Evaluation of Winterfat (*Eurotia lanata*) in Washington

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Highlight: *Winterfat is high in nutritive quality and is especially suited for winter grazing. Improved techniques are needed before winterfat can be established on a practical basis. Winterfat withstood clipping well at intensities of use varying from 0 to 80%. Crude protein content was 17.41% from samples taken October 30, 1969. Strains from Utah proved inferior to native winterfat from Washington State. Cool temperatures seemed to hinder germination and survival of seedlings from Utah.*

Winterfat (*Eurotia lanata*) is a highly palatable, nutritious, and drought tolerant shrub occurring on vast areas of rangeland in the western states. In Washington, ranchers consider winterfat a high quality forage plant, especially during late fall and winter months when the nutritive value of standing grass is low.

Dayton (1931) found that all livestock, especially cattle and sheep, relish winterfat, but its chief value is on winter range. Smith (1900) reported livestock thrive well and are remarkably free from disease when grazing winterfat because of its tonic properties.

Daubenmire (1970) states winterfat areas in Washington are confined closely to the center of the *Artemisia tridentata-Agropyron spicatum* vegetation zone, where there is least rainfall and most heat. This is mainly in Yakima, Benton, Franklin, and Grant counties. It is most abundant in the Great Basin of Utah and Nevada.

The purpose of this study was to gather much-needed information on establishment, reproduction, and response to fall clipping preliminary to using winterfat in range seedings.

Procedure

The study was conducted at the Dryland Research Station about 3 miles northeast of Lind, Adams County, Washington, during 1968, 1969, and 1970. The study plots were observed again in 1973.

Forty-six winterfat plants were transplated on March 5, 1968, from the Wahluke slope (southern foot of Saddle Mountain), approximately 14 miles east of Mattawa, Grant County,

Fig. 1. *Winterfat on Wahluke Slope in Washington. Plants have an average height of 7 inches and make up 81% of plant composition on this site. Tape is 3 ft long. Total yield was 531 lb/acre. Photo taken July 28, 1970.*

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Manuscript received May 23, 1974.

Fig. 2. *Transplanted winterfat on Dryland Research Station before clipping. Plants have an average height of 15 inches.*

Wash., to the Dryland Research Station. The plants were taken from an almost "pure" stand of winterfat (Fig. 1). A ten-plot (9.6 ft^2) transect showed the plant composition to be: 81% winterfat, 11% cheatgrass (*Bromus tectorum*), and 8% Sandberg bluegrass (*Poa sandbergii*). In a relatively undisturbed winterfat site, Daubenmire (1970) reports that winterfat and Sandberg bluegrass make up the vascular vegetation and that cheatgrass invades the site in proportion to the reduction of Sandberg bluegrass.

The winterfat plants were dormant at the time of transplanting and had only 1.5-inch stubble height because cattle had been grazing the area through the winter. The plants were dug, keeping as much soil around roots as possible, placed in cardboard boxes, and taken to the research station. On a plot area that had been summer-fallowed the previous year, holes were dug 3 ft apart. The holes were filled with water, and as the water soaked into the soil, plants were firmly placed. Out of the 46 winterfat transplants, 42 survived. The plot area was kept free of weeds by hoeing.

The soil on the Dryland Research Station is described as Ritzcal silt loam, 5% slope and 60 inches deep. The pH ranges from 7.6 at surface to 8.4 at 24 inches deep. Longtime average annual precipitation is 10.11 inches, with elevation of 1,700 ft. Temperatures range from a maximum of 116° to a minimum of -33°F.

The soil on the Wahluke slope is Babcock silt loam, 5-10% slope. A strongly cemented lime-silica hardpan is present in the profile at 26 inches. The pH ranges from 8.3 at the surface to 8.6 at the 26-inch depth. Annual precipitation is 6.36 inches, and elevation is 1,100 ft. Temperatures range from a maximum of 118°F to a minimum of -23°F.

Established transplants were divided into four groups and clipped November 5, 1968, October 30, 1969, and November 2, 1970, to simulate 0, 30, 50, 80% use. Each use group consisted of 10 plants, except for the 30% group, which had 11 plants. Each fall, the plants were measured for height (Fig. 2) and then clipped for production weights at the different degrees of use (Fig. 3). It was determined that, for 30% use, a 7-inch stubble was to be left; for 50%, a 5-inch stubble; and for 80%, a 3-inch stubble. The no-use group, which was not clipped, served as a check plot.

Plants were clipped, placed in paper sacks and weighed. When air-dry, they were reweighed so pounds-per-acre of forage produced at different degrees of use could be obtained. In 1968 and 1969, stems with seed were sent to the Plant Materials Center, Pullman, for threshing and cleaning. In 1970, seed was not cleaned. Some of the 1969 clippings were sent to Agriculture Research Service, Pullman, for crude protein analysis.

In the spring of 1969, studies included: germination, seedling vigor, and plant survival of seed grown from transplanted winterfat. For a comparison, Utah winterfat seed was

Fig. 3. *Transplanted winterfat after clipping to 0 (lower left), 30, 50 and 80% (upper right) use; or to a height of 0, 7, 5 or 3 inches.*

Table 1. Average height (inches) at time of clipping, forage production (lb/acre air-dry) and for winterfat transplanted March 5, 1968, Lind, Washington.

Utilization (%)	Clipping height (inches)	November 5, 1968		October 30, 1969		November 2, 1970		Average	
		Avg ht	Production	Avg ht	Production	Avg ht	Production	Avg ht	Production
0	0	16.3	–	14.6	–	15.0	–	15.3	–
30	7	15.2	697	14.5	1670	13.4	1044	14.4	1137
50	5	15.9	1011	15.0	1787	13.8	1068	14.9	1289
80	3	17.9	2041	15.7	2745	15.8	2844	16.5	2543

obtained from a collection made October 12, 1968, approximately 2 miles south of Vernal, Utah. Elevation there is 5,280 ft and annual rainfall, 8.53 inches.

Seed collected from Washington and Utah in fall of 1968 was stored in a refrigerator (38° to 40°F) to maintain high viability. Springfield (1968) found five out of six different seed sources stored at 38° to 41°F for 2.5 years germinated 14% better than seeds stored at 55° to 90°F.

On April 1, 1969, seed from Washington and Utah was planted on a summer-fallowed plot at the research station. Furrows 12 ft long and 28 inches apart were made with a hoe. Seeds were placed about 1 inch apart and covered with ¼ inch of soil.

Results and Discussion

The average height of the transplanted winterfat plants at clipping time and the forage production for the 3 years are shown in Table 1. Five of the ten plants in the 80% use group were next to a summer-fallow field 2 of the 3 years. This may account for some of the height and production, since plants would have additional moisture to draw on from the adjacent summer-fallow area. The only noticeable effect that different degrees of clipping had on the three groups was a delay in spring growth of the 80%-clipped group. However, with two-thirds of the growing season past, plants in the clipped groups had the same height as the non-use group. No plants showed any damage in vigor or health because of fall clipping.

In July, 1970, the winterfat site on Wahluke Slope was observed. This area had been grazed hard for many years in the fall-winter-spring season. However, it had been rested from grazing for the past year and responded favorably. This indicates that the plant withstands some over-use and does respond to regulated grazing.

Winterfat is a prolific seed producer (Dayton, 1931). (And it was true in this study.) Most of the plants in each group produced good seed each year; however, by clipping date, the wind had already scattered much of the seed. Each spring seedlings were abundant, but only about 10% survived. The study area, undisturbed since the 1970 fall clipping, was revisited in July, 1973. Twenty winterfat seedlings had become established on the plot area with an average height of 9 inches. Also, 11 bluebunch wheatgrass (*Agropyron inerme*), 2 big bluegrass (*Poa ampla*), and numerous cheatgrass plants had become established.

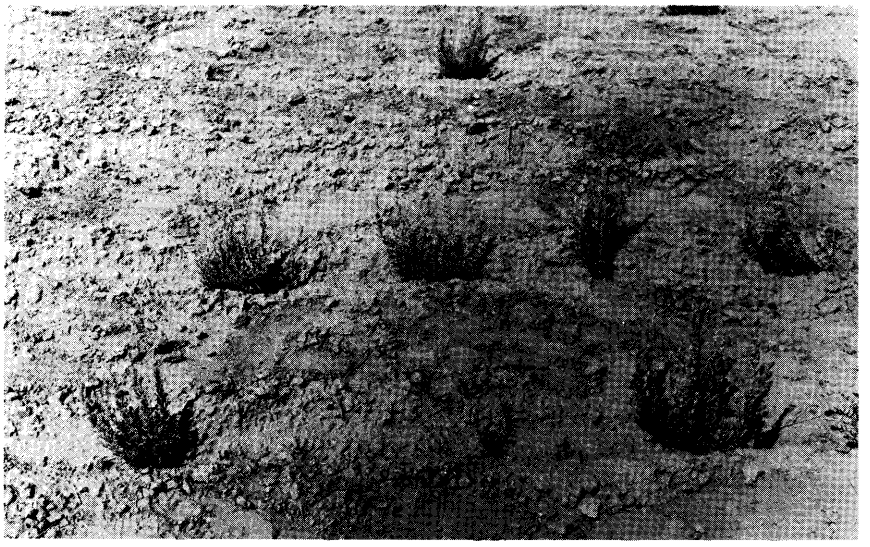

Fig. 4. *Established winterfat seedlings at end of first growing season, August 1969, averaged 10 inches high. Seed was collected from transplanted winterfat (Fig. 2) and seeded April 1, 1969.*

Using seed collected in the fall of 1968 from Washington and Utah, a germination test was conducted twice by placing 50 seeds, from each location, between paper towels and kept moist with distilled water at room temperature, 72°F. Within 5 days, seeds were germinated. The Washington seed had 94% germination; the Utah seed, 100%. The Utah seed was larger and seemed to be more vigorous. It was collected from mature plants. The smaller size and lower germination rate of Washington seed may be a result of the plants having been transplated, thus yielding some immature seeds.

Seed planted April 1, 1969, was covered with about ¼ inch of soil. Statler (1967) found ¼ inch deep best in his Wyoming study, and Springfield (1970, 1971) states "surface–and 1/6-inch-depth seeding was superior to 1/8 inch depth in New Mexico." Seedlings were counted and recorded on five different dates (Table 2).

Although the Utah seed had a higher germination rate, the

Fig. 5. *Winterfat (same as pictured in Fig. 4) after five growing seasons averaged 17 inches high. Many young plants with an average height of 8 inches have become established in the plot area through natural reproduction.*

Washington seed appeared to be better adapted (Fig. 4), since twice as many plants survived.

During April and the first week of May, some seedlings appeared to have frozen. Weather records confirmed this by showing that night-time temperatures during the period from April 1 to May 3 had dropped to 32°F three times, 31°F four times, and 30°F twice. The average minimum temperature for April was 36.1°F. These cool temperatures undoubtedly had an effect on germination and seedling survival. Statler (1967) and Springfield (1972) found germination and seedling establishment to be hampered by low temperatures. Precipitation for April and May was above average, indicating moisture was not a detrimental factor in germination or seedling survival.

Plant heights for both seed sources were much the same after the first growing season (note Oct. 30 date in Table 2). During the second growing year, plants from both sources became larger and more mature. On November 2, 1970, the 24 Washington plants had an average height of 15 inches, and the 11 Utah plants averaged 16 inches high.

It was estimated the Utah plants produced about 3 times more seed than the Washington plants. Approximately 50% of the Washington seed was produced by only 4 of the 24 plants.

Many seedlings had become established from seed scattered by wind, rain, and snowfall during the fall and early winter of 1969. These seedlings reached an average height of 12 inches in both Washington and Utah plot areas as observed on November 2, 1970. When plot areas were revisited in July, 1973, a total of 92 seedlings with an average height of 8 inches was recorded in the Washington plot (Fig. 5). The Utah plot had 91 seedlings with an average height of 12 inches. This suggests

Table 2. Seedling count on seven 12-foot rows and average plant height (inches) of winterfat seed planted April 1, 1969, Lind, Washington.

	Washington seed		Utah seed	
Date of count	Number of plants	Avg plant ht	Number of plants	Avg plant ht
May 2, 1969	24	0.5	24	0.5
May 20, 1969	29	1	15	1
June 17, 1969	26	3.5	12	3.5
Aug. 5, 1969	24	9	11	9
Oct. 30, 1969	24	10	11	9.5

winterfat may be established by late fall-early winter broadcast of seed still within the hairy utricles. Removal of seed from the hairy utricles is expensive and is not advocated, because establishment is usually better from planted utricles than from extracted seed (Plummer et al, 1968). Daubenmire (1970) found winterfat had vigorously invaded abandoned cropland because of its natural seeding ability.

Winterfat is very nutritious and palatable. A number of forage analyses have indicated a very high percentage of crude protein. Cook and Harris (1968) reported the average crude protein of winterfat on Utah desert ranges during the winter grazing season (October-March) was 9.1%. Riedl et al. (1964) in a study near Laramie, Wyoming, had crude protein of 10.41% on October 26. A chemical analysis by the Agriculture Research Service, Pullman, of plants clipped October 30, 1969, showed the crude protein to be 17.41%.

Conclusion

Winterfat can be easily transplanted with excellent plant survival. Fall (winter) use up to 80% does not seem to affect vigor or health of winterfat, provided it is not grazed any other time of the year. Planting threshed winterfat seed can be successful if temperatures are not too cold and soil moisture is near field capacity. Planting winterfat seeds still within the hairy utricles in late fall-early winter looks promising. The crude protein percent of winterfat is high. Seedings of winterfat would increase the forage quality of late fall-early winter ranges where the nutritive value of standing grass is low.

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