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Fourwing Saltbush Establishment in the Keating Uniform Shrub Garden--First Year Results

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Abstract

Site preparation techniques to aid establishment of fourwing saltbush (Atriplex canescens) were compared at a test location in eastern Oregon. Survival and growth of transplanted seedlings were improved after one season of growth by either spot spraying with herbicides or scalping to reduce competing vegetation. Average growth of seedlings was greater with the spray treatment than with scalp treatment. Control of plant competition should improve transplanting success of fourwing saltbush in many related rangeland areas.

Keywords: Forage production, range production, seedling establishment, site preparation.

Introduction

Land managers commonly seek information on plant materials and techniques for improving forage and cover on livestock and mule deer (Odocoileus hemionus) 1/ foothill ranges adversely affected by wildfire, improper grazing, and other disturbance. In eastern Oregon, these ranges are typically dominated by less desirable forage plants such as cheatgrass brome (Bromus tectorum L.), medusahead wildrye (Elymus caput-medusae L.), Japanese brome (Bromus japonicus Thunb.), big sagebrush (Artemisia tridentata Nutt.), rabbitbrush (Chrysothamnus spp. Nutt.) and a variety of forbs. Some ranges have been successfully seeded to domestic grasses, usually crested wheatgrass (Agropyron desertorum Schult.), to increase available livestock forage and lessen grazing pressure on desirable perennial native plants. Such

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1/ Scientific and common names are from Garrison and others (1976) and Ingles (1965).

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seedings commonly lack a suitable variety of forage or wildlife cover, so land managers often wish to interseed shrubs and herbaceous species. Benefits to both wild and domestic animals result from diversification of the vegetation species and structure (Margalef 1969).

The Keating range in Baker County, Oregon, is typical of foothill areas where vegetative improvement has been a longstanding concern. The range includes 45,000 acres of crucial deer winter range with a mosaic of depleted sites and extensive grass seedings. Mule deer winter on the range from December through March. Livestock, mostly cattle, graze in a variety of management systems, generally from mid-April to late July, and may return in the fall, depending on forage availability.

Fourwing saltbush (Atriplex canescens (Pursh) Nutt.)) has been widely recognized as a valuable shrub for rangeland plantings on a wide variety of ecological sites (Plummer and others 1966). In shrub adaptability studies conducted on the Keating range, this plant has shown high potential for contributing green forage, wildlife cover, and plant diversity on eastern Oregon rangelands.2/

Competition from herbaceous plants, particularly annual grasses, has been an important factor limiting the establishment and growth of more desirable perennials, including shrubs, on harsh rangeland sites (Holmgren 1956, Hubbard 1957). Effective, yet relatively inexpensive, site preparation techniques are needed to help make range rehabilitation a more attractive investment for range managers. This paper reports the results of a study to determine whether survival and growth of fourwing saltbush transplants would be improved by eliminating herbaceous vegetation through scalping or spraying herbicide.

2/ Unpublished data on file with the junior author at the Forestry Sciences Laboratory, Wenatchee, WA.

Study Area

The trial was conducted in a deer-proof exclosure called the Keating Uniform Garden located about 30 miles east of Baker, Oregon, within the Keating deer winter range. The exclosure is on a terrace with a soil derived principally from weathered granitic outwash from upper slopes. The soil was formerly mapped as the Brownlee series, but we believe it would now be considered of the Brownscombe series, a fine montmorillonitic, mesic Calcic Argixeroll. The lower subsoil is very weakly to moderately calcareous. The solum is about 64 to 76 centimeters (25 to 30 in) thick. It has a loam to silt loam surface layer 20 to 25 centimeters (8 to 10 in) thick over a clay loam subsurface layer that grades into weathered granitic outwash below the solum. The slope ranges from 2 to 7 percent on a dominantly southern aspect at an elevation of 976 meters (3,200 ft). Precipitation averages 30 centimeters (12 in) and occurs mostly in winter and spring. Fall rains may provide adequate moisture for germination of late season annuals and greenup of cool season grasses.

Existing vegetation at the time of exclosure construction was an established crested wheatgrass seeding. Vegetation on nearby unseeded range suggests that the previous plant community was dominated by big sagebrush, cheatgrass brome, and several forbs, with scattered rabbitbrush and remnant native bunchgrasses. Most of the seeded grass in the portion of the exclosure used for this trial had been removed by discing in 1976, and the vegetation had reverted to a dense cover of cheatgrass brome and less desirable forbs (fig. 1).

Figure 1.--The generally abundant grass and forb competition are shown in the untreated (control) plot in the foreground. Planted shrubs are visible in the scalped and chemically treated plots in the background. Photograph was taken near the end of the growing season.

Readers should recognize that there are limitations in application of the study results, because a single location was utilized. It is unlikely that all locations will respond in exactly the same fashion. Our test location is, however, typical of local problem conditions and we are confident the results in general are broadly applicable to the Keating range. This study has provided guidance for subsequent tests whose results will provide better quantification of treatment responses.

On April 23, 1981, when this study was initiated with field layout and spraying, annual grasses and forbs had germinated and developed to an average height of 3 centimeters (1 in). Pre-treatment estimates of layered canopy coverage (Daubenmire 1959) on 90 plots 1-meter square (9-ft^2) showed that total cover averaged 67 percent; annual grasses averaged 42 percent, perennial grasses 3 percent, and forbs 22 percent. Abundant individual species were cheatgrass brome 42 percent, alfilaria (Erodium cicutarium (L.) L'her.)) 10 percent, and tumblemustard (Sisymbrium altissimum L.) 9 percent. Later observation of untreated plots, when grasses and particularly forbs matured, indicated that layered canopy cover exceeded 100 percent.

Methods

Three replications of three treatments were assigned in a completely random design to nine 5.5- by 20.1-meter (18- by 66-ft) plots. The three treatments were: spot scalp, spot spray, and control (no treatment). Spots were about 1 meter square spaced on 1.8-meter (6-ft) centers to give 30 planting spots per replicated plot or 90 planting locations for each treatment over the three replications for a total of 270 planting locations.

Roundup[3/] herbicide was applied on competing vegetation in the spray spots to the foliar wetting point with a backpack sprayer. Herbicide concentration was about 3 percent v/v (4 fluid ounces of herbicide concentrate per gallon of solution, with 2 fluid ounces of No Foam B sticker per gallon). The concentrate contained 41 percent active ingredient. (Our objectives did not include rate testing so we have no idea whether lower rates would have similarly affected the treated vegetation.) Container-grown fourwing saltbush seedlings were hand planted with tree planting bars in the center of spot treatments and in the same spacing in control plots.

3/ The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture of any product or service to the exclusion of others which may be suitable.

Scalping and planting of container stock were performed 2 days after spraying. Scalps were made to about 3-centimeters (1-in) depth with a large hoe. Samples taken at planting indicated an average soil moisture of 24 percent (by weight) in the 2 to 15 centimeters (1 to 6 in) zone and 23 percent in the 15 to 30 centimeters (12 to 18 in) zone. There was a 1 centimeter (1/2 in) thick surface crust of air-dry soil.

The seedlings used in this study were grown from seed provided by the USDA Forest Service, Intermountain Forest and Range Experiment Station and the Utah Department of Fish and Game. The seed was harvested from a seed orchard in central Utah. The original source of the material was Rincon Blanco in Rio Arriba Co., New Mexico, USA (ref. U-92).

Seeds were germinated and seedlings grown in 175-cubic centimeter (10.7-cubic inch) containers for approximately 3 months in a controlled greenhouse environment. A commercial peat and vermiculite potting mix was the growth medium. Water and supplemental fertilizer was applied as necessary. On March 16 lights and heat in the greenhouse were turned off and the seedlings "hardened off" by exposing them to cool, fluctuating temperatures. No temperature records were made. Just prior to planting on April 23 the stems averaged 11.6 centimeters (4.7 in) tall.

First season survival and growth were evaluated in early September 1981. Live plants in each treatment were counted and maximum height of the tallest twigs measured. Missing plants were considered dead but causes of mortality were not determined.

Results were tested by a one-way analysis of variance and by Scheffe's test of treatment means (Freese 1967). Tests of significance were made at a probability less than or equal to 5 percent.

Results

Number of live shrubs, percent survival, and height growth are summarized in table 1. There were significantly more live plants in both scalp and spray treatments than in the control, but there was no difference in survival between the scalp and spray treatments. Height growth on the control was less than half that on other treatments, and height growth was less on scalp than on spray treatments.

Weed invasion at the end of the first growing season was nil and was not quantitatively evaluated. Competition control was excellent by both methods.

Table 1--Mean response by fourwing saltbush transplants to three treatments, measured at the end of the first growing season[1]

Parameter	Control	Scalp	Spray
Number live	13 a	30 b	26 b
Percent live	43 a	99 b	87 b
Mean maximum height of live plants (cm)	15 a	31 b	43 c

[1] Entries on the same line followed by different letters are statistically different, according to Scheffe's test of means. Means were rounded to the nearest whole unit.

Discussion and Conclusions

Preliminary tests of establishment by fourwing saltbush transplants indicate that vegetative competition must be treated to achieve high levels of survival and growth, even when soil moisture conditions are good at planting time.

Fourwing saltbush plants on the control plots, although small, appeared healthy, indicating they had a reasonable chance of surviving winter and possibly growing well the following year.

We suspect that the maintenance of litter and surface soil associated with the spray treatment are advantages over scalping. The litter cover reduces evaporation of surface soil moisture and also provides better protection from erosion. This opinion is based on general conservation principles and was not verified by site-specific data.

Plant spacing was relatively close because of the short duration of this study, and we assumed no rooting interactions among plants. Thus, even if spacing were increased, percentages of survival and growth would likely be unchanged. In an operational project, wider spacing would maximize the area that could be covered with available manpower, plant materials, and time. With wider spacing, however, the value of each shrub increases and initial control of herbaceous competition becomes more critical to the long-term success of the project.

Since funding, labor, and available planting time are usually critically short, we recommend chemical control of competing vegetation under the conditions studied. Although time required for application of treatments was not recorded, spraying was three to four times faster than scalping and was much less tiring.

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