

# Revegetation Equipment Catalog

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

## Controlling Plants Chemically

Chemicals are often used for control of invasive weeds and brush that hamper revegetation efforts on rangelands. Agricultural herbicides undergo extensive toxicological, environmental, plant efficacy, and cost-benefit tests before being released for widespread use. This database of knowledge enables the applicator to select herbicides to fit the targeted weeds and brush for maximum efficacy, efficiency, safety, and economics. The major change in application practice has been a shift from broad-scale aerial applications to individual plant treatments with ground equipment. In either case, the application equipment has been designed for more precision and safer use. Global positioning systems (GPS) and geographic information systems (GIS) on aircraft or ground units allow the operator to "sculpt" the landscape for multiple land-uses, e.g. wildlife habitat, grazing, water harvesting, and aesthetics. Herbicides will continue to play a significant role both singly and in combination with fire and mechanical treatments in revegetation projects. Persons applying restricted-use pesticides must have state certified Applicator's License and follow specifications on the chemical's Product Label. It is important to note that the Directions for Use section of all pesticide product labels begin with the statement: "It is a violation of Federal law to use this product in a manner inconsistent with its labeling."

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## Aircraft Sprayers

### Fixed-Wing

Fixed-wing aircraft with spray booms mounted below the lower wing have been used effectively to apply herbicidal sprays over extensive areas to control brush and weeds since the 1950s.



### *Description*

Today's spray planes are designed specifically for aerial application of liquid and dry materials and meet strict safety requirements. They use radial-piston or turbine engines with a range in horsepower from 600 to 1300. Current spray tank capacities vary from 400 to 800 gallons while older aircraft had spray tank capacities of 300 gallons or less. Airspeed can vary from 100 to 160 mph but is about 120 mph for brush and weed spraying. Spray boom length should not be more than three-fourths the length of the wingspan because the turbulent wingtip vortices cause drift. Spray pumps must have positive shut-off valves and nozzles must have check-valves to prevent continuous spraying or leakage over off-target areas. Hydraulic spray nozzles are the predominate type used on aircraft and many styles and sizes are available. GPS/GIS systems are helpful for precision applications.

### *Application*

Spraying equipment and techniques are designed to minimize drift while applying spray droplets of efficacious size to the plant canopy. Aerial sprays are normally applied when wind speed is between 2 and 10 mph and air temperatures are not above 90 °F. Spraying should not be conducted in no-wind conditions because of inversions (warm air over cold air) or potential shifts in wind direction. Federal (EPA) and state regulatory agencies have strict regulations for aerial spraying, and applications must follow the specifications on the chemical's Product Label. Fixed-wing aircraft are cost effective because they can spray large areas quickly and effectively. They have larger payload capacities and greater airspeeds than helicopters. Airstrips are required for landing, servicing, and takeoff. Excessive ferrying distances are wasteful and costly. GPS/GIS units negate the use of flagmen and can record flight patterns. Fixed-wing planes are not suited for spraying highly irregular shaped sites or mountainous areas.

### *Sources*

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

[Air Tractor, Inc.](#)  
Olney, TX 76374

[Thrush Aircraft](#)  
Albany, GA 31706-3149

[Weatherly Aircraft Company](#)  
Bogalusa, LA 70427

## Helicopters

Helicopters with boom sprayers are well suited for use in mountainous areas, steep terrain, sites with highly irregular shapes and remote areas.



### *Description*

They are highly maneuverable and apply sprays at much slower speeds than fixed-wing aircraft. Airspeed can vary from 30 to 80 mph, but is about 45 mph for brush and weed spraying. To maintain precision application rates, aircraft should be equipped with variable-rate, flow-control units to compensate for changes in airspeed. GPS/GIS systems are helpful for precision applications. Spray tanks vary in size from 90 to 230 gallons, and the spray boom should not exceed 90% of the rotor diameter. Many types and sizes of [nozzles](#) are available.

### *Application*

The conditions and regulations outlined in the fixed-wing aircraft section also apply to helicopters. Applications must follow the chemical's Product Label, and the applicator must be certified by the state. Batch trucks that carry clean water and chemical mixing tanks for helicopters usually have landing pads atop the truck for convenience and safety in servicing. Ground personnel must always be alert to the helicopter's moving rotors during servicing. Helicopters are more expensive to operate than fixed-wing aircraft, but they have the advantage of operating where fixed-wing aircraft cannot. Helicopters do not need landing strips and are adapted to remote rugged terrain and irregularly shaped sites. GPS/GIS units negate the need for flagmen in these remote sites and can record flight patterns.

### *Sources*

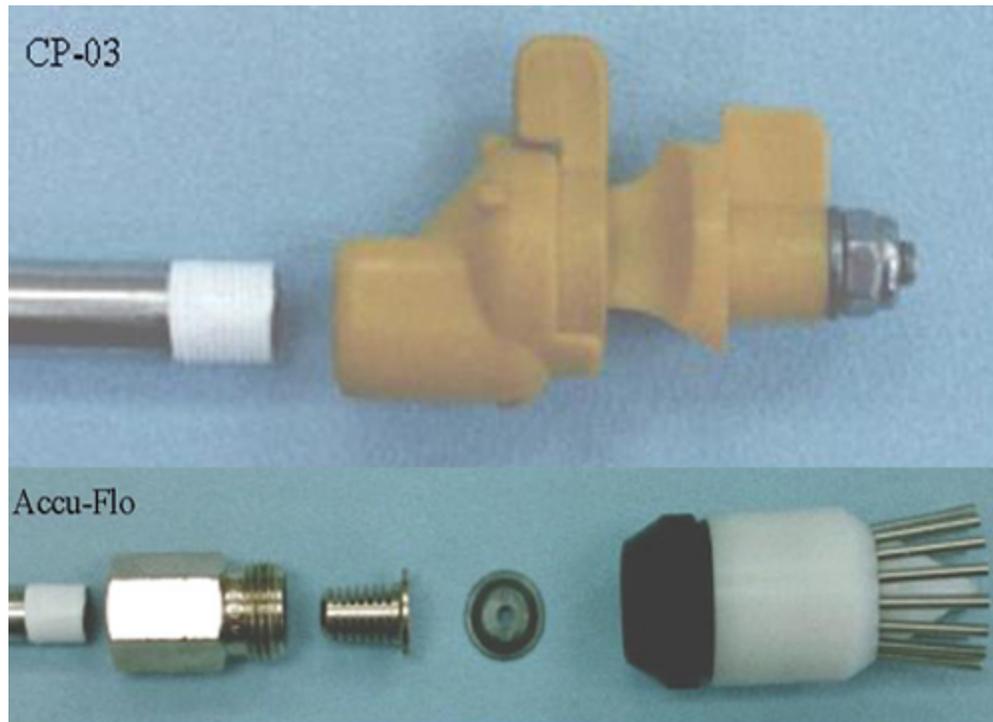
The manufacturers' websites list information on equipment sizes, accessories, dealers, and contact information.

[Bell Helicopter Textron Inc.](#)  
Fort Worth, TX 76101

Hiller Aircraft  
Marina, CA 93933-5101  
831-384-4500

[North Star Helicopters, Inc. \(Application, Mfg.\)](#)  
Jasper, TX 76951

## Booms and Nozzles



### *Description*

Spray pattern tests should be conducted to determine the optimum location of nozzles along the boom and the spray droplet size categories following initial setup. Spray boom shape should be airfoil or streamline to reduce turbulence around the nozzles. Catalogs from nozzle manufacturers list types and sizes for aircraft. A check valve is necessary on each nozzle to prevent leakage. Spray nozzles type, size and orientation, operating pressure, and wind shear (aircraft speed) all influence spray droplet size. Small droplet sizes are prone to drift from the application site, so the largest droplet size possible that will maintain the desired efficacy on the targeted plant should be used. Pressure at the spray nozzle should be between 20 and 60 psi. Research has shown that low spray pressures and high aircraft speed can increase the percentage of spray droplets that have a propensity to drift. All nozzles produce a range in droplet size particles and manufacturers usually rate their nozzles with a volume median diameter droplet size (DV0.5). The percentage of spray droplets less than 100  $\mu\text{m}$  (DV0.1) is an indication of potential drift. Considerable research has been conducted to determine droplet sizes under actual airspeed conditions. ASAE Standards and predictive models are available.

### *Additional Information*

ASAE Standards 2003, 50th ed. 2003. ASAE S572 AUG99. Spray nozzle classification by droplet spectra. ASAE, 2950 Niles Rd., St. Joseph, MI 49085-9659.

Kirk, I.W. 2001. Droplet spectra classification for fixed-wing aircraft spray nozzles. Paper 01-1082. ASAE, 2950 Niles Rd., St. Joseph, MI 49085-9659. (Metric units available upon request)

Kirk, I.W. 2000. Spray quality for helicopters spray nozzles. Paper AA00-006. ASAE, 2950 Niles Rd., St. Joseph, MI 49085-9659. (Metric units available upon request)

### *Sources*

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

[Bishop Equipment Mfg., Inc. \(Accu-Flo nozzles\)](#)  
Hatfield, PA 19440

[Delavan, Inc. \(Nozzles\)](#)  
Bamberg, SC 29003

[Dultmeier Sales \(CP Products, nozzles\)](#)  
Tempe, AZ 85281

[Hypro Corporation \(Nozzle\)](#)  
New Brighton, MN 55112

[Spraying Systems Co. \(Nozzles\)](#)  
Wheaton, IL 60189-7900

[Simplex Manufacturing \(Helicopter accessories\)](#)  
Portland, OR 97230

[Transland, Inc. \(Fixed-wing accessories\)](#)  
Wichita Falls, TX 76302

## Dry-Material Spreaders



### *Description*

Venturi-type and rotary-slinger spreaders are used to distribute dry formulations of herbicides, fertilizers, and seed. Fixed-wing aircraft use venturi spreaders while helicopters use rotary spreaders. Venturi spreaders clamp to the gate box at the base of the hopper. Gate boxes are 25-, 38-, or 41-inches wide. Agitators and positive metering systems are available. Rotor spreaders are self-contained units that hang below the helicopter. A recent approach for helicopters is to use saddle tanks with an auger and forced-air boom. Addition information is covered in the chapter on [Aerial Seeding](#).

### *Application*

Vanes in the spreader can be adjusted to control the swath pattern, and the pattern should be tested for even distribution of materials upon initial spreader installation. Agitators are available to assist the flow of material from the hopper. Positive metering systems are valuable for metering pelleted herbicides or hard slick grass seed in fixed-wing aircraft. Chaffy grass seed can be especially difficult to meter and operator "know-how" is valuable.

### *Sources*

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

[Northstar Aerospace \(Mfg. applications\)](#)

Phoenix, AZ 85034

[Simplex Manufacturing \(Helicopter accessories\)](#)

Portland, OR 97230

[Transland, Inc. \(Fixed-wing accessories\)](#)

Wichita Falls, TX 76302

## Ground Sprayers

### ATV Sprayers



#### *Description*

All-terrain vehicles (ATV) equipped with spray tanks, electric pumps, and hand-held spray guns are well suited to the selective application of herbicidal leaf or stem sprays to noxious plants on rangeland. Units with 10- to 25-gallon spray tanks; a chemical resistant, 12-volt, 1.4-gallon/minute diaphragm pump; and a polypropylene hand gun with a ConeJet 5500 X-8 adjustable cone nozzle (Spraying Systems Company) for leaf spray or ConeJet 5500 X-1 for stem spray are available from spray equipment manufacturers or suppliers. These units are effective for treating individual shrubs, and can be rigged with hoses for three spray guns so that the ATV driver and a ground crew of two can treat a 40-foot swath. Booms or boomless nozzles can be attached to ATVs for weed spraying. ATVs are typically 4-wheel units but larger units with 6 and 8 wheels can carry larger spray tanks and accessories, see chapter on [All-Terrain Vehicles](#).

#### *Additional Information*

McGinty, A.; Ueckert, D. 2001. The Brush Busters success story. *Rangelands*. 23(6): 3-8.

Wallace, J. 1996. Rig your four-wheeler for spraying brush. *The Cattleman*. 82(11): 34.

## Booms and Boomless Sprayers



### *Description*

Boom sprayers mounted on ATVs, pickups, tractors, trailers, or self-propelled vehicles are useful on relatively smooth, unobstructed rangeland. Booms can vary from simple shop-built units to manufactured units that are self-leveling, compensate for vibration, and fold for transport. Sprayers consist of a tank, pump, pressure gauge and relief valve, nozzles evenly spaced along a boom, and hoses. Tanks that hold the liquid spray solution are plastic, fiberglass, or stainless steel. Pumps are gear, piston, diaphragm, or centrifugal type. Pumps are powered by a tractor power-take-off, hydraulic or electric motor, or a small gasoline engine. Nozzles are available that distribute the spray solution in a variety of patterns, e.g. flat-fan, solid-cone, or hollow-cone shapes. Numerous types of controllers including GPS units are available to enhance the precision of spray applications. Some boomless sprayers use a nozzle body with a cluster of nozzles to distribute the spray solution over a 15- to 30-foot-wide swath. The FieldJet KLC-5 or KLC-9 nozzle (Spraying Systems Company) is a single, small nozzle that distributes the spray over a 15- to 18-foot-wide swath. Another style of boomless sprayer is a mist blower. It uses a blast of air around several nozzles to carry the spray over the target area.

### *Application*

Boom sprayers are useful for treating weeds or small shrubs (less than 4-feet tall) where obstructions do not restrict the boom. Boomless sprayers are used where booms are impractical. Boomless sprayers generally must be used when winds are relatively calm. Catalogs are available from the nozzle manufacturers that list nozzle type, sizes, spray pattern, nozzle spacing and height placement, and output in gallons/minute at various pressures. Many nozzles are color coded to prevent the use of an improper nozzle size. Spray output and speed determines application rate (gallons/acre [gpa]) which is usually 10 to 20 gpa for ground spraying. Production rates (acres/hour) vary widely depending on the

width of the boom and speed of the sprayer. Ground spraying gives uniform coverage with minimal drift. However, caution should always be observed for potential drift from the target area. Mist blowers have very strict regulation for herbicide applications; they are used more for orchard spraying. Rangeland ground spraying is practical on sites of less than 200 acres or where aerial applications are not available or feasible. State pesticide applicator licenses are required if restricted-use herbicides are used. All applications should follow the chemical's Product Label.

A recent innovation is spraying herbicide on the blade of a shredder for a stem application at the time of cutting. Additional information is in the [Mechanical Control](#) chapter under the shredder topic.

### *Sources*

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

[Ag-Chem Division \(Self-propelled floaters\)](#)

Jackson, MN 56143

[Bishop Equipment Mfg., Inc. \(Accu-flo nozzles\)](#)

Hatfield, PA 19440

[Bowman Manufacturing Co., Inc. \(Sprayers\)](#)

Newport, AR 72112

[Buffalo Turbine \(Mist blowers\)](#)

Gowanda, NY 14070

[Delavan, Inc. \(Nozzles\)](#)

Bamberg, SC 29003

[Great Plains Manufacturing, Inc. \(Sprayers\)](#)

Salina, KS 67402

[Hypro Corporation \(Nozzles\)](#)

New Brighton, MN 55112

[NTech Industries, Inc. \(Optical sensing sprayers\)](#)

Ukiah, CA 95482

[Spraying Systems Co. \(Nozzles\)](#)

Wheaton, IL 60189

[Stahly \(Self-propelled sprayers\)](#)

Bloomington, IL 61702

[The CP Products Co., Inc. \(Nozzles\)](#)

Wichita Falls, Texas 76302

[Wylie Sprayers, Inc. \(Sprayers, nozzles\)](#)

Petersburg, TX 79250

## Miscellaneous Sprayers

Protection of the operator and critical tractor parts are vital to the successful use of tractors in the brush control phase of revegetation.



### *Description*

Hand-operated and backpack sprayers, tree injectors, rope-wick applicators, protective clothing, safety equipment, and chemical supplies are available through catalogs, local farm and ranch stores, and chemical dealers.

### *Application*

Operation of hand-operated and backpack sprayers and tree injectors is very labor intensive and best suited for individual plant treatment on limited areas. Hand-operated units consist of a metal or plastic, pressurized tank with a plunger pump, a hand gun, and a strap or handle. Tank capacities vary from 1 to 3 gallons, and are used on very small areas. Backpack sprayers use a 3- to 5-gallon-plastic tank and a piston or diaphragm pump which is hand operated while spraying with a hand gun. These sprayers are used for leaf sprays on shrubs or basal sprays on trees and shrubs, and they can be operated for extended periods. Tree injectors apply a dose of herbicide into the tree as the sharp point of the injector is thrust into the tree. Because of small tank capacities, all of the above sprayers may require frequent re-filling.

### *Sources*

Company websites list information about various sprayers, accessories, safety equipment and clothing, dealers, and contact information. Local farm and ranch supply stores and chemical dealers may stock hand-held and backpack sprayers and accessories.

[Chapin Manufacturing, Inc.](#)

Batavia, NY 14021

[Forestry Suppliers, Inc. \(Catalog\)](#)

Jackson, MS 39284

[H.D. Hudson Manufacturing Co.](#)

Chicago, IL 60611

[Jacto Inc.](#)

Tualatin, OR 97062

[Solo](#)

Newport News, VA 23605