Technical Report No. 33

PRELIMINARY METHODOLOGY AND RESULTS FOR ABOVEGROUND HERBAGE BIOMASS SAMPLING ON THE PAWNEE SITE

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GRASSLANDS BIOME

U. S. International Biological Program

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ABSTRACT

Biweekly sampling of herbage biomass including (1) standing vegetation of all species, (2) standing live and dead of blue grama (*Bouteloua gracilis*), and (3) litter was conducted during the summer 1969. Phenology data was taken on the primary species at each sampling date. The procedures of data collection and data summaries are presented.

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INTRODUCTION

This report describes the methodology of sampling standing crop and compartmental transfers of plants on the Pawnee Site during the 1969 growing season. The primary objectives were to study compartmental transfers and seasonal and annual changes in standing crop of herbage biomass. Information collected will be used to improve our present sampling techniques for further studies.

DESCRIPTION OF STUDY AREA

This study area is located at the Pawnee Site on the Central Plains Experimental Range, eight miles NE of Nunn, Sections 15 and 23, Township 10 N, Range 66 W of Weld County, Colorado.

Eight microwatersheds, consisting of 0.5 hectare are located on a sandy loam soil belonging to the Ascalon Series. Herbage dynamics study areas were located adjacent to each microwatershed. The microwatersheds and the study areas were selected and replicated on four different levels of grazing intensities (none, light, moderate, and heavy grazing). These grazing treatments have been in effect since 1939. Technical Report No. 1 contains a description of the Pawnee Site and the history of the study areas.

METHODOLOGY

The eight study areas were sampled once each in the pre-growing and post-growing seasons and biweekly during the season of rapid vegetative growth and flowering.

Forty permanent micro-plots were selected within the study area. Each area was sampled using two "fast methods", i.e., (1) visual estimation of weight, and (2) dry-weight ranking. Ten micro-plots were estimated and ranked

by species with a 50 cm x 50 cm quadrat. Correction factors were obtained by clipping an eleventh plot at the end of the study area after visual estimation and ranking by species. Clipping of vegetation was conducted at the ends of each study area to minimize destruction. This procedure was repeated until all forty permanent micro-plots had been estimated and ranked by species. The clipped vegetation was separated by species and the wet weights were determined for the sorted material in the field. All samples were dried at 65°C for 48 hours.

Two 25 cm x 25 cm quadrats were selected at random on each of the grazing treatments to determine the amount of standing live and dead blue grama and the amount of litter. These samples were clipped for grass and the litter collected for hand separation in the laboratory. After separation, each compartment including litter was oven-dried for 48 hours at 65°C and weighed. Chemical analyses will be run for each compartment of blue grama. From the results, it will be possible to determine the amount and rate of transfer of nutrients from one compartment to another and the transfer rate of standing green to standing dead to litter and decomposition for blue grama.

Chemical analyses will be made on each of the major species of plants for nitrogen, carbon, phosphorous and gross energy.

Nylon litter bags, 22 cm x 22 cm, each containing air dry litter taken from four grazing intensities (none, light, moderate, and heavy) were weighed and placed in each of these treatments. Five litter bags are collected randomly from each treatment of grazing on specified dates and weighed after drying for 48 hours at 65°C and saved for chemical analyses.

PRELIMINARY RESULTS

Aboveground Biomass

Data from eleven sampling periods are available from the 1969 sampling season.

Standing crop data are expressed in kilograms per hectare for each sampling period. Seasonal trends of total standing crop show a low on March 27 and a high of 1,059 kg/hectare on August 11 (Fig. 1). A summary of the data by grazing treatments shows that moderate grazing has the lowest seasonal standing crop and no grazing and moderate the highest standing crop (Fig. 2). It is doubtful, however, that any biological or statistical significance should be assigned to these differences.

Seasonal trends for the total standing crop of blue grama went from a low on March 27 to a high on June 30 and then remained uniform throughout the season (Fig. 3). Standing crop of blue grama by grazing treatments was higher on the no grazing treatment throughout the season than the other three treatments as shown in Fig. 4.

Standing green and standing dead have been expressed as percentages by treatment on sampling dates (Fig. 5). On the heavy grazing treatment, a higher percentage of standing green occurs throughout this treatment and may be the result of very little or no standing dead from the previous season's growth due to grazing by cattle. Percent standing green on the no grazing treatment was lower than the other three treatments which may be a carry-over from the previous year's growth. Light and moderate treatments fall in between the percentage of standing green for heavy and no grazing. These data show the percentage of standing green decreasing in the following order on grazing treatments; heavy, moderate, light, and none as being the lowest during the season of active growth.

Litter was accumulated throughout the sampling season for heavy and light grazing. The accumulation of litter occurred on moderate and no grazing treatments until July 15. After this date, the amount of litter decreased.

Herbage Meter Studies

In addition to the meter furnished by this project, three other meters were tested. These three meters furnished were: A - Meredith Morris, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado; B - Don F. Burzlaff, Agronomy Department, University of Nebraska, Lincoln, Nebraska; and C - James K. Lewis, Animal Science Department, South Dakota State University, Brookings, South Dakota. Late in the fall 1969, another meter was obtained from Custom Scientific Electronics Pty. Ltd., Brisbane, Australia. This latter meter was not used in the following studies, but was used for some late fall testing to determine the feasibility of measuring standing crop biomass under dry conditions.

Description of Sites

The purpose of this initial study with capacitance meters was to determine the feasibility of estimating total herbage production on green vs. dry sites at both high and low production. Table 1 is a description of the sites used.

Results of Herbage Meter Studies

Fig. 6 and 7 are representative plots of linear regression analyses for capacitance meters A, B, and C between the capacitance readings and the amount of water from each clipped plot. The weight of water was chosen as

the independent factor instead of plant biomass because it is the water in the plant which most significantly changes the dielectric constant and therefore the capacitance of the meter.

The correlation coefficients for the three capacitance meters (A, B, and C) were satisfactorily high for both the high and low amounts of standing Lincoln brome. Meter D, the IBP meter, was unsatisfactory for sites 1 and 2 because it was too sensitive and consequently read off scale.

The correlation coefficients for both the high and low amounts of standing blue grama range were extremely low. The correlation coefficients ranged from zero to about .34.

During the late fall of 1969 the Australian herbage meter was tested at the Eastern Colorado Range Station, Akron, Colorado. This meter was tested in pure stands of switchgrass (*Panicum virgatum*), side-oats grama (*Bouteloua curtipendula*), blue grama (*B. gracilis*) and western wheatgrass (*Agropyron smithii*). The moisture content of these stands of grasses was 10 and 15%. In all cases meter readings were erratic or negligible and no reliable results were obtained. Small areas of crested wheatgrass (*A. cresatum*) with a moisture content of 40 to 80% were also examined with the herbage meter. Repeatable results were obtained with the meter but the areas were too small for an adequate sample.

Table 1. Site characteristics for herbage meter studies, 1968.

Site	Type of Vegetation	Standing Crop[1] (g/m^2)	Moisture content (%)	Vegetation height (cm)	Standing Dead[2] (%)
1	Lincoln brome	255	46	10-30	59
2	Lincoln brome	134	59	2-12	51
3	Blue grama range	308	21	6-20	100
4	Blue grama range	102	18	2-10	100

[1]Based on clipped samples, dry-matter basis

[2]Based on hand separated material (ocular determination)

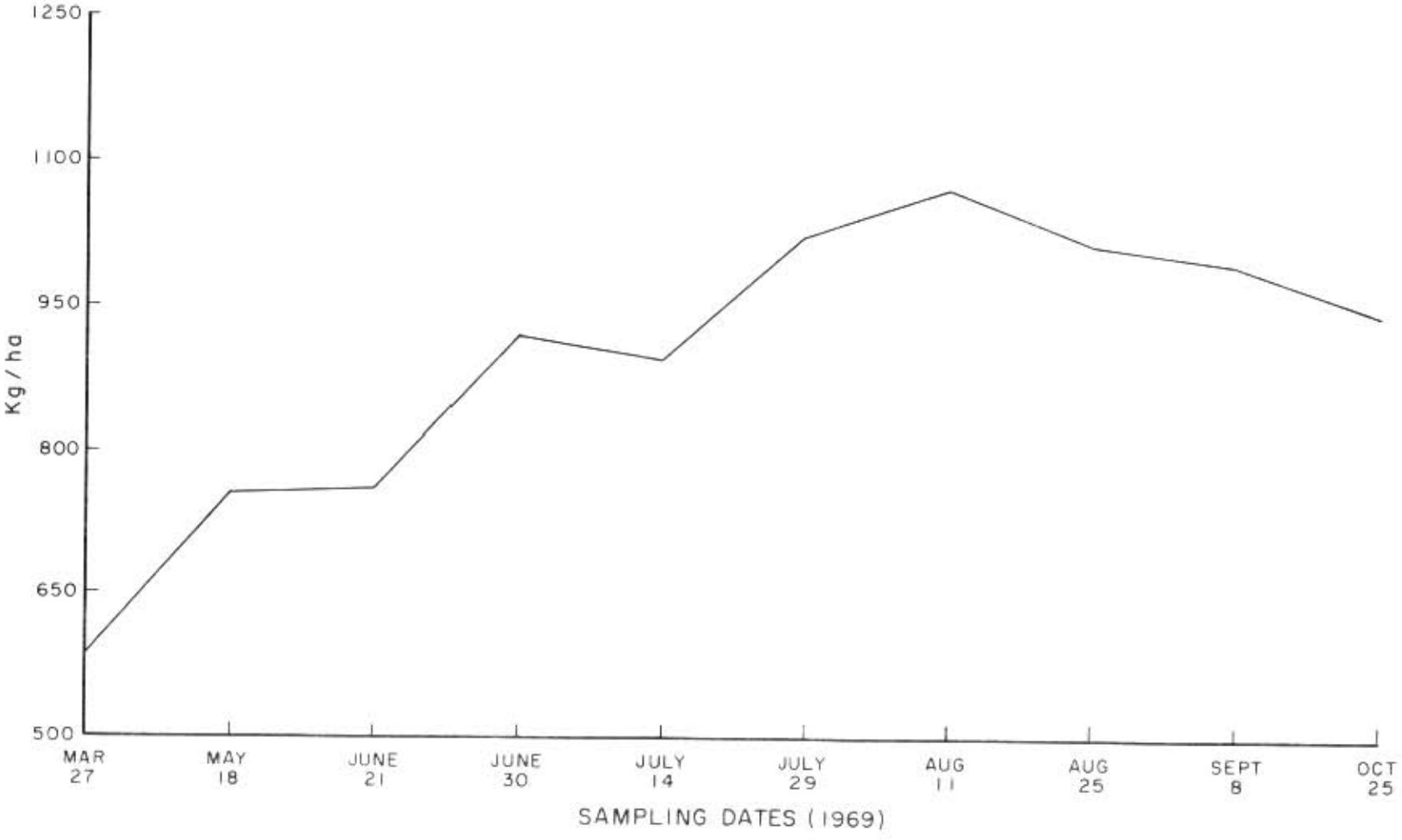

Fig. 1. Total standing crop, average of all treatments.

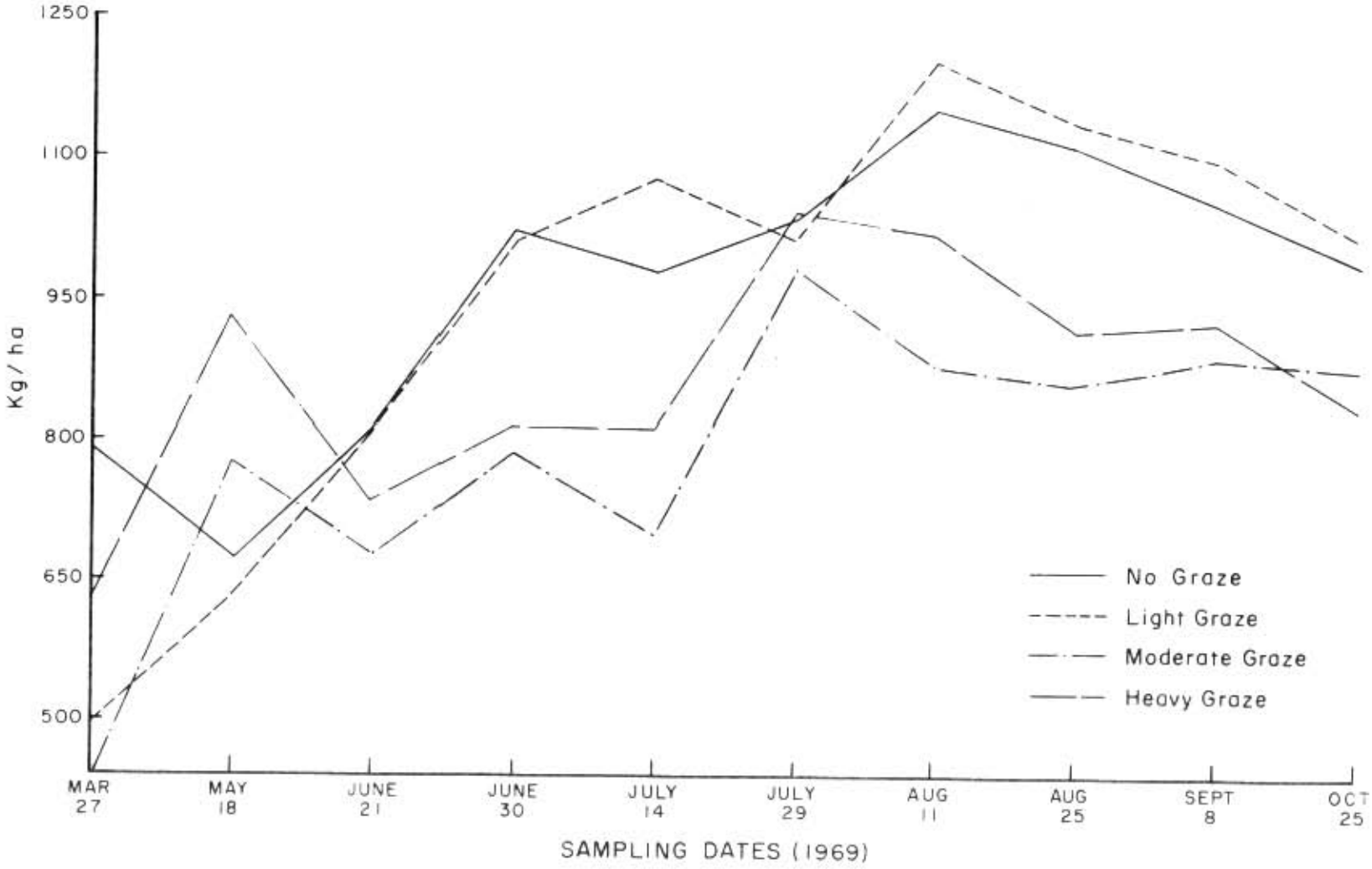

Fig. 2. Total standing crop on four grazing intensities.

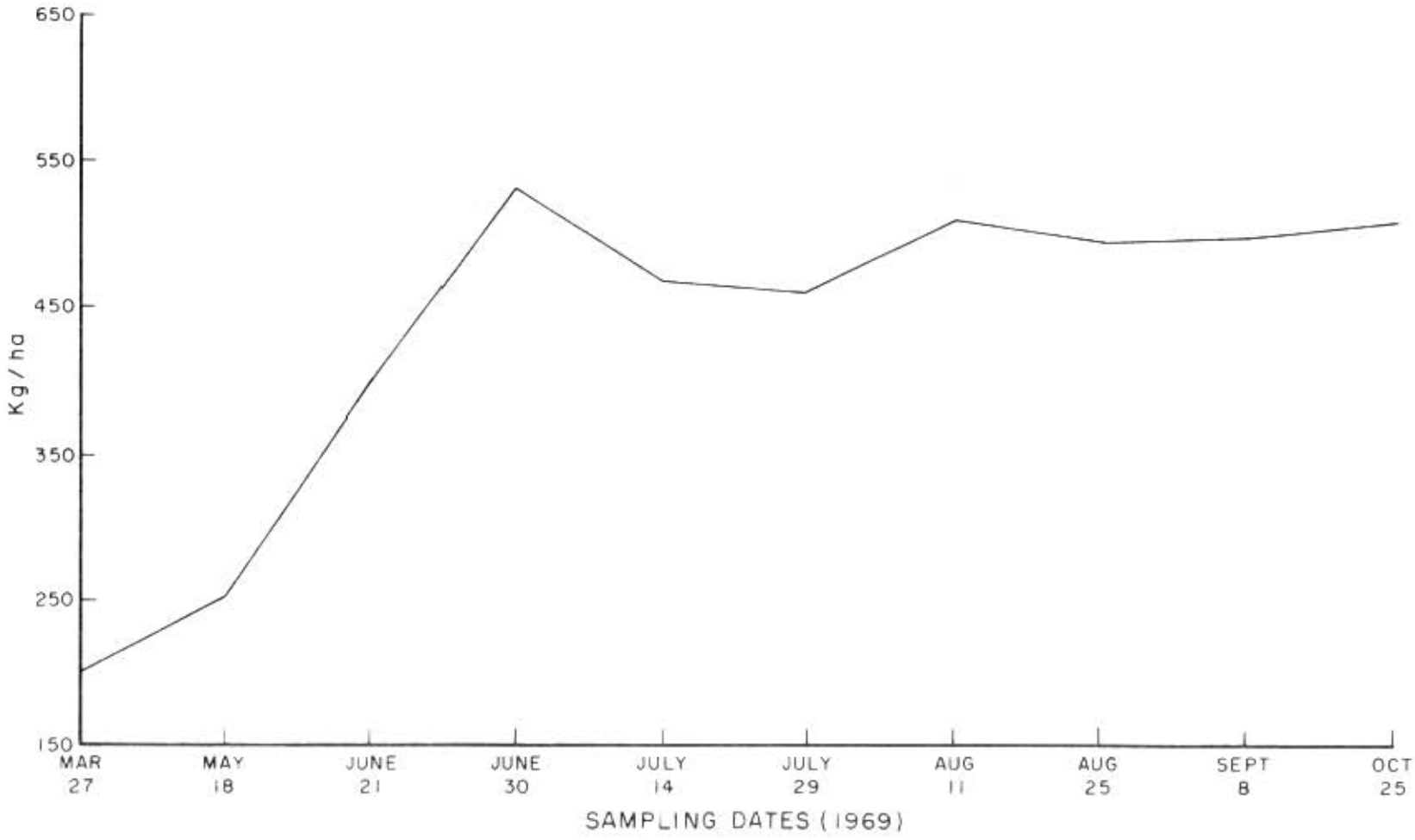

Fig. 3. Standing crop of blue grama, average of all treatments.

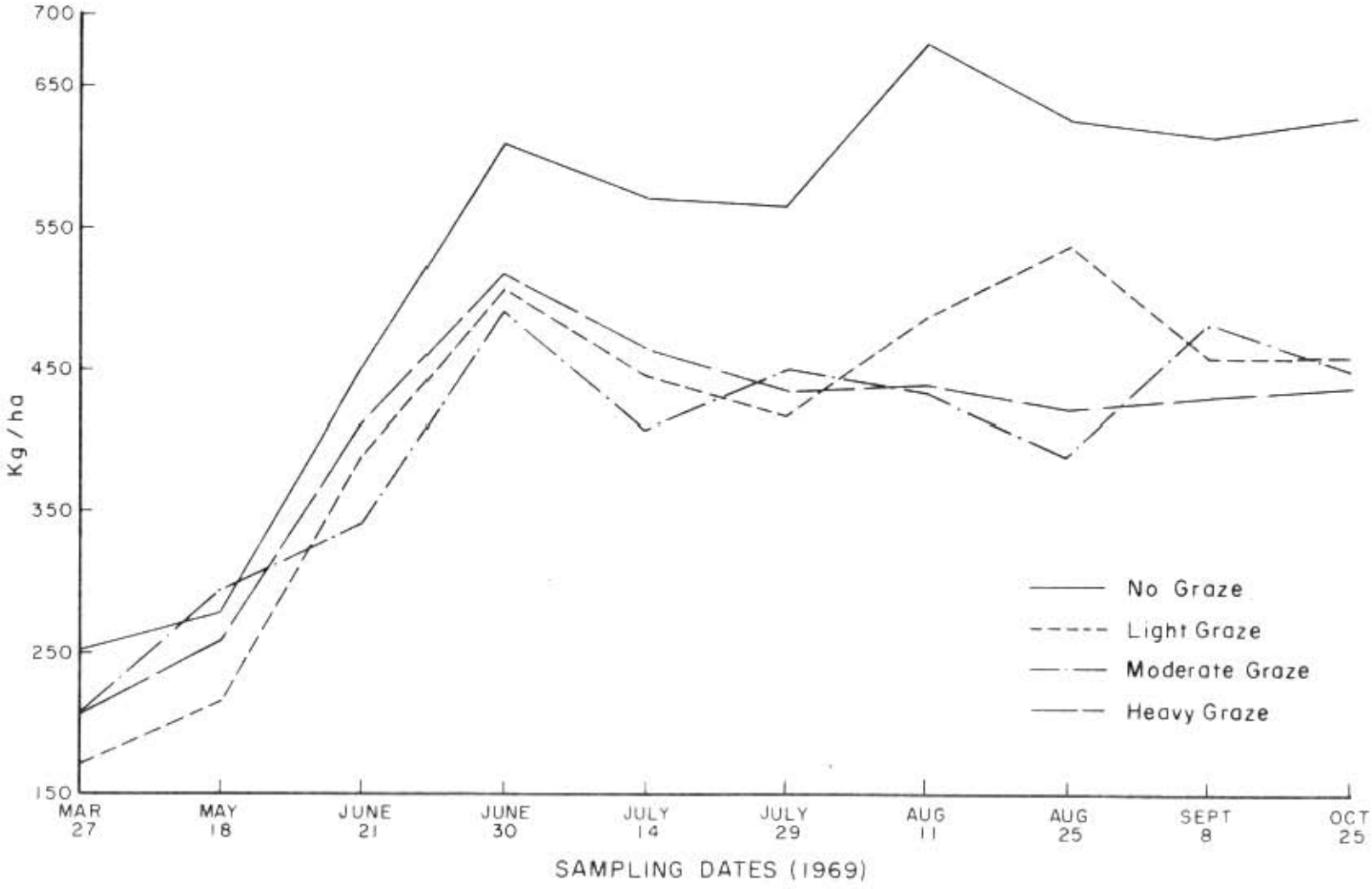

Fig. 4. Standing crop of blue grama on four grazing intensities.

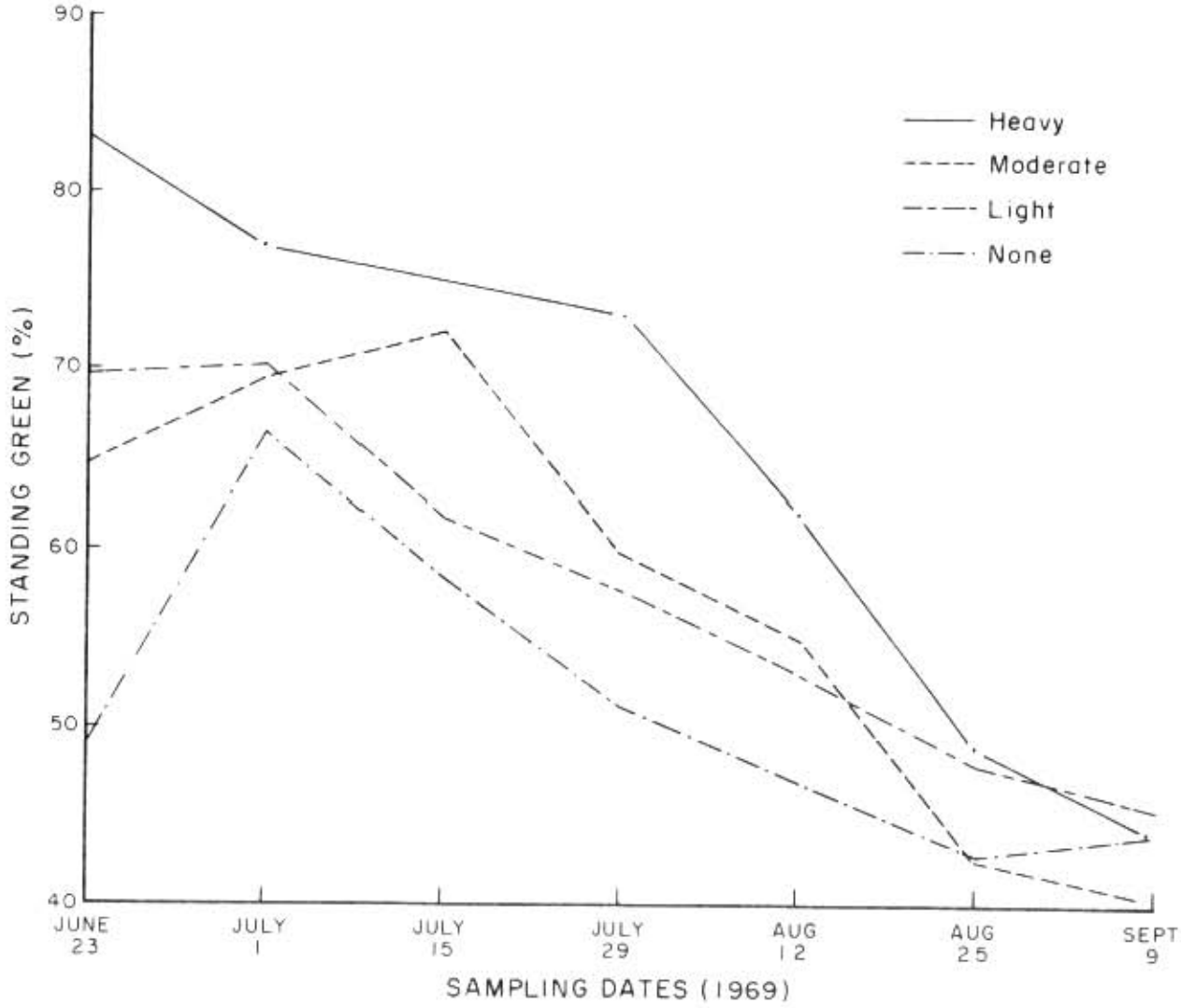

Fig. 5. Changes in percentages of standing green blue grama on four grazing intensities during the summer, 1969.

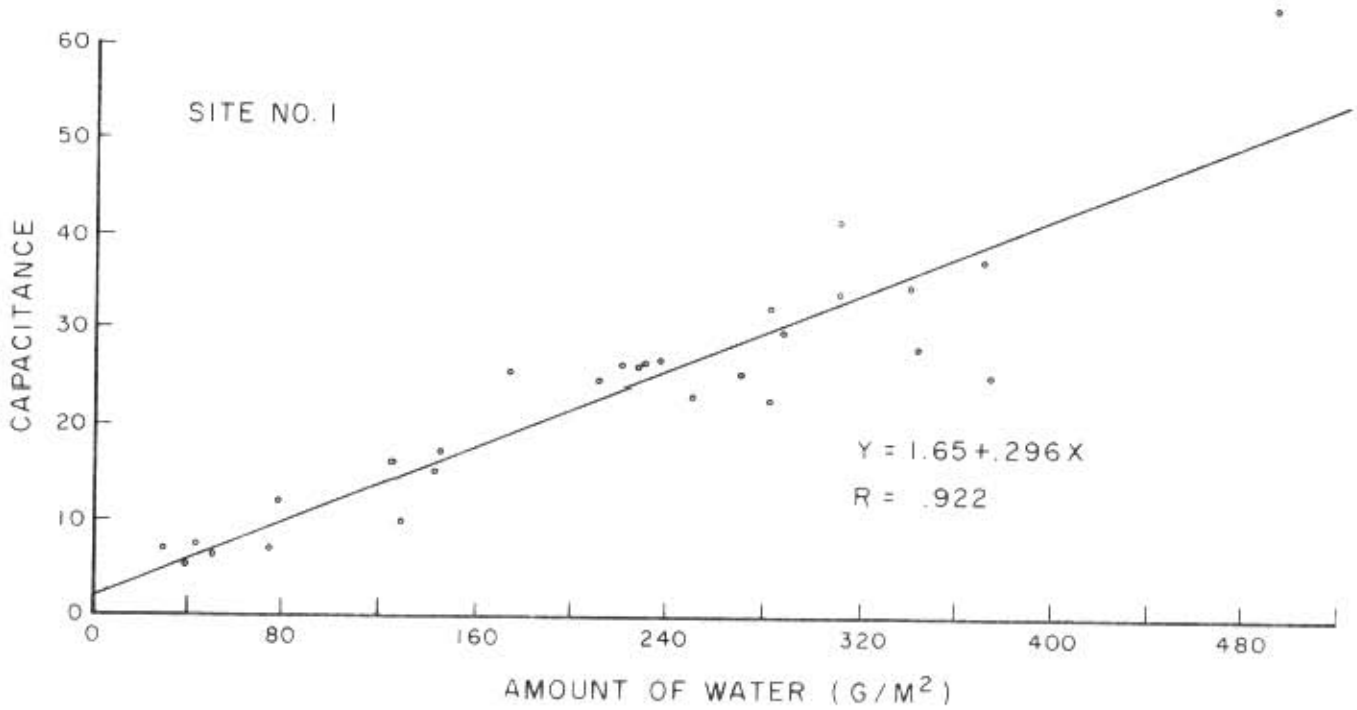

Fig. 6. Regression line of capacitance reading on the amount of water on a "relatively high yielding, green site".

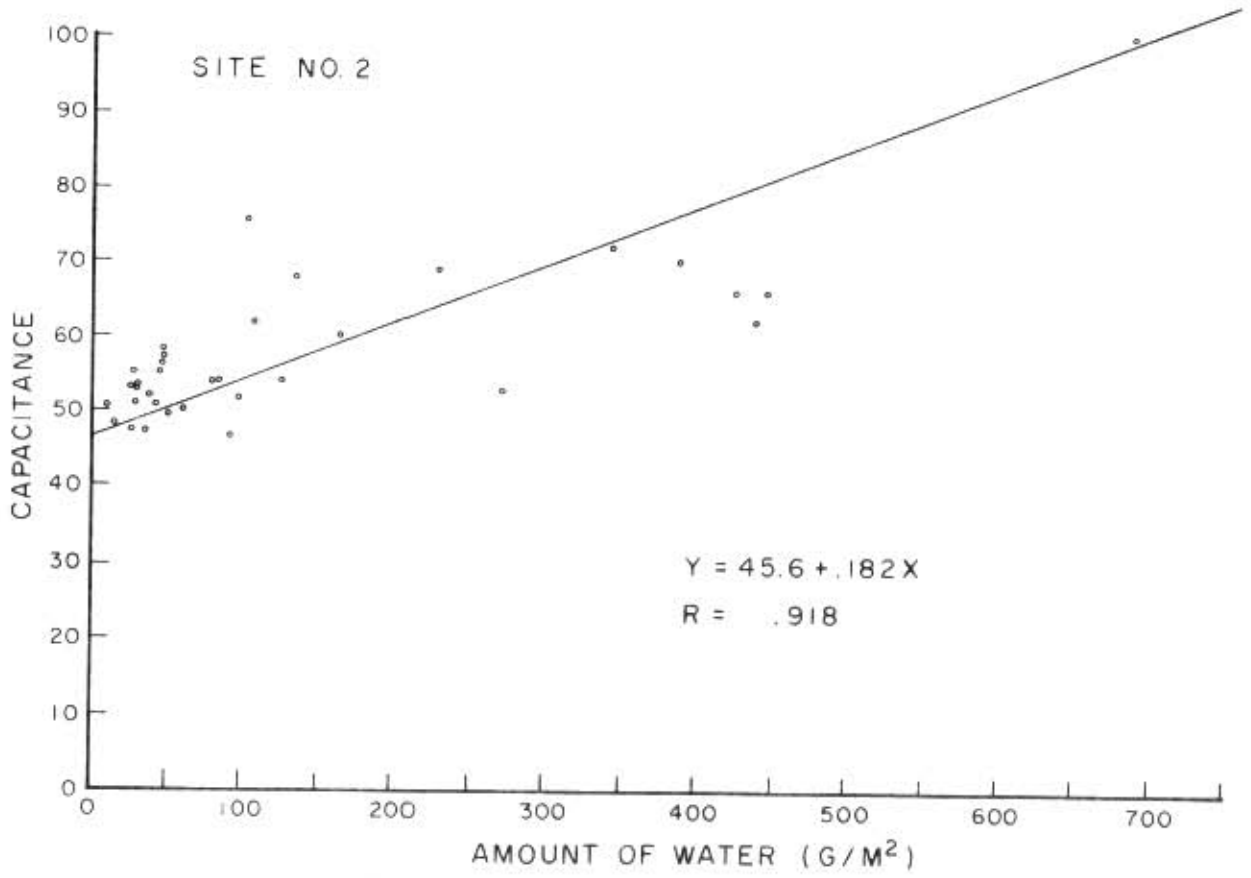

Fig. 7. Regression line of capacitance reading on the amount of water on a "relatively low yielding, green site".