



GRAIN PROCESSING EQUIPMENT: FROM FIELD TO BIN

Many people who are interested in growing grains wonder what type of equipment they'll need to get started. One step of growing grains is understanding and attaining the equipment used for threshing and cleaning. Combines reap and thresh simultaneously, so that the harvested grain is collected and separated, fanned or winnowed to remove chaff, and fed into a compartment of the combine. However, it is possible to harvest small-scale grains by hand and then use a stationary thresher to separate the seeds from the stem before cleaning.

For most small-scale growers, processing equipment does not necessarily need to have a large capacity. As Tom Stearns, president of High Mowing Organic Seeds in Wolcott, VT points out, most growers will only use this equipment for a few hours or days in a year, so investing in large-capacity equipment might not make sense. Smaller equipment is sometimes less expensive and easier to maintain, and the smaller initial investment can allow growers to spend more resources on getting the accessories and maintenance that they'll need. In many cases, equipment can be found used at auctions or through dealers, built with relatively inexpensive materials, or improvised. Here we will describe some of the basic processes and types of equipment associated with getting your grains from the combine to the bin, using examples from High Mowing Organic Seeds.

THRESHERS

Threshers essentially separate the seed head from the stem of the grain. If harvesting without a combine, your threshing equipment may be an individual piece of machinery, like High Mowing's stationary thresher, pictured at right. Another example of a threshing machine is John Howe's simple design (below), which winnows chaff while it removes beans or grains from the plant.



Stationary thresher used to clean grain in the field.



Any process that removes the edible grain from the plant can be considered threshing. Many crops (such as wheat, rye, and grain legumes) will leave the combine or thresher ready for immediate drying and cleaning, but others (such as oats, spelt, barley, and buckwheat) have hulls that need to be removed before further processing, especially if they'll be used for human consumption. De-hullers can be homemade or sometimes found used at auctions or through equipment dealers.

A thresher/winnower for dry beans and small grains, built by John Howe of Waterford, Maine.

SEED CLEANERS

To clean seed once it has been harvested, threshed, and roughly winnowed, there are three main types of seed cleaning equipment used: fanning mills, spiral cleaners, and gravity tables. Cleaners like this may be purchased used from companies like Idaho-Oregon Mill Supply or Commodity Traders International, and because the cleaning process is stationary, growers could combine resources and share equipment. The grain must be cleaned or sorted based on five main characteristics: size, shape, weight, density, and color. The cleaning process should remove from the final product any foreign materials like stems, insects, or stones, as well as any weed or other crop seed and grains that are of poor quality.

Fanning Mills



Clipper Eclipse 324, with screens at right.

These machines clean the crop primarily based on size, shape, and weight. A batch of grain is fed into the machine, and a series of screens that shake back and forth separate the sample. With three screens that have mesh of varying sizes, the first screen scalps off any large materials, such as stems or foreign plant material. The second screen has smaller apertures, sifting out anything smaller than the desired grain seed. The third and final stage of the process involves forced air, which removes any material that is of the same size as the grain but is of a lighter weight. The model shown at left costs about \$5000 new, and can process up to 2,000 lb. of seed per hour. This is much larger

than the equipment most small-scale growers need. Small rubber balls under the first screen bounce as the machine shakes, which discourages the screens from clogging with seed during the scalping process. Operators can adjust the speed of the incoming seed and the amount of air used in the fanning process. Each of the component screens costs about \$120-150, but lasts almost indefinitely, if used under normal conditions.

Smaller fanning mills are available, which use the same mechanisms of gyration and forced air to separate large foreign plant materials, weed seeds, and lightweight grain from the final product. The small model shown at right costs roughly \$1500 new, and can process very small batches of grain or be used to determine the screen sizes needed for larger batches.

Many growers use fanning mills as the first step in cleaning their grains, as they efficiently separate foreign objects and grain that is diseased, broken, or otherwise oddly-shaped. Used fanning mills in between the two sizes shown can often be found at auctions for \$50-500.



High Mowing's Clipper "Office Tester."

Spiral Cleaners

Spiral cleaners have no moving parts but separate seed of different shapes very efficiently as the seeds trickle down the assembly. A large, finned central structure allows round seed to travel down the metal fins very quickly. Centrifugal force moves the round seed off the fins of the central cylinder and towards the cleaner's rubber outside walls. This seed is collected and fed into a container on the side of the cleaner. Any seed that is not as round will travel down the chutes more slowly, and is eventually collected at the bottom of the cleaner. This process works very well for seed that is of similar size but slightly different shape, and can be used either to remove undesirable round seed (like vetch) or to collect and save desirable round seed (like canola). The model at right costs about \$5,000 new, but many auctions or used equipment dealers will have comparable cleaners for as little as \$1,000.



Amos single spiral cleaner.

Gravity Tables



High Mowing's Oliver 30 gravity table.

Gravity tables employ vibration and forced air to sort grains according to density. The angle of the deck, which is made of fine mesh, can be adjusted, as can the air pressure, vibration, and flow rate of incoming seed. Before grain reaches the gravity table, it should be sorted by size and shape, so that the batch of grain will form a ½" thick layer of similar seed. The denser seed settles to the bottom of the layer while less dense seed stratifies to the top and then slides "downhill" on the slippery seed surface, moving the plumpest, densest kernels to the "uphill" side of the table. Baffles on the surface of the deck prevent seed from moving across the table too quickly. The paddles at the front of the table can be adjusted to divert grain of different densities into separate containers. A gravity table like the one pictured at left is an expensive piece of equipment (about \$18,000-20,000) but can be very helpful in separating grain of different quality. Often a less expensive, used gravity table can be found to do the job.

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