

# Revegetation Equipment Catalog

Descriptions, applications, pictures, and sources for equipment used on rangelands.

## Seed Cleaning

Successful revegetation projects rely on the use of high quality seed. Seed from harvesting machines or hand collections will include a mix of stems, leaves, chaff, appendages, empty glumes, and seeds of various sizes and quality. The extraneous materials must be removed to insure a quality product and to allow uniform dispensing through seeding equipment. This chapter deals primarily with machinery used by USDA NRCS Plant Material Centers (PMC) and researchers. Manufacturers have developed numerous seed cleaning devices for small lots as well as very large lots. With experience and some ingenuity, operators can adjust the cleaning machinery to produce a quality seed product with high purity levels. Pre-cleaning is the rapid removal of excessive, extraneous materials by scalpers, hammermills, or debearders prior to basic cleaning with air-screen separators. The air-screen separator, properly adjusted, can supply a finished product for many grasses, forbs, and shrubs. However, finishing machines are also available to separate seed by density, length, width, thickness, and shape. These include specific gravity separators, pneumatic separators, velvet rolls, spiral and indent cylinders, indent disks, magnetic separators, electrostatic separators, vibrator separators, stoners, fresh fruit separators, and others. Moisture content may be high in freshly harvested seed and drying may be required prior to cleaning. Processed seed should remain viable for several years if stored in a clean facility where temperature and humidity are kept low.

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## Scalpers



### *Description & Application*

Scalpers are used to remove large trash, stems, leaves, and associated chaff prior to basic cleaning. There are numerous types, but they basically use the same style of cleaning. Raw material is metered onto a flat screen that is set at a slight incline and vibrated mechanically. Trash is removed as the seed fall through the holes in the screen and onto a second screen. This screen traps the seeds and moves them to a hopper as smaller trash falls through the holes and is sweep away by an air current. Another style uses a round drum made from a perforated metal screen set at a slight incline. As the drum rotates, seed fall through the screen and trash remaining in the drum is removed.

### *Sources*

Since many of the seed processing companies manufacture a full line of equipment, a single list was developed for the machines described in this section.

The Sources can be found in the [Gravity Separators](#) section.

## Hammermills



### *Description & Application*

Hammermills are aggressive pre-cleaners designed to remove appendages. They use "hammers" attached to a horizontal shaft that rotates inside a compartment with an interchangeable, perforated, outlet screen. Appendages, awns, and other chaff are removed as the hammers vigorously scrape the seed over and through the screen. Holes in the screen must be large enough to allow the seed to pass through without damage, but small enough to remove appendages. Screen with openings of various sizes and shapes are available. The shaft speed should be adjustable. Units are equipped with baggers for the processed seed.

### *Sources*

Since many of the seed processing companies manufacture a full line of equipment, a single list was developed for the machines described in this section.

The Sources can be found in the [Gravity Separators](#) section.

## Debearders



### *Description & Application*

After excessive trash has been removed by scalping, debearders are used to remove awns or beards and other appendages from seed that are difficult to clean with air-screen separators. Debearders use a beater that rotates inside a steel cylinder. The beater uses projecting posts that are positioned to move the seed mass through the cylinder. Stationary posts on the steel cylinder prevent the seed mass from rotating with the horizontal shaft and provide vigorous rubbing action between the moving and stationary posts, other seed, and appendages. A weighted discharge gate controls the amount of time the seed mass remains in the unit. A debearder is a very versatile machine that has been used successfully on many types of seed. Its cleaning action is less aggressive than that of a hammermill.

### *Sources*

Since many of the seed processing companies manufacture a full line of equipment, a single list was developed for the machines described in this section.

The Sources can be found in the [Gravity Separators](#) section.

## Dybvig Separator



### *Description & Application*

A Dybvig separator or macerator is similar to a large blender, and it is used to clean seed of both fleshy and dry fruit. It consists of a variable-speed spinning plate at the bottom of the seed hopper. The adjustable, flanged plate is set to leave an opening slightly smaller than the seed to be cleaned. As the plate spins, flesh is removed as fruits rub against each other, the flange, and the wall of the hopper. A stream of water washes the flesh from the hopper, leaving the clean seed. When working with small lots or very small seed, a home blender can be used as a macerator. The blender blades must be covered with rubber tubing or replaced with rubber blades to prevent damage to the seed.

### *Sources*

Since many of the seed processing companies manufacture a full line of equipment, a single list was developed for the machines described in this section.

The Sources can be found in the [Gravity Separators](#) section.

## Air-screen Separators



### *Description & Application*

The primary method of seed cleaning is the air-screen separator. It uses a combination of air, gravity, and screens to separate seed based on size, shape, and density. These widely-use units come in a variety of models with two to eight vibrating screens. In all cases, the cleaning principles are the same. The seed mass drops onto the top screen which scalps and removes large trash and impurities. Seed and smaller trash pass through to the next screen which retains the seed and allows the trash to pass through. Multiple screens provide seed size and density separation. Air streams remove the trash and impurities and the seed moves to bagging or collection units. Numerous types and sizes of screen are available. The rate of feed, airflow, oscillation of the screens, and screen pitch are adjustable. With experience, an operator can set all the variables and achieve excellent results.

### *Sources*

Since many of the seed processing companies manufacture a full line of equipment, a single list was developed for the machines described in this section.

The Sources can be found in the [Gravity Separators](#) section.

## Gravity Separators



### *Description & Application*

Gravity separators are used to classify materials according to density or specific gravity. This is important when seed and/or impurities are similar in size but different in density. The separator uses a vibrating perforated deck that can be tilted in two directions at various pitches. Air moving through the perforated deck separates the seed and any impurities by weight as the deck oscillates. As the materials are classified, they move into appropriate slots or containers. Scalping or other pre-treatments are helpful in removing excessive impurities before gravity separation. Seed of the same species can be separated into various size-weight classes, and many species can be cleaned to 98 or better percent purity with a gravity separator. They are also effective at removing stones.

### *Additional Information*

St. John L. 2005. Information on seed processing equipment at the Aberdeen Plant Material Center is available on a CD. The address is in the Sources section.

Desai, B.B.; Kotecha, P.M.; Salunkhe, D.K. 1997. Seeds handbook: Biology, production, processing, and storage. New York, NY: Marcel Dekker, Inc.

Harmond, J.E.; Brandenburg, N.R.; Klein, L.M. 1968. Mechanical seed cleaning and handling. USDA Agricultural Handbook No. 354. Washington, DC: U.S. Department of Agriculture, Forest Service.

Jorgensen, K.R.; Stevens, R. 2004. Seed collection, cleaning, and storage, Chapter 24. In: Monsen, S.B.; Stevens, R.; Shaw, N., comps. Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-3. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service.

Vaughan, C.E.; Gregg, B.R.; Delouche, J.C. 1968. Seed processing and handling. State College, MI: Mississippi State University, Seed Technology Laboratory.

Young, J.A.; Young, C.G. 1986. Collecting, processing, and germinating seeds of wildland plants. 3rd ed. Portland, OR: Timber Press.

### *Sources*

The manufacturers' websites list information on equipment sizes, accessories, dealers, and their contact information.

[A.T. Ferrell Company, Inc. \(Clipper\)](#)

Bluffton, IN 46714

[Bouldin & Lawson, LLC \(Dybvig separator\)](#)

McMinnville, TN 37111-7177

[Carter Day International, Inc.](#)

Minneapolis, MN 55432

[Crippen Manufacturing Company](#)

St. Louis, MI 48880

[Dybvig Seed Cleaner](#)

Astoria, OR 97103

[Forsbergs, Inc.](#)

Thief River Falls, MN 56701

[Huntsman, Inc.](#)

Twin Falls, ID 83301

888-812-3377

[Seedburo Equipment Co.](#)

Chicago, IL 60607

[USDA NRCS Aberdeen Plant Materials Center](#)

Aberdeen, ID 83210

[USDA Forest Service National Seed Laboratory](#)

Dry Branch, GA 31020

[Westrup, Inc.](#)

Plano, TX 75054

## Air Impinging Devices



### *Description & Application*

Air impinging devices encompass a group of seed cleaners that use very high-speed air to strip appendages from the seed kernel (caryopsis or grain). These devices were developed by Aaron Beisel and the late Chet Dewald in Woodward, Oklahoma. Between the two men there are six U.S. Patents. First was the Woodward Laboratory Air-Seed Shucker. The unit recycled seed material through a venturi until the impelling air blast and the acceleration force strips the subtending appendages free from the grain. The dense clean grain drops from the recycling system. An air compressor powers the system, and sample size is about 10 grams. To obtain percentage grain, use the grain mass extracted divided by the total mass of the material sampled and multiply by 100. The shucker is very quick and effective at determining cleaning quality at any phase in the seed cleaning process.

Second was the Woodward Chaffy Seed Conditioning System. Unprocessed seed is metered from a variable-speed, rotating basket onto a high-intensity, oscillating scalper to remove stems, leaves, and light debris. Rotation of the wire basket loosens the entangled unprocessed seed, provides rough cleaning, and controls the flow of material to the scalper and the aerodynamic conditioning system. Following scalping, the aerodynamic conditioning system uses an air blast and resulting acceleration force caused by a venturi to detach a selected amount of the subtending appendages from the grain. The amount of detachment can be controlled by the amount of air blast and acceleration force. A cross-air-flow device removes trash and sends the air-entrained seed to a momentum discriminator that separates seed according to density. The system has effectively processed bluestem species (*Bothriochloa spp.*) and similar chaffy seed.

Third was the Woodward Chaffy Seed Conditioner 2000. This unit was developed to clean Texas bluegrass (*Poa arachnifera* Torr.) seed, an extremely fuzzy seed that clings together to form cotton-like rolls or balls. The conditioner 2000 is a single unit with three phases: uniform metering, preconditioning, and quality classification of chaffy seeds. Two, variable-speed, horizontal feed augers supply seed to a variable-speed, seed-delivery auger. The rubbing action between the seed masses and the augers separates the seed masses into smaller portions that are then fed into a preconditioning chamber. In the chamber, rotating paddles force seed through a scalping screen. Compressed air aids movement of the seed to the classification unit and assists in expelling debris from the chamber. The classifier sends the air-entrained seed through a venturi for further cleaning. A change in the direction of the air stream carries extraneous material from the system and classifies the seed by propelling the heavier seed further in the momentum discrimination collector.

### *Additional information*

Dewald, C.L.; Beisel, V.A.; Sims, P.L. 1987. Concepts and principles of the Woodward chaffy seed conditioning system. In: Frasier, G.W.; Evans, R.A., eds. Seed and seedbed ecology of rangeland plants. Washington, DC: U.S. Department of Agriculture: 278-282.

Dewald, C.L.; Springer, T.L.; Beisel, V.A. 2003. The Woodward chaffy seed conditioner 2000. Applied Engineering in Agriculture. 19(2): 219-223.

### *Sources*

The manufacturers' websites list information on equipment sizes, accessories, dealers, and their contact information.

[Aaron's Engineering](#)

Fargo, OK 73840

[Ag-Renewal, Inc.](#)

Weatherford, OK 73096