Selecting Quality Seed of Cereal Grains

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Farmers are particular about the variety of seed they grow. That means they understand the advantage of improved genetic potential. They should also be aware of the agronomic characteristics of the seed lot they select. After variety selection, the most emphasis must be put on obtaining and maintaining top quality planting seed. A seed contains a young, live plant (the germ) and a supply of food to start the young plant (the endosperm).

What To Look For In Quality Seed

Quality seed can be selected on the basis of both appearance and tests. Spreading out a representative sample in a single layer on a table top gives excellent opportunity to observe physical quality and condition of the seed. Testing, however, is the only reliable means of determining the ability of seed to germinate and the presence of disease, such as loose smut content of barley.

Quality seed should have the following characteristics:

Purity

Varietal purity usually cannot be determined by looking at the seed nor by a laboratory test. Using certified seed, having absolute knowledge of the source, reading the seed tag and relying on the credibility of the seller are the only ways to be sure of purity.

Seed should not be mixed with other classes or crops, especially those that mature at the same time and will be removed as dockage or be a market grade factor.

Weed seeds—no prohibited or restricted noxious weeds, low levels of other weed seeds.

Inert material—free of sticks, chaff, stones, parts of insects, dirt, cracked seed, etc. This material may not be injurious to the field or crop produced but adds to the seed cost and may interfere with uniform seeding.

Germination

Germinability of seed cannot be determined by visual inspection. Testing a good representative sample is the only way to be certain the seeds will grow. Minimum germination of good seed is:

Hard red spring wheat	90%
Durum wheat	85%
Hard red winter wheat	90%
Barley	90%
Oats	90%
Rye	80%
Flaxseed	85%

Other Factors

Test weight. High test weight per bushel indicates well matured seed.

Kernel plumpness. Large, well filled, plump kernels produce strong, fast growing, healthy seedlings that may tiller more. Such seedlings can withstand early growing season stress, produce more expansive root systems, compete more effectively with weeds and are better able to tolerate low levels of disease.

Color. Good seed color, normal for the crop, indicates freedom from disease and no weather or storage damage. This kind of injury may cause weak seedlings even though the germination is satisfactory. Starchy kernels (yellow belly) in wheat affects appearance but not seed germination.

Condition. Seed must not be high in moisture and must not be heated, musty, moldy or insect damaged. Germination may be affected considerably, even if mold damage is visible only as a dull grayish color or is noticeable as a slightly musty odor.

Diseases. Discolored, black, pink, grayish seeds, or shriveled, offcolor seeds, indicate disease and should be avoided. Barley seed should have a loose smut test because this disease is carried inside the kernel and is not visible.

Uniform size. Good seed should be large, plump and uniform in size to permit even seeding.

What To Avoid In Seed Selection

Many factors can cause kernel damage, making a lot of grain unsuitable for seed. Such damage should be looked for and avoided when choosing seed or grain that is to be conditioned and made into planting seed.

Weather damage: Can be simply a loss of color and a lowering of test weight. If the germination is satisfactory, plant weather damaged seed at a normal rate. With stress conditions during germination, seedling vigor may be reduced.

Spout damage: Varying degrees of sprouting are possible (Table 1). Slightly sprouted grain will resprout several times if it is dried to safe storage levels between each sprouting so molds do not develop. Moldfree seed will continue to resprout as long as the coleoptile (stem) is not broken off in threshing and handling, or until the food reserve in the kernel is exhausted. Each time the kernel resprouts, the seedling is weakened.

Table 1. Germination Percentage of Hard Red Spring Wheat With Different Degrees of Sprout Damage.

	Lot 1 %	Lot 2 %	Lot 3 %	Lot 4 %	Ave. %
A	96	91	98	92	94
B	54	67	80	73	68
C	11	16	18	52	24

A = Weather damaged but no sprout showing.
B = Sprouted, germ end split only.
C = Easily visible sprout damage.

The value of sprouted grain for seed should be based on both a germination test and general appearance. The practical approach is to use seed that has a minimum amount of visible sprout damage. When the sprout itself is alive, it is easily broken off in handling during cleaning and seeding operations, and the break provides an opening for molds to develop.

Frost damage: Lowers test weight and germination. Grain with visible although slight frost damage will be lower in germination and have reduced seedling emergence.

High moisture in storage: Wheat, rye, oats and barley that went into permanent storage with more than 13 percent moisture, or flax with over 9 percent, should not be used for seed. Damp stored grain is likely to develop molds and will heat and spoil when the first warm weather occurs in the spring. Never use moldy, heated or spoiled grain for seed. Even if the mold damage is not indicated except as a dull grayish color or as a slightly musty odor, the viability of the seed may be injured.

Heat dried grain: Grain mechanically dried at temperatures over 110 degrees is not suitable for seed. Such drying injures germination.

Spring harvested grain: Grain left unharvested over winter has little or no value as seed, especially if it entered the winter with high moisture.

Low test weight may result from any of several causes such as:

(a) Weathering, sprouting and frost as just discussed.

(b) Diseased kernels caused by head blights and scab result in shriveled, low test weight kernels. These kernels produce weak and diseased seedlings. Many such kernels can be removed by heavy cleaning if it is necessary to use such a lot for seed.

(c) Seed that is shriveled by drought, or by plant diseases such as rust or leaf diseases which cause the crop to ripen prematurely, may actually germinate well. While low test weight seed may germinate quite well, the size and vigor of young plants produced from such seed are considerably less than from good, plump seed (Table 2) and yield is reduced (Table 3).

Table 2. Average Plant Green Weight of 100 Wheat Seedlings From Shriveled and Plump Seed.

Test weight range	Weight of 100 plants (grams)[1]
(lb/bu)	
60–check	10.9
54–54.9	7.1
45–49.9	4.6
40–44.9	3.8

[1]Weights recorded about 14 days after emergence.

Table 3. Effect of seed test weight and planting depth on hard red winter wheat grain yield.[1]

	Seeding depth	
Test Weight	Normal	Deep*
	(Grain yield in bu/acre)	
58	59	46
62	61	52

* Deep planting was one inch deeper than normal.

[1]From, Robertson, L.D. 1984. Kansas State University.

Diseases. Diseased seed, even though plump and of good test weight, with dark brown, black, pink or grayish colored kernels, should be avoided even though these are surface borne and may be helped considerably by seed treatment.

Shriveled grayish or pink kernels may carry disease inside and should be removed in cleaning.

Loose smut is within the germ of the kernel. A laboratory embryo test is needed to determine the percentage of loose smut infected barley kernels on all loose smut susceptible varieties. Yields are decreased in nearly direct proportion to the loose smut percentage. Seed with 5 percent loose smut will have 5 percent less yield than noninfected seed. Such a test is not available for wheat. Seed with over 2 percent loose smut is of questionable economic value for seed unless treated with an approved seed treatment.

Small kernel size within variety: Small kernels may germinate very well, but the seedlings will be smaller and weaker. Emergence is less, seedlings make slower early growth, tiller less, have less vigor and individual plants yield less from small seed than from plump seed (Table 4). Such seedlings are less able to compete with early weed competition, seedling diseases and other early growing season stress.

Table 4. Effect of Seed Size on Seedling Emergence and Grain Yield of Barley and Hard Red Spring Wheat.[1]

	Stand		Grain yield	
Seed Size	**Barley**	**Wheat**	**Barley**	**Wheat**
	(Plants/ft^2)		(bu/acres)	
Small	26	35	82	44
Medium	25	36	85	45
Large	28	39	87	48

[1]Spilde, L.A., 1989. NDSU.

Small kernels of good germination and quality sown at a normal rate (pounds or measure) usually produce more plants per acre than large seed. This greater number of plants per acre may offset, to a considerable extent, the yield advantage of larger plants in a normal or better than normal growing season. Table 5 shows the percentage difference with the advantage of large plump seed being greater in years of low average yields than in years of high yield.

Table 5. Effect of Seed Classification on Yield of Hard Red Spring Wheat at Fargo, N.D.

	Year			
Component	**1936**		**1938**	
	(bu/A)		(bu/A)	
Light	14.4	100%	43.4	100%
Heavy	16.0	111%	45.3	104%

Old seed: Small grain and flaxseed in good storage at safe moisture levels will hold its germination for two or three years. After that, germination will drop slowly on wheat, barley and oats and will drop rapidly on flax and rye seed.

Low germination: All seed should be tested for germination. A good representative sample is needed for an accurate test. Only good, healthy, normal sprouts should be counted as live seed.

Some crops exhibit postharvest dormancy. Usually this dormancy breaks during the winter storage period. On recently harvested seed, a reputable seed testing laboratory will prechill to break dormancy prior to the germination test.

Dead seed can result from frost damage, sprouting or other weather damage, high moisture during storage, or diseases. Molds or fungi, even when invisible, may damage germination of grain stored at higher than recommended moisture levels.

Weak Seed Produces Weak Seedlings

Regardless of the cause, weak seeds produce weak seedlings and should not be used except in extreme shortage of good seed. Weak seedlings cannot withstand adverse spring growing conditions nearly as well as strong vigorous seedlings; this can have a considerable impact on final crop yield (Table 6).

Table 6. Effort of Seed Vigor on Hard Red Spring Wheat Yield.[1]

Vigor Rating*	Grain Yield
	(bu/acre)
Low	84
Medium	87
High	90

*Rating based on standard germination test and seed respiration rate tests.
[1]Ram, C. 1983. Montana State University.

Low vigor seed, small seed, or plump vigorous seed sown in a field on the same day may emerge at about the same time, although the emergence from plump seed will be more even and vigorous. Soil crusting, deep sowing and seedling diseases are more likely to cause poor stands from weak seed than plump vigorous seed.

Unfavorable spring growing conditions following emergence are likely to affect seedlings from low quality seed more than those from high quality seed. Drought sufficient to cause wilting will result in many weak seedlings dying while vigorous seedlings survive. Weak seedlings can result in thin stand and plants which grow slower, tiller less, are more easily attacked by diseases and less able to compete with weeds. Results from using low quality seed will depend on temperature, soil moisture conditions and disease following germination.

Weak seedlings will not recover as well as strong seedlings from spring frost heavy enough to freeze back top growth. Freezing temperatures after early sown crops (wheat or barley) have emerged are quite common. Growing conditions before or immediately after a low temperature greatly influence the extent of freezing injury. If the temperature drop is gradual, small grain plants are in better condition to resist injury and can stand low temperatures. Slowly rising temperatures after a frost and satisfactory soil moisture conditions aid recovery. Drought, wind and high evaporation are likely to aggravate frost injury and lessen the chances of recovery. Plants from low quality seed are less able to recover from serious seedling injury, probably because they do not have as much reserve food material in the planted seed piece.

Seeding Depth

A good, firm seedbed is essential so the seed will always be in close contact with moist soil. A firm seedbed protects against drought and helps to prevent sowing too deep. Seed planted too deep results in poor and slower emergence and requires higher seeding rates to obtain a full stand. Plant as deep as necessary to obtain good seed to soil contact. Semi dwarf spring wheat should be planted no deeper than 2 inches and tall wheat no deeper than 3 inches. Ideal planting depth for wheat is 1.5 to 2 inches.

Seeding Rates

Spring sown small grains of good seed quality usually are seeded 12 to 20 seeds per foot of row. This results in a final stand of 8 to 16 mature plants per foot of row. Normally, crops sown early tiller more then late sown crops. Less productive land tillers less and the seeding rate should be increased. If seed is not top quality, the rate also must be increased. When growing conditions are adverse and the crop retains fewer tillers, then yield must be obtained from main stem heads.

Cleaning or Buying Seed

Planting large, plump, good test weight, disease free high quality seed never results in a lower yield. In seasons less favorable for establishing good stands, high quality seed can be the difference between a good crop yield and a poor yield.

When purchasing seed buy the best. Check it for the many qualities that good seed should have. When cleaning your own seed or having it custom cleaned, be sure a good cleaning and sizing job is done. This normally requires shrinking the lot anywhere from 20 to 50 percent or more after dockage is removed. This cleanout has commercial value but contains small and broken seeds, some weed seeds and other material undesirable for seeding purposes. Save only the large, plump, healthy seeds for sowing. GOOD SEED DOESN'T COST, IT PAYS!

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