Harvesting Grain from Freeze-damaged Sorghum

Department of Agronomy MF-1081 Freeze-damaged Sorghum

Grain sorghum in Kansas often is subjected to a killing freeze before maturity. When this happens, test weights may be unacceptably low, and producers must decide what to do with the grain.

It is crucial to make a test cutting and analyze it for test weight and yield potential before making any decisions. Once the information from the test cutting is known, management decisions can be made. Options include:

1. Accepting the test weight as harvested at normal combine settings and selling the grain at a discount without further cleaning.
2. Improving the test weight by adjusting combine settings to remove more foreign material and broken kernels.
3. Cleaning the grain after harvest.
4. Processing and feeding the grain to on-farm livestock.
5. Grazing or harvesting the sorghum for silage.

How an early freeze affects grain sorghum

Freeze damage lowers the test weight of grain sorghum. In general, grain from immature sorghum has lower test weight compared to grain harvested from sorghum that has reached physiological maturity (black layer). Low test weights of combine-harvested, freeze-damaged grain sorghum are due primarily to high levels of foreign material and broken kernels. A killing freeze before maturity stops the growth of the seed, creating small, lightweight grain, which may be shriveled and difficult to thresh. Signs of freeze damage include watery patches on plant leaves, followed by necrotic white lesions on the affected area. A light freeze may kill the leaves, but the grain may continue to fill until the stalk dies. Death does not occur until the stalks have been frozen, breaking the flow of nutrients to the grain.

Discounts for low-test weight sorghum

Grain sorghum with a test weight less than 45 pounds per bushel is normally considered unmarketable at elevators and feedlots. Grain with test weights between 45 and 55 pounds per bushel is marketable, although at a discount (Table 1). Few premiums are paid for grain grading better than U.S. No. 2, making test weight improvement above 55 pounds per bushel unnecessary.

Methods for improving low test weights

The test weight of freeze-damaged grain sorghum can be improved by removing the foreign material and broken kernels from the grain. Either adjusting the combine for better threshing and foreign matter removal, or cleaning the grain can accomplish this.

Research at Kansas State University tested these two methods on freeze-damaged grain sorghum. About two-thirds of the unmarketable samples, with a test weight of less than 45 pounds per bushel, were improved to marketable condition by better threshing and foreign material removal. Nearly all samples were improved to marketable condition by cleaning with scalper screens and an air aspirator.

In freeze-damaged sorghum, better combining and cleaning also will improve the visual quality of the grain. In contrast, sorghum that reaches maturity before the first killing freeze shows no appreciable increase in test weight or visual quality from better combining and cleaning.

Economics of cleaning and better combining

Better combining and/or postharvest cleaning will improve the test weight of freeze-damaged grain sorghum, but the amount of marketable grain will be reduced. Therefore, measures to improve test weight may or may not be economical. The profitability of improving test weight depends on the initial test weight and estimated yield of the sorghum (obtained from a test cutting), the market price of the grain, and the value of the clean-out material when the grain is cleaned. Freeze-damaged sorghum should be harvested whenever the value of the grain exceeds harvesting costs.

Guidelines presented in Table 2 discuss the economics of the various harvest management options for handling and marketing grain from freeze-damaged sorghum. They are based on costs that include an average custom harvest rate of $17.45 per acre.

Other alternatives

To avoid discounts at sale, the cost of cleaning, or the expense of better combine settings, freeze-damaged grain sorghum may be fed to livestock on-farm. Low-test-weight

Table 1. *Discounts for low-test-weight grain sorghum, reported by a survey of Kansas elevators. Discount rates vary at different elevators and in different years.*

Test Weight (lbs/bu)	Discount ($/cwt)
55 or greater	0.00
54-54.9	0.02
53-53.9	0.05
52-52.9	0.08
51-51.9	0.11
50-50.9	0.16
49-49.9*	0.19
48-48.9*	0.22
47-47.9*	0.25
46-46.9*	0.29
45-45.9*	0.34
Less than 45	not accepted

**Some elevators may reject grain with test weights less than 50 lbs/bu.*

grain sorghum can make good livestock feed as long as it is properly processed. Numerous trials in Kansas indicate that the feeding value of 40- to 60-pound grain sorghum is similar on a weight basis.

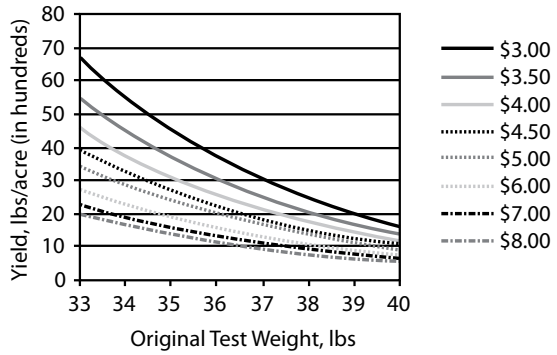
Other options for freeze-damaged grain sorghum include cutting for ensilage or grazing. For more information, see K-State Research and Extension *Nitrate and Prussic Acid Toxicity in Forage,* MF-1018.

For future crops, producers can reduce the risk of freeze damage by using shorter season sorghum hybrids. K-State's *Grain Sorghum Production Handbook*, C-687 provides guidelines on management practices that allow for optimum sorghum yields, even with shorter season hybrids. Producers must decide whether the occurrence of freeze in their area warrants the possible yield limitations associated with shorter season hybrids.

Table 2. *Harvest decision guide for low-test-weight grain sorghum.*

Test Weight (lbs/bu)	Market Factors	Recommended Actions
55 or more	No discount or premium.	No processing necessary.
45-54.9	Discounted, but marketable at most elevators.	Test weight improvement by better combining and cleaning is not economical.
40-44.9	Normally unmarketable.	Better combining can improve test weight to 45 lbs/bu or more. This is economical for some combinations of price and yield. See Table 3 for yields required to justify harvesting at several grain prices.
33-39.9	Normally unmarketable.	Better combining cannot improve the grain enough to make it marketable. Postharvest cleaning may recapture some production costs if test weights can be improved to more than 45 lbs/bu and if harvesting and cleaning costs can be recovered. Producers should use normal combine settings to minimize expenses. See Figure 1 for yields required to justify cleaning costs at several grain prices.
Less than 33	Unmarketable.	Harvesting for grain is not economical under any conditions. The grain can be fed to livestock on-farm, or the crop can be grazed or cut for silage.

Figure 1. *Yields from test cuttings required to justify cleaning costs of grain sorghum with test weights of 33-40 lbs/bu.**



**These guidelines are conservative because they assume the clean-out has no value. Finding a market for the clean-out would decrease the yield requirement necessary to break-even.*

Table 3. *Yields from test cuttings required to justify harvest using combine settings for better threshing and foreign matter removal.*

Price per cwt	Initial yield from test cutting (lbs/acre)
$3.00	750 – 870
$3.50	670 – 750
$4.00	600 – 670
$4.50	540 – 600
$5.00	480 – 540
$6.00	420 – 480
$7.00	370 – 420
$8.00	320 – 370

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