

MULTI-SPECIES GRAZING OF LEAFY SPURGE INFESTED RANGELAND IN SOUTHWESTERN NORTH DAKOTA USING ROTATIONAL GRAZING

Lyndon L. Johnson¹, Kevin K. Sedivec², Timothy C. Faller³,

Jack D. Dahl⁴, and Jerrold L. Dodd⁵

Investigators are ¹graduate research assistant and ²extension rangeland specialist/assistant professor, Animal & Range Sciences Dept., North Dakota State University, Fargo, ND 58105;

³Director and ⁴agricultural research technician, Hettinger Research Extension Center, Hettinger, ND 58639; ⁵Professor/Chair, Animal & Range Sciences Dept., North Dakota State University, Fargo, ND 58105.

Significance of Leafy Spurge

Leafy spurge (*Euphorbia esula* L.) is a competitive, noxious plant species of Eurasian origin now widely dispersed across the northern hemisphere, including the United States and Canada. The infestation is concentrated in southern Canada and the north-central United States (Whitson 1996). Leafy spurge was first observed in New England in 1827 and in North Dakota in 1909; it has since spread to all of North Dakota's 53 counties (Lym et al. 1993 in Hirsch and Leitch 1998). The N. D. Agricultural Experiment Station has researched leafy spurge since the 1920's; Canadian scientists are credited with the most extensive research on the species during the 1950's and 1960's (Messersmith and Lym 1990). N.D. Dept. of Ag. (1996) estimates are that leafy spurge infests one million acres in the state. This equates to six percent of North Dakota's untilled land--more leafy spurge infested land area than in any other state. Leafy spurge infestations in the four-state region of North Dakota, Montana, South Dakota, and Wyoming have significant economic consequences (Leitch et al. 1994). These economic consequences are enormous because the species' invasive characteristics allow it to displace native plant communities, chemical controls are very costly and difficult to apply in rugged terrain, and the plant is unsuitable for cattle grazing due to intrinsic aversive compounds, i.e, digestive tract irritants. Leafy spurge infestations may reduce grass production as much as 50%; cattle carrying capacity on native rangeland may be reduced by as much as 75% due to leafy spurge infestations (Lacey et al. 1984).

Leafy spurge is a perennial forb that begins growing in early spring that reproduces vegetatively and by

seed. Lajeunesse et al. (1995) reported that the species produces an extensive adventitious root system with vertical roots as deep as 26 feet and horizontal roots extending as far as 15 feet per year; new shoots may sprout from buds significant distances from the parent plant. This root complex allows the plants access to extensive nutrient and water resources. Seeds and root pieces may be spread mechanically by man, grazing livestock, and wildlife; the seeds will float on water. Mature leafy spurge seed capsules explode--projecting seeds up to fifteen feet--and these seeds remain viable in the soil for as long as eight years (Lajeunesse et al. 1995).



Management of leafy spurge infestations may include physical control (cultivation, mowing and burning, and hand weeding), plant competition (reseeding and grazing management), biological control (naturally occurring insects and pathogens), and chemical control (herbicides) (Lajeunesse et al. 1995). Sheep and goats will consume the plant though Walker et al. (1994) demonstrated that goats had a higher preference for leafy spurge than sheep. The experience of ranchers and range researchers shows that goat and sheep grazing can be effective and relatively rapid in controlling leafy spurge infestations on native rangelands (Lacey et al. 1984).

Complementary dietary preferences and foraging behaviors among ungulate herbivores generally make multi-species grazing economically and ecologically advantageous over single-species grazing in any situation. Domestic goats, deer, and pronghorn are categorized as browsers (selective for forbs and shrubs), domestic sheep, burros, and mountain goats are intermediate feeders (variably selective for grasses, forbs, and shrubs) while cattle, horses, and bison are grazers (consuming primarily grasses) (Vallentine 1990). The principal objective of multi-species grazing is better utilization of grasslands and improved animal production. For these reasons the grazing habits of cattle and sheep complement one another and offer economical and ecological benefits (Esmail 1991).

These advantages may be accentuated when employing goats or sheep in multi-species grazing efforts on leafy spurge infested rangeland. These two species are generally able to overcome leafy spurge's intrinsic aversive compounds following a transition period. Leafy spurge plants are leafy and succulent with significant nutritive value (based on chemical composition) throughout much of the growing season (Fox et al. 1991) though Kronberg and Walker (1999) demonstrated that several factors may account for differences in animal preference for leafy spurge. Sedivec et al. (1995) stated that goats, and especially sheep, should be forced to graze leafy spurge in the spring to improve selectivity, making leafy spurge their dominant food source. Lacey et al. (1984) determined selective grazing of leafy spurge by goats and sheep to be an effective method for controlling large infestations by materially

suppressing the noxious weed but that grazing cannot be considered a route to eradication.

Purpose of This Study

The objectives of this study are to determine if simultaneous grazing of leafy spurge infested rangeland with cattle and sheep employing a rotational grazing system in concert with insect controls will, first, enhance plant diversity and richness and reduce leafy spurge density compared to season-long grazing and, second, enhance livestock grazing efficiency compared to season-long grazing.

The hypotheses of this study are, first, plant species diversity and richness on leafy spurge infested rangeland will demonstrate greater improvement under a rotational grazing system managed with biological control and simultaneous cattle and sheep grazing as compared to season-long grazing and biological control. Second, livestock grazing efficiency will be enhanced on leafy spurge infested rangeland managed with a rotational grazing system using biological control while simultaneously grazed with cattle and sheep versus season-long grazing of cattle or sheep.

Study Area and Design



This project is being conducted on leafy spurge infested rangeland in southwestern North Dakota from 1998 through 2001. The study area is located six miles north of Sentinel Butte and 150 miles west of Bismarck. Two tracts of rangeland of 635 and 395 acres comprise the replicated multi-species grazing trial in the Badlands vegetative region of North Dakota. Vegetation in this region is typical of northern mixed grass prairie and is classified as a wheatgrass-grama-needlegrass plant community (Barker and Whitman 1989). Leafy spurge infests

approximately forty to fifty percent of the land on these two study sites.

This research tests the effects of twice-over rotation and season-long grazing on leafy spurge infested rangeland using multi-species grazing with cattle and sheep in conjunction with a biological control program. Each of two tracts of land were blocked into four cells with one cell randomly selected as season-long treatment. The remaining three cells in each replicate are grazed using twice-over rotation grazing treatment. Four one-acre exclosures, containing forty to fifty percent leafy spurge, are excluded from grazing and classified as biological control treatments.

Fifty permanent 100-meter (109-yard) line transects are located in leafy spurge clumps (26 transects) and native range (devoid of leafy spurge) vegetation sites (24 transects) throughout the study area to monitor changes in (1) leafy spurge stem density, (2) grass and grass-like species frequency, diversity, and richness, (3) forb and shrub species, frequency, density, diversity, and richness, and (4) basal vegetative cover. Barbour et al. (1999) defined density as the number of plants and frequency as the percentage of area that contains at least one rooted individual of a given species. Species richness is simply the number of species per unit area; diversity is a combination of richness and evenness, i.e., species richness weighted by species evenness (Barbour et al. 1999).

Livestock performance and production data is collected for cattle and sheep for determination of average daily weight gain and gain per area. Livestock are weighed at the beginning and end of each grazing season.

Grazing Plan of the Study

Cattle will graze the study area from June 1 through September 15 while stocked in accordance with the recommended carrying capacity of the land as outlined in USDA Natural Resources Conservation Service (NRCS) technical guidelines (1984). Sheep will graze the study area from May 15 through September 15 while stocked at forty percent of carrying capacity without adjustments to cattle numbers. Stocking rates of the twice-over rotation grazing treatments are 0.28 and 0.31 animal unit months (AUMs) per acre. Type of cattle grazed is Hereford-Angus cross cow/calf pairs; type of sheep grazed is mature white-faced ewes.

Livestock graze the season-long treatment continuously throughout the grazing season. Livestock graze the twice-over rotation grazing treatment as one herd and rotate simultaneously. The entire herd of cattle and sheep graze one cell at a time, grazing forty percent of the available carrying capacity of the cell in the first rotation and sixty percent of available carrying capacity in the second rotation.

Summary

Leafy spurge infestations warrant continued study as the species ranks as one of the region's most devastating weeds. Expectations are that this study will offer additional insight into integrated management of leafy spurge infestations thereby enhancing rangeland productivity.



Example of the density (top) and understory (bottom) of an area heavily infested by leafy spurge.



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