



Printed from the:
MU Agronomy Extension Web Site
<http://www.psu.missouri.edu/soyx>
for more information contact:
Bill Wiebold (wieboldw@missouri.edu)

Soybean Plants Killed before Maturity Possess Grain that Remains Green Bill Wiebold

Weather events that occur during seed-filling can kill plants before their normal maturation process takes place. The most common weather event that has this affect of plants is freezing temperatures. As a rule of thumb, leaf temperatures below 28F for four hours are required to kill plants. Other weather conditions such as wind speed, humidity and cloud cover will greatly influence the degree of damage. When temperatures drop quickly ice crystals form inside cells. Because water expands upon freezing, plants cells and their membranes are literally torn apart. As temperatures rise and plant tissues thaw, cell contents leak outside the cells and the plants quickly die. Another weather event, which is rarer but occurred in 2000, is high (100+) temperatures usually in concert with dry soil. These temperatures greatly increase water evaporation from leaf surfaces. Because of dry soils, roots cannot provide enough water to keep the leaves and other plant parts cool. High leaf temperatures cause denaturing (literally frying) of life-sustaining enzymes in the leaves and the plants quickly die.

In both weather events, yield is reduced through reduced seed size, but just as important the seeds do not mature normally and remain 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. Sometimes, seeds are so badly damaged that they 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 slightly lower because oil accumulation occurs mostly in the later phases of seed-filling. However, the effect is likely to be minor. 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.

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 free 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 inhibitors and make soybeans useable for these animals. Research at MU concluded 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.

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