

# Drilling Wheatgrass into Sprayed Sagebrush In Northeastern California

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There are a great many approaches to the improvement of sagebrush ranges. The purpose is to reduce sagebrush and other undesirables and increase good grasses and other valuable forage plants. Common methods used in northeastern California are: plowing and seeding, burning and seeding, burning alone, spraying alone, and sometimes burning, plowing and seeding, or spraying, plowing, and seeding. Another possibility is spraying to kill the sagebrush and drilling seed of desirable forage species directly into the stand of dead sagebrush. The cost of plowing is eliminated. Unlike

plowing, discing, or burning, the spraying and drilling technique is characterized by minimum disturbance of vegetation and soil. In some cases this can be an advantage. Dead standing sagebrush will catch more snow, improve temperatures, reduce frost heaving, reduce wind velocity at the soil surface, and reduce erosion. The abrasive action of windblown soil on plant seedlings has been reported (Lyles 1960). Native perennial grasses are not destroyed as with plowing. Rocky ground can be seeded by this method. Likewise, there may be benefits from drilling without other soil dis-

turbance, depending on the soil involved. Soil crusting, reduced infiltration, and erosion can be averted. It also provides a firm seedbed for direct drilling. These possible manifold advantages are difficult to measure and will vary with soil type and climate. The technique has not been widely used because the heavy-duty planting equipment necessary for operation in the dead brush has been lacking. Now, however, this two-step low-erosion-hazard range conversion program is possible because of two pieces of machinery—agricultural aircraft and the rangeland drill (Hull 1957, 1958). Approximately 5,200 acres of sagebrush in Idaho has been treated by this method at an average total cost of \$5.00 per acre.

Sagebrush in northeastern California can be killed with aircraft application of 2,4-D when plants are susceptible. Two pounds active ingredient of 2,4-

D ester (2-4-dichlorophenoxy-acetic acid) properly applied to sagebrush by airplane during the active growing period will give 95-100 per cent kill if soil moisture is sufficient for brush growth (Cornelius 1955, 1958). Most years there is sufficient soil moisture. Spraying of sagebrush is accepted as a common practice in the study area, and is widely used by ranchers and public land managers. Thus step number one of this two-point conversion is readily accomplished. The remainder of this paper deals with the second step of the conversion—the establishment of wheatgrasses in the stand of dead sagebrush.

The effectiveness of direct drilling of wheatgrasses is inversely proportional to weed production or competition. Weed competition or production of resident annual plants in arid sagebrush country is extremely variable from season to season, being primarily a function of weather and soil moisture.

### Methods and Results

The study area, two miles northeast of the town of Likely, Modoc County, California, is commonly referred to as table land and usually grows big sagebrush (*Artemisia tridentata*), cheatgrass (*Bromus tectorum*), squirrel tail (*Sitanion hystrix*), Sandberg bluegrass (*Poa secunda*), and red-stem filaree (*Erodium cicutarium*)<sup>1</sup>. Annual precipitation averages 12½ inches, though seasonal totals vary widely. The elevation is 4500 feet. The growing season is short and variable. The cheatgrass may germinate as early as October. Grazable growth, however, may not appear until May of the following year, though it may start as early as February in a warm wet spring. In all

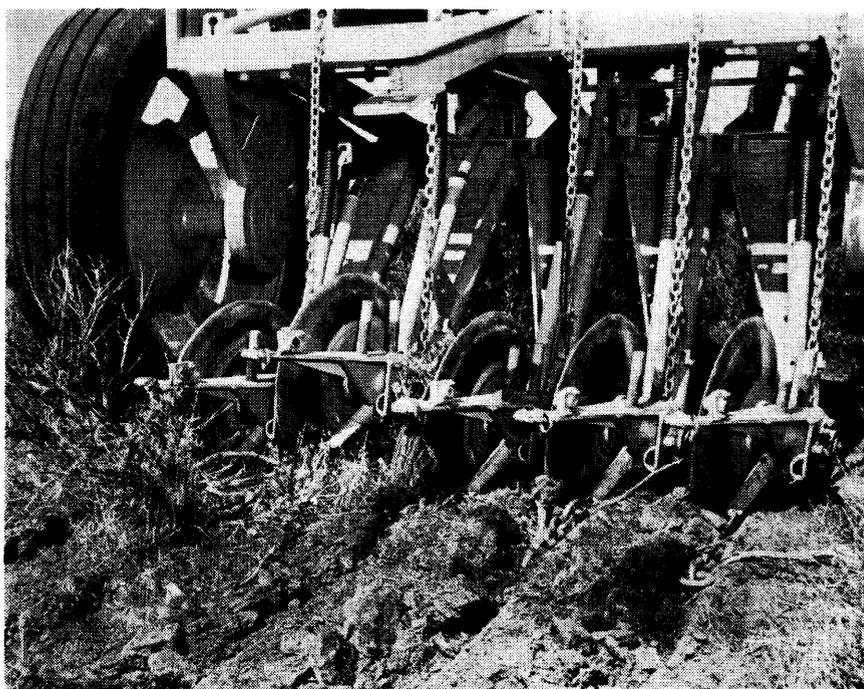


FIGURE 1. Rangeland drill seeding directly into dead sagebrush.

years, the annual grasses are dry by the end of June. Winter temperatures may fall below zero.

The soil is classified as Yancy slightly gravelly loam. The A horizon is 0-4 inches deep and is a gray brown slightly gravelly loam of pH 6. The B<sub>1</sub> horizon is located at 3-8" depth and is a slightly gravelly clay loam. The B<sub>2</sub> horizon is located at 8-18" and is a brown to dark brown clay of pH 7. Below this is an indurated layer several inches thick which is silicic cemented.

Crested wheatgrass (*Agropyron desertorum*) intermediate wheatgrass (*A. intermedium*) and pubescent wheatgrass (*A. trichophorum*) seed was drilled into sprayed sagebrush in four successive seasons. The resulting wheatgrass stands were sampled by the stocked quadrat system described by Hyder (1954).

Ratings of excellent, good, etc. were applied as suggested by Hyder for this rainfall zone. Fifty percent or better stocking of one-square-foot quadrats was rated excellent, 40-50 percent good, 25-40 percent fair, 10-25 percent poor, and 9 percent or

less as failure. Only the area between sagebrush plants was sampled. The drill openers rode up and over sagebrush plants, resulting in no planting in these areas. Measurements before spraying indicated that only 12 percent of the ground was covered by sagebrush.

During years of adequate spring rainfall the area between the sagebrush plants is covered by weedy annuals, primarily cheatgrass. In seasons with low spring rainfall this interspace is largely bare ground. The measure of competition was total herbage production (mostly cheatgrass), measured on adjacent areas cleared of brush.

The first seeding germinated in the spring of 1955, a year when the interspaces were essentially bare. Competition from resident annual plants was considered about median in the spring of 1955. The establishment of pubescent wheatgrass was excellent.

Competitive conditions during 1956 were similar to 1955. Again cheatgrass production was about median for the area. An excel-

<sup>1</sup>The area was officially established as a University of California demonstration range in June 1954 and has been used for research in range problems since that time.

**Table 1. Result of drilling directly into sprayed sagebrush.**

Date of Seeding	9-17-54	11-2-55	4-4-57	10-23-57		
Yield of resident annuals-pounds oven dry/acre year of establishment of wheatgrasses	210	240	970	90		
Species seeded	Pubescent wheatgrass	Mixture of crested, pubescent and intermediate	Mixture of crested and intermediate	Intermediate wheatgrass	Pubescent wheatgrass	Crested wheatgrass
Percent stocking of wheatgrass plants June 1960 <sup>1</sup> (one square foot frame)	65	81	13	7	12	65
Rating <sup>1</sup> of wheatgrass stand.	Excellent	Excellent	Poor	Failure	Poor	Excellent

<sup>1</sup>Hyder 1954 50-100% excellent, 40-50% good, 24-40% fair, 10-25% poor, 9% or less failure.

lent stand of a mixture of pubescent and intermediate wheatgrasses resulted.

The third seeding was rated poor. Production of resident annuals was 970 pounds of dry matter per acre, several times that of the previous two years. A multiple increase in ground cover (mostly cheatgrass) competed seriously with the seeded species. The interspaces between brush plants were well covered with cheatgrass.

This was the only seeding of the four reported made in spring. Lack of success of this seeding was not attributed to season of seeding. Spring seedings have consistently proven to be more reliable than fall seedings and produce equally as good stands in this area.

Stand establishment was excellent again on the fourth seeding. Cheatgrass production was 90 pounds, the lowest of the four years studied. Because of the large amount of cheatgrass seed produced the previous season, a dense stand of cheatgrass started between the brush plants. Most of the cheatgrass died before reaching one inch in height. It is

interesting to note that under these conditions pubescent and intermediate wheatgrasses established poorly whereas crested wheatgrass produced an excellent stand.

**Discussion and Conclusion**

Wheatgrasses were successfully established following the

killing of sagebrush with 2,4-D with a minimum of disturbance to the site. Seed was planted between dead sagebrush plants with a rangeland drill. Sagebrush was not removed.

Establishment was excellent in years when production of the associated resident annuals was high. Median production of resident annuals is about that experienced during the first two years of this study. It therefore appears that drilling wheatgrass seed directly into an area of dead sagebrush is a good risk in the area studied.

**LITERATURE CITED**

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FIGURE 2. Pubescent and intermediate wheatgrasses seeded in November, 1955. Photo was taken June 1960.