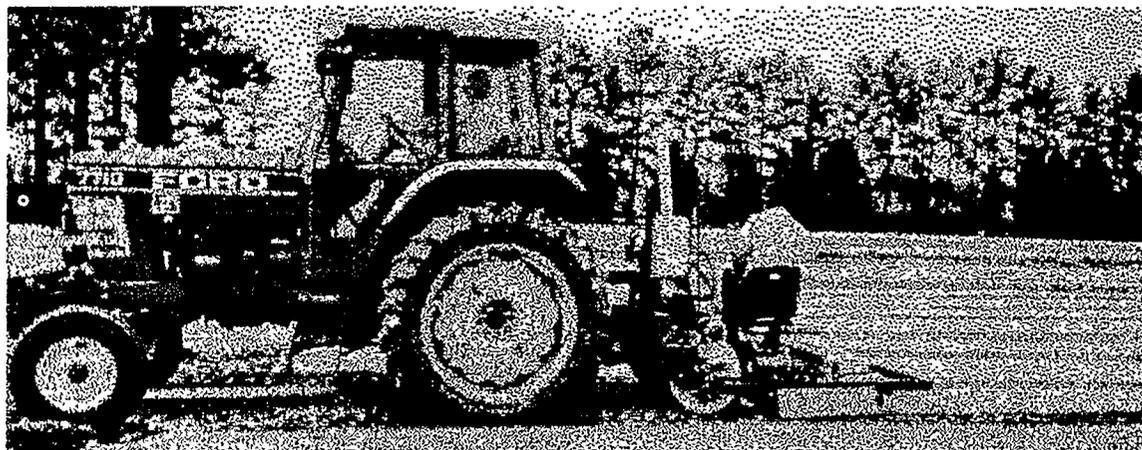


# 4.0 Sowing and Transplanting



<b>4.1 Seed Bed Formation</b>	<b>86</b>	<b>4.5 Transplanting</b>	<b>102</b>
<b>Bed Formers</b>	86	<b>Transplanters</b>	102
Frobro Multi-Rotor Bed Shaper		Egedal Transplanter	
Whitfield Bed Builder and Leveler		Mechanical Transplanter	
Rototiller Bed Formers		Holland Transplanter	
<b>Drum Rollers</b>	88	Hardwood Cuttings Transplanter	
Egedal Bed Roller		Plug Transplanters	
<b>4.2 Row Seeding</b>	<b>89</b>		
<b>Seeders and Planters</b>	89		
Whitfield Nursery Seeder			
Wind River Seed Drill			
Love/Oyjord Seed Drill			
Frobro Pneumatic Seeder			
Hege Drill Planter			
Egedal Seeder			
Stanhay Seeder			
Love Precision Vacuum Seed Drill			
Silver Mountain Seed Drill			
Frobro Miniair Seed Drill			
<b>4.3 Applying Fertilizer and Mycorrhizal Fungi</b>			
<b>Inoculum</b>	95		
<b>Solid Fertilizer Injectors</b>	95		
<b>Mycorrhizal Injectors</b>	95		
<b>4.4 Seedbed Mulching and Stabilization</b>	<b>96</b>		
<b>Spreaders</b>	96		
Egedal Sand Spreader			
J. Herbert Stone Mulch Spreader			
Coeur d'Alene Sander			
Mulch Stabilization Chemicals			
<b>Hydro Mulchers</b>	99		
<b>Miscellaneous</b>	100		
Erosion Netting			
Stake Driver			
Netting Spreader Retrieval System			

To produce the requested number of seedlings, nurseries progress through a number of steps. Seed and ground must be prepared for sowing and cared for after sowing.

An initial step is completing sowing calculations that take into consideration the seedlot information—germination percentage, purity percentage, seeds per pound, and factors that are unique to individual nurseries. An estimate of the amount of nursery ground required to sow the seed is also necessary.

Ground preparation includes the incorporation of pre-sown fertilizers and seedbed formation. Seedbeds must be of a texture that allows the seed to be sown to the proper depth and to be covered.

Sowing is accomplished utilizing broadcast sowers or seed drills. Broadcast sowers scatter seed randomly over a section of seedbed. Seed drills drop the seed in individual rows. Precision seed drills are capable of placing seeds at specific distances between seeds.

Once the seed has been placed in the ground it needs to be covered. Coverings include native soil, sand, and various types of mulches. Mulches of sawdust, peat moss, and other fine textured or light weight material may need to be secured to the ground. This can be accomplished with either a hydromulching material or a liquid polymer mulch.

## 4.1 Seed Bed Formation

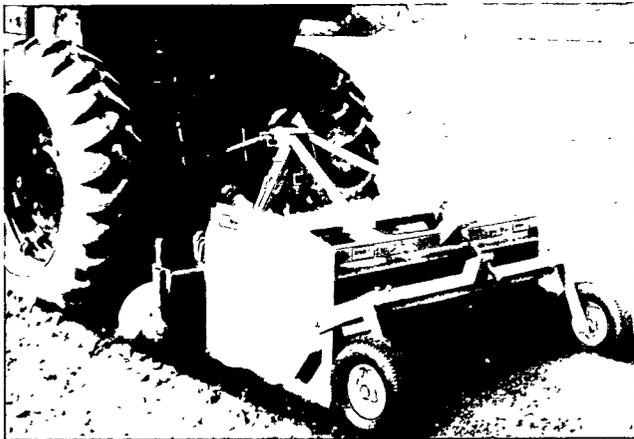


Seedbeds are formed using a variety of sowing and cultural equipment to enhance drainage.

The most efficient use of nursery ground depends on the formation of straight seedbeds. Seedbeds are formed using different equipment and techniques including rototillers (See Section 3.3) and bed formers.

### Bed Formers

Bed formers are designed to shape seedbeds and condition the soil to the proper tilth. These implements work the soil to the middle, shape it to create a raised bed, and smooth and firm the surface. Bedforming equipment is usually capable of forming beds between 1 and 6 inches high. Four inches is common.

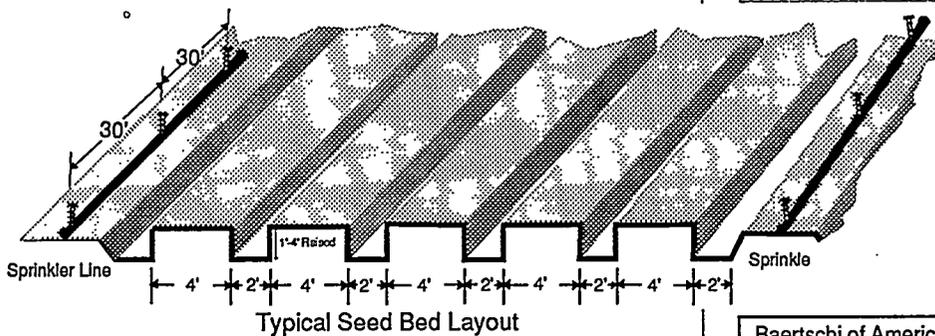
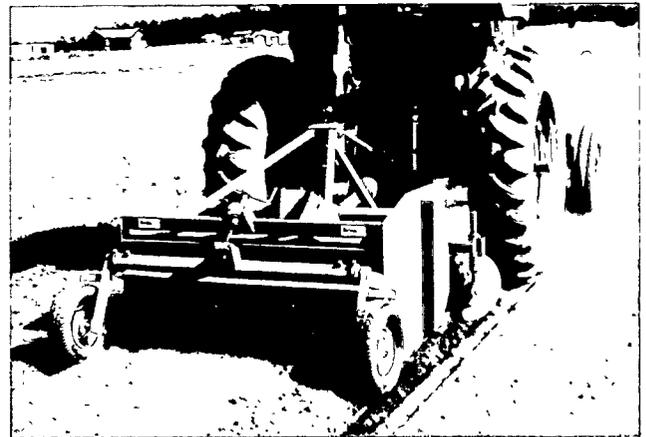


### Frobro Kulti-Rotor Bed Shaper

This small tractor-pulled implement is designed to shape seed or transplant beds after basic soil preparation like subsoiling, chiseling, discing, or plowing.

The front rotor with curved blades breaks the ground into clods without forming a plow pan. The two adjustable front discs raise the bed to the desired height. Then, a counter-driven rear drum with spikes crumbles and firms the top soil.

Fertilizer spreaders or bed rollers may be attached to the implement. A furrowing implement is available to form furrows for hand-planting.



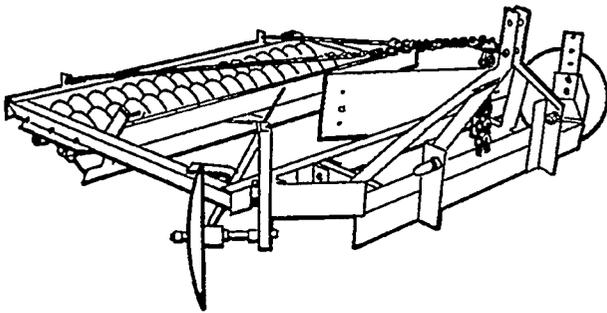
Baertschi of America Inc.  
P.O. Box 5139  
Sevierville, TN 37864  
(615) 428-3961

---

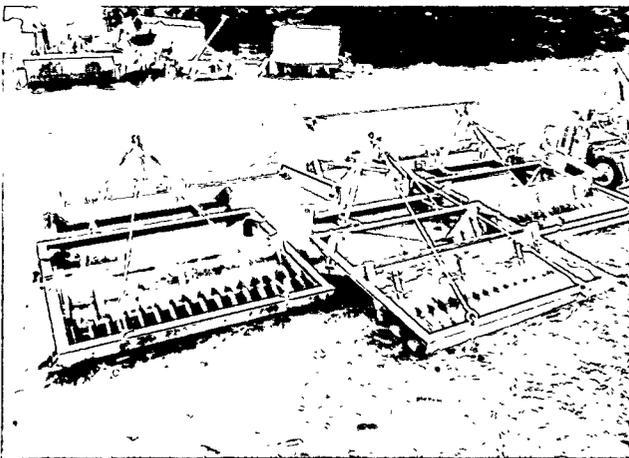
---

## Whitfield Bed Builder and Leveler

The Whitfield bed builder opens and lifts seedbeds to the desired height. The machine consists of two front discs, shaping bars, and tandem rollers. The discs work the center soil, while the shaping bars deflect soil to the middle of the row to create a raised bed. The tandem rollers in the rear pulverize the soil and prepare it for planting. The bed builder is available in category I and II 3-point hitch. The finished bed is 54 inches wide on the top, 60 inches wide at the base.



Some nurseries are mounting bed builders in parallel on tool bars to do three beds in one pass.



### Bed Builder and Leveler:

R.A. Whitfield Mfg. Co.  
Whitfield Forestry Equipment  
P.O. Box 188  
6431 Gordon Circle SW  
Mableton, GA 30059  
(404) 948-1212

## Rototiller Bed Formers

Some rototillers have bed-forming accessories. A wide variety of sizes are available (See *Rotary Tillers Sec. 3.3*).

### Bed Formers:

Baertschi of America, Inc  
P.O. Box 5139  
Sevierville, TN 37864  
(615) 428-3961

Kennco Mfg., Inc.  
P. O. Box 1158  
Ruskin, FL 33570  
(813) 645-2591

Larchmont Engineering &  
Irrigation, Inc.  
11 Larchmont Lane  
Lexington, MA 02173

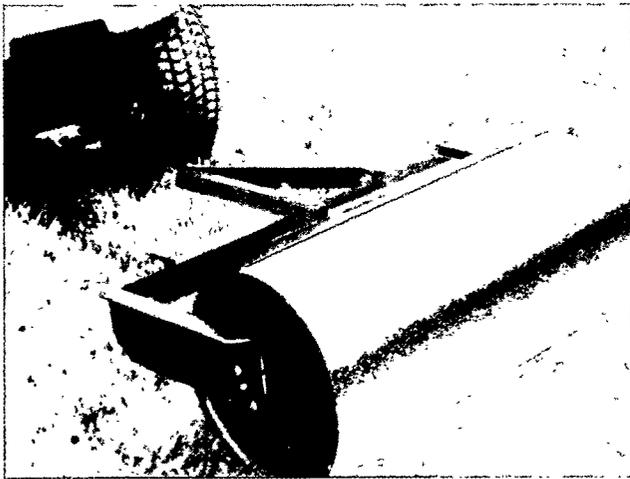
R.A. Whitfield Mfg. Co.  
Whitfield Forestry Equipment  
P.O. Box 188  
6431 Gordon Circle SW  
Mableton, GA 30059  
(404) 948-1212

## Drum Rollers

Drum rollers have a smooth surface and are used to firm the soil or seal the surface. They are often mounted directly in front of seed drills or used alone to seal the soil surface after incorporating granular fumigants. Some models can be filled with water to increase their weight. They come in a variety of widths.

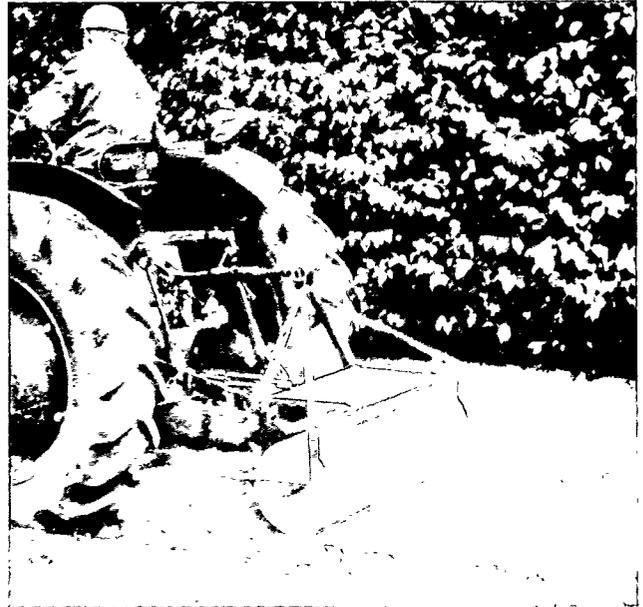
Before sowing, many nurseries roll seedbeds with smooth or collared rollers. Collared rollers have a smooth drum with 1/4- to 1/2-inch rings welded around it. The rings are positioned to provide a depression corresponding to the seed rows.

Rolling may be done as a separate operation; however, some nurseries have rollers mounted on seeders and combine rolling with seeding. Most rollers are custom built.



## Egedal Bed Roller

The Egedal Bed Roller is a smooth 100-centimeter-wide drum roller that mounts on a 3-point hitch. A screw plug at one end allows it to be filled with water for weight control. Various widths are available on special order.



### Egedal Bed Roller:

Timm Enterprises, Ltd.  
P.O. Box 157  
5204 Trafalgar Rd.  
Oakville, Ontario  
Canada L6J 4Z5  
(416) 878-4244

### Drum Rollers:

Ames Lawn and Garden Tools  
P.O. Box 1774  
Parkersburg, WV 26102  
(304) 424-3288

Baertschi of America, Inc  
P.O. Box 5139  
Sevierville, TN 37864  
(615) 428-3961

Gandy Co.  
P.O. Box 528  
528 Gandrud Rd.  
Owatonna, MN 55060  
(507) 451-5430

Keneco Mfg., Inc.  
P. O. Box 1158  
Ruskin, FL 33570  
(813) 645-2591

A.M. Leonard, Inc.  
P. O. Box 816  
Piqua, OH 45356-0816  
(513) 773-2694

Timm Enterprises, Ltd.  
P.O. Box 157  
5204 Trafalgar Rd.  
Oakville, Ontario  
Canada L6J 4Z5  
(416) 878-4244

True Temper Hardware Div.  
Ernhart Consumer Group  
P.O. Box 3500  
465 Railroad Ave.  
Shiremanstown, PA 17011

R.A. Whitfield Mfg. Co.  
Whitfield Forestry Equip.  
P.O. Box 188  
6431 Gordon Circle SW  
Mableton, GA 30059  
(404) 948-1212

Worksaver, Inc.  
P.O. Box 1000  
S State St.  
Litchfield, IL 62056  
(217) 324-5973

## 4.2 Row Seeding

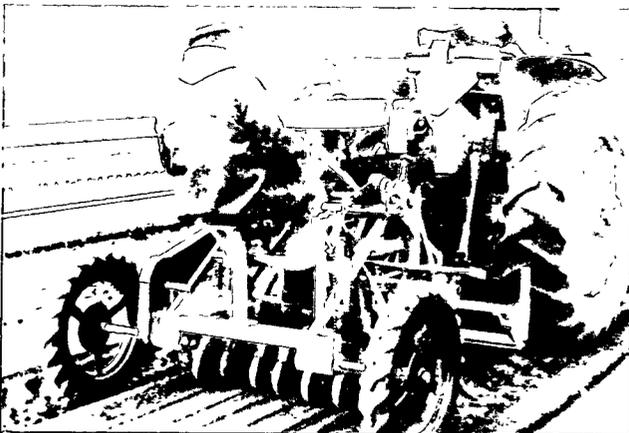


*Precision row spacing and uniform spacing of trees within the row aid in weed control, other cultural activities, and lifting of seedlings. Due to these requirements, seeders commonly used in today's tree nurseries are row-crop seeders. They drop seeds individually in rows. The rows are normally spaced on 6-inch centers. Seed spacing within the rows varies depending on the desired seedling density and the sowing calculations.*

### Seeders and Planters

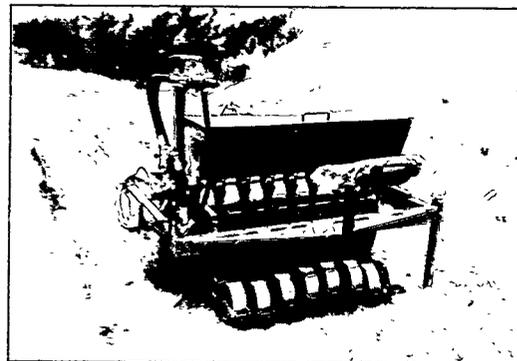
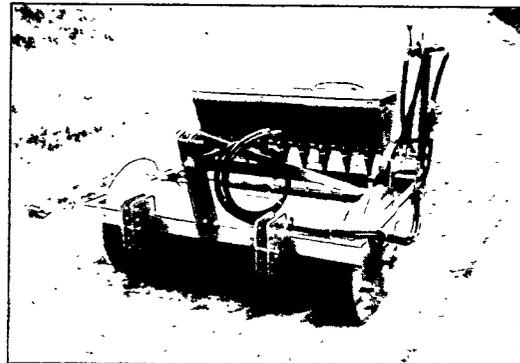
In most bareroot nurseries, seed drills are used to sow tree seed in rows. Sometimes the rows are referred to as drills. The seed drill delivers seed from a hopper to a metering device and through a drop tube to the seedbed. Once the seed is distributed to the bed, it is usually packed and covered by the closing devices located on the drill. Some seed drills do not cover the rows and a separate pass over the bed with a different piece of equipment is necessary. Drum rollers (Section 4.1) and spreaders (Section 4.4) are often used for this secondary operation.

Grain seed drills are used to sow cover and green manure crops. Some nurseries use grain drills to spread fertilizer as well (See Section 3.2).



### Whitfield Nursery Seeder

The Whitfield Nursery Seeder consists of a feeder box, a seed metering device, eight drop tubes, a ground penetrating drill, and eight seed-covering devices. Row spacing is 6 inches. Eight V-type planting shoes are supplied with height adjustment. Customers can choose either a flat drum roller or a concave drum for raised beds.



#### Whitfield Nursery Seeder:

R.A. Whitfield Mfg. Co.  
Whitfield Forestry Equipment  
P. O. Box 188  
6431 Gordon Circle SW  
Mableton, GA 30059  
(404) 948-1212

---

---

## Wind River Seed Drill

The Wind River Seed Drill is custom-made following local patterns. It was originally designed and built at the Forest Service Wind River Nursery, Carson, Washington. This seed drill is not commercially manufactured and no plans are available. It is used by some tree nurseries.

The Wind River Seed Drill consists of a hopper, drop tubes, rollers, soil-penetrating shoes, and metering devices. A metering device consists of ground-driven short cylinders that are fluted and cup-shaped at both ends. When the cups rotate, the seed is metered from the hopper into the drop tubes. To allow different seed sizes, the cups at one end of the cylinder are deeper than the other. Most nurseries using Wind River seed drills have made changes in the basic design. Parts are difficult, if not impossible, to obtain. The original Wind River Seed Drill was a combination of parts from an International Harvester grain drill and a Planet Jr. Seeder.



## Love/Oyjord Seed Drill

The Love/Oyjord seed drill adjusts to different row sizes and seeding depths, and consists of a wide front-packing roller that firms the ground. Ground opening discs dig furrows into which a seed metering device distributes the seed. Trailing packer wheels close and firm the furrow. Three- to eight-row models are available as well as a 16-row version. The seeder is designed for use on prepared flat or raised (6-inch maximum) seedbeds.

This seed drill has a unique metering device. Seed empties into a spinner that divides the seed equally to each planting head. Calibration is simple and may be done by seed weight or count. Ground openers adjust to depth and follow ground contour for uniform depth of seed. The trailing packer wheels may be either flat or concave.



### Love/Oyjord Seed Drill:

J.E. Love Co.  
309 California St.  
Garfield, WA 99130  
(509) 635-1321

---

## Frobro Pneumatic Seeder

This seed drill uses a wheel-driven metering system for seed metering and then an air and distributing head to distribute the seed in up to eight rows. Each row has independently adjustable planting shoes with rubber packing wheels. This seeder is capable of planting speeds of 3 mph or more.

## Hege Drill Planter

Primarily designed for planting cereal grain crops, this system has been used to plant other sizes of seed, including forest tree seed.

Double discs open a furrow for the seed. Seeds fall from a belt cone into a rotary distributor. This is adjustable for all sizes of seeds. The seeds fall into a slotted metering device enclosed in clear plastic for visibility. The seeding rate is controlled by a mechanical unit with precision settings. These can easily be changed.

The standard model uses seven drills with 7-inch centers, but the seeder can be custom-made to other specifications. The operator can manipulate the number of rows and distance between centers by adjusting the dividers in the seed box. These can be set so that seed falls through some holes but not others.



### Frobro Pneumatic Seeder:

Baertschi of America, Inc.  
P.O. Box 5139  
Sevierville, TN 37864  
(615) 428-3961

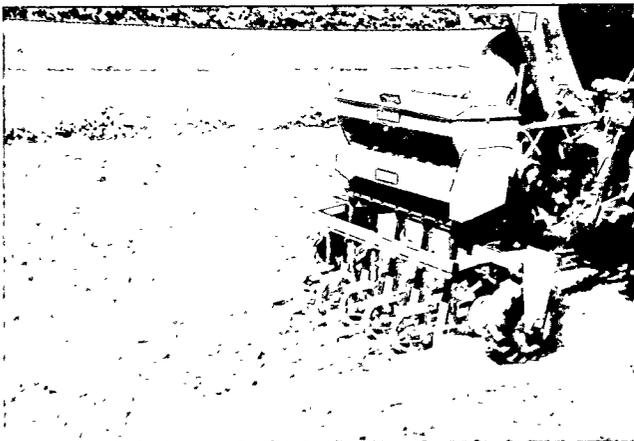
### Hege Drill Planter:

Hege Equipment, Inc.  
P.O. Box 34A  
Rt. 1  
Colwich, KS 67030  
(316) 796-0992

---

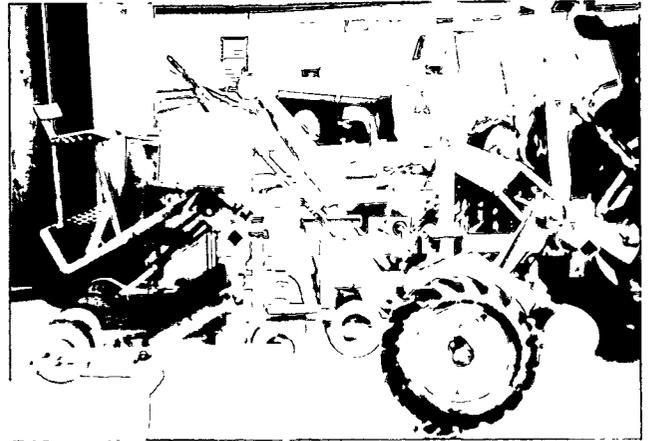
## Egedal Seeder

The Egedal Seeder is a ground-driven seeder that can be delivered with the required number of sowing units and row widths up to a maximum of nine rows. Calibration is accomplished by gear cassettes and a cone gear box. This provides 160 settings. To insure uniform and correct sowing depth, the units are independent, which allows them to follow the ground surface.



## Stanhay Seeder

The Stanhay Seeder is manufactured in England and sold commercially in the U.S. It has been used by Weyerhaeuser Co. as well as other private nurseries. Individual units for each row are mounted on a common frame. Each unit has a rubber belt with holes that meters the seeds onto the ground. The seeding rate can be adjusted by gearing changes, using belts with different hole sizes and spacing, and by using different plates under the belt.



### Egedal Seeder:

Timm Enterprises, Ltd.  
P.O. Box 157  
5204 Trafalgar Rd.  
Oakville, Ontario  
Canada L6J 4Z5  
(416) 878-4244

### Stanhay Seeder:

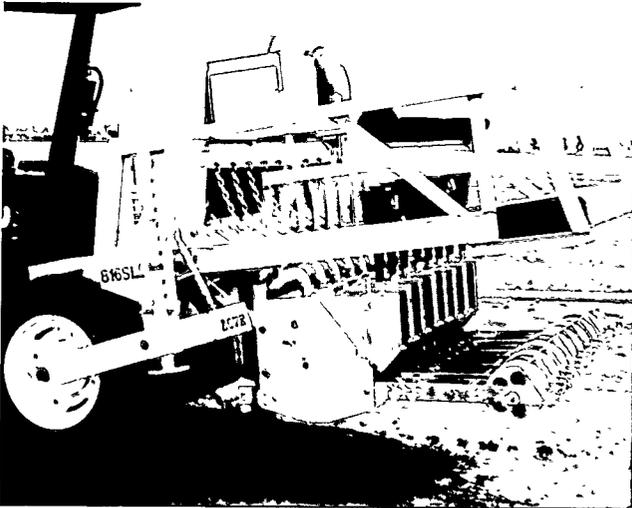
Solex  
P. O. Box 490  
220 S Jefferson  
Dixon, CA 95620

---

---

## Love Precision Vacuum Seed Drill

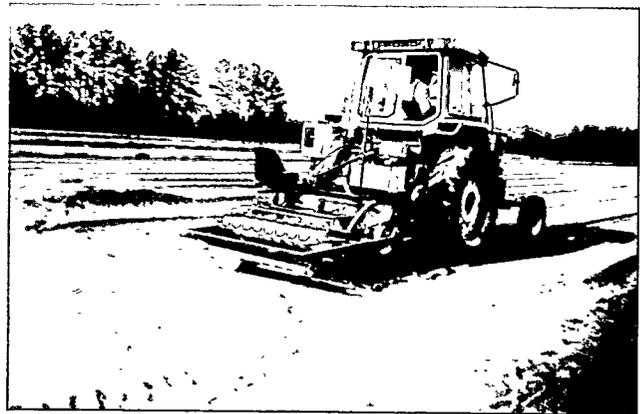
This seed drill uses vacuum discs to place the seed. Eight double-row planting heads using two discs per planting head are normally used. The discs are easily changed to accommodate different seed sizes. Vacuum pressure can be adjusted according to seed and soil conditions. The seed heads maintain a uniform distance from the ground, and seed depth is easily adjustable. A soil layer of 1/8- to 1/4-inch covers the seeds. Tractor sizes of 40 hp and 5,000 lbs are needed to pull this seeder.



## Silver Mountain Seed Drill

The Silver Mountain Seed Drill shapes a seed bed and sows it with a precisely controlled vacuum drum seeder. A rotating vacuum head picks up a single seed from the hopper. From inside the vacuum head, a metal spine emerges to break the vacuum and shove the seed off the head where it falls to the earth. The head retracts, then thrusts out again to knock away any dirt that has attached to the drum. Because pickup is by vacuum and not entrance to a particular size of seed tube, the seeder can plant any size and shape of seed. Calibration is done by entering the spacing desired on the seeder's computer. The computer controls the speed of the vacuum drum in relation to ground speed. Spacing between seeds is kept constant, despite fluctuations in tractor speed. The operator can control all aspects of sowing while in operation. The furrow depth, depth of seed covering, and amount of bed firming are adjustable.

The seed drill has eight seeding units, and is designed for a tractor of 60 hp, although it has been used successfully by smaller tractors. The seed drill comes equipped with either flat or concave bed formers.



### Love Precision Seed Drill:

J.E. Love Co.  
309 California St.  
Garfield, WA 99130  
(509) 635-1321

### Silver Mountain Seed Drill:

Silver Mountain Equipment, Inc.  
4672 Drift Creek Rd. SE  
Sublimity, OR 97385  
(503) 769-7127

---

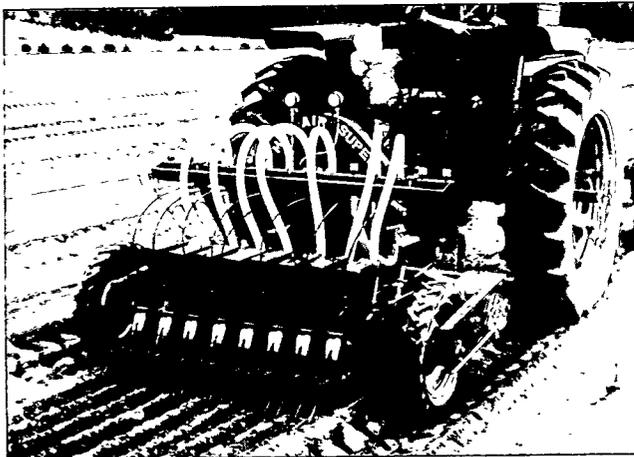
---

## Frobro Miniair Seed Drill

The Frobro Miniair Super-Precision Seed Drill shapes the bed and plants seeds using a vacuum disc. Discs are different sizes to accommodate a wide variety of tree seed sizes and shapes. Discs can be changed in the field without tools.

In operation, seeds are drawn onto a revolving seed disc that turns and brings the seed near the planting entrance. An angled metal flap prevents more than one seed from reaching the seeder opening. The seed is brushed through the opening into the furrow, and a jet of air cleans dust from the opening in preparation for the next cycle.

The number of seeding units is adjustable from 3 to 25. Sowing depth, vacuum strength, and distance between rows are adjustable.



### Frobro Miniair Seed Drill:

Baertschi of America, Inc.  
P.O. Box 5139  
Sevierville, TN 37864  
(615) 428-3961

### Seed Drills:

Baertschi of America, Inc.  
P.O. Box 5139  
Sevierville, TN 37864  
(615) 428-3961

Hege Equipment, Inc.  
P.O. Box 34A  
Rt. 1  
Colwich, KS 67030  
(316) 796-0992

J.E. Love Co.  
309 California St.  
Garfield, WA 99130  
(509) 635-1321

Silver Mountain Equipment, Inc.  
4672 Drift Creek Rd. SE  
Sublimity, OR 97385  
(503) 769-7127

Solex  
220 S. Jefferson  
P.O. Box 490  
Dixon, CA 95620

Timm Enterprises, Ltd.  
P.O. Box 157  
5204 Trafalgar Rd.  
Oakville, Ontario  
Canada L6J 4Z5  
(416) 878-4244

R.A. Whitfield Mfg. Co.  
Whitfield Forestry Equipment  
P.O. Box 188  
6431 Gordon Circle SW  
Mableton, GA 30059  
(404) 948-1212

## 4.3 Applying Fertilizer and Mycorrhizal Fungi Inoculum



*Fertilizer is often applied just before the sowing operation or as part of the sowing process. Because certain minerals are insoluble, they need to be incorporated in the soil before sowing. Because of the possible increase in pathogen levels and the inability of the seedling to immediately utilize nitrogen, the application of nitrogen before sowing is not recommended.*

*Either broadcast or drill-type fertilizer spreaders may be used (See Section 3.5 Applying Soil Amendments). Solid and liquid formulations of fertilizer are both used.*

### Solid Fertilizer Injectors

Units are available to attach to cultivators, tractors, or seeders. A unit consists of a hopper, a metering system, and drop tubes. The tubes can be routed to furrow openers on planters, or to tines for cultivators. They are used to incorporate fertilizers in the soil.



#### Solid Fertilizer Injectors:

Baertschi of America, Inc.  
P.O. Box 5139  
Sevierville, TN 37864  
(615) 428-3961

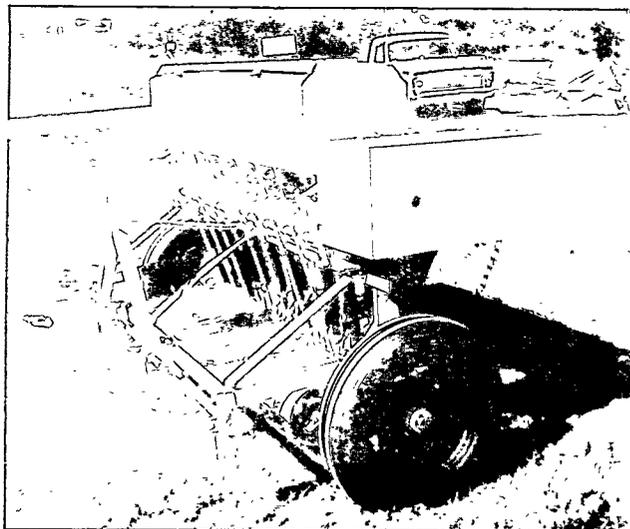
Barber Agricultural Sales  
E 2904 Mission  
Spokane, WA 99202  
(509) 535-3051

Gandy Co.  
P.O. Box 528  
528 Gandrud Rd.  
Owatonna, MN 55060-0528  
(507) 451-5430

### Mycorrhizal Injectors

Mycorrhizal Fungi Inoculum can be injected into the soil approximately 3 inches deep in 2-inch wide strips with an attachment mounted to a seeder. Whitfield manufactures a multi-row nursery seeder with a detachable mycorrhizal applicator. The mycorrhizal applicator can be bought separately and installed by bolting the unit onto a seeder. Plans for a mycorrhizal applicator are also available from:

USDA Forest Service  
Missoula Technology and  
Development Center  
Building 1, Fort Missoula  
Missoula, MT 59801  
(406) 329-3900



#### Mycorrhizal Injectors:

R.A. Whitfield Mfg., Co.  
P.O. Box 188  
6431 Gordon Circle SW  
Mableton, GA 30059  
(404) 948-1212

## 4.4 Seedbed Mulching and Stabilization

---

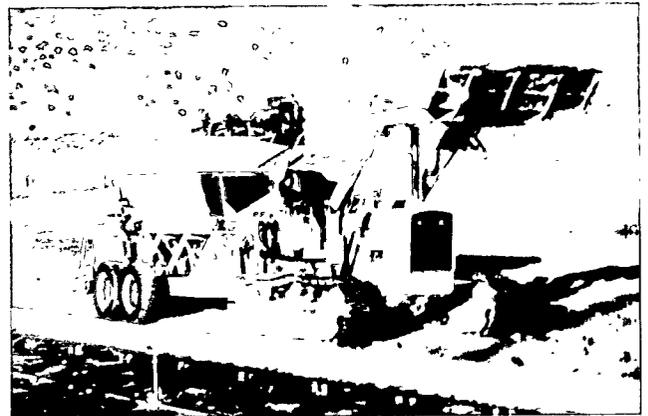


*Some nurseries cover seedbeds with sand, sawdust, or mulch (See Section 3.5, Applying Soil Amendments Fertilization for Seeder Spreaders) for better seedling emergence. The recent emergence of vinyl polymer mulches that act as adhesives provides an additional use for spray rigs.*

---

### Spreaders

Spreaders are used at tree nurseries to protect newly-sown seed. Many are custom-built or modified for spreading sand and sawdust. Others that separate and blow solids or a liquid/solid mix onto the seedbed are commercially available.

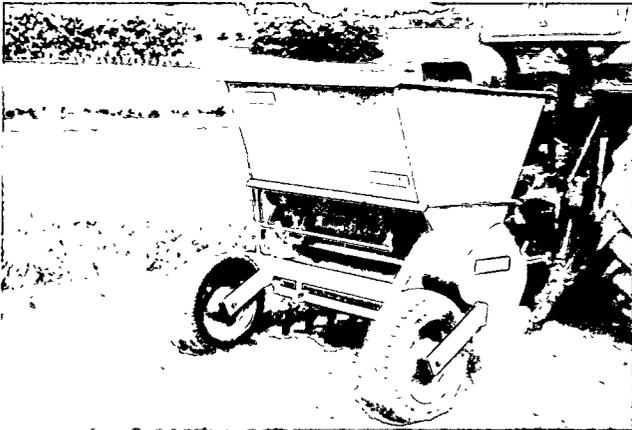


---

---

## Egedal Sand Spreader

This sand spreader consists of a spreading mechanism and a hopper that can hold 27 cubic feet of sand. A spiral at the bottom of the hopper spreads the sand. The machine can lay down different depths of sand covering. Because of a distributor plate, the machine can selectively apply sand only over the rows of seeds. The machine is available in various widths.

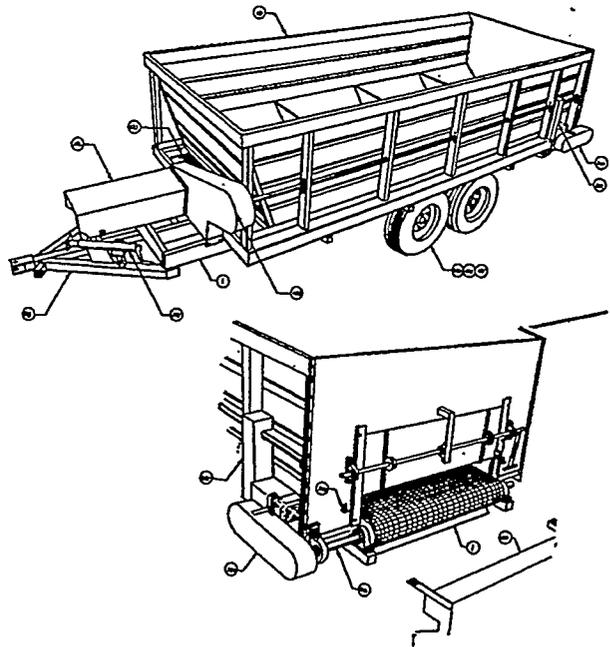


## J. Herbert Stone Mulch Spreader

Personnel at USDA Forest Service J. Herbert Stone Nursery designed and built a sawdust, sand, or mulch spreader that has been well received by users. Plans are available upon request from:

J. Herbert Stone Nursery  
2606 Old Stage Rd.  
Central Point, OR 97502  
(503) 776-4281

USDA Forest Service  
Missoula Technology and  
Development Center  
Building 1, Fort Missoula,  
Missoula, MT 59801  
(406) 329-3900



### Egedal Sand-Spreader:

Timm Enterprises, Ltd.  
P.O. Box 157  
5204 Trafalgar Rd.  
Oakville, Ontario  
Canada L6J 4Z5  
(416) 878-4244

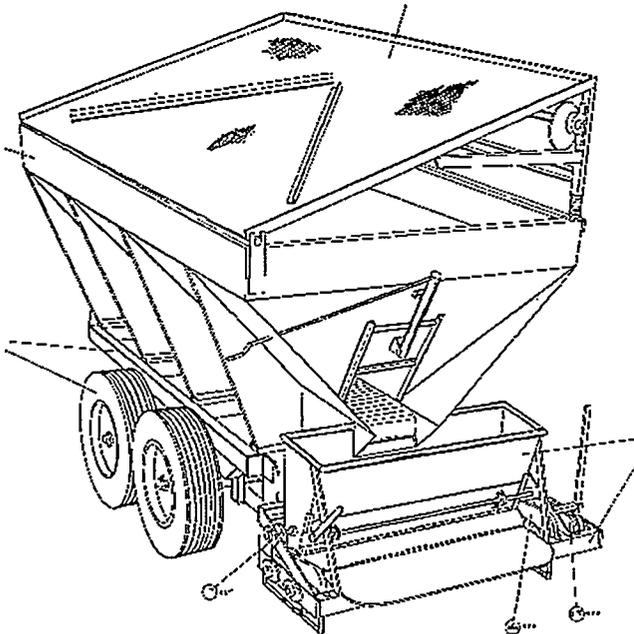
## Coeur d'Alene Sander

Plans are available for this custom-built sand spreader from:

USDA Forest Service.  
Coeur d'Alene Nursery  
3600 Nursery Rd.  
Coeur d'Alene, ID 38314  
(208) 765-6365

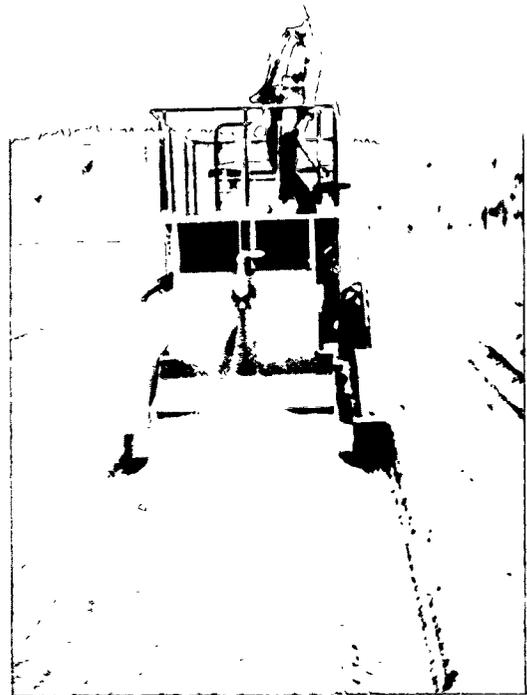
or

USDA Forest Service  
Missoula Technology and  
Development Center  
Building 1, Fort Missoula  
Missoula, MT 59801  
(406) 329-3900



## Mulch Stabilization Chemicals

Various compounds are available. Asphalt compounds are largely no longer in use and have been replaced by new compounds that are largely biodegradable. These are made up of large soluble starches and other natural polymers, or colloidal clay, gelling agents, and fertilizer.



### Stabilization Chemicals:

American Excelsior Co.  
609 S Front St.  
Yakima, WA 98901  
(509) 575-5794

Borden Chemical Co.  
Adhesives & Graphics Div.  
630 Glendale-Milford Rd.  
Cincinnati, OH 45215  
(513) 782-6200

Erosion Control Systems, Inc.  
1800 McFarland Blvd. N  
Suite 180  
Tuscaloosa, AL 35406  
(800) 942-1986

Golden Bear Div.  
Witco Corp.  
P.O. Box 456  
Chandler, AZ 85244-0161  
(601) 963-2267

Reclamare Co.  
20727 7th Ave. S  
Seattle, WA 98198  
(206) 824-2385

Reinco, Inc.  
P.O. Box 584  
Plainfield, NJ 07061  
(207) 755-0921

Sauze Technical Product Corp.  
212 Oak St. Ext.  
Plattsburgh, NY 12901  
(518) 561-6440

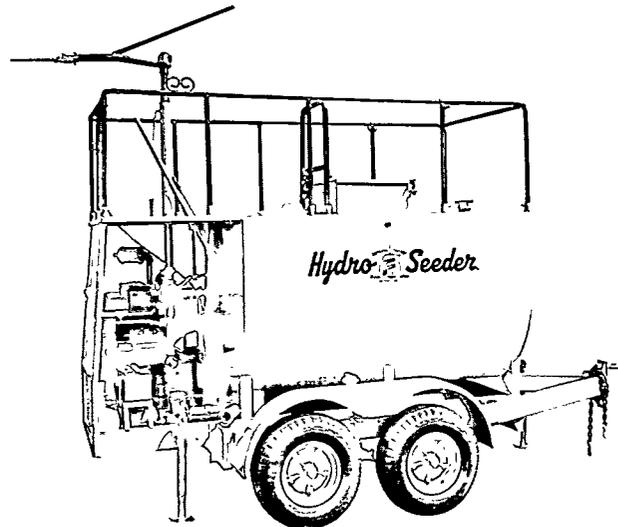
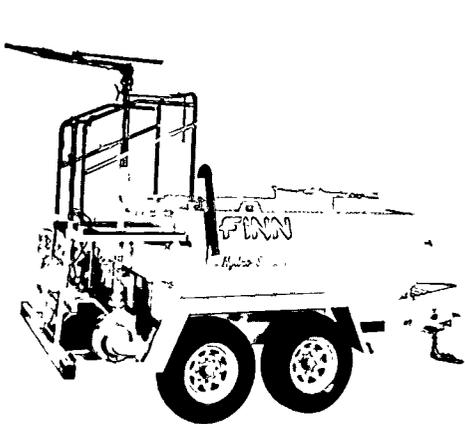
Soil Stabilization Products Co.  
P.O. Box 2779  
Merced, CA 95344  
(209) 383-3296

Southpine, Inc  
P.O. Box 5301267  
Birmingham, AL 35253  
(205) 879-1099

---

## Hydro Mulchers

Hydro mulchers apply a mixture of fibermulch and water and sometimes fertilizers on seedbeds. The mulchers consist of a mixing tank, a pump, and a nozzle that allows spraying in any direction. A useful attachment is the seedbed applicator pan. Paddle agitators mix the mulch. Some machines use a grinder/blender for mixing. Options include a separate pump for spraying. Sprayers are mounted on a truck bed or trailer. Sizes vary from tanks of 500 to 3,500 gallons.



### Hydro Mulchers:

Bowie Industries  
P.O. Box 931  
Bowie, TX 76230  
(817) 872-1106

Finn Corporation  
9281 LeSaint Dr.  
Fairfield, OH 45014  
(513) 874-2818

Reinco, Inc.  
P.O. Box 584  
Plainfield, NJ 07061  
(207) 755-0921

Estes Equipment, Inc.  
Rt. 4, Bybee Rd.  
Winchester, KY 40391  
(606) 744-5900

Penn Line Service, Inc.  
300 Scottsdale Ave.  
Scottsdale, PA 15683  
(412) 887-9110

Sauze Technical Products Corp.  
212 Oak St. Ext.  
Plattsburgh, NY 12901  
(518) 561-6440

---

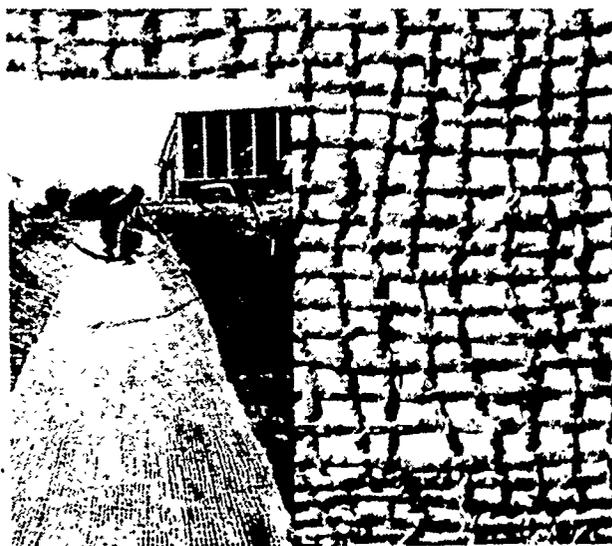
---

## Miscellaneous

Numerous methods have been used to protect freshly sown seed. Under this section, we've included erosion netting as well as equipment to aid in installation of bird netting.

## Erosion Netting

Various nettings and cloths are available to protect newly planted seed from erosion and wind and to fend off the depredations of birds and animals. Some nettings are made of natural materials designed to biodegrade in 1 to 2 years. They generally come in rolls 3 to 4 feet wide and 225 feet long. The netting must be tacked down.



### Erosion Netting:

American Excelsior Co.  
6475 N Franklin  
Denver, CO 80229  
(303) 287-3261

Hobbs and Hopkins, Ltd.  
1712 SE Ankeny  
Portland, OR 97214  
(503) 239-7518

Ben Meadows Co.  
3589 Broad St.  
Chamblee, GA 30366  
(800) 241-6401

PPS Pack Co.  
204 N 7th St.  
Fowler, CA 93625  
(209) 834-1641

Sauze Technical Products Corp.  
212 Oak St. Ext.  
Plattsburgh, NY 12901  
(518) 561-6440

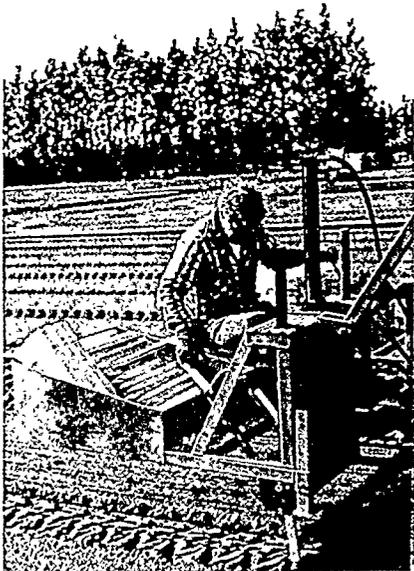
Terra Tech, Inc.  
P.O. Box 5547  
2100 W Broadway  
Eugene, OR 97405  
(503) 345-0597

---

## Stake Driver

A tractor-mounted hydraulic stake driver was designed and built for use at USDA Forest Service Bend Pine Nursery. This system reduces the time required to drive stakes before applying bird netting and requires a tractor operator and a person to operate the machine. The stake driver production rate is about 1,800 stakes per hour. For information contact:

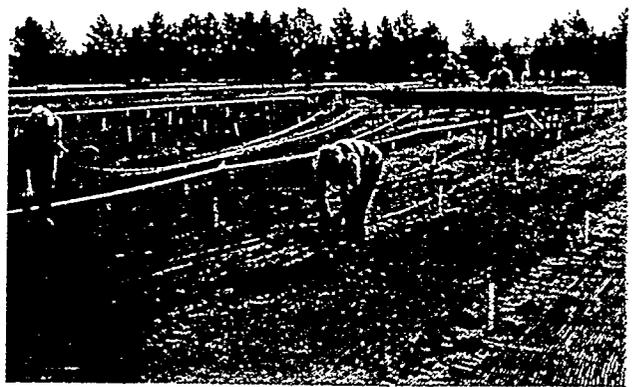
USDA Forest Service  
Missoula Technology and  
Development Center  
Building 1, Fort Missoula  
Missoula, MT 59801  
(406) 329-3900



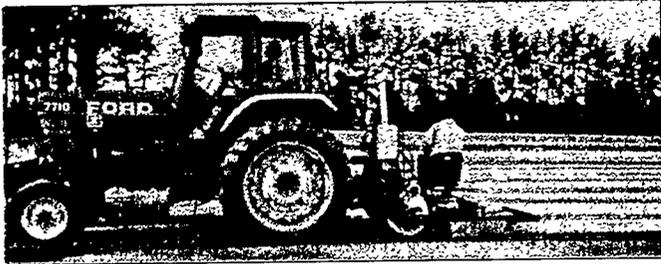
## Netting Spreader Retrieval System

A hand-pulled cart was designed and built at the USDA Forest Service Bend Pine Nursery as an aid in bird netting application and removal. This improved efficiency by 50 percent over past practices. The stake driver and cart are combined as a system for application and removal of netting. For information, contact:

USDA Forest Service  
Bend Pine Nursery  
63095 Deschutes Market Rd.  
Bend, OR 97701  
(503) 382-6922



## 4.5 Transplanting

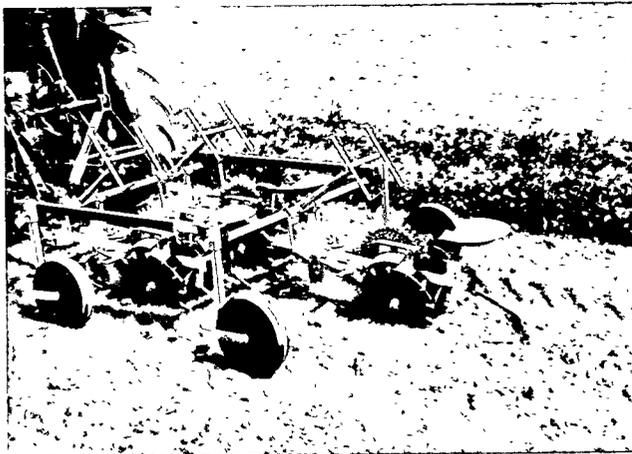


*Transplanting is lifting seedlings from their original seedbed to plant in another location in the nursery. Seedling density in the transplant bed is lower than that in the original seedbed. Seedlings are normally transplanted to achieve specific morphological characteristics such as increased stem diameters, shoot heights, and root-and-shoot dry weights.*

### Transplanters

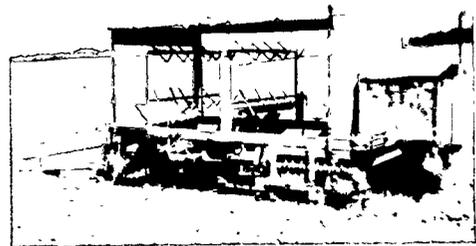
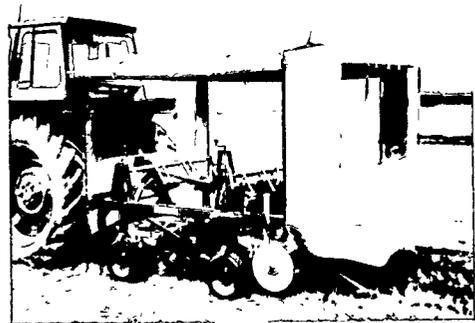
Transplanters are widely used in nurseries. They may be adjusted to provide the desired plant spacing, row width, and planting depth. Transplanters require a number of workers, one to drive the tractor, and one per row to manually feed seedlings into furrows. Transplanters are available to handle one to eight rows at a time.

Most transplanters have a similar design in which a coulter opens the ground, a chisel-type planting foot widens and deepens the furrow, and a scalper behind the coulter enlarges the furrow for the planting foot. Packing wheels firm the soil around the transplanted seedling. Tractors with 25 to 100 hp are needed for transplanting.



### Egedal Transplanter

Egedal's two smallest transplanters are designed for one to two and three to five operators. The machines follow the basic transplanter design, although to dig furrows they use a wheel with spring-loaded projections that further scarify the earth. Transplanter parts are replaceable. Boxes allow extra weight to be added over the packing wheels. The distance between rows may be adjusted. A heavy-duty model that can be used in uncultivated reforestation work features a heavy-weight furrow share with moldboard. A cab covers the transplanter. Planters are spring-mounted to stay near the earth. Large transplanters hold up to eight people and are enclosed. For large transplanters, rows must be more than 10 inches wide.



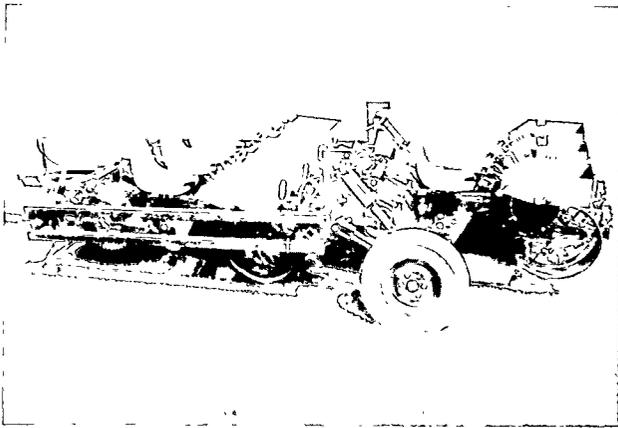
#### Egedal Transplanter:

Timm Enterprises, Ltd.  
P.O. Box 157  
5204 Trafalgar Rd.  
Oakville, Ontario  
Canada L6J 4Z5  
(416) 878-4244

---

## Mechanical Transplanter

Mechanical Transplanter Company makes planters suitable for both small and large seedlings. Planter shoes open a furrow 14 inches deep. The frame is spring-loaded to stay close to the earth. The coulter is 28 inches. The plant boxes are built for large seedlings and have built-in conveyors to bring plants close to the operator. Planting rates have reached 2,000 seedlings an hour.



## Holland Transplanter

Holland Transplanter makes transplanters in light and heavyweight models. The tree transplanter has a 20-inch coultter and a 10-inch planting tool. Holland's Old Faithful handles seedlings up to 3 feet tall and plants roots to 15 inches deep. Holland's large transplanters seat up to 12 people. Each unit is set on its own flotation wheel. The transplanter will set seedlings 2-1/2 inches apart and as close as 9 inches between rows.



### Mechanical Transplanter:

Mechanical Transplanter Co.  
P.O. Box 1708  
1150 S Central Ave.  
Holland, MI 49422-1708  
(616) 396-8738

### Holland Transplanter:

Holland Transplanter Co.  
P.O. Box 1527  
510 E 16th St.  
Holland, MI 49422-1527  
(616) 392-3579

---

## Hardwood Cuttings Transplanter

Canadian Forestry Service nurseries have developed a transplanter for hardwood cuttings. They invite inquiries for testing this transplanter in forest tree nurseries. The transplanter is similar in design to commercial planters. For information, contact:

PFRA Shelterbelt Centre  
Agriculture Canada  
Indian Head, Saskatchewan  
Canada SOG 2K0

## Plug Transplanters

Two new mini plug transplanters have recently emerged in tree nursery operations. For information on these, contact:

Weyerhaeuser Co.  
Tacoma, WA 98401  
(206) 924-3508

or

Castle & Cooke  
Techniculture, Inc.  
P.O. Box 1759  
Salinas, CA 93902  
(408) 754-5278

Transplanters:	
Bouldin & Lawson, Inc. P.O. Box 208 Rt. 10 McMinnville, TN 37110 (615) 668-4090	Mechanical Transplanter Co. P.O. Box 1708 1150 S Central Ave. Holland, MI 49422-1708 (616) 396-8738
Castle & Cooke Techniculture, Inc. P.O. Box 1759 Salinas, CA 93902 (408) 754-5278	Powell Mfg. Co., Inc. P.O. Drawer 707 Bennettsville, SC 29512-0707 (803) 479-6231
Holland Transplanter Co. P.O. Box 1527 510 E 16th St. Holland, MI 49422-1527 (616) 392-3579	Timm Enterprises, Ltd. P.O. Box 157 5204 Trafalgar Rd. Oakville, Ontario Canada L6J 4Z5 (416) 878-4244
	Weyerhaeuser Co. Tacoma, WA 98401 (206) 924-3508