SEEDING RANGELANDS WITH A RANGELAND IMPRINTER IN EASTERN WASHINGTON AND SOUTHEASTERN OREGON

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Drilling is considered a superior method of planting seed except where terrain or obstructions prevent the use of a drill. It is one of the best methods for obtaining uniform distribution of seed and proper depth of planting on a firm seedbed. In loose soil, cultipacking is sometimes needed to obtain the required firmness.

Broadcasting seed is generally recommended where drills cannot be used and only where there is some assurance seed will be covered. Broadcast seeds are exposed to rapidly fluctuating moisture conditions and depredation by birds and rodents. Seedlings from broadcast seeds often fail to root well and short portions of the roots are often exposed to dessicating action of sun and wind.

Several methods have been used to enhance coverage of broadcast seeds. Cultipacking, dragging brush or chains, and trampling by livestock are all effective methods. The land imprinter of recent orgin also may improve establishment of seedlings from broadcast seed.

The imprinter, developed by Robert M. Dixon, U.S. Department of Agriculture's Agricultural Research Service, consists of large steel cylinders that imprint a variety of geometric designs on the soil surface. The patterns are designed to reduce water runoff and enhance infiltration. The imprinter can be used as a primary implement on near barren land or as a secondary implement on loose plowed land. This implement has the potential to press broadcast seeds into the soil and produce small depressions which provide micro sites for germinating seeds. Either one or both processes could improve establishment of seedlings from broadcast seed.

Studies were initiated in 1981 and 1982 to evaluate the effectiveness of the land imprinter versus the rangeland drill for establishing Nordan crested wheatgrass *(Agropyron desertorum)*. Plantings were in eastern Washington and southeastern Oregon.

STUDY I

In 1981, personnel of the Eastern Oregon Agricultural Research Center, in cooperation with the U.S. Department of Agriculture's Soil Conservation Service, initiated a study to evaluate the establishment of weeds and seeded plant species on ash-covered rangelands modified by fire, herbicides, or discing and planted by drilling or imprinting. The project was funded by USDA-ARS.

The study site, 27 miles east of Ritzville, Washington, is representative of areas receiving a 2-inch deposit of ash of the silt loam texture from the Mount St. Helens eruption. Soils are in the Benge series, silt loam in texture, and occur on 0 to 15 percent slopes.

Vegetation consists mainly of annual grasses, forbs, and bluegrasses with scattered plants of bluebunch wheatgrass *(Agropyron spicatum)* and Thurber's needlegrass *(Stipa thurberiana)*. Dominant annual grasses include *Bromus tectorum* and *Ventenata dubia*.

PROCEDURES

Seedbeds were unprepared or prepared by spring or fall discing, summer or fall burning, or summer burning plus fall spraying with glyphosate (1 pound active ingredient per acre). Plots were seeded with Nordan crested wheatgrass at 6 pounds pure live seed per acre. Seeds were planted with a rangeland drill or broadcast after the plots were imprinted with a land imprinter filled with water. Success of seedbed preparation and planting was evaluated by determining density of competing species in early May 1983 and determining standing crops of competing vegetation and frequency and density of crested wheatgrass seedlings in mid-June 1983.

RESULTS

Neither the seedling densities nor the standing crops of competing vegetation appeared to affect seedling densities of crested wheatgrass as much as the thick litter layer remaining when seedbeds were not prepared with burning or discing. Average Nordan seedling densities were 0.5 per square foot on all but the untreated seedbeds and fall burned seedbeds rolled with the imprinter (Table 1). Drilling significantly increased seedling density on seedbeds prepared by fall burning and summer burning plus glyphosate. Differences were, however, not significant when seedbeds were unprepared, disced, or burned in summer. Nordan seedlings were more evenly distributed with drilling than with broadcasting after imprinting on all seedbeds except the untreated ones or those prepared by summer burning and discing (Table 2).

Table 1. Mean density of crested wheatgrass seedlings growing on experimental range seeding plots near Ritzville, Washington, in June 1983

Method of Planting	Untreated	Disc		Burn		Summer Burn	
		Spring	Fall	Summer	Fall	Fall	Glyphosate
	----------Number per square foot----------						
Drill	0.1a[1]	0.7a	0.7a	1.8a	2.0a	3.8a	
Imprint	>0.1a	0.5a	1.1a	1.6a	0.3b	2.1b	

[1] Means within columns followed by the same letter are not significantly different at $P<0.05$.

Table 2. Percent frequency of crested wheatgrass seedlings growing on experimental range seeding plots near Ritzville, Washington, in June 1983

Method of Planting	Untreated	Disc		Burn		Summer Burn
		Spring	Fall	Summer	Fall	Fall Glyphosate
	- - - - - - - - - - - - - - - - % - - - - - - - - - - - - - - - -					
Drill	13a[1]	60a	53a	67a	90a	100a
Imprint	7a	47a	77a	60a	40b	73b

[1] Means within columns followed by the same letter are not significantly different at $P<0.05$.

STUDY 2

Beginning in fall 1982, the effectiveness of establishing Nordan crested wheatgrass seedlings by broadcasting seed before or after imprinting was compared to planting with a rangeland drill equipped with regular or deep furrow openers. The study site, an *Artemisia tridentata* subsp. *wyomingensis/Stipa thurberiana* habitat type, is on the Squaw Butte Experiment Station. At this location soil depth is 30 inches; elevation is 4,620 feet. Shrub canopy cover is 20 percent and herbage production averages 570 pounds per acre.

PROCEDURE

Seedbeds were either unprepared or prepared by brush beating or brush beating followed by discing. Brush beating was applied during August 1982, and seedbeds were disced in August 1982 and again in October 1982 after *Bromus tectorum* seedlings had emerged. Crested wheatgrass seed was planted at the rate of 6 pounds pure live seed per acre in October 1982, and seedling densities and frequency were determined in September 1983.

RESULTS

An average 0.7 seedling per square foot was established by drilling on the untreated seedbeds, and 1.1 seedling per square foot was established by drilling on the brush beat seedbeds (Table 3). Only an average 0.25 seedling per square foot was established with broadcasting seed before or after imprinting. The most seedlings 2.2 and 3.5 per square foot were established by drilling and imprinting after broadcasting, respectively, on seedbeds prepared by brush beating and discing. Almost one seedling per square foot was established by seeding after imprinting. Seedling distribution as determined by percent frequency was similar to seedling density. The greatest density and best distribution resulted from drilling

on seedbeds prepared by brush beating and brush beating plus discing, and from broadcasting seed before imprinting on seedbeds prepared by brush beating plus discing (Table 4).

Table 3. Mean density of crested wheatgrass seedlings growing on experimental range seeding plots on the Squaw Butte Experiment Station in southeastern Oregon in September 1983

Seedbed Preparation	Regular Drill	Deep Furrow Drill	Imprint Seed	Seed Imprint
	Number per square foot			
Untreated	0.8a[1]	0.6a	0.2a	0.3a
Brush beat	1.3a	0.9ab	0.2b	0.3b
Brush beat-disc	2.2b	0.3c	0.9c	3.5a

[1] Means in rows followed by the same letter are not significantly different at $P<0.01$.

Table 4. Percent frequency of crested wheatgrass seedlings growing on experimental range seeding plots on the Squaw Butte Experiment Station in southeastern Oregon in September 1983

Seedbed Preparation	Regular Drill	Deep Furrow Drill	Imprint Seed	Seed Imprint
	%			
Untreated	55a[1]	43a	23a	40a
Brush beat	72a	50ab	25b	33ab
Brush beat-disc	95a	28b	80a	98a

[1] Means in rows followed by the same letter are not significantly different at $P<0.01$.

SUMMARY

We must remember these seeding were planted and seedlings established during periods of above average precipitation in Washington and Oregon. More than one seedling per square foot established on 37 percent of the plots and

1 to 0.5 seedling per square foot established on 29 percent. More than 1 seedling per square foot is considered a good stand and 1 to 0.5 seedling per square foot a fair stand.

In Washington and Oregon, the removal of litter and plant competition enhanced seedling establishment. Removal of litter by burning or discing exposed mineral soil, and discing provided a loose seedbed that allowed the imprinter to operate most effectively.

Drilling was superior to imprinting on seedbeds prepared by fall burning, summer burning plus fall glyphosate, and brush beating. Drilling and imprinting produced similar results on unprepared seedbeds and those prepared by discing, summer burning, and brush beating plus discing. The cause for similar seedling densities resulting from drilling and imprinting after summer burning when compared to the superiority of drilling over imprinting after fall burning is unknown. Competing vegetation, however, was denser after summer burning and the number of *Ventenata dubia* seedlings was twice as great after summer burning.

Imprinting was superior to drilling in number of seedlings established in year 1 only when seed was broadcast just before imprinting into brush beat and disced seedbeds in southeastern Oregon. Good stands were established by both methods, however, pulling the water-filled land imprinter will probably require more horsepower than a comparable sized rangeland drill.