs late in seed-filling, the green color is usually confined to the seed coat. This color may diminish over time in storage. If death occurs during early to mid seed-fill, the green color remains throughout the interior of the seed. This color will probably not disappear even with longtime storage.

Nearly all USA soybeans are classified and sold as yellow soybeans according to the "Official US Standards for Grain". Seeds with green seed coats should be classified as yellow soybeans and not docked. However, seeds in which less than 90% of the cross-section is yellow will be classified as "soybeans of other color". Soybean grain must meet rather strict standards and if the grain-lot has more than 10% seeds of other color it is graded as "standard" and will receive substantial dockage. Many fields in west and southwest Missouri received so much damage that the amounts of "soybeans of other color" were well over the 10% limit. Some of the seeds were very badly damaged and some of these will fall into the "total damage kernels" classification of grain grading.

Few experiments have been conducted studying the effects of premature death on grain quality. Protein accumulates in soybean seeds at the same rate as dry weight resulting in nearly constant protein concentration during seed-fill. Seeds from plants prematurely killed by heat or freeze should have "normal" protein percentages. Oil percentage may be lower because oil accumulation occurs mostly in the later phases of seed-filling. However, grain from the affected area were analyzed by several animal scientists at MU

and found to be “normal” for oil concentration. So in general, seeds affected by these two weather events should be nearly normal for oil and protein content. During soybean oil processing both free fatty acids and green color are removed. Prematurely dead seeds may have increased levels of both fatty acids and color. This will add to the expense of processing and may reduce the amount of salable oil for processors.

Bill Casady (agriculture engineer for MU) writes that these damaged soybeans should store as easily as normal soybeans, although aeration is strongly recommended. The usual precautions of grain moisture, foreign material, and damaged seed coats apply to all stored soybeans. An increase in fatty acid content may increase the likelihood of spoilage, but keeping grain below 11% moisture should be an adequate safeguard. But, storage will probably not reduce green coloration much. Blending with normal soybeans is not recommended because of the strict grade standards. You may end up with two low-grading grain lots instead of one.

One option for use of these damaged soybeans is to feed whole soybeans to livestock. Raw soybeans contain several trypsin inhibitors so feeding to monogastric animals such as chickens or hogs is not recommended. Roasting or extruding will denature the trypsin inhibitor and make soybeans useable for these animals. Monty Kerley (MU animal scientist) says that whole soybeans, including these damaged soybeans, can be substituted for other soy-based feed ingredients for beef cattle. Cows on hay or grazing poor quality pasture can also benefit from soybeans in the diet.

I would not save any of the grain for seeding purposes next spring. Germination percentage and seedling vigor could be affected. Soybeans grown for IP contracts are often held to even stricter requirements than commodity soybeans. Unfortunately, IP contracts may not be met with these damaged beans. Soybeans that prematurely die often produce products with stronger than normal taste or odor. The effects may be objectionable to human consumers.