RR RM

RESEARCH PROGRAM

Tucson, Arizona

Study Plan

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STUDY PLAN

Study No. FS-1-r3-3-RM (SR#2)

A Demonstration to Determine the Feasibility

Of Achieving Rotation-Deferred Grazing within

A Single Pasture by Controlling Access to Water

By

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Study Plan

A DEMONSTRATION TO DETERMINE THE FEASIBILITY

OF ACHIEVING ROTATION DEFERRED GRAZING WITHIN

A SINGLE PASTURE BY CONTROLLING ACCESS TO WATER

THE PROBLEM

Most of the semidesert grass-shrub ranges are grazed yearlong by cattle. Much of this range is in poor condition. Under yearlong grazing areas of cattle concentration, primarily around watering places, grazing is usually heavy and decreases with increasing distance from water. The range, likewise, is usually in poorest condition in the heavily grazed area around water and the condition improves with increasing distance from water. Ranges that are properly stocked or even lightly stocked will be overgrazed every year near water while areas at a distance from water may be grazed lightly or not at all. Closing water to periodically resting adjacent areas has been suggested as a method of overcoming the bad effects of such concentrated use.

Obtaining uniform, yet moderate use over the entire range is a common problem. On short season ranges that can be economically subdivided, rotation-deferred grazing systems provide at least a partial solution to distribution problems. On many semidesert ranges in southern Arizona the cost of fencing and water development necessary to defer and rotate use by entire pastures may not be warranted.

The idea behind this study is that deferred-rotation grazing of a sort can be practiced in a single pasture if there is more than one watering place. If this forage on areas near water can be restored by closing each watering place as frequently as possible during critical growth periods, the cost of fencing and subdividing the range can be eliminated. The system offers other possible economies. For example, if only one watering place is kept open at a time, the number of places the rancher must visit to see his cattle is reduced. Also, if all cows water at one place, fewer bulls should be needed. A plan of grazing incorporating these ideas is planned for pasture 6A on the Santa Rita Experimental Range. The formal observations of the study will be limited to areas within 500 yards of water. It is assumed that the more remote parts of the pasture will be in acceptably good condition if these heavy-use areas can be restored to full production.

OBJECTIVES

1. To determine whether it is practical, in a pasture with several watering places, to force cattle to use only one watering place at a time and so rotate the use periods so that each watering place is used during the growing season not oftener than every other year.

2. To determine whether rotation of use as described in objective 1 results in lighter use and increased herbage production close to water.

METHODS

General Plan

The general plan of the study is to keep only one watering place open at a time and to defer each watering place during the growing season at least in alternate years.

Location and description of the study area

The study will be conducted mainly in pasture 6A on the Santa Rita Experimental Range (Figure 1). Pasture 6A covers 3161 acres and has two permanent watering places (Huerfano and East Rim) and three temporary waters (Box Rim, Red Tank and East Tank). Two courses of transects will also be laid out with reference to Huerfano Rim in 6B where water will be open to livestock yearlong. These two courses in 6B which are just across the fence from pasture 6A provide an opportunity to record changes in vegetation stocking rate to that of 6A.

Grazing Treatment

1. A breeding herd of cows will be kept in pasture 6A yearlong with bulls during the breeding season. Numbers will be adjusted each fall in accordance with the forage crop. Calves will be sold off in the fall. This same plan of management will be applied in pasture 6B.

2. Only one watering place will be open to livestock at any given time in pasture 6A. All watering places will be open at all times in 6B. A schedule for use of watering places in 6A and for Huerfano Rim in 6B is listed in Table 1. Because of the unreliability of temporary watering places the schedule provides alternatives in all cases in which a temporary water is involved. Thus each year's schedule will have to be worked out individually in accordance with the general plan and the location of available water.

3. To aid in keeping cattle from hanging around closed waters salt will be available only at the watering place being used.

Table 1. Seasons when each water is scheduled to be open in pasture 6A. If water is not available at the first watering place listed second will be used unless it too is dry in which case the third watering place will be used, etc.

Year June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May

1959 1. Huerfano Rim 1. East Tank 1. Red Tank 1. Box Rim

2. Red Tank 2. Box Rim 2. East Rim

3. Box Rim 3. East Rim

4. Huerfano Rim

1960 1. East Rim 1. Red Tank 1. Box Rim 1. Huerfano Rim

2. East Tank 2. Red Tank

3. East Rim 3. Huerfano Rim

1961 1. Box Rim 1. East Tank 1. Red Tank 1. East Rim

2. Huerfano Rim 2. Red Tank 2. Box Rim

3. Box Rim 3. East Rim

4. Huerfano Rim

1962 1. Huerfano Rim 1. Red Tank 1. Box Rim 1. Box Rim

2. East Tank 2. Red Tank 2. East Rim

3. Huerfano Rim 3. Huerfano Rim

1963 1. East Rim 1. East Tank 1. Red Tank 1. Huerfano Rim

2. Red Tank 2. Box Rim

3. Box Rim 3. Huerfano Rim

4. East Rim

1964 1. Box Rim 1. Red Tank 1. Box Rim 1. East Rim

2. Huerfano Rim 2. East Tank 2. Red Tank

3. Box Rim 3. Huerfano Rim

4. East Rim

Data to be taken

Existing Records - Records that are available for pasture 6A include: (a) actual stocking, (b) basal density measurements of perennial grasses and crown density of shrubs on 20 permanent line transects for the years 1954, 1955, and 1956, (c) herbage production estimates by species on 10 courses of 5-10 9.6 square foot plots each for the growing seasons of 1954-58 and (d) utilization by species as of June each year for several years using the grazed-plant count method on 10 paced transects rerun in the same approximate locations each year. For the sake of continuity of record items "a", "c" and "d" will be continued as in the past. These data provide the basis for annual adjustments in stocking.

The permanent line transects are to be remeasured in the 4th, 5th and 6th years of the new grazing treatment. Remeasurement now does not seem justified because the three consecutive year measurements in 1954-1956 provide a fair measure of present conditions. Remeasurement of these transects at the end of the study will provide information on general conditions in the pasture as a whole. Additional records to fulfill the specific objectives of this study are described in succeeding sections.

Variables to be tested

1. Changes in density and composition of the perennial grass stand on permanent plots at distances of 100, 200, 300, 400 and 500 yards from permanent and temporary water.

2. Differences in utilization of perennial grasses by species on permanent plots at distances of 100, 200, 300, 400 and 500 yards from permanent and temporary water.

3. Changes in herbage production of perennial grasses by species on permanent plots at distances of 100, 200, 300, 400 and 500 yards from permanent and temporary water.

Location and Marking of Plots

Transects at each water will be located at 300' intervals along courses listed below:

Watering Place Place Transect Series Compass Bearing

Huerfano Rim 6B 1. 51-55 N 75 deg. W

2. 56-60 N 45 deg. W

6A 1. 11-15 S 70 deg. E

2. 16-20 S

East Rim 6A 1. 1-5 S 67 deg. W

2. 6-10 N 55 deg. W

East Tank 6A 1. 41-45 N 69 deg. W

2. 46-50 N

Box Rim 6A 1. 21-25 N 40 deg. W

2. 26-30 N

Red Tank 6A 1. 31-35 S 45 deg. E

2. 36-40 S

These courses are intended to keep all plots on fairly gentle slopes. Distances will be varied slightly between plots if necessary to avoid having transects fall in a sand wash. A 100-ft. permanent line transect will be laid out at right angles to the course bearing at each distance. A fence post 25 feet from the 0 degree end of the transect and in line with it will serve as a photo point and witness post to aid in relocating the transects. Transects will be marked with metal stakes at the 0, 50, and 100-ft. marks.

Instructions for Taking Data

1. Line transects-Line transect measurements around each watering place will be made annually in the fall in accordance with "INSTRUCTIONS FOR LOCATING, ESTABLISHING, AND MEASURING LINE INTERCEPT TRANSECTS" on the Santa Rita Experimental Range.

2. Utilization measurements - Utilization of perennial grasses will be observed around June 30 each year at each transect location. The grazed plant count method by species will be used as described in "INSTRUCTIONS FOR UTILIZATION SURVEY on THE SANTA RITA EXPERIMENTAL RANGE" with the exception that observations will be confined to a plot 200 feet square centered about the transects.

3. Forage estimates - Forage estimates will be made around October 1 each year using the general procedure described in "INSTRUCTIONS FOR FORAGE SURVEY, Santa Rita Experimental Range. Each estimate will consist of 5 separate estimates on 1' x 9.6' plots located along the right hand side of the permanent transect. The beginning points of these permanent plots will be at the 10, 30, 50, 70, and 90 foot marks along the transect. One temporary plot will be clipped and estimated in the immediate vicinity of each permanent transect.

4. Photographs - One general photograph will be taken from one of the two transects at each distance at each watering place at the beginning and at the end of the study. Thus only 1/2 of the transects will be photographed.

5. Water use - A complete record will be kept of actual dates each watering place is open.

6. Livestock Records - The cooperators will keep a record showing his estimate of man days of extra work involved in keeping cattle away from closed water and any cases of cattle hanging around closed water, etc.

Analysis of Data

Two series of transects will be located with reference to each watering place so that two permanent 100-ft. transects will be laid out at each distance. Thus with 5 watering places in pasture 6A, five distances from water and two transects at each distance, the analysis will be:

Source of variation Degrees of Freedom

Watering places (Replications) 4

Distance from water 4

W x D 16

Error 20

Total 49

This analysis will be applied to changes in perennial grass density, herbage production, and utilization that occur during the course of the study. The analysis is based upon the assumption that watering places represent replications and distances from water, the treatments.

The foregoing analysis will be valid only if areas sampled around all 5 watering places in pasture 6A prove to have somewhat similar conditions at the start of the study and receive approximately the same kind of deferment throughout the study. As shown in table 1, areas around permanent water at Huerfano, East and Box Rims may receive different use and deferment than areas around temporary water at Red and East Tanks. Therefore, the data will be examined at the close of the study to determine if data from Huerfano, East and Box Rims should be analyzed separately from those from Red and East Tanks.

Records from the transects around Huerfano Rim in pasture 6B will be used as a climatic check but cannot be incorporated into the overall variance analysis of pasture 6A.

PRESENTATION OF EXPECTED RESULTS

Preliminary results of this demonstration will be presented primarily in popular articles in livestock journals. Enough data should be available for an article in The Stockman, The Cattlelog, or a R M research note after 3 years of measurements. Final results at the end of 6-10 years should warrant publication in the Journal of Range Management.

SCHEDULE OF WORK

1. Winter 1958-59--Fence East Tank.

2. June-July 1959--Establish permanent transects at all waters in 6A and at Huerfano Rim in 6B, take first density measurements, utilization estimates and photographs. Run utilization survey of pasture as in past.

3. Oct. 1, 1959--and annually thereafter through 1964, or until end of study--Make forage estimates, take photos, and take density measurements at permanent transect locations. Run general forage survey of pasture as in past. Verify plans with Ruelas for winter use of watering places.

4. November 1959--begin grazing under plan for rotating water use.

5. June, 1959, 1960, 1961, 1962, 1963, and 1964--record utilization on perennial grasses at each transect location. Run utilization survey. Confirm plans with Ruelas for summer use of watering places.

6. August 1962, 1963, and 1964--remeasure old transects (1-20) established in 1954 and retake photographs on these transects.

7. Winter 1961-62--summarize preliminary results for publication.

8. Winter 1964-65--summarize and publish results.

RESPONSIBILITY AND COST

Assignment - Martin and Cable

Estimated Cost

Manpower

Man Days

Field Office Total

YEAR Permanent Temporary Permanent Temporary Permanent Temporary

1959(1)9 14 3 4 12 18

1960 9 14 3 4 12 18

1961 9 14 10 7 19 21

1962 9 16 7 3 16 19

1963 9 16 7 3 16 19

1964(2)9 16 30 10 39 26

(1) Does not include 5 days labor (Lucero) for fencing East tank.

(2) Assumes 1964 to be end of study. Extra office time allotted for publications.

Materials Cost

60 fence posts On hand (For plot stakes)

120 fence posts On hand (To fence East tank)

180 plot stakes On hand

5 rolls barbed wire On hand (For fencing East tank)

Photo supplies $15.00

Mileage $100.00

Time of Completion - 1964

COOPERATION - Ruelas