The response of western and bluebunch wheatgrass seedlings to clipping and pulling
by Robert E Monroe

A THESIS Submitted to the Graduate Committee in partial fulfillment of the requirements for the degree of Master of Science in Range Management
Montana State University

Abstract:
Greenhouse studies were conducted on western and bluebunch wheatgrass seedlings which were clipped or pulled at a height of 3 inches every 2 weeks. Treatments began at 6 different stages of development as measured by height of growth. Results gave no clear evidence of significant differences in responses by species or stages of development.

Results for methods of treatment were clear out. Ninety- five percent of plants pulled were killed. Statistically significant difference in seen yields were obtained between untreated controls and clipped plants. Pulling after head- ing had no killing effect. Speical paper boxes were tested and found unsatisfactory.

THE RESPONSE OF WESTERN AND BLUEBUNCH WHEATGRASS SEEDLINGS TO CLIPPING AND PULLING

by

Robert E. Monroe

A THESIS

Submitted to the Graduate Committee

in

partial fulfillment of the requirements

for the degree of

Master of Science in Range Management

at

Montana State College

Approved:

Fred S. Willson
Head of Major Department

Chairman, Examining Committee

Dean, Graduate Division

Bozeman, Montana
June, 1949

ACKNOWLEDGEMENTS

Thanks are due to Professor H. E. Morris, of the Botany and Bacteriology Department, for providing space for conduct of the experimental work. The aid and consultation of Dr. R. E. Stitt, of the United States Department of Agriculture, and Dr. E. E. Hahn, of the Agronomy Department, in the statistical work were invaluable. Without the encouragement and guidance of Mr. C. F. Payne, of the Animal Industry and Range Management Department, the project would not have been undertaken. For proofreading and typing we are indebted to Mrs. Jean Norman.

TABLE OF CONTENTS

ABSTRACT

Greenhouse studies were conducted on western and bluebunch wheatgrass seedlings which were clipped or pulled at a height of 6 inches every 2 weeks. Treatments began at 6 different stages of development as measured by height of growth. Results gave no clear evidence of significant differences in responses by species or stages of development. Results for methods of treatment were clear cut. Ninety-five percent of plants pulled were killed. Statistically significant differences in mean yields were obtained between untreated controls and clipped plants. Pulling after heading had no killing effect. Special paper boxes were tested and found unsatisfactory.

INTRODUCTION

The pressure for grazing in the early and late spring has been a constant problem in range management. It has created difficulties in maintenance of established forage. It has presented special problems in the practice of re-seeding. It has intensified the slowness of the already slow march of vegetative recovery from depletion. The present investigation is aimed indirectly at this problem.

A better understanding of the nature of the responses to utilization of the seedlings of the more important range grasses would materially enhance our comprehension of the vegetational aspects of the basic problem stated above. The importance of plant reproduction is well established, yet relatively little is known of the responses of native grass seedlings to various kinds of use. The investigative work upon seedlings is very limited by comparison to that upon established, mature plants. This state of affairs appears somewhat inequitable in view of the importance of seedling reproduction to the long-time maintenance of established forage stands.

The importance and widespread occurrence on native ranges of Montana and various adjacent states of western wheatgrass (Agropyron smithi Rydb) and bluebunch wheatgrass (Agropyron spicatum (Pursh) Scribn and Smith) make these

species suitable for an investigation of seedling responses. Being of the same genus, they are comparable to a large degree. They differ in growth habit: the former is a sodgrass, the latter a bunchgrass. Comparison of the effects of this difference is of interest.

For many years it has been customary in the field to deplore the damage produced by the pulling habits of grazing cattle. The literature makes passing reference to this phenomenon but fails to reveal any experimental evidence of the effect of pulling, whether upon plant survival, root or herbage development, or species response. The notion that pulling is damaging appears to be one of the accepted but untested truisms of the range.

Besides field observation, there is a rational foundation in anatomy for a belief in the factuality of pulling by grazing animals. The horse is supplied with teeth in both mandibles. The extent to which it pulls forage is problematical, yet it is included in generalized remarks about pulling habits of animals. The cow and sheep present a different situation. These animals possess teeth in the lower mandible only, the teeth of the upper mandible having been replaced by a hard, leathery dental-pad. The degree to which the cow or sheep pulls and the degree to which it shears its standing forage is unknown. Tensile strength of the forage appears irrelevant since even if there were no

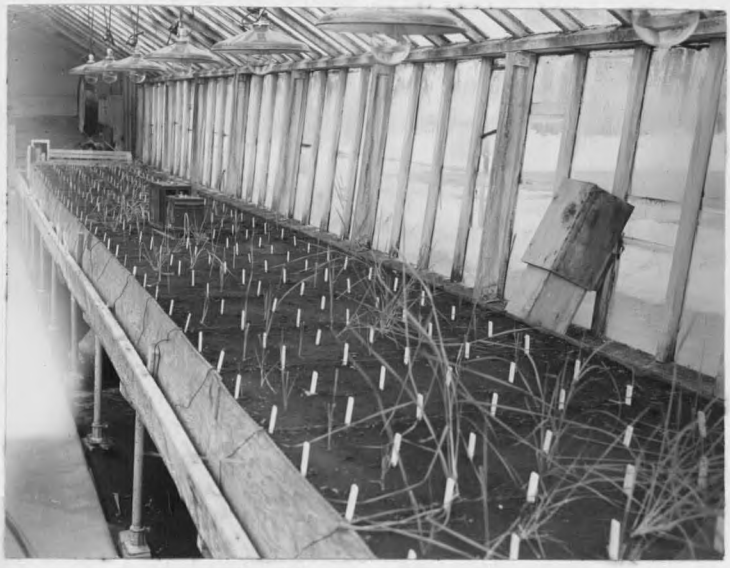

Figure 1 & 2
Two views of experiment.

shearing whatsoever, the animal possesses sufficient strength to pull the most resistant forage grass. The mechanics of grazing by the cow is such that a certain amount of shearing is probable. The teeth are relatively sharp. As the jaws close, the head moves forward in an upward rising parabolic curve raking the forage against the teeth while the tops are firmly anchored by mandibular pressure between teeth and dental pad. The cow has been the primary culprit in mind when pulling habits are attributed to animals.

The effects resulting from pulling are interesting not only in themselves but in their implications in respect to the use of the clipping method as a technique in studying responses of forage plants. If pulling effect is significant, then clipping studies of forage plants are erroneous and misleading to some greater or lesser degree.

Root separation of a large number of individual plants is an omni-present problem in experimental work when proper containers are not available. In this investigation a new technique was attempted involving boxes of a special type of paper.

An inquiry into some restricted aspects of all these subjects was attempted in a greenhouse project. The project was designed to simulate as closely as possible the natural sequence of events from earliest spring until all grazing ceases and stock move on to the national forests and open-

ranges. This concept of spring grazing, with only a limited time to take advantage of whatever forage is produced, has been basic in decisions regarding experimental design and procedure.

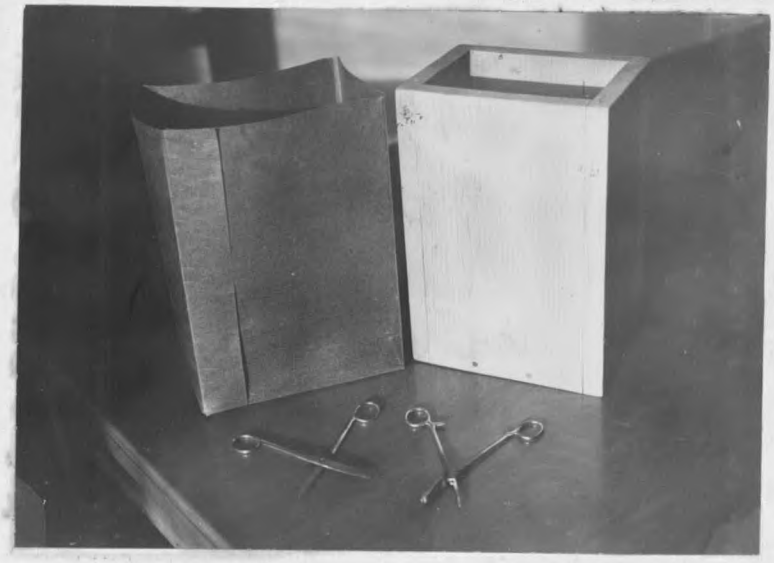

Fig. 3 - Paper box, wood form, and harvesting tools.

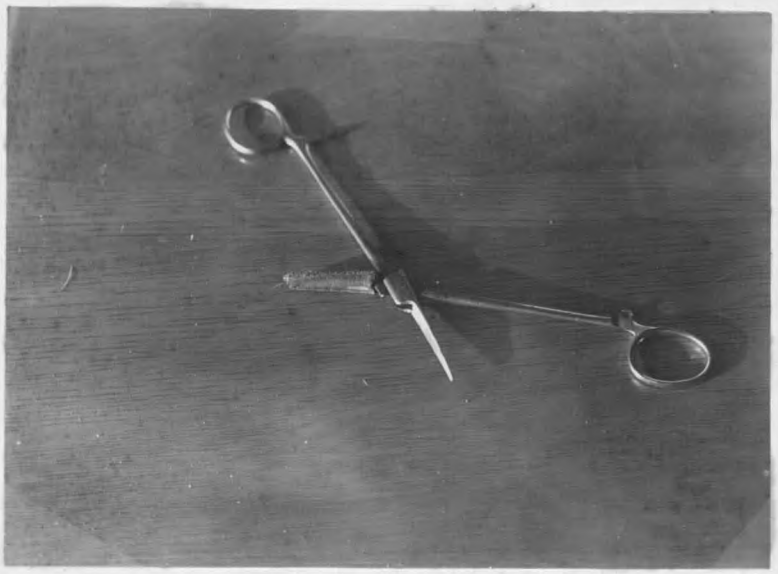

Fig. 4 - Pulling tool

PURPOSE

The purpose of the experiment was to ascertain the responses of 2 species of native wheatgrass (Agropyron) seedlings to clipping or to pulling at a given harvesting intensity beginning at 6 different stages of development. The species used were western wheatgrass and bluebunch wheatgrass.

The experiment was designed to yield itself to statistical analysis and afford the following information:

a. Comparison of the responses within and between species resulting from the various treatments at the various stages of development.

b. Comparison of the effects of clipping and pulling, upon the species and at the various stages.

c. Comparison of the responses of seedlings of the bunchgrass type and the sodgrass type, the species being comparable, i.e., of the same genus.

As a by-product of the physical setup of the experiment, it was possible to test the practicality of the use of a type of paper box (described under methods) in experimentation requiring root separation of a large number of individual plants.

REVIEW OF LITERATURE

Reference has already been made to the absence of experimental evidence in the literature relative to the effects of pulling. Allred (3) mentions the avoidance of pulling as a benefit of double deferment in rotation grazing. Others (20,40) have called attention to pulling in reference to range damage caused by various kinds of livestock. Hull (22) has used it as a reason for deep seeding.

The situation is reversed when clipping is considered. The major portion of the Literature Cited list is of studies involving the use of the clipping technique. Weinmann (44) has reviewed a comprehensive portion of the literature in relation to roots.

Several authors (1,7,8,20,21,26,36,37) have pointed out that clipping fails to duplicate the effects of grazing, but maintain that the results are indicative of the results of grazing, or at least of defoliation. Dulley, Campbell and Canfield (8) have outlined the limitations of the method, have suggested that these limitations may be overcome, and declared the method to be of great value when used in conjunction with actual grazing studies.

Innumerable clipping studies (1,4,6,9,10,12,13,14,15, 17,18,19,21,26,27,28,29,30,31,33,34,35,38,39,41) have been conducted in various places for a wide variety of purposes.

Their results are in general agreement that a reduction of yield and of vigor proportionate to the intensity and the frequency of clipping follows defoliation (4,6,7,15,33,35, 41). This reduction has been found true for both underground and above-ground parts (10,17,34). Reductions, in some cases of unexpected proportions, of roots and rhizomes have been noted particularly (4,12,19,24,27,41,43).

Differential responses to clipping by several individual species have been obtained by various workers (9,18,20, 23,28,35,43). In some cases these differences were associated with differences in form. The rhizomatous species suffered less damage than the non-rhizomatous species (18, 24,28). Weaver (42) has stressed the importance of this difference in relation to grazing. Shortgrass species have survived given treatments longer than midgrass and tallgrass species (9). One writer (20) has indicated a change of growth habit, bluebunch and crested wheatgrass both developing decumbent attitudes when subjected to clipping. De-Peralta (10) found tillering to be proportionate to frequency and intensity of cutting in Sudan grass. Sturkie (41) in studies of Johnson grass found no rhizome development until heading began.

Several workers (29,33,38) have found degree of growth and development in succeeding seasons to be related to clipping treatment.

Various writers have experimented with seedlings (9, 19,20,22,25). In general, their results parallel those results obtained upon mature plants. They indicate also that protection from grazing for at least a year is necessary and advisable for 2 years. Hull (22), however, indicates that despite reduced vigor full stands of reseeded crested wheatgrass may be obtained under grazing the first year under certain conditions.

Robertson's (35) clipping studies of seedlings of 6 grass species showed reductions in top growth weights ranging from 80 percent to 96 percent for the various species. He also found elongation of tops stimulated in half of the species and inhibited in the other half. Width and number of leaves and number of tillers were also reduced by clipping. Hedder's (20) work with bluebunch and crested wheatgrass seedlings showed similar results.

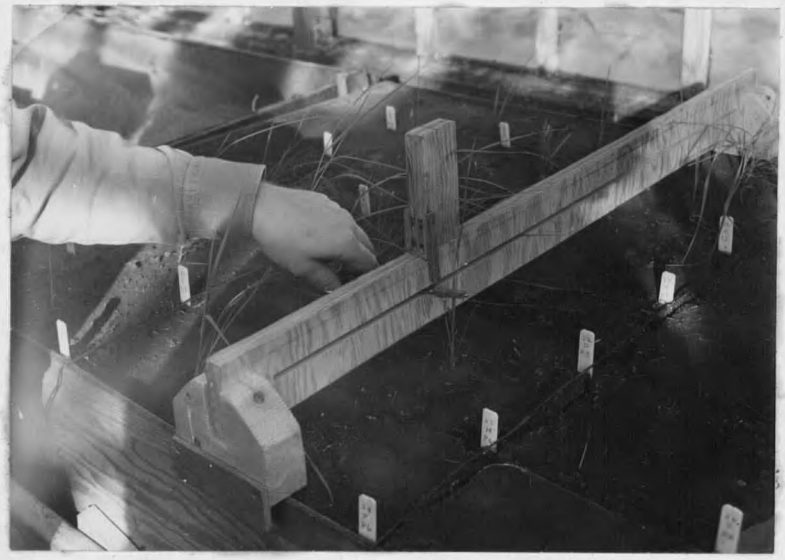

Fig. 5 - Harvesting jig
with pulling tool in place.

Fig. 6 - Harvesting jig.
Plants at north end of bench.