

## INFLUENCE OF INGESTION BY CATTLE ON THE GERMINATION OF ARROWLEAF CLOVER SEED

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### Story in Brief

A known amount of arrowleaf clover (*Trifolium vesiculosum* savi.) seed was administered through the rumen cannula of four, three-year-old heifers. Seed which survived the digestive process was recovered from the feces at intervals after administration. Only 10.8% of the seed fed was recovered from the feces. None of the seed present in the feces germinated, unless the seeds were either isolated from the wet feces (1% germinated) or the isolated seeds were mechanically scarified with emory cloth after recovery. When seed was scarified after recovery, 90% germinated. While only a small portion of ingested seed appears to survive digestion, a large majority of the seeds have the potential to germinate even though the bovine digestion process does not appear to aid germination.

(Key Words: Germination, Arrowleaf Clover Seed, Seed Recovery, Bovine Digestion.)

### Introduction

Arrowleaf clover is an annual legume that can be used effectively as a companion legume in perennial grass forage systems. Traditional means of establishing legumes are usually expensive and can either damage or destroy pasture and rangeland vegetation. Moreover, the terrain of many rangelands may be prohibitive to conventional seeding. An alternate method of establishing clover may be to feed arrowleaf clover, separately or as mature hay, to livestock to permit seed dispersal via feces.

Several workers have shown that some seeds such as mesquite, certain weeds and McCartney rose (Fisher, 1947; Burton and Andrews, 1948; and McCully, 1951, respectively) can be recovered in the feces and will germinate following ingestion by animals. Most studies indicate that a portion of the total seed fed can be recovered, and some of the recovered seed will germinate. However, no studies have reported the effect of ruminant animal digestion on the seed of arrowleaf clover. Establishment of an arrowleaf clover stand may involve dispersal of seed as well as preconditioning of the seed for rapid germination, seedling emergence and survival. The objective of this study was to determine the potential effect of bovine ingestion on the germination of arrowleaf clover seed.

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## Materials and Methods

Arrowleaf clover seeds were separated using a South Dakota Seed Blower Model B to standardize seed weight by removing and discarding light seed. The seeds were counted with an Old Mill Company Electronic Counter, Model 850-2 to determine the number of seed per unit weight. Twenty-gram aliquots were weighed and placed in gelatin capsules; one capsule was placed in the rumen via the rumen cannula in each of four, three year old heifers used in this study. Each heifer was fed a maintenance diet consisting of about 11 lb of good quality prairie hay (cut annually from a prairie meadow early in July) and 2 lb of a 40% crude protein supplement containing vitamins and minerals. After inserting the capsule into the rumen, total fecal collections were taken at 8-hour intervals for a 96-h period. Each fecal sample was thoroughly mixed; then subsamples were obtained for recovery and seed germination.

Seed recovery was accomplished by placing 25 g of each fecal sample into a slant edge bowl, adding water and a water softener to make a slurry. The light particles were skimmed off and filtered, then the remaining solution was filtered. When all fecal material had been removed, seeds were counted and percent of seed recovery determined. Arrowleaf clover seeds were heavier and settled to the bottom, facilitating recovery. Germination was conducted following seed recovery. Arrowleaf clover seeds present in wet feces, as well as seeds isolated from the feces as described above, were germinated at 20 C for a 10 d period immediately following the 96-hour collection. In addition, one-half of the excreted, isolated seeds were mechanically scarified with emory cloth. Germination of unfed arrowleaf clover seed, both scarified and unscarified, also was tested for comparison.

## Results and Discussion

Seeds were recovered from the feces as early as 8 hours after ingestion, although less than 0.1% of the total seed fed was recovered during the first 24 hours. Seed recovery tended to increase until peaking at 80 hours post-dosing. The majority of seed was excreted between 56 and 96-hours (Table 1). Overall, an average of 10.8% of the total seed given to the heifers was recovered in the feces, a recovery rate lower than previously reported for other ingested seeds. McCully (1951) recovered 50% of ingested mesquite seed from the feces of mature cows, whereas Harmon and Keim (1934) recovered 23% and Fisher (1947) 45% of mesquite seed fed to calves. A small amount of arrowleaf clover seed passed intact through the digestive tract of the heifers.

No germination for arrowleaf clover seed occurred unless it was removed from the feces (Table 2). Since seed contained in the wet feces (not isolated) did not germinate, either the seed which survived digestion was not viable or only hard seed survived the digestive process. Germination of seed isolated from the feces was only 1%, much lower than the 90% germination noted for the recovered seed which was hand scarified following excretion (Table 2). There was a large difference in germination between unscarified, unfed seed (21%) and unscarified, fed seed (0-1%). From these data it seems probable that only hard seed (seedcoat not water permeable) survives digestion. Seeds with a softened seedcoat were apparently destroyed or the embryo damaged during the digestive process.

If a producer wishes to establish an arrowleaf clover stand using cattle to disperse the seed, cattle should remain on the field to be

**Table 1. Percent of total arrowleaf clover seeds fed which were recovered in bovine feces.**

Hour <sup>a</sup>	Recovery	Cumulative recovery
8	0.02	0.02
16	0	0.02
24	0	0.02
32	0.52	0.54
40	0.07	0.61
48	1.58	2.19
56	1.36	3.55
64	2.15	5.70
72	0.75	6.45
80	2.80	9.25
88	0.98	10.23
96	0.61	10.84

<sup>a</sup>Hours after insertion of seeds in the rumen.

**Table 2. Percentages of unscarified and scarified arrowleaf seed which germinated.**

Seed Treatment	Unscarified	Scarified
Unfed	21	92
Retained in feces	0	--
Recovered from feces	1	90

established for at least 4 days. Moreover, only a small percentage of the seeds appear to survive digestion, so large amounts may need to be fed. Additionally, more than one year may be required for good stand development since environmental factors (drying, freezing or the like) may be important in permitting subsequent scarification of the hard seeds which survive digestion.

### Literature Cited

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