What does a steer actually eat as he grazes a typical Arizona desert grassland range? Does he get a ration sufficient to support maximum profitable production? What added nutrients could help to make the ration more suitable for maximum production?

A New Look At Range Nutrition Research

R. Phil Shumway and Farris Hubbert, Jr.

The animal himself must help to find the answers. Cattle have a unique digestive system. When forages are grazed they go directly to the rumen, a large storage and fermentation vat capable of holding 50 to 60 gallons of feed and water. Billions of bacteria and other microorganisms are waiting to attack these forages and to break them down and convert them into substances which can be taken into the blood stream for use in the body functions.

In order to determine the composition of the diet selected by grazing cattle, rumen fistulas were established in three yearling steers. These experimental animals were then pastured on the U.S. Forest Service's Santa Rita Experimental Range, a typical desert grassland area 30 miles south of Tucson.

On certain days the animals are held off feed for 12 hours. The rumens are completely cleared of feed and water and the "emptied" steers are then allowed to graze on the range. Visual observations through field glasses are recorded during their grazing period.

After a sufficient length of time (approximately one hour) they are brought back and the forage which has just been grazed is removed from the rumen. The original rumen contents are replaced in the steers, and they return to their normal grazing activities. The material selected by the steers is then analyzed visually and chemically. This gives a rather accurate approximation of the composition of the grazing steer's diet.

The reader's attention is directed to the group of pictures on the preceding two pages. These photos were taken at the site of the study, the Santa Rita Range Experiment Station, 25 miles south of Tucson. It was a misty, rainy day when the pictures were taken, which limited their sharpness. Use of the fistula plug for animal research is common, and despite appearances the discomfort to the animal is relatively minor.

Reveals Seasonal Deficiencies

Table I shows the crude protein composition of the grazing animal's diet for each month of a particular year. Table II, taken from material prepared by the National Research Council, shows the actual requirements for normal growth of steers.

Comparison of the requirements and the actual diet of the experimental animals reveals certain deficiencies. It is clear that for the particular year shown, the ration of the grazing animal is too low in protein for normal growth of 400 to 600 pound steers during the months of January, May and June and questionable during February, July and November. It is true, however, that these data are preliminary and represent the pattern for one year only.

Table I

Crude Protein Content of the Grazing Animal's Diet, By Months

Month	*Crude protein in ration*
	%
January	6.00[1]
February	10.37[2]
March	15.93
April	12.28
May	6.75[1]
June	6.51[1]
July	10.90[2]
August	17.92
September	12.92
October	—
November	9.32[2]

[1]Not sufficient protein to meet the requirements of a 400 to 600 lb. growing steer.
[2]May be deficient in protein for a 400 to 600 lb. growing steer.

It appears that much of the increase in crude protein content of the material selected by the steers is due to their consumption of rapidly growing, succulent annuals that appear following rain or snow if soil temperature is optimum. Many of the shallow rooted annuals are consumed, complete with roots, so no

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Study conducted in cooperation with the Rocky Mountain Forest and Range Experiment Station, Forest Service, U.S.D.A.

Table II

Nutrient Requirements of Beef Cattle Expressed on An Air-Dry Basis

Body weight	*Avg. daily gain*	*Daily feed per animal*	*Total protein*
(lb.)	(lb.)	(lb.)	%
(Normal growth heifers and steers)			
400	1.6	12	11.7
600	1.4	16	9.3
800	1.2	19	7.8
1000	1.0	21	7.8

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evidence of their contribution to the steer's diet is left unless we actually sample what the animal selected.

Quantity, Not Just Quality

Crude protein is probably not the most critical nutritional deficiency, but rather energy consumption, as reflected by the pounds of forage consumed, is of first importance. The available energy value of the rumen contents, and the digestibility and mineral composition of the forages, are now being measured. These determinations may indicate additional ways in which the ration of the steers can be improved.

The cattle themselves also give indications of dissatisfaction with their diet, especially during certain months. For example, grazing observations during January and February of 1963 indicate a tendency to graze some apparently undesirable forages.

Various species of cactus, catclaw and mesquite were found in the rumen, even though apparently palatable grasses were available. (Note the picture on Page 9 of a barrel cactus spine which was taken from the rumen of a steer last January.) Cholla (also called "teddy bear cactus" and "jumping cactus") and prickly pear cactus also were a part of the steers' diet.

Results obtained with fistulated steers as a tool for measuring the vegetative and chemical content of the grazing steer's diet, have been very encouraging. It is believed that use of this same technique for sampling the grazing steer's diet in other range areas in Arizona will yield much valuable information for use in improving range nutrition through either nutrient supplementation or range management.

NOTE: Why did the steers, in the research project reported here and in pictures on the preceding pages, prefer the pulp from a dead barrel cactus?

That loose end of the study has not been left dangling. One theory is that the cactus contained opiates of some sort, alkaloids which the animals craved. (It is known that some cacti, such as saguaro, do contain such material.)

Or perhaps the plant contained salt or phosphorus which the animals craved. Or it could be something else. Your editor was curious enough to go out one Sunday and pick up this selfsame cactus which the animals had eaten into, returning a portion of the pulp which Dr. Cornelius Steelink is examining in the university's chemistry department.

Tucson Youth Wins Soils Award

Shown above, left to right, Dr. Darrel Metcalfe, Director of Resident Instruction in The U of A College of Agriculture; John R. Murphy, recipient of the soil scientist certificate; U of A College of Agriculture Dean Harold E. Myers, presenting the certificate; and at far right, Dr. Wallace E. Fuller, head of The U of A Department of Agricultural Chemistry and Soils.

John R. Murphy, a Tucson graduate student in agricultural chemistry and soils at The University of Arizona, has met the requirements for certification as a soil scientist, as established by the Soil Science Society of America.

"By completing the required courses in the physical and biological sciences and mathematics, along with his training in soils and other subjects, Murphy has established a firm foundation on which to build his future career," said H. B. Cheney, president of the society.

Murphy is the first student at The U of A to receive certification as a soil scientist. Only 10 such certifications were made in the United States last year.

Murphy received his B.S. degree in 1962. He is now completing requirements for the M.S. degree and in September will go to Purdue University for work toward the Ph.D. degree.

The new soil scientist has received high grades despite enrollment in such difficult courses as physical chemistry, calculus, biochemistry and physics. He is a member of five honorary societies and won the National Plant Food Institute Scholarship for the academic year 1961-1962.

He also received the Alpha Zeta Alumni Scholarship in 1960, as the outstanding student in agriculture at The U of A. In 1962 the American Chemical Society named him one of the top 20 chemistry students in the United States.

He received a Baird Scholarship during his undergraduate career and was a finalist candidate for the Rhodes Scholarship.

MYSTERY PICTURE

Heart Trouble Bridge, our mystery picture on Page 7, is on the gravel highway leading from the town of Cibecue southeasterly to Highways 60-77, meeting that main highway about 24 miles south of Show Low.

Like much of the Fort Apache Indian Reservation, this is a summer wonderland of mountains and valleys, flowing rivers, and the never-ending soughing of the towering ponderosa pines.

Why the bridge was named as it is, we do not know.

Hay prices in Arizona averaged about $1 per ton higher in 1962 than in 1961. Acreage was down slightly with yields about the same, resulting in a somewhat smaller crop. Hay acreage in 1962 was 257,000 acres, down 7 per cent from 1961 and slightly less than the 1951-60 average. Average yield was 4.36 tons per acre. Total production of hay was 1,108,000 tons, down 8 per cent from 1961 but 31 per cent greater than the previous ten-year average.