Recovery and Viability of Sulfur Cinquefoil Seeds from the Feces of Sheep and Goats

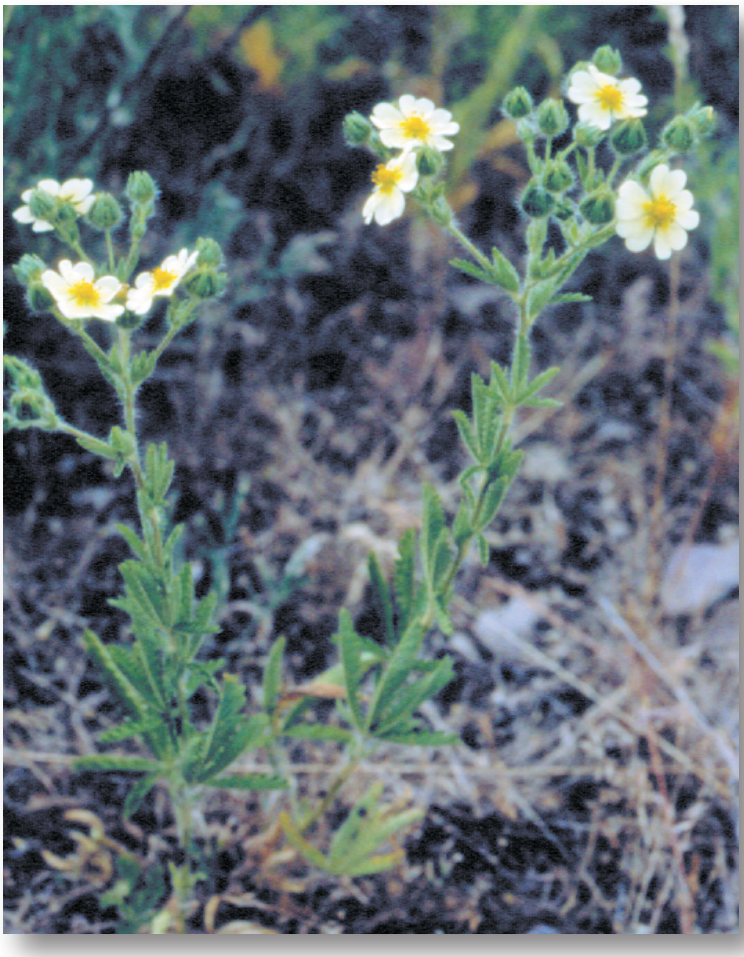
by

R.A. Frost, J.C. Mosley, and B.L. Roeder

Department of Animal and Range Sciences, Montana State University, Bozeman, MT

IMPACT STATEMENT

Sheep or goats that prescriptively graze sulfur cinquefoil infestations during flowering or later plant growth stages should remain in a corral for at least 3 days to allow any viable seeds to be excreted before moving livestock to a new area.



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SUMMARY

Targeted grazing by sheep or goats is a potentially useful tool for suppressing the noxious weed sulfur cinquefoil (Potentilla recta). However, possible transmission of weed seeds by grazing livestock is a serious concern that needs to be addressed in any targeted grazing prescription. We investigated the effect of sheep and goat digestion on the viability of sulfur cinquefoil seeds. Eight sheep and 8 goats were each orally gavaged with 5,000 sulfur cinquefoil seeds. Four animals of each species received immature seeds and 4 animals of each species received mature seeds. Total fecal collection began immediately after oral gavage and continued for 7 consecutive days. Once each day, all identifiable sulfur cinquefoil seeds were recovered and counted from fecal subsamples. Passage through the digestive tract of sheep or goats dramatically reduced the viability of both immature and mature sulfur cinquefoil seeds, but some viable seed was excreted. Almost all (98%) of the viable seeds recovered from sheep and goats were excreted during Day 1 and Day 2 after oral gavage. No viable seeds were recovered from either sheep or goats after Day 3. Grazing livestock that consume sulfur cinquefoil seeds should be kept in a corral for at least 3 days to prevent transferring viable seeds to uninfested areas.

INTRODUCTION

Sulfur cinquefoil (Potentilla recta) is a non-indigenous, perennial forb that can invade healthy, undisturbed rangeland and replace native species (Rice 1999). The plant reproduces only by seed, but each plant can produce thousands of seeds per year (Dwire et al. 2006; Frost and Mosley 2012), and individual plants can live as long as 20 years (Perkins et al. 2006). Once established, sulfur cinquefoil is very difficult to control. There are no approved biological control agents and herbicides have provided mixed results (Lesica and Martin 2003). Current recommendations suggest that sulfur cinquefoil management focus on suppressing seed production and preventing the introduction of seed into uninfested areas (Dwire et al. 2006; Perkins et al. 2006).

Our previous research has demonstrated that defoliation of sulfur cinquefoil at the flower stage or later can reduce viable seed production (Frost and Mosley 2012). Targeted livestock grazing is a potential way to defoliate sulfur cinquefoil on rangeland, however, grazing livestock that consume viable seeds may disseminate the seeds in other areas and contribute to weed expansion (Bartuszevige and Endress 2008, Hogan and Phillips 2011).

We have observed sheep and goats grazing both the foliage and the fruits of sulfur cinquefoil, but it is unknown if livestock consuming the seeds of sulfur cinquefoil can excrete viable seeds. Livestock and wildlife are capable of excreting viable seeds of other noxious weeds, including leafy spurge (Euphorbia esula; Lacey et al. 1992; Olson et al. 1997; Olson and Wallander 2002; Wald et al. 2005), spotted knapweed (Centaurea stoebe; Wallander et al. 1995), and others. To prevent the spread of noxious weeds, confining livestock in a corral is recommended as a best management practice before moving livestock to new areas (Kott et al. 2006). It is important to know the length of time animals should be corralled in order to minimize the amount of time, labor, and feedstuffs required before returning animals to rangeland grazing. Our objective was to determine the recovery and viability of sulfur cinquefoil seeds from the feces of sheep and goats following oral gavage.

PROCEDURES

Yearling wether crossbred goats (Spanish × Boer) and Targhee sheep (8 goats, 8 sheep) were used in this study. All treatments were approved by the Montana State University Animal Care and Use Protocol number AA-039. Animals were placed in individual metabolism stalls 7 days before the experiment began and fitted with fecal collection bags for 2 days before the study began to familiarize the animals with the research procedures. Once daily during the acclimation period and throughout the experiment, animals were fed ground grass hay in excess. Hay intake averaged 2.0% body weight/day.

Sulfur cinquefoil seeds were collected from infested foothill rangeland near Bozeman, MT. Seeds were collected at 2 developmental stages: immature seeds were collected in mid-July, and mature seeds were collected 2 weeks later in late July. In the laboratory, collected seeds were purified, counted, and stored in cool, dry conditions from July to October when they were administered to the animals.

Each animal was orally gavaged with 5,000 sulfur cinquefoil seeds suspended in water, with 4 goats and 4 sheep receiving immature seeds, and 4 goats and 4 sheep receiving mature seeds. Total fecal collection began immediately after oral gavage and continued for 7 consecutive days. Fecal collection bags were emptied once daily. After thoroughly mixing fecal material within each collection bag, a sample was collected from each bag and examined for sulfur cinquefoil seeds. All identifiable sulfur cinquefoil seeds were extracted, counted, and tested for viability.

RESULTS AND DISCUSSION

Recovery of viable sulfur cinquefoil seeds did not differ between sheep and goats. Most (91%) of the viable seeds that were recovered were mature seeds. Almost all (98%) of the viable seeds that were recovered from sheep and goats were excreted during Day 1 and Day 2 after oral gavage. No viable sulfur cinquefoil seeds were recovered from either sheep or goats after Day 3.

Sulfur cinquefoil seed viability before oral gavage averaged 36% for immature seeds and 76% for mature seeds, while viability of recovered seeds averaged 3% for immature seeds and 27% for mature seeds. Thus, passage through the digestive tract of sheep or goats dramatically reduced the viability of both immature and mature seeds. Therefore, even when sheep or goats excrete sulfur cinquefoil seeds on the landscape, the number of viable seeds added to the soil seedbank will be less when the area is grazed by sheep or goats than if the area had remained ungrazed. Finally, our estimates of sulfur cinquefoil seed excretion and viability in sheep and goat feces are likely inflated compared with targeted grazing animals because oral gavage with seeds bypassed mastication.

Our results indicate that targeted grazing by sheep or goats is a promising tool for reducing the number of viable sulfur cinquefoil seeds added to the soil seedbank. However, some viable seed is capable of surviving the digestive system of sheep and goats. Sulfur cinquefoil plants in the pre-flower growth stage have not yet produced seeds. Therefore, grazing livestock that consume sulfur cinquefoil during this stage do not need to be quarantined before moving to a new area. Sulfur cinquefoil plants in the early-flowering stage also have not yet produced viable seeds. However, sulfur cinquefoil infestations characterized to be in the flowering stage likely contain some sulfur cinquefoil plants that are more advanced into the seedset stage. Therefore, sheep or goats that have grazed within sulfur cinquefoil infestations during flowering or later plant growth stages should remain in a corral for at least 3 days afterwards to allow any viable seeds to be excreted before moving the livestock to a new area. Complete details about our study are published in Frost et al. (2013).

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