FIGURE 4. Annual exclosure showing growth April, 1958 to April, 1959. Surrounding area represents severe use. Only a minor part of the refuge is used to this degree in any year.

salting have also played an important part in improving the distribution of range grazing.

Summary

Cooperative grazing use checks on the Wichita Mountains Wildlife Refuge are made annually by the U.S. Fish and Wildlife Service and the U.S. Soil Conservation Service. Degree of use is determined by ocular appraisal supplemented by quantitative measurements. Results of these checks are playing an important role in refuge management.

LITERATURE CITED


TECHNICAL NOTES

A POCKET HERBARIUM FOR RANGE MEN

DONALD L. NEAL

Range Conservationist, Pacific Southwest Forest and Range Experiment Station, Susanville, California

It is often valuable to have mounted plant specimens available in the field. Standard mounting techniques are not satisfactory: the mounts are too large and fragile. Range men have tried several methods with only partial success, but mounting the plants with sheets of self-laminating plastic will provide a rugged field reference.

Mounts can be made small enough to carry in a pocket. No pressing is necessary for most range plants. They retain color and shape and do not fall apart, even after several years use. The mounts can be used in wind or rain without damage. Plants mounted at any stage of growth stay together and appear natural.

Mounts can be punched and placed in a small loose-leaf binder, Figure 1. Range researchers and administrators will find that one of these “pocket herbaria”, when supplied to seasonal help, will cut training time and reduce mistakes in plant identification.

Only two or three minutes are required to prepare each mount since only woody plants need to be pressed. The self-laminating plastic is placed on a flat surface, adhesive side up. The plant and a label are placed face down on
AN ARTIFICIAL RUMEN SYSTEM FOR RANGE NUTRITION STUDIES

GEORGE M. VAN DYNE

Research Nutritionist, Animal Husbandry Department, University of California, Davis, California.

The artificial rumen recently has been used to estimate empirically the nutritive value of range plants (Taylor et al., 1960; Frederiksen and Washburn, 1961; Wallace et al., 1961; and Van Dyne, 1962). Two special requirements of an artificial rumen system for studies on the range, as compared to barn or feedlot investigations are: 1. Large capacity—the ability to digest a given forage sample varies more among classes of livestock under range grazing than it does under corral-feeding conditions (Van Dyne, 1962). Thus, to account for variations among animals and treatments, a larger number of samples often is required in range studies. 2. Simplicity and portability—widespread use of the artificial rumen as an analytical tool in range investigations requires simplicity of construction and use. The equipment should be durable and portable; its power requirements should be such that the apparatus can be used in field laboratories.

Four general types of artificial rumen systems exist: 1. continuous flow, 2. semipermeable membrane, 3. all glass volumetric, and 4. all glass gravimetric. This article describes the components and operation of an artificial rumen system of the fourth type. The system is used to evaluate digestion of cellulose in small samples of ground forages or purified cellulose. However, digestion of other nutrients and dry matter can be followed by similar techniques.

Capacity

A schematic diagram of the system is presented in Figure 1. The system accommodates 170 round bottom Pyrex centrifuge tubes of 100-ml capacity. Each tube is equipped with a pouring lip which allows loss of gas from the tube and permits addition of buffer. The water bath is fitted with a locally constructed, height-adjustable, stainless steel rack (Figure 2).

Gas Control

Tygon inlet tubing from two CO₂ cylinders leads into a water trap through which the gas bubbles. The trap provides a rapid visual means of checking the flow of CO₂ into the system. A low rate of simultaneous release from each of two cylinders prevents frosting and freezing of the lines that is caused by expansion of gas during rapid release from only one cylinder.

A tube from the water trap enters the main manifold system. Flexible rubber tubing connects the main manifold to nine branch manifolds and to the pressure gauge. The branch manifolds (labelled as "bench manifold" in the diagram) each connect to a maximum of 20 centrifuge tubes by flexible rubber tubing. An eight-inch length of five-mm glass tubing with a jet tip is inserted through a rubber stopper in each centrifuge tube. The fine tip produces a stream of bubbles which mixes fluids in the tube. Screw clamps adjust gas flow rate in each tube.

One rubber tube from the main manifold attaches to a glass tube extending to the bottom of a water-filled graduated cylinder. The gas pressure within the entire system is evaluated qualitatively by the water height in the glass tube within the graduated cylinder. This simple pressure gauge device also permits escape of gas if a branch manifold malfunctions. The manifolds are made from copper tubing in this system, but should be of glass for trace mineral studies.

pH Control

Nutrient and buffer solutions are added to the centrifuge tubes at the beginning of the trial as described below. The nutrient media and buffer solutions vary according to the purposes of the investigation, but modifications of those suggested by Quicke et al. (1959) have proved satisfactory. Enzymatic casein hydrolysate (2.5 ml/tube of a 20 mg/ml solution) is added to Quicke's original mixture. The buffer-nutrient mixture is saturated with CO₂ before use. Approximately 10, 20, and 20 ml, respectively, of buffer, nutrient medium, and rumen fluid are added to each tube. The pH remains near 6.9-7.0 during the fermentation.

Operation Sequence

The following sequence of operation is used:

1. Oven-dried feed samples are weighed into the centrifuge tubes. Standard samples are included in each trial for comparisons between trials. Blank tubes are included for each fermentation period to account for constituents added by the rumen fluid.

2. Gas flow through the individual jet tubes is pre-set by adjusting the screw clamps while the jet tubes are immersed in water.

3. The centrifuge tubes are placed in the prewarmed water bath and nutrient and buffer solutions are added with a graduated syringe. A few drops of mineral oil are added to each tube to lower evaporative losses and to decrease foaming. Rumen fluid, which may be processed by several methods, is added to provide microorganisms.

4. Gas flow is initiated prior to insertion of the jet tubes to prevent clogging of the tips. Equalization of gas flow is accomplished by decreasing the flow rate in all the tubes which have a high rate of gas release rather than by increasing the rate in slow tubes.

5. A few hours after the start of,...